REACTOR CONTAINMENT BUILDING

INTEGRATED LEAK RATE TEST

TYPES A, B, AND C

PERIODIC TEST

VIRGINIA ELECTRIC AND POWER COMPANY

Surry Nuclear

Power Station

Unit No. 2

September 1983

PREPARED BY STONE & WEBSTER ENGINEERING CORPORATION

BOSTON, MASS

TABLE OF CONTENTS

REFERENCES

1. 10CFR50 Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, October 22, 1980.

2. 2-PT-16.3, Reactor Containment Building Integrated Leak Rate Test, 1983.

3. ANSI N45.4, American National Standard Leakage-Rate Testing of Containment Structures for Nuclear Reactors, March 16, 1972.

4. ANSI/ANS-56.8, Containment System Leakage Testing Requirements, February 19, 1981[1].

[1]This document used only as a guideline and any reference to said document in no way implies compliance.

LIST OF ATTACHMENTS

SECTION 1

PURPOSE

The purpose of this report is to present a description and analysis of the September 1983, Type A Periodic Containment Integrated Leak Rate Test (CILRT), and a summary of the Type B and C tests conducted on the Virginia Electric and Power Company's Surry Nuclear Power Station, Unit No. 2.

This report is submitted as required by 10CFR50, Appendix J, Paragraph V.B.

SECTION 2

SUMMARY

2.1 TYPE A TEST

Pressurization for the CILRT was started at 1620 hours on September 10, 1983. Equipment problems with the refrigerant air-dryer control circuitry and with the mechanical chillers interrupted containment pressurization at 1716 hours. The pressurization was restarted at 2147 hours and continued until 2330 hours. The compressors were secured due to the loss of the chillers. The containment pressure at 2354 hours on September 10, 1983, was 26.016 psia. Repairs on the chillers continued through the night. At 0705 hours on September 11, 1983, the compressors were restarted. The containment pressure was 25.989 psia, the containment weighted average temperature was 85.23 DEGF, and the containment weighted average dewpoint temperature was 70.96 DEGF.

Containment pressurization was secured at 1549 hours on September 11, 1983, with a peak pressure of 61.550 psia. Containment weighted average air temperature was 89.77 DEGF and the containment weighted average dewpoint temperature was 77.69 DEGF. The temperature stabilization criterion was satisfied at 2008 hours.

During the pressurization sequence, periodic leakage investigations were conducted. Leakage paths, identified during these investigations, were closely monitored into the leakage data collection interval. The following leakage paths were contributing to the leakage rate:

1. Secondary side leakage (steam generator to the main steam header)

2. The "A" Recirculation Spray Loop

3. The electrical penetration E18

From 2008 hours on September 11, 1983, to 1023 hours on September 12, 1983, the average mass loss per hour was decreasing. The average mass loss over these 14 hours was -18.8 lbm/hr; however, over the last 6 hours of this interval, the average mass loss was -12.83 lbm/hr. The acceptance criteria of less than 0.75LA is equivalent to -17.36 lbm/hr.

This encouraging decreasing trend did not last. Over the next 7 hours, from 1023 hours to 1724 hours on September 12, 1983, the average mass loss sharply increased to approximately -35.4 lbm/hr. This is equivalent to a 7.77 standard cubic feet per minute (scfm) leak. This sudden and dramatic increase in the

leakage could only be attributable to a component failure. Leakage investigations were instituted without corroborating results. No new leakage paths were identified and no significant increases in known leakage paths were observed.

The secondary system was monitored for leakage by observation of pressure gages on the main steam headers. The lineup for main steam is not specifically included in the Type A procedure. Thus, leakage from containment through the steam generators could pass through the main steam system without showing significant pressure increase. Upon further investigation, drain lines were opened and significant air leakage was detected.

Since the secondary side is not considered a Type A leakage path, the decision was made to fill the main steam headers with water to create a water seal. The headers were only filled with water, i.e., they were not pressurized.

