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IDAHO NATIONAL ENGINEERING LABORATORY

EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1 TESTS
S-03-1 THROUGH S-03-4
(REFLOOD HEAT TRANSFER TESTS)

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EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1

TESTS S-03-1, S-03-2, S-03-3, and S-03-4

(Reflood Heat Transfer Tests)

By

H. S. Crapo
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ABSTRACT

Recorded test data are presented for Tests S-03-1, S-03-2, S-03-3, and S-03-4 of the Semiscale Mod-1 reflood heat transfer series (Test Series 3). The tests conducted in this series are separate effects core reflood tests performed to determine the reflood heat transfer characteristics of the 5.5-foot-long Mod-1 rod bundle. Tests S-03-1 through S-03-4 were forced feed reflood tests in which the reflood rate was held constant during each test, although the reflood rate varied from test to test.

Tests S-03-1 through S-03-4 were conducted from an initial system temperature of about 290°F at a pressure of 60 psia. The electrically heated core was used in the pressure vessel to simulate the effects of a nuclear core during reflood. In all four tests, reflood coolant at 153°F was injected directly into the core barrel by means of a specially designed core inlet manifold. Test S-03-4 was performed with a peaked radial power profile, in contrast to the flat profile used in the first three tests. During reflood, core power was reduced from the initial level of 0.097 MW, according to the American Nuclear Society decay heat curve for pressurized water reactor (PWR) core decay heat, +20%. The cold leg broken loop piping was open to the pressure suppression system (PSS). A separate steam supply system connected to the PSS system was controlled to maintain constant pressure during the tests.

The purpose of this report is to make available the uninterpreted data from Tests S-03-1 through S-03-4 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 account for known nonlinearities in transducer calibrations and to obtain the appropriate engineering units.

SUMMARY

Tests S-03-1, S-03-2, S-03-3, and S-03-4 were performed as part of the Semiscale Mod-1 portion of the Semiscale Program conducted by Aerojet Nuclear Company for the United States Government. These tests were part of the reflood heat transfer test series, which is the first Semiscale Mod-1 test series employing reflooding of the electrically heated core. Hardware configuration and test parameters were selected to yield a system response that simulates the response of a PWR to the reflood portion of a hypothesized loss-of-coolant accident. Tests S-03-1 through S-03-4 utilized a pressure vessel with internals, including a core inlet manifold to permit direct injection of cooling water into the core; and intact loop with pump, heated steam generator, and phase separator; a partial broken loop (cold leg only); and a pressure suppression system with header, pressure suppression tank, and a heated steam supply system. The electrically heated core consisted of 40 heater rods with a 5.5-foot heated length.

The test objectives specific to Tests S-03-1 through S-03-4 were (a) to determine the basic reflood characteristics of the Mod-1 core, (b) to determine whether methods for calculating heat transfer coefficients based on previous reflood tests with longer cores at constant injection rates are applicable to the shorter Mod-1 core, and (c) to determine the effect on core reflood behavior of a peaked radial power profile. For all four tests, reflood was initiated from an initial system temperature of about 290°F with core power at 97 kW, and maximum heater rod temperature at 1,400°F. Pressure was maintained essentially constant at 60 psia throughout each test.

In general, the Semiscale Mod-1 system performed in a manner adequate to meet the test objectives. Specified operating conditions were met within acceptable tolerances, and data loss was also held to an acceptable level. During none of the four tests did more than 15 of the approximate 200 measurements taken fail to yield data suitable to be reported. However, most of the 32 differential pressure measurements taken during Tests S-03-1 through S-03-4 were of questionable value due to difficulties encountered in maintaining the sense lines in a liquid-full condition, when hot steam drained from the steam generator secondary, backed up through the drain lines of the cooled probes on the differential pressure sense lines.

CONTENTS

ABSTRACT	ii
SUMMARY	iii
I. INTRODUCTION	1
II. SYSTEM, PROCEDURES, CONDITIONS AND EVENTS FOR TESTS S-03-1, S-03-2, S-03-3, and S-03-4	2
1. SYSTEM CONFIGURATION AND TEST PROCEDURES	2
2. INITIAL TEST CONDITIONS AND SEQUENCE OF EVENTS	3
III. DATA PRESENTATION	6
IV. REFERENCE	136

FIGURES

1. Semiscale Mod-1 system and instrumentation for partial cold leg break with phase separator – isometric	7
2. Semiscale Mod-1 system and instrumentation for partial cold leg break with phase separator – schematic	8
3. Semiscale Mod-1 pressure vessel -- cross section showing instrumentation	9
4. Semiscale Mod-1 pressure vessel – isometric showing instrumentation	10
5. Semiscale Mod-1 pressure vessel – penetrations and instrumentation	11
6. Semiscale Mod-1 heated core, plan view	12
7. Fluid temperature in intact loop (TFU-1)	21
8. Fluid temperature in phase separator (TFU-PHSEP-W)	21
9. Fluid temperature in intact loop (TSU-6)	22

10.	Fluid temperature in intact loop (TSU-7)	22
11.	Fluid temperature in intact loop (TFU-8)	23
12.	Fluid temperature in intact loop (TFU-8)	23
13.	Fluid temperature in intact loop (TFU-10)	24
14.	Fluid temperature in intact loop (TFU-10)	24
15.	Fluid temperature in intact loop (TSU-12)	25
16.	Fluid temperature in intact loop (TSU-12)	25
17.	Fluid temperature in intact loop (RBU-14A)	26
18.	Fluid temperature in intact loop (RBU-14A)	26
19.	Fluid temperature in broken loop (TFB-20)	27
20.	Fluid temperature in broken loop (TFB-20)	27
21.	Fluid temperature in broken loop (TFB-23)	28
22.	Fluid temperature in downcomer annulus (TFV-ANN-35A)	28
23.	Fluid temperature in upper plenum (TFV-UP+13)	29
24.	Fluid temperature in core, Grid Spacer 5 (TFG-5CD-45)	30
25.	Fluid temperature in core, Grid Spacer 5 (TFG-5CD-45)	30
26.	Fluid temperature in core, Grid Spacer 6 (TFG-6AB-45)	31
27.	Fluid temperature in core, Grid Spacer 6 (TFG-6AB-45)	31
28.	Fluid temperature in core, Grid Spacer 6 (TFG-6CD-45)	32
29.	Fluid temperature in core, Grid Spacer 6 (TFG-6CD-45)	32
30.	Fluid temperature in core, Grid Spacer 6 (TFG-6DE-45)	33
31.	Fluid temperature in core, Grid Spacer 6 (TFG-6DE-45)	33
32.	Fluid temperature in core, Grid Spacer 6 (TFG-6DE-67)	34

33.	Fluid temperature in core, Grid Spacer 6 (TFG-6DE-67)	34
34.	Fluid temperature in core, Grid Spacer 8 (TFG-8CD-45)	35
35.	Fluid temperature in core, Grid Spacer 10 (TFG-10CD-45)	35
36.	Fluid temperature in core, Grid Spacer 10 (TFG-10DE-67)	36
37.	Fluid temperature in core, Grid Spacer 10 (TFG-10EF-45)	36
38.	Fluid temperature in core, Grid Spacer 10 (TFG-10GH-45)	37
39.	Fluid temperature in steam generator steam dome (TFU-SGSD)	37
40.	Fluid temperature in steam generator (TFU-SG1)	38
41.	Fluid temperature in steam generator (TFU-SG2)	38
42.	Fluid temperature in steam generator (TFU-SG3)	39
43.	Fluid temperature in steam generator (TFU-SG4)	39
44.	Fluid temperature in pressure suppression tank (TF-PSS-33)	40
45.	Fluid temperature in pressure suppression tank (TF-PSS-130)	40
46.	Material temperature in intact loop (TMU-1T16)	41
47.	Material temperature in intact loop (TMU-5B16)	41
48.	Material temperature in intact loop (TMU-7S16)	42
49.	Material temperature in intact loop (TMU-8S16)	42
50.	Material temperature in intact loop (TMU-10S16)	43
51.	Material temperature in intact loop (TMU-15B16)	43
52.	Material temperature in broken loop (TMB-20T16)	44
53.	Material temperature in broken loop (TMB-20T16)	44
54.	Material temperature in vessel wall (TMV-VI-35A)	45
55.	Material temperature in vessel wall (TMV-VI-177M)	45
56.	Material temperature in vessel filler (TMV-FI-35M)	46

57.	Material temperature in vessel filler insulator (TIV-FO-35A)	46
58.	Material temperature in core barrel (TMV-CO-35A)	47
59.	Material temperature in core barrel (TMV-CO-115A)	47
60.	Material temperature in core barrel (TMV-CO-115M)	48
61.	Material temperature in core barrel (TMV-CO-127A)	48
62.	Material temperature in core barrel (TMV-CI-35A)	49
63.	Material temperature in core barrel (TMV-CI-70A)	49
64.	Material temperature in core barrel (TMV-CI-95M)	50
65.	Material temperature in core barrel (TMV-CI-95M)	50
66.	Material temperature in core barrel (TMV-CI-115A)	51
67.	Material temperature in core housing filler (TMV-HF-115W)	51
68.	Material temperature in core housing filler (TMV-HF-127W)	52
69.	Material temperature in core housing filler (TMV-HF-138W)	52
70.	Core heater temperature, Rod D-4 (TH-D4-14)	53
71.	Core heater temperature, Rod D-4 (TH-D4-29)	53
72.	Core heater temperature, Rod D-5 (TH-D5-09)	54
73.	Core heater temperature, Rod D-5 (TH-D5-29)	54
74.	Core heater temperature, Rod D-5 (TH-D5-39)	55
75.	Core heater temperature, Rod E-4 (TH-E4-23)	55
76.	Core heater temperature, Rod E-4 (TH-E4-27)	56
77.	Core heater temperature, Rod E-5 (TH-E5-21)	56
78.	Core heater temperature, Rod E-5 (TH-E5-25)	57
79.	Core heater temperature, Rod A-4 (TH-A4-09)	57
80.	Core heater temperature, Rod A-4 (TH-A4-29)	58

