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EXPERIMENT DATA REPORT FOR SEMISCALE
MOD-1 TEST S-01-5
(ISOTHERMAL BLOWDOWN WITH CORE RESISTANCE SIMULATOR)

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

MASTER

Aerojet Nuclear Company

IDAHO NATIONAL ENGINEERING LABORATORY

Idaho Falls, Idaho — 83401

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Light Water Reactor Safety and Technology –
System Interactions and Effects
TID-4500

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by

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ABSTRACT

Recorded test data are presented for Test S-01-5 of the semiscale Mod-1 isothermal blowdown test series. Test S-01-5 is one of several semiscale Mod-1 experiments which are counterparts of the LOFT nonnuclear experiments. System hardware is representative of LOFT with the design based on volumetric scaling methods and with initial conditions duplicating those identified for LOFT nonnuclear tests.

Test S-01-5 was conducted with the secondary side of the steam generator pressurized with nitrogen gas in order to effectively eliminate heat transfer from the steam generator during blowdown and thereby to investigate the effect on overall system behavior of heat transfer from the steam generator. An orificed structure was used in the pressure vessel to simulate the LOFT core simulator. The test was initiated at isothermal conditions of 2270 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 operating loop to simulate emergency core cooling (ECC). Following the blowdown portion of the test, 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 Test S-01-5 and to provide the reference material needed 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

Test S-01-5 was 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. This test was one 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. Test S-01-5 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 (LOCA). The semiscale Mod-1 program has the further general 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 area of interest specific to Test S-01-5 was the effect of heat transfer from the steam generator to the intact loop primary fluid during blowdown. The secondary side of the steam generator was pressurized with nitrogen gas instead of the saturated steam and water used during previous tests. All other system operating conditions were set to duplicate the conditions of Test S-01-4.

The recorded initial conditions of 2270 psig and 540°F and other initial conditions were within acceptable bounds to allow analysis of the test data. The rupture assemblies were actuated essentially simultaneously, satisfactorily simulating an instantaneous offset shear of the broken loop cold leg piping. In general, instrumentation used in Test S-01-5 functioned as intended (of 199 measurements attempted, 191 produced usable data). Data loss during Test S-01-5 was sufficiently low that the test was considered to have been conducted successfully.

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EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1

TEST S-01-5

(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 coupled-thermal hydraulic processes occurring during an LOCA.

Test S-01-5 was conducted as part of a series of tests 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. Test S-01-5 was conducted with the secondary side of the steam generator filled with pressurized nitrogen gas to investigate the effects on system response (relative to Test S-01-4^[1]) by effectively eliminating heat transfer from the steam generator to the intact loop fluid during blowdown. The test was initiated by a simulated offset shear of the broken loop cold leg piping. An accumulator was used to inject simulated ECC into the cold leg of the intact loop during blowdown at a system pressure of 600 psig. ECC injection was also provided by one low-pressure injection pump. 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 briefly describes the system configuration, procedures, initial test conditions, and events that are applicable to Test S-01-5. 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 2. Data from other tests in this series are presented in References 1 through 3.

II. SYSTEM, PROCEDURES, CONDITIONS, AND EVENTS FOR TEST S-01-5

The following system configuration, procedures, initial test conditions, and events are specific to Test S-01-5.

1. SYSTEM CONFIGURATION AND TEST PROCEDURES

The semiscale Mod-1 system used for Test S-01-5 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 2.

For Test S-01-5, the secondary side of the intact loop steam generator was flushed and filled with nitrogen gas instead of the saturated steam and water used in previous tests. The nitrogen pressure was maintained at 960 psig throughout both the warmup period and the test.

In preparation for Test S-01-5, 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°F 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 test, initial test conditions were held for about 20 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. However, a posttest review of the temperature data from the hot leg bypass line indicated a leak through one block valve that allowed this line to blow down with the rest of the system.

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 rupture to allow the pump to coast down to a speed of 1320 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, beginning approximately 20 seconds after initiation of blowdown, and continued for approximately 68 seconds. Injection from the low-pressure injection pump was initiated 35.5 seconds after the initiation of blowdown; however, due to the pump response lag, actual low-pressure injection did not start until 38 seconds after initiation of blowdown. Low-pressure injection was continued until the pressure in the suppression tank reached an equilibrium value at 188 seconds after initiation of blowdown.

2. INITIAL TEST CONDITIONS AND SEQUENCE OF EVENTS

Conditions in the semiscale Mod-1 system at initiation of blowdown are given at 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

	<u>Measured</u> ^[a]	<u>Specified</u>
System fluid temperature (intact loop, vessel outlet)	540°F	540° <u>+2</u> °F
System pressure (vessel upper plenum)	2270 psig	2250 <u>+25</u> psig
Intact loop cold leg flow	175 gpm	173 <u>+2</u> gpm
Intact loop accumulator pressure	598 psig	600 psig ^[b]
Temperature of injected coolant	82°F	85°F ^[b]
Intact loop accumulator water volume	2.55 ft ³	2.37 ft ³ ^[b]
Intact loop accumulator gas volume	1.28 ft ³	1.47 ft ³ ^[b]
Pressurizer water volume	0.74 ft ³	0.73 <u>+0.05</u> ft ³
Steam generator secondary pressure	960 psig	963 <u>+40</u> psig
Steam generator secondary fluid temperature	519°F	540° <u>+5</u> °F
Pressure suppression tank water level	47 in.	47.5 in. ^[b]
Pressure suppression tank pressure	17.9 psig	17.4 <u>+1</u> psig
Pressure suppression tank water temperature	156°F	156° <u>+1</u> °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)
Vessel lower plenum (lower portion)	TFV-LP-1-1/2	537
Vessel lower plenum (upper portion)	TFV-LP-27-1/2	544
Hot leg, intact loop (near vessel)	RBU-2	540
Hot leg, intact loop (104 in. from vessel center)	TFU-5	543
Hot leg, intact loop (near steam generator)	TSU-7	543
Cold leg, intact loop	RBU-14A	542
Cold leg, broken loop (near vessel)	TFB-20	541
Cold leg, broken loop (near nozzle)	TFB-23	543
Hot leg, broken loop (near vessel)	TFB-30	540
Broken loop (near pump-side nozzle)	TFB-42	535
Reflood bypass, cold leg	TFB-RFBC	537
Reflood bypass, hot leg	TFB-RFBC	535

TABLE III

WATER CHEMISTRY PRIOR TO BLOWDOWN^[a]

pH	10.38
Conductivity (μmhos/cm)	56.2
Suspended Solids (ppm)	2.31
Chlorides (ppm)	0.112
H ₂ (cc/l)	1.9
O ₂ (cc/l)	0.6
N ₂ (cc/l)	160.3
CO ₂ (cc/l)	0.2
Total Gas (cc/l)	164.3

[a] Water sample taken at a system pressure of 2250 psig and a system temperature of 540°F.