From 1724 hours on September 12, 1983, to 0530 hours on September 13, 1983, the average mass loss was less than 4 lbm/hr. Each header was filled one at a time with the last completed around midnight. The essentially flat mass trend continued until around 0530 hours, when the mass loss started increasing. From 0530 to 1132 hours on September 13, 1983, the average mass loss was -33.3 lbm/hr. This trend was almost identical to the previous interval (1023 to 1724 hours on September 12, 1983). It was concluded that the effect of the water seal had diminished.

The filling of the headers had confirmed the secondary side as the primary leakage path. However, the water seal would not last the 12-20 hrs required to complete the leakage test. Instead of refilling, it was decided to double valve the entire main steam system outside containment. Double valving was initiated at approximately 1000 hours on September 13, 1983. In addition to double valving, the non-return valves were manually torgued. There was a slight improvement in the mass loss trend, however, not what had been achieved with the water seal. At approximately 1800 hours on September 13, 1983, the non-return valves were manually torgued again and an open manual isolation valve to the main steam PORV was closed. These actions created a "tight" boundary to essentially minimize the secondary side leakage from the Type A analysis. The start of the Type A leakage period was conservatively set at 1300 hours on September 13, 1983. The test was run for 16 hours and was successfully completed at 0500 hours on September 14, 1983.

At 0609 hours on September 14, 1983, the mass pump-back verification test started. At 0749 hours, the mass-pump back test was completed. The verification test satisfied the requirements of the procedure.

Depressurization of the containment began at 1044 hours and was completed at 2004 hours on September 14, 1983.

2.2 LOCAL LEAK RATE TESTS (TYPES B AND C)

The Local Leak Rate Tests of containment isolation valves and primary containment penetrations were conducted as required by station surveillance procedures since the last Type A Test performed in December of 1981.

In accordance with Appendix J to 10CFR50, Paragraph V.B., data for the Local Leak Rate Tests are summarized in Section 4 of this report.

SECTION 3

TYPE A TEST

3.1 EDITED LOG OF EVENTS

This log was edited from the Official Log of Events

September 10, 1983

1530 - Completed containment inspection

1620 - Commenced containment pressurization

1621 - Declared Dewpoint Analyzer No. 10 as a failed sensor

1716 - Secured pressurization due to inoperable air dryer and loss of chilled component cooling water

2147 - Restarted pressurization

2306 - Containment pressue 23.4 psig

Containment temperature 87.9°F

Containment dewpoint 69°F

2330 Lost chillers, stopped compressors

September 11, 1983

0705 - Containment pressure 26.02 psig. Compressors re-started.

0810 - Pressure observed on gauges installed on main steam lines to monitor steam generator pressure were:

"A" 19 psig; "B", 6 psig; "C", 5 psig

0957 - Identified slight packing leak on MOV-2860B suction to low head pump.

1022 - Lost "C" containment air recirculation fan.

1217 - Lost "A" containment air recirculation fan.

1549 - Secured pressurization.

1725 - Observed electrical penetration E18 leaking at flange at approximately three o'clock position.

1758 - Observed minor packing leak on MOV-CS-201D and body to bonnet leak on TV-SI-200.

September 12, 1983

0221 - Observed minor packing leaks and/or body to bonnet leaks on penetrations 57B, 42 and 58.

1616 - Opened drain valve between NRV and TV on "A" and "B" steam generator main steam lines.

1730 - Filling main steam lines in accordance with Attachment of Type A Procedure.

September 13, 1983

0030 - Completed filling of main steam lines

1005 - Torqued each main steam NRV two turns.

1215 - Performed double valve isolation of main steam system in safeguards area.

1808 - Torqued each main steam NRV again. Found manual isolation to "B" main steam PORV open. Closed valve.

September 14, 1983

0204 - Removed one manometer U0963 from program. Failed at 0100 hours.

0530 - Leak rate satisfied.

0750 - Pump back verification test satisfied.

0800 - Torqued E-18 electrical penetration to stop leak. No significant improvement observed.

1044 - Commenced depressurization.

2004 - Completed depressurizaiton.

2015 - Containment inspection for pretest deviations complete.