81.	Core heater temperature, Rod A-4 (TH-A4-39)	58
82.	Core heater temperature, Rod A-5 (TH-A5-29)	59
83.	Core heater temperature, Rod A-5 (TH-A5-44)	59
84.	Core heater temperature, Rod B-3 (TH-B3-32)	60
85.	Core heater temperature, Rod B-3 (TH-B3-52)	60
86.	Core heater temperature, Rod B-5 (TH-B5-29)	61
87.	Core heater temperature, Rod B-5 (TH-B5-38)	61
88.	Core heater temperature, Rod B-6 (TH-B6-29)	62
89.	Core heater temperature, Rod C-2 (TH-C2-28)	62
90.	Core heater temperature, Rod C-2 (TH-C2-38)	63
91.	Core heater temperature, Rod C-3 (TH-C3-13)	63
92.	Core heater temperature, Rod C-3 (TH-C3-28)	64
93.	Core heater temperature, Rod C-3 (TH-C3-60)	64
94.	Core heater temperature, Rod C-4 (TH-C4-26)	65
95.	Core heater temperature, Rod C-4 (TH-C4-53)	65
96.	Core heater temperature, Rod C-5 (TH-C5-28)	66
97.	Core heater temperature, Rod C-5 (TH-C5-44)	66
98.	Core heater temperature, Rod C-6 (TH-C6-32)	67
99.	Core heater temperature, Rod C-7 (TH-C7-15)	67
100.	Core heater temperature, Rod D-1 (TH-D1-21)	68
101.	Core heater temperature, Rod D-2 (TH-D2-14)	68
102.	Core heater temperature, Rod D-2 (TH-D2-61)	69
103.	Core heater temperature, Rod D-3 (TH-D3-29)	69

104. Core heater temperature, Rod D-3 (TH-D3-39)	70
105. Core heater temperature, Rod D-6 (TH-D6-15)	70
106. Core heater temperature, Rod D-6 (TH-D6-25)	71
107. Core heater temperature, Rod D-7 (TH-D7-20)	71
108. Core heater temperature, Rod D-8 (TH-D8-26)	72
109. Core heater temperature, Rod E-1 (TH-E1-33)	72
110. Core heater temperature, Rod E-1 (TH-E1-54)	73
111. Core heater temperature, Rod E-2 (TH-E2-21)	73
112. Core heater temperature, Rod E-2 (TH-E2-33)	74
113. Core heater temperature, Rod E-3 (TH-E3-05)	74
114. Core heater temperature, Rod E-3 (TH-E3-20)	75
115. Core heater temperature, Rod E-3 (TH-E3-24)	75
116. Core heater temperature, Rod E-6 (TH-E6-08)	76
117. Core heater temperature, Rod E-6 (TH-E6-28)	76
118. Core heater temperature, Rod E-6 (TH-E6-31)	77
119. Core heater temperature, Rod E-6 (TH-E6-37)	77
120. Core heater temperature, Rod E-7 (TH-E7-13)	78
121. Core heater temperature, Rod E-7 (TH-E7-44)	78
122. Core heater temperature, Rod E-8 (TH-E8-14)	79
123. Core heater temperature, Rod E-8 (TH-E8-29)	79
124. Core heater temperature, Rod E-8 (TH-E8-45)	80
125. Core heater temperature, Rod F-2 (TH-F2-22)	80
126. Core heater temperature, Rod F-2 (TH-F2-25)	81

127. Core heater temperature, Rod F-3 (TH-F3-15)	81
128. Core heater temperature, Rod F-3 (TH-F3-22)	82
129. Core heater temperature, Rod F-3 (TH-F3-25)	82
130. Core heater temperature, Rod F-4 (TH-F4-14)	83
131. Core heater temperature, Rod F-4 (TH-F4-28)	83
132. Core heater temperature, Rod F-4 (TH-F4-44)	84
133. Core heater temperature, Rod F-4 (TH-F4-60)	84
134. Core heater temperature, Rod F-5 (TH-F5-20)	85
135. Core heater temperature, Rod F-5 (TH-F5-26)	85
136. Core heater temperature, Rod F-5 (TH-F5-33)	86
137. Core heater temperature, Rod F-5 (TH-F5-53)	86
138. Core heater temperature, Rod F-6 (TH-F6-08)	87
139. Core heater temperature, Rod F-6 (TH-F6-28)	87
140. Core heater temperature, Rod F-7 (TH-F7-29)	88
141. Core heater temperature, Rod F-7 (TH-F7-39)	88
142. Core heater temperature, Rod G-3 (TH-G3-13)	89
143. Core heater temperature, Rod G-3 (TH-G3-45)	89
144. Core heater temperature, Rod G-4 (TH-G4-09)	90
145. Core heater temperature, Rod G-4 (TH-G4-29)	90
146. Core heater temperature, Rod G-4 (TH-G4-33)	91
147. Core heater temperature, Rod G-4 (TH-G4-38)	91
148. Core heater temperature, Rod G-5 (TH-G5-14)	92
149. Core heater temperature, Rod G-5 (TH-G5-24)	92

150. Core heater temperature, Rod G-6 (TH-G6-21)	93
151. Core heater temperature, Rod G-6 (TH-G6-33)	93
152. Core heater temperature, Rod H-5 (TH-H5-28)	94
153. Material temperature in steam generator (TMU-SG1)	94
154. Material temperature in steam generator (TMU-SG2)	95
155. Material temperature in steam generator (TMU-SG3)	95
156. Material temperature in steam generator (TMU-SG4)	96
157. Pressure in vessel, upper plenum (PV-UP+10)	96
158. Pressure in vessel, inlet annulus (PV-IANN-9)	97
159. Pressure in steam generator, secondary side (PU-SGSD)	97
160. Pressure in pressure suppression tank (P-PSS)	98
161. Pressure in pressure suppression tank header (P-PSS-HD)	98
162. Differential pressure in intact loop, low range (DPU-UP-1 L)	99
163. Differential pressure in intact loop (DPU-UP-9)	99
164. Differential pressure in intact loop (DPU-1-3)	100
165. Differential pressure in intact loop, low range (DPU-1-3L)	100
166. Differential pressure in intact loop, (DPU-3-7)	101
167. Differential pressure in intact loop, low range (DPU-3-7L)	101
168. Differential pressure in intact loop (DPU-3-SGIP)	102
169. Differential pressure in steam generator primary (DPU-SGIP-SG1)	102
170. Differential pressure in steam generator primary (DPU-SG1-SG2)	103
171. Differential pressure in steam generator primary (DPU-SG2-SG3)	103
172. Differential pressure in steam generator primary (DPU-SG3-SG4)	104
173. Differential pressure in intact loop (DPU-7-10)	104

174. Differential pressure in intact loop (DPU-8C-7)	105
175. Differential pressure in intact loop pump trap (DPU-8C-8D)	105
176. Differential pressure in intact loop, low range (DPU-12-10).	106
177. Differential pressure in intact loop (DPU-15-1)	106
178. Differential pressure in intact loop (DPU-15-IANN)	107
179. Differential pressure in intact loop (DPU-15-ATM)	107
180. Differential pressure in broken loop (DPB-21-IANN)	108
181. Differential pressure in broken loop (DPB-21-23)	108
182. Differential pressure in vessel (DPV-9-180QQ)	109
183. Differential pressure in vessel (DPV-166-191QT)	109
184. Differential pressure in vessel core (DPVC-CBI-UP)	110
185. Differential pressure in vessel core (DPVC-83W-UP)	110
186. Differential pressure in vessel core (DPVC-83-100WQ)	111
187. Differential pressure in vessel core (DPVC-100-117QJ)	111
188. Differential pressure in vessel core (DPVC-117-133JD)	112
189. Differential pressure in vessel core (DPVC-133-191DT)	112
190. Volumetric flow in intact loop (FTU-1)	113
191. Volumetric flow in intact loop (FTU-9)	113
192. Volumetric flow in intact loop (FTU-15)	114
193. Volumetric flow in broken loop (FTB-21)	114
194. Volumetric flow in core barrel manifold (FTV-CBM)	115
195. Volumetric flow in core barrel manifold (FTV-CBM)	115
196. Momenum flux in intact loop (FDU-1)	116
197. Momentum flux in intact loop (FDU-1)	116