TABLE IV

SEQUENCE OF EVENTS DURING TEST S-01-5^[a]

	<u>Time Relative To Rupture (sec)</u>
Heatup bypass lines valved out of system	-6
Initiation of blowdown	0
Initiation of ECC injection from intact loop ECC accumulator	20
Initiation of ECC injection from intact loop low-pressure injection system	38
Termination of ECC injection from intact loop ECC accumulator	88
Initiation of spray to suppression tank	129
Termination of ECC injection from intact loop low-pressure injection system	188

[a] A time-control sequencer was used to control critical events during the test.

III. DATA PRESENTATION

The data from semiscale Mod-1 Test S-01-5 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 in the isothermal tests may have subjected the measurement devices to nonhomogeneous fluid conditions.

The performance of the semiscale Mod-1 system during Test S-01-5 was monitored by 199 detectors. The data obtained were recorded on a digital data acquisition system and on an analog data acquisition system. The digital system, which is part of the computerized data acquisition 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 2.

Figures 1 through 5 and Table V provide supporting information for interpretation of the data graphs shown in Figures 6 through 278. 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 Test S-01-5 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 267 present the data obtained. In addition, selected measurements are repeated for Test S-01-5 in Figures 268 through 278 on a line scale of -2 to 205 seconds to provide data on the effects of pressure suppression system cooling spray. Time zero on all graphs presented is the time of rupture initiation.

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

Fig. 2 Semiscale Mod-1 system and instrumentation -- schematic.

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

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

Fig. 5 Semiscale Mod-1 pressure vessel -- penetrations and instrumentation.

TABLE V
DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

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>					
RBU-2	Hot leg, Spool 2, 46 in. from vessel center (platinum resistance bulb)	0-2300°F	0-591°F	6, 7	
TFU-5	Hot leg, Spool 5, 104 in. from vessel center	0-1000°F	0-1000°F	6, 7	
TSU-7	Cold leg, Spool 7, 246 in. from vessel center			6, 7	
TFU-10	Cold leg, Spool 10, 144 in. from vessel center			6, 7	
TFU-13	Cold leg, Spool 13, 51 in. from vessel center			8, 9	
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	10, 11	
TFU-14B	Cold leg, Spool 14, 39 in. from vessel center, downstream of cold leg injection port			10, 11	
TFU-15	Cold leg, Spool 15, 16 in. from vessel center			8, 9	
<u>Broken Loop</u>					
TFB-20	Cold leg, Spool 20, 21 in. from vessel center	0-2300°F	0-591°F	12, 13	
TFB-23	Cold leg, Spool 23, 91 in. from vessel center, upstream of vessel-side nozzle				
TFB-30	Hot leg, Spool 30, 16 in. from vessel center				
TFB-42	Cold leg, Spool 42, 414 in. from vessel center along hot leg, upstream of pump-side nozzle				
TFB-RFBC	Reflood bypass, near end cap, cold-leg side				
TFB-RFBH	Reflood bypass, near end cap, hot-leg side				
<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	14, 15	
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°			16, 17	
TFV-ANN-15M	15 in. below cold leg centerline, 180°			16, 17	
TFV-ANN-15T	15 in. below cold leg centerline, 270°			16, 17	
TFV-ANN-35A	35 in. below cold leg centerline, 0°			16, 17	
TFV-ANN-35M	35 in. below cold leg centerline, 180°			18, 19	
TFV-ANN-35T	35 in. below cold leg centerline, 270°			18, 19	
TFV-ANN-115A	115 in. below cold leg centerline, 0°			18, 19	
TFV-ANN-156A	156 in. below cold leg centerline, 0°			18, 19, 268	
<u>Lower Plenum</u>					
	On fluid thermocouple rack, 1 in. from vessel center, 45°	0-2300°F	0-591°F	20, 21	
TFV-LP-1-1/2	1.5 in. from bottom				
TFV-LP-7-1/2	7.5 in. from bottom			268	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Lower Plenum (Contd.)</u>					
TFV-LP-14-1/2	14.5 in. from bottom				
TFV-LP-21-1/2	21.5 in. from bottom				
TFV-LP-27-1/2	27.5 in. from bottom				
<u>Core</u>		0-2300°F	0-591°F	22, 23, 268	
TFV-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	24, 25	
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	26, 27	
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	28, 29, 269	
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	30, 31	
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	32, 33	
TFU-PRIZE	In surge line, near pressurizer exit, between turbine flowmeter and pressurizer				
<u>Pressure Suppression System</u>		0-2300°F	0-591°F	34, 35, 270	
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				
MATERIAL TEMPERATURE	Chromel-Alumel thermocouples unless specified otherwise	0-2300°F	0-591°F		
<u>Intact Loop</u>					
TMU-1S16	Hot leg, Spool 1, side, 1/16 in. from pipe ID, 29 in. from vessel center			36, 37	
TMU-1B16	Hot leg, Spool 1, bottom, 1/16 in. from pipe ID, 29 in. from vessel center			36, 37	
TMU-7S16	Cold leg, Spool 7, side, 1/16 in. from pipe ID, 242 in. from vessel center (vertical pipe)			36, 37	
TMU-8S4	Cold leg, Spool 8, side, in pump trap, 1/4 in. from pipe ID, 195 in. from vessel center			38, 39	
TMU-8S16	Cold leg, Spool 8, side, in pump trap, 1/16 in. from pipe ID, 195 in. from vessel center			38, 39	
TMU-10S16	Cold leg, Spool 10, side, 1/16 in. from pipe ID, 144 in. from vessel center			38, 39	
TMU-15T16	Cold leg, Spool 15, top, 1/16 in. from pipe ID, 17 in. from vessel center			38, 39	
TMU-15B16	Cold leg, Spool 15, bottom, 1/16 in. from pipe ID, 17 in. from vessel center			38, 39	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

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	40, 41	
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				
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	42, 43	
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°			44, 45	
TMV-FO-156A	156 in. below cold leg centerline, 0.65 in. from filler ID, 0°			44, 45	
TMV-FO-177M	177 in. below cold leg centerline, 0.65 in. from filler ID, 180°			44, 45	
TMV-FI-4M	4 in. below cold leg centerline, 1/16 in. from filler ID, 180°			46, 47	Thinness of filler at this location exposes thermocouple to fluid
TMV-FI-15A	15 in. below cold leg centerline, 1/16 in. from filler ID, 0°			46, 47	
TMV-FI-35A	35 in. below cold leg centerline, 1/16 in. from filler ID, 0°			46, 47	
TMV-FI-35M	35 in. below cold leg centerline, 1/16 in. from filler ID, 180°			46, 47	
TMV-FI-70A	70 in. below cold leg centerline, 1/16 in. from filler ID, 0°			48, 49	
TMV-FI-115A	115 in. below cold leg centerline, 1/16 in. from filler ID, 0°			48, 49	
TMV-FI-156A	156 in. below cold leg centerline, 1/16 in. from filler ID, 0°			48, 49	
TMV-FI-156M	156 in. below cold leg centerline, 1/16 in. from filler ID, 180°			48, 49	
TMV-FI-177M	177 in. below cold leg centerline, 1/16 in. from filler ID, 180°			48, 49	
<u>Vessel Filler Insulator</u>	Outer surface of insulator, Type J iron-constantan thermocouples	0-1400°F	0-692°F	50, 51	
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	52, 53	
TMV-LH	In vessel bottom head, 1/8 in. from inside surface, 2 in. from vessel centerline, 90°				

