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EXPERIMENT DATA REPORT FOR SEMISCALE SYSTEM COUNTERCURRENT FLOW TESTS

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**EXPERIMENT DATA REPORT FOR SEMISCALE
SYSTEM COUNTERCURRENT FLOW TESTS**

by

S. A. Naff
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ABSTRACT

Gas-liquid countercurrent flow tests were performed as part of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project. These tests included: (a) preliminary tests to establish the lower plenum liquid level for subsequent tests and to investigate bypass flow phenomena; (b) steady state tests to investigate the relation between steam flow and ECC entrainment; and (c) transient tests to investigate the effect of steam generation and high wall heat flux on countercurrent flow behavior.

The tests were conducted using the semiscale vessel, a phase separator, and a storage tank.

Results are presented as dimensionless volumetric flux graphs, computer printout of digital data at discrete time intervals, and computer-produced graphs of analog data as a function of time. Descriptions of the test facility, instrumentation, operating procedures, and test conditions are presented. Maximum errors are identified and an error analysis is presented for the volumetric flux presentations.

The purpose of this document is to present the data with minimum interpretation for use by the nuclear community and for support of subsequent interpretative analyses.

SUMMARY

Gas-liquid countercurrent flow tests were performed as part of the Semiscale Blowdown and Emergency Core Cooling (ECC) Project conducted by Aerojet Nuclear Company for the Atomic Energy Commission. These tests included: (a) preliminary tests; (b) steady state tests; and (c) transient tests.

The tests were conducted using the semiscale vessel, a phase separator, and a storage tank. Countercurrent flow conditions were established by injecting water through a vessel cold leg nozzle and steam or air through a vessel hot leg nozzle. The steam injected into the core barrel through the vessel hot leg nozzle flowed to the lower plenum and subsequently up the downcomer annulus between the core barrel and the vessel wall (or vessel filler piece). Water, supplied to the vessel through the cold leg nozzle, flowed down the downcomer annulus in opposition to the steam flow. The water was removed from the vessel either through the lower plenum drain or through the vessel outlet to the phase separator, and the steam was removed from the system only through the vessel outlet to the phase separator or by condensation.

The lower plenum voiding tests, which were conducted to investigate the relation between steam flow, lower plenum liquid level, and ECC entrainment, established that the liquid level in the lower plenum should be maintained 10 inches or more below the bottom of the core barrel to preclude liquid pickup from the lower plenum during the subsequent steady state and transient countercurrent flow tests. The liquid bypass tests provided data showing the lack of capability of the steam to entrain water in the upper annulus and carry it out the opposite cold leg.

The steady state tests were conducted to determine the influence of condensation and low wall heat flux on countercurrent flow behavior. These tests, which were conducted with the annulus walls at or below saturation temperature and with countercurrent flows of steam (or air) and water, provided data relating the rate of water delivery to the lower plenum to the gas velocity in the hot leg for several different parameters (downcomer gap size, cold leg water flow rate, cold leg water temperature, cold leg steam flow rate, water level in the lower plenum, and wall heat flux).

The transient tests were conducted with an initial vessel wall temperature of about 600°F. The wall temperature was allowed to decrease as water was injected into the system through the cold leg. These tests provided data on the effect of steam generation and high wall heat flux on countercurrent flow behavior.

Results from the steady state tests are presented in the form of dimensionless volumetric flux ($j_g^{*1/2} D^{1/4}$ versus $j_f^{*1/2} D^{1/4}$) graphs and computer printout of digital data at discrete time intervals. Results from the transient tests are presented as computer-produced graphs of analog data versus time.

Except for data known to be erroneous, all data recorded are presented with the intent of documenting the entire output of the test series and providing as much information as possible to the varying interests of the nuclear community. Maximum errors have been identified for the data and an error analysis has been performed to establish the error in the detailed volumetric flux presentations.

Descriptions of the test facility, instrumentation, operating procedures, and test conditions are presented.

In general, the countercurrent flow and related tests were considered successful due, in part, to the versatility of the test program. The test procedure described was the result of a trial-and-error process culminating in a procedure which produced usable data. The data, when presented in dimensionless volumetric flux form, are considered to have an error of less than 9% when nonhomogeneous flow effects are excluded.

NOMENCLATURE

- A Area of annulus = $\frac{\pi}{4}(D_o^2 - D_i^2)$
- D Hydraulic diameter = $(D_o - D_i)$
- D_o Outside diameter of annulus or inside diameter of filler piece
- D_i Inside diameter of annulus or outside diameter of core barrel
- g Acceleration due to gravity
- J_g Volumetric flux of steam or air = $\frac{Q_g}{A}$
- J_f Volumetric flux of water = $\frac{Q_f}{A}$
- L Water level
- M_g Mass flow rate of steam or air
- l Linear distance
- P Pressure
- Q_g Volumetric flow rate of steam or air
- Q_f Volumetric flow rate of water
- T Temperature
- t Time
- α Coefficient of thermal expansion
- ρ_g Density of air or steam
- ρ_f Density of water
- ν_g Specific volume of air or steam
- ν_f Specific volume of water
- J_g^* Dimensionless volumetric gas flux = $\frac{J_g}{\sqrt{gD}} \left(\frac{\rho_g}{\rho_f - \rho_g} \right)^{1/2}$
- J_f^* Dimensionless volumetric liquid flux = $\frac{J_f}{\sqrt{gD}} \left(\frac{\rho_f}{\rho_f - \rho_g} \right)^{1/2}$

ACKNOWLEDGMENTS

The authors acknowledge the contributions of the individuals responsible for successfully completing the semiscale countercurrent flow tests and for verifying the resulting data. Appreciation is expressed to personnel of the Fluids Laboratory Division for their assistance in the performance of the experiments. Appreciation is also extended to Clinton J. Shaffer who directed the majority of the experiments and whose contributions aided materially in verifying the data.

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EXPERIMENT DATA REPORT FOR SEMISCALE

SYSTEM COUNTERCURRENT FLOW TESTS

I. INTRODUCTION

Separate effects countercurrent flow experiments were performed to determine the effect of condensation and heated walls on countercurrent flow behavior in the semiscale vessel downcomer. The data presented represent one phase of an experimental effort by Aerojet Nuclear Company to evaluate countercurrent flow behavior in small systems. The purpose of the semiscale countercurrent flow experiments was to contribute to the AEC data base for developing and verifying analytical models needed to predict the behavior of pressurized water reactors (PWRs) during the emergency core cooling (ECC) phase of a loss-of-coolant accident (LOCA).

The tests reported represent the first step in the overall effort of the AEC to provide a comprehensive experimental data base to describe steam-water hydraulic behavior in vessel downcomers. The diameter of the semiscale vessel (about 1 foot) is at least five times larger than that of vessels used heretofore to obtain annulus countercurrent flow data. To assure that suitable experimental results are available to evaluate the effect of physical scale, the AEC safety research is also to include acquisition of countercurrent flow data from vessels of larger diameters. Results from the semiscale tests and the larger scale programs are expected to provide a suitable base for evaluating the effect of physical scale on countercurrent flow behavior.

The countercurrent flow tests reported are a portion of a more extensive investigation of countercurrent flow behavior. Prior to these tests, countercurrent (air and water) flow experiments were conducted in a full-sized plexiglass model of the semiscale vessel and subsequent to these tests the semiscale vessel was installed in the semiscale system, and integral system countercurrent flow effects were studied during blowdown tests with water injection^[1-8].

The countercurrent flow tests were conducted in a system consisting of the semiscale vessel, a phase separator, and a water storage tank. The tests included preliminary tests, steady state countercurrent flow tests, and transient countercurrent flow tests. Table I summarizes the tests and test conditions. The preliminary tests were conducted to investigate the removal of water from the lower plenum by steam flowing down the inside of the core barrel and to investigate the extent of ECC entrainment in the steam and subsequent loss through the opposite cold leg of the vessel. These tests established the minimum distance between the liquid level in the lower plenum and the bottom of the core barrel to preclude liquid pickup from the lower plenum during the countercurrent flow tests. The steady state countercurrent flow tests were conducted to determine the effect of condensation and low wall heat flux on countercurrent flow behavior. These tests were

TABLE I

CONDITIONS FOR SEMISCALE SYSTEM COUNTERCURRENT FLOW TESTS

Tests	Downcomer Radial Gap (in.)	Heater Power (kW)	Core Barrel To Water Surface ^[a] (in.)	Hot Leg Gas Flow (cfm)	Cold Leg Water Temperature (°F)	Cold Leg Water Flow (gpm)	Bypass Water Flow (gpm)	Cold Leg Steam Flow (cfm)
Preliminary Tests								
Lower Plenum Voiding								
3.3.1	0.5	0	3 to 7	200	170 ^[b]	0	0	0
3.3.2	0.5	0	3 to 5	150	170 ^[b]	0	0	0
3.3.3	0.5	0	2 to 3	100	170 ^[b]	0	0	0
3.4.1	1.0	0	6 to 9	250	170 ^[b]	0	0	0
3.4.2	1.0	0	4 to 8	200	170 ^[b]	0	0	0
3.4.3	1.0	0	2 to 4	150	170 ^[b]	0	0	0
Upper Annulus Liquid Bypass								
11.	0.5	0	16	0	120	6 to 26	0 to 0.4	152 to 205
Steady State Countercurrent Flow Tests								
Air-Water								
1.4	0.5	0	9	9 to 128	50	0 to 75	1 to 59	0
Steam-Water								
Baseline								
4.1	0.5	12	16	59 to 203	190	3 to 9	4	0
5.2	0.5	12	16	54	190	140	0	0
9.1	1.0	12	16	105 to 250	190	5 to 72	4	0
Cold Leg Water Flow Rate								
4.3	0.5	12	16	67 to 198	190	9 to 14	15	0
4.8	0.5	12	16	106 to 170	190	21 to 26	25	0
9.3A (data points 9.3.1 - 9.3.3)	1.0	12	16	194 to 260	190	11 to 26	25	0
9.3B (data points 9.3.4 - 9.3.6)	1.0	12	16	194 to 260	190	11 to 26	15	0
Lower Plenum Water Level								
4.4	0.5	12	9	58 to 205	190	4 to 10	4	0
Boundary Heat Flux								
4.5	0.5	0	16	68 to 235	190	4 to 9	4	0
4.7	0.5	38	16	59 to 153	190	4 to 9	4	0
9.2A (data points 9.2.1 - 9.2.4)	1.0	38	16	137 to 252	190	5 to 11	4	0
9.2B (data points 9.2.5 - 9.2.8)	1.0	0	16	137 to 252	190	5 to 11	4	0
Cold Leg Water Temperature								
4.6	0.5	12	16	74 to 197	120	4 to 7	4	0
Cold Leg Steam								
6.1	0.5	12	16	57 to 151	120	4 to 7	4	280
6.2	0.5	12	16	65 to 189	120	4 to 7	4	120
9.4A (data points 9.4.1 - 9.4.4)	1.0	12	16	129 to 229	120	5 to 7	4	280
9.4B (data points 9.4.5 - 9.4.7)	1.0	12	16	129 to 229	120	5 to 7	4	120
Hysteresis								
5.1	0.5	12	16	66 to 186	190	4 to 9	4	0
Transient Tests								
Vessel Thermal Response								
1.2.1.2 - 1.2.7	0.5	0 to 56	7 to 16	0 to 65	50	5 to 100	0	0
1.3.1 - 1.3.3	0.5	50	0	75 to 375	--	0	0	0
Countercurrent Flow ^[c]								
10.1.1 - 10.1.3	1.0	0	7 to 16	120 to 240	120	25	35 to 45	120
12.1.1 - 12.1.9	0.5	0	7 to 16	0 to 100	120	25	20 to 40	120
12.1.10 and 12.1.13	0.5	0	7 to 16	50 to 70	120	25	30 to 40	180
12.1.11 and 12.1.14	0.5	0	7 to 16	45 to 75	120	25	30 to 54	60
12.1.12 and 12.1.15	0.5	0	7 to 16	55	120	15	20	120
13.1	1.0	0	7 to 16	280 to 0	120	25	40 to 50	140
14.1 and 14.2	0.5	0	7 to 16	200 to 0	120	14 to 25	17 to 32	120

[a] Distance measured between the bottom of the core barrel and the lower plenum water surface.

[b] Temperature of water in lower plenum.

[c] Walls initially heated to about 600°F. Heater power turned off prior to test initiation.

conducted using steam (or air) and water as opposing flow streams and with the vessel walls at saturation (or lower) temperatures. The objective of the tests was to provide data relating the rate at which water is delivered into the lower plenum to the velocity of the gas stream in the annulus and the velocity of the incoming water. Downcomer gap size, cold leg water and steam flow rates, hot leg steam flow rate, lower plenum water level, and wall heat flux were the parameters investigated. The experimental approach was to select a specific set of parameters, obtain a set of data corresponding to that set, and to vary one parameter at a time in subsequent tests. Data were recorded for each set of steady state conditions established. The transient tests were conducted to provide countercurrent flow data in an environment more representative of blowdown conditions. The vessel walls were initially heated to 600°F, heater power was turned off prior to test initiation, and the wall temperature was allowed to decrease as water was injected into the system. The data obtained in this manner show the effects of steam generation and high wall heat flux on countercurrent flow behavior.

The intent of this document is to provide the information needed for an in-depth evaluation of the experimental results. Section II of the report provides a description of the experimental apparatus, instrumentation, and data acquisition and processing system. Section III describes the test procedures. Complete listings of all collected data are presented in Sections IV, V, and VI for the preliminary tests, the steady state countercurrent flow tests, and the transient countercurrent flow tests, respectively. Appendix A presents details of the system piping. Appendix B quantifies the errors in the measured fluid properties and relates those errors to the resulting errors in the calculated values of the dimensionless volumetric fluxes.

II .EXPERIMENTAL SYSTEM, INSTRUMENTATION, AND

DATA PROCESSING EQUIPMENT

The steam-water countercurrent flow apparatus consists of the semiscale pressure vessel, a phase separator, and a storage tank as shown in Figure 1. The system configuration was varied slightly during the program to meet the needs of each specific test; all elements used are shown schematically in Figure 2.

1 .EXPERIMENTAL SYSTEM

The pressure vessel, shown in Figure 3, is constructed of 10-inch Schedule 160 Type A106-B carbon steel pipe and has a length of about 12 feet, an OD of 10.75 inches, and an ID of 8.50 inches. The top and bottom heads are fabricated from 10-inch Grayloc blind hubs and the top head is closed with a 4-inch Grayloc hub. Simulated emergency core cooling (ECC) liquid is admitted through one of the two 3-inch cold leg nozzles, and ECC bypass liquid may exit through the other. A 3-inch hot leg nozzle is utilized for supplying the gas (air or steam). The bottom head contains a 4-inch drain to extract liquid from the lower plenum. Other vessel penetrations are provided for instrumentation.

The vessel internals are composed of a main core barrel assembly and either of two downcomer filler pieces to provide downcomer gaps of 0.5 or 1.0 inch. The main core barrel assembly consisting of sections of 5- and 6-inch Schedule 80 Type A106-B carbon steel pipe is suspended from the 10-inch top head. The OD of the core barrel is about 5-1/4 inches. The 0.5-inch gap downcomer filler piece, which has an ID of 6-1/4 inches, extends from just below the inlet nozzle to within a foot of the bottom flange. The 1.0-inch gap downcomer filler piece is similar except it has an ID of 7-1/4 inches. The lower plenum (the space between the bottom of the inner core barrel and the bottom flange) is about 18 inches in depth.

Resistance heating elements (band heaters) are installed on the vessel exterior. This system is capable of transmitting a controlled heat input of 0 to 50 kW evenly over the exterior of the vessel wall. The entire vessel and heater system are insulated to minimize heat loss.

The phase separator tank is used to separate the two-phase fluid leaving the pressure vessel cold leg exit nozzle into components for measurement. Two-phase fluid enters the tank through a 3-inch nozzle. Separation occurs within the tank and liquid is extracted from the bottom and gas from the top through 2-inch nozzles. An external sightglass is provided to indicate water level. The tank is made of 18-inch Schedule 80 carbon steel pipe about 32 inches long and has an internal perforated baffle plate to aid in phase separation. Top and bottom end plates are 1-inch carbon steel.

Fig. 1 Semiscale system for countercurrent flow tests.

Fig. 2 Piping and instrument diagram for countercurrent flow tests.

Fig. 3 Pressure vessel for countercurrent flow tests -- cross-sectional view.

The water storage tank, which has a capacity of about 85 ft³, both supplies water for testing and receives water after testing. Either a pressurization system or a pump may be used to circulate the water from the vessel and phase separator to the storage tank for continuous operation.

Details of the semiscale system piping are given in Appendix A.

2. INSTRUMENTATION

Detectors used during the countercurrent flow test program are listed and described in Table II. Figures 4 and 5, together with Figure 2 (previously presented) show the measurement locations. The measurements made during each test are indicated in the sections in which the data are presented. Appendix B quantifies the errors associated with these measurements by showing the detailed error analysis of a typical test.

3. SIGNAL CONDITIONING AND DATA RECORDING AND PROCESSING SYSTEM

A block diagram showing the general measurement and signal conditioning processes for the countercurrent flow lists is shown in Figure 6. As indicated, all detectors, except thermocouples, are connected through junction boxes in the test cell to signal conditioning and amplifying equipment. Thermocouples are connected to reference junctions, maintained at 150°F by reference ovens, and then to junction boxes. Conditioned signals from all instrumentation can be monitored manually by digital voltmeter or recorded on magnetic tape using frequency modulated (FM) tape recorders.

3.1 Signal Transmission and Conditioning Equipment

The signal transmission and conditioning equipment is designed to provide: (a) signal patching capability to allow rapid changes in measurement locations because of channel reassignments or equipment failures; (b) signal conditioning which provides signal amplification, isolation, strain gage bridge completion, excitation, balancing, and impedance matching; and (c) manual monitoring by digital voltmeter of each measurement channel to verify proper operation, calibration, and noise level.

Several termination points are installed in the test system to accommodate changing detector requirements. The termination stations, referred to as detector junction boxes, interface between the detector wiring and the signal cabling from the signal conditioners. Essentially, instrumentation cabling terminates at the detector junction boxes. In order to minimize signal noise, the detector junction boxes are designed to continue cable shielding through the junction and to maintain electrical isolation. Thermocouple reference junction ovens are installed at various locations in the test cell to minimize thermocouple length.

TABLE II

MEASUREMENTS DURING COUNTERCURRENT FLOW TESTS^[a]

Measurement	Location	Measurement Range		Measurement System Maximum Error	Detector Manufacturer
		Minimum	Maximum		
<u>Liquid Flow (turbine flowmeters)</u>					
FT-VI-L1	Vessel Cold Leg Inlet	2.0	75 gpm	+ 1.0 gpm	ITT Barton
FT-VI-L75	Vessel Cold Leg Inlet	1.5	35 gpm	+ 0.4 gpm	ITT Barton
FT-VL-L3	Vessel Cold Leg Inlet	50.0	800 gpm	+ 4.0 gpm	Flow Technology, Inc.
FT-VO-L38	Vessel Bottom Head Outlet	0.7	6 gpm	+ 0.1 gpm	ITT Barton
FT-VO-L75	Vessel Bottom Head Outlet	1.5	35 gpm	+ 0.4 gpm	ITT Barton
FT-VO-L1	Vessel Bottom Head Outlet	2.0	75 gpm	+ 1.0 gpm	ITT Barton
FT-VO-L3	Vessel Bottom Head Outlet	50.0	800 gpm	+ 4.0 gpm	Flow Technology, Inc.
FT-SO-L75	Phase Separator Outlet	1.5	35 gpm	+ 0.4 gpm	ITT Barton
FT-SO-L1	Phase Separator Outlet	2.0	75 gpm	+ 1.0 gpm	ITT Barton
<u>Gas Flow (turbine flowmeters)</u>					
					ITT Barton
FT-SO-G1	Phase Separator Outlet	12	80 cfm	+ 1.0 cfm	
FT-SO-G3	Phase Separator Outlet	80	540 cfm	+ 10.0 cfm	
FT-CO-G1	Core Hot Leg Inlet	12	80 cfm	+ 1.0 cfm	
FT-CO-G3	Core Hot Leg Inlet	80	540 cfm	+ 10.0 cfm	
FT-CL-G3	Vessel Cold Leg Inlet	80	540 cfm	+ 10.0 cfm	
<u>Pressure</u>					
		0	100 psig	+ 1.0 psig	
P-256	Vessel Lower Plenum				Heise Bourdon Tube Co., Inc.
P-VI-L					and Precise Sensors, Inc.
P-VO-L	Upstream of Turbine Flowmeters in Vessel Cold Leg Inlet				Precise Sensors, Inc.
	Upstream of Turbine Flowmeters in Vessel Bottom Outlet				Precise Sensors, Inc.

TABLE II (contd.)

MEASUREMENTS DURING COUNTERCURRENT FLOW TESTS^[a]

Measurement	Location	Measurement Range		Measurement System Maximum Error	Detector Manufacturer
		Minimum	Maximum		
<u>Pressure (contd.)</u>		0	100 psig	± 1.0 psig	
P-SI	Between Vessel Cold Leg Outlet and Phase Separator				Precise Sensors, Inc.
P-SO-L	Upstream of Turbine Flowmeters in Phase Separator Liquid Outlet				Precise Sensors, Inc.
P-SO-G	Upstream of Turbine Flowmeters in Phase Separator Gas Outlet				Precise Sensors, Inc.
P-CO-G	Upstream of Turbine Flowmeters in Vessel Hot Leg Inlet				Precise Sensors, Inc.
P-CL-G	Upstream of Turbine Flowmeters in Cold Leg Steam Inlet				Precise Sensors, Inc.
P-CL-VL	Cold Leg Inlet Nozzle				Precise Sensors, Inc.
<u>Differential Pressure</u>					BLH Electronics, Inc.
DP-264-255	Inlet Annulus to Lower Plenum	- 0.72	0.72 psid	+0.01 psid	
DP-CL-NOZ	Cold Leg Steam Leg to Vessel Cold Leg Nozzle	-18.05	18.05 psid	+0.2 psid	
DP-CL-CLB	Cold Leg Steam Leg to Separator Inlet	-18.05	18.05 psid	+0.2 psid	
DP-248-VOL	Lower Annulus to Lower Plenum	- 0.72	0.72 psid	+0.01 psid	
<u>System Fluid Temperatures</u> (Type K thermocouples)		0	370°F	+4°F	American Standard, Inc. and Aerojet Nuclear Company
TF-VI-L1	Cold Leg Inlet Upstream of Turbine Flowmeter				
TF-VI-L75	Cold Leg Inlet Upstream of Turbine Flowmeter				
TF-VI-L3	Cold Leg Inlet Upstream of Turbine Flowmeter				
TF-255	Vessel Lower Plenum				
TF-263	Near Bottom Vessel Surface				

TABLE II (contd.)

MEASUREMENTS DURING COUNTERCURRENT FLOW TESTS^[a]

Measurement	Location	Measurement Range		Measurement System Maximum Error	Detector Manufacturer
		Minimum	Maximum		
<u>System Fluid Temperatures</u> (contd.)		0	370°F	+4°F	American Standard, Inc. and Aerojet Nuclear Company
TF-V0-L38	Upstream of Vessel Bottom Outlet Turbine Flowmeter				
TF-V0-L1	Upstream of Vessel Bottom Outlet Turbine Flowmeter				
TF-V0-L75	Upstream of Vessel Bottom Outlet Turbine Flowmeter				
TF-V0-L3	Upstream of Vessel Bottom Outlet Turbine Flowmeter				
TF-SI	Phase Separator Inlet				
TF-S0-L75	Upstream of Separator Outlet Turbine Flowmeter				
TF-S0-L1	Upstream of Separator Outlet Turbine Flowmeter				
TF-S0-G1	Upstream of Separator Outlet Turbine Flowmeter				
TF-S0-G3	Upstream of Separator Outlet Turbine Flowmeter				
TF-C0-G1	Upstream of Core Hot Leg Inlet Turbine Flowmeter				
TF-C0-G3	Upstream of Core Hot Leg Inlet Turbine Flowmeter				
TF-CL-G1	Upstream of Steam Cold Leg Inlet Turbine Flowmeter				
TF-CL-G3	Upstream of Steam Cold Leg Inlet Turbine Flowmeter				
TF-CL-V1	Vessel Cold Leg Inlet Nozzle				
TF-CL-V2	Vessel Cold Leg Inlet Nozzle				
TF-CL-V3	Vessel Cold Leg Inlet Nozzle				

TABLE II (contd.)

MEASUREMENTS DURING COUNTERCURRENT FLOW TESTS^[a]

Measurement	Location	Measurement Range		Measurement System Maximum Error	Detector Manufacturer
		Minimum	Maximum		
<u>Annulus Fluid Temperatures</u> (Type K thermocouples)		0	370°F	+4°F	American Standard, Inc. and Aerjet Nuclear Company
TF-47C-0	47 in. from Vessel Top Flange Face - 0° ^[b]				
TF-47C-180	47 in. from Vessel Top Flange Face - 180°				
TF-77C-0	77 in. from Vessel Top Flange Face - 0°				
TF-77C-180	77 in. from Vessel Top Flange Face - 180°				
TF-94C-45	94 in. from Vessel Top Flange Face - 45°				
TF-94C-285	94 in. from Vessel Top Flange Face - 285°				
TF-48D-0	48 in. from Vessel Top Flange Face - 0°				
TF-48D-180	48 in. from Vessel Top Flange Face - 180°				
TF-78D-0	78 in. from Vessel Top Flange Face - 0°				
TF-78D-180	78 in. from Vessel Top Flange Face - 180°				
TF-95D-45	95 in. from Vessel Top Flange Face - 45°				
TF-95D-225	95 in. from Vessel Top Flange Face - 225°				
<u>Annulus Filler and Core Barrel Material Temperatures</u> (Type K thermocouples)		0	370°F	+4°F	American Standard, Inc. and Aerjet Nuclear Company
TM-47C-90	47 in. from Vessel Top Flange Face - 90°				
TM-47C-285	47 in. from Vessel Top Flange Face - 285°				
TM-62C-285	62 in. from Vessel Top Flange Face - 285°				
TM-77C-90	77 in. from Vessel Top Flange Face - 90°				
TM-77C-285	77 in. from Vessel Top Flange Face - 285°				
TM-94C-285	94 in. from Vessel Top Flange Face - 285°				
TM-48D-0	48 in. from Vessel Top Flange Face - 0°				
TM-48D-180	48 in. from Vessel Top Flange Face - 180°				
TM-63D-45	63 in. from Vessel Top Flange Face - 45°				
TM-63D-225	63 in. from Vessel Top Flange Face - 225°				
TM-78D-0	78 in. from Vessel Top Flange Face - 0°				
TM-78D-180	78 in. from Vessel Top Flange Face - 180°				

TABLE II (contd.)

MEASUREMENTS DURING COUNTERCURRENT FLOW TESTS^[a]

Measurement	Location	Measurement Range		Measurement System Maximum Error	Detector Manufacturer
		Minimum	Maximum		
<u>Annulus Filler and Core Barrel Material Temperatures</u> (contd.)					
		0	370°F	+4°F	American Standard, Inc. and Aerojet Nuclear Company
TM-95D-45	95 in. from Vessel Top Flange Face - 45°				
TM-95D-225	95 in. from Vessel Top Flange Face - 225°				
TM-116D-0	116 in. from Vessel Top Flange Face - 0°				
TM-116D-45	116 in. from Vessel Top Flange Face - 45°				
TM-116D-225	116 in. from Vessel Top Flange Face - 225°				
<u>Vessel Wall Temperature</u> (Type K thermocouple)					
		0	370°	+4°F	American Standard, Inc. and Aerojet Nuclear Company
TM-254-14	Outside Surface 119 in. from Vessel Top Flange Face, 135°				
TM-254-IS	Inside Surface 119 in. from Vessel Top Flange Face, 135°				
TM-254-OS	1/8-in. from ID, 119 in. from Vessel Top Flange Face, 135°				
TM-254-18	1/4-in. from ID, 119 in. from Vessel Top Flange Face, 135°				
TM-218T	0.198 ± 0.01 in. from ID, 82 in. from Vessel Top Flange Face, 75°				
TM-218B	0.072 ± 0.01 in. from ID, 82 in. from Vessel Top Flange Face, 75°				

[a] The range, maximum error, and manufacturer given at the beginning of a measurement category apply to all measurements within the category.

[b] Radial 0° reference is vertical centerline of cold leg inlet.

Fig. 5 Pressure vessel, cross-sectional view showing instrumentation.

ANC-8-73-H

Fig. 6 Measurement and data acquisition diagram.

Signal conditioners consist of low-level amplifiers, detector excitation and balancing networks, power supplies, attenuation networks, and the electronics necessary to route, monitor, and calibrate data channels. An output patch panel is provided between data recording equipment and signal conditioning equipment to allow convenience in routing.

3.2 Data Recording Equipment

The recording equipment consists of six 14-channel, high performance, 1-inch magnetic tape recorders. For data recording, the magnetic tape recorders are operated in the frequency modulation (FM) mode at 30 in./sec, producing a dc to 10-kHz frequency response with an overall record, store, and reproduce accuracy to within $\pm 0.5\%$ of full scale.

Timing information for data correlation and event correlation is provided by simultaneously recording an IRIG "A" modulated 10-kHz carrier signal mixed with a 100-kHz sine wave in direct mode on one trace of each of the tape recorders.

3.3 Data Processing Equipment

Recorded data are processed using a Honeywell DDP-124 digital computer system, which consists of an analog-to-digital converter, tape search unit, input filter, cathode ray tube plotter, and hardware and software programs. This system converts raw data into graphs and digital data in engineering units and records each channel of data on digital tape. For nonlinear conversions or other additional processing, the IBM 360/75 computer system is used.

III. TEST PROCEDURES

The experimental system and supporting systems were utilized to obtain several basically different types of information, and system operation was varied slightly for each test purpose. Details of operations, as they relate to individual tests, are described in Sections IV, V, and VI for the respective preliminary, steady state countercurrent flow, and transient countercurrent flow tests. The general test procedure is as follows.

Figure 7 illustrates the water and steam (air) injection locations and the flow paths. Cold water was injected into the system through the vessel cold leg nozzle, and steam or air was injected into the system through the vessel hot leg nozzle or through the vessel cold leg nozzle in combination with the cold water. The steam injected through the hot leg nozzle entered the core barrel and flowed downward to the lower plenum and then upward through the downcomer gap between the core barrel and the vessel wall or filler piece. The cold water flowed down the downcomer gap in opposition to the steam flow. The water was removed from the vessel either through the lower plenum drain or through the vessel outlet to the phase separator. Steam was removed from the vessel only through the vessel outlet to the phase separator.

The operational testing procedure for the steady state tests was as follows:

- (1) The electrical power to the band heaters was set for the desired vessel wall heat.
- (2) The desired hot-leg gas inflow was established and the more appropriate of the two available flowmeters was valved-in for flow rate measurement.
- (3) The cold-leg water and gas inflows were established and the appropriate flowmeters were valved-in.
- (4) A constant liquid level was established and maintained in the lower plenum by throttling the drain valve. The appropriate lower plenum drain flowmeter for measurement of the ECC flow rate to the lower plenum was valved-in.
- (5) The selected system pressure was established by throttling the gas discharge valve on top of the steam separator. The appropriate flowmeter for gas outflow measurement was valved-in.
- (6) A constant liquid level was established and maintained in the phase separator by throttling the discharge valve. The appropriate flowmeter was valved-in for measurement of the ECC bypass flow rate.

(7) Flows were continuously adjusted until steady state operation was established.

(8) Data were recorded on magnetic tape for 60 to 80 seconds.

During operation, all discharged liquid was returned to the storage tank for reutilization in testing. The temperature of the incoming water was controlled by mixing heated water from the system with freshly supplied cooler water in the storage tank.

Transient tests were performed similarly to the steady state tests, the main difference being that steady state conditions were not achieved either because of the transient nature of the conditions imposed or because of limitations in available wall heat.

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Fig. 7 Countercurrent flow sources and flow paths.

IV. RESULTS OF PRELIMINARY TESTS

Preliminary tests were conducted to investigate the interaction between the water level in the lower plenum and steam flow from the core barrel into the lower plenum (lower plenum voiding) and to determine the capability of steam at high flow rates in the cold leg to entrain ECC and carry it around the upper annulus and out the opposite cold leg (liquid bypass).

1. LOWER PLENUM VOIDING (TESTS 3.3.1 - 3.3.3 AND 3.4.1 - 3.4.3)

Tests were run to determine the maximum liquid level which could be maintained in the lower plenum as a function of steam flow down the inside of the core barrel and back up the annulus. Data were obtained by completely filling the lower plenum, introducing a constant steam flow down the inside of the core barrel, and measuring the lower plenum liquid level as a function of time through use of the lower plenum sight glass and a stop watch. Six different preliminary tests were conducted, three with the 1/2-inch downcomer gap at steam flows of 100, 150, and 200 cfm, and three with the 1-inch downcomer gap at steam flows of 150, 200, and 250 cfm. All tests were performed with a lower plenum pressure of 50 psig. Water temperature in the lower plenum varied between 160 and 190°F for all tests. Results of these tests are presented in Figure 8. On the basis of these results, the conclusion was reached that subsequent countercurrent flow tests could be performed with little liquid pickup from the lower plenum provided water levels were maintained 10 inches or more below the bottom of the core barrel.

2. UPPER ANNULUS LIQUID BYPASS (TEST 11)

A test was conducted to determine condensation rates in the cold leg and the capability of steam, when inserted with the incoming cold leg water, to entrain ECC and carry it around the upper annulus and out the other cold leg with no countercurrent flow of gas up the downcomer. The tests were performed with the 1/2-inch downcomer gap and with the liquid level maintained about 15 inches below the bottom of the core barrel. Neither hot leg steam nor air was injected during this test.

Test data were obtained by establishing steam and water injection rates in the cold leg, establishing steady state conditions, and recording all system data on magnetic tape. Six data points were obtained. Table III summarizes test conditions and measured rate of flow to the lower plenum and Table IV presents the data.

Fig. 8 Lower plenum liquid voiding rates (Tests 3.3.1 - 3.3.3 and 3.4.1 - 3.4.3).