198. Momentum flux in intact loop (FDU-1)	117
199. Momentum flux in intact loop (FDU-1)	117
200. Density in intact loop (GU-1VR)	118
201. Density in intact loop (GU-1VR)	118
202. Density in intact loop (GU-1VR)	119
203. Density in intact loop (GU-1VR)	119
204. Density in intact loop (GU-1HZ)	120
205. Density in intact loop (GU-1HZ)	120
206. Density in intact loop (GU-1HZ)	121
207. Density in intact loop (GU-1HZ)	121
208. Density in intact loop (GU-5VR)	122
209. Density in intact loop (GU-5VR)	122
210. Density in intact loop (GU-5VR)	123
211. Density in intact loop (GU-5VR)	123
212. Density in intact loop (GU-10VR)	124
213. Density in intact loop (GU-10VR)	124
214. Density in intact loop (GU-10VR)	125
215. Density in intact loop (GU-10VR)	125
216. Density in intact loop (GU-15VR)	126
217. Density in intact loop (GU-15VR)	126
218. Density in intact loop (GU-15VR)	127
219. Density in intact loop (GU-15VR)	127
220. Density in broken loop (GB-21VR)	128

221. Density in broken loop (GB-21 VR)	128.
222. Density in broken loop (GB-21 VR)	129
223. Density in broken loop (GB-21 VR)	129
224. Density in broken loop (GB-23VR)	130
225. Density in broken loop (GB-23VR)	130
226. Density in broken loop (GB-23VR)	131
227. Density in broken loop (GB-23VR)	131
228. Differential pressure in intact loop (phase separator liquid level) (DPU-PSEP-W)	132
229. Differential pressure in steam generator secondary (DPU-SG-SEC)	132
230. Core heater pin total power (PWRCOR T-1)	133
231. Core heater pin total power (PWRCOR T-1)	133
232. Core heater pin total power (PWRCOR T-2)	134
233. Core heater pin total power (PWRCOR T-2)	134
234. Core heater voltage (VOLTCOR-T)	135
235. Core heater total current (AMPCOR-T)	135

TABLES

I. Conditions at Reflood Initiation	4
II. Water Chemistry	4
III. Sequence of Events During Tests	5
IV. Data Presentation for Semiscale Mod-1 Tests S-03-1 Through S-03-4	13

EXPERIMENT DATA REPORT FOR SEMISCALE MOD-1

TESTS S-03-1, S-03-2, S-03-3, and S-03-4

(Reflood Heat Transfer Tests)

I. INTRODUCTION

The Semiscale Mod-1 experiments represent the current phase of the Semiscale Program conducted by Aerojet Nuclear Company for the United States Government. The program, which is sponsored by the Nuclear Regulatory Commission through the Energy Research and Development Administration, is part of the overall program designed 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 Program are to quantify the physical processes controlling system behavior during a 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.

Tests S-03-1 through S-03-4 were conducted in the Semiscale Mod-1 system as part of the reflood heat transfer test series to obtain thermal hydraulic response data from a reflood transient in a simulated nuclear reactor with a heated core to provide an experimental basis for analytical model development and evaluation.

For Tests S-03-1 through S-03-4, the pressure vessel was equipped with a core inlet manifold to allow reflood coolant to be injected directly into the bottom of the 40-electric-heater-rod heated core. Reflood was initiated at an initial core power level of 97 kW and a peak initial heater rod temperature of 1,400°F. During reflood, the core heater power was adjusted to simulate the response characteristics of nuclear rods. The broken loop cold leg piping was open to the pressure suppression system header to allow for pressure control and system heatup using the pressure suppression system steam supply.

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 Tests S-03-1 through S-03-4. 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 Semiscale Mod-1 system, and a description of the measurement and data processing techniques and uncertainties can be found in Reference 1.

II. SYSTEM, PROCEDURES, CONDITIONS AND EVENTS FOR TESTS S-03-1, S-03-2, S-03-3, and S-03-4

The following system configuration, procedures, initial test conditions, and events are specific to Tests S-03-1 through S-03-4 as indicated.

1. SYSTEM CONFIGURATION AND TEST PROCEDURES

The Semiscale Mod-1 system used for Tests S-03-1 through S-03-4 consisted of a pressure vessel with internals, 40-electric-heater-rod heated core, and a core inlet manifold; and intact loop with steam generator, pump, and phase separator; a partial broken loop (cold leg only); and a pressure suppression system with a header, suppression tank, and a heated steam supply system. The core inlet manifold was attached to the core barrel inlet plate and allowed reflood coolant to be injected directly into the heated core. The phase separator was installed in the intact loop hot leg to allow determination of the vessel outlet fluid quality. The broken loop cold leg piping was attached directly to the pressure suppression header without a restricting nozzle or rupture discs. The pressure suppression system was equipped with a steam supply system for system heatup and for regulating system pressure. The Semiscale Mod-1 experimental system is described in more detail in Reference 1.

In preparation for each test (Tests S-03-1 through S-03-4), the steam generator feedwater and low-pressure injection supply tanks were filled with treated demineralized water and heated to 500 and 153°F, respectively. Prior to warmup, system instrumentation was checked and transducer readings were initialized. Warmup to initial test conditions was accomplished by introducing saturated steam from the pressure suppression system steam supply. The condensate was drained periodically during warmup.

After the system was heated to 293°F, the steam generator secondary was heated to 500°F by circulating water from the feedwater tank. As soon as acceptable initial temperature conditions were established, the core barrel was filled to the bottom of the heated length on the heater rods with 153°F reflood cooling water, and power was applied to the core (97 kW). When the peak heater rod thermocouple temperature reached 1,400°F reflood was initiated and the core power control was switched to a power decay transient to simulate the thermal response of nuclear fuel rods using the American Nuclear Society decay heat curve +20%. The tests were terminated 60 seconds after all rod thermocouples indicated quenching had occurred.

The adjustment of the initial liquid level at the bottom of the core heated length was accomplished by observation of the response of a density detector near the bottom of the core and thermocouples located at grid spacer 10.

During Tests S-03-1 through S-03-4, the drain for discharge of the feedwater used to heat the steam generator secondary shared a common manifold with the drains of the differential pressure sense line cooled probes. The hot water drained from the steam generator caused the drain manifold to become pressurized with hot steam which flowed back into the sense line cooled probes. The steam heated the probes and vaporized the water in the sense-lines, rendering many of the differential pressure readings unreliable.

2. INITIAL TEST CONDITIONS AND SEQUENCE OF EVENTS

Conditions in the Semiscale Mod-1 system at initiation of reflood are given in Table I; the water chemistry from samples of injected coolant drained from the core after reflood are given in Table II; and the sequence of events relative to initiation of reflood is given in Table III.

TABLE I
CONDITIONS AT REFLOOD INITIATION

	<u>Specified</u>	<u>Measured</u>			
		<u>Test S-03-1</u>	<u>Test S-03-2</u>	<u>Test S-03-3</u>	<u>Test S-03-4</u>
System Pressure (psia)	60	59.4	58.6	59.8	59.7
Core Power (kW)	97 $\pm$ 3	96.5	96.5	96	97
Peak Core Temperature ($^{\circ}$ F) (TH-D5-29)	1,400	1,400	1,395	1,398	1,401
PSS Tank Water Temperature ($^{\circ}$ F) (TF-PSS-33)	293 $\pm$ 2	294	287	289	292
PSS Tank Water Level (in.)	46.5 $\pm$ 1	46.0	46.0	46.0	46.1
Steam Generator Feedwater Temperature ($^{\circ}$ F)	500 $\pm$ 10	484	511	507	495
Steam Generator Secondary Liquid Level (in.)	116 $\pm$ 2	116	116	116	116
Core Barrel Metal Temperature ($^{\circ}$ F) (TMV-CO-35A)	293 $\pm$ 5	290	290	289	291
Intact Loop Hot Leg Metal Temperature (TMU-5B16)	293 $\pm$ 5	290	290	failed	290
Broken Loop Cold Leg Metal Temperature ($^{\circ}$ F) (TMB-20T16)	293 $\pm$ 5	295	294	295	295

TABLE II
WATER CHEMISTRY

	<u>Tests S-03-1 and S-03-2</u>	<u>Tests S-03-3 and S-03-4</u>
ph	9.9	7.4
Conductivity (μ mhos/cm)	53.1	33.0
Lithium (ppm)	2.6	1.9
Chlorides (ppm)	0.03	0.03
Fluorides (ppm)	<0.34	<0.34
Oxygen (ppm)	33.1	37.9
Total Gas (cc/l)	167.6	226.1
Suspended Solids (ppm)	0.15	0.33

TABLE III
SEQUENCE OF EVENTS DURING TESTS

Event	Time Relative to Reflood Initiation			
	Test S-03-1	Test S-03-2	Test S-03-3	Test S-03-4
Initial Fluid Level Established in Core	-22 min	-15 min	-9 min	~ = -10 min
Core Power Level Established	-60 sec	-75 sec	~ -90 sec	~ -90 sec
Heater Rod Temperature Reaches 1,400°F	0	0	0	0
Initiation of Reflood	0	0	0	0
Test Terminated	180 sec	212 sec	330 sec ^[a]	208 sec

[a] Data reported to 248 sec.

III. DATA PRESENTATION

The data from Semiscale Mod-1 Tests S-03-1 through S-03-4 are presented with brief comment. Processing analysis has been performed only to the extent necessary to account for known nonlinearities in transducer calibrations and to obtain appropriate engineering units.

The performance of the system during Tests S-03-1 through S-03-4 was monitored by about 200 detectors. The data obtained were recorded on both digital and analog data acquisitions systems. The digital system was used to process the data presented in this report. The analog system was used primarily to provide redundancy.

The data are presented, in most instances, in the form of composite graphs to facilitate comparison of a given variable in different tests. In cases for which composite graphs might be difficult to interpret, data for a given variable have been plotted on multiple figures. The scales selected for the graphs do not reflect the obtainable resolution of the data. (The data processing techniques are described in greater detail in Reference 1.)