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments
		Detector	Data Acquisition System		
<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°			54, 55	
TMV-CO-4M	4 in. below cold leg centerline, in inlet annulus region, 1/16 in. from core barrel OD, 180°			54, 55	
TMV-CO-15A	15 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			54, 55	
TMV-CO-70A	70 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			56, 57	
TMV-CO-115A	115 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			56, 57	
TMV-CO-115M	115 in. below cold leg centerline, 1/16 in. from core barrel OD, 180°			56, 57	
TMV-CO-127A	127 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			56, 57	
TMV-CI-70A	70 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°			58, 59	
TMV-CI-115A	115 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°			58, 59	
<u>Steam Generator</u>		0-2300°F	0-591°F	60, 61	
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)				Recorded on analog only. 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)			62, 63	
PB-CN1	Vessel-side nozzle, nozzle throat, 96 in. from vessel center, (tee off DP tap)			62, 63	
PB-42	Cold leg, Spool 42, 415 in. from vessel center along hot leg, upstream of pump-side nozzle (tee off DP tap)			64, 65	
PB-HN1	Pump-side nozzle, nozzle throat, 419 in. from vessel center along hot leg (tee off DP tap)			64, 65	Data have a -40 psig offset before rupture
<u>Vessel</u>		0-3000 psig	0-4000 psig	66, 67	
PV-UP+10	In upper plenum, 10 in. above cold leg centerline, mounted on standoff, 30°				
PV-LP-180	In upper part of lower plenum, 180 in. below cold leg centerline, mounted on standoff, 225°				
PV-IANN-9	In vessel inlet annulus, 9 in. below cold leg centerline, mounted on standoff, 225°				
<u>ECC System</u>		0-750 psig	0-750 psig	68, 69, 271	Decrease in pressure at t=3 sec caused by automatic opening of accumulator valve
PECC-UL-ACC	In intact loop accumulator				

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Pressurizer</u>		0-3000 psig	0-4000 psig	70, 71	
PU-PRIZE	Steam dome				
<u>Pressure Suppression System</u>		0-100 psig	0-100 psig	72, 73, 272	
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	74, 75	
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	76, 77	
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 10 in. above Spool 7 tap	+500 in. water	+25 psid	78, 79	Data have an apparent -0.64 psid drift by 150 sec; detector should measure 0.64 psid for empty system with no flow
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	80, 81	
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	82, 83	
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	84, 85	
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	86, 87	Data questionable; detector sense lines have potential for draining
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	88, 89	
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	90, 91	
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	92, 93	Data questionable; suspected polarity reversal; questionable detector calibration
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	94, 95	Data suspect due to 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	96, 97	
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	98, 99	Data acquisition system saturated until t=5 sec
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	100, 101	Detector ranged exceeded before rupture and data acquisition system saturated immediately after rupture
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	102, 103	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

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	104, 105	Data have an apparent -0.8 psid offset.
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	106, 107	
DPU-15-ATH	Cold leg Spool 15, 16 in. from vessel center to atmosphere	+500 psid	+500 psid	108, 109, 273	Data acquisition system saturated until t=24 sec
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	110, 111, 274	The measured liquid level resulted in a calculated liquid volume of 0.70 ft ³ at blowdown
<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	112, 113	
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	114, 115	
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	116, 117	
DPB-CNI-CN4	Vessel-side nozzle, nozzle throat, 96 in. from vessel center to nozzle divergent section, 101 in. from vessel center	+1000 psid	+1300 psid	118, 119	
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	120, 121	
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	122, 123	
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	124, 125	
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	126, 127	
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	128, 129	
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	130, 131	
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	132, 133	
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 transducer
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	134, 135	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

Measurement	Location and Comments	Detector	Range (a)	Figure (a)	Measurement Comments (b)
			Data Acquisition System		
Intact Loop (Contd.)					
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	136, 137	Data have an apparent 7.5 psid drift by 150 sec; detector should measure 0 psid for empty system with no flow
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	138, 139	Data have an apparent 15 psid drift by 150 sec; detector should measure 0 psid for empty system with no flow
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	140, 141	
Vessel					
DPV-15-IANN	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	+50 psid	+50 psid	106, 107	
DPB-IANN-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	+50 psid	+50 psid	112, 113	
DPV-UT-IANN	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	+15 psid	142, 143	
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 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	144, 145	Data questionable; leaking manifold common to differential pressure cells 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	+15 psid	146, 147	Data questionable; leaking manifold common to differential pressure cells 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	148, 149	
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	150, 151	
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	152, 153	
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	154, 155	Data suspect due to 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	156, 157	Data suspect due to 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 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 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	+1.0 psid	158, 159	
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. water	+15.0 psid	160, 161	Data questionable; leaking manifold common to differential pressure cells 180 in. below cold leg centerline

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

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	74, 75	
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	+15 psid	76, 77	
DPB-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	122, 123	
<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	82, 83	
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	84, 85	
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	86, 87	Data questionable; detector sense lines have potential for draining
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	88, 89	
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		Steam generator secondary contained nitrogen instead of water for this test
<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	110, 111, 274	The measured liquid level resulted in a calculated liquid volume of 0.70 ft ³ at blowdown
VOLUMETRIC FLOW RATE					
Turbine flowmeter, bidirectional					
<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	162, 163	Detector range exceeded at various times throughout test
FTU-9	Cold leg, Spool 9, 154 in. from vessel center	+20-400 gpm	+649 gpm	162, 163	Detector range exceeded and data acquisition system saturated at various times throughout test
FTU-13	Cold leg, Spool 13, 64 in. from vessel center	+20-400 gpm	+640 gpm		Detector failed
FTU-15	Cold leg, Spool 15, 29 in. from vessel center	+10-200 gpm	+389 gpm	164, 165	
<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		
FTB-30	Hot leg, Spool 30, 25 in. from vessel center, 3-in. pipe	+20-400 gpm	+408 gpm		
FTB-37	Cold leg, Spool 37, 290 in. from vessel center along hot leg, 2-in. pipe	+10-200 gpm	+657 gpm		Detector range exceeded from t=15 sec to t=50 sec
<u>Core</u>					
FTV-CORE-IN	Entrance to core, approximately 158 in. below cold leg centerline	+20-400 gpm	+405 gpm	168, 169	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 TEST S-01-5

