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EXPERIMENT DATA REPORT FOR SEMISCALE
MOD-1 TESTS S-01-4 AND S-01-4A
(ISOTHERMAL BLOWDOWN WITH CORE RESISTANCE SIMULATOR)

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EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1

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(Isothermal Blowdown with Core Resistance Simulator)

by

S. N. Zender
M. F. Jensen
K. E. Sackett

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ABSTRACT

Recorded test data are presented for Tests S-01-4 and S-01-4A of the semiscale Mod-1 isothermal blowdown test series. These tests are among several semiscale Mod-1 experiments which are counterparts of the planned Loss-of-Fluid Test (LOFT) nonnuclear experiments. System hardware is representative of LOFT design based on volumetric scaling methods, and initial conditions duplicate those identified for the LOFT nonnuclear tests.

Tests S-01-4 and S-01-4A employed an intact loop resistance that was similar to that of Test S-01-3 and low relative to that of Test S-01-2. An orificed structure was used in the pressure vessel to simulate the LOFT core simulator. The tests were initiated at initial isothermal conditions of about 2250 psig and 540°F by a simulated offset shear of the cold-leg broken-loop piping. During system depressurization, coolant was injected into the cold leg of the intact loop to provide data on the effects of emergency core cooling on system response. Following the blowdown portion of Test S-01-4, coolant spray was introduced into the pressure suppression tank to determine the response of the pressure suppression system.

The purpose of this report is to make available the uninterpreted data from Tests S-01-4 and S-01-4A for future data analysis and test results reporting activities. The data, presented in the form of graphs in engineering units, have been analyzed only to the extent necessary to assure that they are reasonable and consistent.

SUMMARY

Tests S-01-4 and S-01-4A were performed as part of the semiscale Mod-1 portion of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project conducted by Aerojet Nuclear Company for the United States Energy Research and Development Administration. These tests were part of the semiscale Mod-1 tests in Test Group 1 performed with hardware configuration and test parameters selected to yield a system response that simulates the Loss-of-Fluid Test (LOFT) system response during the LOFT nonnuclear blowdown experiments. Tests S-01-4 and S-01-4A utilized a pressure vessel with internals; an intact loop with active pump, steam generator, and pressurizer; a broken loop with simulated pump, simulated steam generator, and rupture assemblies; a pressure suppression system with header and pressure suppression tank; and a coolant injection system with low-pressure injection pumps, high-pressure injection pumps, and accumulators. An orificed structure was used in the core barrel of the pressure vessel to simulate the flow resistance of the core simulator to be used in the LOFT nonnuclear tests.

The overall objective of the semiscale program is to provide data for use in the development and verification of analytical models that are used to predict the transient thermal-hydraulic response of a water-cooled nuclear reactor system during a hypothetical loss-of-coolant accident (LOCA). The semiscale Mod-1 program has the further general objective of providing support to the experimental programs in the form of instrumentation assessment, optimization of test series, selection of test parameters, and evaluation of test results.

The areas of interest specific to S-01-4 were the effect of heat transfer from the steam generator and the effect on system response of coolant injection into the cold leg of the intact loop, including mixing effects at the cold-leg injection point. The delay time for injected coolant to reach the lower plenum was also of interest as well as the effect of high versus low intact loop flow resistance on system behavior (Test S-01-2 versus Test S-01-4).

Coolant was injected into the cold leg of the intact loop from a pressurized accumulator and from one low-pressure injection system (LPIS) pump. Coolant spray was admitted to the pressure suppression tank following the completion of blowdown to investigate the effects on pressure suppression system behavior.

Test S-01-4 was rerun as Test S-01-4A following the discovery during a subsequent test that a block valve in the hot-leg warmup bypass line had not been closing completely prior to initiation of blowdown. S-01-4A was run as nearly identical to Test S-01-4 as possible but without spray to the suppression tank.

In general, both tests were completed successfully. The problem with the warmup bypass line valve experienced during Test S-01-4 was corrected prior to Test S-01-4A. Initial test conditions were held for a minimum of ten minutes prior to initiation of blowdown to establish thermal equilibrium in the system. The recorded initial isothermal conditions of approximately 2250 and approximately 540°F for both tests were within acceptable

bounds of the specified conditions to allow analysis of the test data. An instantaneous offset shear of the broken-loop cold-leg piping was satisfactorily simulated by almost simultaneous actuation (within 10 milliseconds) of the rupture assemblies. The instrumentation used in Tests S-01-4 and S-01-4A generally functioned as intended. Of approximately 200 measurements attempted in each test, all but 17 in Test S-01-4 and 16 in Test S-01-4A produced usable data.

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EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1

TESTS S-01-4 AND S-01-4A

(Isothermal Blowdown with Core Resistance Simulator)

I. INTRODUCTION

The semiscale Mod-1 experimental program is part of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project conducted by Aerojet Nuclear Company. The semiscale project in turn is part of the United States Energy Research and Development Administration-sponsored research and development program to investigate the response of a water-cooled nuclear reactor system to a hypothesized loss-of-coolant accident (LOCA). The underlying objectives of the semiscale project are to quantify the physical processes controlling system behavior during an LOCA and to provide an experimental data base for assessing reactor safety evaluation models. The semiscale Mod-1 program has the further objective of providing support to other experimental programs in the form of instrumentation assessment, optimization of test series, selection of test parameters, and evaluation of test results.

The semiscale Mod-1 program is conducted with an experimental system designed to simulate the major components of a pressurized water reactor (PWR). Relative to previous experimental systems, the semiscale Mod-1 system advances the representation of a PWR and thus provides a means of acquiring coupled-system response data from which to obtain a more comprehensive understanding of the thermal and hydraulic processes during an LOCA.

Tests S-01-4 and S-01-4A were conducted in the semiscale Mod-1 system as part of a series of tests (Test Group 1) to provide data for comparison of the isothermal blowdown response of the semiscale system with that of the Loss-of-Fluid Test (LOFT) system. The semiscale Mod-1 experimental configuration for this test utilized hardware components selected to produce a system performance which simulates LOFT system performance during the LOFT nonnuclear tests. An orificed structure was used in the core barrel of the pressure vessel to simulate the flow resistance of the core simulator to be used in the LOFT nonnuclear tests.

Tests S-01-4 and S-01-4A employed an intact loop flow resistance similar to that used in Test S-01-3^[2] and low relative to that used in Test S-01-2 to further establish the importance of the magnitude of intact loop resistance on system response during blowdown. The lower resistance was scaled from the LOFT system. Each test was initiated by a simulated offset shear of the cold-leg broken-loop piping, and was conducted with ECC injection into the cold leg of the intact loop during blowdown. Water was injected from a pressurized accumulator at an initial 600-psig system pressure. Low-pressure coolant injection was initiated 35.5 seconds after initiation of blowdown. Additionally, for Test S-01-4, coolant spray was introduced into the pressure suppression tank.

The purpose of this report is to present the test data in an uninterpreted, but readily usable, form for use by the nuclear community in advance of detailed analysis and interpretation. Section II describes the semiscale Mod-1 system, the test procedures and conditions, and the sequence of test events. Section III presents the data graphs and provides comments and supporting information necessary for interpretation of the data. A description of the overall semiscale program and test series, a detailed description of the Mod-1 semiscale system, and a description of the measurement and data processing techniques and uncertainties can be found in Appendices A, B, and C of Reference 1.

II. SYSTEM, PROCEDURES, CONDITIONS, AND EVENTS FOR

TESTS S-01-4 AND S-01-4A

The following system configuration, procedures, initial test conditions, and events are specific to Tests S-01-4 and S-01-4A.

1. SYSTEM CONFIGURATION AND TEST PROCEDURES

The semiscale Mod-1 system used for Tests S-01-4 and S-01-4A consisted of a pressure vessel with internals; an intact loop with steam generator, pump, and pressurizer; a blowdown loop with simulated steam generator, simulated pump, and two rupture assemblies; a coolant injection system with accumulators and both high- and low-pressure injection pumps; and a pressure suppression system with a suppression tank and header. The semiscale Mod-1 experimental system is described in detail in Appendix B of Reference 1.

For Tests S-01-4 and S-01-4A, the intact loop steam generator was maintained in the hot standby condition, in which the steam generator secondary side was valved off and the steam generator primary tubes were completely covered with water (at isothermal system temperature) when blowdown occurred. The system was heated to isothermal conditions with heaters in the bypass lines between the broken and unbroken loops.

In preparation for Tests S-01-4 and S-01-4A, the system was filled with treated demineralized water and vented at strategic points to assure a liquid full system. Prior to warmup, the system was pressurized to check for leakage. Warmup to initial test conditions was accomplished with heaters located in the bypass lines which served to allow circulation through the broken loop. During warmup, the purification and sampling systems were valved into the primary system to maintain water chemistry requirements and to provide a water sample at system conditions for subsequent analysis. These systems were valved out just prior to initiation of blowdown. At 100-degree temperature intervals during warmup, detector readings were sampled to allow the integrity of the measurement instrumentation and the operability of the data acquisition system to be checked.

Prior to initiation of the blowdown tests, initial test conditions were held for a minimum of ten minutes to establish equilibrium in the system. At the end of this period, all auxiliary systems, including the bypass lines, were isolated to prevent blowdown through those systems.

Pressure to operate the rupture assemblies and initiate blowdown was taken from the system through lines connected to the reflood bypass simulators. Immediately following initiation of blowdown (0.02 second after initiation of blowdown) these lines were again isolated.

Power to the primary coolant circulating pump was cut off at blowdown to allow the pump to coast down to a speed of 1300 rpm. This speed was then maintained throughout the remainder of the test. A flywheel mounted on the pump motor shaft provided a simulation of the predicted coastdown of the LOFT pumps.

The system was successfully subjected to a simulated double-ended cold-leg pipe break through two blowdown nozzles each having a break area of 0.00262 ft^2 . The effluent was ejected from the primary system into the pressure suppression system.

The accumulator and low-pressure injection system injected coolant into the cold leg of the intact loop during blowdown. Injection from the accumulator was initiated at a system pressure of 600 psig. Injection water spray was injected into the suppression tank after blowdown during Test S-01-4. Water spray was not used during Test S-01-4A.

2. INITIAL TEST CONDITIONS AND SEQUENCE OF EVENTS

Conditions in the semiscale Mod-1 system at initiation of blowdown are given in Tables I and II, the primary system water chemistry prior to blowdown is given in Table III, and the sequence of events relative to rupture is given in Table IV.

TABLE I.
CONDITIONS AT BLOWDOWN INITIATION

	Measured ^[a]		Specified	
	S-01-4	S-01-4A	S-01-4	S-01-4A
System fluid temperature (intact loop, vessel outlet)	540°F	542°F	540±2°F	540±2°F
System pressure (vessel upper plenum)	2255 psig	2225 psig	2250±25 psig	2250±25 psig
Intact loop cold-leg flow	173 gpm	174 gpm	173±2 gpm	173±2 gpm
Intact loop accumulator pressure	612 psig	600 psig	600 psig ^[b]	600 psig ^[b]
Temperature of injected coolant	82°F	76°F	85°F ^[b]	85°F ^[b]
Intact loop accumulator water volume	2.67 ft ³	1.60 ft ³	2.37 ft ³ ^[b]	1.63 ft ³ ^[b]
Intact loop accumulator gas volume	1.16 ft ³	1.10 ft ³	1.47 ft ³ ^[b]	1.11 ft ³ ^[b]
Pressurizer water volume	0.72 ft ³	0.82 ft ³	0.73 ft ³ ^[b]	0.73 ft ³ ^[b]
Steam generator secondary steam dome pressure	966 psig	970 psig	963±40 psig	963±40 psig
Steam generator secondary fluid temperature	542°F	543°F	540°F±5°F	540°F±5°F
Steam generator liquid level (from bottom of tube sheet)	121.4 in.	121.4 in.	123±2 in.	123±2 in.
Pressure suppression tank water level	50 in.	47 in.	47.5 in. ^[b]	47.5 in. ^[b]
Pressure suppression tank pressure	18.4 psig	17.3 psig	17.4±1 psig	17.4±1 psig
Pressure suppression tank water temperature	155°F	156°F	156°F±1°F	156°F±1°F

[a] Measured initial conditions which did not meet the specified initial conditions were considered acceptable for analysis purposes within the test objectives.

[b] Tolerance not specified.

TABLE II

PRIMARY COOLANT TEMPERATURE DISTRIBUTION AT RUPTURE

Location	Detector	Temperature (°F)	
		S-01-4	S-01-4A
Vessel lower plenum (lower portion)	TFV-LP-1-1/2	536	536
Vessel lower plenum (upper portion)	TFV-LP-27-1/2	542	544
Hot leg, intact loop (near vessel)	RBU-2	540	542
Hot leg, intact loop (104 in. from vessel center)	TFU-5	542	545
Hot leg, intact loop (near steam generator)	TSU-7	543	545
Cold leg, intact loop	RBU-14A	541	542
Cold leg, broken loop (near vessel)	TFB-20	540	539
Cold leg, broken loop (near nozzle)	TFB-23	542	544
Hot leg, broken loop (near vessel)	TFB-30	539	541
Broken loop (near pump-side nozzle)	TFB-42	536	
Reflood bypass, cold leg	TFB-RFBC	538	536
Reflood bypass, hot leg	TFB-RFBH	535	536

TABLE III

WATER CHEMISTRY PRIOR TO BLOWDOWN^[a]

	S-01-4	S-01-4A
pH	10.35	10.56
Conductivity (μmhos/cm)	44.8	56.0
Suspended solids (ppm)	0.91	0.58
Chlorides (ppm)	0.305	0.232
H ₂ (cc/l)	2.3	1.6
O ₂ (cc/l)	<0.01	0.1
N ₂ (cc/l)	133.8	157.0
CO ₂ (cc/l)	0.01	<0.01
Total gas (cc/l)	137.3	164.0

[a] Water sample taken at a system pressure of 2255 psig and a system temperature of 540°F for Test S-01-4 and at a system pressure of 2225 psig and a system temperature of 540°F for Test S-01-4A.

TABLE IV
SEQUENCE OF EVENTS DURING TEST^[a]

Event	Time Relative to Rupture (sec)	
	Test S-01-4	Test S-01-4A
Heatup bypass lines valved out of system	-6	-6
Initiation of blowdown	0	0
Initiation of ECC injection from intact loop ECC accumulator	22	22
Initiation of ECC injection from intact loop ECC low pressure injection system	35.5	36
Termination of ECC injection from intact loop ECC accumulator	86	62
Termination of ECC injection from intact loop low pressure injection system	[b]	96
Termination of blowdown	126	126
Initiation of spray to suppression tank	126	[c]

[a] A time-control sequencer was used to control critical events during both tests.