Figures 1 through 6 and Table IV provide supporting information for interpretation of the data graphs shown in Figures 7 through 235. Figures 1 through 6 show the relative locations of all detectors used during the Semiscale Mod-1 reflood heat transfer test series. Table IV groups the measurements taken during Tests S-03-1 through S-03-4 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(s).

Figures 7 through 235 present the reflood data obtained. Time zero on the graphs is the time of reflood initiation.

Reported test data for Test S-03-2 include transients associated with system shutdown at $t = 215$ seconds. Some of these transients have been attenuated for presentation of the figures.

Fig. 1 Semiscale Mod-1 system and instrumentation for partial cold leg break with phase separator -- isometric.

Fig. 2 Semiscale Mod-1 system and instrumentation for partial cold leg break with phase separator -- 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.

Fig. 6 Semiscale Mod-1 heated core, plan view.

TABLE IV
DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS
S-03-1 THROUGH S-03-4

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
FLUID TEMPERATURE	Chromel-Alumel thermocouples unless specified otherwise	0-2,300°F	0-1,017°F		
<u>Intact Loop</u>					
TFU-1	Hot leg, Spool 1, 31 in. from vessel center			7	
TFU-PHSEP-W	In hot leg at bottom of phase separator well			8	Data reported for Tests S-03-3 and S-03-4 only. Thermocouple was defective for Tests S-03-1 and S-03-2.
TSU-6	Hot leg, Spool 6, 114 in. from vessel center (shielded)			9	
TSU-7	Cold leg, Spool 7, 243 in. from vessel center (shielded)			10	
TFU-8	Cold leg, Spool 8, 195 in. from vessel center			11, 12	
TFU-10	Cold leg, Spool 10, 144 in. from vessel center		0-591°F	13, 14	
TSU-12	Cold leg, Spool 12, 80 in. from vessel center (shielded)		0-591°F	15, 16	Transient attenuated at T=290°F for Test S-03-2.
RBV-14A	Cold leg, Spool 14, 43 in. from vessel center, upstream of cold leg injection port (platinum resistance bulb)	0-1,000°F	0-1,000°F	17, 18	Transient attenuated at T=290°F for Test S-03-2.
<u>Broken Loop</u>					
TFB-20	Cold leg, Spool 20, 21 in. from vessel center	0-2,300°F	0-591°F	19, 20	Transient attenuated at T=290°F for Test S-03-2.
TFB-23	Cold leg, Spool 23, 91 in. from vessel center, upstream of vessel-side nozzle			21	Transient attenuated at T=290°F for Test S-03-2.
<u>Downcomer Annulus</u>					
TFV-ANN-35A	Centered in annulus, Type J iron-constantan thermocouples 35 in. below cold leg centerline 0°	0-1,400°F	0-803°F	22	Transient attenuated at T=285°F for Test S-03-2.
<u>Upper Plenum</u>					
TFV-UP+13	In upper plenum 13.5 in. above cold leg centerline at 180°	0-2,300°F	0-1,017°F	23	
<u>Core Grid Spacer</u>					
<u>Grid Spacer 5</u>					
TFG-5CD-45	55 in. below cold leg centerline 21.5 in. above top of heated length Thermocouple in space defined by Columns C and D, Rows 4 and 5	0-2,300°F	0-2,382°F	24, 25	
<u>Grid Spacer 6</u>					
TFG-6AD-45	76 in. below cold leg centerline, 1/2 in. above top of heated length Thermocouple in space defined by Columns A and B, Rows 4 and 5			26, 27	
TFG-6CD-45	Thermocouples in space defined by Columns C and D, Rows 4 and 5			28, 29	
TFG-6DE-45	Thermocouples in space defined by Columns D and E, Rows 4 and 5, and 6 and 7			30, 31	
TFG-6DE-67				32, 33	
<u>Grid Spacer 8</u>					
TFG-8CD-45	109 in. below cold leg centerline at center of heated length Thermocouple in space defined by Columns C and D, Rows 4 and 5			34	
TFG-8EF-45	Thermocouple in space defined by Columns E and F, Rows 4 and 5			---	Data indicate probable detector failure; data not reported.
<u>Grid Spacer 10</u>					
TFG-10CD-45	143 in. below cold leg centerline at bottom of heated length Thermocouple in space defined by Columns C and D, Rows 4 and 5			35	
TFG-10DE-67	Thermocouple in space defined by Columns D and E, Rows 6 and 7			36	
TFG-10FF-45	Thermocouple in space defined by Columns E and F, Rows 4 and 5			37	
TFG-10GH-45	Thermocouple in space defined by Columns G and H, Rows 4 and 5			38	

TABLE IV (contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS
S-03-1 THROUGH S-03-4.

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Steam Generator</u>					
TFU-SGSD	In steam generator dome, 129.5 in. from bottom of tube sheet	0-2,300°F	0-591°F	39	Data reported for Tests S-03-1 and S-03-2 only.
TFU-SG1	Secondary side, 12 in. above bottom of tube sheet			40	
TFU-SG2	Secondary side, 24 in. above bottom of tube sheet			41	
TFU-SG3	Secondary side, 48 in. above bottom of tube sheet			42	
TFU-SG4	Secondary side, 96 in. above bottom of tube sheet			43	
<u>Pressure Suppression System</u>					
TF-PSS-33	33 in. from bottom of tank	0-2,300°F	0-591°F	44	Transient attenuated at T=285°F for Test S-03-2.
TF-PSS-130	130 in. from bottom of tank			45	Transient attenuated at T=290°F for Test S-03-2.
<u>MATERIAL TEMPERATURE</u>					
	Chromel-Alumel thermocouples unless specified otherwise	0-2,300°F	0-591°F		
<u>Intact Loop</u>					
TMU-1T16	Hot leg, Spool 1, top 1/16 in. from pipe ID, 29 in. from vessel center			46	Transient attenuated at T=293°F for Test S-03-2.
TMU-5B16	Hot leg, Spool 5, bottom 1/16 in. from pipe ID, 102 in. from vessel center			47	
TMU-7S16	Cold leg, Spool 7, side, 1/16 in. from pipe ID, 242 in. from vessel center (vertical pipe)			48	
TMU-8S16	Cold leg, Spool 8, side, in pump trap, 1/16 in. from pipe ID, 195 in. from vessel center			49	
TMU-10S16	Cold leg, Spool 10, side, 1/16 in. from pipe ID, 144 in. from vessel center			50	Data recorded for Tests S-03-1 and S-03-2 only.
TMU-15B16	Cold leg, Spool 15, bottom, 1/16 in. from pipe ID, 17 in. from vessel center			51	
<u>Broken Loop</u>					
TMB-20T16	Cold leg, Spool 20, top, 1/16 in. from pipe ID, 21 in. from vessel center	0-2,300°F	0-591°F	52, 53	Transient attenuated at T=290°F for Test S-03-2.
<u>Vessel Wall</u>					
TMV-VI-35A	35 in. below cold leg centerline, 0°	0-1,400°F	0-803°F	54	Data recorded for Tests S-03-1 and S-03-2 only.
TMV-VI-177M	177 in. below cold leg centerline, 180°			55	Data recorded for Tests S-03-1 and S-03-2 only.
<u>Vessel Filler</u>					
TMV-FI-35M	Type J iron-constantan thermocouples 35 in. below cold leg centerline, 1/16 in. from filler ID, 180°	0-1,400°F	0-803°F	56	Data recorded for Tests S-03-1 and S-03-2 only.
<u>Vessel Filler Insulator</u>					
TIV-FO-35A	Outer surface of insulator, Type J iron-constantan thermocouples 35 in. below cold leg centerline, 0°	0-1,400°F	0-803°F	57	Data recorded for Tests S-03-1 and S-03-2 only; transient attenuated at T=285°F for Test S-03-2.
<u>Core Barrel</u>					
TMV-CO-35A	Type J iron-constantan thermocouples 35 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°	0-1,400°F	0-803°F	58	Transient attenuated at T=287.5°F for Test S-03-2.
TMV-CO-115A	115 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			59	
TMV-CO-115M	115 in. below cold leg centerline, 1/16 in. from core barrel OD, 180°			60	
TMV-CO-127A	127 in. below cold leg centerline, 1/16 in. from core barrel OD, 0°			61	

TABLE IV (contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS
S-03-1 THROUGH S-03-4