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	10 gpm	170	
FTU-ACC	In line immediately after intact loop accumulator, 1-in. line	4-75 gpm	75 gpm	171, 172, 275	Spike at t=3 sec caused by automatic opening of accumulator valve
<u>Pressurizer</u>					
FTU-PRIZE	Surge line	5-100 gpm	100 gpm	173, 174	
PRESSURE SUPPRESSION SYSTEM					
FTPSS-SPRAY	1-1/2-in. line from accumulator for suppression tank spray	0.5-10 gpm	10 gpm	175, 276	Data have a 0.3 gpm offset prior to initiation of spray at t=129 sec
FLUID VELOCITY					
Turbine flowmeter, bidirectional					
<u>Downcomer Cap</u>					
FTV-22M	22 in. below cold leg centerline, 180°	+2.5-50 ft/sec	+50.4 ft/sec	176, 177	Detector should indicate positive velocity before rupture. Data before rupture questionable; possible sticking bearings not allowing measurement of flow until large velocities after rupture. Transient data exceeded detector range at various times during test
FTV-40A	40 in. below cold leg centerline, 0°	+2.5-50 ft/sec	+50 ft/sec	178, 179	Transient data exceeded detector range at various times during test
FTV-40M	40 in. below cold leg centerline, 180°	+2.5-50 ft/sec	+50 ft/sec	178, 179	Transient data exceeded detector range at various times during test
FTV-83A	83 in. below cold leg centerline, 0°	+1.8-36 ft/sec	+36 ft/sec	182, 183	Unidirectional, measured magnitude only. Data have an apparent 2.0 ft/sec offset after t=44 sec. Transient data exceeded detector range at various times during test
FTV-83M	83 in. below cold leg centerline, 180°	+1.8-36 ft/sec	+36 ft/sec	184, 185	Transient data exceeded detector range at various times during test
FTV-130M	130 in. below cold leg centerline, 180°	+1.0-18 ft/sec	+18 ft/sec	186, 187	
FTV-161M	161 in. below cold leg centerline, 180°	+1.0-18 ft/sec	+18 ft/sec	188, 189	Transient data exceeded detector range at various times during test
MOMENTUM FLUX					
Drag-disc bidirectional. Computer conversion of voltage output to momentum flux is unidirectional and therefore shows magnitude only					
<u>Intact Loop</u>					
3-in. pipe					
FDU-1	Hot leg, Spool 1, 29 in. from vessel center, target size 0.875	+250-11,500 lb _m /ft-sec ²	+15,000 lb _m /ft-sec ²	190, 191	
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	192, 193	Data not valid prior to t=0 sec
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	194, 195	
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	196, 197	
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	198, 199	
<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	200, 201	
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	202, 203	
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		High range of detector insensitive to flow
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	204, 205	
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	206, 207	

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

Measurement	Location and Comments (a)	Range (a)		Figure (a)	Measurement Comments (b)
		Detector	Data Acquisition System		
<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	208, 209, 277	
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>		0.1-100 lb _m /ft ³	0.1-100 lb _m /ft ³		
GU-1VR	Hot leg, Spool 1, 24 in. from vessel center, vertical			210, 211	
GU-1HZ	Hot leg, Spool 1, 26 in. from vessel center, horizontal			210, 211	
GU-5VR	Hot leg, Spool 5, 96 in. from vessel center, vertical			212, 213	
GU-10VR	Cold leg, Spool 10, 141 in. from vessel center, vertical			212, 213	
GU-13VR	Cold leg, Spool 13, 59 in. from vessel center, vertical			214, 215	
GU-15HZ	Cold leg, Spool 15, 20 in. from vessel center, horizontal			216, 217	
GU-15VR	Cold leg, Spool 15, 23 in. from vessel center, vertical			216, 217	
<u>Broken Loop</u>		0.1-100 lb _m /ft ³	0-100 lb _m /ft ³		
GB-21VR	Cold leg, Spool 21, 49 in. from vessel center, vertical			218, 219	
GB-23VR	Cold leg, Spool 23, 92 in. from vessel center, vertical			218, 219	
GB-30VR	Hot leg, Spool 30, 18 in. from vessel center, vertical			220, 221	
GB-37HZ	Cold leg, Spool 37, 279 in. from vessel center along hot leg, across vertical pipe, simulated steam generator discharge			220, 221	
GB-42VR	Cold leg, Spool 42, 415 in. from vessel center along hot leg, vertical			220, 221	
<u>Vessel</u>		0.1-100 lb _m /ft ³	0-100 lb _m /ft ³		
GV-COR-150HZ	Core flow mixer box, 152 in. below cold leg centerline, horizontal, 0-180°			222, 223, 278	
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		15-45 lb _m /ft ³	222, 223, 278	
GVL-165HZ	Upper part of lower plenum, 165 in. below cold leg centerline, 1.724 in. below downcomer exit, horizontal, 0-180°			224, 225	
GVL-172HZ	Lower plenum, 172 in. below cold leg centerline, 8.729 in. below downcomer exit, horizontal, 90-270°			224, 225	
<u>Pressurizer</u>		0.1-100 lb _m /ft ³	0-100 lb _m /ft ³	226, 227	
GU-PRIZE	Surge line				
LIQUID LEVEL					
<u>Steam Generator</u>					
DPU-SC-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		Steam generator secondary contained nitrogen instead of water for this test
<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	110, 111, 274	The measured liquid level resulted in a calculated liquid volume of 0.70 ft ³ at blowdown

TABLE V (Contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TEST S-01-5

Measurement	Location and Comments	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
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 individual ranges of instruments used in calibration			
<u>Intact Loop</u>					
FDU-1 GU-1VR FTU-1 GU-1VR	Hot leg, Spool 1			228, 229 230, 231	
FTU-PRIZE GU-PRIZE	Pressurizer surge line			232, 233	
FDU-5 GU-5VR	Hot leg, Spool 5			234, 235	
FDU-10 GU-10VR	Cold leg, Spool 10			236, 237	
FDU-13 GU-13VR FTU-13 GU-13VR	Cold leg, Spool 13			238, 239	FTU-13 failed
FDU-15 GU-15VR FTU-15 GU-15VR	Cold leg, Spool 15			240, 241 242, 243	
<u>Broken Loop</u>					
FDB-21 GB-21VR FTB-21 GB-21VR	Cold leg, Spool 21			244, 245 246, 247	
FDB-23 GB-23VR	Cold leg, Spool 23			240, 240	
FTB-30 GB-30VR	Hot leg, Spool 30			250, 251	
FDB-37 GB-37HZ FTB-37 GB-37HZ	Cold leg, Spool 37			252, 253 254, 255	
FDB-42 GB-42VR	Cold leg, Spool 42			256, 257	
<u>Vessel</u>					
FTV-CORE-IN GV-COR-150HZ	Entrance to core			258, 259	
FDV-CORE-IN GV-COR-150HZ	Entrance to core			260, 261	
<u>PUMP CHARACTERISTICS</u>					
PUMP-TORQ	Pump torque	0-500 in.-lb	0-500 in.-lb	262, 263	
PUMP-POW	Pump motor power		0-24.2 kW	264, 265	
PUMP-RPM	Pump speed	0-3600 rpm	0-3600 rpm	266, 267	

[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 operating or measuring characteristics when the physical conditions were again within the detector range.

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

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

Fig. 8. Fluid temperatures in intact loop (TFU-13 and TFU-15) from -2 to 150 seconds.

Fig. 9 Fluid temperatures in intact loop (TFU-13 and TFU-15) from -2 to 30 seconds.

Fig. 10 Fluid temperatures in intact loop (RBU-14A, TFU-14B) from -2 to 150 seconds.