TABLE III
SUMMARY OF CONDITIONS AND RESULTS OF LIQUID
BYPASS TEST

<u>Data Point</u>	<u>Vessel Pressure (psig)</u>	<u>Cold Leg Water Flow (gpm)</u>	<u>Cold Leg Water Temperature (°F)</u>	<u>Cold Leg Steam Flow (cfm)</u>	<u>Water Flow To Lower Plenum (gpm)</u>
11.1	50	25.5	133	205	31.5
11.2	48.4	15.4	122	202	16.0
11.3	48.5	5.8	125	200	5.6
11.4	47.7	16.3	122	163	19.5
11.5	48.4	11.1	122	152	12.4
11.6	47.2	5.6	123	152	6.5

The liquid bypass data presented in Table IV were obtained primarily from the digital tapes at discrete time intervals. Any data believed to be questionable were compared to the manually collected data. The method of annotating the data utilizes the symbols Q, A, F, C, NN, HH, and M. Application of these symbols is as follows:

- Q Indicates questionable data. One example is the case of flowmeter readings. When the reading was below the range of the flowmeter, the data are indicated as questionable.
- A Signifies that the data may be in error by more than 20%. This symbol is most commonly used for flowmeters and differential pressure measurements obtained over the lower range of the detector.
- F Signifies the detector failed as noted by observation of the data. Most failures were associated with thermocouples that read well above the possible temperature of the system.
- C Indicates that some thermocouples in the top of the vessel never reached a steady value because of the mixing of hot gas and cold water. The data from these thermocouples oscillated around some mean value.
- NN Indicates data that were set to zero when the readings on magnetic tape were determined to be noise.

HH Used only for flows out of the lower plenum and signifies that another measuring technique was used to measure the data instead of the turbine flowmeter. In such cases, the lower plenum drain was closed and the rate of

level increase was used to measure the flow down the annulus. The accuracy of this technique was found to be better than that of turbine flowmeters.

M Indicates that the data acquisition system failed and the manually recorded data taken during the test were used.

TABLE IV

TEST 11 - UPPER ANNULUS LIQUID BYPASS

DETECTOR	FT-VI-L1	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN ID.	TIME (SEC)							
11.1	425.00	25.53	0.0 NN	31.47 C	0.0 NN	0.30 HH	0.0 NN	0.0 NN
11.2	500.00	15.44	0.0 NN	16.09 C	0.0 NN	0.40 HH	0.0 NN	35.00 MQ
11.3	570.00	5.78	0.0 NN	5.58	0.0 NN	0.0 NN	0.0 NN	122.72
11.4	645.00	16.31	0.0 NN	19.49 C	0.0 NN	0.0 NN	0.0 NN	0.0 NN
11.5	720.00	11.10	0.0 NN	12.44	0.0 NN	0.0 NN	0.0 NN	28.99 QA
11.6	135.00	5.63	0.0	6.46	0.0	0.0 NN	0.0	85.19

DETECTOR	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-255	P-VO-L	P-S1	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN ID.	TIME (SEC)							
11.1	425.00	0.0 NN	0.0 NN	205.33 C	137.83 Q	50.03 C	46.40 C	51.60 C
11.2	500.00	0.0 NN	0.0 NN	201.60 C	137.28 Q	48.42	48.36 C	47.78 C
11.3	570.00	0.0 NN	0.0 NN	159.88	144.74 C	48.52	49.72	49.33
11.4	645.00	0.0 NN	0.0 NN	163.37 C	146.36 C	47.67 C	47.22 C	49.10 C
11.5	720.00	0.0 NN	0.0 NN	152.31 C	0.0 F	48.45	47.88 C	48.47 C
11.6	135.00	0.0	0.0 NN	151.79	0.0 F	47.21	48.37	47.78

DETECTOR	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS	PSIG	PSIG	PSIG	PSIG	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
11.1	425.00	49.92 C	50.79 C	51.36	83.36 C	132.58	109.93	262.28
11.2	500.00	36.86 C	46.94 C	48.43	79.55	122.25	127.01	290.15
11.3	570.00	49.93	48.76	50.05	81.92	125.00	135.97	296.47
11.4	645.00	46.75 C	48.40 C	46.86	77.24 C	122.01	132.09	290.67
11.5	720.00	46.75 C	47.80 C	47.83	78.57	122.17	139.84	295.51
11.6	135.00	46.47	47.54	47.83	78.14	123.30	111.85	295.83

DETECTOR	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-S1	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
11.1	425.00	94.51	262.03	212.63 C	255.82	69.99	154.68	95.50
11.2	500.00	90.47	252.04	196.46	296.72	72.49	167.26	99.02
11.3	570.00	92.57	274.29	241.14	297.12	73.70	156.13	102.57
11.4	645.00	86.36	286.07	217.27	275.83	72.49	122.90	103.06
11.5	720.00	89.99	290.18	226.54	246.96	72.49	143.06	100.80
11.6	135.00	91.28	284.21	212.51	296.64	73.21	168.71	101.44

TABLE IV (contd.)

TEST 11 - UPPER ANNULUS LIQUID BYPASS

DETECTOR	TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSID
RUN ID.	TIME (SEC)							
11.1	425.00	295.99	276.87	302.36	302.44	263.97	265.42	300.99
11.2	500.00	294.54	293.01	298.41	299.86	295.83	298.57	299.70
11.3	570.00	295.67	294.05	300.19	310.91	297.68	300.27	300.99
11.4	645.00	294.54	294.05	297.20	303.25	273.65	275.99	297.52
11.5	720.00	296.23	295.67	297.93	305.91	295.35	298.41	299.06
11.6	135.00	295.83	295.35	296.15	305.51	293.49	296.47	297.12

DETECTOR	DP-CL-NOZ	DP-CL-CLB	DP-248-VOL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS	INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
11.1	425.00	-21.65	26.96	-11.58	265.99	264.53	264.21	266.15
11.2	500.00	5.35 QA	55.10	-11.96	298.41	296.88	298.17	300.83
11.3	570.00	3.44 QA	88.09	-0.01 A	299.70	297.52	299.22	301.64
11.4	645.00	-5.95 QA	15.51	1.62 A	277.44	279.05	284.30	289.86
11.5	720.00	4.34 QA	21.24	0.97 A	298.41	296.72	298.41	300.99
11.6	135.00	5.59 QA	21.49	0.89 A	298.73	296.64	298.57	300.99

DETECTOR	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
11.1	425.00	262.28	261.55	261.07	261.15	260.34	253.48	265.66
11.2	500.00	297.28	298.80	296.96	297.28	296.39	289.86	299.30
11.3	570.00	298.17	297.44	297.77	297.77	297.12	290.67	299.94
11.4	645.00	289.62	288.73	288.49	290.02	289.38	282.04	282.92
11.5	720.00	298.25	297.12	297.52	297.85	297.12	290.34	299.14
11.6	135.00	297.85	297.28	297.12	297.12	297.20	290.02	299.70

DETECTOR	TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
11.1	425.00	263.00	265.58	261.55	261.31	262.03	260.50	262.44
11.2	500.00	296.72	300.43	295.35	295.91	296.72	295.51	296.64
11.3	570.00	297.12	301.15	296.64	296.64	297.12	295.99	297.12
11.4	645.00	287.84	288.73	286.80	284.86	286.55	287.68	286.47
11.5	720.00	296.07	300.67	295.67	295.18	296.88	294.54	296.47
11.6	135.00	297.12	300.75	295.99	295.83	297.12	295.99	297.12

TABLE IV (contd.)

TEST 11 - UPPER ANNULUS LIQUID BYPASS

DETECTOR		TM-78D-16D	TM-95D-45	TM-95C-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S	TM-254-OS
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
11.1	425.00	259.29	257.27	265.10	260.76	262.76	262.28	266.79	263.08
11.2	500.00	293.81	292.12	294.78	295.59	297.68	291.55	300.27	286.39
11.3	570.00	294.38	292.60	295.02	295.83	298.25	291.15	300.99	286.31
11.4	645.00	286.31	285.99	287.44	289.38	290.67	287.44	294.54	284.46
11.5	720.00	293.25	290.67	293.41	294.70	297.77	289.70	300.99	284.21
11.6	135.00	294.22	292.36	295.02	295.83	298.41	290.43	299.94	285.26

DETECTOR		TM-254-18	TM-218-T	TM-218-B	PWR-V	
UNITS		DEG-F	DEG-F	DEG-F	kW	
RUN	TIME					
ID	SECT					
11.1	425.00	262.28	262.84	259.94	0.0	NN
11.2	500.00	294.62	291.96	285.67	0.0	NN
11.3	570.00	295.51	292.60	286.15	0.0	NN
11.4	645.00	291.07	291.23	285.51	0.0	NN
11.5	720.00	296.56	290.02	284.21	0.0	NN
11.6	135.00	295.59	290.91	284.21	0.0	NN

V. RESULTS OF STEADY STATE TESTS

Steady state tests were performed with the downcomer walls at or below the saturation temperature to determine the influence of condensation and wall heat flux on countercurrent flow behavior. During these tests, the system was allowed to stabilize at equilibrium conditions before data were recorded.

Air was used as the gas phase during the first steady state test primarily to obtain data for comparison with air-water data from an earlier test series performed in a transparent vessel. The remainder of the steady state tests used steam as the gas phase. Table V references the applicable figures, Figures 9 through 19, and data tables, Tables VI through XXIV, to the appropriate test for which they are presented.

These tests generated data relating the rate of water delivery into the lower plenum to the gas velocity in the annulus for several different system and vessel parameters. Parameters investigated included: downcomer gap size (Tests 4.1 and 9.1), cold leg water flow rate (Tests 4.3, 4.8, 9.3A, and 9.3B), water level in the lower plenum (Test 4.4), wall heat flux (Tests 4.5, 4.7, 9.2A, and 9.2B), cold leg water temperature (Test 4.6), and cold leg steam flow rate (Tests 6.1, 6.2, 9.4A, and 9.4B). The experimental approach was to select a specific set of parameters (baseline), obtain a set of data relating these baseline parameters, vary one parameter at a time from the baseline conditions, and obtain a set of data for each parameter variation. The parameters selected for the baseline tests were as follows:

Downcomer gap size	1/2 and 1 inch
Power of vessel wall heaters	12 kW
Water level in lower plenum	16 inches below bottom of core barrel
Cold leg water temperature	190°F
Water bypass ^[a]	4 gpm
Cold leg steam flow	0 cfm

The data required for each countercurrent flow test were obtained by establishing an upward gas flow in the annulus and water flow in the inlet cold leg, and allowing system conditions to reach equilibrium. Minor adjustments were made as required to achieve a specific water flow out of the phase separator. This sequence was repeated for several gas and liquid flows to obtain a range of liquid flows to the lower plenum for each parameter variation. The resulting rates of flow to the lower plenum ranged from near zero to a value

[a] Specifying annulus water bypass flow instead of cold leg injection rate assured that the data were obtained with maximum water in the downcomer annulus.

TABLE V

INDEX TO STEADY STATE TEST DATA

Test	Applicable Figure	Applicable Table
Steady State Countercurrent Flow		
Air-water		
1.4	9	VI
Steam-water		
Baseline		
4.1	10, 11, 13, 14, 16, 17, 19	VII
5.2	--	VIII
9.1	10, 12, 15, 18	IX
Cold leg water flow rate		
4.3	11	X
4.8	11	XI
9.3A (Data points 9.3.1 - 9.3.3)	12	XII
9.3B (Data points 9.3.4 - 9.3.6)	12	XIII
Lower plenum water level		
4.4	13	XIV
Boundary heat flux		
4.5	14	XV
4.7	14	XVI
9.2A (Data points 9.2.1 - 9.2.4)	15	XVII
9.2B (Data points 9.2.5 - 9.2.8)	15	XVIII
Cold leg water temperature		
4.6	16	XIX
Cold leg steam flow rate		
6.1	17	XX
6.2	17	XXI
9.4A (Data points 9.4.1 - 9.4.4)	18	XXII
9.4B (Data points 9.4.5 - 9.4.7)	18	XXIII
Hysteresis		
5.1	19	XXIV

near the point at which any subsequent reduction in gas flow resulted in all injected water going to the lower plenum. Volumetric flux data for the steady state tests are shown in Figures 9 through 19.

Prior to the countercurrent flow tests with steam and water, tests were run using air and water (Test 1.4). This test was performed to provide a base for correlating semiscale vessel data with the data from countercurrent flow tests performed previously in the semiscale transparent vessel.

Test 5.2, as an extension of Test 4.1, was designed to determine the effect of condensation on volumetric flux. A small hot leg steam flow (54 cfm) was supplied through the core barrel and as much water as possible was supplied to the cold leg inlet. The result was that virtually all the water supplied to the vessel reached the lower plenum, indicating that the steam had no effect and was completely condensed.

During the majority of the countercurrent flow tests, the hot leg gas flow was established before the cold leg water flow. In the hysteresis test (Test 5.1) this procedure was reversed to determine whether the order of establishing the gas and water flows would have an influence on the results.

The data from the steady state tests are presented in Tables VI through XXIV. The data were initially recorded in analog form on magnetic tape; 5 or 6 tapes were required for each sequence of data points to record 64 to 78 channels of information. Recorded data were then processed using a Honeywell DDP-124 digital computer system and digital tape was generated. The original digital tape had to be corrected because of minor inaccuracies, and a second digital tape was generated.

The data were obtained primarily from the digital tapes at discrete time intervals. Any data believed to be questionable were compared to the manually collected data. The method of annotating the data utilizes the symbols Q, A, F, T, C, NN, HH, and M. Application of these symbols is as follows:

- Q Indicates questionable data. One example is the case of flowmeter readings. When the reading was below the range of the flowmeter, then the data are indicated as questionable.
- A Signifies that the data may be in error by more than 20%. This symbol is most commonly used for flowmeters, and differential pressure measurements obtained over the lower range of the meter.
- F Signifies the detector failed as noted by observation of the data. Most failures were associated with thermocouples that read well above the possible temperature of the system.
- T Signifies that the data on magnetic tape were transient and not representative of the entire test interval over which data were collected.

- C Indicates that some thermocouples in the top of the vessel never reached a steady value because of the mixing of hot gas and cold water. The data from these thermocouples oscillated around some mean value.
- NN Indicates data that were set to zero when the readings on magnetic tape were determined to be noise.
- HH Used only for flows out of the lower plenum and signifies that another measuring technique was used to measure the data instead of the turbine flowmeter. In such cases, the lower plenum drain was closed and the rate of level increase was used to measure the flow down the annulus. The accuracy of this technique was found to be better than that of utilizing turbine flowmeters.
- M Indicates that the data acquisition system failed and the manually recorded data taken during the test were used.

Fig. 9 Volumetric flux data for air-water test (Test 1.4).

Fig. 10 Volumetric flux data for baseline tests (Tests 4.1 and 9.1).

Fig. 11 Volumetric flux data for cold leg water flowrate tests -- 0.5-inch gap (Tests 4.1, 4.3, and 4.8).

Fig. 12 Volumetric flux data for cold leg water flowrate tests -- 1.0-inch gap (Tests 9.1, 9.3A, and 9.3B).

Fig. 13 Volumetric flux data for lower plenum water level tests (Tests 4.1 and 4.4).

Fig. 14 Volumetric boundary heat flux tests -- 0.5-inch gap (Tests 4.1, 4.5, and 4.7).

Fig. 15 Volumetric flux data for boundary heat flux tests -- 1.0-inch gap (Tests 9.1, 9.2A, and 9.2B).

Fig. 16 Volumetric flux data for cold leg water temperature tests (Tests 4.1 and 4.6).

Fig. 17 Volumetric flux data for cold leg steam tests -- 0.5-inch gap (Tests 4.1, 6.1, and 6.2).

Fig. 18 Volumetric flux data for cold leg steam test -- 1.0-inch gap (Tests 9.1, 9.4A, and 9.4B).

Fig. 19 Volumetric flux data for hysteresis tests (Tests 4.1 and 5.1).

TABLE VI

TEST 1.4 -- AIR WATER TEST

DETECTOR	FT-VI-L1	FT-VI-L75	FT-VO-L75	FT-VO-L1	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	CEM	CEM
RUN ID.	TIME (SEC)							
1.4.02	15.00	36.27	18.39	0.0	41.14	0.0	14.97	0.00 F
1.4.2	100.00	40.09	0.00 NN	0.0	31.49	8.06	0.0	0.00 F
1.4.3	230.00	38.65	0.00 NN	0.0	22.41	13.58	0.0	0.00 F
1.4.4	360.00	38.83	0.00 NN	0.0	18.79	0.0	26.36	0.00 F
1.4.5	440.00	0.00 NN	15.07	0.0	10.93	5.78	0.00 NN	0.00 F
1.4.6	500.00	0.00 NN	15.60	0.0	6.33	9.99	0.00 NN	0.00 F
1.4.7	570.00	0.00 NN	15.38	0.0	3.33 A	12.25	0.00 NN	0.00 F
1.4.8	50.00	0.00 NN	3.86	0.0	1.46 A	1.72 A	0.00 NN	0.00 F
1.4.91	140.00	0.00 NN	3.84	0.0	0.54 QA	1.63 A	0.00 NN	0.00 F
1.4.92	220.00	0.00 NN	3.86	0.0	1.20 A	2.57	0.00 NN	0.00 F
1.4.10	340.00	0.00 NN	3.95	0.0	0.29 QA	3.22	0.00 NN	0.00 F
1.4.11	440.00	38.13	0.0	0.0	32.20	6.41	0.00 NN	0.00 F
1.4.12	560.00	0.00 NN	15.64	0.0	8.16	7.65	0.00 NN	0.00 F
1.4.13	670.00	0.00 NN	4.36	0.0	2.59 A	1.76 A	0.00 NN	0.00 F
1.4.03	760.00	38.12	19.60	0.0	43.85	19.19	0.00 NN	0.00 F

DETECTOR	FT-CO-G1	FT-CO-G3	P-VI-L	P-VO-L	P-S1	P-SO-L	P-SO-G	P-CO-G
UNITS	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG	PSIG
RUN ID.	TIME (SEC)							
1.4.02	15.00	23.15	0.0	35.01	15.44	18.62	18.85	19.22
1.4.2	100.00	28.37	0.0	19.75	17.14	18.85	19.77	19.40
1.4.3	230.00	35.81	0.0	20.35	19.24	18.56	19.34	19.18
1.4.4	360.00	44.28	0.0	20.26	19.61	18.10	17.53	18.70
1.4.5	440.00	56.59	0.0	27.76	20.43	19.13	20.48	19.91
1.4.6	500.00	69.59	0.0	28.39	20.92	18.90	20.13	19.62
1.4.7	570.00	84.14	0.0	28.39	21.49	18.62	19.91	19.11
1.4.8	50.00	0.00 NN	83.20	22.73	21.98	21.29	21.76	21.27
1.4.91	140.00	0.0	106.81	21.91	21.20	20.02	20.66	19.69
1.4.92	220.00	0.0	102.31	21.82	20.99	20.02	20.59	19.77
1.4.10	340.00	0.0	128.17	21.91	21.27	19.71	20.23	18.37
1.4.11	440.00	19.37	0.0	20.75	15.53	19.97	20.70	20.86
1.4.12	560.00	49.25	0.0	28.19	20.36	19.31	19.98	20.09
1.4.13	670.00	0.0	87.47	21.43	20.64	20.08	20.87	20.53
1.4.03	760.00	15.58	0.0	38.39	17.07	20.51	21.12	21.74

TABLE VI (contd.)

TEST 1.4 -- AIR WATER TEST

DETECTOR	TF-VI-L1	TF-VI-L75	TF-255	TF-V0-L1	TF-V0-L75	TF-S1	TF-S0-L75	TF-S0-L1
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
1.4.02	15.00	63.70	65.23	60.95	64.02	70.87	64.18	76.28
1.4.2	100.00	47.10	51.44	47.24	50.39	67.65	49.98	50.06
1.4.3	230.00	49.10	53.86	47.65	50.63	66.60	49.82	49.90
1.4.4	360.00	49.34	56.92	48.05	50.79	66.20	49.90	50.71
1.4.5	440.00	52.40	51.44	48.45	51.03	65.23	50.23	50.39
1.4.6	500.00	53.69	51.92	48.61	51.27	65.31	49.98	49.98
1.4.7	570.00	55.39	52.57	49.10	51.92	65.39	50.15	50.15
1.4.8	50.00	68.21	52.97	0.00 F	55.23	65.71	0.00 F	53.53
1.4.91	140.00	68.78	51.92	0.00 F	54.98	65.55	0.00 F	53.69
1.4.92	220.00	69.18	51.52	0.00 F	54.74	65.63	0.00 F	53.53
1.4.10	340.00	69.50	52.08	0.00 F	54.26	65.39	0.00 F	53.21
1.4.11	440.00	49.58	54.66	0.00 F	50.87	65.07	0.00 F	50.87
1.4.12	560.00	51.19	52.08	0.00 F	51.76	64.18	0.00 F	51.11
1.4.13	670.00	52.89	53.61	0.00 F	51.92	63.70	0.00 F	51.19
1.4.03	760.00	52.32	55.39	0.00 F	53.37	63.53	0.00 F	52.97

DETECTOR	TF-S0-G1	TF-S0-G3	TF-C0-G1	TF-C0-G3	OP-264-255	TF-47C-0	TF-47C-180	TF-78C-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	PSID	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
1.4.02	15.00	69.83	73.62	76.44	89.18	0.01 QA	60.07	58.45
1.4.2	100.00	61.20	73.21	73.13	87.49	0.05 QA	42.89	41.35
1.4.3	230.00	59.02	71.60	71.92	84.99	0.27 QA	43.69	41.52
1.4.4	360.00	57.81	67.57	70.63	84.18	0.20 QA	43.37	41.60
1.4.5	440.00	56.19	63.62	67.81	82.89	0.22 QA	43.53	41.84
1.4.6	500.00	55.39	63.70	68.44	77.25	0.21 QA	43.29	41.76
1.4.7	570.00	54.50	62.16	64.42	79.02	0.19 QA	43.69	41.84
1.4.8	50.00	57.57	64.50	78.38	63.29	0.0 QA	0.00 F	0.00 F
1.4.91	140.00	55.79	61.11	78.30	61.28	0.0 QA	0.00 F	0.00 F
1.4.92	220.00	55.79	61.11	78.54	60.23	0.0 QA	0.00 F	0.00 F
1.4.10	340.00	53.45	61.68	78.13	57.89	0.0 QA	0.00 F	0.00 F
1.4.11	440.00	56.11	62.89	61.44	62.24	0.04 QA	0.00 F	0.00 F
1.4.12	560.00	55.47	62.32	61.28	62.81	0.19 QA	0.00 F	0.00 F
1.4.13	670.00	54.50	60.31	64.50	61.03	0.13 QA	0.00 F	0.00 F
1.4.03	760.00	57.24	63.70	63.53	63.94	0.04 QA	0.00 F	0.00 F

TABLE VI (contd.)

TEST 1.4 -- AIR WATER TEST

DETECTOR	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
1.4.02	15.00	62.91	62.18	62.73	61.44	61.76	59.66	75.15
1.4.2	100.00	48.81	46.23	48.69	44.18	47.81	42.48	51.60
1.4.3	230.00	48.73	46.23	48.53	44.34	48.05	40.79	49.98
1.4.4	360.00	48.89	46.39	48.69	44.42	48.21	43.13	46.27
1.4.5	440.00	49.29	46.79	49.02	46.03	48.53	42.40	48.69
1.4.6	500.00	49.13	46.55	49.10	46.03	48.29	42.32	49.98
1.4.7	570.00	49.86	47.36	49.90	46.19	48.45	43.53	53.86
1.4.8	50.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.91	140.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.92	220.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.10	340.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.11	440.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.12	560.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.13	670.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.03	760.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F

DETECTOR	TM-95C-285	TF-480-0	TF-480-180	TF-780-0	TF-780-180	TF-950-45	TF-950-225	TM-480-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
1.4.02	15.00	60.41	62.00	60.47	60.95	61.70	60.33	62.08
1.4.2	100.00	43.01	47.56	43.53	45.71	46.23	43.09	47.48
1.4.3	230.00	43.81	47.81	43.69	45.87	44.62	43.17	47.32
1.4.4	360.00	43.81	47.89	43.69	46.11	44.54	43.33	47.40
1.4.5	440.00	44.14	48.05	45.63	46.19	46.07	43.81	48.05
1.4.6	500.00	44.30	47.73	45.47	46.11	45.99	43.65	47.81
1.4.7	570.00	46.39	48.05	44.18	46.44	46.39	45.75	48.45
1.4.8	50.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.91	140.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.92	220.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.10	340.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.11	440.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.12	560.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.13	670.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.03	760.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F

TABLE VI (contd.)

TEST 1.4 -- AIR WATER TEST

DETECTOR	TM-480-180	TM-630-45	TM-630-225	TM-780-01	TM-780-180	TM-950-45	TM-950-225	TM-1160-45	
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	
RUN ID.	TIME (SEC)								
1.4.02	15.00	62.89	0.00 F	62.41	57.19	61.76	59.28	55.74	58.86
1.4.2	100.00	48.94	0.00 F	47.81	41.32	47.81	42.77	39.79	42.16
1.4.3	230.00	49.10	0.00 F	47.81	41.24	47.81	42.69	39.79	42.24
1.4.4	360.00	49.10	0.00 F	48.05	41.56	48.05	43.01	39.95	42.40
1.4.5	440.00	49.02	0.00 F	48.05	41.48	48.45	43.25	40.43	42.89
1.4.6	500.00	48.69	0.00 F	48.05	41.48	48.21	43.01	40.43	42.64
1.4.7	570.00	48.85	0.00 F	48.21	41.72	48.69	43.81	41.07	43.37
1.4.8	50.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.91	140.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.92	220.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.10	340.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.11	440.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.12	560.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.13	670.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F
1.4.03	760.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F

DETECTOR	TM-1160-225	TM-254-14	TM-254-15	TM-254-05	TM-254-18	TM-218-T	TM-218-B	PWR-V	
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	KW	
RUN ID.	TIME (SEC)								
1.4.02	15.00	63.31	0.00 F	65.41	61.11	62.24	61.76	67.16	0.00 NN
1.4.2	100.00	50.26	0.00 F	54.13	49.90	49.98	51.19	56.68	0.00 NN
1.4.3	230.00	50.26	0.00 F	53.88	49.34	48.69	50.95	56.44	0.00 NN
1.4.4	360.00	50.34	0.00 F	54.13	49.82	49.10	51.27	56.68	0.00 NN
1.4.5	440.00	50.74	0.00 F	53.96	49.74	50.06	51.19	56.52	0.00 NN
1.4.6	500.00	50.74	0.00 F	53.88	49.50	49.90	50.95	56.36	0.00 NN
1.4.7	570.00	51.39	0.00 F	54.05	49.74	49.90	51.19	56.44	0.00 NN
1.4.8	50.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0
1.4.91	140.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0
1.4.92	220.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0
1.4.10	340.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0
1.4.11	440.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0
1.4.12	560.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0
1.4.13	670.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0
1.4.03	760.00	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.00 F	0.0

TABLE VI (contd.)

TEST 1.4 -- AIR WATER TEST

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME								
1.4.14 11C.CC	40.11	0.0	0.0	41.77	0.0	0.00 NN	0.00 NN	9.34 Q
1.4.15 2C0.CC	74.46	0.0	0.0	28.56	0.0	15.69	43.12	18.27 Q
1.4.16 3C0.CC	32.33	0.0	0.0	12.96	0.0	0.00 NN	16.44	38.58 Q
1.4.17 4C0.CC	15.13	0.0	0.0	7.87	0.0	0.00 NN	9.43	60.90 Q
1.4.18 5C0.CC	15.70	0.0	0.0	3.40 A	0.0	0.00 NN	13.54	83.35 Q

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN TIME								
1.4.14 11C.CC	0.0	9.11	0.0	41.58	17.74	13.28 Q	20.25	22.90
1.4.15 2C0.CC	0.0	15.76	0.0	78.41	26.78	0.00 F	28.00	20.91
1.4.16 3C0.CC	0.0	36.27	0.0	41.43	18.04	0.00 F	20.04	21.94
1.4.17 4C0.CC	0.0	57.12	0.0	55.10	14.96	0.00 F	20.33	22.80
1.4.18 5C0.CC	0.0	72.90	0.0	56.38	14.57	0.00 F	19.18	21.91

DETECTOR	P-SO-G	P-CO-G	TF-VI-L1	TF-VI-L3	TF-255	TF-VO-L38	TF-VC-L1	TF-VO-L3
UNITS	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
1.4.14 11C.CC	0.00 F	19.58 Q	64.66	84.34	78.46	67.81	80.80	79.50
1.4.15 2C0.CC	0.00 F	31.21	62.65	67.81	62.65	59.26	66.12	65.44
1.4.16 3C0.CC	0.00 F	21.38	62.89	72.25	64.10	65.63	68.78	67.73
1.4.17 4C0.CC	0.00 F	21.59	63.53	75.31	64.10	58.37	69.34	69.75
1.4.18 5C0.CC	0.00 F	21.26	64.42	78.21	64.58	59.66	71.20	71.28

DETECTOR	TF-SI	TF-SC-L75	TF-SC-L1	TF-SC-G1	TF-SO-G3	TF-CO-G1	TF-CC-G3	CP-264-255
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSIG
RUN TIME								
1.4.14 11C.CC	81.12	72.25	78.21	84.02	65.95	75.39	79.18	0.02 QA
1.4.15 2C0.CC	66.20	65.15	67.00	66.28	63.29	72.49	70.71	0.01 QA
1.4.16 3C0.CC	69.59	68.13	70.23	69.50	66.20	70.15	70.79	0.01 QA
1.4.17 4C0.CC	72.41	69.99	72.41	71.92	68.21	63.94	66.84	0.02 QA
1.4.18 5C0.CC	75.63	73.94	75.88	75.15	71.92	59.50	66.60	0.01 QA

TABLE VI (contd.)

TEST 1.4 -- AIR WATER TEST

DETECTOR	TF-47C-0	TF-47C-180	TF-78C-0	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90	TM-47C-285
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
IL	1SEC							
1.4.14	11C.00	79.42	78.94	79.02	81.44	85.47	80.96	79.02
1.4.15	20C.00	64.02	63.45	63.37	66.28	69.58	65.71	63.53
1.4.16	30C.00	57.41	66.52	66.76	69.58	72.49	68.70	66.76
1.4.17	40C.00	70.23	69.34	69.18	71.84	73.94	69.58	69.34
1.4.18	50C.00	73.37	72.33	70.55	71.92	74.10	70.15	72.49

DETECTOR	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-480-0	TF-480-180	TF-780-0	TF-780-180
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
IL	1SEC							
1.4.14	11C.00	77.49	51.52	79.10	76.20	80.07	78.54	81.68
1.4.15	20C.00	62.49	64.58	63.79	60.71	64.34	63.53	63.29
1.4.16	30C.00	65.55	56.19	66.68	63.21	67.57	66.68	66.12
1.4.17	40C.00	68.13	0.00 F	68.70	64.42	70.31	69.34	68.70
1.4.18	50C.00	70.55	0.00 F	70.47	64.83	73.62	72.49	70.55

DETECTOR	TF-95C-45	TF-95C-225	TM-480-0	TM-480-180	TM-630-45	TM-630-225	TM-780-0	TM-780-180
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
IL	1SEC							
1.4.14	11C.00	80.31	77.73	79.67	81.60	78.94	76.60	75.55
1.4.15	20C.00	64.99	63.13	64.18	65.63	64.26	61.92	60.31
1.4.16	30C.00	67.57	66.12	67.57	68.70	67.65	64.99	62.81
1.4.17	40C.00	69.75	67.57	70.07	71.20	70.31	67.97	65.39
1.4.18	50C.00	70.39	68.54	72.49	74.13	73.45	70.63	67.73

DETECTOR	TM-95C-45	TM-95C-225	TM-1160-45	TM-1160-225	TM-254-08	TM-254-15	TM-254-18	TM-254-14
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
IL	1SEC							
1.4.14	11C.00	76.20	75.88	74.92	82.33	76.76	79.83	75.15
1.4.15	20C.00	60.95	61.28	61.52	66.92	62.81	65.87	61.92
1.4.16	30C.00	63.78	63.86	63.86	69.10	64.42	67.49	63.53
1.4.17	40C.00	65.47	65.63	64.99	69.58	66.12	69.02	65.39
1.4.18	50C.00	67.41	66.68	65.79	69.83	68.37	70.79	67.41

TABLE VI (contd.)

TEST 1.4 -- AIR WATER TEST

DETECTOR		TM-218-T	TM-219-B	PWR-V
UNITS		DEG-F	DEG-F	kW
RLN	TIME			
1.4.14	110.001	80.31	82.25	0.00 NN
1.4.15	200.001	66.28	68.29	0.00 NN
1.4.16	300.001	68.45	70.39	0.00 NN
1.4.17	400.001	71.52	72.49	0.00 NN
1.4.18	500.001	75.15	77.00	0.00 NN

TABLE VII

TEST 4.1 -- BASELINE TEST DATA FOR 0.5-INCH GAP

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	CEM
RUN ID.	TIME (SEC)							
4.1.70	110.001	3.52 A	0.0	0.22 AQ	0.0 NN	0.0	4.36	0.0 NN
4.1.71	185.001	3.64 A	0.0	0.54 MQ	0.0 NN	0.0	4.09	0.0 NN
4.1.72	260.001	4.11 A	0.0	0.70 MQ	0.0 NN	0.0	3.99	0.0 NN
4.1.73	340.001	4.97 A	0.0	1.30 A	0.0 NN	0.0	3.69	0.0 NN
4.1.74	420.001	5.23	0.0	0.66 AQ	0.0 NN	0.0	4.04	0.0 NN
4.1.75	500.001	9.17	0.0	0.0 NN	7.66	0.0	4.30	0.0 NN
4.1.76	575.001	7.17	0.0	0.0 NN	3.81 A	0.0	4.07	0.0 NN
4.1.77	650.001	4.56 A	0.0	1.30 A	0.0 NN	0.0	4.27	0.0 NN
4.1.78	730.001	6.52	0.0	0.0 NN	2.72 A	0.0	4.64	0.0 NN
4.1.80	170.001	4.37 A	0.0 NN	1.00 HH	0.0 NN	0.0	3.81	0.0
4.1.81	250.001	4.40 A	0.0 NN	1.00 HH	0.0 NN	0.0	4.20	0.0
4.1.82	330.001	3.82 A	0.0 NN	0.55 HH	0.0 NN	0.0	4.15	0.0
4.1.83	410.001	3.85 A	0.0 NN	0.0 HH	0.0 NN	0.0	4.14	0.0
4.1.84	480.001	7.29	0.0 NN	0.00 NN	4.31 A	0.0	3.97	0.0
4.1.85	560.001	8.93	0.0 NN	0.00 NN	7.65	0.0	4.28	0.0
4.1.86	490.001	5.27	0.0 NN	1.20 HH	0.0 NN	0.0 NN	4.07	0.0 NN
4.1.87	570.001	6.20	0.0 NN	2.40 HH	0.0 NN	0.0 NN	4.03	0.0 NN

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	P-VI-L	P-256	P-VO-L	P-S1	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN ID.	TIME (SEC)							
4.1.70	110.001	100.61	0.0 NN	113.75	82.81	49.32	55.86 Q	50.22
4.1.71	185.001	79.74 Q	0.0 NN	98.45	82.81	49.57	56.25 Q	50.67
4.1.72	260.001	64.37 Q	0.0 NN	85.72	83.06	49.13	55.79 Q	50.24
4.1.73	340.001	49.29 QA	0.0 NN	77.89 Q	87.49	49.45	56.20 Q	50.94
4.1.74	420.001	0.0 NN	70.07	0.0 NN	82.19	49.57	50.24 Q	51.15
4.1.75	500.001	0.0 NN	58.89	0.0 NN	85.06	49.69	53.87 Q	51.65
4.1.76	575.001	0.0 NN	66.41	0.0 NN	84.32	49.90	54.22 Q	51.56
4.1.77	650.001	72.06 Q	0.0 NN	103.42	83.38	49.59	51.96 Q	49.43
4.1.78	730.001	0.0 NN	68.81	0.0 NN	79.39	49.88	52.76 Q	49.33
4.1.80	170.001	99.28	0.0	119.64	83.61	47.28	49.87 Q	49.03
4.1.81	250.001	142.64	0.0	165.05	84.11	47.44	50.75 Q	47.90
4.1.82	330.001	173.19	0.0	185.93	87.34	47.18	50.39 Q	46.92
4.1.83	410.001	189.45	0.0	202.96	85.50	47.44	50.67 Q	47.41
4.1.84	480.001	0.0 NN	70.14	0.0 NN	84.75	47.70	51.56 Q	49.36
4.1.85	560.001	0.0 NN	65.73	0.0 NN	80.30	37.59	41.66 Q	39.28
4.1.86	490.001	75.75 Q	0.0 NN	101.44	85.13	49.01	55.12 Q	51.56
4.1.87	570.001	45.80 QA	0.0 NN	77.36 Q	78.24	48.72	52.81 Q	51.47

TABLE VII (contd.)