Measurement	Location and Comments [a]	Range (a)		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
TMV-CI-35A	35 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°			62	Data recorded for Tests S-03-1 and S-03-2 only; transient attenuated at T=287°F for Test S-03-2.
TMV-CI-70A	70 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°			63	Transient attenuated at T=287°F for Test S-03-2.
TMV-CI-95M	95 in. below cold leg centerline, 1/16 in. from core barrel ID, 180°			64, 65	Transient attenuated at T=287°F for Test S-03-2.
TMV-CI-115A	115 in. below cold leg centerline, 1/16 in. from core barrel ID, 0°			66	
Core Housing Filler		0-2,300°F	0-592°F		
TMV-HF-115W	On core housing filler, 115 in. below cold leg centerline, 0.20 in. from outer surface, 315°			67	
TMV-HF-127W	On core housing filler, 127 in. below cold leg centerline, 0.20 in. from outer surface, 315°			68	
TMV-HF-138W	On core housing filler, 138 in. below cold leg centerline, 0.02 in. from outer surface, 315°			69	
Core Heater Cladding Temperatures		0-2,300°F	0-2,382°F		
High-Power Heaters					
TH-D4-14	Heater at Column D Row 4. Thermocouples 14 in. (270°) and 29 in. (315°) above bottom of core			70	
TH-D4-29				71	
TH-D5-09	Heater at Column D Row 5. Thermocouples 9 in. (45°), 29 in. (225°), and 39 in. (135°) above bottom of core			72	
TH-D5-29				73	
TH-D5-39				74	
TH-E4-23	Heater at Column E Row 4. Thermocouples 23 in. (90°) and 27 in. (0°) above bottom of core			75	
TH-E4-27				76	
TH-E5-21	Heater at Column E Row 5. Thermocouples 21 in. (180°) and 25 in. (90°) above bottom of core			77	
TH-E5-25				78	
Low-Power Heaters					
TH-A4-09	Heater at Column A Row 4. Thermocouples 9 in. (105°), 29 in. (240°), and 39 in. (300°) above bottom of core			79	
TH-A4-29				80	
TH-A4-39				81	
TH-A5-29	Heater at Column A Row 5. Thermocouples 29 in. (180°) and 44 in. (255°) above bottom of core			82	
TH-A5-44				83	
TH-B3-32	Heater at Column B Row 3. Thermocouples 32 in. (135°) and 52 in. (195°) above bottom of core			84	
TH-B3-52				85	Questionable measurement.
TH-B5-29	Heater at Column B Row 5. Thermocouples 29 in. (150°) and 38 in. (240°) above bottom of core			86	
TH-B5-38				87	
TH-B6-29	Heater at Column B Row 6. Thermocouple 29 in. (45°) above bottom of core			88	
TH-C2-28	Heater at Column C Row 2. Thermocouples 28 in. (135°) and 38 in. (225°) above bottom of core			89	
TH-C2-38				90	TH-C2-38 recorded for Tests S-03-3 and S-03-4 only.
TH-C3-13	Heater at Column C Row 3. Thermocouples 13 in. (285°), 28 in. (0°), and 60 in. (150°) above bottom of core			91	
TH-C3-28				92	
TH-C3-60				93	
TH-C4-26	Heater at Column C Row 4. Thermocouples 26 in. (75°) and 53 in. (300°) above bottom of core			94	
TH-C4-53				95	
TH-C5-28	Heater at Column C Row 5. Thermocouples 28 in. (315°), 44 in. (45°), and 60 in. (105°) above bottom of core			96	
TH-C5-44				97	
TH-C5-60				---	Thermocouple failed.
TH-C6-32	Heater at Column C Row 6. Thermocouples 32 in. (255°) and 53 in. (270°) above bottom of core			98	
TH-C6-53				---	Thermocouple failed.
TH-C7-13	Heater at Column C Row 7. Thermocouple 15 in. (255°) above bottom of core			99	

TABLE IV (contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS

S-03-1 THROUGH S-03-4

Measurement	Location and Comments [a]	Detector	Range [a]	Figure [a]	Measurement Comments [b]
			Data Acquisition System		
Low-Power Heaters (contd.)					
TH-D1-21	Heater at Column D Row 1. Thermocouple 21 in. (330°) above bottom of core			100	
TH-D2-14	Heater at Column D Row 2. Thermocouples 14 in. (0°), 45 in. (165°), and 61 in. (270°) above bottom of core			101	Thermocouple failed.
TH-D2-45				---	
TH-D2-61				102	
TH-D3-29	Heater at Column D Row 3. Thermocouples 29 in. (150°), 33 in. (45°), and 39 in. (225°) above bottom of core			103	Thermocouple failed.
TH-D3-33				---	
TH-D3-39				104	
TH-D6-15	Heater at Column D Row 6. Thermocouples 15 in. (90°) and 25 in. (255°) above bottom of core			105	
TH-D6-25				106	
TH-D7-20	Heater at Column D Row 7. Thermocouple 20 in. (60°) above bottom of core			107	
TH-D8-26	Heater at Column D Row 8. Thermocouple 26 in. (180°) above bottom of core			108	
TH-E1-33	Heater at Column E Row 1. Thermocouples 33 in. (60°) and 54 in. (0°) above bottom of core			109	
TH-E1-54				110	
TH-E2-21	Heater at Column E Row 2. Thermocouples 21 in. (210°) and 33 in. (315°) above bottom of core			111	
TH-E2-33				112	
TH-E3-05	Heater at Column E Row 3. Thermocouples 5 in. (15°), 20 in. (165°), and 24 in. (75°) above bottom of core			113	
TH-E3-20				114	
TH-E3-24				115	
TH-E6-08	Heater at Column E Row 6. Thermocouples 8 in. (150°), 28 in. (285°), 31 in. (225°), and 37 in. (330°) above bottom of core			116	TH-E6-31 failed for Test S-03-2; data not recorded for Tests S-03-3 and S-03-4.
TH-E6-28				117	
TH-E6-31				118	
TH-E6-37				119	
TH-E7-13	Heater at Column E Row 7. Thermocouples 13 in. (45°) and 44 in. (195°) above bottom of core			120	
TH-E7-44				121	
TH-E8-14	Heater at Column E Row 8. Thermocouples 14 in. (150°), 29 in. (225°), and 45 in. (300°) above bottom of core			122	
TH-E8-29				123	
TH-E8-45				124	
TH-F2-22	Heater at Column F Row 2. Thermocouples 22 in. (105°) and 25 in. (0°) above bottom of core			125	
TH-F2-25				126	
TH-F3-15	Heater at Column F Row 3. Thermocouples 15 in. (240°), 22 in. (105°), and 25 in. (30°) above bottom of core			127	TH-F2 25 failed for Test S-03-4
TH-F3-22				128	
TH-F3-25				129	
TH-F4-14	Heater at Column F Row 4. Thermocouples 14 in. (90°), 28 in. (165°), 44 in. (210°), and 60 in. (285°) above bottom of core			130	
TH-F4-28				131	
TH-F4-44				132	
TH-F4-60				133	
TH-F5-20	Heater at Column F Row 5. Thermocouples 20 in. (255°), 26 in. (165°), 33 in. (315°), and 53 in. (30°) above bottom of core			134	
TH-F5-26				135	
TH-F5-33				136	
TH-F5-53				137	
TH-F6-08	Heater at Column F Row 6. Thermocouples 8 in. (60°) and 28 in. (135°) above bottom of core			138	
TH-F6-28				139	
TH-F7-29	Heater at Column F Row 7. Thermocouples 29 in. (150°) and 39 in. (210°) above bottom of core			140	
TH-F7-39				141	
TH-G3-13	Heater at Column G Row 3. Thermocouples 13 in. (150°), and 45 in. (270°) above bottom of core			142	Data recorded for Tests S-03-2 and S-03-4 only.
TH-G3-45				143	
TH-G4-09	Heater at Column G Row 4. Thermocouples 9 in. (150°), 29 in. (300°), 33 in. (225°), and 38 in. (30°) above bottom of core			144	TH-G4-09 not recorded for Tests S-03-1 and S-03-2; failed for test S-03-3. TH-G4-29 not recorded for Tests S-03-1 and S-03-2.
TH-G4-29				145	
TH-G4-33				146	
TH-G4-38				147	
TH-G5-14	Heater at Column G Row 5. Thermocouples 14 in. (45°) and 24 in. (330°) above bottom of core			148	
TH-G5-24				149	

TABLE IV (contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS
S-03-1 THROUGH S-03-4

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Low-Power Heaters (contd.)</u>					
TH-G6-21	Heater at Column G Row 6. Thermocouples 21 in. (60°) and 33 in. (135°) above bottom of core			150	
TH-G6-33				151	
TH-H4-14	Heater at Column H Row 4. Thermocouple 14 in. (105°) above bottom of core			---	Thermocouple failed.
TH-H5-28	Heater at Column H Row 5. Thermocouple 28 in. (150°) above bottom of core			152	
<u>Steam Generator</u>					
TMU-SG1	On steam generator tubes, 12 in. above bottom of tube sheet, on OD of tube			153	
TMU-SG2	On steam generator tubes, 24 in. above bottom of tube sheet, on OD of tube			154	
TMU-SG3	On steam generator tubes, 48 in. above bottom of tube sheet, on OD of tube			155	
TMU-SG4	On steam generator tubes, 96 in. above bottom of tube sheet, on OD of tube			156	
<u>PRESSURE</u>					
<u>Vessel</u>					
PV-UP+10	In upper plenum, 10.5 in. above cold leg centerline, mounted on standoff, 30°	0-250 psi	0-330.7 psi	157	Transient attenuated at P=57.5 psia for Test S-03-2.
PV-IANN-9	In vessel inlet annulus, 9 in. below cold leg centerline, mounted on standoff, 225°	0-250 psi	0-345.5 psi	158	Transient attenuated at P=55 psia for Test S-03-2.
<u>Steam Generator</u>					
PU-SGSD	Secondary side, steam dome	0-3,000 psi	0-1,521 psi	159	Detector failed for Tests S-03-1 and S-03-2. Data have not been corrected to match saturation pressure; use for transient response only.
<u>Pressure Suppression System</u>					
P-PSS	Suppression tank top	0-750 psi	0-321 psia	160	Transient attenuated at P=55 psia for Test S-03-2.
P-PSS-HD	In suppression tank header	0-200 psi	0-380 psia	161	Data for Test S-03-3 not reported due to detector failure.
<u>DIFFERENTIAL PRESSURE</u>					
	Elevation difference between transducer taps is zero unless otherwise specified				Differential pressure readings were set to zero with the sense lines full and the system empty. The sense lines may not have remained full during the test; questionable data.
<u>Intact Loop</u>					
DPU-UP-1L	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 ~2 in. above Spool 1 tap (low range)	±20 in. water	±1.0 psid	162	Liquid may have boiled from the sense lines. Data for Tests S-03-1 and S-03-2 not reported due to detector failure
DPU-UP-9	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	163	Transient attenuated at 5.0 psid for Test S-03-2.
DPU-1-3	Hot leg Spool 1, 31 in. from vessel center to hot leg Spool 3, 62 in. from vessel center	±50 in. water	±2.5 psid	164	
DPU-1-3L	Hot leg Spool 1, 31 in. from vessel center to hot leg Spool 3, 62 in. from vessel center (low range)	±20 in. water	±1.0 psid	165	
DPU-PSEP-W	Phase separator liquid level, hot leg, Spool 2, elevation difference between taps is 84 in.	±100 in. water	±5.0 psid	228	Steam may have been present in sense lines.
DPU-PSEP-WL	Phase separator liquid level, hot leg Spool 2, elevation difference between taps is 84 in. (low range)	±50 in. water	±2.5 psid	---	Data not recorded for Test S-03-3; detector remained saturated for other tests.