Fig. 11 Fluid temperatures in intact loop (RBU-14A, TFU-14B) from -2 to 30 seconds.

Fig. 12 Fluid temperatures in broken loop from -2 to 150 seconds.

Fig. 13 Fluid temperatures in broken loop from -2 to 30 seconds.

Fig. 14 Fluid temperatures in inlet annulus from -2 to 150 seconds.

Fig. 15 Fluid temperatures in inlet annulus from -2 to 30 seconds.

Fig. 16 Fluid temperatures in downcomer annulus (TFV-ANN-15A, TFV-ANN-15M, TFV-ANN-15T, and TFV-ANN-35A) from -2 to 150 seconds.

Fig. 17 Fluid temperatures in downcomer annulus (TFV-ANN-15A, TFV-ANN-15M, TFV-ANN-15T, and TFV-ANN-35A) from -2 to 30 seconds.

Fig. 18 Fluid temperatures in downcomer annulus (TFV-ANN-35M, TFV-ANN-35T, TFV-ANN-115A, and TFV-ANN-156A) from -2 to 150 seconds.

Fig. 19 Fluid temperatures in downcomer annulus (TFV-ANN-35M, TFV-ANN-35T, TFV-ANN-115A, and TFV-ANN-156A) from -2 to 30 seconds.

Fig. 20 Fluid temperatures in lower plenum from -2 to 150 seconds.

Fig. 21 Fluid temperatures in lower plenum from -2 to 30 seconds.

Fig. 22 Fluid temperature in core (LOFT) from -2 to 150 seconds.

Fig. 23 Fluid temperature in core (LOFT) from -2 to 30 seconds.

Fig. 24 Fluid temperatures in core barrel insulation gap from -2 to 150 seconds.

Fig. 25 Fluid temperatures in core barrel insulation gap from -2 to 30 seconds.

Fig. 26 Fluid temperatures in vessel filler insulation gap from -2 to 150 seconds.

Fig. 27 Fluid temperatures in vessel filler insulation gap from -2 to 30 seconds.

Fig. 28 Fluid temperature in ECC injection line to Spool 14 from -2 to 150 seconds.

Fig. 29 Fluid temperature in ECC injection line to Spool 14 from -2 to 30 seconds.

Fig. 30 Fluid temperatures in steam generator from -2 to 150 seconds.

Fig. 31 Fluid temperatures in steam generator from -2 to 30 seconds.

Fig. 32 Fluid temperature in pressurizer surge line from -2 to 150 seconds.

Fig. 33 Fluid temperature in pressurizer surge line from -2 to 30 seconds.

Fig. 34 Fluid temperatures in pressure suppression tank from -2 to 150 seconds.

Fig. 35 Fluid temperatures in pressure suppression tank from -2 to 30 seconds.

Fig. 36 Material temperatures in intact loop (TMU-1S16, TMU-1B16, and TMU-7S16) from -2 to 150 seconds.

Fig. 37 Material temperatures in intact loop (TMU-1S16, TMU-1B16, and TMU-7S16) from -2 to 30 seconds.

Fig. 38 Material temperatures in intact loop (TMU-8S4, TMU-8S16, TMU-10S16, TMU-15T16, and TMU-15B16) from -2 to 150 seconds.

Fig. 39 Material temperatures in intact loop (TMU-8S4, TMU-8S16, TMU-10S16, TMU-15T16, and TMU-15B16) from -2 to 30 seconds.

Fig. 40 Material temperatures in broken loop from -2 to 150 seconds.

Fig. 41 Material temperatures in broken loop from -2 to 30 seconds.

Fig. 42 Material temperatures in vessel wall from -2 to 150 seconds..

Fig. 43 Material temperatures in vessel wall from -2 to 30 seconds.

Fig. 44 Material temperatures in vessel filler outside diameter from -2 to 150 seconds.

Fig. 45 Material temperatures in vessel filler outside diameter from -2 to 30 seconds.

Fig. 46 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.

Fig. 47 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.

Fig. 48 Material temperatures in vessel filler inside diameter (TMV-FI-70A, TMV-FI-115A, TMV-FI-156A, TMV-FI-156M, and TMV-FI-177M) -2 to 150 seconds.

Fig. 49 Material temperatures in vessel filler inside diameter (TMV-FI-70A, TMV-FI-115A, TMV-FI-156A, TMV-FI-156M, and TMV-FI-177M) -2 to 30 seconds.

Fig. 50 Material temperatures in vessel filler insulator from -2 to 150 seconds.

Fig. 51 Material temperatures in vessel filler insulator from -2 to 30 seconds.

Fig. 52 Material temperature in vessel lower head from -2 to 150 seconds.

Fig. 53 Material temperature in vessel lower head from -2 to 30 seconds.

Fig. 54 Material temperatures in core barrel outside diameter (TMV-CO-4A, TMV-CO-4M, and TMV-CO-15A) from -2 to 150 seconds.

Fig. 55 Material temperatures in core barrel outside diameter (TMV-CO-4A, TMV-CO-4M, and TMV-CO-15A) from -2 to 30 seconds.

Fig. 56 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.

Fig. 57 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.

Fig. 58 Material temperatures in core barrel inside diameter from -2 to 150 seconds.

Fig. 59 Material temperatures in core barrel inside diameter from -2 to 30 seconds.

Fig. 60 Material temperatures in steam generator from -2 to 150 seconds.

Fig. 61 Material temperatures in steam generator from -2 to 30 seconds.

Fig. 62 Pressures in broken loop (PB-23 and PB-CN1) from -2 to 150 seconds.

Fig. 63 Pressures in broken loop (PB-23 and PB-CN1) from -2 to 30 seconds.

Fig. 64 Pressures in broken loop (PB-42 and PB-HN1) from -2 to 150 seconds.

Fig. 65 Pressures in broken loop (PB-42 and PB-HN1) from -2 to 30 seconds.

Fig. 66 Pressures in vessel from -2 to 150 seconds.

Fig. 67 Pressures in vessel from -2 to 30 seconds.

Fig. 68 Pressure in intact loop ECC accumulator from -2 to 150 seconds.

Fig. 69 Pressure in intact loop ECC accumulator from -2 to 30 seconds.

Fig. 70 Pressure in pressurizer from -2 to 150 seconds.

Fig. 71 Pressure in pressurizer from -2 to 30 seconds.

Fig. 72 Pressure in pressure suppression tank from -2 to 150 seconds.

Fig. 73 Pressure in pressure suppression tank from -2 to 30 seconds.

Fig. 74 Differential pressure in intact loop (upper plenum to Spool 1) from -2 to 150 seconds.

Fig. 75 Differential pressure in intact loop (upper plenum to Spool 1) from -2 to 30 seconds.

Fig. 76 Differential pressure in intact loop (upper plenum to Spool 3) from -2 to 150 seconds.

Fig. 77 Differential pressure in intact loop (upper plenum to Spool 3) from -2 to 30 seconds.

Fig. 78 Differential pressure in intact loop (Spool 3 to Spool 7) from -2 to 150 seconds.