[b] Flow measurement not available to establish termination of injection.

[c] Spray was not initiated.

III. DATA PRESENTATION

The data from semiscale Mod-1 Tests S-01-4 and S-01-4A are presented with brief comment. Processing analysis has been performed only to the extent necessary to obtain appropriate engineering units and to assure that the data are reasonable and consistent. In all cases, in converting transducer output to engineering units, a homogeneous fluid was assumed. Further interpretation and analysis should consider that sudden decompression processes such as those occurring during blowdown may have subjected the measurement devices to nonhomogeneous fluid conditions.

The performance of the system during Tests S-01-4 and S-01-4A was monitored by about 200 detectors. The data obtained were recorded on both a digital and an analog data acquisition system. The digital system was used to process the data presented in this report. The analog system was used to provide better resolution capability (needed as input to various data analysis codes) and to provide redundancy.

The data are presented in many instances in the form of composite graphs to facilitate comparison of a given variable at several locations. Each set of data is presented on two time scales. The first time scale presents data for the entire test, or from -2 to 150 seconds. The second time scale expands the data for the first 30 seconds of the test. The data for each time scale were generated from a separate digital data tape. Since different time intervals exist between sampled data points for different time-base graphs, small differences are present in the transient data. The scales selected do not reflect the obtainable resolution of the data. The data processing techniques are described in greater detail in Appendix C of Reference 1.

Figures 1 through 5 and Table V provide supporting information for interpretation of the data graphs shown in Figures 6 through 509. Figures 1 through 5 show the relative locations of all detectors used during the Mod-1 isothermal series. Table V groups the measurements taken during Tests S-01-4 and S-01-4A according to measurement type; identifies the specific measurement location and the range of the detector and actual recording range of the data acquisition system; provides brief comments regarding the data; and references the measurements and comments to the corresponding figure. Figures 6 through 499 present all the data obtained. In addition, selected measurements are repeated for Test S-01-4 in Figures 500 through 509 to provide data on the effects of pressure suppression system cooling spray. Time zero on the graphs is the time of rupture initiation.

Fig. 1 Semiscale Mod-1 system and instrumentation -- isometric.

Fig. 3 Semiscale Mod-1 pressure vessel -- cross section showing instrumentation.

Fig. 4 Semiscale Mod-1 pressure vessel -- isometric showing instrumentation.

TABLE V

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-1 AND S-01-4A

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
FLUID TEMPERATURE	Chromel-Alumel thermocouples unless specified otherwise				
<u>Intact Loop</u>		0-2300°F	0-591°F		
RBU-2	Hot leg, Spool 2, 46 in. from vessel center (platinum resistance bulb)	0-1000°F	0-1000°F	6-9	
TFU-5	Hot leg, Spool 5, 104 in. from vessel center			6-9	
TSU-7	Cold leg, Spool 7, 243 in. from vessel center (shielded)			6-9	
TFU-10	Cold leg, Spool 10, 144 in. from vessel center			6-9	
TFU-13	Cold leg, Spool 13, 51 in. from vessel center			10-13	Data spike at t=17.5 sec due to tape dropout during Test S-01-4A
RBU-14A	Cold leg, Spool 14, 43 in. from vessel center, upstream of cold leg injection port (platinum resistance bulb)	0-1000°F	0-1000°F	14-17	
TFU-14B	Cold leg, Spool 14, 39 in. from vessel center, downstream of cold leg injection port			14-17	
TFU-15	Cold leg, Spool 15, 16 in. from vessel center			10-13	
<u>Broken Loop</u>		0-2300°F	0-591°F		
TFB-20	Cold leg, Spool 20, 21 in. from vessel center			18-21	
TFB-23	Cold leg, Spool 23, 91 in. from vessel center, upstream of vessel-side nozzle			18-21	
TFB-30	Hot leg, Spool 30, 16 in. from vessel center			18-21	
TFB-42	Cold leg, Spool 42, 414 in. from vessel center along hot leg, upstream of pump-side nozzle			18, 20	Detector failed during Test S-01-4A
TFB-RFBC	Reflood bypass, near end cap, cold-leg side			18-21	
TFB-RFBH	Reflood bypass, near end cap, hot-leg side			18-21	
<u>Inlet Annulus</u>	4 in. below cold leg centerline, 0.2 in. from vessel wall, Type J iron-constantan thermocouples	0-1400°F	0-692°F	22-25	
TFV-ANN-4A	0°				
TFV-ANN-4M	180°				
<u>Downcomer Annulus</u>	Centered in annulus, Type J iron-constantan thermocouples	0-1400°F	0-692°F		
TFV-ANN-15A	15 in. below cold leg centerline, 0°			26-29	
TFV-ANN-15M	15 in. below cold leg centerline, 180°			26-29	
TFV-ANN-15T	15 in. below cold leg centerline, 270°			26-29	
TFV-ANN-35A	35 in. below cold leg centerline, 0°			26-29	
TFV-ANN-35M	35 in. below cold leg centerline, 180°			30-33	
TFV-ANN-35T	35 in. below cold leg centerline, 270°			30-33	
TFV-ANN-115A	115 in. below cold leg centerline, 0°			30-33	
TFV-ANN-156A	156 in. below cold leg centerline, 0°			30-33, 501	
<u>Lower Plenum</u>	On fluid thermocouple rack, 1 in. from vessel center, 45°	0-2300°F	0-591°F		
TFV-LP-1-1/2	1.5 in. from bottom			34-37	
TFV-LP-7-1/2	7.5 in. from bottom			34-37, 501	
TFV-LP-14-1/2	14.5 in. from bottom			34-37	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Lower Plenum (Contd.)</u>					
TFV-LP-21-1/2	21.5 in. from bottom			34-37	
TFV-LP-27-1/2	27.5 in. from bottom			34-37	
<u>Core</u>		0-2300°F	0-591°F	38-41, 501	Increase in measured fluid temperature from t=2 sec to t=5 sec questionable
TF-LOFT-COR	Near LOFT core turbine flowmeter, 14 in. below cold leg centerline				
<u>Core Barrel Insulation Gap</u>	Type J iron-constantan thermocouples	0-1400°F	0-692°F		
TFV-CIG-70A	70 in. below cold leg centerline, 0°				
TFV-CIG-115A	115 in. below cold leg centerline, 0°				
<u>Vessel Filler - Insulation Gap</u>		0-1400°F	0-692°F		
TFV-FIG-70A	70 in. below cold leg centerline, 0°				
TFV-FIG-156A	156 in. below cold leg centerline, 0°				
<u>ECC System</u>		0-2300°F	0-591°F	50-53, 500	
TFU-ECC-14	On centerline of ECC line just upstream of junction with Spool 14				
<u>Steam Generator</u>		0-2300°F	0-591°F	54-57	
TFU-SG1	Secondary side, 12 in. above bottom of tube sheet				
TFU-SG2	Secondary side, 24 in. above bottom of tube sheet				
TFU-SG3	Secondary side, 48 in. above bottom of tube sheet				
TFU-SG4	Secondary side, 96 in. above bottom of tube sheet				
<u>Pressurizer</u>		0-2300°F	0-591°F	58-61	
TFU-PRIZE	In surge line, near pressurizer exit, between turbine flowmeter and pressurizer				
<u>Pressure Suppression System</u>		0-2300°F	0-591°F	62-65, 502	
TF-PSS-17	17 in. from bottom of tank				
TF-PSS-33	33 in. from bottom of tank				
TF-PSS-130	130 in. from bottom of tank				
<u>MATERIAL TEMPERATURE</u>	Chromel-Alumel thermocouples unless specified otherwise				
TMU-1S16	Hot leg, Spool 1, side, 1/16 in. from pipe ID, 29 in. from vessel center			66-69	
TMU-1B16	Hot leg, Spool 1, bottom, 1/16 in. from pipe ID, 29 in. from vessel center			66-69	
TMU-7S16	Cold leg, Spool 7, side, 1/16 in. from pipe ID, 242 in. from vessel center (vertical pipe)			66-69	
TMU-8S4	Cold leg, Spool 8, side, in pump trap, 1/4 in. from pipe ID, 195 in. from vessel center			70-72	Data not available on 30-sec time base for Test S-01-4A
TMU-8S16	Cold leg, Spool 8, side, in pump trap, 1/16 in. from pipe ID, 195 in. from vessel center			70-73	
TMU-10S16	Cold leg, Spool 10, side, 1/16 in. from pipe ID, 144 in. from vessel center			70-73	
TMU-15T16	Cold leg, Spool 15, top, 1/16 in. from pipe ID, 17 in. from vessel center			70-73	
TMU-15B16	Cold leg, Spool 15, bottom, 1/16 in. from pipe ID, 17 in. from vessel center			70-73	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
<u>Broken Loop</u>		0-2300°F	0-591°F	74-77	
TMB-20B4	Cold leg, Spool 20, bottom, 1/4 in. from pipe ID, 21 in. from vessel center				
TMB-20S16	Cold leg, Spool 20, side, 1/16 in. from pipe ID, 21 in. from vessel center				Data have a -35°F offset for Test S-01-4A
TMB-20B16	Cold leg, Spool 20, bottom, 1/16 in. from pipe ID, 21 in. from vessel center				
TMB-30B16	Hot leg, Spool 30, bottom, 1/16 in. from pipe ID, 16 in. from vessel center				
TMB-40S16	Cold leg, Spool 40, discharge of simulated pump, vertical section, side, 1/16 in. from pipe ID, 368 in. from vessel center along hot leg				
<u>Vessel Wall</u>	1/8 in. from vessel ID	0-2300°F	0-591°F	78-81	
TMV-VI-35A	35 in. below cold leg centerline, 0°				
TMV-VI-177M	177 in. below cold leg centerline, 180°				
<u>Vessel Filler</u>	Type J iron-constantan thermocouples	0-1400°F	0-692°F		
TMV-FO-35A	35 in. below cold leg centerline, 0.65 in. from filler ID, 0°			82-85	
TMV-FO-156A	156 in. below cold leg centerline, 0.65 in. from filler ID, 0°			82-85	
TMV-FO-177M	177 in. below cold leg centerline, 0.65 in. from filler ID, 180°			82-85	
TMV-FI-4M	4 in. below cold leg centerline, 1/16 in. from filler ID, 180°			86-89	Thinness of filler at this location exposes thermocouple to fluid temperature
TMV-FI-15A	15 in. below cold leg centerline, 1/16 in. from filler ID, 0°			86-89	
TMV-FI-35A	35 in. below cold leg centerline, 1/16 in. from filler ID, 0°			86-89	
TMV-FI-35M	35 in. below cold leg centerline, 1/16 in. from filler ID, 180°			86-89	
TMV-FI-70A	70 in. below cold leg centerline, 1/16 in. from filler ID, 0°			90-93	
TMV-FI-115A	115 in. below cold leg centerline, 1/16 in. from filler ID, 0°			90-93	
TMV-FI-156A	156 in. below cold leg centerline, 1/16 in. from filler ID, 0°			90-93	
TMV-FI-156M	156 in. below cold leg centerline, 1/16 in. from filler ID, 180°			90-93	
TMV-FI-177M	177 in. below cold leg centerline, 1/16 in. from filler ID, 180°			90-93	
<u>Vessel Filler Insulator</u>	Outer surface of insulator, Type J iron-constantan thermocouples	0-1400°F	0-692°F	94-97	
TIV-FO-4A	4 in. below cold leg centerline, 0°				
TIV-FO-35A	35 in. below cold leg centerline, 0°				
TIV-FO-35M	35 in. below cold leg centerline, 180°				
TIV-FO-70A	70 in. below cold leg centerline, 0°				
TIV-FO-115A	115 in. below cold leg centerline, 0°				
TIV-FO-156A	156 in. below cold leg centerline, 0°				
<u>Lower Plenum</u>	Chromel-Alumel thermocouple	0-2300°F	0-591°F	98-101	
TMV-LH	In vessel bottom head, 1/8 in. from inside surface, 2 in. from vessel centerline, 90°				
<u>Core Barrel</u>	Type J iron-constantan thermocouples	0-1400°F	0-692°F		
TMV-CO-4A	4 in. below cold leg centerline, in inlet annulus region, 1/16 in. from core barrel OD, 0°			102-105	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
<u>Core Barrel (Contd.)</u>					
TMV-CO-4M	4 in. below cold leg centerline, in inlet annulus region, 1/16 in. from core barrel OD, 180°			102-104	Data not available on 30-sec time base for Test S-01-4A
TMV-CO-15A	15 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			102-105	
TMV-CO-70A	70 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			106-109	
TMV-CO-115A	115 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			106-109	
TMV-CO-115M	115 in. below cold leg centerline, 1/16 in. from core barrel OD, 180°			106-109	
TMV-CO-127A	127 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			106-109	
TMV-CI-70A	70 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°			110-113	
TMV-CI-115A	115 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°			110-113	
<u>Steam Generator</u>		0-2300°F	0-591°F	114-117	
TMU-SG1	On steam generator tubes, 12 in. above bottom of tube sheet, on OD of tube				
TMU-SG2	On steam generator tubes, 24 in. above bottom of tube sheet, on OD of tube				
TMU-SG3	On steam generator tubes, 48 in. above bottom of tube sheet, on OD of tube				
TMU-SG4	On steam generator tubes, 96 in. above bottom of tube sheet, on OD of tube				
<u>PRESSURE</u>					
<u>Intact Loop</u>		0-3000 psig	0-4000 psig		
PU-13(F)	Cold leg, Spool 13, 54 in. from vessel center (flush mount)				Data available on analog system; data not digitized due to limited channel availability
<u>Broken Loop</u>		0-3000 psig	0-4000 psig		
PB-23	Cold leg, Spool 23, 92 in. from vessel center, upstream of nozzle (tee off DP tap)			118-121	
PB-CN1	Vessel-side nozzle, nozzle throat, 96 in. from vessel center, (tee off DP tap)			118, 121	
PB-42	Cold leg, Spool 42, 415 in. from vessel center along hot leg, upstream of pump-side nozzle (tee off DP tap)			122-125	
PB-HN1	Pump-side nozzle, nozzle throat, 419 in. from vessel center along hot leg (tee off DP tap)			122-125	
<u>Vessel</u>		0-3000 psig	0-4000 psig	126-129	
PV-UP+10	In upper plenum, 10 in. above cold leg centerline, mounted on stand-off, 30°				
PV-LP-180	In upper part of lower plenum, 180 in. below cold leg centerline, mounted on stand-off, 225°				
PV-IANN-9	In vessel inlet annulus, 9 in. below cold leg centerline, mounted on stand-off, 225°				
<u>ECC System</u>		0-750 psig	0-750 psig	130-133, 503	
PECC-UL-ACC	In intact loop accumulator				Pressure decrease at t=3 sec during Test S-01-4A caused by automatic opening of accumulator valve
<u>Pressurizer</u>		0-3000 psig	0-4000 psig	134-137	
PU-PRIZE	Steam dome				