TABLE IV (contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS

S-03-1 THROUGH S-03-4

Measurement	Location and Comments ^[a]	Detector	Range ^[a]	Figure	Measurement Comments ^[b]
			Data Acquisition System		
<u>Intact Loop (contd.)</u>					
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	±2.5 psid	166	Transient attenuated at 1.0 psid for Test S-03-2.
DPU-3-7L	Above 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	167	Transient attenuated at 1.0 psid for Test S-03-2.
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	+50 in. water	±2.5 psid	168	
DPU-SGIP-SG1	Steam generator inlet plenum, 145 in. from vessel center to 12.25 in. above bottom of tube sheet, SG1 tap is 24 in. above SGIP tap	+300 in. water	±15 psid	169	Sense line from tap at SG1 may have drained. Transient attenuated at ~5.0 psid for Test S-03-2.
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	170	Sense lines may have drained. Transient attenuated for Test S-03-2.
DPU-SG2-SG3	Across primary side tubes, 24 to 48 in. above bottom of tube sheet, SG2 tap is 24 in. below SG3 tap	+50 in. water	±2.5 psid	171	Sense lines may have drained. Detector remained saturated for Tests S-03-2, S-03-3, and S-03-4; data not reported.
DPU-SG3-SG4	Across primary side tubes, 48 to 96 in. above bottom of tube sheet, SG3 tap is 48 in. below SG4 tap	+100 in. water	±5.0 psid	172	Sense lines may have drained. Detector remained saturated for Tests S-03-1 and S-03-2; data not reported.
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	+20 in. water	±1.0 psid	173	
DPU-8C-7	From pump trap, cold leg Spool 8, tap 8C, 197 in. from vessel center to steam generator outlet, cold leg Spool 7, 231 in. from vessel center. Tap 8C is 32 in. below Spool 7 tap	+100 in. water	±5.0 psid	174	
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	175	
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	176	Transient attenuated at ~1.4 psid for Test S-03-2.
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 9 in. below Spool 1 tap	+500 in. water	±2.5 psid	177	Transient attenuated at ~8.0 psid for Test S-03-2.
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	178	
DPU-15-ATM	Cold leg Spool 15, 16 in. from vessel center to atmosphere	±100 psi	±100 psia	179	Transient attenuated at 56.0 psid for Test S-03-2.
<u>Broken Loop</u>					
DPB-21-IANN	Cold leg Spool 21, 49 in. from vessel center to vessel inlet annulus, 9 in. below cold leg centerline at 225°, inlet annulus tap 9 in. below Spool 21 tap	+100 in. water	±5.0 psid	180	Liquid may have boiled from sense lines.
DPB-21-23	Cold leg Spool 21, 49 in. from vessel center to cold leg Spool 23, 92 in. from vessel center	+20 in. water	±1.0 psid	181	Transient attenuated at 0.4 psid for Test S-03-2.
<u>Vessel</u>					
DPB-21-IANN	Cold leg Spool 21, 49 in. from vessel center to vessel inlet annulus, 9 in. below cold leg centerline at 225°, inlet annulus tap 9 in. below Spool 21 tap	+100 in. water	±5.0 psid	180	

TABLE IV (contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS

S-03-1 THROUGH S-03-4

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
<u>Vessel (contd.)</u>					
DPV-9-180QQ	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.	+500 in. water	±2.5 psid	182	
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	183	
<u>Vessel Core</u>					
DPVC-CBI-UP	From core barrel injection point 17 in. below lower head, to upper plenum 10.5 in. above cold leg centerline (30°). Elevation difference between taps is 222.5 in.	+300 in. water	±15 psid	184	Sense lines may have drained.
DPVC-CBM-UP	From core barrel manifold 152 in. below cold leg centerline to upper plenum 10.5 in. above cold leg centerline (30°). Elevation difference between taps is 162.5 in.	+100 in. water	±5.0 psid	---	Data indicate probable detector failure; data not reported.
DPVC-83W-UP	Upper segment of active core region 89 in. below cold leg centerline (315°) to upper plenum core tube 10.5 in. above cold leg centerline (30°). Elevation difference between taps is 100 in.	+100 in. water	±5.0 psid	185	Detector saturated for most of Test S-03-2.
DPVC-83-100WQ	Upper segment of active core region 89 in. below cold leg centerline (315°) to 106 in. below cold leg centerline (225°). Elevation difference between taps is 17 in.	+50 in. water	±2.5 psid	186	
DPVC-100-117QJ	Across center segment of active core region 106 in. below cold leg centerline (225°) to 122 in. below cold leg centerline (135°). Elevation difference between taps is 16 in.	+100 in. water	±5.0 psid	187	
DPVC-117-133JD	In active core region, lower segment, 122 in. below cold leg centerline (135°) to 140 in. below cold leg centerline (45°). Elevation difference between taps is 18 in.	+100 psid	±5.0 psid	188	Detector failed for Tests S-03-3 and S-03-4; transient attenuated at -4.0 psid for Test S-03-2.
DPVC-133-191DT	Lower Segment of active core region 140 in. below cold leg centerline (45°) to 191 in. below cold leg centerline (270°). Elevation difference between taps is 51 in.	+100 in. water	±5.0 psid	189	Detector remained saturated throughout Test S-03-2; data not reported.
<u>Steam Generator</u>					
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	229	Sense lines may have been heated.
<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-+400gpm	±1,800 gpm	190	
FTU-9	Cold leg, Spool 9, 154 in. from vessel center	+80-+800gpm	±1,800 gpm	191	Transient attenuated at 700 GPM for Test S-03-2.
FTU-15	Cold leg, Spool 15, 29 in. from vessel center	+20-+800gpm	±1,800 gpm	192	Transient attenuated at 700 GPM for Test S-03-2.
<u>Broken Loop</u>					
FTS-21	Cold leg, Spool 21, 58 in. from vessel center, 3-in. pipe	+20-+400gpm	±1,800 gpm	193	Transient attenuated at 600 GPM for Test S-03-2.
<u>Core</u>					
FTV-CBM	In core barrel manifold ECC injection point	+5.0-+50gpm	±25.0 gpm	194, 195	
<u>ECC System</u>					
FTU-LPIS	In line leading from LPIS for intact loop, 1/2-in. line	+0.75-+7.5gpm	±5.0 gpm	---	Failed due to AC interference.

TABLE IV (contd.)

DATA PRESENTATION FOR SEMISCALE MOD-1 TESTS

S-03-1 THROUGH S-03-4

Measurement	Location and Comments [a]	Range [a]		Figure [a]	Measurement Comments [b]
		Detector	Data Acquisition System		
MOMENTUM FLUX					
	Range of drag disc is bi-directional. Computer conversion of voltage output to momentum flux is unidirectional, and therefore shows magnitude only.				
Intact Loop					
FDU-1	Hot leg, Spool 1, 24 in. from vessel center, target size 1.0 in.	$\pm 1 \pm 2,000 \text{ lb}_m / \text{ft-sec}$	$\pm 3,250 \text{ lb}_m / \text{ft-sec}$	196, 197 198, 199	Transient attenuated at 200 lb/ft-sec ² for Test S-03-2.
DENSITY					
	Some vertical density measurements indicate the presence of condensate in system piping near t = 0.				
Intact Loop					
GU-1VR	Hot leg, Spool 1, 24 in. from vessel center, vertical	0-100 lb _m /ft ³	0.1-100 lb _m /ft ³	200, 201 202, 203	
GU-1HZ	Hot leg, Spool 1, 26 in. from vessel center, horizontal			204, 205 206, 207	Transient attenuated at 0.4 lb/ft ³ for Test S-03-2. Plot has been smoothed.
GU-5VR	Hot leg, Spool 5, 96 in. from vessel center, vertical			208, 209 210, 211	
GU-10VR	Cold leg Spool 10, 141 in. from vessel center, vertical			212, 213 214, 215	
GU-15VR	Cold leg Spool 15, 20 in. from vessel center, vertical			216, 217 218, 219	
Broken Loop					
GB-21VR	Cold leg, Spool 21, 49 in. from vessel center, vertical	0-1-100 lb _m /ft ³	0-100 lb _m /ft ³	220, 221 222, 223	
GB-23VR	Cold leg, Spool 23, 92 in. from vessel center, vertical			224, 225 226, 227	
LIQUID LEVEL					
Phase Separator					
DPU-PSEP-W	Phase separator liquid level, hot leg, Spool 2, elevation difference between taps is 84 in.	± 100 in. water	± 5.0 psid	220	Steam may have been present in sense lines. Detector failed for Tests S-03-3 and S-03-4.
DPU-PSEP-WL	Phase separator liquid level, hot leg, Spool 2, elevation difference between taps is 84 in. (low range)	± 50 in. water	± 2.5 psid	---	Data not recorded for Test S-03-3; detector remained saturated for other tests.
Steam Generator					
DPU-SG-SEC	Secondary side, differential pressure taps at 45 and 126 in. above tube sheet, elevation difference between rans is 81 in	1100 in. water	± 3.0 psid	229	Sense lines may have been heated.
CORE CHARACTERISTICS					
	Core power was terminated at t=213 sec. for Test S-03-2; transients have been attenuated for protection				
PWRCOR T-1	Core power	1,600 KW	1,600 KW	231, 232	
PWRCOR T-2	Core power	1,600 KW	1,600 KW	232, 233	
VOLTCOR T	Core volts	200 volts	200 volts	234	Data not recorded for Test S-03-1.
AMPCOR T	Core amps	10,000 amps	10,000 amps	235	