Fig. 79 Differential pressure in intact loop (Spool 3 to Spool 7) from -2 to 30 seconds.

Fig 80 Differential pressure in intact loop, low range (Spool 3 to Spool 7) from -2 to 150 seconds.

Fig. 81 Differential pressure in intact loop, low range (Spool 3 to Spool 7) from -2 to 30 seconds.

Fig. 82 Differential pressure in intact loop (Spool 3 to steam generator inlet plenum) from -2. to 150 seconds.

Fig. 83 Differential pressure in intact loop (Spool 3 to steam generator inlet plenum) from -2 to 30 seconds.

Fig. 84 Differential pressure in intact loop (Spool 6 to steam generator inlet plenum) from -2 to 150 seconds.

Fig. 85 Differential pressure in intact loop (Spool 6 to steam generator inlet plenum) from -2 to 30 seconds.

Fig. 86 Differential pressure in intact loop (SG1 to SG2) from -2 to 150 seconds.

Fig. 87 Differential pressure in intact loop (SG1 to SG2) from -2 to 30 seconds.

Fig. 88 Differential pressure in intact loop (steam generator outlet plenum to Spool 7) from -2 to 150 seconds.

Fig. 89 Differential pressure in intact loop (steam generator outlet plenum to Spool 7) from -2 to 30 seconds.

Fig. 90 Differential pressure in intact loop (Spool 7 to Spool 10) from -2 to 150 seconds.

Fig. 91 Differential pressure in intact loop (Spool 7 to Spool 10) from -2 to 30 seconds.

Fig. 92 Differential pressure in intact loop (Spool 8C to Spool 8D) from -2 to 150 seconds.

Fig. 93 Differential pressure in intact loop (Spool 8C to Spool 8D) from -2 to 30 seconds.

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Fig. 94 Differential pressure in intact loop (Spool 8D to Spool 8E) from -2 to 150 seconds.

Fig. 95 Differential pressure in intact loop (Spool 8D to Spool 8E) from -2 to 30 seconds.

Fig. 96 Differential pressure in intact loop (Spool 12 to Spool 10) from -2 to 150 seconds.

Fig. 97 Differential pressure in intact loop (Spool 12 to Spool 10) from -2 to 30 seconds.

Fig. 98 Differential pressure in intact loop, low range (Spool 12 to Spool 10) from -2 to 150 seconds.

Fig. 99 Differential pressure in intact loop, low range (Spool 12 to Spool 10) from -2 to 30 seconds.

Fig. 100 Differential pressure in intact loop (Spool 12 to Spool 15) from -2 to 150 seconds.

Fig. 101 Differential pressure in intact loop (Spool 12 to Spool 15) from -2 to 30 seconds.

Fig. 102 Differential pressure in intact loop (Spool 15 to Spool 1) from -2 to 150 seconds.

Fig. 103 Differential pressure in intact loop (Spool 15 to Spool 1) from -2 to 30 seconds.

Fig. 104 Differential pressure in intact loop, low range (Spool 15 to Spool 1) from -2 to 150 seconds.

Fig. 105 Differential pressure in intact loop, low range (Spool 15 to Spool 1) from -2 to 30 seconds.

Fig. 106 Differential pressure in intact loop (Spool 15 to vessel inlet annulus) from -2 to 150 seconds.

Fig. 107 Differential pressure in intact loop (Spool 15 to vessel inlet annulus) from -2 to 30 seconds.

Fig. 108 Differential pressure in intact loop (Spool 15 to atmosphere) from -2 to 150 seconds.

Fig. 109 Differential pressure in intact loop (Spool 15 to atmosphere) from -2 to 30 seconds.

Fig. 110 Differential pressure in intact loop (pressurizer liquid level) from -2 to 150 seconds.

Fig. 111 Differential pressure in intact loop (pressurizer liquid level) from -2 to 30 seconds.

Fig. 112 Differential pressure in broken loop (vessel inlet annulus to Spool 21) from -2 to 150 seconds.

Fig. 113 Differential pressure in broken loop (vessel inlet annulus to Spool 21) from -2 to 30 seconds.

Fig. 114 Differential pressure in broken loop (Spool 21 to Spool 23) from -2 to 150 seconds.

Fig. 115 Differential pressure in broken loop (Spool 21 to Spool 23) from -2 to 30 seconds.

Fig. 116 Differential pressure in broken loop (Spool 23 to vessel-side nozzle throat) from -2 to 150 seconds.

Fig. 117 Differential pressure in broken loop (Spool 23 to vessel-side nozzle throat) from -2 to 30 seconds.

Fig. 118 Differential pressure in broken loop (vessel-side nozzle throat to divergent section) from -2 to 150 seconds.

Fig. 119 Differential pressure in broken loop (vessel-side nozzle throat to divergent section) from -2 to 30 seconds.

Fig. 120 Differential pressure in broken loop (Spool 23 to Spool 24) from -2 to 150 seconds.

Fig. 121 Differential pressure in broken loop (Spool 23 to Spool 24) from -2 to 30 seconds.

Fig. 122 Differential pressure in broken loop (upper plenum to Spool 30) from -2 to 150 seconds.

Fig. 123 Differential pressure in broken loop (upper plenum to Spool 30) from -2 to 30 seconds.

Fig. 124 Differential pressure in broken loop (Spool 30 to Spool 38) from -2 to 150 seconds.

Fig. 125 Differential pressure in broken loop (Spool 30 to Spool 38) from -2 to 30 seconds.

Fig. 126 Differential pressure in broken loop (Spool 30 to Spool 32U) from -2 to 150 seconds.

Fig. 127 Differential pressure in broken loop (Spool 30 to Spool 32U) from -2 to 30 seconds.

Fig. 128 Differential pressure in broken loop (Spool 32U to Spool 36L) from -2 to 150 seconds.

Fig. 129 Differential pressure in broken loop (Spool 32U to Spool 36L) from -2 to 30 seconds.

Fig. 130 Differential pressure in broken loop (Spool 36L to Spool 37) from -2 to 150 seconds.

Fig. 131 Differential pressure in broken loop (Spool 36L to Spool 37) from -2 to 30 seconds.

Fig. 132 Differential pressure in broken loop (Spool 38 to Spool 40) from -2 to 150 seconds.

Fig. 133 Differential pressure in broken loop (Spool 38 to Spool 40) from -2 to 30 seconds.

Fig. 134 Differential pressure in broken loop (Spool 42 to Spool 43) from -2 to 150 seconds.

Fig. 135 Differential pressure in broken loop (Spool 42 to Spool 43) from -2 to 30 seconds.

Fig. 136 Differential pressure in broken loop (Spool 42 to pump-side nozzle throat) from -2 to 150 seconds.

Fig. 137 Differential pressure in broken loop (Spool 42 to pump-side nozzle throat) from -2 to 30 seconds.

Fig. 138 Differential pressure in broken loop (pump-side nozzle throat to divergent section) from -2 to 150 seconds.

Fig. 139 Differential pressure in broken loop (pump-side nozzle throat to divergent section) from -2 to 30 seconds.