TEST 4.1 -- BASELINE TEST DATA FOR 0.5-INCH GAP

DETECTOR	P-SO-G	P-CO-G	TF-VI-L1	TF-VI-L3	TF-255	TF-263	TF-VO-L38	TF-VO-L1
UNITS	PSIG	PSIG	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME [SEC]							
4.1.70	110.00	50.30	50.39	198.56	153.23	298.73	295.83	262.52
4.1.71	185.00	50.92	50.70	188.72	154.44	298.98	252.27	246.55
4.1.72	260.00	50.92	50.03	190.65	159.84	298.57	253.40	266.95
4.1.73	340.00	51.86	50.57	190.97	161.45	298.98	229.53	282.92
4.1.74	420.00	49.07	51.14	191.05	143.22	299.22	289.38	291.31
4.1.75	500.00	50.16	51.59	193.47	165.97	299.06	298.98	228.48
4.1.76	575.00	50.16	51.54	190.97	166.13	299.22	293.89	152.10
4.1.77	650.00	47.96	49.44	195.81	167.34	298.98	298.17	281.39
4.1.78	730.00	48.14	50.34	194.85	160.97	299.06	298.17	241.47
4.1.80	170.00	47.17	49.43	184.92	155.48	295.83	250.98	282.04
4.1.81	250.00	46.26	48.85	187.10	161.13	295.51	246.79	271.63
4.1.82	330.00	45.02	48.54	184.12	157.82	295.59	235.98	254.13
4.1.83	410.00	45.31	49.18	186.22	150.81	295.83	235.82	197.75
4.1.84	480.00	47.85	50.18	192.83	145.24	296.15	256.23	239.77
4.1.85	560.00	39.21	40.19	180.09	163.31	284.86	246.22	145.16
4.1.86	490.00	51.76	52.79	189.12	104.99	94.99 Q	263.08	276.71
4.1.87	570.00	51.09	52.26	190.01	166.13	0.0 F	297.52	289.13

DETECTOR	TF-VO-L3	TF-S1	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3	TF-CO-G1	TF-CO-G3
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME [SEC]							
4.1.70	110.00	268.08	297.77	297.44	254.94	94.51	299.22	298.09
4.1.71	185.00	254.53	298.17	296.80	249.85	93.38	299.78	248.64
4.1.72	260.00	270.02	297.85	298.33	259.13	94.99	299.86	272.36
4.1.73	340.00	280.18	298.41	297.68	259.37	94.91	300.99	293.89
4.1.74	420.00	252.60	298.65	298.25	258.40	93.78 Q	300.99	299.06
4.1.75	500.00	276.71	298.41	297.52	259.69	92.81	300.59	298.89
4.1.76	575.00	280.59	298.81	298.57	259.45	91.93 Q	300.99	299.14
4.1.77	650.00	281.63	298.09	298.33	259.05	91.28	300.27	294.70
4.1.78	730.00	258.40	298.73	298.57	248.48	92.57 Q	300.35	299.38
4.1.80	170.00	249.13	294.54	296.47	235.98	96.36	296.39	289.78
4.1.81	250.00	238.40	293.57	295.51	237.11	98.70	295.83	266.63
4.1.82	330.00	226.14	292.76	294.94	224.12	96.36	294.05	241.14
4.1.83	410.00	198.64	292.93	294.78	185.57	96.12	294.30	233.00
4.1.84	480.00	250.82	295.51	297.52	160.73	93.54	297.60	295.99
4.1.85	560.00	248.89	283.73	285.51	211.78	96.20	285.67	292.76
4.1.86	490.00	242.03	298.41	298.89	232.76	87.41	93.70 Q	298.89
4.1.87	570.00	255.82	297.77	298.81	211.95	94.02	99.83 Q	297.77

TABLE VII (contd.)

TEST 4.1 -- BASELINE TEST DATA FOR 0.5-INCH GAP

DETECTOR	DP-264-255	TF-47C-0	TF-47C-180	TF-78C-0	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90
UNITS	PSID	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME [SEC]							
4.1.70	110.00	0.0 Q	271.71 C	300.83	0.0 F	301.64	300.19	299.78
4.1.71	185.00	0.0 Q	260.34 C	300.83	0.0 F	301.96	300.19	300.19
4.1.72	260.00	0.0 Q	270.02 C	300.19	0.0 F	301.48	299.70	299.70
4.1.73	340.00	0.0 Q	280.18 C	300.51	0.0 F	301.64	299.70	300.02
4.1.74	420.00	0.0 Q	270.02 C	300.43	0.0 F	300.99	299.70	300.19
4.1.75	500.00	0.0 Q	275.34 C	294.62	0.0 F	301.64	299.70	300.19
4.1.76	575.00	0.0 Q	279.46 C	299.54	0.0 F	302.04	300.27	300.35
4.1.77	650.00	0.0 Q	270.66 C	300.35	0.0 F	301.64	299.86	300.27
4.1.78	730.00	0.0 Q	268.89 C	299.86	0.0 F	301.15	300.51	300.83
4.1.80	170.00	0.0 Q	262.28 C	299.30	355.19 Q	298.17	295.59	297.52
4.1.81	250.00	0.0 Q	284.21 C	297.22	390.52 Q	297.93	295.18	297.36
4.1.82	330.00	0.0 Q	282.28 C	299.06	383.59 Q	297.85	295.10	297.36
4.1.83	410.00	0.0 Q	270.42 C	299.06	393.75 Q	297.93	295.18	297.52
4.1.84	480.00	0.0 Q	270.18 C	297.52	366.49 Q	298.09	295.51	297.77
4.1.85	560.00	0.0 Q	246.79 C	286.80	347.29 Q	286.63	284.21	286.80
4.1.86	490.00	-0.01 QA	261.63 C	299.22	0.0 F	302.93	304.14	305.91
4.1.87	570.00	-0.01 QA	268.73 C	297.85	0.0 F	301.88	304.14	306.80

DETECTOR	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180	TF-78D-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME [SEC]							
4.1.70	110.00	300.27	299.46	0.0 F	300.59	295.83	291.23 C	300.10
4.1.71	185.00	300.51	299.30	0.0 F	300.27	296.07	288.49 C	300.02
4.1.72	260.00	299.86	298.89	0.0 F	299.86	295.67	289.05 C	299.14
4.1.73	340.00	299.70	299.06	0.0 F	300.10	295.67	295.02 C	299.70
4.1.74	420.00	299.46	299.06	0.0 F	299.86	295.18	284.30 C	299.70
4.1.75	500.00	295.83	298.25	0.0 F	299.94	295.10	280.99 C	291.96
4.1.76	575.00	298.41	299.06	0.0 F	300.51	295.35	284.30 C	297.77
4.1.77	650.00	299.86	299.46	0.0 F	300.51	295.35	282.60 C	299.46
4.1.78	730.00	298.09	299.06	0.0 F	300.67	295.83	278.57 C	299.06
4.1.80	170.00	300.02	299.70	0.0 F	299.38	291.31	288.33 C	298.98
4.1.81	250.00	299.94	299.70	0.0 F	299.30	291.15	290.02 C	298.89
4.1.82	330.00	299.94	299.70	0.0 F	298.98	290.99	294.54 C	298.81
4.1.83	410.00	300.19	299.70	0.0 F	299.14	290.91	291.39 C	298.89
4.1.84	480.00	298.98	298.81	0.0 F	298.98	290.83	280.34 C	294.54
4.1.85	560.00	284.30	286.96	0.0 F	287.76	279.70	253.81 C	286.39
4.1.86	490.00	299.22	300.59	0.0 F	299.22	299.70	284.38 C	299.06
4.1.87	570.00	298.41	299.70	0.0 F	298.81	299.06	280.34 C	297.77

TABLE VII (contd.)

TEST 4.1 -- BASELINE TEST DATA FOR 0.5-INCH GAP

DETECTOR	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME [SEC]							
4.1.70	110.00	300.59	298.01	299.22	288.09	294.94	299.46	300.75
4.1.71	185.00	300.51	298.17	299.86	285.26	294.70	299.06	299.78
4.1.72	260.00	299.86	297.60	299.30	284.94	294.30	299.22	300.19
4.1.73	340.00	299.86	297.85	299.70	283.89	293.81	298.89	299.78
4.1.74	420.00	299.38	297.44	299.70	282.52	293.89	297.28	300.35
4.1.75	500.00	299.78	297.68	299.70	273.25	288.89	290.18	300.27
4.1.76	575.00	300.51	298.09	299.78	280.10	293.49	295.83	298.81
4.1.77	650.00	300.51	297.77	299.30	284.38	294.70	298.57	301.15
4.1.78	730.00	299.78	298.41	299.70	280.59	293.17	295.67	300.10
4.1.80	170.00	295.83	294.54	296.64	284.21	0.0 F	297.93	301.64
4.1.81	250.00	295.83	294.54	296.47	288.73	0.0 F	298.01	301.64
4.1.82	330.00	295.67	294.14	296.47	284.70	0.0 F	298.17	300.99
4.1.83	410.00	296.07	294.54	296.15	284.46	0.0 F	298.41	301.96
4.1.84	480.00	296.07	294.70	296.31	278.25	0.0 F	295.18	300.75
4.1.85	560.00	284.54	283.25	284.94	262.68	0.0 F	279.86	288.97
4.1.86	490.00	305.02	303.33	305.43	281.79	0.0 F	296.56	299.70
4.1.87	570.00	304.06	302.28	304.62	282.12	0.0 F	294.62	298.41

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-15	TM-254-05
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME [SEC]							
4.1.70	110.00	298.57	296.47	297.77	298.57	298.57	296.23	298.41
4.1.71	185.00	299.06	296.96	298.01	298.73	298.57	296.47	299.06
4.1.72	260.00	299.06	296.72	298.01	298.57	298.41	296.23	298.81
4.1.73	340.00	298.65	296.72	297.68	298.41	297.77	296.56	299.30
4.1.74	420.00	298.25	296.47	297.36	298.25	297.85	296.88	299.70
4.1.75	500.00	297.60	296.07	297.28	298.33	297.93	296.64	299.70
4.1.76	575.00	298.65	296.31	297.93	298.65	298.41	297.12	300.02
4.1.77	650.00	298.81	296.31	297.93	298.49	298.41	297.28	299.70
4.1.78	730.00	298.81	297.85	298.09	298.98	298.57	297.60	299.86
4.1.80	170.00	296.07	293.09	293.73	293.57	295.67	295.83	299.70
4.1.81	250.00	295.99	292.60	293.73	293.49	295.59	295.99	299.86
4.1.82	330.00	295.83	292.60	293.41	293.25	295.43	295.83	299.86
4.1.83	410.00	295.83	292.60	293.49	293.41	295.59	296.47	300.27
4.1.84	480.00	295.43	292.28	293.25	293.57	295.83	295.99	300.43
4.1.85	560.00	283.57	280.99	282.04	282.36	284.70	285.10	288.73
4.1.86	490.00	298.98	299.70	299.06	300.27	301.72	298.41	301.64
4.1.87	570.00	298.49	299.14	298.57	299.70	301.15	298.41	301.31

TABLE VII (contd.)

TEST 4.1 -- BASELINE TEST DATA FOR 0.5-INCH GAP

DETECTOR		TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS		DEG-F	DEG-F	DEG-F	KW
RUN ID.	TIME (SEC)				
4.1.70	110.00	299.78	304.62	302.69	12.76
4.1.71	185.00	299.30	304.22	302.36	12.48
4.1.72	260.00	300.19	306.72	306.15	12.41
4.1.73	340.00	300.83	305.02	303.09	12.12
4.1.74	420.00	300.99	305.51	303.57	12.85
4.1.75	500.00	300.75	304.62	302.36	12.64
4.1.76	575.00	300.99	305.83	304.14	12.74
4.1.77	650.00	300.99	306.56	305.02	12.58
4.1.78	730.00	300.99	305.59	303.81	13.12
4.1.80	170.00	299.06	303.65	301.15	19.87
4.1.81	250.00	299.38	304.14	301.72	19.94
4.1.82	330.00	299.70	305.51	303.41	19.96
4.1.83	410.00	299.70	305.02	302.77	19.93
4.1.84	480.00	299.70	295.67	289.05	19.90
4.1.85	560.00	288.33	294.38	292.68	18.41
4.1.86	490.00	302.36	305.59	303.57	12.91
4.1.87	570.00	302.28	306.80	304.94	11.78

TABLE VIII

TEST 5.2 -- BASELINE VERIFICATION TEST

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VU-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME								
ID (SEC)								
5.2.1 100.00	2.39 A	147.58	0.00 NN	50.60	132.24	0.00 NN	0.0	0.00 NN

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	P-VI-L	P-256	P-VO-L	P-S1	P-SO-L
UNITS	GPM	GPM	GPM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN TIME								
ID (SEC)								
5.2.1 100.00	0.00 NN	53.37	0.00 NN	36.44	50.46	43.01	51.86	55.70

DETECTOR	P-SO-G	P-CO-G	TF-VI-L1	TF-VI-L3	TF-255	TF-263	TF-VO-L38	TF-VO-L1
UNITS	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
5.2.1 100.00	51.38	53.29	0.0 F	205.65	205.49	175.33	142.66	205.01

DETECTOR	TF-VO-L3	TF-S1	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3	TF-CO-G1	TF-CO-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
5.2.1 100.00	203.40	177.10	206.14	179.68	97.89	93.78	301.15	298.65

DETECTOR	DP-264-255	TF-47C-0	TF-47C-180	TF-78C-0	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90
UNITS	PSID	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
5.2.1 100.00	0.00 OA	200.81 C	196.62	0.00 F	202.27	203.64	219.53	264.13

DETECTOR	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D0	TF-48D-180	TF-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
5.2.1 100.00	265.66	260.34	0.00 F	260.18	253.89	199.52 C	197.91	200.09

DETECTOR	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
5.2.1 100.00	199.04	201.30	203.07	197.27	0.00 F	200.09	200.09	202.91

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-15	TM-254-08
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
5.2.1 100.00	201.78	200.33	201.62	205.49	202.71	205.49	207.51	203.64

TABLE IX

TEST 9.1 -- BASELINE TEST DATA FOR 1.0-INCH GAP

DETECTOR	FT-VI-L1	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME								
ID. (SEC)								
9.1.1	115.001	4.88 A	1.14 HH	0.00 NN	0.0	4.17	0.0	231.47
9.1.2	190.001	7.00	3.88 HH	0.00 NN	0.0	4.28	0.0	139.13
9.1.3	260.001	17.28	0.00 NN	14.80 HH	0.0	4.12	0.0	18.78 Q
9.1.4	340.001	5.62	2.25 HH	0.00 NN	0.0	4.42	0.0	174.16
9.1.5	415.001	9.53	0.00 NN	6.71 HH	0.0	4.36	0.0	92.06
9.1.6	490.001	5.67	1.42 HH	0.00 NN	0.00 NN	4.72	0.0	201.13
9.1.7	560.001	13.15	0.00 NN	9.00 HH	0.00 NN	4.08	0.0	52.95 Q
9.1.8	640.001	13.95	0.00 NN	9.58 HH	0.00 NN	4.40	0.0	45.18 Q
9.1.9	715.001	72.09	0.00 NN	0.0	99.61 Q	4.49	0.0	0.0

DETECTOR	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	GPM	GPM	GPM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN TIME								
ID. (SEC)								
9.1.1	115.001	0.0	255.56	0.0	143.53 Q	49.04	47.19	48.64
9.1.2	190.001	0.0	173.82	0.0	144.33 Q	49.38	45.76	50.33
9.1.3	260.001	0.0	122.55	0.0	143.11 Q	50.21	47.96	51.31
9.1.4	340.001	0.0	204.21	0.00 NN	136.74 Q	51.08	43.32	49.73
9.1.5	415.001	0.0	153.68	0.00 NN	140.47 Q	51.35	45.04	50.91
9.1.6	490.001	0.0	225.09	0.00 NN	137.73 Q	52.41	45.88	50.10
9.1.7	560.001	0.0	142.14	0.00 NN	138.44 Q	46.66	41.70	49.33
9.1.8	640.001	0.0	132.07	0.00 NN	144.97 Q	47.99	43.38	50.82
9.1.9	715.001	0.0	104.79	0.00 NN	103.11 Q	51.34	46.71	55.33

DETECTOR	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS	PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
9.1.1	115.001	63.47	64.02	48.35	56.31	181.62	149.03	300.51
9.1.2	190.001	65.88	62.61	47.77	56.81	186.22	154.27	299.94
9.1.3	260.001	65.36	63.21	47.93	58.64	196.62	158.23	300.35
9.1.4	340.001	39.20	61.83	48.05	61.61	182.75	142.42	299.70
9.1.5	415.001	40.41	61.62	48.10	62.17	188.07	151.05	299.70
9.1.6	490.001	38.65	63.00	49.02	63.76	193.64	156.45	300.59
9.1.7	560.001	47.95	59.64	45.68	46.58	179.04	155.45	298.01
9.1.8	640.001	49.19	61.23	47.03	48.23	188.72	156.45	298.98
9.1.9	715.001	66.84	65.93	52.25	53.69	204.20	160.89	277.28

TABLE IX (contd.)

TEST 9.1 -- BASELINE TEST DATA FOR 1.0-INCH GAP

DETECTOR	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-S1	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
9.1.1	115.00	0.00 F	219.69	277.75	297.12	294.94	111.28	108.62
9.1.2	190.00	0.00 F	257.76	285.18	298.25	297.26	116.45	112.90
9.1.3	260.00	0.00 F	298.81	282.84	299.22	298.73	109.59	117.01
9.1.4	340.00	205.26	257.76	261.55	297.20	296.72	120.16	138.06
9.1.5	415.00	261.79	294.94	264.13	298.49	297.52	116.45	140.32
9.1.6	490.00	289.54	276.96	265.50	297.52	295.99	110.80	141.61
9.1.7	560.00	163.31	293.09	218.40	297.12	290.34	102.17	138.55
9.1.8	640.00	155.32	296.96	256.07	297.77	297.68	102.65	140.32
9.1.9	715.00	266.15	283.81	247.03	257.36	287.04	101.85	137.90

DETECTOR	TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	PSIO
RUN ID.	TIME (SEC)							
9.1.1	115.00	303.51	298.17	230.66	274.54	179.84	0.00 F	189.60
9.1.2	190.00	291.31	297.12	232.27	274.86	184.76	0.00 F	189.28
9.1.3	260.00	299.70	297.60	186.78	273.97	194.52	0.00 F	194.28
9.1.4	340.00	253.81	297.36	219.93	280.34	186.13	0.00 F	230.66
9.1.5	415.00	260.50	297.28	214.53	276.57	188.15	0.00 F	193.39
9.1.6	490.00	257.03	298.17	212.19	276.47	193.07	0.00 F	194.68
9.1.7	560.00	282.20	296.07	258.57	259.53	180.17	0.00 F	188.88
9.1.8	640.00	286.96	296.96	240.34	266.95	188.96	0.00 F	188.80
9.1.9	715.00	288.09	300.75	228.16	269.53	203.64	0.00 F	200.49

DETECTOR	DP-CL-107	DP-CL-CLB	DP-248-VOL	TF-47C-G	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS	INCHES	INCHES	INCHES	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
9.1.1	115.00	0.87 QA	0.0 Q	1.37 A	273.73 C	0.00 F	302.52	302.04
9.1.2	190.00	-0.16 QA	0.0 Q	-1.17 A	276.47 C	0.00 F	302.04	301.23
9.1.3	260.00	0.05 QA	0.0 Q	1.21 A	288.25 C	0.00 F	302.04	301.64
9.1.4	340.00	-1.05 QA	61.04	-1.28 A	272.44 C	0.00 F	302.04	303.59
9.1.5	415.00	-0.81 QA	26.36	-0.65 A	243.48 C	0.00 F	301.72	300.35
9.1.6	490.00	-0.65 QA	77.14	-0.06 A	263.57 C	0.00 F	302.60	301.15
9.1.7	560.00	-1.65 QA	12.79 A	-0.76 A	235.58 C	0.00 F	299.78	298.41
9.1.8	640.00	-1.30 QA	14.21 A	1.69 A	258.08 C	0.00 F	301.48	299.86
9.1.9	715.00	-7.47 QA	39.19	13.15	205.49 C	0.00 F	209.36	227.92

TABLE IX (contd.)

TEST 9.1 -- BASELINE TEST DATA FOR 1.0-INCH GAP

DETECTOR	TM-47C-9C	TM-47C-285	TM-63C-285	TM-78C-9C	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
9.1.1	115.00	298.65	295.35	299.22	299.70	0.00 F	293.65	298.89 C
9.1.2	190.00	297.28	294.54	298.65	299.06	0.00 F	293.01	297.28 C
9.1.3	260.00	296.31	292.12	298.89	299.70	0.00 F	293.57	291.64 C
9.1.4	340.00	297.12	295.59	299.06	299.70	0.00 F	292.68	298.17 C
9.1.5	415.00	297.12	292.76	299.06	299.22	0.00 F	292.20	293.73 C
9.1.6	490.00	297.77	295.83	299.70	300.19	0.00 F	293.01	298.41 C
9.1.7	560.00	293.97	293.01	297.28	298.17	0.00 F	290.91	285.51 C
9.1.8	640.00	294.55	291.31	298.41	299.06	0.00 F	291.96	281.63 C
9.1.9	715.00	264.37	271.23	265.02	264.53	0.00 F	256.07	207.11 C

DETECTOR	TF-78D-0	TF-78D-180	TM-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
9.1.1	115.00	299.22	303.01	0.00 F	299.66	298.73	298.89	298.17
9.1.2	190.00	298.81	302.28	0.00 F	299.22	297.52	297.93	297.52
9.1.3	260.00	298.49	302.04	0.00 F	299.70	288.89	295.83	296.07
9.1.4	340.00	299.36	301.23	0.00 F	299.86	298.01	299.14	297.85
9.1.5	415.00	298.89	300.99	0.00 F	299.70	294.94	297.77	297.28
9.1.6	490.00	299.70	301.64	0.00 F	300.51	299.06	299.78	298.41
9.1.7	560.00	295.18	298.65	0.00 F	297.77	288.09	296.47	295.10
9.1.8	640.00	298.33	299.78	0.00 F	299.30	293.49	297.36	296.47
9.1.9	715.00	223.80	206.62	0.00 F	206.07	207.51	217.51	210.33

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-0	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
9.1.1	115.00	296.64	295.02	295.99	297.85	299.70	301.64	297.36
9.1.2	190.00	296.15	294.70	295.43	297.12	299.06	300.99	297.36
9.1.3	260.00	296.47	294.94	295.67	297.36	299.70	301.31	297.93
9.1.4	340.00	296.88	294.54	295.83	296.47	298.57	300.51	297.60
9.1.5	415.00	296.47	293.97	295.35	296.47	298.25	300.10	297.44
9.1.6	490.00	297.60	294.94	296.31	297.12	298.89	300.83	298.25
9.1.7	560.00	295.26	292.60	293.97	294.54	296.72	298.41	296.47
9.1.8	640.00	296.47	293.57	295.26	295.83	297.77	299.70	297.36
9.1.9	715.00	211.22	231.71	213.48	266.15	259.45	220.25	272.76

TABLE IX (contd.)

TEST 9.1 -- BASELINE TEST DATA FOR 1.0-INCH GAP

RUN ID.	DETECTOR	TM-254-OS	TM-254-18	TM-218-T	TM-218-B	PWR-V
	UNITS	DEG-E	DEG-E	DEG-E	DEG-E	KW
	TIME (SEC)					
9.1.1	115.00	292.20	299.06	303.17	299.06	12.13
9.1.2	190.00	291.76	298.57	304.86	300.99	12.16
9.1.3	260.00	292.44	299.46	304.86	302.28	12.14
9.1.4	340.00	292.73	298.57	304.22	301.64	12.57
9.1.5	415.00	292.76	298.41	305.91	303.57	12.56
9.1.6	490.00	293.77	299.70	306.88	305.11	12.58
9.1.7	560.00	291.96	297.77	303.57	300.83	12.43
9.1.8	640.00	293.49	298.57	306.15	303.98	12.41
9.1.9	715.00	277.12	251.95	287.76	293.25	12.32

TABLE X

TEST 4.3 -- COLD LEG WATER FLOW RATE (0.5-INCH GAP)

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME								
ID (SEC)								
4.3.70	110.00	9.64	0.0	1.00 MA	0.00 NN	0.0	15.61	0.0
4.3.71	185.00	9.34	0.0	0.90 AQ	0.00 NN	0.0	15.27	0.0
4.3.72	260.00	9.17	0.0	1.20 AQ	0.00 NN	0.0	14.95	0.0
4.3.73	335.00	9.68	0.0	1.08 AQ	0.00 NN	0.0	14.67	0.0
4.3.74	415.00	10.55	0.0	0.00 NN	3.84 A	0.0	14.46	0.0
4.3.75	490.00	10.47	0.0	0.00 NN	6.40 M2	0.0	12.29	0.0
4.3.76	725.00	11.58	0.00 NN	0.00 NN	2.79 A	0.0	14.89	0.0
4.3.77	645.00	11.77	0.00 NN	0.00 NN	2.29 A	0.00 NN	14.72	0.00 NN
4.3.78	720.00	10.67	0.00 NN	0.00 NN	2.13 A	0.00 NN	14.68	0.00 NN
4.3.79	95.00	11.21	0.00 NN	1.00 H4	0.00 NN	0.0	14.25	0.0
4.3.80	170.00	13.51	0.00 NN	0.75 HH	0.00 NN	0.0	17.47	0.0

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	P-VI-L	P-256	P-VO-L	P-S1	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN TIME								
ID (SEC)								
4.3.70	110.00	101.51	0.0	159.31	87.04	51.50	55.34	49.43
4.3.71	185.00	70.51 Q	0.0	135.32	99.64	50.71	53.00	49.73
4.3.72	260.00	17.91 QA	0.0	98.52	228.89 Q	49.90	51.52	50.65
4.3.73	335.00	0.00 NN	0.0	83.87	79.92	48.82	48.96	50.79
4.3.74	415.00	0.00 NN	0.0	80.94	75.65	41.46	43.72	42.64
4.3.75	490.00	0.00 NN	67.07	0.0	81.93	27.68	28.34	28.16
4.3.76	725.00	0.00 NN	0.00 NN	82.68	79.76	48.34	51.80	50.02
4.3.77	645.00	3.90 QA	0.00 NN	92.68	79.66	49.46	52.42	51.69
4.3.78	720.00	59.79 Q	0.00 NN	121.92	75.57	49.03	52.93	50.96
4.3.79	95.00	113.55	0.0	169.70	132.87 Q	49.71	54.71	49.68
4.3.80	170.00	147.42	0.0	198.22	135.94 Q	49.02	53.62	47.72

DETECTOR	P-SO-G	P-CO-G	TF-VI-L1	TF-VI-L3	TF-255	TF-263	TF-VO-L38	TF-VO-L1
UNITS	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID (SEC)								
4.3.70	110.00	50.16	50.73	194.68	155.97	303.65	269.45	238.80
4.3.71	185.00	49.92	50.02	198.88	123.38	303.49	296.47	263.41
4.3.72	260.00	48.65	49.20	203.88	151.69	302.28	297.52	283.33
4.3.73	335.00	47.53	48.67	197.27	143.31	301.80	297.44	283.73
4.3.74	415.00	40.81	41.12	201.86	162.91	294.05	278.65	268.57
4.3.75	490.00	26.66	27.87	198.72	164.84	274.37	251.47	157.26
4.3.76	725.00	48.62	49.44	196.94	162.42	300.99	279.46	151.05
4.3.77	645.00	51.33	52.00	190.73	175.81	0.00 F	258.73	146.77
4.3.78	720.00	49.31	51.95	225.90	187.02	0.00 F	261.87	155.64
4.3.79	95.00	49.20	51.84	810.67	164.84	300.02	296.47	271.79
4.3.80	170.00	47.04	51.12	190.25	153.23	298.98	298.98	276.96

TABLE X (contd.)

TEST 4.3 -- COLD LEG WATER FLOW RATE (0.5-INCH GAP)

DETECTOR	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3	TF-CO-G1	TF-CO-G3
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME								
ID (SEC)								
4.3.70	110.00	252.03	299.06	300.67	292.75	96.04	300.19	280.51
4.3.71	185.00	272.60	300.10	301.64	261.23	93.78	302.28	210.65
4.3.72	260.00	251.95	299.86	301.64	264.29	97.41	302.85	243.56
4.3.73	335.00	251.95	299.70	301.80	258.97	97.73	302.44	218.24
4.3.74	415.00	256.39	291.47	293.73	247.19	99.35	294.86	249.13
4.3.75	490.00	236.47	272.44	274.54	237.35	98.38	275.34	295.67
4.3.76	725.00	285.34	300.35	300.99	186.62	99.10	301.56	300.43
4.3.77	645.00	279.70	298.25	300.10	245.66	97.09	95.15	292.44
4.3.78	720.00	284.21	297.12	299.22	252.44	100.72	161.13-0	293.09
4.3.79	95.00	237.76	297.12	296.88	243.24	89.02	83.30 0	238.72
4.3.80	170.00	278.33	294.86	295.26	249.94	98.14	93.62 0	244.37

DETECTOR	DP-264-255	TF-47C-0	TF-47C-180	TF-700=L	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90
UNITS	PSID	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME								
ID (SEC)								
4.3.70	110.00	-0.03 QA	303.41 C	301.07	301.64 0	301.64	301.80	301.15
4.3.71	185.00	-0.03 QA	289.70 C	300.43	300.75 0	301.31	300.51	300.27
4.3.72	260.00	-0.04 QA	287.28 C	298.73	0.00 F	300.43	299.22	299.30
4.3.73	335.00	-0.03 QA	276.87 C	298.98	0.00 F	300.27	298.81	299.06
4.3.74	415.00	-0.03 QA	276.71 C	288.81	0.00 F	291.31	290.18	290.67
4.3.75	490.00	-0.03 QA	251.95 C	268.49	0.00 F	273.00	271.47	272.60
4.3.76	725.00	-0.01 QA	285.91 C	295.10	0.00 F	300.67	301.56	300.35
4.3.77	645.00	-0.01 QA	288.41 C	297.12	0.00 F	302.44	304.46	306.80
4.3.78	720.00	-0.01 QA	300.19 C	297.28	0.00 F	302.28	304.22	306.15
4.3.79	95.00	-0.00 QA	301.88 C	300.27	0.00 F	303.81	301.64	302.77
4.3.80	170.00	0.00 QA	301.88 C	299.46	0.00 F	302.44	300.02	301.48

DETECTOR	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180	TF-78C-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME								
ID (SEC)								
4.3.70	110.00	300.99	302.12	0.00 F	300.99	297.28	303.65 C	300.59
4.3.71	185.00	300.43	302.12	0.00 F	300.59	295.83	291.96 C	299.17
4.3.72	260.00	297.77	300.99	0.00 F	299.38	294.54	288.97 C	298.73
4.3.73	335.00	297.60	301.07	0.00 F	299.70	294.30	286.80 C	296.88
4.3.74	415.00	287.36	293.01	0.00 F	291.96	286.15	282.04 C	287.44
4.3.75	490.00	270.02	272.36	0.00 F	272.76	267.76	258.97 C	269.29
4.3.76	725.00	297.93	301.31	0.00 F	300.35	297.12	287.60 C	295.67
4.3.77	645.00	296.64	300.27	0.00 F	299.22	298.81	292.68 C	295.02
4.3.78	720.00	297.68	300.59	0.00 F	299.30	298.73	300.75 C	295.83
4.3.79	95.00	302.28	301.80	0.00 F	301.64	298.98	302.85 C	298.81
4.3.80	170.00	301.64	301.15	0.00 F	300.83	297.93	302.44 C	298.25

TABLE X (contd.)