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments ^[a]	Range ^[a]		Figure ^[a]	Measurement Comments ^[b]
		Detector	Data Acquisition System		
<u>Pressure Suppression System</u>		0-100 psig	0-100 psig	138-141, 504	
P-PSS	Suppression tank top				
DIFFERENTIAL PRESSURE	Elevation difference between transducer taps is zero unless otherwise specified				
<u>Intact Loop</u>					
DPU-UP-1	Upper plenum 10.5 in. above cold leg centerline at 30° to hot leg, Spool 1, 31 in. from vessel center, upper plenum tap approximately 2 in. above Spool 1 tap	+50 in. water	+2.5 psid	142-145	Data have an apparent 0.23 psid drift during Test S-01-4A by 150 sec; detector should measure 0.072 psid for empty system with no flow
DPU-UP-3	Upper plenum 10.5 in. above cold leg centerline at 30° to hot leg, Spool 3, 62 in. from vessel center, upper plenum tap approximately 2 in. above Spool 3 tap	+300 in. water	+15 psid	146-149	
DPU-3-7	Across steam generator, hot leg, Spool 3, 62 in. from vessel center to cold leg Spool 7, 231 in. from vessel center, Spool 3 tap approximately 18 in. above Spool 7 tap	+500 in. water	+25 psid	150-153	
DPU-3-7L	Across steam generator, hot leg, Spool 3, 62 in. from vessel center to cold leg Spool 7, 231 in. from vessel center, Spool 3 tap approximately 18 in. above Spool 7 tap (low range)	+50 in. water	+2.5 psid	154-157	Data have a 0.15 psid offset during Test S-01-4
DPU-3-SGIP	Across inlet orifice of steam generator; hot leg, Spool 3, 62 in. from vessel center to steam generator inlet plenum, 145 in. from vessel center, Spool 3 tap is 16 in. below SGIP tap	+500 in. water	+25 psid	158-159	Data doubtful for Test S-01-4A; posttest calibration revealed faulty transducer
DPU-6-SGIP	Hot leg, Spool 6, 114 in. from vessel center to steam generator inlet plenum, 145 in. from vessel center, Spool 6 tap is 16 in. below SGIP tap	+800 in. water	+40 psid	160-163	Data have an apparent 0.60 psid drift during Test S-01-4A by 150 sec; detector should measure -0.57 psid for empty system with no flow
DPU-SG1-SG2	Across primary side tubes, 12 to 24 in. above bottom of tube sheet, SG1 tap is 12 in. below SG2 tap	+20 in. water	+1.0 psid	164-165	Data questionable; cell sense lines have potential for draining during blowdown. Detector failed during Test S-01-4A
DPU-SGOP-7	From steam generator outlet plenum, 269 in. from vessel center along cold leg to cold leg Spool 7, 231 in. from vessel center, including orifice, Spool 7 tap is 35 in. below SGOP tap	+500 in. water	+25 psid	166-169	
DPU-7-10	Steam generator outlet to pump inlet, cold leg Spool 7, 231 in. from vessel center to cold leg Spool 10, 141 in. from vessel center	+50 in. water	+2.5 psid	170-173	
DPU-8C-8D	In pump trap, cold leg Spool 8, Tap 8C, 197 in. from vessel center to Tap 8D, 184 in. from vessel center, Tap 8C is 10 in. below Tap 8D	+20 in. water	+1.0 psid	174-177	Data suspect; polarity appears reversed and calibration is questionable
DPU-8D-8E	In pump trap, cold leg Spool 8, Tap 8D, 184 in. from vessel center to Tap 8E, 174 in. from vessel center, Tap 8D is 10 in. below Tap 8E	+20 in. water	+1.0 psid	178-181	Data suspect; questionable calibration
DPU-12-10	Pump outlet to pump inlet, cold leg Spool 12, 75 in. from vessel center to cold leg Spool 10, 141 in. from vessel center, Spool 10 tap is 10 in. below Spool 12 tap	+50 psid	+50 psid	182-185	
DPU-12-10L	Pump outlet to pump inlet, cold leg Spool 12, 75 in. from vessel center to cold leg Spool 10, 141 in. from vessel center, Spool 10 tap is 10 in. below Spool 12 tap (low range)	+100 in. water	+5.0 psid	186-189	
DPU-12-15	Across cold leg injection point, cold leg Spool 12, 75 in. from vessel center to cold leg Spool 15, 16 in. from vessel center	+100 in. water	+5.0 psid	190-193	Data have an apparent 0.25 psid drift during Test S-01-4A by 150 sec; detector should measure 0 psid for empty system with no flow
DPU-15-1	Cold leg to hot leg, cold leg Spool 15, 16 in. from vessel center to hot leg Spool 1, 31 in. from vessel center, Spool 15 tap is 8.5 in. below Spool 1 tap	+500 in. water	+25 psid	194-197	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Intact Loop (Contd.)</u>					
DPU-15-1L	Cold leg to hot leg, cold leg Spool 15, 16 in. from vessel center to hot leg Spool 1, 31 in. from vessel center, Spool 15 tap is 8.5 in. below Spool 1 tap (low range)	+50 in. water	2.5 psid	198-201	Data acquisition system saturated at various times during Test S-01-4
DPU-15-IANN	Cold leg Spool 15, 16 in. from vessel center to inlet annulus 9 in. below cold leg centerline at 225°, Spool 15 tap is 9 in. above inlet annulus tap	+100 in. water	+5.0 psid	202-205	
DPU-15-ATM	Cold leg Spool 15, 16 in. from vessel center to atmosphere	+500 psid	+500 psid	206-209, 505	Data acquisition system saturated until t=23.5 sec during both tests
DPU-PRESLL	Pressurizer water level, elevation difference between taps is 34 in., lower tap is approximately 3.5 in. above pressurizer exit	+50 in. water	+2.5 psid	210-213, 506	The measured liquid level resulted in a calculated liquid volume at blowdown of 0.72 ft ³ for Test S-01-4 and 0.82 ft ³ for Test S-01-4A
<u>Broken Loop</u>					
DPB-IANN-21	Vessel inlet annulus, 9 in. below cold leg centerline at 225° to cold leg Spool 21, 49 in. from vessel center, inlet annulus tap, 9 in. below Spool 21 tap	+100 in. water	+5.0 psid	214-217	
DPB-21-23	Cold leg Spool 21, 49 in. from vessel center to cold leg Spool 23, 92 in. from vessel center	+800 in. water	+40 psid	218-221	
DPB-23-CNI	Cold leg Spool 23, 92 in. from vessel center to vessel-side nozzle throat, 96 in. from vessel center	+500 psid	+500 psid	222-225	
DPB-CN1-CN4	Vessel-side nozzle, nozzle throat, 96 in. from vessel center to nozzle divergent section, 101 in. from vessel center	+1000 psid	+1300 psid	226-229	
DPB-23-24	Across vessel-side nozzle, Spool 23, 92 in. from vessel center to Spool 24, 104 in. from vessel center	+1000 psid	+1300 psid	230-233	
DPB-UP-30	Vessel upper plenum 10.5 in. above cold leg centerline at 30° to hot leg Spool 30, 18 in. from vessel center, tap is 2 in. above Spool 30 tap	+100 in. water	+5.0 psid	234-237	
DPB-30-38	Across entire simulated steam generator assembly and instrument spool downstream of simulated steam generator, hot leg Spool 30, 18 in. from vessel center to cold leg Spool 38, 305 in. from vessel center along hot leg, Spool 30 is 40 in. above Spool 38	+100 psid	+100 psid	238-241	
DPB-30-32U	Hot leg Spool 30, 18 in. from vessel center to Spool 32 upper tap, 73 in. from vessel center, Spool 30 tap is 30 in. below Spool 32 upper tap	+50 psid	+50 psid	242-245	By 150 sec data have an apparent 0.85 psid drift during Test S-01-4 and an apparent 0.70 psid drift during Test S-01-4A; detector should measure -1.08 psid for empty system and no flow
DPB-32U-36L	Across simulated steam generator orifice assembly, hot leg Spool 32 upper tap, 73 in. from vessel center to Spool 36 lower tap, 242 in. from vessel center, Spool 32 upper tap is 16 in. above Spool 36 lower tap	+50 psid	+50 psid	246-249	
DPB-36L-37	Across nozzle assembly Spool 36 lower taps, 242 in. from vessel center along hot leg and Spool 37, 282 in. from vessel center along hot leg, Spool 37 is 40 in. below Spool 36 lower tap	+50 psid	+50 psid	250-253	
DPB-38-40	Across simulated pump, cold leg Spool 38, 305 in. from vessel center along hot leg to cold leg Spool 40, 365 in. from vessel center along hot leg	+1000 psid	+1300 psid	254-257	
DPB-40-42	Across elbow leading to spool upstream of pump-side nozzle, cold leg Spool 40, 365 in. from vessel center along hot leg to Spool 42, 415 in. from vessel center along hot leg, Spool 40 tap is 40 in. below Spool 42 tap	+50 psid	+50 psid		Posttest calibration revealed faulty detector
DPB-42-43	Across pump-side nozzle, cold leg Spool 42, 415 in. from vessel center along hot leg to cold leg Spool 43, 427 in. from vessel center along hot leg	+1500 psid	+2000 psid	258-261	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments (a)	Range (a)		Figure (a)	Measurement Comments (b)
		Detector	Data Acquisition System		
<u>Broken Loop (Contd.)</u>					
DPB-42-HN1	Spool 42 upstream of pump-side nozzle, 415 in. from vessel center along hot leg to nozzle throat, 419 in. from vessel center along hot leg	+500 psid	+500 psid	262-265	
DPB-HN1-HN4	Pump-side nozzle, nozzle throat, 419 in. from vessel center along hot leg to nozzle divergent section, 424 in. from vessel center along hot leg	+1500 psid	+2000 psid	266-269	
DPB-HN4-43	Pump-side nozzle, divergent section, 424 in. from vessel center along hot leg to downstream Spool 43, 427 in. from vessel center along hot leg	+50 psid	+50 psid	270-273	
<u>Vessel</u>					
DPU-15-1ANN	Intact loop cold leg Spool 15, 16 in. from vessel center to inlet annulus 9 in. below cold leg centerline at 225°, Spool 15 tap is 9 in. above inlet annulus tap	+100 in. water	+5.0 psid	202-205	
DPB-TANN-21	Vessel inlet annulus, 9 in. below cold leg centerline at 225° to broken loop cold leg, Spool 21, 49 in. from vessel center, inlet annulus tap is 9 in. below Spool 21 tap	+100 in. water	+5.0 psid	214-217	
DPV-UP-1ANN	Upper plenum, 10.5 in. above cold leg centerline at 30° to inlet annulus, 9 in. below cold leg centerline at 225° elevation difference between taps is 19 in.	+300 in. water	+14.8 psid	274-277	
DPV-0-9CQ	Inlet annulus cold leg centerline at 90° to 9 in. below cold leg centerline at 225°, elevation difference between taps is 9 in.	+20 in. water	+1.0 psid		Data not valid; leaking manifold common to differential pressure cells at 9 in. below cold leg centerline
DPV-9-26CQ	Inlet annulus, 9 in. below cold leg centerline at 225° to downcomer gap approximately 26 in. below cold leg centerline at 225°, elevation difference between taps is 17 in.	+50 in. water	+2.5 psid		Data not valid; leaking manifold common to differential pressure cells at 9 in. below cold leg centerline
DPV-9-180CQ	Inlet annulus, 9 in. below cold leg centerline at 225° to lower plenum, 180 in. below cold leg centerline at 225°, elevation difference between taps is 171 in.	+300 in. water	+14.8 psid		Data not valid; leaking manifold common to differential pressure cells at 9 in. below cold leg centerline
DPV-26-55QM	Across part of downcomer, 26 in. (225°) to 55 in. (180°) below centerline of cold leg, elevation difference between taps is 29 in.	+50 in. water	+2.5 psid	278-281	
DPV-55-110AM	Across part of downcomer, 55 in. (0°) to 110 in. (180°) below cold leg centerline, elevation difference between taps is 55 in.	+100 in. water	+5.0 psid	282-285	
DPV-110-156MQ	Across part of downcomer, 110 in. (180°) to 156 in. (225°) below cold leg centerline, elevation difference between taps is 46 in.	+100 in. water	+5.0 psid	286-289	
DPV-156-173CQ	Across downcomer exit, 7 in. above exit to 10 in. below exit, taps at 156 in. (225°) and 173 in. (225°) below cold leg centerline, elevation difference between taps is 17 in.	+20 in. water	+1.0 psid	290-293	Data suspect; questionable calibration
DPV-166-173CQ	Across part of lower plenum, 166 in. (225°) to 173 in. (225°) below cold leg centerline, elevation difference between taps is 7 in.	+20 in. water	+1.0 psid		Data suspect; questionable calibration
DPV-173-180CQ	Across part of lower plenum, 173 in. (225°) to 180 in. (225°) below cold leg centerline, elevation difference between taps is 7 in.	+20 in. water	+1.0 psid		Data not valid; leaking manifold common to differential pressure cells at 180 in. below cold leg centerline
DPV-180-191QT	Across part of lower plenum, 180 in. (225°) to 191 in. (270°) below cold leg centerline, elevation difference between taps is 11 in.	+20 in. water	+1.0 psid		Data not valid; leaking manifold common to differential pressure cells at 180 in. below cold leg centerline
DPV-166-191QT	Across lower plenum, 166 in. (225°) to 191 in. (270°) below cold leg centerline, elevation difference between taps is 25 in.	+50 in. water	+2.5 psid	298-301	
DPV-LP-UP	Lower plenum, 180 in. below cold leg centerline at 225° to upper plenum 10.5 in. above cold leg centerline at 30°, elevation difference between taps is 191 in.	+300 in.	+14.8 psid		Data not valid; leaking manifold common to differential pressure cells at 180 in. below cold leg centerline