3.2 GENERAL TEST DESCRIPTION

3.2.1 Prerequisites

In accordance with the Surry Unit No. 2 CILRT procedure, 2-PT-16.3 (Reference 2), the following is a partial listing of the prerequisites that were completed and documented prior to containment pressurization:

a. Controlled access plan in effect

b. General inspection of the accessible interior and exterior surfaces of the containment structure was performed

c. All required Type B and C leak rate testing completed

d. All test instrumentation calibrated or functionally verified within 6 months of the test.

e. All required system valve line-ups completed

f. Component cooling and chilled water systems were operable.

g. Plant computers were operational and programmed for the CILRT.

h. The Official Log of Events was established and available prior to commencement of the test.

i. Site meteorology data recorded during the performance of the CILRT (Attachment 3.2A).

3.2.2 Equipment and Instrumentation

Pressurization of the containment was achieved by utilization of eight air compressors. Air was piped through two aftercoolers in parallel and a refrigerated air dryer. Instrumentation and valving were installed to maintain proper monitoring and control during pressurization. The total capacity of the pressurization system as installed was rated at 9,900 scfm.

During the test the necessary variables used to determine containment leakage were continually monitored using instrumentation which consisted of multiple resistance temperature detectors (RTDs), chilled mirror dew point indicators, and two absolute pressure quartz manometers (Attachment 3.2B). The general locations of the temperature and moisture sensors are shown in Attachments 3.2C and 3.2D.

A mass flowmeter in the service air system was used during the mass pump back verification test. All test instrumentation

readings were input into the plant computer for data acquisition and averaging.

3.2.3 Data Acquisition System

The Surry Unit No. 2 CILRT utilized a Westinghouse Prodac P250 to scan, log, average, and analyze data received from the containment instrumentation.

The P250 analog scan package reads all the analog inputs in a preestablished manner, converts these readings into engineering units, and then stores these values for use by the plant operators and by the plant application programs.

For the CILRT, the P250 Plant Computer monitored the following instrumentation:

Type	Scan Rate (sec)
22 RTDs	20
5 chilled mirrors	20
2 quartz manometers	2

Instantaneous values of the CILRT instruments were recorded every 5 minutes during the test period, using the P250 digital trend function on the operator's console.

A 10-minute time average of the readings, calculated by the P250 Average and Integrate (A&I) package, was used as input in the plant computer CILRT programs.

The plant computer CILRT program consists of ILRTDATA, which runs every 10 minutes, collects A&I data for all the instrumentation, performs sensor validity checks, and calculates weighted average dew point temperature, vapor pressure, weighted average containment temperature, and containment air mass.

3.2.4 Data Resolution System

After the appropriate data have been acquired and averaged, utilizing the plant computer system, the results are manually input to a remote computer system for leakage rate calculations.

Absolute Method of Mass Point Analysis

The Absolute Method of Mass Point Analysis consists of calculating air masses within the containment structure, over the test period, from pressure, temperature, and dew point observations made during the CILRT. The air masses are computed using the ideal gas law as follows:

$$M = \frac{144V\,(P-Pv)}{RT} \qquad \text{(Eq 1)}$$

where:

M = air mass, lbm
P = total pressure, psia
Pv = average vapor pressure, psia
R = 53.35 ft lbf/lbm °R (for air)
T = average containment temperature, °R
V = containment free volume, 1.8×10^6 ft^3

The leakage rate is then determined by plotting the air mass as a function of time, using a least-squares fit to determine the slope, A = dM/dt. The leakage rate is expressed as a percentage of air mass lost in 24 hours or symbolically:

$$\text{Leakage rate} = (A/B)\ (-2400) \qquad \text{(Eq 2)}$$

where A is the slope of the least-squares curve and B is the y-intercept. The sign convention is such that leakage out of the containment is positive and the units are in percent/day. The air mass is computed and the result is correlated as a function of time by means of a least-squares fit of the form:

$$m = At + B \qquad \text{(Eq 3)}$$

The slope A and the y-intercept B are then used in Equation 2 to determine the leakage rate.