TEST 4.3 -- COLD LEG WATER FLOW RATE (0.5-INCH GAP)

DETECTOR	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME ID (SEC)								
4.3.70	110.00	302.28	297.28	300.51	300.27	293.17	299.06	301.07
4.3.71	185.00	300.27	295.83	300.35	292.44	291.47	297.52	309.30
4.3.72	260.00	298.57	294.54	299.78	284.62	288.49	295.10	301.64
4.3.73	335.00	297.93	294.30	299.70	281.71	287.52	295.10	306.56
4.3.74	415.00	288.97	286.15	291.55	274.29	276.47	286.15	300.83
4.3.75	490.00	269.13	267.76	271.47	259.69	261.79	270.02	273.25
4.3.76	725.00	301.48	298.49	299.94	282.44	0.00 F	293.89	299.22
4.3.77	645.00	304.06	303.17	305.27	283.57	0.00 F	291.72	299.06
4.3.78	720.00	303.49	302.28	305.27	290.34	0.00 F	294.70	299.70
4.3.79	95.00	303.09	300.83	302.93	298.41	292.44	298.81	301.64
4.3.80	170.00	301.72	299.38	301.64	296.07	293.17	298.41	300.83

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S	TM-254-0S
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME ID (SEC)								
4.3.70	110.00	298.17	299.70	298.25	298.49	301.23	296.88	299.70
4.3.71	185.00	298.41	298.41	297.93	297.77	300.19	297.12	300.10
4.3.72	260.00	297.77	297.68	297.12	296.64	299.06	296.15	299.22
4.3.73	335.00	298.01	297.52	297.28	296.47	298.89	295.83	299.22
4.3.74	415.00	289.78	289.38	288.89	288.25	290.83	288.57	290.67
4.3.75	490.00	270.66	269.37	270.02	269.86	271.31	270.66	272.60
4.3.76	725.00	296.64	298.65	297.60	299.14	300.19	300.75	302.04
4.3.77	645.00	298.65	299.06	298.65	299.70	300.99	299.06	302.44
4.3.78	720.00	298.93	298.81	298.57	299.70	300.99	299.22	302.36
4.3.79	95.00	301.56	300.27	300.75	300.99	302.85	297.12	299.38
4.3.80	170.00	300.67	299.06	299.70	299.70	301.80	297.28	298.98

DETECTOR	TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS	DEG-E	DEG-E	DEG-E	KW
RUN TIME ID (SEC)				
4.3.70	110.00	298.57	305.35	302.44
4.3.71	185.00	299.38	305.99	302.36
4.3.72	260.00	298.17	305.83	302.69
4.3.73	335.00	297.20	305.11	301.31
4.3.74	415.00	290.59	299.38	297.12
4.3.75	490.00	271.87	280.34	280.26
4.3.76	725.00	302.85	301.88	300.27
4.3.77	645.00	303.01	299.70	298.09
4.3.78	720.00	303.33	304.86	303.65
4.3.79	95.00	299.86	304.30	302.36
4.3.80	170.00	299.70	305.99	304.46

TABLE XI

TEST 4.8 -- COLD LEG WATER FLOW RATE (0.5-INCH GAP)

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-G3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN	TIME							
ID.	ISEC							
4.8.70	420.00	22.05	0.00 NN	1.58 HH	0.00 NN	0.0	0.00 NN	27.87
4.8.71	500.00	20.72	0.00 NN	2.68 HH	0.00 NN	0.0	0.00 NN	24.30
4.8.72	570.00	26.33	0.00 NN	0.00 NN	2.95 HH	0.0	0.00 NN	26.66

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-C	P-256	P-VO-L	P-SI
UNITS	GPM	GPM	GPM	GPM	PSIG	PSIG	PSIG	PSIG
RUN	TIME							
ID.	ISEC							
4.8.70	420.00	22.22 QA	0.0	169.88	0.00 NN	137.36 Q	48.78	50.66
4.8.71	500.00	0.00 NN	0.0	124.54	0.00 NN	126.79 Q	49.21	50.44
4.8.72	570.00	0.00 NN	0.0	106.49	0.00 NN	130.66 Q	47.14	50.34

DETECTOR	P-SO-L	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255
UNITS	PSIG	PSIG	PSIG	PSIG	PSIG	DEG-E	DEG-E	DEG-E
RUN	TIME							
ID.	ISEC							
4.8.70	420.00	49.47	47.06	49.98	46.55	47.60	190.89	134.51
4.8.71	500.00	51.27	49.04	51.50	48.00	48.35	190.89	154.03
4.8.72	570.00	49.99	49.41	50.16	46.18	46.79	185.97	155.16

DETECTOR	TF-263	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME							
ID.	ISEC							
4.8.70	420.00	286.96	265.74	216.06	234.13	295.91	85.47	252.60
4.8.71	500.00	282.92	284.46	233.88	254.77	296.56	131.29	194.68
4.8.72	570.00	291.96	157.42	284.94	239.05	259.21	89.43	144.43

DETECTOR	TF-SO-G3	TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME							
ID.	ISEC							
4.8.70	420.00	299.70	294.54	295.99	245.50	251.31	192.99	190.41
4.8.71	500.00	288.09	295.99	297.77	197.75	265.02	193.88	194.93
4.8.72	570.00	248.97	294.54	296.47	237.76	244.85	188.80	167.43

TABLE XI (contd.)

TEST 4.8 -- COLD LEG WATER FLOW RATE (0.5-INCH GAP)

DETECTOR	DP-264-255	DP-CL-NOZ	DP-CL-CLB	DP-248-VOL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45
UNITS	PSID	INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID.	(SEC)							
4.8.70	420.001	0.00 QA	0.17 QA	39.94	-1.39 A	301.64	294.86	298.41
4.8.71	500.001	0.00 QA	0.69 QA	15.44	-0.21 A	281.96 C	298.25	300.10
4.8.72	570.001	0.00 QA	0.78 QA	4.75 A	0.32 A	285.99 C	296.31	298.57
							298.57	297.23

DETECTOR	TF-95C-225	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME							
ID.	(SEC)							
4.8.70	420.001	293.01	295.99	300.43	300.27	300.43	300.19	291.72
4.8.71	500.001	299.70	294.54	298.17	301.56	301.64	301.39	293.25
4.8.72	570.001	298.57	290.75	291.96	300.27	300.75	300.35	292.12
								293.41 C

DETECTOR	TF-48D-180	TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TF-48D-180	TM-63D-45
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME							
ID.	(SEC)							
4.8.70	420.001	297.60	300.99	298.41	295.83	296.31	297.28	0.00 F
4.8.71	500.001	297.52	300.02	300.02	297.12	297.77	277.12	0.00 F
4.8.72	570.001	296.64	298.89	298.81	295.83	296.47	263.08	0.00 F
								297.12

DETECTOR	TM-63D-225	TM-78D-C	TM-78D-180	TM-95C-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME							
ID.	(SEC)							
4.8.70	420.001	299.94	298.41	295.83	293.89	296.23	297.28	297.20
4.8.71	500.001	298.89	293.57	297.12	291.96	295.35	298.41	298.57
4.8.72	570.001	299.06	291.96	295.99	290.67	295.43	297.12	297.77
								297.52

DETECTOR	TM-254-1S	TM-254-0S	TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	KW
RUN	TIME					
ID.	(SEC)					
4.8.70	420.001	300.43	293.41	298.33	302.52	301.64
4.8.71	500.001	301.80	294.54	299.70	291.96	290.91
4.8.72	570.001	300.75	293.89	298.81	288.89	287.60
						11.26

TABLE XII

TEST 9.3A -- COLD LEG WATER FLOW RATE (1.0-INCH GAP)

DETECTOR UNITS		FT-VI-L1 GPM	FT-VO-L38 GPM	FT-VO-L1 GPM	FT-VO-L3 GPM	FT-SO-L75 GPM	FT-SO-L1 GPM	FT-SO-G1 GPM	FT-SO-G3 GPM
RUN	TIME (SEC)								
9.3.1	720.00	21.10	4.39 FH	0.00 NN	0.0	0.00 NN	27.06	0.0	141.63
9.3.2	85.00	26.48	0.00 NN	10.73 HH	0.0	0.00 NN	23.79	0.0	0.00 NN
9.3.3	165.00	23.73	0.00 NN	5.23 HH	0.0	0.00 NN	24.61	0.0	100.59

DETECTOR UNITS		FT-CO-G1 GPM	FT-CO-G3 GPM	FT-CL-G3 GPM	P-VI-L PSIG	P-256 PSIG	P-VO-L PSIG	P-SI PSIG	P-SO-L PSIG
RUN	TIME (SEC)								
9.3.1	720.00	0.0	251.92	0.0	135.47 0	47.34	49.90	45.79	46.64
9.3.2	85.00	0.0	266.21	0.00 NN	138.11 0	48.72	51.63	49.85	50.97
9.3.3	165.00	0.0	230.56	0.00 NN	145.94 0	48.29	52.09	47.32	48.54

DETECTOR UNITS		P-SO-G PSIG	P-CO-G PSIG	P-CL-G PSIG	P-CL-V1 PSIG	TF-VI-L1 DEG-F	TF-VI-L3 DEG-F	TF-255 DEG-F	TF-263 DEG-F
RUN	TIME (SEC)								
9.3.1	720.00	45.28	52.34	47.18	47.72	193.23	143.55 C	295.51	273.16
9.3.2	85.00	49.08	51.16	47.89	50.05	183.39	144.27	295.47	277.12
9.3.3	165.00	46.63	50.93	47.46	49.97	199.12	146.93	296.15	279.62

DETECTOR UNITS		TF-VO-L38 DEG-F	TF-VO-L1 DEG-F	TF-VO-L3 DEG-F	TF-SI DEG-F	TF-SO-L75 DEG-F	TF-SO-L1 DEG-F	TF-SO-G1 DEG-F	TF-SO-G3 DEG-F
RUN	TIME (SEC)								
9.3.1	720.00	288.65	246.95	250.66	289.86	262.92	289.94	142.90	292.76
9.3.2	85.00	230.17	287.52	227.51	294.54	122.17	294.14	133.95	205.49
9.3.3	165.00	218.08	291.31	254.77	291.96	113.78	292.76	136.45	295.26

DETECTOR UNITS		TF-CO-G1 DEG-F	TF-CO-G3 DEG-F	TF-CL-G1 DEG-F	TF-CL-G3 DEG-F	TF-CL-V1 DEG-F	TF-CL-V2 DEG-F	TF-CL-V3 DEG-F	DP-264-255 PSID
RUN	TIME (SEC)								
9.3.1	720.00	294.54	296.47	258.16	259.69	194.12	193.47	189.52	0.02 GA
9.3.2	85.00	280.34	296.88	239.69	249.61	185.09	184.20	182.26	0.00 QA
9.3.3	165.00	283.45	296.64	220.50	254.53	200.57	199.44	200.73	0.00 QA

TABLE XII (contd.)

TEST 9.3A -- COLD LEG WATER FLOW RATE (1.0-INCH GAP)

DETECTOR		DP-CL-NOZ	DP-CL-CLD	DP-248-VOL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS		INCHES	INCHES	INCHES	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
10	(SEC)								
9.3.1	720.00	C.47 QA	148.68	-3.95 A	292.76 C	0.00 F	298.41	295.91	299.70
9.3.2	85.00	C.08 QA	48.27	-3.71 A	296.47 C	0.00 F	299.94	297.20	300.59
9.3.3	165.00	C.23 QA	110.88	-1.57 A	295.59 C	0.00 F	299.38	296.47	300.35

DETECTOR		TM-47C-90	TM-47C-245	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
10	(SEC)								
9.3.1	720.00	293.89	294.30	296.15	297.44	0.00 F	288.09	297.12	299.70
9.3.2	85.00	291.15	296.47	295.83	297.28	0.00 F	288.73	290.99 C	289.54
9.3.3	165.00	294.22	296.31	296.23	297.68	0.00 F	288.57	297.85	300.83

DETECTOR		TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
10	(SEC)								
9.3.1	720.00	297.93	294.70	0.00 F	296.07	296.23	296.47	293.49	291.80
9.3.2	85.00	298.01	294.70	0.00 F	296.47	287.76	289.94	288.73	287.84
9.3.3	165.00	298.17	295.10	0.00 F	296.64	295.83	296.07	293.09	291.55

DETECTOR		TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-0	TM-116D-45	TM-116D-225	TM-254-0S	TM-254-1S
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
10	(SEC)								
9.3.1	720.00	291.31	290.02	291.07	292.36	293.89	295.59	293.17	298.39
9.3.2	85.00	281.60	286.96	286.55	291.47	293.89	294.14	293.09	300.35
9.3.3	165.00	291.96	290.75	291.23	292.76	294.03	295.91	292.85	299.14

DETECTOR		TM-254-18	TM-254-14	TM-218-T	TM-218-B	PWR-V
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	KW
RUN	TIME					
10	(SEC)					
9.3.1	720.00	289.54	295.18	300.59	0.00 F	10.36
9.3.2	85.00	289.36	296.23	288.89	0.00 F	10.90
9.3.3	165.00	289.67	295.59	300.83	0.00 F	10.86

TABLE XIII

TEST 9.3B -- COLD LEG WATER FLOW RATE (1.0-INCH GAP)

DETECTOR		FT-VI-L1	FT-VO-L3B	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS		GPM	GPM	GPM	GPM	GPM	GPM	CEM	CEM
RUN	TIME								
ID	(SEC)								
9.3.4	255.00	13.09	0.0 NN	4.19 HH	0.0	13.88	0.0	0.0	186.56
9.3.5	335.00	10.94	0.0 NN	2.05 HH	0.0	13.95	0.0	0.0	209.28
9.3.6	410.00	14.70	0.0 NN	2.86 HH	0.0	14.21	0.0	0.0	151.59

DETECTOR		FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS		CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN	TIME								
ID	(SEC)								
9.3.4	255.00	0.0	259.47	0.0 NN	137.92 0	47.90	51.67	46.63	47.47
9.3.5	335.00	0.0	252.51	0.0 NN	114.10 0	48.24	52.87	47.20	48.37
9.3.6	410.00	0.0	193.57	0.0 NN	112.17 0	48.09	53.36	48.72	50.41

DETECTOR		P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS		PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.3.4	255.00	44.58	51.68	47.86	50.30	184.20	148.87	296.23	245.02
9.3.5	335.00	45.28	52.26	48.23	50.80	195.81	153.87	297.12	268.73
9.3.6	410.00	47.36	51.53	48.00	50.54	201.78	159.20	296.64	269.45

DETECTOR		TF-VO-L3B	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.3.4	255.00	153.87	286.80	280.18	291.07	291.07	248.64	137.82	293.89
9.3.5	335.00	143.06	289.38	281.23	291.55	290.43	246.79	144.35	294.54
9.3.6	410.00	138.39	288.09	280.34	293.25	293.41	248.16	138.39	296.47

DETECTOR		TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSID
RUN	TIME								
ID	(SEC)								
9.3.4	255.00	267.60	297.36	251.23	262.44	185.89	184.84	182.34	0.00 QA
9.3.5	335.00	267.60	297.77	217.11	263.57	198.23	197.18	203.07	0.00 QA
9.3.6	410.00	258.57	297.12	202.27	265.34	203.56	202.59	205.09	0.00 QA

TABLE XIII (contd.)

TEST 9.3B -- COLD LEG WATER FLOW RATE (1.0-INCH GAP)

DETECTOR		DP-CL-NOZ	DP-CL-CLB	DP-248-VOL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS		INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
10.4	(SEC)								
9.3.4	255.00	0.89 QA	131.48	2.75 A	291.15 C	0.0 F	299.78	297.12	300.51
9.3.5	335.00	1.22 QA	130.10	2.68 A	291.15 C	0.0 F	300.10	297.36	300.75
9.3.6	410.00	1.12 QA	87.46	1.99 A	283.57 C	0.0 F	300.02	297.12	300.99

DETECTOR		TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-480-0	TF-480-180
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
10.4	(SEC)								
9.3.4	255.00	294.54	294.54	296.64	298.31	0.0 F	289.38	298.25	301.48
9.3.5	335.00	295.83	295.75	297.12	298.57	0.0 F	289.54	297.77	302.28
9.3.6	410.00	294.86	295.10	297.28	298.49	0.0 F	289.38	298.01	301.88

DETECTOR		TF-780-0	TF-790-180	TF-95D-45	TF-95D-225	TM-480-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
10.4	(SEC)								
9.3.4	255.00	298.81	295.91	0.0 F	297.20	296.15	298.09	296.80	292.12
9.3.5	335.00	299.30	296.47	0.0 F	297.44	296.31	297.77	298.41	292.76
9.3.6	410.00	299.06	296.47	0.0 F	297.36	295.83	297.68	298.41	292.68

DETECTOR		TM-78C-180	TM-95D-45	TM-95D-225	TM-116D-0	TM-116D-45	TM-116D-225	TM-254-14	TM-254-15
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
10.4	(SEC)								
9.3.4	255.00	294.62	291.07	292.76	293.25	294.14	296.47	293.97	300.43
9.3.5	335.00	293.99	291.47	293.25	293.69	295.10	296.80	294.78	300.99
9.3.6	410.00	295.99	291.47	293.25	293.69	294.86	296.72	295.02	300.99

DETECTOR		TM-254-05	TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	kW
RUN	TIME					
10.4	(SEC)					
9.3.4	255.00	290.91	296.80	294.05	0.0 F	0.0 NN
9.3.5	335.00	291.23	297.28	299.38	0.0 F	10.44
9.3.6	410.00	291.55	297.36	301.39	0.0 F	10.46

TABLE XIV

TEST 4.4 -- LOWER PLENUM WATER LEVEL

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME ID. (SEC)								
4.4.70 565.001	4.02 A	0.0	1.12 A	0.0 NN	0.0	4.19	0.0	0.0
4.4.71 640.001	4.74 A	0.0	1.01 A	0.0 NN	0.0	4.43	0.0	0.0
4.4.72 715.001	5.16	0.0	1.19 A	0.0 NN	0.0	4.58	0.0	0.0
4.4.73 110.001	5.17	0.0	1.29 A	0.0 NN	0.0	4.57	0.0	0.0
4.4.74 185.001	6.32	0.0	1.48 A	0.0 NN	0.0	4.69	0.0	0.0
4.4.75 260.001	7.05	0.0	0.0 NN	3.73 A	0.0	4.60	0.0	0.0
4.4.76 335.001	7.11	0.0	0.0 NN	3.81 A	0.0	4.41	0.0	0.0
4.4.77 415.001	9.57	0.0	0.00 NN	8.05	0.0	4.74	0.0	0.0
4.4.78 560.001	4.96 A	0.0	1.64 HH	0.0 NN	0.0	3.98	0.0	0.0
4.4.79 630.001	3.59 A	0.0	0.0 HH	0.0 NN	0.0	4.97	0.0	0.0
4.4.80 705.001	4.72 A	0.0	0.98 HH	0.0 NN	0.0	4.79	0.0	0.0
4.4.81 100.001	4.21 A	0.0 NN	0.49 HH	0.0 NN	0.0	4.24	0.0	0.0

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	P-VI-L	P-256	P-VO-L	P-S1	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN TIME ID. (SEC)								
4.4.70 565.001	112.75	0.0	138.25	81.29	48.77	49.61 Q	48.37	51.66
4.4.71 640.001	97.80	0.0	122.87	84.73	49.33	52.65 Q	50.49	53.74
4.4.72 715.001	83.22	0.0	108.77	86.58	48.15	51.87 Q	51.07	53.23
4.4.73 110.001	59.94	0.0	86.50	82.66	48.49	51.22 Q	50.24	51.85
4.4.74 185.001	48.72 A	0.0	76.25	81.90	48.25	51.84 Q	50.46	53.24
4.4.75 260.001	24.87 A	0.0	70.94	84.86	49.15	52.67 Q	51.34	54.25
4.4.76 335.001	30.32 A	0.0	65.08	90.66	48.22	52.06 Q	50.55	53.62
4.4.77 415.001	7.31 QA	57.78	0.0	86.44	42.58	45.95 C	44.82	47.79
4.4.78 560.001	90.05	0.0	121.29	83.61	49.10	50.02 Q	48.90	51.61
4.4.79 630.001	194.64	0.0	204.97	84.07	49.01	51.00 Q	47.46	50.09
4.4.80 705.001	142.59	0.0	161.39	83.56	48.99	50.90 Q	48.42	51.43
4.4.81 100.001	173.59	0.0	180.80	83.66	48.29	52.47 Q	47.30	50.54

DETECTOR	P-SO-G	P-CO-G	TF-VI-L1	TF-VI-L3	TF-255	TF-263	TF-VO-L38	TF-VO-L1
UNITS	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME ID. (SEC)								
4.4.70 565.001	47.32	49.27	190.57	163.39	298.73	298.09	272.28	238.16
4.4.71 640.001	49.28	50.83	190.57	167.18	300.10	297.44	280.34	246.31
4.4.72 715.001	48.74	50.30	193.23	174.76	298.81	263.00	271.15	224.85
4.4.73 110.001	48.79	50.93	185.49	133.87	298.25	292.52	272.44	224.45
4.4.74 185.001	49.70	50.88	192.75	145.16	299.70	300.27	289.38	260.99
4.4.75 260.001	51.05	51.40	189.28	157.10	297.68	243.56	156.86	289.54
4.4.76 335.001	50.35	50.64	197.02	160.40	300.19	248.48	144.19	296.88
4.4.77 415.001	45.12	45.30	194.36	157.34	294.78	269.29	132.98	292.60
4.4.78 560.001	48.18	49.58	192.75	133.30	300.35	292.44	281.63	238.40
4.4.79 630.001	48.11	49.43	189.36	157.74	300.27	248.73	198.23	192.43
4.4.80 705.001	47.21	49.72	189.28	162.18	299.86	248.16	270.18	240.98
4.4.81 100.001	46.03	48.96	191.62	154.68	295.83	280.34	265.50	250.02

TABLE XIV (contd.)

TEST 4.4 -- LOWER PLENUM WATER LEVEL

DETECTOR	TF-V0-L3	TF-S1	TF-S0-L75	TF-S0-L1	TF-S0-G1	TF-S0-G3	TF-C0-G1	TF-C0-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.4.70	565.00	271.31	299.22	298.89	258.40	97.73	301.56	282.76
4.4.71	640.00	282.20	300.43	299.46	257.19	98.38	302.77	231.55
4.4.72	715.00	238.89	299.06	300.19	260.34	99.02	301.80	242.92
4.4.73	110.00	226.95	299.22	299.27	261.87	94.27	301.88	195.81
4.4.74	185.00	265.42	298.81	299.70	256.87	95.23	301.80	233.40
4.4.75	260.00	279.05	299.70	299.06	258.97	95.15	302.28	248.08
4.4.76	335.00	286.31	298.89	299.70	261.47	95.31	301.23	267.68
4.4.77	415.00	277.04	295.18	295.26	244.53	92.49	297.52	294.30
4.4.78	560.00	280.34	300.02	300.27	175.41	94.10	301.88	242.92
4.4.79	630.00	197.99	298.09	298.25	216.46	95.31	299.46	268.00
4.4.80	705.00	277.44	298.65	298.89	245.50	97.89	300.27	259.05
4.4.81	100.00	249.37	292.60	295.18	237.03	94.99	294.22	174.92

DETECTOR	DP-264-255	TF-47C-0	TF-47C-180	TF-78C-0	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90
UNITS	PSID	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.4.70	565.00	-0.02 QA	297.38 C	299.70	0.0 F	300.43	298.57	299.14
4.4.71	640.00	-0.02 QA	237.27 C	300.27	0.0 F	300.99	299.14	299.86
4.4.72	715.00	-0.01 QA	254.69 C	299.30	0.0 F	299.86	297.93	298.73
4.4.73	110.00	0.0 Q	257.11 C	300.99	0.0 F	300.51	298.73	299.70
4.4.74	185.00	0.0 Q	282.04 C	300.51	0.0 F	300.27	298.41	299.30
4.4.75	260.00	0.0 Q	264.86 C	300.75	0.0 F	300.19	299.30	300.35
4.4.76	335.00	0.0 Q	282.92 C	299.70	0.0 F	299.70	298.25	297.22
4.4.77	415.00	0.0 Q	264.86 C	294.54	0.0 F	296.80	295.83	295.88
4.4.78	560.00	0.0 Q	265.26 C	300.10	0.0 F	298.98	298.65	298.89
4.4.79	630.00	0.0 Q	299.30 C	300.19	0.0 F	299.06	298.41	298.89
4.4.80	705.00	0.0 Q	303.01 C	300.27	0.0 F	299.22	298.41	298.89
4.4.81	100.00	0.0 Q	301.07 C	299.22	0.0 F	297.93	295.43	297.28

DETECTOR	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180	TF-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.4.70	565.00	300.02	299.70	0.0 F	299.70	293.89	297.20 C	299.06
4.4.71	640.00	299.86	300.10	0.0 F	300.10	294.30	280.26 C	299.86
4.4.72	715.00	299.06	299.70	0.0 F	299.70	293.41	277.76 C	298.89
4.4.73	110.00	300.83	301.48	0.0 F	301.48	293.41	284.21 C	300.51
4.4.74	185.00	300.35	301.15	0.0 F	300.99	293.25	289.38 C	300.02
4.4.75	260.00	300.19	301.23	0.0 F	301.64	293.89	268.89 C	300.35
4.4.76	335.00	299.86	300.27	0.0 F	300.75	292.85	288.73 C	297.12
4.4.77	415.00	293.01	297.20	0.0 F	298.41	289.78	276.79 C	292.20
4.4.78	560.00	300.59	301.56	0.0 F	300.35	294.14	288.25 C	299.06
4.4.79	630.00	301.39	301.64	0.0 F	300.99	294.22	302.04 C	299.86
4.4.80	705.00	301.64	301.80	0.0 F	300.99	292.44	302.69 C	299.70
4.4.81	100.00	300.02	299.70	0.0 F	298.89	291.47	301.31 C	299.22

TABLE XIV (contd.)

TEST 4.4 -- LOWER PLENUM WATER LEVEL

DETECTOR	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME								
ID. (SEC)								
4.4.70	565.00	297.77	293.89	298.17	295.10	291.07	298.25	301.07
4.4.71	640.00	298.41	294.30	298.57	285.67	286.80	298.49	302.28
4.4.72	715.00	297.36	293.41	297.68	283.33	282.44	298.41	300.75
4.4.73	110.00	297.68	296.56	298.25	283.25	0.0 F	298.73	303.98
4.4.74	185.00	297.52	296.47	298.01	282.68	0.0 F	298.57	303.09
4.4.75	260.00	297.60	297.52	298.73	279.21	0.0 F	298.41	301.64
4.4.76	335.00	297.20	296.23	297.68	282.28	0.0 F	298.01	301.23
4.4.77	415.00	294.94	293.81	295.10	272.52	0.0 F	287.44	300.35
4.4.78	560.00	298.57	294.30	298.25	284.54	0.0 F	298.57	302.28
4.4.79	630.00	298.41	293.97	298.17	292.52	0.0 F	299.22	301.80
4.4.80	705.00	298.25	294.14	298.41	296.64	0.0 F	299.22	301.96
4.4.81	100.00	295.91	294.70	296.47	288.73	0.0 F	298.41	300.99

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S	TM-254-0S
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME								
ID. (SEC)								
4.4.70	565.00	297.68	295.83	296.47	297.60	290.99	296.47	284.70
4.4.71	640.00	297.85	295.83	296.56	296.64	297.77	293.73	297.85
4.4.72	715.00	297.36	295.18	296.07	296.23	297.36	292.60	297.12
4.4.73	110.00	296.78	294.78	296.56	297.12	298.01	288.57	296.64
4.4.74	185.00	297.12	294.78	296.64	297.12	297.93	291.55	298.57
4.4.75	260.00	297.12	295.10	297.12	297.52	298.41	288.01	296.47
4.4.76	335.00	296.47	294.54	296.15	296.64	297.77	292.36	299.22
4.4.77	415.00	292.60	290.67	292.60	293.41	294.62	290.75	294.62
4.4.78	560.00	295.83	295.59	294.70	297.28	297.12	297.68	299.78
4.4.79	630.00	296.07	295.83	295.02	297.12	297.12	298.25	300.27
4.4.80	705.00	296.15	295.83	295.18	296.72	297.12	298.49	300.51
4.4.81	100.00	296.15	293.25	293.97	294.05	295.67	295.43	298.89

DETECTOR	TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS	DEG-E	DEG-E	DEG-E	KW
RUN TIME				
ID. (SEC)				
4.4.70	565.00	293.89	302.69	299.94
4.4.71	640.00	295.18	302.52	299.70
4.4.72	715.00	294.14	302.28	299.30
4.4.73	110.00	294.14	303.73	301.64
4.4.74	185.00	297.68	306.15	304.46
4.4.75	260.00	294.86	304.86	302.93
4.4.76	335.00	296.96	306.15	304.66
4.4.77	415.00	292.44	302.28	300.51
4.4.78	560.00	299.70	295.26	288.57
4.4.79	630.00	299.06	305.59	303.09
4.4.80	705.00	299.06	305.51	302.85
4.4.81	100.00	298.57	303.01	300.35

TABLE XV

TEST 4.5 -- BOUNDARY HEAT FLUX

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN ID.	TIME [SEC]							
4.5.70	740.00	6.02	0.00 NN	2.00 HH	0.00 NN	0.0	4.25	0.00 NN
4.5.71	120.00	5.65	0.00 NN	2.00 HH	0.00 NN	0.0	3.92	0.0
4.5.72	200.00	4.84 A	0.00 NN	1.60 HH	0.00 NN	0.0	3.90	0.0
4.5.73	270.00	4.73 A	0.00 NN	1.00 HH	0.00 NN	0.0	3.79	0.0
4.5.74	345.00	3.76 A	0.00 NN	0.80 HH	0.00 NN	0.0	4.02	0.0
4.5.75	495.00	4.29 A	0.00 NN	0.80 HH	0.00 NN	0.0	3.70	0.0
4.5.76	570.00	4.85 A	0.00 NN	2.00 HH	0.00 NN	0.0	3.54	0.0
4.5.77	645.00	7.80	0.00 NN	0.00 NN	4.80 MA	0.0	3.79	0.0
4.5.78	250.00	6.45	0.00 NN	1.80 HH	0.00 NN	0.0	4.00	0.0
4.5.79	325.00	8.44	0.00 NN	0.00 NN	4.60 MA	0.0	4.24	0.0
4.5.80	405.00	9.10	0.00 NN	0.00 NN	5.80 MA	0.0	4.23	0.0
4.5.81	710.00	8.77	0.00 NN	2.70 HH	0.00 NN	0.0	4.38	0.0

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN ID.	TIME [SEC]							
4.5.70	740.00	117.32	0.0	152.16	85.80	49.48	51.69	50.30
4.5.71	120.00	145.43	0.00 NN	181.09	0.00 F	48.79	50.54	48.02
4.5.72	200.00	159.93	0.00 NN	193.33	85.86	49.63	51.15	48.81
4.5.73	270.00	174.45	0.00 NN	203.54	80.38	49.88	52.07	48.93
4.5.74	345.00	197.84	0.00 NN	219.89	81.24	49.78	52.63	46.98
4.5.75	495.00	216.43	0.00 NN	235.01	82.39	48.44	57.26	47.78
4.5.76	570.00	66.42 Q	0.00 NN	98.83	83.85	48.53	52.39	50.22
4.5.77	645.00	3.02 QA	67.95	0.00 NN	82.75	48.71	52.50	50.29
4.5.78	250.00	57.52 Q	0.0	88.78	138.20 Q	49.67	51.64	51.89
4.5.79	325.00	18.52 QA	0.0	70.07 Q	135.70 Q	49.54	54.08	51.72
4.5.80	405.00	0.00 NN	72.93	0.91	135.28 Q	49.57	54.96	52.55
4.5.81	710.00	30.00 QA	0.0	80.80	138.69 Q	49.44	52.13	51.11

DETECTOR	P-SO-G	P-CO-G	TF-VI-L1	TF-VI-L3	TF-255	TF-263	TF-VO-L38	TF-VO-L1
UNITS	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME [SEC]							
4.5.70	740.00	49.08	50.44	189.12	134.51	299.30	274.86	286.31
4.5.71	120.00	45.88	48.99	196.22	137.74	300.35	272.52	286.80
4.5.72	200.00	47.73	50.22	186.94	148.55	301.64	263.97	281.23
4.5.73	270.00	47.34	50.68	191.86	155.16	302.28	245.74	281.31
4.5.74	345.00	47.28	50.86	189.85	155.16	302.44	253.81	274.62
4.5.75	495.00	45.06	50.08	190.97	143.31	301.39	285.26	274.46
4.5.76	570.00	49.16	50.32	184.68	158.15	301.23	279.46	288.25
4.5.77	645.00	48.68	51.38	194.77	160.65	301.48	272.60	244.93
4.5.78	250.00	50.52	52.14	0.00 F	136.77	300.02	300.51	289.38
4.5.79	325.00	50.63	51.90	190.49 Q	152.58	300.10	276.71	252.52
4.5.80	405.00	51.54	53.57	189.60 Q	160.32	299.70	272.44	155.16
4.5.81	710.00	49.65	50.83	188.72 Q	134.84	299.70	298.01	295.10

TABLE XV (contd.)

TEST 4.5 -- BOUNDARY HEAT FLUX

DETECTOR	TF-VC-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3	TF-CO-G1	TF-CO-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.5.70	740.00	248.08	298.17	299.06	222.27	84.18	298.57	303.10
4.5.71	120.00	262.28	298.33	299.22	237.76	84.18	298.89	300.51
4.5.72	200.00	248.24	299.70	300.51	222.27	88.30	299.94	293.97
4.5.73	270.00	252.92	299.70	300.67	154.52	89.99	300.19	254.77
4.5.74	345.00	246.55	299.86	300.67	220.98	91.60	299.86	255.66
4.5.75	495.00	250.90	298.41	298.17	163.07	89.99	298.89	302.77
4.5.76	570.00	257.86	300.59	300.27	183.55	97.33	302.28	271.31
4.5.77	645.00	261.07	300.99	300.43	225.74	98.62	302.28	301.88
4.5.78	250.00	246.95	299.30	298.17	222.67	97.81	92.17 Q	239.21
4.5.79	325.00	283.65	299.70	298.57	226.30	103.06	95.48 Q	253.24
4.5.80	405.00	284.21	299.46	298.57	203.15	102.90	97.65 Q	297.85
4.5.81	710.00	269.13	299.06	298.41	214.53	99.19	92.17 Q	300.19

DETECTOR	DP-264-255	TF-47C-0	TF-47C-180	TF-78C-0	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90
UNITS	PSIA	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.5.70	740.00	-0.00 QA	255.34 C	300.51	0.00 F	302.28	300.99	300.83
4.5.71	120.00	-0.01 QA	284.62 C	298.09	0.00 F	300.35	299.22	299.78
4.5.72	200.00	-0.01 QA	233.48 C	299.70	0.00 F	301.80	300.67	301.23
4.5.73	270.00	-0.01 QA	259.29 C	299.86	0.00 F	302.04	300.75	301.64
4.5.74	345.00	-0.01 QA	289.05 C	299.94	0.00 F	302.28	301.15	301.88
4.5.75	495.00	-0.02 QA	264.36 C	300.99	0.00 F	301.64	303.09	302.36
4.5.76	570.00	-0.01 QA	270.66 C	300.27	0.00 F	301.15	302.44	301.23
4.5.77	645.00	-0.01 QA	273.89 C	299.70	0.00 F	300.99	302.44	301.64
4.5.78	250.00	0.00 QA	290.02 C	300.27	0.00 F	303.41	301.23	302.69
4.5.79	325.00	0.00 QA	287.44 C	299.06	0.00 F	303.57	301.64	302.93
4.5.80	405.00	0.01 QA	280.34 C	299.14	0.00 F	302.93	301.07	302.44
4.5.81	710.00	-0.00 QA	280.34 C	299.70	0.00 F	304.06	305.83	302.85

DETECTOR	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180	TF-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.5.70	740.00	300.87	300.59	0.00 F	301.39	294.94	283.49 C	300.99
4.5.71	120.00	298.73	298.89	0.00 F	299.22	293.49	290.18 C	299.06
4.5.72	200.00	300.27	300.35	0.00 F	300.51	294.70	279.21 C	300.27
4.5.73	270.00	300.75	300.43	0.00 F	300.99	294.86	290.91 C	300.67
4.5.74	345.00	301.39	300.75	0.00 F	301.15	295.18	297.68 C	300.99
4.5.75	495.00	300.99	301.80	0.00 F	300.43	299.30	286.15 C	300.59
4.5.76	570.00	299.86	301.15	0.00 F	300.10	298.41	285.51 C	299.30
4.5.77	645.00	299.14	301.15	0.00 F	300.99	298.65	273.89 C	296.47
4.5.78	250.00	300.83	301.15	0.00 F	301.23	297.93	293.89 C	297.77
4.5.79	325.00	299.06	300.51	0.00 F	301.15	298.09	295.51 C	297.12
4.5.80	405.00	298.73	300.59	0.00 F	301.15	298.01	295.10 C	295.83
4.5.81	710.00	298.41	300.75	0.00 F	300.67	296.23	285.75 C	295.35

TABLE XV (contd.)