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Vessel (Contd.)</u>					
DPU-UP-1	Upper plenum, 10.5 in. above cold leg centerline at 30° to intact loop hot leg Spool 1, 31 in. from vessel center, upper plenum tap is approximately 2 in. above Spool 1 tap	+50 in. water	+2.5 psid	142-145	Data have an apparent 0.23 psid drift during Test S-01-4A by 150 sec; detector should measure 0.072 psid for empty system with no flow
DPU-UP-3	Vessel upper plenum, 10.5 in. above cold leg centerline at 30° to intact loop hot leg Spool 3, 62 in. from vessel center, upper plenum tap is approximately 2 in. above Spool 3 tap	+300 in. water	+14.8 psid	146-149	
DPU-UP-30	Vessel upper plenum, 10.5 in. above cold leg centerline at 30° to broken loop hot leg Spool 30, 18 in. from vessel center, upper plenum tap is 2 in. above Spool 30 tap	+100 in. water	+5.0 psid	234-237	
<u>Steam Generator</u>					
DPU-3-SGIP	Across inlet orifice, hot leg Spool 3, 62 in. from vessel center to steam generator inlet plenum, 145 in. from vessel center, Spool 3 tap is 16 in. below SGIP tap	+500 in. water	+25 psid	158, 159	Data doubtful for Test S-01-4A; posttest calibration revealed faulty transducer
DPU-6-SGIP	Hot leg Spool 6, 114 in. from vessel center to steam generator inlet plenum, 145 in. from vessel center, Spool 6 tap is 16 in. below SGIP tap	+800 in. water	+40 psid	160-163	Data have an apparent 0.6 psid drift during Test S-01-4A by 150 sec; detector should measure -0.57 psid for empty system with no flow
DPU-SG1-SG2	Across primary side tubes, 12 to 24 in. above bottom of tube sheet, SG1 tap is 12 in. below SG2 tap	+20 in. water	+1.0 psid	164, 165	Data questionable; cell sense lines have potential for draining during blowdown. Detector failed during Test S-01-4A
DPU-SGOP-7	From steam generator outlet plenum, 269 in. from vessel center along cold leg to cold leg Spool 7, 231 in. from vessel center, including orifice, Spool 7 tap is 35 in. below SGOP tap	+500 in. water	+25 psid	166-169	
DPU-SG-SEC	Secondary side, differential pressure taps at 45 and 126 in. above bottom of tube sheet, elevation difference between taps is 81 in.	+100 in. water	+5.0 psid	302-305	Level calculated to be 118 in. for Test S-01-4 and 119.5 in. for Test S-01-4A
<u>Pressurizer</u>					
DPU-PRESLL	Pressurizer water level, elevation difference between taps is 34 in., lower tap is approximately 3.5 in. above pressurizer exit	+50 in. water	+2.5 psid	210-213, 506	The measured liquid level resulted in a calculated liquid volume at blowdown of 0.72 ft ³ for Test S-01-4 and 0.82 ft ³ for Test S-01-4A
<u>VOLUMETRIC FLOW RATE</u>					
<u>Intact Loop</u>					
3-in. Schedule 160 pipe					
FTU-1	Hot leg, Spool 1, 18 in. from vessel center	+20-400 gpm	+655 gpm	306-309	Detector range exceeded at various times during both tests
FTU-9	Cold leg, Spool 9, 154 in. from vessel center	+20-400 gpm	+649 gpm	306-309	Data acquisition system saturated at various times during both tests
FTU-13	Cold leg, Spool 13, 64 in. from vessel center	+20-400 gpm	+640 gpm	310-313	Data acquisition system saturated at various times during both tests
FTU-15	Cold leg, Spool 15, 29 in. from vessel center	+10-200 gpm	+389 gpm	310-313	
<u>Broken Loop</u>					
All measurements bidirectional, Schedule 160 pipe					
FTB-21	Cold leg, Spool 21, 58 in. from vessel center, 3-in. pipe	+20-400 gpm	+847 gpm	314, 316	Detector range exceeded at various times during Test S-01-4. Detector failed during Test S-01-4A
FTB-30	Hot leg, Spool 30, 25 in. from vessel center, 3-in. pipe	+20-400 gpm	+408 gpm	314-317	
FTB-37	Cold leg, Spool 37, 290 in. from vessel center along hot leg, 2-in. pipe	+10-200 gpm	+657 gpm	314-317	Detector range exceeded at various times during both tests
<u>Core</u>					
FTV-CORE-IN	Entrance to core, approximately 158 in. below cold leg centerline	+10-200 gpm	+405 gpm	318-321	Data acquisition system saturated at -380 gpm
FTV-LOFT-COR	In LOFT core simulator, 14 in. below cold leg centerline (LOFT drag-disc, turbine flowmeter combination)				Experimental detector; data not processed for this report

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>ECC System</u>					
FTU-LPIS	In line leading from LPIS for intact loop, 1/2-in. line	0.5-10 gpm	0-10 gpm	322	Detector failed during Test S-01-4
FTU-ACC	In line immediately after intact loop accumulator, 1-in. line	4-75 gpm	0-75 gpm	323-326, 507	Data spike at t=3 sec caused by air in line being forced through turbine flowmeter at automatic opening of accumulator valve. Data acquisition system saturated at t=95 sec during Test S-01-4 and at t=67 sec during Test S-01-4A
<u>Pressurizer</u>					
FTU-PRIZE	Surge line	5-100 gpm	0-111 gpm	327-330.	
<u>PRESSURE SUPPRESSION SYSTEM</u>					
FTPSS-SPRAY	1-1/2-in. line from accumulator for suppression tank spray	0.5-10 gpm	0-10 gpm	331-333, 508	Data have a 0.3 gpm offset prior to 126 sec during Test S-01-4 due to spurious electrical noise prior to actuation of flowmeter device. Time signal not affected during spray test. The same phenomena occur prior to rupture and after 33 seconds during Test S-01-4A. From 0 to 33 sec during Test S-01-4A measured flow is actually from pressure suppression tank to spray tank due to inadvertent opening of spray valve
<u>FLUID VELOCITY</u>					
<u>Downcomer Gap</u>					
FTV-22M	22 in. below cold leg centerline, 180°	+2.5-50 ft/sec	+50.4 ft/sec	334-337	Measured magnitude only during Test S-01-4. Detector range exceeded at t=52 sec during Test S-01-4 and at various times during Test S-01-4A
FTV-40A	40 in. below cold leg centerline, 0°	+2.5-50 ft/sec	+50.4 ft/sec	338-341	Detector range exceeded at various times during both tests. Failure of one of the two magnetic coil pickups during Test S-01-4 results in unidirectional capability only and makes measurement of velocity magnitude questionable
FTV-40M	40 in. below cold leg centerline, 180°	+2.5-50 ft/sec	+50.4 ft/sec	342-345	Detector range exceeded at various times during both tests
FTV-83A	83 in. below cold leg centerline, 0°	+1.8-36 ft/sec	+36 ft/sec	346-349	Detector measured magnitude only during both tests. Detector range exceeded at various times during both tests
FTV-83M	83 in. below cold leg centerline, 180°	+1.8-36 ft/sec	+36 ft/sec	350-353	Detector range exceeded at various times during both tests
FTV-130M	130 in. below cold leg centerline, 180°	+1-18 ft/sec	+18 ft/sec	354-357	Detector range exceeded at various times during Test S-01-4
FTV-161M	161 in. below cold leg centerline, 180°	+1-18 ft/sec	+18 ft/sec		Detector failed
<u>MOMENTUM FLUX</u>					
<u>Intact Loop</u>					
3-in. pipe					
FDU-1	Hot leg, Spool 1, 29 in. from vessel center, target size 0.875	+250-11,000 lb _m /ft-sec ²	+15,300 lb _m /ft-sec ²	358-361	
FDU-5	Hot leg, Spool 5, 100 in. from vessel center, target size 1.0	+1-2000 lb _m /ft-sec ²	+2000 lb _m /ft-sec ²		Data not valid; thermocouple in contact with drag disc
FDU-10	Cold leg, Spool 10, 137 in. from vessel center, target size 0.875	+200-104,000 lb _m /ft-sec ²	+130,000 lb _m /ft-sec ²	362-365	
FDU-13	Cold leg, Spool 13, 54 in. from vessel center, target size 0.875	+200-11,000 lb _m /ft-sec ²	+14,800 lb _m /ft-sec ²	366-369	
FDU-15	Cold leg, Spool 15, 19 in. from vessel center, target size 0.875	+200-11,600 lb _m /ft-sec ²	+15,500 lb _m /ft-sec ²	370-373	
<u>Broken Loop</u>					
FDB-21	Cold leg, Spool 21, 53 in. from vessel center, 3-in. pipe, target size 0.406	+200-70,500 lb _m /ft-sec ²	+94,000 lb _m /ft-sec ²	374-377	
FDB-23	Cold leg, Spool 23, 93 in. from vessel center, upstream of vessel-side nozzle 1.5-in. pipe, target size 0.406	+200-125,000 lb _m /ft-sec ²	+167,000 lb _m /ft-sec ²	378-381	
FDB-30	Hot leg, Spool 30, 21 in. from vessel center, 3-in. pipe, target size 0.656	+200-60,000 lb _m /ft-sec ²	+80,000 lb _m /ft-sec ²		Detector range resulted in an insensitivity to flows occurring at this location
FDB-37	Cold leg, Spool 37, 284 in. from vessel center along hot leg, steam generator outlet vertical pipe, 2-in. pipe, target size 0.406	+200-131,000 lb _m /ft-sec ²	+175,000 lb _m /ft-sec ²	382-385	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Broken Loop (Contd.)</u>					
FDB-42	Cold leg, Spool 42, 416 in. from vessel center along hot leg, upstream of pump-side nozzle, downstream of injection point, 1.5-in. pipe, target size 0.406	+200-116,000 lb _m /ft-sec ²	+155,000 lb _m /ft-sec ²	386-389	
<u>Vessel</u>					
FDV-CORE-IN	In core flow mixer box, 150 in. below cold leg centerline, target size 1.0	+100-1000 lb _m /ft-sec ²	+1000 lb _m /ft-sec ²	390, 391	Detector failed during Test S-01-4. Detector range exceeded prior to rupture and at t=65 sec during Test S-01-4A
FDV-LOFT-COR	In LOFT core simulator, 14 in. below cold leg centerline (LOFT drag-disc, turbine flowmeter combination) target size 0.500 in.				Experimental detector; data not processed for this report
DENSITY					
<u>Intact Loop</u>					
GU-1VR	Hot leg, Spool 1, 24 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	392-395	
GU-1HZ	Hot leg, Spool 1, 26 in. from vessel center, horizontal	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	392-395	
GU-5VR	Hot leg, Spool 5, 96 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	396-399	
GU-10VR	Cold leg, Spool 10, 141 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	396-399	
GU-13VR	Cold leg, Spool 13, 59 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	400-403	
GU-15HZ	Cold leg, Spool 15, 20 in. from vessel center, horizontal	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	404-407	
GU-15VR	Cold leg, Spool 15, 23 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	404-407	
<u>Broken Loop</u>					
GB-21VR	Cold leg, Spool 21, 49 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	408-411	
GB-23VR	Cold leg, Spool 23, 92 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	408-411	Increase in density immediately after rupture questionable during Test S-01-4A
GB-30VR	Hot leg, Spool 30, 18 in. from vessel center, vertical	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	412-415	
GB-37HZ	Cold leg, Spool 37, 279 in. from vessel center along hot leg, across vertical pipe, simulated steam generator discharge	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	412, 414	Not recorded during Test S-01-4A
GB-42VR	Cold leg, Spool 42, 415 in. from vessel center along hot leg, vertical	0-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	412-415	
<u>Vessel</u>					
GV-COR-150HZ	Core flow mixer box, 152 in. below cold leg centerline, horizontal, 0-180°	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	416-419, 509	
GV-161/192D	Lower plenum 161 in. below cold leg centerline (270°) to 192 in. below cold leg centerline (90°), 31 in. vertical 32.2 in. diagonal	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	416-419, 509	
GVLP-165HZ	Upper part of lower plenum, 165 in. below cold leg centerline, 1.724 in. below downcomer exit, horizontal, 0-180°	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	420, 421	Not recorded during Test S-01-4A
GVLP-172HZ	Lower plenum, 172 in. below cold leg centerline, 8.729 in. below downcomer exit, horizontal, 90-270°	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	420-423	
<u>Pressurizer</u>					
GU-PRIZE	Surge line	0.1-100 lb _m /ft-sec ²	0-100 lb _m /ft-sec ²	424-427	
LIQUID LEVEL					
<u>Steam Generator</u>					
DPV-SG-SEC	Secondary side, differential pressure taps at 45 and 126 in. above tube sheet, elevation difference between taps is 81 in.	+100 in. water	+5.0 psid	302-305	Level calculated to be 118 in. during Test S-01-4 and 119.5 in. during Test S-01-4A.

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS S-01-4 AND S-01-4A

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Pressurizer</u>					
DPU-PRESLL	Pressurizer water level, elevation difference between taps is 34 in., lower tap is approximately 3.5 in. above pressurizer exit	+50 in. water	+2.5 psid	210-213, 506	The measured liquid level resulted in a calculated liquid volume at blowdown of 0.72 ft ³ for Test S-01-4 and 0.82 ft ³ for Test S-01-4A
MASS FLOW RATE	Mass flow rate obtained by combining density (gamma attenuation technique) with volumetric flow rate (turbine flowmeter) or momentum flux (drag disc)	Range determined by range of individual measurements used in calculation			
<u>Intact Loop</u>					
FDU-1 GU-1VR	Hot leg, Spool 1			428-431	
FTU-1 GU-1VR				432-435	
FTU-PRIZE GU-PRIZE	Pressurizer surge line			436-439	
FDU-5 GU-5VR	Hot leg, Spool 5				Data not valid; FDU-5 in contact with drag disc
FDU-10 GU-10VR	Cold leg, Spool 10			440-443	
FDU-13 GU-13VR	Cold leg, Spool 13			444-447	
FTU-13 GU-13VR				448-451	
FDU-15 GU-15VR	Cold leg, Spool 15			452-455	
FTU-15 GU-15VR				456-459	
<u>Broken Loop</u>					
FDB-21 GB-21VR	Cold leg, Spool 21			460-463	
FTB-21 GB-21VR				464-465	FTB-21 failed during Test S-01-4A
FDB-23 GB-23VR	Cold leg, Spool 23			466-469	
FTB-30 GB-30VR	Hot leg, Spool 30			470-473	
FDB-37 GB-37HZ	Cold leg, Spool 37			474-475	GB-37HZ data not recorded during Test S-01-4A
FTB-37 GB-37HZ				476-477	
FDB-42 GB-42VR	Cold leg, Spool 42			478-481	
<u>Vessel</u>					
FTV-CORE-IN	Entrance to core			482-485	
GV-COR-150HZ					
FDV-CORE-IN	Entrance to core			486-487	FDV-CORE-IN failed during Test S-01-4
GV-COR-150HZ					
<u>PUMP CHARACTERISTICS</u>					
PUMPU-TORQ	Pump torque	0-500 in.-lb	0-500 in.-lb	488-491	
PUMPU-POW	Pump motor power		0-24.2 kW	492-495	
PUMPU-RPM	Pump speed	0-3600 rpm	0-3600 rpm	496-499	

[a] Statements at the beginning of a measurement category regarding location and comments, range, and figure apply to all subsequent measurements within the given category unless specified otherwise.