Fig. 140 Differential pressure in broken loop (pump-side nozzle divergent section to Spool 43) from -2 to 150 seconds.

Fig. 141 Differential pressure in broken loop (pump-side nozzle divergent section to Spool 43) from -2 to 30 seconds.

Fig. 142 Differential pressure in vessel (upper plenum to inlet annulus) from -2 to 150 seconds.

Fig. 143 Differential pressure in vessel (upper plenum to inlet annulus) from -2 to 30 seconds.

Fig. 144 Differential pressure in vessel (DPV-9-26QQ) from -2 to 150 seconds.

Fig. 145 Differential pressure in vessel (DPV-9-26QQ) from -2 to 30 seconds.

Fig. 146 Differential pressure in vessel (DPV-9-180QQ) from -2 to 150 seconds.

Fig. 147 Differential pressure in vessel (DPV-9-180QQ) from -2 to 30 seconds.

Fig. 148 Differential pressure in vessel (DPV-26-55QM) from -2 to 150 seconds.

Fig. 149 Differential pressure in vessel (DPV-26-55QM) from -2 to 30 seconds.

Fig. 150 Differential pressure in vessel (DPV-55-110AM) from -2 to 150 seconds.

Fig. 151 Differential pressure in vessel (DPV-55-110AM) from -2 to 30 seconds.

Fig. 152 Differential pressure in vessel (DPV-110-156MQ) from -2 to 150 seconds.

Fig. 153 Differential pressure in vessel (DPV-110-156MQ) from -2 to 30 seconds.

Fig. 154 Differential pressure in vessel (DPV-156-173QQ) from -2 to 150 seconds.

Fig. 155 Differential pressure in vessel (DPV-156-173QQ) from -2 to 30 seconds.

Fig. 156 Differential pressure in vessel (DPV-166-173QQ) from -2 to 150 seconds.

Fig. 157 Differential pressure in vessel (DPV-166-173QQ) from -2 to 30 seconds.

Fig. 158 Differential pressure in vessel (DPV-166-191QT) from -2 to 150 seconds.

Fig. 159 Differential pressure in vessel (DPV-166-191QT) from -2 to 30 seconds.

Fig. 160 Differential pressure in vessel (lower plenum to upper plenum) from -2 to 150 seconds.

Fig. 161 Differential pressure in vessel (lower plenum to upper plenum) from -2 to 30 seconds.

Fig. 162 Volumetric flows in intact loop (FTU-1 and FTU-9) from -2 to 150 seconds.

Fig. 163 Volumetric flows in intact loop (FTU-1 and FTU-9) from -2 to 30 seconds.

Fig. 164 Volumetric flow in intact loop (FTU-15) from -2 to 150 seconds.

Fig. 165 Volumetric flow in intact loop (FTU-15) from -2 to 30 seconds.

Fig. 166 Volumetric flows in broken loop (FTB-21, FTB-30, and FTB-37) from -2 to 150 seconds.

Fig. 167 Volumetric flows in broken loop (FTB-21, FTB-30, and FTB-37) from -2 to 30 seconds.

Fig. 168 Volumetric flow in core entrance from -2 to 150 seconds.

Fig. 169 Volumetric flow in core entrance from -2 to 30 seconds.

Fig. 170 Volumetric flow from low pressure injection system from -2 to 150 seconds.

Fig. 171 Volumetric flow from intact loop accumulator from -2 to 150 seconds.

Fig. 172 Volumetric flow from intact loop accumulator from -2 to 30 seconds.

Fig. 173 Volumetric flow from pressurizer from -2 to 150 seconds.

Fig. 174 Volumetric flow from pressurizer from -2 to 30 seconds.

Fig. 175 Volumetric flow from pressure suppression spray system from -2 to 150 seconds.

Fig. 176 Fluid velocity in vessel (FTV-22M) from -2 to 150 seconds.

Fig. 177 Fluid velocity in vessel (FTV-22M) from -2 to 30 seconds.

Fig. 178 Fluid velocity in vessel (FTV-40A) from -2 to 150 seconds.

Fig. 179 Fluid velocity in vessel (FTV-40A) from -2 to 30 seconds.

Fig. 180 Fluid velocity in vessel (FTV-40M) from -2 to 150 seconds.

Fig. 181 Fluid velocity in vessel (FTV-40M) from -2 to 30 seconds.

Fig. 182 Fluid velocity in vessel (FTV-83A) from -2 to 150 seconds.

Fig. 183 Fluid velocity in vessel (FTV-83A) from -2 to 30 seconds.

Fig. 184 Fluid velocity in vessel (FTV-83M) from -2 to 150 seconds.

Fig. 185 Fluid velocity in vessel (FTV-83M) from -2 to 30 seconds.

Fig. 186 Fluid velocity in vessel (FTV-130M) from -2 to 150 seconds.

Fig. 187 Fluid velocity in vessel (FTV-130M) from -2 to 30 seconds.

Fig. 188 Fluid velocity in vessel (FTV-161M) from -2 to 150 seconds.

Fig. 189 Fluid velocity in vessel (FTV-161M) from -2 to 30 seconds.

Fig. 190 Momentum flux in intact loop (Spool 1) from -2 to 150 seconds.

Fig. 191 Momentum flux in intact loop (Spool 1) from -2 to 30 seconds.

Fig. 192 Momentum flux in intact loop (Spool 5) from -2 to 150 seconds.

Fig. 193 Momentum flux in intact loop (Spool 5) from -2 to 30 seconds.

Fig. 194 Momentum flux in intact loop (Spool 10) from -2 to 150 seconds.

Fig. 195 Momentum flux in intact loop (Spool 10) from -2 to 30 seconds.

Fig. 196 Momentum flux in intact loop (Spool 13) from -2 to 150 seconds.

Fig. 197 Momentum flux in intact loop (Spool 13) from -2 to 30 seconds.

Fig. 198 Momentum flux in intact loop (Spool 15) from -2 to 150 seconds.

Fig. 199 Momentum flux in intact loop (Spool 15) from -2 to 30 seconds.

Fig. 200 Momentum flux in broken loop (Spool 21) from -2 to 150 seconds.

Fig. 201 Momentum flux in broken loop (Spool 21) from -2 to 30 seconds.

Fig. 202 Momentum flux in broken loop (Spool 23) from -2 to 150 seconds.

Fig. 203 Momentum flux in broken loop (Spool 23) from -2 to 30 seconds.

Fig. 204 Momentum flux in broken loop (Spool 37) from -2 to 150 seconds.

Fig. 205 Momentum flux in broken loop (Spool 37) from -2 to 30 seconds.

Fig. 206 Momentum flux in broken loop (Spool 42) from -2 to 150 seconds.

Fig. 207 Momentum flux in broken loop (Spool 42) from -2 to 30 seconds.

Fig. 208 Momentum flux in core entrance from -2 to 150 seconds.

Fig. 209 Momentum flux in core entrance from -2 to 30 seconds.

Fig. 210 Densities in intact loop (GU-1VR and GU-1HZ) from -2 to 150 seconds.

Fig. 211 Densities in intact loop (GU-1VR and GU-1HZ) from -2 to 30 seconds.