TEST 4.5 -- BOUNDARY HEAT FLUX

DETECTOR	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45	TM-63D-225	TM-78D-0	
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	
RUN	TIME								
ID	[SEC]								
4.5.70	740.00	302.44	298.41	299.30	285.51	299.94	297.85	301.88	297.85
4.5.71	120.00	299.86	297.20	297.93	282.04	298.01	296.47	299.70	295.83
4.5.72	200.00	301.15	298.73	299.22	283.41	299.22	298.33	300.99	297.28
4.5.73	270.00	301.39	298.89	299.70	284.21	299.70	298.57	301.39	297.60
4.5.74	345.00	301.72	299.22	299.86	289.54	299.86	298.98	301.64	297.60
4.5.75	495.00	303.98	299.70	300.51	284.86	299.70	297.68	302.12	300.10
4.5.76	570.00	302.93	299.06	300.27	283.73	0.00 F	297.28	301.23	299.70
4.5.77	645.00	301.64	299.70	300.99	278.57	0.00 F	294.54	299.70	298.25
4.5.78	250.00	302.85	300.27	302.04	283.57	295.18	298.73	300.99	299.06
4.5.79	325.00	303.01	300.75	302.28	280.83	293.25	296.96	299.70	297.52
4.5.80	405.00	302.69	300.27	301.72	279.05	293.41	296.80	299.70	297.28
4.5.81	710.00	305.51	299.86	300.27	283.17	261.63	296.80	298.89	296.39

DETECTOR	TM-78D-180	TM-90D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-15	TM-254-08	
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	
RUN	TIME								
ID	[SEC]								
4.5.70	740.00	298.98	295.35	296.56	297.44	299.86	296.23	299.22	294.70
4.5.71	120.00	297.12	294.14	295.35	295.67	298.49	294.54	297.52	292.85
4.5.72	200.00	298.57	295.26	296.47	296.76	299.78	296.23	299.06	294.38
4.5.73	270.00	298.57	295.43	296.64	297.28	299.94	297.36	299.94	295.18
4.5.74	345.00	299.06	295.83	297.28	297.68	300.35	297.44	300.35	295.83
4.5.75	495.00	297.52	299.54	298.33	300.51	302.12	298.65	300.35	295.18
4.5.76	570.00	297.12	299.06	298.01	299.94	301.15	299.22	300.59	295.99
4.5.77	645.00	297.52	299.70	298.57	300.35	301.48	300.75	302.12	297.28
4.5.78	250.00	300.51	298.73	299.70	300.35	302.44	297.12	299.70	293.49
4.5.79	325.00	300.75	299.06	299.86	300.75	302.69	297.77	300.19	294.30
4.5.80	405.00	300.27	298.73	299.70	300.59	302.52	297.77	299.86	294.30
4.5.81	710.00	299.06	297.20	299.70	301.64	302.60	296.31	300.35	293.49

DETECTOR	TM-254-18	TM-218-T	TM-216-B	PWK-V	
UNITS	DEG-F	DEG-F	DEG-F	KW	
RUN	TIME				
ID	[SEC]				
4.5.70	740.00	298.98	291.15	283.73	0.00 N
4.5.71	120.00	297.28	290.51	283.17	0.00 N
4.5.72	200.00	298.89	293.33	286.15	0.00 N
4.5.73	270.00	299.22	294.30	286.96	0.00 N
4.5.74	345.00	299.14	294.62	287.28	0.00 N
4.5.75	495.00	300.99	294.22	289.05	0.00 N
4.5.76	570.00	301.15	296.07	290.67	0.00 N
4.5.77	645.00	303.33	296.88	291.31	0.00 N
4.5.78	250.00	298.73	295.83	289.86	0.00 N
4.5.79	325.00	300.51	295.51	289.46	0.00 N
4.5.80	405.00	300.51	295.43	289.38	0.00 N
4.5.81	710.00	300.75	294.30	287.44	0.00 N

TABLE XVI

TEST 4.7 -- BOUNDARY HEAT FLUX

DETECTOR	FT-VI-L1	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN ID.	TIME (SEC)							
4.7.70	210.00	3.56 A	0.0	0.00 NN	0.0	0.00 NN	0.0	150.48
4.7.71	450.00	4.02 A	0.00 NN	0.00 NN	4.26	0.00 NN	0.00 NN	131.97
4.7.72	530.00	5.34	0.36 HH	0.00 NN	4.57	0.00 NN	0.00 NN	98.28
4.7.73	600.00	5.96	1.25 HH	0.00 NN	4.58	0.00 NN	0.00 NN	60.38
4.7.74	100.00	7.75	0.0	3.25 HH	4.43	0.00 NN	0.00 NN	56.75
4.7.75	170.00	9.11	0.0	5.75 HH	4.21	0.00 NN	0.00 NN	96.00 Q

DETECTOR	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN ID.	TIME (SEC)							
4.7.70	210.00	0.0	153.20	0.00 NN	47.43 Q	48.68	52.43	50.94
4.7.71	450.00	0.00 NN	128.18	0.00 NN	142.07 Q	49.53	52.80	0.66
4.7.72	530.00	0.00 NN	102.73	0.00 NN	137.07 Q	49.21	51.56	0.80
4.7.73	600.00	0.00 NN	84.78	0.00 NN	135.84 Q	48.19	49.97	1.21
4.7.74	100.00	64.83	0.00 NN	0.00 NN	128.42 Q	50.03	53.89	53.81
4.7.75	170.00	59.21	0.00 NN	0.00 NN	137.19 Q	48.36	51.52	52.42

DETECTOR	P-SO-G	P-CO-G	P-CL-G	P-CL-VI	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS	PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.7.70	210.00	47.37	50.21	47.94	59.34	185.41	153.37	232.35
4.7.71	450.00	50.11	51.30	48.60	48.06	0.00 F	126.69	297.77
4.7.72	530.00	48.32	50.35	47.15	46.33	0.00 F	143.06	296.64
4.7.73	600.00	50.15	51.93	47.06	45.52	182.26 Q	134.03	298.17
4.7.74	100.00	49.96	52.19	47.32	47.20	156.86 Q	143.95	298.09
4.7.75	170.00	50.15	51.75	47.40	46.85	220.33 Q	151.94	297.77

DETECTOR	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
4.7.70	210.00	97.99	208.72	217.99	297.12	296.47	161.61	107.41
4.7.71	450.00	75.79	204.20	195.98	295.99	296.72	164.76	97.41
4.7.72	530.00	79.59	215.98	195.98	294.78	294.94	151.13	102.90
4.7.73	600.00	270.50	258.08	257.92	296.88	296.88	172.83	104.19
4.7.74	100.00	265.02	295.35	286.31	296.72	297.12	176.62	104.59
4.7.75	170.00	153.15	293.81	286.47	296.64	296.56	163.55	116.61

TABLE XVI (contd.)

TEST 4.7 -- BOUNDARY HEAT FLUX

DETECTOR	TF-CG-G1	TF-CG-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSID
RUN ID	TIME (SEC)							
4.7.70	210.00	298.17	297.44	267.03	289.38	184.04	185.09	205.17
4.7.71	450.00	279.70	297.93	196.86	256.47	177.10	179.68	181.05
4.7.72	530.00	294.05	297.04	258.48	273.25	181.13	184.04	202.43
4.7.73	600.00	278.49	298.41	132.58	263.00	177.99	180.97	176.21
4.7.74	100.00	295.02	298.01	206.14	221.30	186.86	189.52	184.20
4.7.75	170.00	295.18	297.68	248.16	265.58	185.89	189.04	185.73

DETECTOR	DP-CL-NOZ	DP-CL-CLH	DP-248-VCL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS				DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID	TIME (SEC)							
4.7.70	210.00	6.41 QA	80.90	1.14 A	300.19 C	299.06	300.67	303.33
4.7.71	450.00	-1.99 QA	29.32	-0.07 A	290.26 C	295.91	301.23	302.93
4.7.72	530.00	-1.64 QA	25.09	0.36 A	266.71 C	294.70	299.94	301.64
4.7.73	600.00	-3.29 QA	11.88 A	-1.55 TA	269.78 C	295.67	301.23	302.85
4.7.74	100.00	-0.13 QA	10.10 A	1.28 A	283.81 C	295.99	299.86	301.80
4.7.75	170.00	-0.21 QA	3.19 A	0.43 A	271.31 C	294.54	299.70	301.64

DETECTOR	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID	TIME (SEC)							
4.7.70	210.00	298.57	299.78	299.78	299.70	299.46	292.12	298.41 C
4.7.71	450.00	298.09	298.09	297.77	298.69	297.85	289.54	292.52 C
4.7.72	530.00	296.56	296.47	296.31	297.68	296.64	288.09	286.30 C
4.7.73	600.00	297.12	296.88	297.20	298.25	297.28	288.89	280.75 C
4.7.74	100.00	297.77	294.54	296.72	298.41	297.36	288.49	289.78 C
4.7.75	170.00	295.91	293.73	296.07	297.85	297.12	287.44	285.18 C

DETECTOR	TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID	TIME (SEC)							
4.7.70	210.00	299.86	302.85	298.01	298.01	296.64	298.09	299.70
4.7.71	450.00	299.30	301.64	298.41	298.73	291.39	298.57	298.25
4.7.72	530.00	297.93	300.02	297.12	297.44	283.65	297.12	297.12
4.7.73	600.00	298.89	300.75	298.25	298.61	282.28	297.60	297.68
4.7.74	100.00	298.81	299.78	297.12	297.77	289.13	296.47	298.39
4.7.75	170.00	298.57	299.70	297.12	297.44	291.72	295.99	297.28

TABLE XVI (contd.)

TEST 4.7 -- BOUNDARY HEAT FLUX

DETECTOR		TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S	TM-254-0S
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID.	(SEC)								
4.7.70	210.00	296.64	294.54	297.36	298.25	300.59	293.17	299.70	289.78
4.7.71	450.00	297.77	292.28	295.91	297.44	300.75	298.09	300.59	294.14
4.7.72	530.00	296.64	291.07	294.54	296.07	299.38	297.12	299.46	293.09
4.7.73	600.00	297.28	291.72	295.18	296.80	300.27	297.44	300.51	293.41
4.7.74	100.00	296.64	291.31	295.10	296.64	300.10	298.17	300.51	294.30
4.7.75	170.00	295.43	290.43	293.81	295.83	299.30	297.44	299.86	293.41

DETECTOR		TM-254-18	TM-218-7	TM-218-8	PWR-V
UNITS		DEG-F	DEG-F	DEG-F	kW
RUN	TIME				
ID.	(SEC)				
4.7.70	210.00	294.86	320.99	330.19	37.63
4.7.71	450.00	298.01	327.29	338.82	36.78
4.7.72	530.00	296.96	325.51	336.97	38.91
4.7.73	600.00	297.52	329.95	341.72	37.27
4.7.74	100.00	297.77	334.71	344.55	36.78
4.7.75	170.00	297.20	330.92	346.16	40.19

TABLE XVII

TEST 9.2A -- BOUNDARY HEAT FLUX

DETECTOR	FT-VI-L1	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	4.65 A	0.00 NN	0.00 NN	0.0	4.45	0.0	248.90
9.2.2	200.00	6.04	1.77 HH	0.00 NN	0.0	4.45	0.0	156.63
9.2.3	270.00	10.56	0.00 NN	5.20 HH	0.0	4.66	0.0	81.82
9.2.4	350.00	5.37	1.10 HH	0.00 NN	0.0	4.36	0.0	180.90

DETECTOR	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	GEM	GEM	GEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	0.0	252.02	0.0	139.62 Q	48.55	52.76	48.41
9.2.2	200.00	0.0	172.60	0.0	141.55 Q	47.93	51.84	49.64
9.2.3	270.00	0.0	137.33	0.0	141.74 Q	48.59	53.54	51.51
9.2.4	350.00	0.0	190.11	0.0	137.02 Q	47.93	53.15	49.41

DETECTOR	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS	PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	46.16	53.21	48.48	48.47	181.78	159.03 C	300.19
9.2.2	200.00	48.06	52.22	48.00	48.18	184.52	155.16 C	299.70
9.2.3	270.00	50.07	53.09	48.74	48.99	189.28	155.97 C	303.99
9.2.4	350.00	47.44	52.43	48.28	48.76	193.07	149.68 C	300.02

DETECTOR	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	160.32	230.01	215.41	295.91	233.57	96.52	128.30
9.2.2	200.00	277.78	252.27	246.14	297.20	297.20	93.22	129.92
9.2.3	270.00	252.35	237.12	257.36	298.98	297.60	88.70	131.13
9.2.4	350.00	282.04	276.55	264.37	297.20	297.12	90.80	130.32

DETECTOR	TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSID
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	264.21	299.06	274.05	263.57	181.78	0.00 F	181.13
9.2.2	200.00	256.47	298.01	246.63	265.50	185.25	0.00 F	198.72
9.2.3	270.00	272.36	298.89	266.79	266.79	190.65	0.00 F	206.78
9.2.4	350.00	269.29	298.01	218.64	268.00	193.23	0.00 F	201.62

TABLE XVII (contd.)

TEST 9.2A -- BOUNDARY HEAT FLUX

DETECTOR	DP-CL-NO7	DP-CL-CL8	DP-248-VOL	TF-47C-C	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS	INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	0.14 QA	103.73	0.03 A	277.60 C	0.00 F	301.15	298.89
9.2.2	200.00	0.34 QA	55.85	0.04 A	278.33 C	0.00 F	300.51	298.25
9.2.3	270.00	0.38 QA	28.75	-0.70 A	247.27 C	0.00 F	301.07	298.57
9.2.4	350.00	0.40 QA	68.39	-0.64 A	275.83 C	0.00 F	300.75	298.17

DETECTOR	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	298.57	297.12	300.10	300.35	0.00 F	291.31	298.57
9.2.2	200.00	297.20	296.31	299.54	300.10	0.00 F	290.67	297.85
9.2.3	270.00	297.20	293.81	299.86	300.02	0.00 F	290.75	294.14
9.2.4	350.00	297.12	296.47	299.70	299.94	0.00 F	290.83	298.09

DETECTOR	TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	299.86	298.89	0.00 F	299.22	299.22	300.51	298.81
9.2.2	200.00	299.56	298.17	0.00 F	298.57	298.81	300.02	298.33
9.2.3	270.00	299.78	298.49	0.00 F	299.06	295.83	300.02	298.01
9.2.4	350.00	299.38	297.93	0.00 F	298.89	299.22	300.27	298.41

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-0	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.1	120.00	296.72	293.25	294.70	295.83	296.88	298.73	297.68
9.2.2	200.00	296.47	292.60	294.38	295.18	296.23	298.41	298.17
9.2.3	270.00	296.56	292.85	294.54	295.43	296.39	298.25	297.52
9.2.4	350.00	296.47	292.68	294.38	295.26	296.39	298.25	297.77

DETECTOR	TM-254-0S	TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	KW
RUN	TIME				
ID	(SEC)				
9.2.1	120.00	292.93	299.22	315.83	319.95
9.2.2	200.00	293.09	298.81	327.45	335.35
9.2.3	270.00	292.76	299.22	330.75	339.71
9.2.4	350.00	292.60	298.65	333.25	340.19

TABLE XVIII

TEST 9.2B -- BOUNDARY HEAT FLUX

DETECTOR	FT-VI-L1	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN	TIME							
ID	(SEC)							
9.2.5	420.00	4.49 A	0.80 HH	0.00 NN	0.0	4.47	0.0	249.46
9.2.6	500.00	9.68	0.00 NN	5.39 HH	0.0	4.52	0.0	111.24
9.2.7	570.00	14.27	0.00 NN	8.68 HH	0.0	4.25	0.0	47.60 QA
9.2.8	645.00	5.83	2.38 HH	0.00 NN	0.0	4.47	0.0	213.36

DETECTOR	FT-CU-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	GPM	GPM	GPM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN	TIME							
ID	(SEC)							
9.2.5	420.00	0.0	250.23	0.0	141.03 Q	47.47	50.31	44.93
9.2.6	500.00	0.0	171.36	0.0	138.63 Q	47.37	50.68	47.69
9.2.7	570.00	0.0	141.58	0.0	141.13 Q	47.77	52.58	50.05
9.2.8	645.00	0.0	236.85	0.0	147.31 Q	47.21	51.52	47.60

DETECTOR	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS	PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.5	420.00	41.51	50.35	46.04	48.35	177.10	151.94 C	297.28
9.2.6	500.00	45.17	50.08	49.75	48.70	182.51	144.84 C	297.44
9.2.7	570.00	47.62	52.02	47.49	50.84	188.88	152.58 C	299.22
9.2.8	645.00	44.29	51.69	47.09	50.84	194.44	155.16 C	296.31

DETECTOR	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
9.2.5	420.00	180.09 Q	184.84	194.68	293.25	291.72	94.51	136.69
9.2.6	500.00	199.12	290.18	275.91	296.15	295.83	100.31	139.03
9.2.7	570.00	244.45	293.65	279.46	296.07	294.94	100.72	140.72
9.2.8	645.00	292.76	275.34	289.91	293.25	292.76	100.96	141.05

DETECTOR	TF-CC-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSIG
RUN	TIME							
ID	(SEC)							
9.2.5	420.00	294.70	296.07	263.89	261.55	177.18	176.38	180.97
9.2.6	500.00	287.28	295.83	239.13	266.79	182.26	161.54	181.62
9.2.7	570.00	292.93	297.12	226.14	266.79	188.88	188.07	189.52
9.2.8	645.00	294.78	296.47	218.40	268.73	195.81	194.93	197.43

TABLE XVIII (contd.)

TEST 9.2B -- BOUNDARY HEAT FLUX

DETECTOR		DP-CL-NOZ	DP-CL-CLB	DP-248-VCL	TF-47C-C	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS		INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.2.5	420.00	-C.09 QA	103.27	-0.93 A	277.52 C	0.00 F	297.93	295.18	298.73
9.2.6	500.00	-C.32 QA	28.96	-0.65 A	242.92 C	0.00 F	297.28	294.70	298.23
9.2.7	570.00	-0.54 QA	15.96	0.29 A	285.02 C	0.00 F	298.89	296.47	300.02
9.2.8	645.00	-C.34 QA	68.74	1.70 A	272.12 C	0.00 F	298.81	296.15	299.70

DETECTOR		TM-47C-90	TM-47C-285	TM-63C-285	TM-73C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.2.5	420.00	294.54	293.01	295.02	297.85	0.00 F	297.36	296.07	299.30
9.2.6	500.00	291.94	289.70	294.70	296.31	0.00 F	296.80	293.89	298.41
9.2.7	570.00	290.67	290.02	296.47	297.85	0.00 F	298.41	290.43	295.83
9.2.8	645.00	294.05	292.93	296.47	297.77	0.00 F	288.17	297.12	300.33

DETECTOR		TF-78D-C	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.2.5	420.00	297.28	295.83	0.00 F	296.72	296.64	298.09	295.43	292.85
9.2.6	500.00	296.88	294.05	0.00 F	294.78	291.96	293.89	292.10	289.62
9.2.7	570.00	298.17	295.83	0.00 F	296.31	289.38	293.89	294.43	290.83
9.2.8	645.00	298.41	295.59	0.00 F	296.31	296.23	296.88	296.56	291.47

DETECTOR		TM-78C-180	TM-95D-45	TM-95D-225	TM-116D-0	TM-116D-45	TM-116D-225	TM-254-14	TM-254-15
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.2.5	420.00	294.05	290.67	291.31	293.09	294.05	295.10	295.10	300.59
9.2.6	500.00	293.09	288.09	290.75	290.63	293.33	294.54	293.18	300.27
9.2.7	570.00	293.89	289.38	291.31	291.96	293.81	295.91	293.25	301.64
9.2.8	645.00	294.54	290.18	292.04	292.12	293.73	295.83	293.81	299.70

DETECTOR		TM-254-0S	TM-254-18	TM-218-I	TM-218-B	PWR-V
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	KW
RUN	TIME					
ID	(SEC)					
9.2.5	420.00	291.27	296.80	303.73	298.81	0.00 NN
9.2.6	500.00	291.47	296.31	296.47	291.96	0.00 NN
9.2.7	570.00	292.20	297.68	296.72	291.96	0.00 NN
9.2.8	645.00	290.83	296.15	295.18	293.65	0.00 NN

TABLE XIX

TEST 4.6 -- COLD LEG WATER

DETECTOR	FI-VI-L1	FI-VI-L3	FI-VO-L38	FI-VO-L1	FI-VO-L3	FI-SO-L75	FI-SO-L1	FI-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME								
ID. (SEC)								
4.6.70	640.00	4.38 A	0.00 NN	1.30 A	0.00 NN	0.0	4.30 M	0.0
4.6.71	145.00	4.99 A	0.00 NN	1.40 A	0.00 NN	0.0	3.88	0.00 NN
4.6.72	220.00	4.46 A	0.00 NN	1.20 HH	0.00 NN	0.0	3.86	0.00 NN
4.6.73	300.00	3.60 A	0.00 NN	0.20 HH	0.00 NN	0.0	3.97	0.00 NN
4.6.74	375.00	5.03	0.00 NN	1.49 A	0.00 NN	0.00 NN	3.95	0.00 NN
4.6.75	450.00	4.54 A	0.00 NN	1.70 HH	0.00 NN	0.0	3.73	0.00 NN
4.6.76	525.00	5.40	0.00 NN	2.00 HH	0.00 NN	0.0	4.10	0.00 NN
4.6.77	600.00	5.93	0.00 NN	3.00 HH	0.00 NN	0.00 NN	3.97	0.00 NN
4.6.78	660.00	7.03	0.00 NN	5.40 M	0.00 NN	0.00 NN	3.63	0.0
4.6.79	600.00	7.26	0.00 NN	3.20 HH	0.00 NN	0.0	4.41	0.0

DETECTOR	FI-SU-G3	FI-CO-G1	FI-CO-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN TIME								
ID. (SEC)								
4.6.70	640.00	116.72	0.0	152.97	85.57	47.44	49.83 Q	48.29
4.6.71	145.00	126.48	0.0	170.10	85.94	50.30	52.86 Q	50.33
4.6.72	220.00	153.03	0.0	190.07	86.67	47.68	49.47 Q	47.59
4.6.73	300.00	173.35	0.0	197.21	84.34	49.98	51.90 Q	49.04
4.6.74	375.00	181.43	0.0	122.69	84.97	48.08	50.31 Q	49.18
4.6.75	450.00	54.88 Q	0.0	93.96	82.90	46.87	49.29 Q	47.95
4.6.76	525.00	28.52 QA	0.0	76.94 Q	85.34	50.11	50.38 Q	51.02
4.6.77	600.00	9.47 QA	0.0	77.50 Q	86.59	48.60	49.01 Q	50.48
4.6.78	660.00	2.51 QA	75.02	0.0	74.46	30.26	32.22 Q	31.77
4.6.79	600.00	4.75 QA	74.24	0.0	142.85 Q	49.71	52.92 Q	51.21

DETECTOR	P-SO-G	P-CO-G	IF-VI-L1	IF-VI-L3	IF-255	IF-263	IF-VO-L38	IF-VO-L1
UNITS	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
4.6.70	640.00	46.39	48.99	130.64	126.13	296.07	269.78	282.44
4.6.71	145.00	49.19	50.53	127.74	77.17	298.41	288.73	277.92
4.6.72	220.00	46.16	49.10	126.45	97.89	296.64	281.23	251.87
4.6.73	300.00	47.11	50.53	128.87	103.54	298.09	268.81	178.47 Q
4.6.74	375.00	48.02	49.33	130.96	98.38	297.77	263.89	277.76
4.6.75	450.00	46.74	47.84	129.27	101.77	295.91	283.57	123.06 Q
4.6.76	525.00	49.60	50.76	130.00	99.02	300.10	273.41	281.47
4.6.77	600.00	49.19	49.66	130.16	99.67	298.65	267.03	291.07
4.6.78	660.00	30.71	32.26	132.82	96.85	277.68	267.60	107.17 Q
4.6.79	600.00	49.87	51.87	130.00 Q	118.14	299.22	298.65	289.94

TABLE XIX (contd.)

TEST 4.6 -- COLD LEG WATER

DETECTOR	TF-V0-L3	TF-S1	TF-S0-L75	TF-S0-L1	TF-S0-G1	TF-S0-G3	TF-C0-G1	TF-C0-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
4.6.70	640.00	276.47	294.70	297.12	236.14	90.23	296.47	253.00
4.6.71	145.00	251.87	296.88	299.06	258.40	91.52	297.93	290.51
4.6.72	220.00	225.66	294.70	296.47	233.16	91.85	295.91	238.72
4.6.73	300.00	166.78	295.99	297.85	124.59	91.52	297.12	211.70
4.6.74	375.00	244.21	296.88	297.77	231.87	89.51	297.44	217.11
4.6.75	450.00	251.95	295.26	296.96	196.86	88.38	296.23	246.31
4.6.76	525.00	235.82	299.70	299.94	163.87	84.67	300.99	220.17
4.6.77	600.00	265.50	298.41	299.14	161.13	84.34	299.22	244.93
4.6.78	660.00	235.17	276.47	277.76	169.28	79.50	277.12	292.12
4.6.79	600.00	255.18	298.17	297.04	162.91	102.01	94.51	299.70

DETECTOR	DP-264-255	IE-47C-0	TF-47C-180	TF-78C-0	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90
UNITS	PSID	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
4.6.70	640.00	0.0 QA	241.47 C	299.30	0.00 F	298.49	295.83	298.17
4.6.71	145.00	0.00 QA	295.67 C	300.99	0.00 F	301.72	300.67	300.83
4.6.72	220.00	0.00 QA	247.43 C	299.22	0.00 F	300.35	299.06	290.22
4.6.73	300.00	0.01 QA	302.04 C	300.99	0.00 F	301.80	300.67	300.59
4.6.74	375.00	0.00 QA	217.11 C	299.22	0.00 F	300.27	299.06	290.06
4.6.75	450.00	0.00 QA	251.31 C	297.12	0.00 F	298.41	297.60	297.28
4.6.76	525.00	0.00 QA	266.31 C	300.10	0.00 F	302.60	301.72	301.31
4.6.77	600.00	0.0 QA	276.63 C	297.93	0.00 F	301.23	300.35	300.10
4.6.78	660.00	0.00 QA	246.06 C	274.13	0.00 F	279.70	278.81	279.21
4.6.79	600.00	0.00 QA	259.53 C	295.59	0.00 F	303.09	305.02	302.04

DETECTOR	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180	TF-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
4.6.70	640.00	300.10	299.86	0.00 F	299.70	291.15	282.92 C	299.70
4.6.71	145.00	301.96	301.07	0.00 F	301.31	295.43	299.94 C	300.99
4.6.72	220.00	300.35	299.70	0.00 F	299.78	293.89	289.38 C	299.70
4.6.73	300.00	302.29	301.15	0.00 F	301.23	295.10	302.69 C	301.31
4.6.74	375.00	299.70	299.78	0.00 F	300.10	293.65	270.66 C	299.06
4.6.75	450.00	297.68	297.77	0.00 F	298.57	291.96	280.50 C	296.07
4.6.76	525.00	300.27	300.99	0.00 F	302.12	295.51	273.49 C	297.44
4.6.77	600.00	299.06	299.06	0.00 F	300.75	294.05	291.96 C	296.64
4.6.78	660.00	275.18	278.41	0.00 F	279.38	273.25	250.34 C	270.66
4.6.79	600.00	294.70	298.65	0.00 F	299.70	295.83	286.96 C	295.26

TABLE XIX (contd.)

TEST 4.6 -- COLD LEG WATER

DETECTOR	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME								
ID (SEC)								
4.6.70	640.00	296.72	294.94	296.47	281.88	297.36 0	297.12	301.39
4.6.71	145.00	301.46	298.33	299.70	291.96	298.89	297.68	302.69
4.6.72	220.00	299.86	296.80	293.41	287.28	297.85	297.12	300.51
4.6.73	300.00	300.99	298.01	299.46	291.96	299.22	299.70	302.60
4.6.74	375.00	300.27	296.72	297.77	275.83	296.56	296.47	299.94
4.6.75	450.00	299.06	295.35	296.23	277.76	295.83	294.54	298.41
4.6.76	525.00	303.09	299.22	300.10	275.83	298.01	295.02	301.15
4.6.77	600.00	302.28	297.77	298.65	274.78	296.47	294.54	298.89
4.6.78	660.00	280.34	276.63	277.04	250.66	270.99	270.83	278.17
4.6.79	600.00	304.46	299.30	299.70	268.00	291.31	288.89	296.07

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-15	TM-254-05
UNITS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN TIME								
ID (SEC)								
4.6.70	640.00	295.99	292.68	293.65	293.97	296.31	296.23	300.51
4.6.71	145.00	299.46	297.44	297.77	297.12	299.46	295.59	298.57
4.6.72	220.00	298.01	295.83	296.31	295.59	297.77	293.73	296.86
4.6.73	300.00	299.70	297.28	298.01	297.12	299.22	295.43	299.06
4.6.74	375.00	297.12	294.78	295.43	295.51	297.93	294.54	297.60
4.6.75	450.00	295.59	293.65	294.05	294.54	296.64	293.09	295.83
4.6.76	525.00	298.73	296.80	297.44	297.93	300.19	295.91	299.86
4.6.77	600.00	297.60	295.26	296.07	296.64	299.30	295.83	298.81
4.6.78	660.00	276.47	274.46	275.18	275.83	278.41	275.26	277.52
4.6.79	600.00	297.52	295.83	298.73	300.75	301.64	295.35	299.70

DETECTOR	TM-254-18	TM-218-1	TM-218-8	PWR-V
UNITS	DEG-E	DEG-E	DEG-E	KW
RUN TIME				
ID (SEC)				
4.6.70	640.00	299.94	304.22	301.31
4.6.71	145.00	298.41	302.04	299.38
4.6.72	220.00	296.80	300.99	299.70
4.6.73	300.00	298.65	304.46	302.69
4.6.74	375.00	297.77	302.28	299.46
4.6.75	450.00	296.07	302.28	300.35
4.6.76	525.00	299.70	302.44	298.98
4.6.77	600.00	297.68	306.15	304.38
4.6.78	660.00	277.36	265.67	285.02
4.6.79	600.00	298.98	299.14	296.56

TABLE XX

TEST 6.1 -- COLD LEG STEAM

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-G3	FT-SO-L75	FT-SO-L1	FT-SO-G1	
UNITS	GPM	MM	GPM	GPM	GPM	GPM	GPM	CEM	
RUN	TIME								
ID	(SEC)								
6.1.1	720.00	4.25 A	0.00 NN	0.49 HH	0.00 NN	0.0	4.83	0.00 NN	0.0
6.1.3	790.00	4.54 A	0.00 NN	0.94 HH	0.00 NN	0.0	4.37	0.00 NN	0.0
6.1.4	860.00	5.35	0.00 NN	1.80 HH	0.00 NN	0.0	4.38	0.00 NN	0.0
6.1.5	140.00	7.53	0.00 NN	0.00 NN	5.10 HH	0.0	3.77	0.0	0.0
6.1.2	210.00	3.84 A	0.00 NN	0.76 HH	0.00 NN	0.0	3.83	0.0	0.0

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	
UNITS	CEM	CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	
RUN	TIME								
ID	(SEC)								
6.1.1	720.00	474.56 Q	0.0	150.87	271.64	142.92 Q	48.45	50.13	40.04
6.1.3	790.00	397.47 Q	0.0	100.15	278.69	144.57 Q	48.62	49.52	41.19
6.1.4	860.00	371.47 Q	0.0	81.11	287.39	139.86 Q	48.98	50.37	42.28
6.1.5	140.00	314.12 Q	56.78	0.00 NN	279.88	138.96 Q	47.34	51.49	44.65
6.1.2	210.00	475.02 Q	0.00 NN	133.57	276.48	145.23 Q	46.98	49.16	40.34

DETECTOR	P-SO-L	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	
UNITS	PSIG	PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	
RUN	TIME								
ID	(SEC)								
6.1.1	720.00	42.48	37.55	49.65	50.39	48.18	117.09	84.91	295.83
6.1.3	790.00	44.38	39.85	48.61	50.16	47.72	122.90	94.83	294.78
6.1.4	860.00	45.49	41.39	49.32	50.96	48.53	120.00	101.52	295.59
6.1.5	140.00	47.33	43.78	50.70	51.92	50.20	117.74	98.78	296.47
6.1.2	210.00	42.45	38.36	48.23	49.51	48.47	120.88	100.96	295.10

DETECTOR	TF-263	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	
RUN	TIME								
ID	(SEC)								
6.1.1	720.00	287.20	0.00 F	192.10	201.14	285.34	285.91	126.04	99.51
6.1.3	790.00	291.07	0.00 F	179.04	191.22	286.55	287.44	139.17	101.44
6.1.4	860.00	291.72	0.00 F	180.49	246.87	287.44	287.60	122.33	102.09
6.1.5	140.00	295.99	0.00 F	289.38	255.82	290.02	287.44	189.44	106.61
6.1.2	210.00	285.75	0.00 F	190.81	227.67	285.42	284.94	137.09	107.57

TABLE XX (contd.)