[b] Detectors which were subjected to overrange conditions during portions of the test were capable of withstanding these conditions without change in operation or measuring characteristics, when the physical conditions were again within the detector range.

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Fig. 6 Fluid temperatures in intact loop (RBU-2, TFU-5, TSU-7, TFU-10) from -2 to 150 seconds -- Test S-01-4.

Fig. 7 Fluid temperatures in intact loop (RBU-2, TFU-5, TSU-7, TFU-10) from -2 to 150 seconds -- Test S-01-4A.

Fig. 8 Fluid temperatures in intact loop (RBU-2, TFU-5, TSU-7, TFU-10) from -2 to 30 seconds -- Test S-01-4.

Fig. 9 Fluid temperatures in intact loop (RBU-2, TFU-5, TSU-7, TFU-10) from -2 to 30 seconds -- Test S-01-4A.

Fig. 10 Fluid temperatures in intact loop (TFU-13 and TFU-15) from -2 to 150 seconds -- Test S-01-4.

Fig. 11 Fluid temperatures in intact loop (TFU-13 and TFU-15) from -2 to 150 seconds -- Test S-01-4A.

Fig. 12 Fluid temperatures in intact loop (TFU-13 and TFU-15) from -2 to 30 seconds -- Test S-01-4.

Fig. 13 Fluid temperatures in intact loop (TFU-13 and TFU-15) from -2 to 30 seconds -- Test S-01-4A.

Fig. 14 Fluid temperatures in intact loop (TFU-14B and RBU-14A) from -2 to 150 seconds -- Test S-01-4.

Fig. 15 Fluid temperatures in intact loop (TFU-14B and RBU-14A) from -2 to 150 seconds -- Test S-01-4A.

Fig. 16 Fluid temperatures in intact loop (TFU-14B and RBU-14A) from -2 to 30 seconds -- Test S-01-4.

Fig. 17 Fluid temperatures in intact loop (TFU-14B and RBU-14A) from -2 to 30 seconds -- Test S-01-4A.

Fig. 18 Fluid temperatures in broken loop from -2 to 150 seconds -- Test S-01-4.

Fig. 19 Fluid temperatures in broken loop from -2 to 150 seconds -- Test S-01-4A.

Fig. 20 Fluid temperatures in broken loop from -2 to 30 seconds -- Test S-01-4.

Fig. 21 Fluid temperatures in broken loop from -2 to 30 seconds -- Test S-01-4A.

Fig. 22 Fluid temperatures in inlet annulus from -2 to 150 seconds -- Test S-01-4.

Fig. 23 Fluid temperatures in inlet annulus from -2 to 150 seconds -- Test S-01-4A.

Fig. 24 Fluid temperatures in inlet annulus from -2 to 30 seconds -- Test S-01-4.

Fig. 25 Fluid temperatures in inlet annulus from -2 to 30 seconds -- Test S-01-4A.

Fig. 26 Fluid temperatures in downcomer annulus (TFV-ANN-15A, TFV-ANN-15M, TFV-ANN-15T, and TFV-ANN-35A) from -2 to 150 seconds -- Test S-01-4.

Fig. 27 Fluid temperatures in downcomer annulus (TFV-ANN-15A, TFV-ANN-15M, TFV-ANN-15T, and TFV-ANN-35A) from -2 to 150 seconds -- Test S-01-4A.

Fig. 28 Fluid temperatures in downcomer annulus (TFV-ANN-15A, TFV-ANN-15M, TFV-ANN-15T, and TFV-ANN-35A) from -2 to 30 seconds -- Test S-01-4.

Fig. 29 Fluid temperatures in downcomer annulus (TFV-ANN-15A, TFV-ANN-15M, TFV-ANN-15T, and TFV-ANN-35A) from -2 to 30 seconds -- Test S-01-4A.

Fig. 30 Fluid temperatures in downcomer annulus (TFV-ANN-35M, TFV-ANN-35T, TFV-ANN-115A, and TFV-ANN-156A) from -2 to 150 seconds -- Test S-01-4.

Fig. 31 Fluid temperatures in downcomer annulus (TFV-ANN-35M, TFV-ANN-35T, TFV-ANN-115A, and TFV-ANN-156A) from -2 to 150 seconds -- Test S-01-4A.

Fig. 32 Fluid temperatures in downcomer annulus (TFV-ANN-35M, TFV-ANN-35T, TFV-ANN-115A, and TFV-ANN-156A) from -2 to 30 seconds -- Test S-01-4.

Fig. 33 Fluid temperatures in downcomer annulus (TFV-ANN-35M, TFV-ANN-35T, TFV-ANN-115A, and TFV-ANN-156A) from -2 to 30 seconds -- Test S-01-4A.

Fig. 34 Fluid temperatures in lower plenum from -2 to 150 seconds -- Test S-01-4.

Fig. 35 Fluid temperatures in lower plenum from -2 to 150 seconds -- Test S-01-4A.

Fig. 36 Fluid temperatures in lower plenum from -2 to 30 seconds -- Test S-01-4.

Fig. 37 Fluid temperatures in lower plenum from -2 to 30 seconds -- Test S-01-4A.

Fig. 38 Fluid temperature in core (LOFT) from -2 to 150 seconds -- Test S-01-4.

Fig. 39 Fluid temperature in core (LOFT) from -2 to 150 seconds -- Test S-01-4A.

Fig. 40 Fluid temperature in core (LOFT) from -2 to 30 seconds -- Test S-01-4.

Fig. 41 Fluid temperature in core (LOFT) from -2 to 30 seconds -- Test S-01-4A.

Fig. 42 Fluid temperatures in core barrel insulation gap from -2 to 150 seconds -- Test S-01-4.

Fig. 43 Fluid temperatures in core barrel insulation gap from -2 to 150 seconds -- Test S-01-4A.

Fig. 44 Fluid temperatures in core barrel insulation gap from -2 to 30 seconds -- Test S-01-4.

Fig. 45 Fluid temperatures in core barrel insulation gap from -2 to 30 seconds -- Test S-01-4A.

Fig. 46 Fluid temperatures in vessel filler insulation gap from -2 to 150 seconds -- Test S-01-4.

Fig. 47 Fluid temperatures in vessel filler insulation gap from -2 to 150 seconds -- Test S-01-4A.

Fig. 48 Fluid temperatures in vessel filler insulation gap from -2 to 30 seconds -- Test S-01-4.

Fig. 49 Fluid temperatures in vessel filler insulation gap from -2 to 30 seconds -- Test S-01-4A.

Fig. 50 Fluid temperature in ECC injection line to Spool 14 from -2 to 150 seconds -- Test S-01-4.

Fig. 51 Fluid temperature in ECC injection line to Spool 14 from -2 to 150 seconds -- Test S-01-4A.

Fig. 52 Fluid temperature in ECC injection line to Spool 14 from -2 to 30 seconds -- Test S-01-4.

Fig. 53 Fluid temperature in ECC injection line to Spool 14 from -2 to 30 seconds -- Test S-01-4A.

Fig. 54 Fluid temperatures in steam generator from -2 to 150 seconds -- Test S-01-4.

Fig. 55 Fluid temperatures in steam generator from -2 to 150 seconds -- Test S-01-4A.

Fig. 56 Fluid temperatures in steam generator from -2 to 30 seconds -- Test S-01-4.

Fig. 57 Fluid temperatures in steam generator from -2 to 30 seconds -- Test S-01-4A.

Fig. 58 Fluid temperature in pressurizer surge line from -2 to 150 seconds -- Test S-01-4.

Fig. 59 Fluid temperature in pressurizer surge line from -2 to 150 seconds -- Test S-01-4A.

Fig. 60 Fluid temperature in pressurizer surge line from -2 to 30 seconds -- Test S-01-4.

Fig. 61 Fluid temperature in pressurizer surge line from -2 to 30 seconds -- Test S-01-4A.

Fig. 62 Fluid temperatures in pressure suppression tank from -2 to 150 seconds -- Test S-01-4.

Fig. 63 Fluid temperatures in pressure suppression tank from -2 to 150 seconds -- Test S-01-4A.

Fig. 64 Fluid temperatures in pressure suppression tank from -2 to 30 seconds -- Test S-01-4.

Fig. 65 Fluid temperatures in pressure suppression tank from -2 to 30 seconds -- Test S-01-4A.

Fig. 66 Material temperatures in intact loop (TMU-1S16, TMU-1B16, and TMU-7S16) from -2 to 150 seconds -- Test S-01-4.

Fig. 67 Material temperatures in intact loop (TMU-1S16, TMU-1B16, and TMU-7S16) from -2 to 150 seconds -- Test S-01-4A.

Fig. 68 Material temperatures in intact loop (TMU-1S16, TMU-1B16, and TMU-7S16) from -2 to 30 seconds -- Test S-01-4.

Fig. 69 Material temperatures in intact loop (TMU-1S16, TMU-1B16, and TMU-7S16) from -2 to 30 seconds -- Test S-01-4A.

Fig. 70 Material temperatures in intact loop (TMU-8S4, TMU-8S16, TMU-10S16, TMU-15T16, and TMU-15B16) from -2 to 150 seconds -- Test S-01-4.

Fig. 71 Material temperatures in intact loop (TMU-8S4, TMU-8S16, TMU-10S16, TMU-15T16, and TMU-15B16) from -2 to 150 seconds -- Test S-01-4A.

Fig. 72 Material temperatures in intact loop (TMU-8S4, TMU-8S16, TMU-10S16, TMU-15T16, and TMU-15B16) from -2 to 30 seconds -- Test S-01-4.

Fig. 73 Material temperatures in intact loop (TMU-8S16, TMU-10S16, TMU-15T16, and TMU-15B16) from -2 to 30 seconds -- Test S-01-4A.

Fig. 74 Material temperatures in broken loop from -2 to 150 seconds -- Test S-01-4.

Fig. 75 Material temperatures in broken loop from -2 to 150 seconds -- Test S-01-4A.

Fig. 76 Material temperatures in broken loop from -2 to 30 seconds -- Test S-01-4.

Fig. 77 Material temperatures in broken loop from -2 to 30 seconds -- Test S-01-4A.

Fig. 78 Material temperatures in vessel wall from -2 to 150 seconds -- Test S-01-4.

Fig. 79 Material temperatures in vessel wall from -2 to 150 seconds -- Test S-01-4A.

Fig. 80 Material temperatures in vessel wall from -2 to 30 seconds -- Test S-01-4.

Fig. 81 Material temperatures in vessel wall from -2 to 30 seconds -- Test S-01-4A.

Fig. 82 Material temperatures in vessel filler outside diameter from -2 to 150 seconds -- Test S-01-4.

Fig. 83 Material temperatures in vessel filler outside diameter from -2 to 150 seconds -- Test S-01-4A.

Fig. 84 Material temperatures in vessel filler outside diameter from -2 to 30 seconds -- Test S-01-4.

Fig. 85 Material temperatures in vessel filler outside diameter from -2 to 30 seconds -- Test S-01-4A.

Fig. 86 Material temperatures in vessel filler inside diameter (TMV-FI-4M, TMV-FI-15A, TMV-FI-35A, and TMV-FI-35M) from -2 to 150 seconds -- Test S-01-4.

Fig. 87 Material temperatures in vessel filler inside diameter (TMV-FI-4M, TMV-FI-15A, TMV-FI-35A, and TMV-FI-35M) from -2 to 150 seconds -- Test S-01-4A.

Fig. 88 Material temperatures in vessel filler inside diameter (TMV-FI-4M, TMV-FI-15A, TMV-FI-35A, and TMV-FI-35M) from -2 to 30 seconds -- Test S-01-4.

Fig. 89 Material temperatures in vessel filler inside diameter (TMV-FI-4M, TMV-FI-15A, TMV-FI-35A, and TMV-FI-35M) from -2 to 30 seconds -- Test S-01-4A.

Fig. 90 Material temperatures in vessel filler inside diameter (TMV-FI-70A, TMV-FI-115A, TMV-FI-156A, TMV-FI-156M, and TMV-FI-177M) from -2 to 150 seconds -- Test S-01-4.

Fig. 91 Material temperatures in vessel filler inside diameter (TMV-FI-70A, TMV-FI-115A, TMV-FI-156A, TMV-FI-156M, and TMV-FI-177M) from -2 to 150 seconds -- Test S-01-4A.

Fig. 92 Material temperatures in vessel filler inside diameter (TMV-FI-70A, TMV-FI-115A, TMV-FI-156A, TMV-FI-156M, and TMV-FI-177M) from -2 to 30 seconds -- Test S-01-4.

Fig. 93 Material temperatures in vessel filler inside diameter (TMV-FI-70A, TMV-FI-115A, TMV-FI-156A, TMV-FI-156M, and TMV-FI-177M) from -2 to 30 seconds -- Test S-01-4A.

Fig. 94 Material temperatures in vessel filler insulator from -2 to 150 seconds -- Test S-01-4.

Fig. 95 Material temperatures in vessel filler insulator from -2 to 150 seconds -- Test S-01-4A.

Fig. 96 Material temperatures in vessel filler insulator from -2 to 30 seconds -- Test S-01-4.

Fig. 97 Material temperatures in vessel filler insulator from -2 to 30 seconds -- Test S-01-4A.

Fig. 98 Material temperature in vessel lower head from -2 to 150 seconds -- Test S-01-4.

Fig. 99 Material temperature in vessel lower head from -2 to 150 seconds -- Test S-01-4A.

Fig. 100 Material temperature in vessel lower head from -2 to 30 seconds -- Test S-01-4.

Fig. 101 Material temperature in vessel lower head from -2 to 30 seconds -- Test S-01-4A.

Fig. 102 Material temperatures in core barrel outside diameter (TMV-CO-4A, TMV-CO-4M, and TMV-CO-15A) from -2 to 150 seconds -- Test S-01-4.

Fig. 103 Material temperatures in core barrel outside diameter (TMV-CO-4A, TMV-CO-4M, and TMV-CO-15A) from -2 to 150 seconds -- Test S-01-4A.

Fig. 104 Material temperatures in core barrel outside diameter (TMV-CO-4A, TMV-CO-4M, and TMV-CO-15A) from -2 to 30 seconds -- Test S-01-4.

Fig. 105 Material temperatures in core barrel outside diameter (TMV-CO-4A and TMV-CO-15A) from -2 to 30 seconds -- Test S-01-4A.