Fig. 212 Densities in intact loop (GU-5VR and GU-10VR) from -2 to 150 seconds.

Fig. 213 Densities in intact loop (GU-5VR and GU-10VR) from -2 to 30 seconds.

Fig. 214 Density in intact loop (GU-13VR) from -2 to 150 seconds.

Fig. 215 Density in intact loop (GU-13VR) from -2 to 30 seconds.

Fig. 216 Densities in intact loop (GU-15HZ and GU-15VR) from -2 to 150 seconds.

Fig. 217 Densities in intact loop (GU-15HZ and GU-15VR) from -2 to 30 seconds.

Fig. 218 Densities in broken loop (GB-21VR and GB-23VR) from -2 to 150 seconds.

Fig. 219 Densities in broken loop (GB-21VR and GB-23VR) from -2 to 30 seconds.

Fig. 220 Densities in broken loop (GB-30VR, GV-37HZ, and GB-42VR) from -2 to 150 seconds.

Fig. 221 Densities in broken loop (GB-30VR, GV-37HZ, and GB-42VR) from -2 to 30 seconds.

Fig. 222 Densities in vessel (GV-COR-150HZ and GV-161/192D) from -2 to 150 seconds.

Fig. 223 Densities in vessel (GV-COR-150HZ and GV-161/192D) from -2 to 30 seconds.

Fig. 224 Densities in vessel (GVLP-165HZ and GVLP-172HZ) from -2 to 150 seconds.

Fig. 225 Densities in vessel (GVLP-165HZ and GVLP-172HZ) from -2 to 30 seconds.

Fig. 226 Density in pressurizer from -2 to 150 seconds.

Fig. 227 Density in pressurizer from -2 to 30 seconds.

Fig. 228 Mass flow in intact loop (FDU-1 and GU-1VR) from -2 to 150 seconds.

Fig. 229 Mass flow in intact loop (FDU-1 and GU-1VR) from -2 to 30 seconds.

Fig. 230 Mass flow in intact loop (FTU-1 and GU-1VR) from -2 to 150 seconds.

Fig. 231 Mass flow in intact loop (FTU-1 and GU-1VR) from -2 to 30 seconds.

Fig. 232 Mass flow from pressurizer from -2 to 150 seconds.

Fig. 233 Mass flow from pressurizer from -2 to 30 seconds.

Fig. 234 Mass flow in intact loop (FDU-5 and GU-5VR) from -2 to 150 seconds.

Fig. 235 Mass flow in intact loop (FDU-5 and GU-5VR) from -2 to 30 seconds.

Fig. 236 Mass flow in intact loop (FDU-10 and GU-10VR) from -2 to 150 seconds.

Fig. 237 Mass flow in intact loop (FDU-10 and GU-10VR) from -2 to 30 seconds.

Fig. 238 Mass flow in intact loop (FDU-13 and GU-13VR) from -2 to 150 seconds.

Fig. 239 Mass flow in intact loop (FDU-13 and GU-13VR) from -2 to 30 seconds.

Fig. 240 Mass flow in intact loop (FDU-15 and GU-15VR) from -2 to 150 seconds.

Fig. 241 Mass flow in intact loop (FDU-15 and GU-15VR) from -2 to 30 seconds.

Fig. 242 Mass flow in intact loop (FTU-15 and GU-15VR) from -2 to 150 seconds.

Fig. 243 Mass flow in intact loop (FTU-15 and GU-15VR) from -2 to 30 seconds.

Fig. 244 Mass flow in broken loop (FDB-21 and GB-21VR) from -2 to 150 seconds.

Fig. 245 Mass flow in broken loop (FDB-21 and GB-21VR) from -2 to 30 seconds.

Fig. 246 Mass flow in broken loop (FTB-21 and GB-21VR) from -2 to 150 seconds.

Fig. 247 Mass flow in broken loop (FTB-21 and GB-21VR) from -2 to 30 seconds.

Fig. 248 Mass flow in broken loop (FDB-23 and GB-23VR) from -2 to 150 seconds.

Fig. 249 Mass flow in broken loop (FDB-23 and GB-23VR) from -2 to 30 seconds.

Fig. 250 Mass flow in broken loop (FTB-30 and GB-30VR) from -2 to 150 seconds.

Fig. 251 Mass flow in broken loop (FTB-30 and GB-30VR) from -2 to 30 seconds.

Fig. 252 Mass flow in broken loop (FDB-37 and GB-37HZ) from -2 to 150 seconds.

Fig. 253 Mass flow in broken loop (FDB-37 and GB-37HZ) from -2 to 30 seconds.

Fig. 254 Mass flow in broken loop (FTB-37 and GB-37HZ) from -2 to 150 seconds.

Fig. 255 Mass flow in broken loop (FTB-37 and GB-37HZ) from -2 to 30 seconds.

Fig. 256 Mass flow in broken loop (FDB-42 and GB-42VR) from -2 to 150 seconds.

Fig. 257 Mass flow in broken loop (FDB-42 and GB-42VR) from -2 to 30 seconds.

Fig. 258 Mass flow in core entrance (FTV-CORE-IN and GV-COR-150HZ) from -2 to 150 seconds.

Fig. 259 Mass flow in core entrance (FTV-CORE-IN and GV-COR-150HZ) from -2 to 30 seconds.

Fig. 260 Mass flow in core entrance (FDV-CORE-IN and GV-COR-150HZ) from -2 to 150 seconds.

Fig. 261 Mass flow in core entrance (FDV-CORE-IN and GV-COR-150HZ) from -2 to 30 seconds.

Fig. 262 Primary pump torque from -2 to 150 seconds.

Fig. 263 Primary pump torque from -2 to 30 seconds.

Fig. 264 Primary pump power from -2 to 150 seconds.

Fig. 265 Primary pump power from -2 to 30 seconds.

Fig. 266 Primary pump speed from -2 to 150 seconds.

Fig. 267 Primary pump speed from -2 to 30 seconds.

Fig. 268 Fluid temperature in vessel (TFV-LOFT-COR, TFV-ANN-156A, and TFV-LP-7-1/2) from -2 to 205 seconds.

Fig. 269 Fluid temperature from ECC injection line to Spool 14 from -2 to 205 seconds.

Fig. 270 Fluid temperatures in pressure suppression tank from -2 to 205 seconds.

Fig. 271 Pressure in intact loop ECC accumulator from -2 to 205 seconds.

Fig. 272 Pressure in pressure suppression tank from -2 to 205 seconds.

Fig. 273 Differential pressure in intact loop (DPU-15-ATM) from -2 to 205 seconds.

Fig. 274 Differential pressure in intact loop (pressurizer liquid level) from -2 to 205 seconds.

Fig. 275 Volumetric flow from intact loop accumulator from -2 to 205 seconds.

Fig. 276 Volumetric flow from pressure suppression spray system from -2 to 205 seconds.

Fig. 277 Momentum flux in core entrance from -2 to 205 seconds.

Fig. 278 Densities in vessel (GV-COR-150HZ and GV-161/192D) from -2 to 205 seconds.

IV . REFERENCES

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