TEST 6.1 -- COLD LEG STEAM

DETECTOR	TF-SO-G3	TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID.	(SEC)							
6.1.1	720.00	285.91	285.51	294.94	299.70	300.99	299.22	298.41
6.1.3	790.00	288.09	291.96	293.89	299.06	300.51	298.89	297.93
6.1.4	860.00	289.86	289.94	294.70	299.86	301.64	299.70	298.57
6.1.5	140.00	293.01	293.89	296.07	301.07	302.60	300.99	299.38
6.1.2	210.00	286.15	292.36	293.97	298.57	300.10	298.41	297.12

DETECTOR	DP-264-255	DP-CL-NGZ	DP-CL-CLH	DP-248-VOL	TF-47C-G	TF-47C-180	TF-78C-180	TF-95C-45
UNITS	PSID	INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID.	(SEC)							
6.1.1	720.00	0.00 Q	-6.76 A	301.67	-0.56 A	299.30	296.80	297.77
6.1.3	790.00	0.00 Q	-6.41 A	269.46	-1.29 A	298.25	295.99	296.88
6.1.4	860.00	0.00 Q	-5.55 A	260.70	-1.20 A	299.38	296.47	297.52
6.1.5	140.00	0.01 Q	-5.55 A	235.31	-1.20 A	298.49	295.35	298.25
6.1.2	210.00	0.01 Q	-5.55 A	290.02	1.20 A	296.47	293.57	296.64

DETECTOR	TF-95C-225	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-480-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID.	(SEC)							
6.1.1	720.00	297.28	294.94	298.81	298.17	298.41	297.60	283.49
6.1.3	790.00	296.47	294.05	298.17	297.28	297.52	296.96	287.68
6.1.4	860.00	297.12	294.70	298.98	298.09	298.41	297.93	288.09
6.1.5	140.00	297.60	295.83	298.09	296.64	297.12	296.88	289.89
6.1.2	210.00	296.23	294.54	296.47	294.94	295.51	295.18	287.36

DETECTOR	TF-480-180	TF-780-C	TF-780-180	TF-950-45	TF-950-225	TM-480-C	TM-430-180	TM-630-45
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID.	(SEC)							
6.1.1	720.00	297.85	298.57	296.23	294.70	294.94	296.39	0.00 F
6.1.3	790.00	296.96	297.77	295.59	293.89	294.22	295.83	0.00 F
6.1.4	860.00	297.44	298.41	295.67	294.22	294.94	296.07	0.00 F
6.1.5	140.00	296.72	297.36	296.23	295.35	295.35	297.28	0.00 F
6.1.2	210.00	295.26	295.67	294.78	293.65	293.81	296.07	0.00 F

TABLE XX (contd.)

TEST 6.1 -- COLD LEG STEAM

DETECTOR	TM-630-225	TM-780-0	TM-780-180	TM-950-45	TM-950-225	TM-1160-45	TM-1160-225	TM-254-14
UNIIS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN ID.	TIME (SEC)							
6.1.1	720.00	298.73	295.59	294.54	291.31	293.89	295.35	295.59
6.1.3	790.00	297.93	294.78	293.89	290.91	293.33	294.78	295.02
6.1.4	860.00	298.49	295.35	294.54	291.23	293.89	295.10	295.26
6.1.5	140.00	297.28	294.30	295.18	292.12	294.70	295.51	295.99
6.1.2	210.00	295.59	292.68	293.49	290.67	293.01	294.05	294.54
								292.52

DETECTOR	TM-254-15	TM-254-05	TM-254-18	TM-218-Y	TM-218-B	PWR-V
UNIIS	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	kw
RUN ID.	TIME (SEC)					
6.1.1	720.00	299.30	291.96	297.28	300.02	296.56
6.1.3	790.00	298.25	291.55	296.31	302.28	299.06
6.1.4	860.00	299.06	291.96	296.88	301.80	299.70
6.1.5	140.00	298.17	290.67	295.26	301.23	298.57
6.1.2	210.00	296.64	289.38	293.89	300.02	298.81
						11.70
						10.90
						12.10
						10.57
						12.41

TABLE XXI

TEST 6.2 -- COLD LEG STEAM

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME								
ID. (SEC)								
6.2.1	270.00	4.05 A	0.00 NN	0.00 NN	0.00 NN	0.0	3.96	0.0
6.2.6	360.00	4.23 A	0.00 NN	0.79 HH	0.00 NN	0.0	3.92	0.0
6.2.2	440.00	4.35 A	0.00 NN	1.60 HH	0.00 NN	0.0	3.91	0.0
6.2.3	520.00	5.17	0.00 NN	1.55 HH	0.00 NN	0.0	4.28	0.0
6.2.4	610.00	5.67	0.00 NN	0.00 NN	2.46 HH	0.0	3.97	0.0
6.2.5	680.00	6.39	0.00 NN	0.00 NN	2.58 HH	0.0	3.95	0.0

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI
UNITS	GPM	GPM	GPM	GPM	PSIG	PSIG	PSIG	PSIG
RUN TIME								
ID. (SEC)								
6.2.1	270.00	311.50	0.00 NN	189.30	126.35	145.23 Q	47.01	50.22
6.2.6	360.00	282.45	0.00 NN	171.08	125.54	140.98 Q	47.21	50.71
6.2.2	440.00	215.89	0.00 NN	123.61	119.73	139.62 Q	46.78	50.01
6.2.3	520.00	166.75	0.00 NN	104.89	120.14	144.38 Q	47.31	50.15
6.2.4	610.00	141.01	73.09	0.00 NN	120.52	142.07 Q	46.95	51.31
6.2.5	680.00	117.16	65.51	0.00 NN	122.70	143.72 Q	46.72	51.14

DETECTOR	P-SO-L	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255
UNITS	PSIG	PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
6.2.1	270.00	45.71	42.75	48.86	46.41	46.68	120.00	102.90
6.2.6	360.00	46.78	43.92	49.04	46.58	47.26	121.93	102.73
6.2.2	440.00	48.09	45.61	48.62	45.95	46.85	122.41	104.83
6.2.3	520.00	49.31	47.14	49.36	47.03	48.47	118.87	103.86
6.2.4	610.00	50.10	47.73	50.05	46.64	48.30	124.11	105.96
6.2.5	680.00	50.24	48.32	49.75	46.49	48.18	127.42	107.49

DETECTOR	TF-263	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
6.2.1	270.00	273.49	168.79	179.04	195.33	288.33	287.76	150.16
6.2.6	360.00	292.52	203.23	180.97	220.58	288.97	290.18	160.89
6.2.2	440.00	289.70	246.87	197.59	248.97	290.59	290.67	172.18
6.2.3	520.00	293.09	265.18	244.37	264.45	292.36	290.10	146.13
6.2.4	610.00	291.96	171.94	282.92	264.13	292.52	287.84	142.01
6.2.5	680.00	292.44	149.19	283.89	271.95	293.25	291.15	139.60

TABLE XXI (contd.)

TEST 6.2 -- COLD LEG STEAM

DETECTOR	TF-SO-G3	TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
6.2.1 270.001	291.31	293.01	294.54	295.18	306.40	295.35	294.54	293.89
6.2.6 360.001	291.96	292.85	294.30	295.43	308.90	295.59	294.54	293.89
6.2.2 440.001	294.14	292.20	293.89	294.54	308.98	294.78	293.73	293.25
6.2.3 520.001	296.07	293.41	294.70	295.51	309.54	295.67	294.94	294.38
6.2.4 610.001	296.47	293.57	294.54	294.94	308.90	295.02	294.14	293.81
6.2.5 680.001	297.20	293.49	294.54	294.54	308.57	294.70	293.81	293.25

DETECTOR	DP-264-255	DP-CL-NOZ	DP-CL-CLB	DP-248-VOL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45
UNITS	PSID	INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
6.2.1 270.001	0.01 QA	2.08 QA	152.77	0.54 A	296.80	293.89	296.96	295.26
6.2.6 360.001	0.01 QA	1.39 QA	137.25	1.23 A	297.36	294.05	297.12	295.26
6.2.2 440.001	0.01 QA	2.95 QA	85.22	0.81 A	296.23	293.49	296.47	294.78
6.2.3 520.001	0.01 QA	3.03 QA	69.85	2.48 A	296.72	294.38	297.52	295.83
6.2.4 610.001	0.01 QA	2.77 QA	52.26	1.07 A	296.64	293.89	297.36	295.83
6.2.5 680.001	0.01 QA	1.21 QA	36.52	0.93 A	296.39	293.65	296.80	295.43

DETECTOR	TF-95C-225	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
6.2.1 270.001	296.47	294.78	296.47	295.18	295.83	295.43	287.52	297.36
6.2.6 360.001	296.47	294.70	296.64	295.43	295.99	295.83	287.60	297.60
6.2.2 440.001	295.99	294.05	296.15	294.86	295.43	295.18	287.04	297.12
6.2.3 520.001	296.64	295.10	296.72	295.59	296.23	295.83	287.93	297.93
6.2.4 610.001	296.72	294.86	296.64	295.35	296.23	296.15	288.09	297.77
6.2.5 680.001	296.39	294.70	295.91	294.76	295.51	295.18	287.28	297.36

DETECTOR	TF-48D-180	TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME								
ID. (SEC)								
6.2.1 270.001	295.43	295.91	295.51	293.97	293.97	296.07	0.00 NN	296.31
6.2.6 360.001	295.67	296.23	295.67	294.05	294.05	296.23	0.00 NN	296.64
6.2.2 440.001	295.18	295.59	295.18	293.41	293.57	295.83	0.00 NN	295.26
6.2.3 520.001	295.83	296.31	296.47	294.54	294.54	296.23	0.00 NN	295.59
6.2.4 610.001	295.67	296.39	296.31	294.54	294.05	296.31	0.00 NN	295.91
6.2.5 680.001	295.35	295.83	295.83	293.97	293.81	295.91	0.00 NN	295.18

TABLE XXI (contd.)

TEST 6.2 -- COLD LEG STEAM

DETECTOR	TM-630-225	TM-780-C	TM-780-180	TM-950-45	TM-950-225	TM-1160-45	TM-1160-225	TM-254-14
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME ID. (SEC)								
6.2.1 270.00	295.83	292.85	293.33	290.67	293.25	294.54	294.78	292.60
6.2.6 360.00	295.99	293.09	293.49	290.75	293.25	294.54	294.36	292.93
6.2.2 440.00	295.43	292.52	293.09	290.43	292.85	294.30	294.54	292.52
6.2.3 520.00	296.07	293.17	293.65	291.07	293.65	295.18	295.35	293.25
6.2.4 610.00	296.15	293.33	293.73	291.07	293.49	295.10	295.43	293.09
6.2.5 680.00	295.59	292.60	293.09	290.26	293.01	294.54	294.78	292.93

DETECTOR	TM-254-15	TM-254-08	TM-254-18	TM-218-Y	TM-218-B	PWR-V
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	KW
RUN TIME ID. (SEC)						
6.2.1 270.00	297.20	290.43	294.54	302.85	300.99	12.70
6.2.6 360.00	297.28	290.18	294.54	301.56	299.94	12.67
6.2.2 440.00	296.72	289.38	293.89	296.96	293.25	11.28
6.2.3 520.00	298.01	288.89	295.18	297.12	293.25	11.10
6.2.4 610.00	297.60	289.38	295.02	299.70	297.12	11.59
6.2.5 680.00	297.36	289.94	294.54	299.70	295.99	10.90

TABLE XXII

TEST 9.4A-- COLD LEG STEAM

DETECTOR		FT-VI-L1	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SC-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS		GPM	GPM	GPM	GPM	GPM	GPM	CEM	CEM
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	5.20 M	0.48 HH	0.0 NN	0.0	4.28	0.0	0.0	0.0 F
9.4.2	570.00	5.10 M	0.95 HH	0.0 NN	0.0	4.13	0.0	0.0	0.0 F
9.4.3	650.00	4.70 MA	1.29 HH	0.0 NN	0.0	4.36	0.0	0.0	587.81
9.4.4	725.00	4.70 MA	1.41 HH	0.0 NN	0.0	4.14	0.0	0.0	493.68

DETECTOR		FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS		CEM	CEM	CEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	0.0	228.92	248.98	138.86 Q	51.56	52.87	37.23	36.63
9.4.2	570.00	0.0	201.26	268.70	133.20 Q	47.08	50.32	34.56	34.87
9.4.3	650.00	0.0	162.44	276.41	137.73 Q	47.05	51.31	39.76	40.72
9.4.4	725.00	0.0	129.13	272.62	139.81 Q	47.50	51.74	42.66	44.18

DETECTOR		P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS		PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	28.55	54.11	54.60	52.02	177.99	124.75	293.06	241.63
9.4.2	570.00	26.94	50.34	52.24	49.58	162.91	133.47	295.91	236.47
9.4.3	650.00	34.19	51.01	59.78	50.07	186.13	146.61	296.72	234.53
9.4.4	725.00	38.14	51.26	53.18	50.66	188.80	152.90	297.20	232.27

DETECTOR		TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	239.61 Q	215.09	220.98	280.34	278.17	236.71	121.61	273.39
9.4.2	570.00	264.45 Q	232.76	245.02	276.79	275.02	234.69	122.25	270.66
9.4.3	650.00	270.02 Q	239.69	249.53	283.41	281.88	240.98	124.51	281.15
9.4.4	725.00	274.54 Q	242.27	254.53	287.04	285.91	241.79	125.53	286.39

DETECTOR		TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS		DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSID
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	258.97	299.86	302.77	305.91	303.57	302.44	302.28	0.00 QA
9.4.2	570.00	248.73	295.83	303.59	303.65	301.15	300.27	299.86	0.00 QA
9.4.3	650.00	248.24	296.64	301.15	304.22	301.64	300.75	300.51	0.00 QA
9.4.4	725.00	257.36	297.12	301.64	304.86	302.28	301.15	301.07	0.00 QA

TABLE XXII (contd.)

TEST 9.4A -- COLD LEG STEAM

DETECTOR		DP-CL-NQZ	DP-CL-CLB	DP-24B-VOL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS		INCHES	INCHES	INCHES	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	-7.30 A	328.52	2.38 A	302.93	0.0 F	302.69	300.10	303.17
9.4.2	570.00	-6.45 A	327.96	1.85 A	299.70	0.0 F	299.30	296.64	299.94
9.4.3	650.00	-6.99 A	319.98	1.63 A	300.43	0.0 F	299.86	297.28	300.35
9.4.4	725.00	-6.91 A	314.89	1.78 A	300.99	0.0 F	300.35	297.68	301.15

DETECTOR		TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	299.70	301.64	299.30	300.51	0.0 F	291.64	301.39	304.86
9.4.2	570.00	296.31	298.17	295.99	297.12	0.0 F	288.33	298.01	301.48
9.4.3	650.00	297.12	298.89	296.72	297.85	0.0 F	288.73	298.73	302.12
9.4.4	725.00	297.60	299.30	297.20	298.57	0.0 F	289.38	299.22	302.60

DETECTOR		TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	301.48	299.22	0.0 F	299.70	299.70	300.99	302.67	295.10
9.4.2	570.00	298.17	295.99	0.0 F	296.23	296.47	297.85	297.28	291.64
9.4.3	650.00	298.98	296.31	0.0 F	296.72	297.52	298.41	298.01	292.44
9.4.4	725.00	299.46	296.88	0.0 F	297.28	297.85	298.98	298.49	292.76

DETECTOR		TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-0	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E	DEG-E
RUN	TIME								
ID	(SEC)								
9.4.1	485.00	297.85	293.81	295.35	296.80	297.52	299.06	296.47	303.33
9.4.2	570.00	294.54	290.26	292.12	293.25	294.05	295.83	293.89	300.35
9.4.3	650.00	293.18	290.75	292.52	293.89	294.54	296.31	294.70	301.15
9.4.4	725.00	295.67	291.31	293.09	294.22	294.94	296.80	294.94	301.39

DETECTOR		TM-254-0S	TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS		DEG-E	DEG-E	DEG-E	DEG-E	KW
RUN	TIME					
ID	(SEC)					
9.4.1	485.00	293.33	299.70	302.28	300.43	12.37
9.4.2	570.00	291.97	296.31	302.28	303.98	12.35
9.4.3	650.00	291.25	297.28	303.01	0.0 F	12.37
9.4.4	725.00	291.47	297.77	303.49	304.06	12.41

TABLE XXIII

TEST 9.4B -- COLD LEG STEAM

DETECTOR	FT-VI-L1	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1	FT-SO-G3
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GEM	GEM
RUN ID.	TIME (SEC)							
9.4.5	155.00	5.31	1.37 HH	0.0 NN	0.0	3.92	0.0	341.86 Q
9.4.6	230.00	7.32	0.0 NN	4.10 HH	0.0	3.93	0.0	266.06
9.4.7	310.00	5.42	0.0 NN	2.14 HH	0.0	4.14	0.0	314.58 Q

DETECTOR	FT-CO-G1	FT-CO-G3	FT-CL-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	GEM	GEM	GEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN ID.	TIME (SEC)							
9.4.5	155.00	0.0	222.31	117.62	145.37 Q	48.26	50.15	44.13
9.4.6	230.00	0.0	162.00	123.02	145.51 Q	48.29	51.10	46.20
9.4.7	310.00	0.0	195.42	121.46	137.49 Q	48.19	52.69	46.71

DETECTOR	P-SO-G	P-CO-G	P-CL-G	P-CL-V1	TF-VI-L1	TF-VI-L3	TF-255	TF-263
UNITS	PSIG	PSIG	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
9.4.5	155.00	42.97	50.94	47.92	46.10	178.39	144.03 C	296.47
9.4.6	230.00	46.12	51.36	48.14	46.22	184.36	132.98 C	296.47
9.4.7	310.00	46.38	52.64	49.51	47.31	190.01	149.11 C	297.93

DETECTOR	TF-VO-L38	TF-VO-L1	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
9.4.5	155.00	270.66 Q	210.17	236.95	290.34	288.89	249.37	95.48
9.4.6	230.00	274.46	289.38	257.11	292.20	291.15	245.50	96.69
9.4.7	310.00	243.72	288.25	260.50	292.76	291.72	250.74	98.54

DETECTOR	TF-CO-G1	TF-CO-G3	TF-CL-G1	TF-CL-G3	TF-CL-V1	TF-CL-V2	TF-CL-V3	DP-264-255
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	PSID
RUN ID.	TIME (SEC)							
9.4.5	155.00	287.36	296.15	297.12	309.30	298.01	297.12	296.23
9.4.6	230.00	278.08	296.23	297.28	310.83	298.17	297.28	296.64
9.4.7	310.00	281.79	297.36	298.57	307.44	299.70	298.65	297.93

TABLE XXIII (contd.)

TEST 9.4B -- COLD LEG STEAM

DETECTOR	DP-CL-NOZ	DP-CL-CLB	DP-248-VOL	TF-47C-0	TF-47C-180	TF-78C-180	TF-95C-45	TF-95C-225
UNITS	INCHES	INCHES	INCHES	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
9.4.5	155.00	-0.85 QA	161.34	2.61 A	298.65	0.0 F	297.52	295.18
9.4.6	230.00	-2.35 QA	112.35	2.24 A	298.65	0.0 F	297.60	295.35
9.4.7	310.00	-2.33 QA	137.37	2.67 A	300.19	0.0 F	298.89	296.72

DETECTOR	TM-47C-90	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
9.4.5	155.00	296.88	297.28	296.31	297.77	0.0 F	286.80	297.12
9.4.6	230.00	296.80	297.28	296.23	297.77	0.0 F	286.96	297.12
9.4.7	310.00	298.33	298.65	297.60	299.22	0.0 F	288.17	298.41

DETECTOR	TF-78D-0	TF-78D-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
9.4.5	155.00	298.41	293.73	0.0 F	295.51	297.12	297.12	296.47
9.4.6	230.00	298.17	293.81	0.0 F	295.67	297.12	296.72	296.39
9.4.7	310.00	299.70	295.02	0.0 F	296.88	298.57	298.17	297.77

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-0	TM-116D-45	TM-116D-225	TM-254-14	TM-254-1S
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN ID.	TIME (SEC)							
9.4.5	155.00	292.76	288.73	290.91	291.96	293.09	294.94	292.68
9.4.6	230.00	293.01	288.97	291.07	291.72	293.25	295.35	293.25
9.4.7	310.00	294.22	290.18	292.36	293.17	294.54	296.64	294.54

DETECTOR	TM-254-0S	TM-254-18	TM-218-T	TM-218-B	PWR-V
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	KW
RUN ID.	TIME (SEC)				
9.4.5	155.00	288.25	294.78	299.06	297.36
9.4.6	230.00	288.81	295.10	302.12	302.77
9.4.7	310.00	290.26	296.47	303.57	304.30

TABLE XXIV

TEST 5.1 -- HYSTERESIS

DETECTOR	FT-VI-L1	FT-VI-L3	FT-VO-L38	FT-VO-L1	FT-VO-L3	FT-SO-L75	FT-SO-L1	FT-SO-G1
UNITS	GPM	GPM	GPM	GPM	GPM	GPM	GPM	GPM
RUN TIME I								
ID (SEC)								
5.1.2 470.00	9.36	0.00 NN	0.00 NN	2.20 MA	0.0	4.00	0.0	0.0
5.1.1 180.00	5.96	0.00 NN	0.00 NN	1.60 HH	0.00 NN	3.27	0.0	0.00 NN
5.1.3 260.00	8.71	0.00 NN	0.00 NN	3.70 HH	0.00 NN	4.45	0.0	0.00 NN
5.1.6 340.00	6.50	0.00 NN	1.50 HH	0.00 NN	0.00 NN	3.84	0.0	0.00 NN
5.1.4 120.00	8.78	0.00 NN	4.90 HH	0.0	0.0	4.27	0.0	0.0
5.1.5 190.00	4.58 A	0.00 NN	1.20 HH	0.0	0.0	3.79	0.0	0.0
5.1.7 270.00	4.35 A	0.00 NN	0.50 HH	0.0	0.0	3.89	0.0	0.0

DETECTOR	FT-SO-G3	FT-CO-G1	FT-CO-G3	P-VI-L	P-256	P-VO-L	P-SI	P-SO-L
UNITS	GEM	GEM	GEM	PSIG	PSIG	PSIG	PSIG	PSIG
RUN TIME I								
ID (SEC)								
5.1.2 470.00	60.08 Q	76.70	0.0	151.79 Q	49.61	58.07 Q	54.99	57.22
5.1.1 180.00	54.84 Q	0.00 NN	88.20	0.00 F	49.39	53.90 Q	51.60	55.27
5.1.3 260.00	44.84 QA	0.00 NN	73.27 Q	0.00 F	49.40	56.88 Q	53.52	57.97
5.1.6 340.00	93.07 Q	0.00 NN	94.05	0.00 F	49.31	57.53 Q	53.54	58.42
5.1.4 120.00	0.00 NN	65.79	0.0	138.66 Q	49.47	52.80 Q	50.37	52.84
5.1.5 190.00	145.74	0.0	171.79	139.62 Q	49.57	52.29 Q	49.59	51.17
5.1.7 270.00	169.53	0.0	185.52	139.52 Q	49.50	53.00 Q	49.86	51.81

DETECTOR	P-SO-G	P-CO-G	TF-VI-L1	TF-VI-L3	TF-255	TF-263	TF-VO-L38	TF-VO-L1
UNITS	PSIG	PSIG	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME I								
ID (SEC)								
5.1.2 470.00	54.55	55.67	191.62 Q	168.31	300.35	284.46	151.29	295.83
5.1.1 180.00	51.61	52.41	182.10	175.41	297.12	233.48	121.85	286.15
5.1.3 260.00	54.52	54.45	194.04	180.33	297.28	258.40	153.87	291.47
5.1.6 340.00	54.91	55.30	189.68	184.20	297.12	268.16	289.38	277.92
5.1.4 120.00	49.30	50.25	0.00 F	150.97	299.22	294.94	294.14	288.09
5.1.5 190.00	47.94	50.50	0.00 F	153.39	299.70	287.68	274.86	265.50
5.1.7 270.00	48.13	50.68	0.00 F	159.68	299.70	273.25	275.91	260.42

DETECTOR	TF-VO-L3	TF-SI	TF-SO-L75	TF-SO-L1	TF-SO-G1	TF-SO-G3	TF-CO-G1	TF-CO-G3
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN TIME I								
ID (SEC)								
5.1.2 470.00	286.39	299.86	298.89	218.40	112.98	91.44 Q	298.57	300.43
5.1.1 180.00	270.02	296.23	295.18	200.73	97.35	95.80 Q	295.26	297.36
5.1.3 260.00	259.94	296.47	296.56	188.23	97.91	100.96 Q	295.59	297.44
5.1.6 340.00	259.86	296.23	296.07	214.93	100.48	101.36 Q	295.51	297.28
5.1.4 120.00	267.84	297.93	298.01	208.07	107.98	95.64 Q	299.14	298.01
5.1.5 190.00	271.31	297.20	296.64	256.63	109.19	97.49 Q	299.30	298.17
5.1.7 270.00	264.29	297.12	296.47	248.08	108.46	96.77 Q	299.30	298.01

TABLE XXIV (contd.)

TEST 5.1 -- HYSTERESIS

DETECTOR	DP-264-255	TF-47C-0	TF-47C-180	TF-78C-0	TF-78C-180	TF-95C-45	TF-95C-225	TM-47C-90
UNITS	PSID	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
5.1.2	470.001	0.02 QA	279.54 C	299.94	0.00 F	303.57	301.80	303.17
5.1.1	180.001	-0.00 QA	270.91 C	297.12	0.00 F	300.99	300.75	304.38
5.1.3	260.001	0.01 QA	260.50 C	296.47	0.00 F	300.67	300.99	304.06
5.1.6	340.001	0.01 QA	279.05 C	296.72	0.00 F	300.99	300.91	305.67
5.1.4	120.001	0.01 QA	291.07 C	298.17	0.00 F	299.78	303.65	300.67
5.1.5	190.001	0.01 QA	297.12 C	300.75	0.00 F	300.19	304.06	301.15
5.1.7	270.001	0.02 QA	281.63 C	300.35	0.00 F	299.94	303.90	301.15

DETECTOR	TM-47C-285	TM-63C-285	TM-78C-90	TM-78C-285	TM-95C-285	TF-48D-0	TF-48D-180	TF-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
5.1.2	470.001	300.27	300.83	0.00 F	301.15	298.25	287.04 C	297.93
5.1.1	180.001	298.17	298.41	0.00 F	297.77	295.83	276.07 C	297.68
5.1.3	260.001	296.98	298.01	0.00 F	297.77	295.83	274.78 C	296.31
5.1.6	340.001	298.25	298.25	0.00 F	297.68	295.59	285.51 C	297.20
5.1.4	120.001	296.23	299.22	0.00 F	300.10	294.05	292.44 C	297.12
5.1.5	190.001	299.54	300.19	0.00 F	300.10	293.89	299.46 C	299.70
5.1.7	270.001	299.70	300.10	0.00 F	300.27	293.81	293.65 C	299.70

DETECTOR	TF-78C-180	TF-95D-45	TF-95D-225	TM-48D-0	TM-48D-180	TM-63D-45	TM-63D-225	TM-78D-0
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
5.1.2	470.001	303.25	300.83	302.28	284.86	295.26	297.60	300.59
5.1.1	180.001	300.35	304.86	303.65	280.34	0.00 F	296.23	297.85
5.1.3	260.001	300.59	301.64	304.22	279.86	0.00 F	294.70	296.23
5.1.6	340.001	300.51	301.80	304.22	283.00	0.00 F	296.96	298.01
5.1.4	120.001	301.64	298.25	298.41	279.05	0.00 F	293.09	298.89
5.1.5	190.001	302.28	298.65	298.81	288.89	0.00 F	297.68	300.92
5.1.7	270.001	302.28	298.41	298.65	286.07	0.00 F	298.01	299.36

DETECTOR	TM-78D-180	TM-95D-45	TM-95D-225	TM-116D-45	TM-116D-225	TM-254-14	TM-254-15	TM-254-05
UNITS	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F	DEG-F
RUN	TIME							
ID	(SEC)							
5.1.2	470.001	300.67	299.08	299.94	300.99	302.93	298.01	300.43
5.1.1	180.001	298.25	296.47	297.93	298.41	297.78	296.88	300.99
5.1.3	260.001	298.41	296.56	298.01	298.57	299.86	297.28	301.39
5.1.6	340.001	298.25	296.23	297.93	298.41	299.70	297.77	301.48
5.1.4	120.001	295.83	294.70	298.25	299.70	300.51	295.35	299.70
5.1.5	190.001	296.47	294.70	298.01	299.22	300.51	295.99	299.70
5.1.7	270.001	296.31	294.54	297.93	299.30	300.51	295.99	299.70

TABLE XXIV (contd.)

TEST 5.1 -- HYSTERESIS

DETECTOR		TM-254-18	TM-218-T	TM-218-B	PWR-V
WHIS		DEQ-L	DEQ-E	DEQ-E	KW
RUN	TIME				
ID	(SEC)				
5.1.2	470.00	300.75	297.12	291.15	0.00
5.1.1	180.00	298.57	306.15	303.98	12.87
5.1.3	260.00	299.94	306.15	306.15	12.95
5.1.6	340.00	303.10	307.04	306.96	13.36
5.1.4	120.00	299.30	302.85	300.51	11.85
5.1.5	190.00	299.70	304.86	303.41	12.31
5.1.7	270.00	299.22	304.86	303.73	12.23

VI. RESULTS OF TRANSIENT TESTS

Transient tests were performed with the annulus walls initially above saturation temperature to obtain countercurrent flow data with the possibility of steam generation along the annulus walls. During transient tests, the wall temperatures were allowed to decrease as soon as fluid injection was initiated. Tests, performed in this manner, included both vessel thermal response tests and transient countercurrent flow tests.

Vessel thermal response tests were conducted to provide information concerning heat distribution in the vessel walls with various cold leg water flows (Test 1.2) or various hot leg steam flows (Test 1.3). The procedure for both of these test series was to heat the vessel to 450°F (as measured by TM-78C-0) and then establish the specified gas or liquid flow.

Transient countercurrent flow tests were designed to determine the effect of steam generation on countercurrent flow data. For these tests, the vessel wall was heated to about 600°F before the hot leg steam flow and then the water flow were established. Four inches of water was maintained in the separator tank prior to test initiation, and an operator manually controlled the water level during the test by adjusting the separator liquid drain valve. In order to drain the vessel lower plenum, the pressure in the separator was maintained at 50 psig or higher. An air supply line (into the FT-SO-G3 line between the flowmeter and phase separator) maintained this pressure. The air flow never exceeded 0.13 cfm. The lower plenum water level was maintained by regulating a manually controlled throttle valve.

Tests 13.1, 14.1, and 14.2 were performed with decreasing hot leg steam flow. From the initial value, the flow was reduced to zero in a time similar to that in which a flow reduction may occur in future semiscale blowdown tests.

Table XXV provides a guide to Figures 20 through 509 which present the data for the entire transient test series. Table XXVI provides pertinent information for specific tests or measurements. This information is in many cases related to anomalous indications.

TABLE XXV

INDEX TO FIGURES FOR TRANSIENT TESTS

<u>Test</u>	<u>Applicable Figure</u>
Vessel Thermal Response	
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1.2.2.2	34 - 47
1.2.3	48 - 60
1.2.4	61 - 74
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1.2.7	102 - 114
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Countercurrent Flow	
10.1.1	156 - 172
10.1.2	173 - 188
10.1.3	189 - 205
12.1.1	206 - 222
12.1.2	223 - 239
12.1.3.1	240 - 256
12.1.4	257 - 273
12.1.5	274 - 290
12.1.6	291 - 307
12.1.7	308 - 324
12.1.8	325 - 341
12.1.9	342 - 358
12.1.10	359 - 375
12.1.11	376 - 392
12.1.12	393 - 409
12.1.13	410 - 426
12.1.14	427 - 442
12.1.15	443 - 458
13.1	459 - 475
14.1	476 - 492
14.2	493 - 509

TABLE XXVI

COMMENTS ON TRANSIENT TESTS

Test	Figure	Measurement	Comments
<u>Vessel Thermal Response</u>			
1.2.2.2			Power during test was 50 kW.
1.2.3	55	Core Barrel Metal Temperatures	Power during test was 51 kW. TM-47C-90; a nonphysical dip at 360 seconds
	57	Vessel Wall Metal Temperatures	TM-63D-225; questionable data; thermocouple may have been disconnected from the wall.
1.2.4			Power during test was 51 kW.
1.2.5	85	Vessel Wall Metal Temperatures	Power during test was 50 kW. TM-78D-0; questionable data; from 375 to 425 seconds, data appear low.
1.3.1	116	Steam Flows	FT-SO-G1 and FT-SO-G3 failed. Power during test was 54 kW.
1.3.2	130	Steam Flows	FT-SO-G1 and FT-SO-G3 failed. Power during test was 56 kW.
1.3.3	None	Water Flows	All water flows were zero. Power during test was 56 kW.
<u>Countercurrent Flow</u>			
10.1.1	171	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.1	221	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.3.1	244	Pressure at Steam Flowmeters	P-SO-G; a nonphysical pressure spike at 812 seconds.
	255	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.4	272	Lower Plenum Fluid Temperatures	TM-263; questionable data.
12.1.5	289	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.6	306	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.7	309	Steam Flows	FT-SO-G3; questionable data; the data are below the range of the flowmeter.
	323	Lower Plenum Fluid Temperatures	TF-263; questionable data.

TABLE XXVI (contd.)

COMMENTS ON TRANSIENT TESTS

Test	Figure	Measurement	Comments
12.1.8	326	Steam Flows	FT-SO-G3; questionable data; the data are below the range of the flowmeter for most of the test.
	340	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.9	357	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.10	374	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.11	391	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.12	406	Vessel Wall Metal Temperatures	TM-218T and TM-218B; nonphysical spike at 768 seconds.
	408	Lower Plenum Fluid Temperatures	TF-263; questionable data.
	409	Lower Plenum Metal Temperatures	All channels; nonphysical spike at 768 seconds.
12.1.13	425	Lower Plenum Fluid Temperatures	TF-263; questionable data.
12.1.14	437	Core Barrel Metal Temperatures	TM-47C-285; questionable data
12.1.15	450	Cold Leg Mixing Temperatures	TF-CL-V2; questionable data; nonphysical spike at 568 seconds.
	457	Lower Plenum Fluid Temperatures	TF-263; questionable data.
14.1	491	Lower Plenum Fluid Temperatures	TF-263; questionable data.

Fig. 20 Water flows -- Test 1.2.1.2.

Fig. 21 Steam flow -- Test 1.2.1.2.

Fig. 22 Pressure at water flowmeters -- Test 1.2.1.2.

Fig. 23 System pressure -- Test 1.2.1.2.

Fig. 24 Pressure at steam flowmeters -- Test 1.2.1.2.

Fig. 25 Temperature at inlet flowmeters -- Test 1.2.1.2.

Fig. 26 Temperature at outlet flowmeters -- Test 1.2.1.2.