[a] Statement at the beginning of a measurement category regarding the 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 which change in operating or measuring characteristics when the physical conditions were again within the detector range.

Fig. 7 Fluid temperature in intact loop (TFU-1).

Fig. 8 Fluid temperature in phase separator (TFU-PHSEP-W).

Fig. 9 Fluid temperature in intact loop (TSU-6).

Fig. 10 Fluid temperature in intact loop (TSU-7).

Fig. 11 Fluid temperature in intact loop (TFU-8).

Fig. 12 Fluid temperature in intact loop (TFU-8).

Fig. 13 Fluid temperature in intact loop (TFU-10).

Fig. 14 Fluid temperature in intact loop (TFU-10).

Fig. 15 Fluid temperature in intact loop (TSU-12).

Fig. 16 Fluid temperature in intact loop (TSU-12).

Fig. 17 Fluid temperature in intact loop (RBU-14A).

Fig. 18 Fluid temperature in intact loop (RBU-14A).

Fig. 19 Fluid temperature in broken loop (TFB-20).

Fig. 20 Fluid temperature in broken loop (TFB-20).

Fig. 21 Fluid temperature in broken loop (TFB-23).

Fig. 22 Fluid temperature in downcomer annulus (TFV-ANN-35A).

Fig. 23 Fluid temperature in upper plenum (TFV-UP+13).

Fig. 24 Fluid temperature in core, Grid Spacer 5 (TFG-5CD-45).

Fig. 25 Fluid temperature in core, Grid Spacer 5 (TFG-5CD-45).

Fig. 26 Fluid temperature in core, Grid Spacer 6 (TFG-6AB-45).

Fig. 27 Fluid temperature in core, Grid Spacer 6 (TFG-6AB-45).

Fig. 28 Fluid temperature in core, Grid Spacer 6 (TFG-6CD-45).

Fig. 29 Fluid temperature in core, Grid Spacer 6 (TFG-6CD-45).

Fig. 30 Fluid temperature in core, Grid Spacer 6 (TFG-6DE-45).

Fig. 31 Fluid temperature in core, Grid Spacer 6 (TFG-6DE-45).

Fig. 32 Fluid temperature in core, Grid Spacer 6 (TFG-6DE-67).

Fig. 33 Fluid temperature in core, Grid Spacer 6 (TFG-6DE-67).

Fig. 34 Fluid temperature in core, Grid Spacer 8 (TFG-8CD-45).

Fig. 35 Fluid temperature in core, Grid Spacer 10 (TFG-10CD-45).

Fig. 36 Fluid temperature in core, Grid Spacer 10 (TFG-10DE-67).

Fig. 37 Fluid temperature in core, Grid Spacer 10 (TFG-10EF-45).

Fig. 38 Fluid temperature in core, Grid Spacer 10 (TFG-10GH-45).

Fig. 39 Fluid temperature in steam generator steam dome (TFU-SGSD).

Fig. 40 Fluid temperature in steam generator (TFU-SG1).

Fig. 41 Fluid temperature in steam generator (TFU-SG2).

Fig. 42 Fluid temperature in steam generator (TFU-SG3).

Fig. 43 Fluid temperature in steam generator (TFU-SG4).

Fig. 44 Fluid temperature in pressure suppression tank (TF-PSS-33).

Fig. 45 Fluid temperature in pressure suppression tank (TF-PSS-130).

Fig. 46 Material temperature in intact loop (TMU-1T16).

Fig. 47 Material temperature in intact loop (TMU-5B16).

Fig. 48 Material temperature in intact loop (TMU-7S16).

Fig. 49 Material temperature in intact loop (TMU-8S16).

Fig. 50 Material temperature in intact loop (TMU-10S16).

Fig. 51 Material temperature in intact loop (TMU-15B16).

Fig. 52 Material temperature in broken loop (TMB-20T16).

Fig. 53 Material temperature in broken loop (TMB-20T16).

Fig. 54 Material temperature in vessel wall (TMV-VI-35A).

Fig. 55 Material temperature in vessel wall (TMV-VI-177M).

Fig. 56 Material temperature in vessel filler (TMV-FI-35M).

Fig. 57 Material temperature in vessel filler insulator (TIV-FO-35A).

Fig. 60 Material temperature in core barrel (TMV-CO-115M).

Fig. 61 Material temperature in core barrel (TMV-CO-127A).

Fig. 62 Material temperature in core barrel (TMV-CI-35A).

Fig. 63 Material temperature in core barrel (TMV-CI-70A).

Fig. 64 Material temperature in core barrel (TMV-CI-95M).

Fig. 65 Material temperature in core barrel (TMV-CI-95M).

Fig. 66 Material temperature in core barrel (TMV-CI-115A).

Fig. 67 Material temperature in core housing filler (TMV-HF-115W).

Fig. 68 Material temperature in core housing filler (TMV-HF-127W).

Fig. 69 Material temperature in core housing filler (TMV-HF-138W).

Fig. 70 Core heater temperature, Rod D-4 (TH-D4-14).

Fig. 71 Core heater temperature, Rod D-4 (TH-D4-29).

Fig. 72 Core heater temperature, Rod D-5 (TH-D5-09).

Fig. 73 Core heater temperature, Rod D-5 (TH-D5-29).

Fig. 74 Core heater temperature, Rod D-5 (TH-D5-39).

Fig. 75 Core heater temperature, Rod E-4 (TH-E4-23).

Fig. 76 Core heater temperature, Rod E-4 (TH-E4-27).

Fig. 77 Core heater temperature, Rod E-5 (TH-E5-21).

Fig. 78 Core heater temperature, Rod E-5 (TH-E5-25).

Fig. 79 Core heater temperature, Rod A-4 (TH-A4-09).

Fig. 80 Core heater temperature, Rod A-4 (TH-A4-29).

Fig. 81 Core heater temperature, Rod A-4 (TH-A4-39).

Fig. 82 Core heater temperature, Rod A-5 (TH-A5-29).

Fig. 83 Core heater temperature, Rod A-5 (TH-A5-44).

Fig. 84 Core heater temperature, Rod B-3 (TH-B3-32).

Fig. 85 Core heater temperature, Rod B-3 (TH-B3-52).

Fig. 86 Core heater temperature, Rod B-5 (TH-B5-29).

Fig. 87 Core heater temperature, Rod B-5 (TH-B5-38).

Fig. 88 Core heater temperature, Rod B-6 (TH-B6-29).

Fig. 89 Core heater temperature, Rod C-2 (TH-C2-28).

Fig. 90 Core heater temperature, Rod C-2 (TH-C2-38).

Fig. 91 Core heater temperature, Rod C-3 (TH-C3-13).

Fig. 92 Core heater temperature, Rod C-3 (TH-C3-28).

Fig. 93 Core heater temperature, Rod C-3 (TH-C3-60).

Fig. 94 Core heater temperature, Rod C-4 (TH-C4-26).

Fig. 95 Core heater temperature, Rod C-4 (TH-C4-53).

Fig. 96 Core heater temperature, Rod C-5 (TH-C5-28).

Fig. 97 Core heater temperature, Rod C-5 (TH-C5-44).

Fig. 98 Core heater temperature, Rod C-6 (TH-C6-32).

Fig. 99 Core heater temperature, Rod C-7 (TH-C7-15).

Fig. 100 Core heater temperature, Rod D-1 (TH-D1-21).

Fig. 101 Core heater temperature, Rod D-2 (TH-D2-14).

Fig. 102 Core heater temperature, Rod D-2 (TH-D2-61).

Fig. 103 Core heater temperature, Rod D-3 (TH-D3-29).

Fig. 104 Core heater temperature, Rod D-3 (TH-D3-39).

Fig. 105 Core heater temperature, Rod D-6 (TH-D6-15).

Fig. 106 Core heater temperature, Rod D-6 (TH-D6-25).

Fig. 107 Core heater temperature, Rod D-7 (TH-D7-20).