Fig. 106 Material temperatures in core barrel outside diameter (TMV-CO-70A, TMV-CO-115A, TMV-CO-115M, and TMV-CO-127A) from -2 to 150 seconds -- Test S-01-4.

Fig. 107 Material temperatures in core barrel outside diameter (TMV-CO-70A, TMV-CO-115A, TMV-CO-115M, and TMV-CO-127A) from -2 to 150 seconds -- Test S-01-4A.

Fig. 108 Material temperatures in core barrel outside diameter (TMV-CO-70A, TMV-CO-115A, TMV-CO-115M, and TMV-CO-127A) from -2 to 30 seconds -- Test S-01-4.

Fig. 109 Material temperatures in core barrel outside diameter (TMV-CO-70A, TMV-CO-115A, TMV-CO-115M, and TMV-CO-127A) from -2 to 30 seconds -- Test S-01-4A.

Fig. 110 Material temperatures in core barrel inside diameter from -2 to 150 seconds -- Test S-01-4.

Fig. 111 Material temperatures in core barrel inside diameter from -2 to 150 seconds -- Test S-01-4A.

Fig. 112 Material temperatures in core barrel inside diameter from -2 to 30 seconds -- Test S-01-4.

Fig. 113 Material temperatures in core barrel inside diameter from -2 to 30 seconds -- Test S-01-4A.

Fig. 114 Material temperatures in steam generator from -2 to 150 seconds -- Test S-01-4.

Fig. 115 Material temperatures in steam generator from -2 to 150 seconds -- Test S-01-4A.

Fig. 116 Material temperatures in steam generator from -2 to 30 seconds -- Test S-01-4.

Fig. 117 Material temperatures in steam generator from -2 to 30 seconds -- Test S-01-4A.

Fig. 118 Pressures in broken loop vessel side of break from -2 to 150 seconds -- Test S-01-4.

Fig. 119 Pressures in broken loop vessel side of break from -2 to 150 seconds -- Test S-01-4A.

Fig. 120 Pressures in broken loop vessel side of break from -2 to 30 seconds -- Test S-01-4.

Fig. 121 Pressures in broken loop vessel side of break from -2 to 30 seconds -- Test S-01-4A.

Fig. 122 Pressures in broken loop pump side of break from -2 to 150 seconds -- Test S-01-4.

Fig. 123 Pressures in broken loop pump side of break from -2 to 150 seconds -- Test S-01-4A.

Fig. 124 Pressures in broken loop pump side of break from -2 to 30 seconds -- Test S-01-4.

Fig. 125 Pressures in broken loop pump side of break from -2 to 30 seconds -- Test S-01-4A.

Fig. 126 Pressures in vessel from -2 to 150 seconds -- Test S-01-4.

Fig. 127 Pressures in vessel from -2 to 150 seconds -- Test S-01-4A.

Fig. 128 Pressures in vessel from -2 to 30 seconds -- Test S-01-4.

Fig. 129 Pressures in vessel from -2 to 30 seconds -- Test S-01-4A.

Fig. 130 Pressure in intact loop ECC accumulator from -2 to 150 seconds -- Test S-01-4.

Fig. 131 Pressure in intact loop ECC accumulator from -2 to 150 seconds -- Test S-01-4A.

Fig. 132 Pressure in intact loop ECC accumulator from -2 to 30 seconds -- Test S-01-4.

Fig. 133 Pressure in intact loop ECC accumulator from -2 to 30 seconds -- Test S-01-4A.

Fig. 134 Pressure in pressurizer from -2 to 150 seconds -- Test S-01-4.

Fig. 135 Pressure in pressurizer from -2 to 150 seconds -- Test S-01-4A.

Fig. 136 Pressure in pressurizer from -2 to 30 seconds -- Test S-01-4.

Fig. 137 Pressure in pressurizer from -2 to 30 seconds -- Test S-01-4A.

Fig. 138 Pressure in pressure suppression tank from -2 to 150 seconds -- Test S-01-4.

Fig. 139 Pressure in pressure suppression tank from -2 to 150 seconds -- Test S-01-4A.

Fig. 140 Pressure in pressure suppression tank from -2 to 30 seconds -- Test S-01-4.

Fig. 141 Pressure in pressure suppression tank from -2 to 30 seconds -- Test S-01-4A.

Fig. 142 Differential pressure in intact loop (upper plenum to Spool 1) from -2 to 150 seconds -- Test S-01-4.

Fig. 143 Differential pressure in intact loop (upper plenum to Spool 1) from -2 to 150 seconds -- Test S-01-4A.

Fig. 144 Differential pressure in intact loop (upper plenum to Spool 1) from -2 to 30 seconds -- Test S-01-4.

Fig. 145 Differential pressure in intact loop (upper plenum to Spool 1) from -2 to 30 seconds -- Test S-01-4A.

Fig. 146 Differential pressure in intact loop (upper plenum to Spool 3) from -2 to 150 seconds -- Test S-01-4.

Fig. 147 Differential pressure in intact loop (upper plenum to Spool 3) from -2 to 150 seconds -- Test S-01-4A.

Fig. 148 Differential pressure in intact loop (upper plenum to Spool 3) from -2 to 30 seconds -- Test S-01-4.

Fig. 149 Differential pressure in intact loop (upper plenum to Spool 3) from -2 to 30 seconds -- Test S-01-4A.

Fig. 150 Differential pressure in intact loop (Spool 3 to Spool 7) from -2 to 150 seconds -- Test S-01-4.

Fig. 151 Differential pressure in intact loop (Spool 3 to Spool 7) from -2 to 150 seconds -- Test S-01-4A.

Fig. 152 Differential pressure in intact loop (Spool 3 to Spool 7) from -2 to 30 seconds -- Test S-01-4.

Fig. 153 Differential pressure in intact loop (Spool 3 to Spool 7) from -2 to 30 seconds -- Test S-01-4A.

Fig. 154 Differential pressure in intact loop, low range (Spool 3 to Spool 7) from -2 to 150 seconds -- Test S-01-4.

Fig. 155 Differential pressure in intact loop, low range (Spool 3 to Spool 7) from -2 to 150 seconds -- Test S-01-4A.

Fig. 156 Differential pressure in intact loop, low range (Spool 3 to Spool 7) from -2 to 30 seconds -- Test S-01-4.

Fig. 157 Differential pressure in intact loop, low range (Spool 3 to Spool 7) from -2 to 30 seconds -- Test S-01-4A.

Fig. 158 Differential pressure in intact loop (Spool 3 to steam generator inlet plenum) from -2 to 150 seconds -- Test S-01-4.

Fig. 159 Differential pressure in intact loop (Spool 3 to steam generator inlet plenum) from -2 to 30 seconds -- Test S-01-4.

Fig. 160 Differential pressure in intact loop (Spool 6 to steam generator inlet plenum) from -2 to 150 seconds -- Test S-01-4.

Fig. 161 Differential pressure in intact loop (Spool 6 to steam generator inlet plenum) from -2 to 150 seconds -- Test S-01-4A.

Fig. 162 Differential pressure in intact loop (Spool 6 to steam generator inlet plenum) from -2 to 30 seconds -- Test S-01-4.

Fig. 163 Differential pressure in intact loop (Spool 6 to steam generator inlet plenum) from -2 to 30 seconds -- Test S-01-4A.

Fig. 164 Differential pressure in intact loop (SG1 to SG2) from -2 to 150 seconds -- Test S-01-4.

Fig. 165 Differential pressure in intact loop (SG1 to SG2) from -2 to 30 seconds -- Test S-01-4.

Fig. 166 Differential pressure in intact loop (steam generator outlet plenum to Spool 7) from -2 to 150 seconds -- Test S-01-4.

Fig. 167 Differential pressure in intact loop (steam generator outlet plenum to Spool 7) from -2 to 150 seconds -- Test S-01-4A.

Fig. 168 Differential pressure in intact loop (steam generator outlet plenum to Spool 7) from -2 to 30 seconds -- Test S-01-4.

Fig. 169 Differential pressure in intact loop (steam generator outlet plenum to Spool 7) from -2 to 30 seconds -- Test S-01-4A.

Fig. 170 Differential pressure in intact loop (Spool 7 to Spool 10) from -2 to 150 seconds -- Test S-01-4.

Fig. 171 Differential pressure in intact loop (Spool 7 to Spool 10) from -2 to 150 seconds -- Test S-01-4A.

Fig. 172 Differential pressure in intact loop (Spool 7 to Spool 10) from -2 to 30 seconds -- Test S-01-4.

Fig. 173 Differential pressure in intact loop (Spool 7 to Spool 10) from -2 to 30 seconds -- Test S-01-4A.

Fig. 174 Differential pressure in intact loop (Spool 8C to Spool 8D) from -2 to 150 seconds -- Test S-01-4.

Fig. 175 Differential pressure in intact loop (Spool 8C to Spool 8D) from -2 to 150 seconds -- Test S-01-4A.

Fig. 176 Differential pressure in intact loop (Spool 8C to Spool 8D) from -2 to 30 seconds -- Test S-01-4.

Fig. 177 Differential pressure in intact loop (Spool 8C to Spool 8D) from -2 to 30 seconds -- Test S-01-4A.

Fig. 178 Differential pressure in intact loop (Spool 8D to Spool 8E) from -2 to 150 seconds -- Test S-01-4.

Fig. 179 Differential pressure in intact loop (Spool 8D to Spool 8E) from -2 to 150 seconds -- Test S-01-4A.

Fig. 180 Differential pressure in intact loop (Spool 8D to Spool 8E) from -2 to 30 seconds -- Test S-01-4.

Fig. 181 Differential pressure in intact loop (Spool 8D to Spool 8E) from -2 to 30 seconds -- Test S-01-4A.

Fig. 182 Differential pressure in intact loop (Spool 12 to Spool 10) from -2 to 150 seconds -- Test S-01-4.

Fig. 183 Differential pressure in intact loop (Spool 12 to Spool 10) from -2 to 150 seconds -- Test S-01-4A.

Fig. 184 Differential pressure in intact loop (Spool 12 to Spool 10) from -2 to 30 seconds -- Test S-01-4.

Fig. 185 Differential pressure in intact loop (Spool 12 to Spool 10) from -2 to 30 seconds -- Test S-01-4A.

Fig. 186 Differential pressure in intact loop, low range (Spool 12 to Spool 10) from -2 to 150 seconds -- Test S-01-4.

Fig. 187 Differential pressure in intact loop, low range (Spool 12 to Spool 10) from -2 to 150 seconds -- Test S-01-4A.

Fig. 188 Differential pressure in intact loop, low range (Spool 12 to Spool 10) from -2 to 30 seconds -- Test S-01-4.

Fig. 189 Differential pressure in intact loop, low range (Spool 12 to Spool 10) from -2 to 30 seconds -- Test S-01-4A.

Fig. 190 Differential pressure in intact loop (Spool 12 to Spool 15) from -2 to 150 seconds -- Test S-01-4.

Fig. 191 Differential pressure in intact loop (Spool 12 to Spool 15) from -2 to 150 seconds -- Test S-01-4A.

Fig. 192 Differential pressure in intact loop (Spool 12 to Spool 15) from -2 to 30 seconds -- Test S-01-4.

Fig. 193 Differential pressure in intact loop (Spool 12 to Spool 15) from -2 to 30 seconds -- Test S-01-4A.

Fig. 194 Differential pressure in intact loop (Spool 15 to Spool 1) from -2 to 150 seconds -- Test S-01-4.

Fig. 195 Differential pressure in intact loop (Spool 15 to Spool 1) from -2 to 150 seconds -- Test S-01-4A.

Fig. 196 Differential pressure in intact loop (Spool 15 to Spool 1) from -2 to 30 seconds -- Test S-01-4.

Fig. 197 Differential pressure in intact loop (Spool 15 to Spool 1) from -2 to 30 seconds -- Test S-01-4A.

Fig. 198 Differential pressure in intact loop, low range (Spool 15 to Spool 1) from -2 to 150 seconds -- Test S-01-4.

Fig. 199 Differential pressure in intact loop, low range (Spool 15 to Spool 1) from -2 to 150 seconds -- Test S-01-4A.

Fig. 200 Differential pressure in intact loop, low range (Spool 15 to Spool 1) from -2 to 30 seconds -- Test S-01-4.

Fig. 201 Differential pressure in intact loop, low range (Spool 15 to Spool 1) from -2 to 30 seconds -- Test S-01-4A.

Fig. 202 Differential pressure in intact loop (Spool 15 to vessel inlet annulus) from -2 to 150 seconds -- Test S-01-4.

Fig. 203 Differential pressure in intact loop (Spool 15 to vessel inlet annulus) from -2 to 150 seconds -- Test S-01-4A.

Fig. 204 Differential pressure in intact loop (Spool 15 to vessel inlet annulus) from -2 to 30 seconds -- Test S-01-4.

Fig. 205 Differential pressure in intact loop (Spool 15 to vessel inlet annulus) from -2 to 30 seconds -- Test S-01-4A.

Fig. 206 Differential pressure in intact loop (Spool 15 to atmosphere) from -2 to 150 seconds -- Test S-01-4.

Fig. 207 Differential pressure in intact loop (Spool 15 to atmosphere) from -2 to 150 seconds -- Test S-01-4A.

Fig. 208 Differential pressure in intact loop (Spool 15 to atmosphere) from -2 to 30 seconds -- Test S-01-4.

Fig. 209 Differential pressure in intact loop (Spool 15 to atmosphere) from -2 to 30 seconds -- Test S-01-4A.

Fig. 210 Differential pressure in intact loop (pressurizer liquid level) from -2 to 150 seconds -- Test S-01-4.

Fig. 211 Differential pressure in intact loop (pressurizer liquid level) from -2 to 150 seconds -- Test S-01-4A.

Fig. 212 Differential pressure in intact loop (pressurizer liquid level) from -2 to 30 seconds -- Test S-01-4.

Fig. 213 Differential pressure in intact loop (pressurizer liquid level) from -2 to 30 seconds -- Test S-01-4A.

Fig. 214 Differential pressure in broken loop (vessel inlet annulus to Spool 21) from -2 to 150 seconds -- Test S-01-4.

Fig. 215 Differential pressure in broken loop (vessel inlet annulus to Spool 21) from -2 to 150 seconds -- Test S-01-4A.

Fig. 216 Differential pressure in broken loop (vessel inlet annulus to Spool 21) from -2 to 30 seconds -- Test S-01-4.

Fig. 217 Differential pressure in broken loop (vessel inlet annulus to Spool 21) from -2 to 30 seconds -- Test S-01-4A.

Fig. 218 Differential pressure in broken loop (Spool 21 to Spool 23) from -2 to 150 seconds -- Test S-01-4.