Fig. 27 Core barrel fluid temperatures -- Test 1.2.1.2.

Fig. 28 Core barrel metal temperatures -- Test 1.2.1.2.

Fig. 29 Vessel wall fluid temperatures -- Test 1.2.1.2.

Fig. 30 Vessel wall metal temperatures -- Test 1.2.1.2.

Fig. 31 Vessel wall metal temperatures -- Test 1.2.1.2.

Fig. 32 Lower plenum fluid temperature -- Test 1.2.1.2.

Fig. 33 Lower plenum metal temperatures -- Test 1.2.1.2.

Fig. 34 Water flows -- Test 1.2.2.2.

Fig. 35 Steam flows -- Test 1.2.2.2.

Fig. 36 Pressure at water flowmeters -- Test 1.2.2.2.

Fig. 37 System pressure -- Test 1.2.2.2.

Fig. 38 Pressure at steam flowmeters -- Test 1.2.2.2.

Fig. 39 Temperature at inlet flowmeters -- Test 1.2.2.2.

Fig. 40 Temperature at outlet flowmeters -- Test 1.2.2.2.

Fig. 41 Core barrel fluid temperatures -- Test 1.2.2.2.

Fig. 42 Core barrel metal temperatures -- Test 1.2.2.2.

Fig. 43 Vessel wall fluid temperatures -- Test 1.2.2.2.

Fig. 44 Vessel wall metal temperatures -- Test 1.2.2.2.

Fig. 45 Vessel wall metal temperatures -- Test 1.2.2.2.

Fig. 46 Lower plenum fluid temperature -- Test 1.2.2.2.

Fig. 47 Lower plenum metal temperatures -- Test 1.2.2.2.

Fig. 48 Water flows -- Test 1.2.3.

Fig. 49 Steam flows -- Test 1.2.3.

Fig. 50 Pressure at water flowmeters -- Test 1.2.3.

Fig. 51 Pressure at steam flowmeters -- Test 1.2.3.

Fig. 52 Temperature at inlet flowmeters -- Test 1.2.3.

Fig. 53 Temperature at outlet flowmeters -- Test 1.2.3.

Fig. 54 Core barrel fluid temperatures -- Test 1.2.3.

Fig. 55 Core barrel metal temperatures -- Test 1.2.3.

Fig. 56 Vessel wall fluid temperatures -- Test 1.2.3.

Fig. 57 Vessel wall metal temperatures -- Test 1.2.3.

Fig. 58 Vessel wall metal temperatures -- Test 1.2.3.

Fig. 59 Lower plenum fluid temperature -- Test 1.2.3.

Fig. 60 Lower plenum metal temperatures -- Test 1.2.3.

Fig. 61 Water flow -- Test 1.2.4.

Fig. 62 Steam flow -- Test 1.2.4.

Fig. 63 Pressure at water flowmeters -- Test 1.2.4.

Fig. 64 System pressure -- Test 1.2.4.

Fig. 65 Pressures at steam flowmeters -- Test 1.2.4.

Fig. 66 Temperature at inlet flowmeters -- Test 1.2.4.

Fig. 67 Temperature at outlet flowmeters -- Test 1.2.4.

Fig. 68 Core barrel fluid temperatures -- Test 1.2.4.

Fig. 69 Core barrel metal temperatures -- Test 1.2.4.

Fig. 70 Vessel wall fluid temperatures -- Test 1.2.4.

Fig. 71 Vessel wall metal temperatures -- Test 1.2.4.

Fig. 72 Vessel wall metal temperatures -- Test 1.2.4.

Fig. 73 Lower plenum fluid temperature -- Test 1.2.4

Fig. 74 Lower plenum metal temperatures -- Test 1.2.4.

Fig. 75 Water flows -- Test 1.2.5.

Fig. 76 Steam flows -- Test 1.2.5.

Fig. 77 Pressure at water flowmeters -- Test 1.2.5.

Fig. 78 System pressure -- Test 1.2.5.

Fig. 79 Pressures at steam flowmeters -- Test 1.2.5.

Fig. 80 Temperature at inlet flowmeters -- Test 1.2.5.

Fig. 81 Temperature at outlet flowmeters -- Test 1.2.5.

Fig. 82 Core barrel fluid temperatures -- Test 1.2.5.

Fig. 83 Core barrel metal temperatures -- Test 1.2.5.

Fig. 84 Vessel wall fluid temperatures -- Test 1.2.5.

Fig. 85 Vessel wall metal temperatures -- Test 1.2.5.

Fig. 86 Vessel wall metal temperatures -- Test 1.2.5.

Fig. 87 Lower plenum fluid temperature -- Test 1.2.5.

Fig. 88 Lower plenum metal temperatures -- Test 1.2.5.

Fig. 89 Water flows -- Test 1.2.6.

Fig. 90 Steam flow -- Test 1.2.6

Fig. 91 Pressure at water flowmeters -- Test 1.2.6.

Fig. 92 Pressure at steam flowmeters -- Test 1.2.6.

Fig. 93 Temperature at inlet flowmeters -- Test 1.2.6.

Fig. 94 Temperature at outlet flowmeters -- Test 1.2.6.

Fig. 95 Core barrel fluid temperatures -- Test 1.2.6.

Fig. 96 Core barrel metal temperatures -- Test 1.2.6.

Fig. 97 Vessel wall fluid temperatures -- Test 1.2.6.

Fig. 98 Vessel wall metal temperatures -- Test 1.2.6.

Fig. 99 Vessel wall metal temperatures -- Test 1.2.6.

Fig. 100 Lower plenum fluid temperature -- Test 1.2.6.

Fig. 101 Lower plenum metal temperatures -- Test 1.2.6.

Fig. 102 Water flows -- Test 1.2.7.

Fig. 103 Pressure at water flowmeters -- Test 1.2.7.

Fig. 104 System pressure -- Test 1.2.7.

Fig. 105 Pressure at steam flowmeters -- Test 1.2.7.

Fig. 106 Temperature at inlet flowmeters -- Test 1.2.7.

Fig. 107 Temperature at outlet flowmeters -- Test 1.2.7.

Fig. 108 Core barrel fluid temperatures -- Test 1.2.7.

Fig. 109 Core barrel metal temperatures -- Test 1.2.7.

Fig. 110 Vessel wall fluid temperatures -- Test 1.2.7.

Fig. 111 Vessel wall metal temperatures -- Test 1.2.7.

Fig. 112 Vessel wall metal temperatures -- Test 1.2.7.

Fig. 113 Lower plenum fluid temperature -- Test 1.2.7.

Fig. 114 Lower plenum metal temperatures -- Test 1.2.7.

Fig. 115 Water flow -- Test 1.3.1.

Fig. 116 Steam flow -- Test 1.3.1.

Fig. 117 Pressure at water flowmeters -- Test 1.3.1.

Fig. 118 System pressure -- Test 1.3.1.

Fig. 119 Pressure at steam flowmeters -- Test 1.3.1.

Fig. 120 Temperature at inlet flowmeters -- Test 1.3.1.

Fig. 121 Temperature at outlet flowmeters -- Test 1.3.1.

Fig. 122 Core barrel fluid temperatures -- Test 1.3.1.

Fig. 123 Core barrel metal temperatures -- Test 1.3.1.

Fig. 124 Vessel wall fluid temperatures -- Test 1.3.1.

Fig. 125 Vessel wall metal temperatures -- Test 1.3.1.

Fig. 126 Vessel wall metal temperatures -- Test 1.3.1.

Fig. 127 Lower plenum fluid temperature -- Test 1.3.1.

Fig. 128 Lower plenum metal temperatures -- Test 1.3.1.

Fig. 129 Water flow -- Test 1.3.2.

Fig. 130 Steam flow -- Test 1.3.2.

Fig. 131 Pressure at water flowmeters -- Test 1.3.2.

Fig. 132 System pressure -- Test 1.3.2.

Fig. 133 Pressure at steam flowmeters -- Test 1.3.2.

Fig. 134 Temperature at inlet flowmeters -- Test 1.3.2.

Fig. 135 Temperature at outlet flowmeters -- Test 1.3.2.

Fig. 136 Core barrel fluid temperatures -- Test 1.3.2.

Fig. 137 Core barrel metal temperatures -- Test 1.3.2.

Fig. 138 Vessel wall fluid temperatures -- Test 1.3.2.

Fig. 139 Vessel wall metal temperatures -- Test 1.3.2.

Fig. 140 Vessel wall metal temperatures -- Test 1.3.2.

Fig. 141 Lower plenum fluid temperatures -- Test 1.3.2.

3

Fig. 142 Lower plenum metal temperatures -- Test 1.3.2.

Fig. 143 Steam flows -- Test 1.3.3.

Fig. 144 Pressure at water flowmeters -- Test 1.3.3.

Fig. 145 System pressure -- Test 1.3.3.

Fig. 146 Pressure at steam flowmeters -- Test 1.3.3.

Fig. 147 Temperature at inlet flowmeters -- Test 1.3.3.

Fig. 148 Temperature at outlet flowmeters -- Test 1.3.3.

Fig. 149 Core barrel fluid temperatures -- Test 1.3.3.

Fig. 150 Core barrel metal temperatures -- Test 1.3.3.

Fig. 151 Vessel wall fluid temperatures -- Test 1.3.3.

Fig. 152 Vessel wall metal temperatures -- Test 1.3.3.

Fig. 153 Vessel wall metal temperatures -- Test 1.3.3.

Fig. 154 Lower plenum fluid temperature -- Test 1.3.3.

Fig. 155 Lower plenum metal temperatures -- Test 1.3.3.

Fig. 156 Water flows -- Test 10.1.1.

Fig. 157 Steam flows -- Test 10.1.1.

Fig. 158 Pressure at water flowmeters -- Test 10.1.1.

Fig. 159 System pressures -- Test 10.1.1.

Fig. 160 Pressure at steam flowmeters -- Test 10.1.1.

Fig. 161 Temperature at inlet flowmeters -- Test 10.1.1.

Fig. 162 Temperature at outlet flowmeters -- Test 10.1.1.

Fig. 163 Cold leg mixing temperatures -- Test 10.1.1.

Fig. 164 Differential pressure -- Test 10.1.1.

Fig. 165 Differential pressure -- Test 10.1.1.

Fig. 166 Core barrel fluid temperatures -- Test 10.1.1.

Fig. 167 Core barrel metal temperatures -- Test 10.1.1.

Fig. 168 Vessel wall fluid temperatures -- Test 10.1.1.

Fig. 169 Vessel wall metal temperatures -- Test 10.1.1.

Fig. 170 Vessel wall metal temperatures -- Test 10.1.1.

Fig. 171 Lower plenum fluid temperatures -- Test 10.1.1.

Fig. 172 Lower plenum metal temperatures -- Test 10.1.1.

Fig. 173 Water flows -- Test 10.1.2.

Fig. 174 Steam flows -- Test 10.1.2.

Fig. 175 Pressure at water flowmeters -- Test 10.1.2.

Fig. 176 System pressures -- Test 10.1.2.

Fig. 177 Pressure at steam flowmeters -- Test 10.1.2.

Fig. 178 Temperature at inlet flowmeters -- Test 10.1.2.

Fig. 179 Temperature at outlet flowmeters -- Test 10.1.2.

Fig. 180 Differential pressure -- Test 10.1.2.

Fig. 181 Differential pressure -- Test 10.1.2.

Fig. 182 Core barrel fluid temperatures -- Test 10.1.2.

Fig. 183 Core barrel metal temperatures -- Test 10.1.2.

Fig. 184 Vessel wall fluid temperatures -- Test 10.1.2.

Fig. 185 Vessel wall metal temperatures -- Test 10.1.2.

Fig. 186 Vessel wall metal temperatures -- Test 10.1.2.

Fig. 187 Lower plenum fluid temperatures -- Test 10.1.2.

Fig. 188 Lower plenum metal temperatures -- Test 10.1.2.

Fig. 189 Water flows -- Test 10.1.3.

Fig. 190 Steam flows -- Test 10.1.3.

Fig. 191 Pressure at water flowmeters -- Test 10.1.3.

Fig. 192 System pressures -- Test 10.1.3.

Fig. 193 Pressure at steam flowmeters -- Test 10.1.3.

Fig. 194 Temperature at inlet flowmeters -- Test 10.1.3.

Fig. 195 Temperature at outlet flowmeters -- Test 10.1.3.

Fig. 196 Cold leg mixing temperatures -- Test 10.1.3.

Fig. 197 Differential pressure -- Test 10.1.3.

Fig. 198 Differential pressure -- Test 10.1.3.

Fig. 199 Core barrel fluid temperatures -- Test 10.1.3.

Fig. 200 Core barrel metal temperatures -- Test 10.1.3.

Fig. 201 Vessel wall fluid temperatures -- Test 10.1.3.

Fig. 202 Vessel wall metal temperatures -- Test 10.1.3.

Fig. 203 Vessel wall metal temperatures -- Test 10.1.3.

Fig. 204 Lower plenum fluid temperatures -- Test 10.1.3.

Fig. 205 Lower plenum metal temperatures -- Test 10.1.3.

Fig. 206 Water flows -- Test 12.1.1.

Fig. 207 Steam flows -- Test 12.1.1.

Fig. 208 Pressure at water flowmeters -- Test 12.1.1.

Fig. 209 System pressures -- Test 12.1.1.

Fig. 210 Pressure at steam flowmeters -- Test 12.1.1.

Fig. 211 Temperature at inlet flowmeters -- Test 12.1.1.

Fig. 212 Temperature at outlet flowmeters -- Test 12.1.1.

Fig. 213 Cold leg mixing temperatures -- Test 12.1.1.

Fig. 214 Differential pressure -- Test 12.1.1.

Fig. 215 Differential pressure -- Test 12.1.1.

Fig. 216 Core barrel fluid temperatures -- Test 12.1.1.

Fig. 217 Core barrel metal temperatures -- Test 12.1.1.

Fig. 218 Vessel wall fluid temperatures -- Test 12.1.1.

Fig. 219 Vessel wall metal temperatures -- Test 12.1.1.

Fig. 220 Vessel wall metal temperatures -- Test 12.1.1.

Fig. 221 Lower plenum fluid temperatures -- Test 12.1.1.

Fig. 222 Lower plenum metal temperatures -- Test 12.1.1.

Fig. 223 Water flows -- Test 12.1.2.

Fig. 224 Steam flows -- Test 12.1.2.

Fig. 225 Pressure at water flowmeters -- Test 12.1.2.

Fig. 226 System pressures -- Test 12.1.2.

Fig. 227 Pressure at steam flowmeters -- Test 12.1.2.

Fig. 228 Temperature at inlet flowmeters -- Test 12.1.2.

Fig. 229 Temperature at outlet flowmeters -- Test 12.1.2.

Fig. 230 Cold leg mixing temperatures -- Test 12.1.2.

Fig. 231 Differential pressure -- Test 12.1.2.

Fig. 232 Differential pressure -- Test 12.1.2.

Fig. 233 Core barrel fluid temperatures -- Test 12.1.2.

Fig. 234 Core barrel metal temperatures -- Test 12.1.2.

Fig. 235 Vessel wall fluid temperatures -- Test 12.1.2.

Fig. 236 Vessel wall metal temperatures -- Test 12.1.2.

Fig. 237 Vessel wall metal temperatures -- Test 12.1.2.

Fig. 238 Lower plenum fluid temperatures -- Test 12.1.2.

Fig. 239 Lower plenum metal temperatures -- Test 12.1.2.

Fig. 240 Water flows -- Test 12.1.3.1.

Fig. 241 Steam flows -- Test 12.1.3.1.

Fig. 242 Pressure at water flowmeters -- Test 12.1.3.1.

Fig. 243 System pressures -- Test 12.1.3.1.

Fig. 244 Pressure at steam flowmeters -- Test 12.1.3.1.

Fig. 245 Temperature at inlet flowmeters -- Test 12.1.3.1.

Fig. 246 Temperature at outlet flowmeters -- Test 12.1.3.1.

Fig. 247 Cold leg mixing temperatures -- Test 12.1.3.1.

Fig. 248 Differential pressure -- Test 12.1.3.1.

Fig. 249 Differential pressure -- Test 12.1.3.1.

Fig. 250 Core barrel fluid temperatures -- Test 12.1.3.1.

Fig. 251 Core barrel metal temperatures -- Test 12.1.3.1.

Fig. 252 Vessel wall fluid temperatures -- Test 12.1.3.1.

Fig. 253 Vessel wall metal temperatures -- Test 12.1.3.1.

Fig. 254 Vessel wall metal temperatures -- Test 12.1.3.1.

Fig. 255 Lower plenum fluid temperatures -- Test 12.1.3.1.

Fig. 256 Lower plenum metal temperatures -- Test 12.1.3.1.

Fig. 257 Water flows -- Test 12.1.4.

Fig. 258 Steam flows -- Test 12.1.4.

Fig. 259 Pressure at water flowmeters -- Test 12.1.4.

Fig. 260 System pressures -- Test 12.1.4.

Fig. 261 Pressure at steam flowmeters -- Test 12.1.4.

Fig. 262 Temperature at inlet flowmeters -- Test 12.1.4.

Fig. 263 Temperature at outlet flowmeters -- Test 12.1.4.

Fig. 264 Cold leg mixing temperatures -- Test 12.1.4.

Fig. 265 Differential pressure -- Test 12.1.4.

Fig. 266 Differential pressure -- Test 12.1.4.

Fig. 267 Core barrel fluid temperatures -- Test 12.1.4.

Fig. 268 Core barrel metal temperatures -- Test 12.1.4.

Fig. 269 Vessel wall fluid temperatures -- Test 12.1.4.

Fig. 270 Vessel wall metal temperatures -- Test 12.1.4.

Fig. 271 Vessel wall metal temperatures -- Test 12.1.4.

Fig. 272 Lower plenum fluid temperatures -- Test 12.1.4.

Fig. 273 Lower plenum metal temperatures -- Test 12.1.4.

Fig. 274 Water flows -- Test 12.1.5.

Fig. 275 Steam flows -- Test 12.1.5.

Fig. 276 Pressure at water flowmeters -- Test 12.1.5.

Fig. 277 System pressures -- Test 12.1.5.

Fig. 278 Pressure at steam flowmeters -- Test 12.1.5.

Fig. 279 Temperature at inlet flowmeters -- Test 12.1.5.

Fig. 280 Temperature at outlet flowmeters -- Test 12.1.5.

Fig. 281 Cold leg mixing temperatures -- Test 12.1.5.

Fig. 282 Differential pressure -- Test 12.1.5.

Fig. 283 Differential pressure -- Test 12.1.5.

Fig. 284 Core barrel fluid temperatures -- Test 12.1.5.

Fig. 285 Core barrel metal temperatures -- Test 12.1.5.

Fig. 286 Vessel wall fluid temperatures -- Test 12.1.5.

Fig. 287 Vessel wall metal temperatures -- Test 12.1.5.

Fig. 288 Vessel wall metal temperatures -- Test 12.1.5.

Fig. 289 Lower plenum fluid temperatures -- Test 12.1.5.

Fig. 290 Lower plenum metal temperatures -- Test 12.1.5.

Fig. 291 Water flows -- Test 12.1.6.

Fig. 292 Steam flows -- Test 12.1.6.

Fig. 293 Pressure at water flowmeters -- Test 12.1.6.

Fig. 294 System pressures -- Test 12.1.6.

Fig. 295 Pressure at steam flowmeters -- Test 12.1.6.

Fig. 296 Temperature at inlet flowmeters -- Test 12.1.6.

Fig. 297 Temperature at outlet flowmeters -- Test 12.1.6.

Fig. 298 Cold leg mixing temperatures -- Test 12.1.6.

Fig. 299 Differential pressure -- Test 12.1.6.

Fig. 300 Differential pressure -- Test 12.1.6.

Fig. 301 Core barrel fluid temperatures -- Test 12.1.6.

Fig. 302 Core barrel metal temperatures -- Test 12.1.6.

Fig. 303 Vessel wall fluid temperatures -- Test 12.1.6.

Fig. 304 Vessel wall metal temperatures -- Test 12.1.6.

Fig. 305 Vessel wall metal temperatures -- Test 12.1.6.

Fig. 306 Lower plenum fluid temperatures -- Test 12.1.6.

Fig. 307 Lower plenum metal temperatures -- Test 12.1.6.

Fig. 308 Water flows -- Test 12.1.7.

Fig. 309 Steam flows -- Test 12.1.7.

Fig. 310 Pressure at water flowmeters -- Test 12.1.7.

Fig. 311 System pressures -- Test 12.1.7.

Fig. 312 Pressure at steam flowmeters -- Test 12.1.7.

Fig. 313 Temperature at inlet flowmeters -- Test 12.1.7.

Fig. 314 Temperature at outlet flowmeters -- Test 12.1.7.

Fig. 315 Cold leg mixing temperatures -- Test 12.1.7.

Fig. 316 Differential pressure -- Test 12.1.7.

Fig. 317 Differential pressure -- Test 12.1.7.

Fig. 318 Core barrel fluid temperatures -- Test 12.1.7.

Fig. 319 Core barrel metal temperatures -- Test 12.1.7.

Fig. 320 Vessel wall fluid temperatures -- Test 12.1.7.

Fig. 321 Vessel wall metal temperatures -- Test 12.1.7.

Fig. 322 Vessel wall metal temperatures -- Test 12.1.7.

Fig. 323 Lower plenum fluid temperatures -- Test 12.1.7.

Fig. 324 Lower plenum metal temperatures -- Test 12.1.7.

Fig. 325 Water flows -- Test 12.1.8.

Fig. 326 Steam flows -- Test 12.1.8.

Fig. 327 Pressure at water flowmeters -- Test 12.1.8.

Fig. 328 System pressures -- Test 12.1.8.

Fig. 329 Pressure at steam flowmeters -- Test 12.1.8.

Fig. 330 Temperature at inlet flowmeters -- Test 12.1.8.

Fig. 331 Temperature at outlet flowmeters -- Test 12.1.8.

Fig. 332 Cold leg mixing temperatures -- Test 12.1.8.

Fig. 333 Differential pressure -- Test 12.1.8.

Fig. 334 Differential pressure -- Test 12.1.8.

Fig. 335 Core barrel fluid temperatures -- Test 12.1.8.

Fig. 336 Core barrel metal temperatures -- Test 12.1.8.

Fig. 337 Vessel wall fluid temperatures -- Test 12.1.8.

Fig. 338 Vessel wall metal temperatures -- Test 12.1.8.

Fig. 339 Vessel wall metal temperatures -- Test 12.1.8.

Fig. 340 Lower plenum fluid temperatures -- Test 12.1.8.

Fig. 341 Lower plenum metal temperatures -- Test 12.1.8.

Fig. 342 Water flows -- Test 12.1.9.

Fig. 343 Steam flows -- Test 12.1.9.

Fig. 344 Pressure at water flowmeters -- Test 12.1.9.

Fig. 345 System pressures -- Test 12.1.9.

Fig. 346 Pressure at steam flowmeters -- Test 12.1.9.

Fig. 347 Temperature at inlet flowmeters -- Test 12.1.9.

Fig. 348 Temperature at outlet flowmeters -- Test 12.1.9.

Fig. 349 Cold leg mixing temperatures -- Test 12.1.9.

Fig. 350 Differential pressure -- Test 12.1.9.

Fig. 351 Differential pressure -- Test 12.1.9.

Fig. 352 Core barrel fluid temperatures -- Test 12.1.9.

Fig. 353 Core barrel metal temperatures -- Test 12.1.9.

Fig. 354 Vessel wall fluid temperatures -- Test 12.1.9.

Fig. 355 Vessel wall metal temperatures -- Test 12.1.9.

Fig. 356 Vessel wall metal temperatures -- Test 12.1.9.

Fig. 357 Lower plenum fluid temperatures -- Test 12.1.9.

Fig. 358 Lower plenum metal temperatures -- Test 12.1.9.

Fig. 359 Water flows -- test 12.1.10.

Fig. 360 Steam flows -- Test 12.1.10.

Fig. 361 Pressure at water flowmeters -- Test 12.1.10.

Fig. 362 System pressures -- Test 12.1.10.

Fig. 363 Pressure at steam flowmeters -- Test 12.1.10.

Fig. 364 Temperature at inlet flowmeters -- Test 12.1.10.

Fig. 365 Temperature at outlet flowmeters -- Test 12.1.10.

Fig. 366 Cold leg mixing temperatures -- Test 12.1.10.

Fig. 367 Differential pressure -- Test 12.1.10.

Fig. 368 Differential pressure -- Test 12.1.10.

Fig. 369 Core barrel fluid temperatures -- Test 12.1.10.

Fig. 370 Core barrel metal temperatures -- Test 12.1.10.

Fig. 371 Vessel wall fluid temperatures -- Test 12.1.10.

Fig. 372 Vessel wall metal temperatures -- Test 12.1.10.

Fig. 373 Vessel wall metal temperatures -- Test 12.1.10.

Fig. 374 Lower plenum fluid temperatures -- Test 12.1.10.

Fig. 375 Lower plenum metal temperatures -- Test 12.1.10.

Fig. 376 Water flows -- Test 12.1.11.

Fig. 377 Steam flows -- Test 12.1.11.

Fig. 378 Pressure at water flowmeters -- Test 12.1.11.

Fig. 379 System pressures -- Test 12.1.11.

Fig. 380 Pressure at steam flowmeters -- Test 12.1.11.

Fig. 381 Temperature at inlet flowmeters -- Test 12.1.11.

Fig. 382 Temperature at outlet flowmeters -- Test 12.1.11.

Fig. 383 Cold leg mixing temperatures -- Test 12.1.11.

Fig. 384 Differential pressure -- Test 12.1.11.

Fig. 385 Differential pressure -- Test 12.1.11.

Fig. 386 Core barrel fluid temperatures -- Test 12.1.11.

Fig. 387 Core barrel metal temperatures -- Test 12.1.11.

Fig. 388 Vessel wall fluid temperatures -- Test 12.1.11.

Fig. 389 Vessel wall metal temperatures -- Test 12.1.11.

Fig. 390 Vessel wall metal temperatures -- Test 12.1.11.

Fig. 391 Lower plenum fluid temperatures -- Test 12.1.11.

Fig. 392 Lower plenum metal temperatures -- Test 12.1.11.

Fig. 393 Water flows -- Test 12.1.12.

Fig. 394 Steam flows -- Test 12.1.12.

Fig. 395 Pressure at water flowmeters -- Test 12.1.12.

Fig. 396 System pressures -- Test 12.1.12.

Fig. 397 Pressure at steam flowmeters -- Test 12.1.12.

Fig. 398 Temperature at inlet flowmeters -- Test 12.1.12.

Fig. 399 Temperature at outlet flowmeters -- Test 12.1.12.

Fig. 400 Cold leg mixing temperatures -- Test 12.1.12.

Fig. 401 Differential pressure -- Test 12.1.12.

Fig. 402 Differential pressure -- Test 12.1.12.

Fig. 403 Core barrel fluid temperatures -- Test 12.1.12.

Fig. 404 Core barrel metal temperatures -- Test 12.1.12.

Fig. 405 Vessel wall fluid temperatures -- Test 12.1.12.

Fig. 406 Vessel wall metal temperatures -- Test 12.1.12.

Fig. 407 Vessel wall metal temperatures -- Test 12.1.12.

Fig. 408 Lower plenum fluid temperatures -- Test 12.1.12.

Fig. 409 Lower plenum metal temperatures -- Test 12.1.12.

Fig. 410 Water flows -- Test 12.1.13.

Fig. 411 Steam flows -- Test 12.1.13.

Fig. 412 Pressure at water flowmeters -- Test 12.1.13.

Fig. 413 System pressures -- Test 12.1.13.

Fig. 414 Pressure at steam flowmeters -- Test 12.1.13.

Fig. 415 Temperature at inlet flowmeters -- Test 12.1.13.

Fig. 416 Temperature at outlet flowmeters -- Test 12.1.13.

Fig. 417 Cold leg mixing temperatures -- Test 12.1.13.

Fig. 418 Differential pressure -- Test 12.1.13.

Fig. 419 Differential pressure -- Test 12.1.13.

Fig. 420 Core barrel fluid temperatures -- Test 12.1.13.

Fig. 421 Core barrel metal temperatures -- Test 12.1.13.

Fig. 422 Vessel wall fluid temperatures -- Test 12.1.13.

Fig. 423 Vessel wall metal temperatures -- Test 12.1.13.

Fig. 424 Vessel wall metal temperatures -- Test 12.1.13.

Fig. 425 Lower plenum fluid temperatures -- Test 12.1.13.

Fig. 426 Lower plenum metal temperatures -- Test 12.1.13.

Fig. 427 Water flows -- Test 12.1.14.

Fig. 428 Steam flows -- Test 12.1.14.

Fig. 429 Pressure at water flowmeters -- Test 12.1.14.

Fig. 430 System pressures -- Test 12.1.14.

Fig. 431 Pressure at steam flowmeters -- Test 12.1.14.

Fig. 432 Temperature at inlet flowmeters -- Test 12.1.14.

Fig. 433 Temperature at outlet flowmeters -- Test 12.1.14.

Fig. 434 Cold leg mixing temperatures -- Test 12.1.14.

Fig. 435 Differential pressure -- Test 12.1.14.

Fig. 436 Core barrel fluid temperatures -- Test 12.1.14.

Fig. 437 Core barrel metal temperatures -- Test 12.1.14.

Fig. 438 Vessel wall fluid temperatures -- Test 12.1.14.

Fig. 439 Vessel wall metal temperatures -- Test 12.1.14.

Fig. 440 Vessel wall metal temperatures -- Test 12.1.14.

Fig. 441 Lower plenum fluid temperatures -- Test 12.1.14.

Fig. 442 Lower plenum metal temperatures -- Test 12.1.14.

Fig. 443 Water flows -- Test 12.1.15.

Fig. 444 Steam flows -- Test 12.1.15.

Fig. 445 Pressure at water flowmeters -- Test 12.1.15.

Fig. 446 System pressures -- Test 12.1.15.

Fig. 447 Pressure at steam flowmeters -- Test 12.1.15.

Fig. 448 Temperature at inlet flowmeters -- Test 12.1.15.

Fig. 449 Temperature at outlet flowmeters -- Test 12.1.15.

Fig. 450 Cold leg mixing temperatures -- Test 12.1.15.

Fig. 451 Differential pressure -- Test 12.1.15.

Fig. 452 Core barrel fluid temperatures -- Test 12.1.15.

Fig. 453 Core barrel metal temperatures -- Test 12.1.15.

Fig. 454 Vessel wall fluid temperatures -- Test 12.1.15.

Fig. 455 Vessel wall metal temperatures -- Test 12.1.15.

Fig. 456 Vessel wall metal temperatures -- Test 12.1.15.

Fig. 457 Lower plenum fluid temperatures -- Test 12.1.15.

Fig. 458 Lower plenum metal temperatures -- Test 12.1.15.

Fig. 459 Water flows -- Test 13.1.

Fig. 460 Steam flows -- Test 13.1.

Fig. 461 Pressure at water flowmeters -- Test 13.1.

Fig. 462 System pressures -- Test 13.1.

Fig. 463 Pressure at steam flowmeters -- Test 13.1.

Fig. 464 Temperature at inlet flowmeters -- Test 13.1.

Fig. 465 Temperature at outlet flowmeters -- Test 13.1.

Fig. 466 Cold leg mixing temperatures -- Test 13.1.

Fig. 467 Differential pressure -- Test 13.1.

Fig. 468 Differential pressure -- Test 13.1.

Fig. 469 Core barrel fluid temperatures -- Test 13.1.

Fig. 470 Core barrel metal temperatures -- Test 13.1.

Fig. 471 Vessel wall fluid temperatures -- Test 13.1.

Fig. 472 Vessel wall metal temperatures -- Test 13.1.

Fig. 473 Vessel wall metal temperatures -- Test 13.1.

Fig. 474 Lower plenum fluid temperatures -- Test 13.1.

Fig. 475 Lower plenum metal temperatures -- Test 13.1.

Fig. 476 Water flows -- Test 14.1.

Fig. 477 Steam flows -- Test 14.1.

Fig. 478 Pressure at water flowmeters -- Test 14.1.

Fig. 479 System pressures -- Test 14.1.

Fig. 480 Pressure at steam flowmeters -- Test 14.1.

Fig. 481 Temperature at inlet flowmeters -- Test 14.1.

Fig. 482 Temperature at outlet flowmeters -- Test 14.1.

Fig. 483 Cold leg mixing temperatures -- Test 14.1.

Fig. 484 Differential pressure -- Test 14.1.

Fig. 485 Differential pressure -- Test 14.1.

Fig. 486 Core barrel fluid temperatures -- Test 14.1.

Fig. 487 Core barrel metal temperatures -- Test 14.1.

Fig. 488 Vessel wall fluid temperatures -- Test 14.1.

Fig. 489 Vessel wall metal temperatures -- Test 14.1.

Fig. 490 Vessel wall metal temperatures -- Test 14.1.

Fig. 491 Lower plenum fluid temperatures -- Test 14.1.

Fig. 492 Lower plenum metal temperatures -- Test 14.1.

Fig. 493 Water flows -- Test 14.2.

Fig. 494 Steam flows -- Test 14.2.

Fig. 495 Pressure at water flowmeters -- Test 14.2.

Fig. 496 System pressures -- Test 14.2.

Fig. 497 Pressure at steam flowmeters -- Test 14.2.

Fig. 498 Temperature at inlet flowmeters -- Test 14.2.

Fig. 499 Temperature at outlet flowmeters -- Test 14.2.

Fig. 501 Differential pressure -- Test 14.2.

Fig. 500 Cold leg mixing temperatures -- Test 14.2.

Fig. 502 Differential pressure -- Test 14.2.

Fig. 503 Core barrel fluid temperatures -- Test 14.2.

Fig. 504 Core barrel metal temperatures -- Test 14.2.

Fig. 505 Vessel wall fluid temperatures -- Test 14.2.

Fig. 506 Vessel wall metal temperatures -- Test 14.2.

Fig. 507 Vessel wall metal temperatures -- Test 14.2.

Fig. 508 Lower plenum fluid temperatures -- Test 14.2.

Fig. 509 Lower plenum metal temperatures -- Test 14.2.

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APPENDIX A

PIPING DETAILS FOR COUNTERCURRENT FLOW TEST SYSTEM

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PIPING DETAILS FOR COUNTERCURRENT FLOW TEST SYSTEM

Figure A-1 shows details and dimensions of piping used to route fluid to, and remove fluid from, the various components.

Fig. A-1. Piping details of semiscale system for countercurrent flow tests (sheet 1 of 2).

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Fig. A-1. Piping details of semiscale system for countercurrent flow tests (sheet 2 of 2).