Fig. 108 Core heater temperature, Rod D-8 (TH-D8-26).

Fig. 109 Core heater temperature, Rod E-1 (TH-E1-33).

Fig. 110 Core heater temperature, Rod E-1 (TH-E1-54).

Fig. 111 Core heater temperature, Rod E-2 (TH-E2-21).

Fig. 112 Core heater temperature, Rod E-2 (TH-E2-33).

Fig. 113 Core heater temperature, Rod E-3 (TH-E3-05).

Fig. 114 Core heater temperature, Rod E-3 (TH-E3-20).

Fig. 115 Core heater temperature, Rod E-3 (TH-E3-24).

Fig. 116 Core heater temperature, Rod E-6 (TH-E6-08).

Fig. 117 Core heater temperature, Rod E-6 (TH-E6-28).

Fig. 118 Core heater temperature, Rod E-6 (TH-E6-31).

Fig. 119 Core heater temperature, Rod E-6 (TH-E6-37).

Fig. 120 Core heater temperature, Rod E-7 (TH-E7-13).

Fig. 121 Core heater temperature, Rod E-7 (TH-E7-44).

Fig. 122 Core heater temperature, Rod E-8 (TH-E8-14).

Fig. 123 Core heater temperature, Rod E-8 (TH-E8-29).

Fig. 124 Core heater temperature, Rod E-8 (TH-E8-45).

Fig. 125 Core heater temperature, Rod F-2 (TH-F2-22).

Fig. 126 Core heater temperature, Rod F-2 (TH-F2-25).

Fig. 127 Core heater temperature, Rod F-3 (TH-F3-15).

Fig. 128 Core heater temperature, Rod F-3 (TH-F3-22).

Fig. 129 Core heater temperature, Rod F-3 (TH-F3-25).

Fig. 130 Core heater temperature, Rod F-4 (TH-F4-14).

Fig. 131 Core heater temperature, Rod F-4 (TH-F4-28).

Fig. 132 Core heater temperature, Rod F-4 (TH-F4-44).

Fig. 133 Core heater temperature, Rod F-4 (TH-F4-60).

Fig. 134 Core heater temperature, Rod F-5 (TH-F5-20).

Fig. 135 Core heater temperature, Rod F-5 (TH-F5-26).

Fig. 136 Core heater temperature, Rod F-5 (TH-F5-33).

Fig. 137 Core heater temperature, Rod F-5 (TH-F5-53).

Fig. 138 Core heater temperature, Rod F-6 (TH-F6-08).

Fig. 139 Core heater temperature, Rod F-7 (TH-F6-28).

Fig. 140 Core heater temperature, Rod F-7 (TH-F7-29).

Fig. 141 Core heater temperature, Rod G-3 (TH-F7-39).

Fig. 142 Core heater temperature, Rod G-3 (TH-G3-13).

Fig. 143 Core heater temperature, Rod G-3 (TH-G3-45).

Fig. 144 Core heater temperature, Rod G-4 (TH-G4-09).

Fig. 145 Core heater temperature, Rod G-4 (TH-G4-29).

Fig. 146 Core heater temperature, Rod G-4 (TH-G4-33).

Fig. 147 Core heater temperature, Rod G-4 (TH-G4-38).

Fig. 148 Core heater temperature, Rod G-5 (TH-G5-14).

Fig. 149 Core heater temperature, Rod G-5 (TH-G5-24).

Fig. 150 Core heater temperature, Rod G-6 (TH-G6-21).

Fig. 151 Core heater temperature, Rod G-6 (TH-G6-33).

Fig. 152 Core heater temperature, Rod H-5 (TH-H5-28).

Fig. 153 Material temperature in steam generator (TMU-SG1).

Fig. 154 Material temperature in steam generator (TMU-SG2).

Fig. 155 Material temperature in steam generator (TMU-SG3).

Fig. 156 Material temperature in steam generator (TMU-SG4).

Fig. 157 Pressure in vessel, upper plenum (PV-UP+10).

Fig. 158 Pressure in vessel, inlet annulus (PV-IANN-9).

Fig. 159 Pressure in steam generator, secondary side (PU-SGSD).

Fig. 160 Pressure in pressure suppression tank (P-PSS).

Fig. 161 Pressure in pressure suppression tank header (P-PSS-HD).

Fig. 162 Differential pressure in intact loop, low range (DPU-UP-1L).

Fig. 163 Differential pressure in intact loop (DPU-UP-9).

Fig. 164 Differential pressure in intact loop (DPU-1-3).

Fig. 165 Differential pressure in intact loop, low range (DPU-1-3L).

Fig. 166 Differential pressure in intact loop (DPU-3-7).

Fig. 167 Differential pressure in intact loop, low range (DPU-3-7L).

Fig. 168 Differential pressure in intact loop (DPU-3-SGIP).

Fig. 169 Differential pressure in steam generator primary (DPU-SGIP-SG1).

Fig. 170 Differential pressure in steam generator primary (DPU-SG1-SG2).

Fig. 171 Differential pressure in steam generator primary (DPU-SG2-SG3).

Fig. 172 Differential pressure in steam generator primary (DPU-SG3-SG4).

Fig. 173 Differential pressure in intact loop (DPU-7-10).

Fig. 174 Differential pressure in intact loop (DPU-8C-7).

Fig. 175 Differential pressure in intact loop, pump trap (DPU-8C-8D).

Fig. 176 Differential pressure in intact loop, low range (DPU-12-10L).

Fig. 177 Differential pressure in intact loop (DPU-15-1).

Fig. 178 Differential pressure in intact loop (DPU-15-IANN).

Fig. 179 Differential pressure in intact loop (DPU-15-ATM).

Fig. 180 Differential pressure in broken loop (DPB-21-IANN).

Fig. 181 Differential pressure in broken loop (DPB-21-23).

Fig. 182 Differential pressure in vessel (DPV-9-180QQ).

Fig. 183 Differential pressure in vessel (DPV-166-191QT).

Fig. 184 Differential pressure in vessel core (DPVC-CBI-UP).

Fig. 185 Differential pressure in vessel core (DPVC-83W-UP).

Fig. 186 Differential pressure in vessel core (DPVC-83-100WQ).

Fig. 187 Differential pressure in vessel core (DPVC-100-117QJ).

Fig. 188 Differential pressure in vessel core (DPVC-117-133JD).

Fig. 189 Differential pressure in vessel core (DPVC-133-191DT).

Fig. 190 Volumetric flow in intact loop (FTU-1).

Fig. 191 Volumetric flow in intact loop (FTU-9).

Fig. 192 Volumetric flow in intact loop (FTU-15).

Fig. 193 Volumetric flow in broken loop (FTB-21).

Fig. 194 Volumetric flow in core barrel manifold (FTV-CBM).

Fig. 195 Volumetric flow in core barrel manifold (FTV-CBM).

Fig. 196 Momentum flux in intact loop (FDU-1).

Fig. 197 Momentum flux in intact loop (FDU-1).

Fig. 198 Momentum flux in intact loop (FDU-1).

Fig. 199 Momentum flux in intact loop (FDU-1).

Fig. 200 Density in intact loop (GU-1VR).

Fig. 201 Density in intact loop (GU-1VR).

Fig. 202 Density in intact loop (GU-1VR).

Fig. 203 Density in intact loop (GU-1VR).

Fig. 204 Density in intact loop (GU-1HZ).

Fig. 205 Density in intact loop (GU-1HZ).

Fig. 206 Density in intact loop (GU-1HZ).

Fig. 207 Density in intact loop (GU-1HZ).

Fig. 208 Density in intact loop (GU-5VR).

Fig. 209 Density in intact loop (GU-5VR).

Fig. 210 Density in intact loop (GU-5VR).

Fig. 211 Density in intact loop (GU-5VR).

Fig. 212 Density in intact loop (GU-10VR).

Fig. 213 Density in intact loop (GU-10VR).

Fig. 214 Density in intact loop (GU-10VR).

Fig. 215 Density in intact loop (GU-10VR).

Fig. 216 Density in intact loop (GU-15VR).

Fig. 217 Density in intact loop (GU-15VR).

Fig. 218 Density in intact loop (GU-15VR).

Fig. 219 Density in intact loop (GU-15VR).

Fig. 220 Density in broken loop (GB-21VR).

Fig. 221 Density in broken loop (GB-21VR).

Fig. 222 Density in broken loop (GB-21VR).

Fig. 223 Density in broken loop (GB-21VR).

Fig. 224 Density in broken loop (GB-23VR).

Fig. 225 Density in broken loop (GB-23VR).

Fig. 226 Density in broken loop (GB-23VR).

Fig. 227 Density in broken loop (GB-23VR).

Fig. 228 Differential pressure in intact loop (phase separator liquid level) (DPU-PSEP-W).

Fig. 229 Differential pressure in steam generator secondary (DPU-SG-SEC).

Fig. 230 Core heater pin total power (PWRCOR T-1).

Fig. 231 Core heater pin total power (PWRCOR T-1).

Fig. 232 Core heater pin total power (PWRCOR T-2).

Fig. 233 Core heater pin total power (PWRCOR T-2).

Fig. 234 Core heater voltage (VOLTCOR-T).

Fig. 235 Core heater total current (AMPCOR-T).

IV. REFERENCE

1. E. M. Feldman, *Semiscale Mod-1 Program and System Description for the Reflood Heat Transfer Tests (Test Series 3)*, ANCR-1305 (May 1976).

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