Fig. 219 Differential pressure in broken loop (Spool 21 to Spool 23) from -2 to 150 seconds -- Test S-01-4A.

Fig. 220 Differential pressure in broken loop (Spool 21 to Spool 23) from -2 to 30 seconds -- Test S-01-4.

Fig. 221 Differential pressure in broken loop (Spool 21 to Spool 23) from -2 to 30 seconds -- Test S-01-4A.

Fig. 222 Differential pressure in broken loop (Spool 23 to vessel-side nozzle throat) from -2 to 150 seconds -- Test S-01-4.

Fig. 223 Differential pressure in broken loop (Spool 23 to vessel-side nozzle throat) from -2 to 150 seconds -- Test S-01-4A.

Fig. 224 Differential pressure in broken loop (Spool 23 to vessel-side nozzle throat) from -2 to 30 seconds -- Test S-01-4.

Fig. 225 Differential pressure in broken loop (Spool 23 to vessel-side nozzle throat) from -2 to 30 seconds -- Test S-01-4A.

Fig. 226 Differential pressure in broken loop (vessel-side nozzle throat to divergent section) from -2 to 150 seconds -- Test S-01-4.

Fig. 227 Differential pressure in broken loop (vessel-side nozzle throat to divergent section) from -2 to 150 seconds -- Test S-01-4A.

Fig. 228 Differential pressure in broken loop (vessel-side nozzle throat to divergent section) from -2 to 30 seconds -- Test S-01-4.

Fig. 229 Differential pressure in broken loop (vessel-side nozzle throat to divergent section) from -2 to 30 seconds -- Test S-01-4A.

Fig. 230 Differential pressure in broken loop (Spool 23 to Spool 24) from -2 to 150 seconds -- Test S-01-4.

Fig. 231 Differential pressure in broken loop (Spool 23 to Spool 24) from -2 to 150 seconds -- Test S-01-4A.

Fig. 232 Differential pressure in broken loop (Spool 23 to Spool 24) from -2 to 30 seconds -- Test S-01-4.

Fig. 233 Differential pressure in broken loop (Spool 23 to Spool 24) from -2 to 30 seconds -- Test S-01-4A.

Fig. 234 Differential pressure in broken loop (upper plenum to Spool 30) from -2 to 150 seconds -- Test S-01-4.

Fig. 235 Differential pressure in broken loop (upper plenum to Spool 30) from -2 to 150 seconds -- Test S-01-4A.

Fig. 236 Differential pressure in broken loop (upper plenum to Spool 30) from -2 to 30 seconds -- Test S-01-4.

Fig. 237 Differential pressure in broken loop (upper plenum to Spool 30) from -2 to 30 seconds -- Test S-01-4A.

Fig. 238 Differential pressure in broken loop (Spool 30 to Spool 38) from -2 to 150 seconds -- Test S-01-4.

Fig. 239 Differential pressure in broken loop (Spool 30 to Spool 38) from -2 to 150 seconds -- Test S-01-4A.

Fig. 240 Differential pressure in broken loop (Spool 30 to Spool 38) from -2 to 30 seconds -- Test S-01-4.

Fig. 241 Differential pressure in broken loop (Spool 30 to Spool 38) from -2 to 30 seconds -- Test S-01-4A.

Fig. 242 Differential pressure in broken loop (Spool 30 to Spool 32U) from -2 to 150 seconds -- Test S-01-4.

Fig. 243 Differential pressure in broken loop (Spool 30 to Spool 32U) from -2 to 150 seconds -- Test S-01-4A.

Fig. 244 Differential pressure in broken loop (Spool 30 to Spool 32U) from -2 to 30 seconds -- Test S-01-4.

Fig. 245 Differential pressure in broken loop (Spool 30 to Spool 32U) from -2 to 30 seconds -- Test S-01-4A.

Fig. 246 Differential pressure in broken loop (Spool 32U to Spool 36L) from -2 to 150 seconds -- Test S-01-4.

Fig. 247 Differential pressure in broken loop (Spool 32U to Spool 36L) from -2 to 150 seconds -- Test S-01-4A.

Fig. 248 Differential pressure in broken loop (Spool 32U to Spool 36L) from -2 to 30 seconds -- Test S-01-4.

Fig. 249 Differential pressure in broken loop (Spool 32U to Spool 36L) from -2 to 30 seconds -- Test S-01-4A.

Fig. 250 Differential pressure in broken loop (Spool 36L to Spool 37) from -2 to 150 seconds -- Test S-01-4.

Fig. 251 Differential pressure in broken loop (Spool 36L to Spool 37) from -2 to 150 seconds -- Test S-01-4A.

Fig. 252 Differential pressure in broken loop (Spool 36L to Spool 37) from -2 to 30 seconds -- Test S-01-4.

Fig. 253 Differential pressure in broken loop (Spool 36L to Spool 37) from -2 to 30 seconds -- Test S-01-4A.

Fig. 254 Differential pressure in broken loop (Spool 38 to Spool 40) from -2 to 150 seconds -- Test S-01-4.

Fig. 255 Differential pressure in broken loop (Spool 38 to Spool 40) from -2 to 150 seconds -- Test S-01-4A.

Fig. 256 Differential pressure in broken loop (Spool 38 to Spool 40) from -2 to 30 seconds -- Test S-01-4.

Fig. 257 Differential pressure in broken loop (Spool 38 to Spool 40) from -2 to 30 seconds -- Test S-01-4A.

Fig. 258 Differential pressure in broken loop (Spool 42 to Spool 43) from -2 to 150 seconds -- Test S-01-4.

Fig. 259 Differential pressure in broken loop (Spool 42 to Spool 43) from -2 to 150 seconds -- Test S-01-4A.

Fig. 260 Differential pressure in broken loop (Spool 42 to Spool 43) from -2 to 30 seconds -- Test S-01-4.

Fig. 261 Differential pressure in broken loop (Spool 42 to Spool 43) from -2 to 30 seconds -- Test S-01-4A.

Fig. 262 Differential pressure in broken loop (Spool 42 to pump-side nozzle throat) from -2 to 150 seconds -- Test S-01-4.

Fig. 263 Differential pressure in broken loop (Spool 42 to pump-side nozzle throat) from -2 to 150 seconds -- Test S-01-4A.

Fig. 264 Differential pressure in broken loop (Spool 42 to pump-side nozzle throat) from -2 to 30 seconds -- Test S-01-4.

Fig. 265 Differential pressure in broken loop (Spool 42 to pump-side nozzle throat) from -2 to 30 seconds -- Test S-01-4A.

Fig. 266 Differential pressure in broken loop (pump-side nozzle throat to divergent section) from -2 to 150 seconds -- Test S-01-4.

Fig. 267 Differential pressure in broken loop (pump-side nozzle throat to divergent section) from -2 to 150 seconds -- Test S-01-4A.

Fig. 268 Differential pressure in broken loop (pump-side nozzle throat to divergent section) from -2 to 30 seconds -- Test S-01-4.

Fig. 269 Differential pressure in broken loop (pump-side nozzle throat to divergent section) from -2 to 30 seconds -- Test S-01-4A.

Fig. 270 Differential pressure in broken loop (pump-side nozzle divergent section to Spool 43) from -2 to 150 seconds -- Test S-01-4.

Fig. 271 Differential pressure in broken loop (pump-side nozzle divergent section to Spool 43) from -2 to 150 seconds -- Test S-01-4A.

Fig. 272 Differential pressure in broken loop (pump-side nozzle divergent section to Spool 43) from -2 to 30 seconds -- Test S-01-4.

Fig. 273 Differential pressure in broken loop (pump-side nozzle divergent section to Spool 43) from -2 to 30 seconds -- Test S-01-4A.

Fig. 274 Differential pressure in vessel (upper plenum to inlet annulus) from -2 to 150 seconds -- Test S-01-4.

Fig. 275 Differential pressure in vessel (upper plenum to inlet annulus) from -2 to 150 seconds -- Test S-01-4A.

Fig. 276 Differential pressure in vessel (upper plenum to inlet annulus) from -2 to 30 seconds -- Test S-01-4.

Fig. 277 Differential pressure in vessel (upper plenum to inlet annulus) from -2 to 30 seconds -- Test S-01-4A.

Fig. 278 Differential pressure in vessel (DPV-26-55QM) from -2 to 150 seconds -- Test S-01-4.

Fig. 279 Differential pressure in vessel (DPV-26-55QM) from -2 to 150 seconds -- Test S-01-4A.

Fig. 280 Differential pressure in vessel (DPV-26-55QM) from -2 to 30 seconds -- Test S-01-4.

Fig. 281 Differential pressure in vessel (DPV-26-55QM) from -2 to 30 seconds -- Test S-01-4A.

Fig. 282 Differential pressure in vessel (DPV-55-110AM) from -2 to 150 seconds -- Test S-01-4.

Fig. 283 Differential pressure in vessel (DPV-55-110AM) from -2 to 150 seconds -- Test S-01-4A.

Fig. 284 Differential pressure in vessel (DPV-55-110AM) from -2 to 30 seconds -- Test S-01-4.

Fig. 285 Differential pressure in vessel (DPV-55-110AM) from -2 to 30 seconds -- Test S-01-4A.

Fig. 286 Differential pressure in vessel (DPV-110-156MQ) from -2 to 150 seconds -- Test S-01-4.

Fig. 287 Differential pressure in vessel (DPV-110-156MQ) from -2 to 150 seconds -- Test S-01-4A.

Fig. 288 Differential pressure in vessel (DPV-110-156MQ) from -2 to 30 seconds -- Test S-01-4.

Fig. 289 Differential pressure in vessel (DPV-110-156MQ) from -2 to 30 seconds -- Test S-01-4A.

Fig. 290 Differential pressure in vessel (DPV-156-173QQ) from -2 to 150 seconds -- Test S-01-4.

Fig. 291 Differential pressure in vessel (DPV-156-173QQ) from -2 to 150 seconds -- Test S-01-4A.

Fig. 292 Differential pressure in vessel (DPV-156-173QQ) from -2 to 30 seconds -- Test S-01-4.

Fig. 293 Differential pressure in vessel (DPV-156-173QQ) from -2 to 30 seconds -- Test S-01-4A.

Fig. 294 Differential pressure in vessel (DPV-166-173QQ) from -2 to 150 seconds -- Test S-01-4.

Fig. 295 Differential pressure in vessel (DPV-166-173QQ) from -2 to 150 seconds -- Test S-01-4A.

Fig. 296 Differential pressure in vessel (DPV-166-173QQ) from -2 to 30 seconds -- Test S-01-4.

Fig. 297 Differential pressure in vessel (DPV-166-173QQ) from -2 to 30 seconds -- Test S-01-4A.

Fig. 298 Differential pressure in vessel (DPV-166-191QT) from -2 to 150 seconds -- Test S-01-4.

Fig. 299 Differential pressure in vessel (DPV-166-191QT) from -2 to 150 seconds -- Test S-01-4A.

Fig. 300 Differential pressure in vessel (DPV-166-191QT) from -2 to 30 seconds -- Test S-01-4.

Fig. 301 Differential pressure in vessel (DPV-166-191QT) from -2 to 30 seconds -- Test S-01-4A.

Fig. 302 Differential pressure in steam generator secondary (secondary side liquid level) from -2 to 150 seconds -- Test S-01-4.

Fig. 303 Differential pressure in steam generator secondary (secondary side liquid level) from -2 to 150 seconds -- Test S-01-4A.

Fig. 304 Differential pressure in steam generator secondary (secondary side liquid level) from -2 to 30 seconds -- Test S-01-4.

Fig. 305 Differential pressure in steam generator secondary (secondary side liquid level) from -2 to 30 seconds -- Test S-01-4A.

Fig. 306 Volumetric flows in intact loop (FTU-1 and FTU-9) from -2 to 150 seconds -- Test S-01-4.

Fig. 307 Volumetric flows in intact loop (FTU-1 and FTU-9) from -2 to 150 seconds -- Test S-01-4A.

Fig. 308 Volumetric flows in intact loop (FTU-1 and FTU-9) from -2 to 30 seconds -- Test S-01-4.

Fig. 309 Volumetric flows in intact loop (FTU-1 and FTU-9) from -2 to 30 seconds -- Test S-01-4A.

Fig. 310 Volumetric flows in intact loop (FTU-13 and FTU-15) from -2 to 150 seconds -- Test S-01-4.

Fig. 311 Volumetric flows in intact loop (FTU-13 and FTU-15) from -2 to 150 seconds -- Test S-01-4A.

Fig. 312 Volumetric flows in intact loop (FTU-13 and FTU-15) from -2 to 30 seconds -- Test S-01-4.

Fig. 313 Volumetric flows in intact loop (FTU-13 and FTU-15) from -2 to 30 seconds -- Test S-01-4A.

Fig. 314 Volumetric flows in broken loop (FTB-21, FTB-30, and FTB-37) from -2 to 150 seconds -- Test S-01-4.

Fig. 315 Volumetric flows in broken loop (FTB-30 and FTB-37) from -2 to 150 seconds -- Test S-01-4A.

Fig. 316 Volumetric flows in broken loop (FTB-21, FTB-30, and FTB-37) from -2 to 30 seconds -- Test S-01-4.

Fig. 317 Volumetric flows in broken loop (FTB-30 and FTB-37) from -2 to 30 seconds -- Test S-01-4A.

Fig. 318 Volumetric flow in core entrance from -2 to 150 seconds -- Test S-01-4.

Fig. 319 Volumetric flow in core entrance from -2 to 150 seconds -- Test S-01-4A.

Fig. 320 Volumetric flow in core entrance from -2 to 30 seconds -- Test S-01-4.

Fig. 321 Volumetric flow in core entrance from -2 to 30 seconds -- Test S-01-4A.

Fig. 322 Volumetric flow from low pressure injection system from -2 to 150 seconds -- Test S-01-4A.

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Fig. 323 Volumetric flow from intact loop accumulator from -2 to 150 seconds -- Test S-01-4.

Fig. 324 Volumetric flow from intact loop accumulator from -2 to 150 seconds -- Test S-01-4A.

Fig. 325 Volumetric flow from intact loop accumulator from -2 to 30 seconds -- Test S-01-4.

Fig. 326 Volumetric flow from intact loop accumulator from -2 to 30 seconds -- Test S-01-4A.

Fig. 327 Volumetric flow from pressurizer from -2 to 150 seconds -- Test S-01-4.

Fig. 328 Volumetric flow from pressurizer from -2 to 150 seconds -- Test S-01-4A.

Fig. 329 Volumetric flow from pressurizer from -2 to 30 seconds -- Test S-01-4.

Fig. 330 Volumetric flow from pressurizer from -2 to 30 seconds -- Test S-01-4A.