APPENDIX B
DATA ERROR ANALYSIS

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DATA ERROR ANALYSIS

An error analysis was performed for a representative test (Test 9.1). The final product of this analysis was error bands based on the following assumptions:

- (1) Each input to the total probable or total maximum error is normally distributed.
- (2) The maximum error limits (reported in Table I of the main body of the test) for each measurement device assumes 95% of the area of a normal distribution is between the maximum error limits.
- (3) The inputs to the total probable or total maximum error are independent.
- (4) Measurements were not adversely affected by nonhomogeneous flow.

An abbreviated Taylor series expansion may be used to obtain a first order approximation to the total probable error^[B-1] in $J_g^* D^{1/2}$ and $J_f^* D^{1/2}$. This Taylor series expansion can be more clearly presented if $j_g^* D^{1/2}$ is assigned to be the independent variable y and $j_f^* D^{1/2}$ is the dependent variable x . With this definition, the Taylor series expansion which defines the error in $J_g^* D^{1/2}$ is:

$$\left(\frac{dy}{y}\right)^2 = \sum \left(\frac{\partial y}{\partial z_i}\right)^2 \left(\frac{dz_i}{y}\right)^2$$

and the error in $J_f^* D^{1/2}$ is:

$$\left(\frac{dx}{x}\right)^2 = \sum \left(\frac{\partial x}{\partial z_i}\right)^2 \left(\frac{dz_i}{x}\right)^2$$

where

$$i = 1, 2, 3, \dots n.$$

The experimentally measured variables, $z_1, z_2, \dots, z_i$, when combined in a mathematical relationship (discussed later), define either $j_f^* D^{1/2}$ or $j_g^* D^{1/2}$. The error computed by the preceding method is referred to in this text as the probable error.

From a statistical viewpoint, the quantity actually being propagated in the preceding equations is two times the coefficient of variance or "the relative error". Stated mathematically:

$$\frac{\partial y}{\partial z_i} \frac{dz_i}{y} \approx \frac{2 \sigma_i}{\hat{z}_i}$$

where σ_i is the variance associated with z_i and $\hat{z}_i$ is the true value. With the preceding definition,

$$\frac{dy}{\hat{y}} = \frac{2 \sigma_y}{\hat{y}}$$

where σ_y is the variance of $j_g^* D^{1/2}$ from the combined measurements which define $J_g^* D^{1/2}$. In a similar manner, σ_x can be defined.

In addition to the probable error, a maximum error was computed. The maximum error is defined as the error that would result if all the instruments which combine to make $j_g^* D^{1/2}$ and $j_f^* D^{1/2}$ read in such a way that the total error is the sum of the individual inaccuracies. Mathematically stated:

$$\begin{aligned} \frac{dy}{y} \big|_{\max} &= \sum \left| \frac{\partial y}{\partial z_i} \frac{dz_i}{x} \right| \\ \frac{dx}{x} \big|_{\max} &= \sum \left| \frac{\partial x}{\partial z_i} \frac{dz_i}{x} \right| . \end{aligned}$$

When the relationship between two variables is considered, one variable is usually expected to be more precisely determined than the other, or the uncertainty of measurement can be solely attributed to the dependent variable y ; that is,

$$\frac{dx}{x} < < \frac{dy}{y} .$$

This type of relationship is not always the case. The error in the dependent and independent variables can be of the same order of magnitude. In such a case, the method suggested in Reference B-1 is to assign all of the error to the dependent variable in the following manner:

$$\sigma_j = \sqrt{\left(\frac{dx}{x}\right)^2 + \left(\frac{dy}{y}\right)^2}$$

where σ_j is the new uncertainty assigned to the dependent variable.

The uncertainties in $j_g^* D^{1/2}$ and $j_f^* D^{1/2}$ for the steady state countercurrent flow tests were of the same order of magnitude; therefore, the uncertainties in $j_g^* D^{1/2}$ and $j_g^* D^{1/2}$ were combined by the technique mentioned and assigned to the dependent variable $j_g^* D^{1/2}$.

Errors associated with transient tests are simply those associated with individual measurement errors because minimal data reduction was done.

1. DISCUSSION

The data from the semiscale system steady state countercurrent flow tests are correlated by using the following nondimensional quantities:

5

$$\begin{aligned}
 j_g^* &= j_g \left(\frac{\rho_g}{gD (\rho_f - \rho_g)} \right)^{1/2} \\
 j_f^* &= j_f \left(\frac{\rho_f}{gD (\rho_f - \rho_g)} \right)^{1/2}
 \end{aligned}
 \tag{B-1}$$

where

$$D = D_0 - D_i.$$

To find the error in $j_g^* D^{1/2}$ and $j_f^* D^{1/2}$ total differentials must be obtained; that is

$$d \sqrt{j_g^* D^{1/2}} = \frac{1}{2} \frac{d(j_g^* D^{1/2})}{\sqrt{j_g^* D^{1/2}}}.$$

Division by $\sqrt{j_g^* D^{1/2}}$ results in:

$$\frac{d \sqrt{j_g^* D^{1/2}}}{\sqrt{j_g^* D^{1/2}}} = \frac{1}{2} \frac{d(j_g^* D^{1/2})}{j_g^* D^{1/2}}. \tag{B-2}$$

The error in $d(j_g^* D^{1/2})^{1/2} / (j_g^* D^{1/2})^{1/2}$ is one-half the error of $d(j_g^* D^{1/2}) / (j_g^* D^{1/2})$. Thus, for ease of presentation $(j_g^* D^{1/2}) / (j_g^* D^{1/2})$ is developed.

The location notation shown in Figure B-1 is used to facilitate the presentation of the mathematical model.

1.1 Errors

The magnitude of errors in the gas volumetric flux may be estimated by determining the total differential in terms of basic measured quantities as follows.

Multiplication of Equation (B-1) by $D^{1/2}$ results in:

$$j_g^* D^{1/2} = j_g \left(\frac{\rho_g}{g (\rho_f - \rho_g)} \right)^{1/2} \tag{B-3}$$

such that $j_g^* D^{1/2}$ is a function of j_g , ρ_g , and ρ_f . The total differential of $j_g^* D^{1/2}$ is:

$$d(j_g^* D^{1/2}) = \frac{\partial(j_g^* D^{1/2})}{\partial j_g} d j_g + \frac{\partial(j_g^* D^{1/2})}{\partial \rho_g} d \rho_g + \frac{\partial(j_g^* D^{1/2})}{\partial \rho_f} d \rho_f. \tag{B-4}$$

Location	Location Description
1	Lower Section of Downcomer Annulus
2	Vessel Inlet
3	Vessel Outlet
4	Cold Leg
5	Core Outlet
6	Separator Inlet
7	Separator Outlet (liquid)
8	Separator Outlet (gas)

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Fig. B-1 Data error analysis subscript notation for system locations.

The partial differentials of Equation (B-4) are:

$$\frac{\partial (j_g^* D^{\frac{1}{2}})}{\partial j_g} = \left(\frac{\rho_g}{g (\rho_f - \rho_g)} \right)^{\frac{1}{2}} \quad (B-5)$$

$$\frac{\partial (j_g^* D^{\frac{1}{2}})}{\partial \rho_g} = \frac{1}{2} j_g \left(\frac{1}{g (\rho_f - \rho_g)} \right)^{\frac{1}{2}} \left(\frac{1}{\rho_g^{\frac{1}{2}}} + \frac{\rho_g^{\frac{1}{2}}}{(\rho_f - \rho_g)} \right) \quad (B-6)$$

$$\frac{\partial (j_g^* D^{\frac{1}{2}})}{\partial \rho_f} = -\frac{1}{2} j_g \left(\frac{\rho_g}{g (\rho_f - \rho_g)} \right)^{\frac{1}{2}} \frac{d \rho_f}{(\rho_f - \rho_g)} \quad (B-7)$$

The total differential of Equation (B-3), from Equations (B-4), (B-5), (B-6), and (B-7), is:

$$\begin{aligned} d(j_g^* D^{\frac{1}{2}}) = & \left(\frac{\rho_g}{g (\rho_f - \rho_g)} \right)^{\frac{1}{2}} d j_g - \frac{1}{2} j_g \left(\frac{\rho_g}{g (\rho_f - \rho_g)} \right)^{\frac{1}{2}} \frac{d \rho_f}{(\rho_f - \rho_g)} \\ & + \frac{1}{2} j_g \left(\frac{1}{g (\rho_f - \rho_g)} \right)^{\frac{1}{2}} \left(\frac{1}{\rho_g^{\frac{1}{2}}} + \frac{\rho_g^{\frac{1}{2}}}{(\rho_f - \rho_g)} \right) d \rho_g \end{aligned} \quad (B-8)$$

Then division of Equation (B-8) by Equation (B-3) results in:

$$\frac{d(j_g^* D^{\frac{1}{2}})}{j_g^* D^{\frac{1}{2}}} = \frac{d j_g}{j_g} - \frac{1}{2} \left(\frac{\rho_f}{\rho_f - \rho_g} \right) \frac{d \rho_f}{\rho_f} + \frac{1}{2} \left(1 + \frac{\rho_g}{\rho_f - \rho_g} \right) \frac{d \rho_g}{\rho_g} \quad (B-9)$$

Equation (B-9) must be further broken down into experimentally measurable quantities, and error considerations must be directed to these quantities. The quotient $\frac{dj_g}{j_g}$ is one term not directly measurable, but

$$\frac{d j_g}{j_g} = \frac{d Q_g}{Q_g} \frac{-dA}{A} \quad (B-10)$$

The countercurrent flow tests were designed to aid in understanding fluid behavior in the downcomer annulus and, therefore, measurements of volumetric flow rates were needed in that region for calculation of meaningful volumetric fluxes. Unfortunately, to make these measurements directly in the downcomer region was not practical and turbine flowmeters near the vessel inlets and the separator outlets were utilized for flow measurements. Pressure, temperature, and fluid state changes between the measurement location and the downcomer region produce differences in volumetric flows at these two locations. In order to compute the error terms associated with these differences in volumetric flows, the following procedure was used. The difference in volumetric flow between the vessel inlet and the lower end of the downcomer was estimated from the difference between the volumetric flows measured at the vessel inlet and the separator outlet. Here, the approximation was that the volumetric flow change is directly proportional to the length of the flow path over which the change can occur.

If

l_{5-1} is equal to the distance from the inlet turbine flowmeter to the downcomer and

l_{1-8} is equal to the distance from the downcomer to the outlet turbine flowmeter,

the loss of gas is:

$$m_{g1} = m_{g5} - \frac{l_{5-1}}{l_{5-1} + l_{1-8}} \Delta m_g$$

where

Δm_g = mass of steam condensed to water in the flow path from the vessel inlet to the separator outlet.

$$= m_{gin} - m_{gout} = m_{g5} - m_{g8}.$$

Since

$$m_g = Q_g / v_g,$$

then

$$\frac{Q_{g1}}{v_{g1}} = \frac{Q_{g5}}{v_{g5}} - \frac{l_{5-1}}{l_{5-1} + l_{1-8}} \left(\frac{Q_{g5}}{v_{g5}} - \frac{Q_{g8}}{v_{g8}} \right).$$

Therefore,

$$Q_{g1} = \left((1-K) \frac{Q_{g5}}{v_{g5}} + K \frac{Q_{g8}}{v_{g8}} \right) v_{g1} \quad (B-11)$$

where

$$K = \frac{l_{5-1}}{l_{5-1} + l_{1-8}}.$$

By taking the derivative of Q_{g1} and dividing by Q_{g1}

$$\frac{d Q_{g1}}{Q_{g1}} = \frac{d v_{g1}}{v_{g1}} + \frac{\frac{(1-K)}{v_{g5}^2} (v_{g5} d Q_{g5} - Q_{g5} d v_{g5}) + \frac{K}{v_{g8}^2} (v_{g8} d Q_{g8} - Q_{g8} d v_{g8})}{\left[(1-K) \left(\frac{Q_{g5}}{v_{g5}} \right) + K \left(\frac{Q_{g8}}{v_{g8}} \right) \right]} \quad (B-12)$$

The terms in Equation (B-12) which are not directly measurable are v_{g1} , v_{g5} , and v_{g8} .

v_{g1} is a function of temperature and pressure in a saturated steam and water system. When the pressure, temperature, or v_{g1} is determined, the other properties are fixed. The saturation pressure in the lower plenum as read from P-256 is the most accurate available

means for determining ν_{g1} . The pressure at the inlet and outlet turbine flowmeters is also the most accurate available method for determining ν_{gout} and ν_{gin} . For example:

$$d \nu_{g1} = \frac{\nu_{g1} \left(\text{at } P_1 \text{ plus maximum instrument error} \right) - \nu_{g1} \left(\text{at } P_1 \text{ minus maximum instrument error} \right)}{2}.$$

The $d \nu_{g5}$ and $d \nu_{g8}$ terms can be determined in the same manner.

In general, pressures were used to determine gas and liquid densities in the two-phase regions. The maximum error from a 60 ± 2 psi reading is 0.54 times that of a reading at the corresponding saturation temperature $\pm 4^\circ\text{F}$. The maximum error associated with most of the pressure instruments given in Table II of the body of the text is ± 1.0 psi which makes the error approximately 0.27 times that associated with the $\pm 4^\circ\text{F}$ temperature error.

The errors in downcomer annulus area A are dependent on the following:

- (1) Error in misalignment of core barrel and filler piece
- (2) Dependence of A on wear and scaling
- (3) Variation of A with position in the annulus
- (4) Dependence of A on temperature.

A (annulus) = A (vessel ID) - A (core OD). Neither the area of the vessel ID nor the area of the core OD is dependent on the position of the core barrel within the vessel and, therefore, the annulus area is not dependant on position of the core barrel within the vessel. The vessel liner was measured after the test was completed. No indication of wear, and only negligible scaling, was observed. From measurements of the vessel liner and tolerances for construction of the core barrel, the dependence of A on position in the annulus is determined. By using the following definition for annulus area:

$$A = \frac{\pi}{4} (D_o^2 - D_i^2)$$

the following results:

$$\frac{dA}{A} = \frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2}. \quad (\text{B-13})$$

In computing dA/A , the term $d D_o$ was taken to be:

$$1/2 (D_o [\text{max}] - D_o [\text{min}]).$$

The same technique was employed for $d D_i$ using the tolerances given for the construction of the core barrel.

The initial heatup of the vessel will change the area of the annulus and result in a systematic error as opposed to a random error. This error can be approximated using the coefficient of thermal expansion as follows:

$$D_{oS} = D_o (1 + \alpha T_S)$$

where

T_S is the operation temperature

D_o is the diameter of the vessel liner at room temperature

D_{oS} is the diameter of the vessel liner at operating temperature

$$\begin{aligned} d D_o &= D_{oS} - D_o \\ &= D_o (\alpha T_S) . \end{aligned} \tag{B-14}$$

In the same manner:

$$d D_i = D_i \alpha T_S . \tag{B-15}$$

Substituting Equations (B-14) and (B-15) into Equation (B-13) results in

$$\frac{d A_{(T)}}{A} = \frac{2 D_o^2 \alpha T_S - 2 D_i^2 \alpha T_S}{(D_o^2 - D_i^2)}$$

which reduces to

$$\frac{d A_{(T)}}{A} = 2 \alpha T_S . \tag{B-16}$$

The error in annulus area due to temperature effects is, therefore, insignificant, because α is small.

The terms of Equation (B-9), ρ_g , ρ_f , $d \rho_g$, $d \rho_f$, can be computed if ν_g is known through use of the following:

$$\rho = \frac{1}{\nu} \tag{B-17}$$

and

$$\frac{d\rho}{\rho} = - \frac{d\nu}{\nu} . \tag{B-18}$$

From Equations (B-9), (B-17), and (B-18), the following relationships can be developed:

$$-1/2 \left(\frac{\rho_f}{\rho_f - \rho_g} \right) \frac{d \rho_f}{\rho_f} = 1/2 \left(\frac{v_{g1}}{v_{g1} - v_{f1}} \right) \frac{d v_{f1}}{v_{f1}} \quad (\text{B-19})$$

and

$$1/2 \left(1 + \frac{\rho_g}{\rho_f - \rho_g} \right) \frac{d \rho_g}{\rho_g} = -1/2 \left(1 + \frac{v_{f1}}{v_{g1} - v_{f1}} \right) \frac{d v_{f1}}{v_{f1}} \quad (\text{B-20})$$

By combining Equations (B-9), (B-12), (B-13), (B-19), (B-20), Equation (B-21) is obtained:

$$\frac{d(j_g^* D^{1/2})}{j_g^* D^{1/2}} = \left[\begin{aligned} & \frac{d v_{g1}}{v_{g1}} + \frac{(1-K)(v_{g5} d Q_{g5} - Q_{g5} d v_{g5})}{(v_{g5})^2 \left((1-K) \left(\frac{Q_{g5}}{v_{g5}} \right) + K \left(\frac{Q_{g8}}{v_{g8}} \right) \right)} \\ & + \frac{K(v_{g8} d Q_{g8} - Q_{g8} d v_{g8})}{(v_{g8})^2 \left[(1-K) \left(\frac{Q_{g5}}{v_{g5}} \right) + K \left(\frac{Q_{g8}}{v_{g8}} \right) \right]} \\ & - \frac{2 D_o d D_o - 2 D_i d D_i}{(D_o^2 - D_i^2)} + \frac{1}{2} \left(\frac{v_{g1}}{v_{g1} - v_{f1}} \right) \frac{d v_{f1}}{v_{f1}} \\ & - 1/2 \left[1 + \left(\frac{v_{f1}}{v_{g1} - v_{f1}} \right) \right] \frac{d v_{g1}}{v_{g1}} \end{aligned} \right] \quad (\text{B-21})$$

1.2 Equations for $j_f^* D^{1/2}$

The errors in the liquid volumetric flux can be estimated in a manner analogous to that used in estimating those in the gas volumetric flux terms. Multiplication of the dimensionless volumetric flux equation [Equation (B-1)] by $D^{1/2}$ results in:

$$j_f^* D^{1/2} = j_f \left(\frac{\rho_f}{g(\rho_f - \rho_g)} \right)^{1/2} \quad (\text{B-22})$$

And in a manner analogous to that used in developing Equation (B-9), the following can be shown:

$$\frac{d j_f^* D^{\frac{1}{2}}}{j_f^* D^{\frac{1}{2}}} = \frac{d j_{f1}}{j_{f1}} + 1/2 \left(1 - \frac{\rho_{f1}}{(\rho_{f1} - \rho_{g1})} \right) \frac{d \rho_{f1}}{\rho_{f1}} \quad (B-23)$$

$$+ 1/2 \left(\frac{\rho_{g1}}{(\rho_{f1} - \rho_{g1})} \right) \frac{d \rho_{g1}}{\rho_{g1}}. \quad (B-23)$$

For determining error size, Equation (B-23) must be defined in fundamentally measured terms:

$$j_{f1} = \frac{Q_{f1}}{A} \quad (B-24)$$

$$\frac{d j_{f1}}{j_{f1}} = \frac{d Q_{f1}}{Q_{f1}} - \frac{dA}{A}.$$

The flow reaching the lower plenum was found in most cases to be below the range of the flowmeters. A special technique was devised in these cases to obtain better measurement accuracy than the flowmeters afforded. The technique consisted of closing the drain valve to the lower plenum and measuring the rate of water accumulation. A stop watch was used to measure the time required for the water to accumulate between two levels (L_1 and L_2) observed in the sight glass.

The data generated by this technique were labeled with the symbol HH in Table IV of the text to indicate when this technique was used. The error in this technique can be treated as follows:

$$Q_{f1} = \frac{K_L \Delta L}{\Delta T}$$

where K_L is a constant which converts the rate of change of water level to flowrate. By taking the total differential of Q_{f1} and dividing by Q_{f1} :

$$\frac{d Q_{f1}}{Q_{f1}} = \frac{d \Delta L}{\Delta L} - \frac{d \Delta t}{\Delta t} \quad (B-25)$$

where

$$\Delta L = L_2 - L_1.$$

Therefore:

$$\frac{d Q_{f1}}{Q_{f1}} = \frac{d L_2}{\Delta L} - \frac{d L_1}{\Delta L} - \frac{d \Delta t}{\Delta t} \quad (B-26)$$

and the maximum error is taken to be the sum of the absolute value of these terms.

Liquid level could be measured to within 0.25 inch, and therefore,

$$\pm d L_2 = \pm d L_1 = \pm 0.25 \text{ in.}$$

and

$$d \Delta L = 0.5 \text{ in.}$$

The error in time measurement can be divided into two areas:

- (1) Time required to start or stop the stop watch is ± 0.1 second, contributing ± 0.2 second to the error in Δt
- (2) The precision to which the stop watch is read is ± 0.25 second.

The total error of dt is then equal to ± 0.45 second.

Summing the errors in L and t , as indicated by Equation (B-26), gives the total error in Q_f ,

$$\frac{d Q_{f1}}{Q_{f1}} = \frac{0.5}{5} + \frac{0.45}{45} = 0.11,$$

where 45 seconds is the shortest time required to increase the vessel liquid level by 5 inches.

The other method of measuring the volumetric flow rate of liquid to the downcomer was with the vessel outlet turbine flowmeter. The possibility of temperature changes occurring in the lower head and vessel outlet piping requires a correction in the specific volumes of the liquid leaving the vessel:

$$Q_{f1} = Q_{f3} \frac{v_{f1}}{v_{f3}} \quad (B-27)$$

Taking the differential of Equation (B-27) and dividing by Q_{f1} results in

$$\frac{d Q_{f1}}{Q_{f1}} = \frac{d Q_{f3}}{Q_{f3}} + \frac{d v_{f1}}{v_{f1}} - \frac{d v_{f3}}{v_{f3}} \quad (B-28)$$

The term $d Q_{f3}$ is the maximum error read from Table II of the text and is associated with the particular turbine flowmeter (FT-VI-L1, FT-VI-L75, or FT-VI-L3) used to measure Q_{f3} .

The specific volume term ν_{f1} is measured by P-256 (pressure in the lower plenum), and ν_{f3} is measured by the vessel outlet pressure transducer (P-VO-L). The method for determining the values of $d \nu_{f3}$ and $d \nu_{f1}$ are as previously described for $d \nu_{g1}$.

The area term dA/A is identical to the one developed for Equation (B-13):

$$\frac{dA}{A} = \frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2} \quad (B-13)$$

From Equations (B-23), (B-19), and (B-20), the following relationships can be developed:

$$1/2 \left(1 - \frac{\rho_{f1}}{(\rho_{f1} - \rho_{g1})} \right) \frac{d \rho_{f1}}{\rho_{f1}} = -1/2 \left[1 - \left(\frac{\nu_{g1}}{\nu_{g1} - \nu_{f1}} \right) \right] \frac{d \nu_{f1}}{\nu_{f1}} \quad (B-29)$$

and

$$1/2 \left(\frac{\rho_{g1}}{\rho_{f1} - \rho_{g1}} \right) \frac{d \rho_{g1}}{\rho_{g1}} = -1/2 \left(\frac{\nu_{f1}}{\nu_{g1} - \nu_{f1}} \right) \frac{d \nu_{g1}}{\nu_{g1}} \quad (B-30)$$

Then combining Equations (B-23), (B-13), (B-29), and (B-30) results in

$$\frac{d(j_f^* D^{\frac{1}{2}})}{j_f^* D^{\frac{1}{2}}} = \left[\begin{aligned} & \frac{d Q_{f1}}{Q_{f1}} - \left(\frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2} \right) \\ & - \frac{1}{2} \left(1 - \frac{\nu_{g1}}{\nu_{g1} - \nu_{f1}} \right) \frac{d \nu_{f1}}{\nu_{f1}} \\ & - \frac{1}{2} \left(\frac{\nu_{f1}}{\nu_{g1} - \nu_{f1}} \right) \frac{d \nu_{g1}}{\nu_{g1}} \end{aligned} \right] \quad (B-31)$$

By taking all nonmutually exclusive error terms in Equations (B-21) and (B-31) positive^[a], maximum error Equations (B-32) and (B-33) are obtained.

[a] The size of terms in the error analysis equations for gas volumetric flux [Equation (B-32)] and liquid volumetric flux [Equation (B-33)] is given in the following section.

$$\begin{aligned}
\frac{d \sqrt{j_g^* D^{\frac{1}{2}}}}{\sqrt{j_g^* D^{\frac{1}{2}}}} (\max) = 1/2 & \left[\left| \frac{d v_{g1}}{v_{g1}} \right| + \left| \frac{(1-K) (v_{g5} d Q_{g5} - Q_{g5} d v_{g5})}{v_{g5}^2 \left[(1-K) Q_{g5}/v_{g5} + K Q_{g8}/v_{g8} \right]} \right| \right. \\
& + \left| \frac{K (v_{g8} d Q_{g8} - Q_{g8} d v_{g8})}{v_{g8}^2 \left[(1-K) Q_{g5}/v_{g5} + K Q_{g8}/v_{g8} \right]} \right| \\
& + \left| \frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2} \right| + \frac{1}{2} \left| \frac{v_{g1}}{v_{g1} - v_{f1}} \frac{d v_{f1}}{v_{f1}} \right| \\
& \left. + 1/2 \left| \left(1 + \frac{v_{f1}}{v_{g1} - v_{f1}} \right) \frac{d v_{g1}}{v_{g1}} \right| \right]
\end{aligned}
\tag{B-32}$$

$$\begin{aligned}
\frac{d \sqrt{j_f^* D^{\frac{1}{2}}}}{\sqrt{j_f^* D^{\frac{1}{2}}}} (\max) = 1/2 & \left[\left| \frac{d Q_{f1}}{Q_{f1}} \right| + \left| \frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2} \right| \right. \\
& + 1/2 \left| \left(1 - \frac{v_{g1}}{v_{g1} - v_{f1}} \right) \frac{d v_{f1}}{v_{f1}} \right| \\
& \left. + 1/2 \left| \left(\frac{v_{f1}}{v_{g1} - v_{f1}} \right) \frac{d v_{g1}}{v_{g1}} \right| \right]
\end{aligned}
\tag{B-33}$$

The probable errors for these quantities are expressed by:

$$\frac{d \sqrt{j_g^* D^{\frac{1}{2}}}}{\sqrt{j_g^* D^{\frac{1}{2}}}} (\text{prob}) = 1/2 \left[\begin{aligned} & + \left(\frac{d v_{g1}}{v_{g1}} \right)^2 + \left[\frac{(1-K) (v_{g5} d Q_{g5} - Q_{g5} d v_{g5})}{v_{g5}^2 [(1-K) Q_{g5}/v_{g5} + K Q_{g8}/v_{g8}]} \right]^2 \\ & + \left[\frac{K (v_{g8} d Q_{g8} - Q_{g8} d v_{g8})}{v_{g8}^2 [(1-K) Q_{g5}/v_{g5} + K Q_{g8}/v_{g8}]} \right]^2 \\ & + \left[\frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2} \right]^2 \\ & + \left[1/2 \left(\frac{v_{g1}}{v_{g1} - v_{f1}} \right) \left(\frac{d v_{f1}}{v_{f1}} \right) \right]^2 \\ & + \left[1/2 \left(1 + \frac{v_{f1}}{v_{g1} - v_{f1}} \right) \left| \frac{d v_{g1}}{v_{g1}} \right| \right]^2 \end{aligned} \right]^{\frac{1}{2}} \quad (\text{B-34})$$

$$\frac{d \sqrt{j_f^* D^{\frac{1}{2}}}}{\sqrt{j_f^* D^{\frac{1}{2}}}} (\text{prob}) = 1/2 \left[\begin{aligned} & \left(\frac{d Q_{f1}}{f1} \right)^2 \\ & + \left(\frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2} \right)^2 \\ & + \left[1/2 \left(1 - \frac{v_{g1}}{v_{g1} - v_{f1}} \right) \frac{d v_{f1}}{v_{f1}} \right]^2 \\ & + \left[1/2 \left(\frac{v_{f1}}{v_{g1} - v_{f1}} \right) \frac{d v_{g1}}{v_{g1}} \right]^2 \end{aligned} \right]^{\frac{1}{2}} \quad (\text{B-35})$$

2. RESULTS

The equations relating the test parameters have been reduced to basic measured quantities and the magnitude of error which each measured quantity contributes can be estimated. Table B-I shows the magnitude of each of the error terms for $j_g^* D^{1/2}$. Table B-II shows the magnitude of each of the error terms for $j_f^* D^{1/2}$. The technique of measuring the vessel outlet liquid volumetric flow rate was used for Test 9.1 and, even so, this measurement accounted for 83% of the error in $(j_f^* D^{1/2})^{1/2}$. The other significant error was the error in the area of the downcomer annulus. This error contributed 16% of the total error in $j_f^* D^{1/2}$.

The errors in $j_g^* D^{1/2}$ were more evenly distributed. The first four terms of the error equation (Table B-I) are errors introduced due to measurement of the j_g . They represent 88 to 95% of the error. The terms which represent the correction for steam mass lost due to condensation were 37 to 71% of the error in $(j_g^* D^{1/2})^{1/2}$.

Figure B-2 is a graph of $(j_g^* D^{1/2})^{1/2}$ versus $(j_f^* D^{1/2})^{1/2}$ for Test 9.1. Error bands for both probable error and maximum error are presented. Error values for Test 9.1 are tabulated in Table B-III. These error bands are typical of all steady state tests and can be applied to Figures 9 through 19 of the body of the text.

3. REFERENCE

- B-1. P. R. Bevington, *Data Reduction and Error Analysis for the Physical Sciences*, New York, McGraw-Hill Book Company, Inc. (1969).

TABLE B-I

SIZE OF TERMS IN ERROR ANALYSIS EQUATION FOR GAS VOLUMETRIC FLUX

Data Point	Maximum Error (%)	Largest Term ^[a] (%)		2nd Largest Term ^[a] (%)		3rd Largest Term ^[a] (%)		4th Largest Term ^[a] (%)		5th Largest Term ^[a] (%)		6th Largest Term ^[a] (%)	
9.1.1	3.43	4	1.00	2	0.88	1	0.71	3	0.45	6	0.36	5	0.03
9.1.2	4.46	2	1.55	4	1.00	3	0.81	1	0.72	6	0.36	5	0.03
9.1.3	7.24	2	3.09	3	2.04	4	1.00	1	0.72	6	0.36	5	0.03
9.1.4	4.00	2	1.21	4	1.00	1	0.74	3	0.65	6	0.37	5	0.03
9.1.5	5.19	2	1.95	3	1.10	4	1.00	1	0.74	6	0.37	5	0.03
9.1.6	3.43	4	1.00	2	0.80	1	0.75	3	0.48	6	0.38	5	0.03
9.1.7	5.79	2	2.39	3	1.34	4	1.00	1	0.69	6	0.34	5	0.03
9.1.8	6.20	2	2.64	3	1.48	4	1.00	1	0.70	6	0.35	5	0.03

[a] Explanation of Term

$$\text{Term 1: } \frac{d v_{g1}}{v_{g1}}$$

$$\text{Term 2: } \frac{(1-K) (v_{g5} d Q_{g5} - Q_{g5} d v_{g5})}{v_{g5}^2 \left[(1-K) Q_{g5}/v_{g5} + K Q_{g8}/v_{g8} \right]}$$

$$\text{Term 3: } \frac{K (v_{g8} d Q_{g8} - Q_{g8} d v_{g8})}{v_{g8}^2 \left[(1-K) Q_{g5}/v_{g5} + K Q_{g8}/v_{g8} \right]}$$

$$\text{Term 4: } \frac{2 D_o d D_o - 2 D_i d D_i}{(D_o^2 - D_i^2)}$$

$$\text{Term 5: } 1/2 \left[\frac{v_{g1}}{v_{g1} - v_{f1}} \right] \frac{d v_{f1}}{v_{f1}}$$

$$\text{Term 6: } 1/2 \left[1 + \frac{v_{f1}}{v_{g1} - v_{f1}} \right] \frac{d v_{g1}}{v_{g1}}$$

TABLE B-II

SIZE OF TERMS IN ERROR ANALYSIS EQUATION FOR LIQUID VOLUMETRIC FLUX

Data Point	Maximum Error (%)	Largest		2nd Largest		3rd Largest		4th Largest	
		Term [a]	(%)	Term [a]	(%)	Term [a]	(%)	Term [a]	(%)
9.1.1	6.37	1	5.25	2	1.00	4	0.001	3	0
9.1.2	6.37	1	5.25	2	1.00	4	0.001	3	0
9.1.3	6.37	1	5.25	2	1.00	4	0.001	3	0
9.1.4	6.37	1	5.25	2	1.00	4	0.001	3	0
9.1.5	6.37	1	5.25	2	1.00	4	0.001	3	0
9.1.6	6.37	1	5.25	2	1.00	4	0.001	3	0
9.1.7	6.37	1	5.25	2	1.00	4	0.001	3	0
9.1.8	6.37	1	5.25	2	1.00	4	0.001	3	0

[a] Explanation of Term

$$\text{Term 1: } \frac{d Q_{f1}}{Q_{f1}}$$

$$\text{Term 3: } 1/2 \left[1 - \frac{v_{g1}}{v_{g1} - v_{f1}} \right] \frac{d v_{f1}}{v_{f1}}$$

$$\text{Term 2: } \frac{2 D_o d D_o - 2 D_i d D_i}{D_o^2 - D_i^2}$$

$$\text{Term 4: } 1/2 \left[\frac{v_{f1}}{v_{g1} - v_{f1}} \right] \frac{d v_{g1}}{v_{g1}}$$

Fig. B-2 Probable and maximum error limits for Test Series 9.1.

TABLE B-III

PERCENTAGE ERRORS IN GAS AND LIQUID VOLUMETRIC FLUXES

Data Point	Maximum Error Band		Total Maximum Error $(x^2+y^2)^{1/2}$	Probable Error Band		Total Probable Error $(x^2+y^2)^{1/2}$
	$d(j_g^* D^{1/2})^{1/2}$	$d(j_f^* D^{1/2})^{1/2}$		$d(j_g^* D^{1/2})^{1/2}$	$d(j_f^* D^{1/2})^{1/2}$	
	$(j_g^* D^{1/2})^{1/2}$	$(j_f^* D^{1/2})^{1/2}$		$(j_g^* D^{1/2})^{1/2}$	$(j_f^* D^{1/2})^{1/2}$	
	(x)	(y)		(x)	(y)	
9.1.1	3.431	6.37	7.23	1.617	5.35	5.59
9.1.2	4.461	6.37	7.78	2.167	5.35	5.77
9.1.3	7.242	6.37	9.64	3.917	5.35	6.63
9.1.4	3.997	6.37	7.52	1.890	5.35	5.67
9.1.5	5.186	6.37	8.22	2.587	5.35	5.94
9.1.6	3.430	6.37	7.23	1.603	5.35	5.58
9.1.7	5.793	6.37	8.61	3.018	5.35	6.14
9.1.8	6.199	6.37	8.89	3.281	5.35	6.28