Fig. 331 Volumetric flow from pressure suppression spray system from -2 to 150 seconds -- Test S-01-4.

Fig. 332 Volumetric flow from pressure suppression spray system from -2 to 150 seconds -- Test S-01-4A.

Fig. 333 Volumetric flow from pressure suppression spray system from -2 to 30 seconds -- Test S-01-4A.

Fig. 334 Fluid velocity in vessel (FTV-22M) from -2 to 150 seconds -- Test S-01-4.

Fig. 335 Fluid velocity in vessel (FTV-22M) from -2 to 150 seconds -- Test S-01-4A.

Fig. 336 Fluid velocity in vessel (FTV-22M) from -2 to 30 seconds -- Test S-01-4.

Fig. 337 Fluid velocity in vessel (FTV-22M) from -2 to 30 seconds -- Test S-01-4A.

Fig. 338 Fluid velocity in vessel (FTV-40A) from -2 to 150 seconds -- Test S-01-4.

Fig. 339 Fluid velocity in vessel (FTV-40A) from -2 to 150 seconds -- Test S-01-4A.

Fig. 340 Fluid velocity in vessel (FTV-40A) from -2 to 30 seconds -- Test S-01-4.

Fig. 341 Fluid velocity in vessel (FTV-40A) from -2 to 30 seconds -- Test S-01-4A.

Fig. 342 Fluid velocity in vessel (FTV-40M) from -2 to 150 seconds -- Test S-01-4.

Fig. 343 Fluid velocity in vessel (FTV-40M) from -2 to 150 seconds -- Test S-01-4A.

Fig. 344 Fluid velocity in vessel (FTV-40M) from -2 to 30 seconds -- Test S-01-4.

Fig. 345 Fluid velocity in vessel (FTV-40M) from -2 to 30 seconds -- Test S-01-4A.

Fig. 346 Fluid velocity in vessel (FTV-83A) from -2 to 150 seconds -- Test S-01-4.

Fig. 347 Fluid velocity in vessel (FTV-83A) from -2 to 150 seconds -- Test S-01-4A.

Fig. 348 Fluid velocity in vessel (FTV-83A) from -2 to 30 seconds -- Test S-01-4.

Fig. 349 Fluid velocity in vessel (FTV-83A) from -2 to 30 seconds -- Test S-01-4A.

Fig. 350 Fluid velocity in vessel (FTV-83M) from -2 to 150 seconds -- Test S-01-4.

Fig. 351 Fluid velocity in vessel (FTV-83M) from -2 to 150 seconds -- Test S-01-4A.

Fig. 352 Fluid velocity in vessel (FTV-83M) from -2 to 30 seconds -- Test S-01-4.

Fig. 353 Fluid velocity in vessel (FTV-83M) from -2 to 30 seconds -- Test S-01-4A.

Fig. 354 Fluid velocity in vessel (FTV-130M) from -2 to 150 seconds -- Test S-01-4.

Fig. 355 Fluid velocity in vessel (FTV-130M) from -2 to 150 seconds -- Test S-01-4A.

Fig. 356 Fluid velocity in vessel (FTV-130M) from -2 to 30 seconds -- Test S-01-4.

Fig. 357 Fluid velocity in vessel (FTV-130M) from -2 to 30 seconds -- Test S-01-4A.

Fig. 358 Momentum flux in intact loop (Spool 1) from -2 to 150 seconds -- Test S-01-4.

Fig. 359 Momentum flux in intact loop (Spool 1) from -2 to 150 seconds -- Test S-01-4A.

Fig. 360 Momentum flux in intact loop (Spool 1) from -2 to 30 seconds -- Test S-01-4.

Fig. 361 Momentum flux in intact loop (Spool 1) from -2 to 30 seconds -- Test S-01-4A.

Fig. 362 Momentum flux in intact loop (Spool 10) from -2 to 150 seconds -- Test S-01-4.

Fig. 363 Momentum flux in intact loop (Spool 10) from -2 to 150 seconds -- Test S-01-4A.

Fig. 364 Momentum flux in intact loop (Spool 10) from -2 to 30 seconds -- Test S-01-4.

Fig. 365 Momentum flux in intact loop (Spool 10) from -2 to 30 seconds -- Test S-01-4A.

Fig. 366 Momentum flux in intact loop (Spool 13) from -2 to 150 seconds -- Test S-01-4.

Fig. 367 Momentum flux in intact loop (Spool 13) from -2 to 150 seconds -- Test S-01-4A.

Fig. 368 Momentum flux in intact loop (Spool 13) from -2 to 30 seconds -- Test S-01-4.

Fig. 369 Momentum flux in intact loop (Spool 13) from -2 to 30 seconds -- Test S-01-4A.

Fig. 370 Momentum flux in intact loop (Spool 15) from -2 to 150 seconds -- Test S-01-4.

Fig. 371 Momentum flux in intact loop (Spool 15) from -2 to 150 seconds -- Test S-01-4A.

Fig. 372 Momentum flux in intact loop (Spool 15) from -2 to 30 seconds -- Test S-01-4.

Fig. 373 Momentum flux in intact loop (Spool 15) from -2 to 30 seconds -- Test S-01-4A.

Fig. 374 Momentum flux in broken loop (Spool 21) from -2 to 150 seconds -- Test S-01-4.

Fig. 375 Momentum flux in broken loop (Spool 21) from -2 to 150 seconds -- Test S-01-4A.

Fig. 376 Momentum flux in broken loop (Spool 21) from -2 to 30 seconds -- Test S-01-4.

Fig. 377 Momentum flux in broken loop (Spool 21) from -2 to 30 seconds -- Test S-01-4A.

Fig. 378 Momentum flux in broken loop (Spool 23) from -2 to 150 seconds -- Test S-01-4.

Fig. 379 Momentum flux in broken loop (Spool 23) from -2 to 150 seconds -- Test S-01-4A.

Fig. 380 Momentum flux in broken loop (Spool 23) from -2 to 30 seconds -- Test S-01-4.

Fig. 381 Momentum flux in broken loop (Spool 23) from -2 to 30 seconds -- Test S-01-4A.

Fig. 382 Momentum flux in broken loop (Spool 37) from -2 to 150 seconds -- Test S-01-4.

Fig. 383 Momentum flux in broken loop (Spool 37) from -2 to 150 seconds -- Test S-01-4A.

Fig. 384 Momentum flux in broken loop (Spool 37) from -2 to 30 seconds -- Test S-01-4.

Fig. 385 Momentum flux in broken loop (Spool 37) from -2 to 30 seconds -- Test S-01-4A.

Fig. 386 Momentum flux in broken loop (Spool 42) from -2 to 150 seconds -- Test S-01-4.

Fig. 387 Momentum flux in broken loop (Spool 42) from -2 to 150 seconds -- Test S-01-4A.

Fig. 388 Momentum flux in broken loop (Spool 42) from -2 to 30 seconds -- Test S-01-4.

Fig. 389 Momentum flux in broken loop (Spool 42) from -2 to 30 seconds -- Test S-01-4A.

Fig. 390 Momentum flux in core entrance from -2 to 150 seconds -- Test S-01-4A.

Fig. 391 Momentum flux in core entrance from -2 to 30 seconds -- Test S-01-4A.

Fig. 392 Densities in intact loop (GU-1VR and GU-1HZ) from -2 to 150 seconds -- Test S-01-4.

Fig. 393 Densities in intact loop (GU-1VR and GU-1HZ) from -2 to 150 seconds -- Test S-01-4A.

Fig. 394 Densities in intact loop (GU-1VR and GU-1HZ) from -2 to 30 seconds -- Test S-01-4.

Fig. 395 Densities in intact loop (GU-1VR and GU-1HZ) from -2 to 30 seconds -- Test S-01-4A.

Fig. 396 Densities in intact loop (GU-5VR and GU-10VR) from -2 to 150 seconds -- Test S-01-4.

Fig. 397 Densities in intact loop (GU-5VR and GU-10VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 398 Densities in intact loop (GU-5VR and GU-10VR) from -2 to 30 seconds -- Test S-01-4.

Fig. 399 Densities in intact loop (GU-5VR and GU-10VR) from -2 to 30 seconds -- Test S-01-4A.

Fig. 400 Density in intact loop (GU-13VR) from -2 to 150 seconds -- Test S-01-4.

Fig. 401 Density in intact loop (GU-13VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 402 Density in intact loop (GU-13VR) from -2 to 30 seconds -- Test S-01-4.

Fig. 403 Density in intact loop (GU-13VR) from -2 to 30 seconds -- Test S-01-4A.

Fig. 404 Densities in intact loop (GU-15VR and GU-15HZ) from -2 to 150 seconds -- Test S-01-4.

Fig. 405 Densities in intact loop (GU-15VR and GU-15HZ) from -2 to 150 seconds -- Test S-01-4A.

Fig. 406 Densities in intact loop (GU-15VR and GU-15HZ) from -2 to 30 seconds -- Test S-01-4.

Fig. 407 Densities in intact loop (GU-15VR and GU-15HZ) from -2 to 30 seconds -- Test S-01-4A.

Fig. 408 Densities in broken loop (GB-21VR and GB-23VR) from -2 to 150 seconds -- Test S-01-4.

Fig. 409 Densities in broken loop (GB-21VR and GB-23VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 410 Densities in broken loop (GB-21VR and GB-23VR) from -2 to 30 seconds -- Test S-01-4.

Fig. 411 Densities in broken loop (GB-21VR and GB-23VR) from -2 to 30 seconds -- Test S-01-4A.

Fig. 412 Densities in broken loop (GB-30VR, GB-37HZ, and GB-42VR) from -2 to 150 seconds -- Test S-01-4.

Fig. 413 Densities in broken loop (GB-30VR and GB-42VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 414 Densities in broken loop (GB-30VR, GB-37HZ, and GB-42VR) from -2 to 30 seconds -- Test S-01-4.

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Fig. 417 Densities in vessel (GV-COR-150HZ and GV-161/192D) from -2 to 150 seconds -- Test S-01-4A.

Fig. 418 Densities in vessel (GV-COR-150HZ and GV-161/192D) from -2 to 30 seconds -- Test S-01-4.

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Fig. 421 Density in vessel (GVLP-172HZ) from -2 to 150 seconds -- Test S-01-4A.

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Fig. 423 Density in vessel (GVLP-172HZ) from -2 to 30 seconds -- Test S-01-4A.

Fig. 424 Density in pressurizer from -2 to 150 seconds -- Test S-01-4.

Fig. 425 Density in pressurizer from -2 to 150 seconds -- Test S-01-4A.

Fig. 426 Density in pressurizer from -2 to 30 seconds -- Test S-01-4.

Fig. 427 Density in pressurizer from -2 to 30 seconds -- Test S-01-4A.

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Fig. 429 Mass flow in intact loop (FDU-1 and GU-1VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 430 Mass flow in intact loop (FDU-1 and GU-1VR) from -2 to 30 seconds -- Test S-01-4.

Fig. 431 Mass flow in intact loop (FDU-1 and GU-1VR) from -2 to 30 seconds -- Test S-01-4A.

Fig. 432 Mass flow in intact loop (FTU-1 and GU-1VR) from -2 to 150 seconds -- Test S-01-4.

Fig. 433 Mass flow in intact loop (FTU-1 and GU-1VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 434 Mass flow in intact loop (FTU-1 and GU-1VR) from -2 to 30 seconds -- Test S-01-4.

Fig. 435 Mass flow in intact loop (FTU-1 and GU-1VR) from -2 to 30 seconds -- Test S-01-4A.

Fig. 436 Mass flow from pressurizer from -2 to 150 seconds -- Test S-01-4.

Fig. 437 Mass flow from pressurizer from -2 to 150 seconds -- Test S-01-4A.

Fig. 438 Mass flow from pressurizer from -2 to 30 seconds -- Test S-01-4.

Fig. 439 Mass flow from pressurizer from -2 to 30 seconds -- Test S-01-4A.

Fig. 440 Mass flow in intact loop (FDU-10 and GU-10VR) from -2 to 150 seconds -- Test S-01-4.

Fig. 441 Mass flow in intact loop (FDU-10 and GU-10VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 442 Mass flow in intact loop (FDU-10 and GU-10VR) from -2 to 30 seconds -- Test S-01-4.

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Fig. 445 Mass flow in intact loop (FDU-13 and GU-13VR) from -2 to 150 seconds -- Test S-01-4A.

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Fig. 450 Mass flow in intact loop (FTU-13 and GU-13VR) from -2 to 30 seconds -- Test S-01-4.

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Fig. 455 Mass flow in intact loop (F DU-15 and GU-15VR) from -2 to 30 seconds -- Test S-01-4A.

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Fig. 462 Mass flow in broken loop (FDB-21 and GB-21VR) from -2 to 30 seconds -- Test S-01-4.

Fig. 463 Mass flow in broken loop (FDB-21 and GB-21VR) from -2 to 30 seconds -- Test S-01-4A.

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Fig. 466 Mass flow in broken loop (FDB-23 and GB-23VR) from -2 to 150 seconds -- Test S-01-4.

Fig. 467 Mass flow in broken loop (FDB-23 and GB-23VR) from -2 to 150 seconds -- Test S-01-4A.

Fig. 468 Mass flow in broken loop (FDB-23 and GB-23VR) from -2 to 30 seconds -- Test S-01-4.

Fig. 469 Mass flow in broken loop (FDB-23 and GB-23VR) from -2 to 30 seconds -- Test S-01-4A.

Fig. 470 Mass flow in broken loop (FTB-30 and GB-30VR) from -2 to 150 seconds -- Test S-01-4.

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Fig. 472 Mass flow in broken loop (FTB-30 and GB-30VR) from -2 to 30 seconds -- Test S-01-4.

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Fig. 479 Mass flow in broken loop (FDB-42 and GB-42VR) from -2 to 150 seconds -- Test S-01-4A.

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Fig. 484 Mass flow in vessel (FTV-CORE-IN and GV-COR-150HZ) from -2 to 30 seconds -- Test S-01-4.

Fig. 485 Mass flow in vessel (FTV-CORE-IN and GV-COR-150HZ) from -2 to 30 seconds -- Test S-01-4A.

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Fig. 491 Primary pump torque from -2 to 30 seconds -- Test S-01-4A.

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Fig. 493 Primary pump power from -2 to 150 seconds -- Test S-01-4A.

Fig. 494 Primary pump power from -2 to 30 seconds -- Test S-01-4.

Fig. 495 Primary pump power from -2 to 30 seconds -- Test S-01-4A.

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Fig. 497 Primary pump speed from -2 to 150 seconds -- Test S-01-4A.

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Fig. 499 Primary pump speed from -2 to 30 seconds -- Test S-01-4A.

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