A 95 percent confidence interval is calculated using a Student's t distribution. The sum of the leakage rate and the 95 percent confidence interval is the UCL. The measured leakage rate may be described as 95 percent accurate to within the value of the UCL.

Absolute Method Total Time Analysis

The absolute method of total time analysis consists of calculating air lost from the containment pressure, temperature, and dew point observations during the CILRT.

The containment air mass is computed using Equation 1. The measured leakage rate at any time (t) is then determined by subtracting the mass at the time (Mt) from the initial mass (Mi) and dividing by the initial mass. The measured leak rate is expressed as a percentage of containment mass lost in 24 hours or symbolically:

$$\text{Measured Leak Rage} = \frac{Mi - Mt}{Mi\ (\ t)}\ (2400) \qquad \text{(Eq 4)}$$

The sign convention is such that an outward leak is positive and the units are in percent/day.

The estimated leakage rate is then determined by plotting the measured leak rate as a function of time and then performing a least-squares fit of the mesasured leak rate values as follows:

Estimated Leak Rate = At + B

where A is the slope and B is the y intercept of the least-squares curves.

The 95 percent confidence interval is determined withe the T distribution.

The analysis method was used in conjunction with procedure 2-PT-16.3 (Reference 3).

ATTACHMENT 3.2A

SITE METEOROLOGY

Date	Time	Drybulb Temperature (°F)	Barometric Pressure (in Hg)
9-10-83	1620	93.2	30.08
	1720	93.2	30.08
	1820	89.6	30.06
	1920	86.0	30.02
	2020	75.0	30.04
	2120	75.0	30.05
	2220	77.0	30.05
	2320	73.4	30.09
9-11-83	0020	73.4	30.09
	0120	69.8	30.08
	0745	71.6	30.09
	0845	77.0	30.08
	0945	82.0	30.08
	1045	86.0	30.08
	1145	91.0	30.08
	1245	95.0	30.06
	1345	95.0	30.05
	1445	95.0	30.03
	1545	95.0	30.03
	1645	98.6	30.08
	1745	97.0	30.09
	1845	90.0	30.08
	1945	86.0	30.07
	2045	80.6	30.07
	2145	80.6	29.99
	2245	80.6	29.97
	2345	78.8	29.97
9-12-83	0045	78.8	29.97
	0145	77.0	29.97
	0245	77.0	29.97
	0345	75.4	29.97
	0445	72.0	29.97
	0545	68.0	29.97
	0645	72.0	29.97
	0745	73.0	29.97
	0845	76.0	29.97
	0945	78.0	29.97
	1045	83.6	30.00
	1145	89.0	30.01
	1245	90.0	30.00
	1345	93.0	30.00

ATTACHMENT 3.2A (Cont)

Date	Time	Drybulb Temperature (°F)	Barometric Pressure (in Hg)
	1445	95.0	29.99
	1545	94.5	29.99
	1645	93.0	29.98
	1745	92.0	29.97
	1845	90.5	29.96
	1945	88.0	29.97
	2045	81.0	29.97
	2145	80.0	29.98
	2245	77.6	29.99
	2345	77.0	29.99
9-13-83	0045	75.0	29.99
	0145	73.5	30.01
	0245	73.0	30.00
	0345	71.5	30.00
	0445	70.0	30.03
	0545	70.0	30.03
	0645	71.5	30.03
	0745	72.0	30.03
	0845	73.0	30.04
	0945	74.0	30.05
	1045	74.0	30.08
	1145	76.0	30.08
	1245	77.0	30.05
	1345	79.0	30.02
	1445	80.6	30.02
	1545	82.0	30.01
	1645	81.0	30.00
	1745	79.0	30.00
	1845	75.2	30.02
	1945	74.0	30.01
	2045	73.5	30.01
	2145	73.0	30.01
	2245	71.0	30.02
	2345	70.6	30.03
9-14-83	0045	70.5	30.03
	0145	68.6	30.02
	0245	68.5	30.00
	0345	67.0	30.00
	0445	65.5	30.01
	0545	65.0	30.01
	0645	67.0	30.02
	0745	69.5	30.02

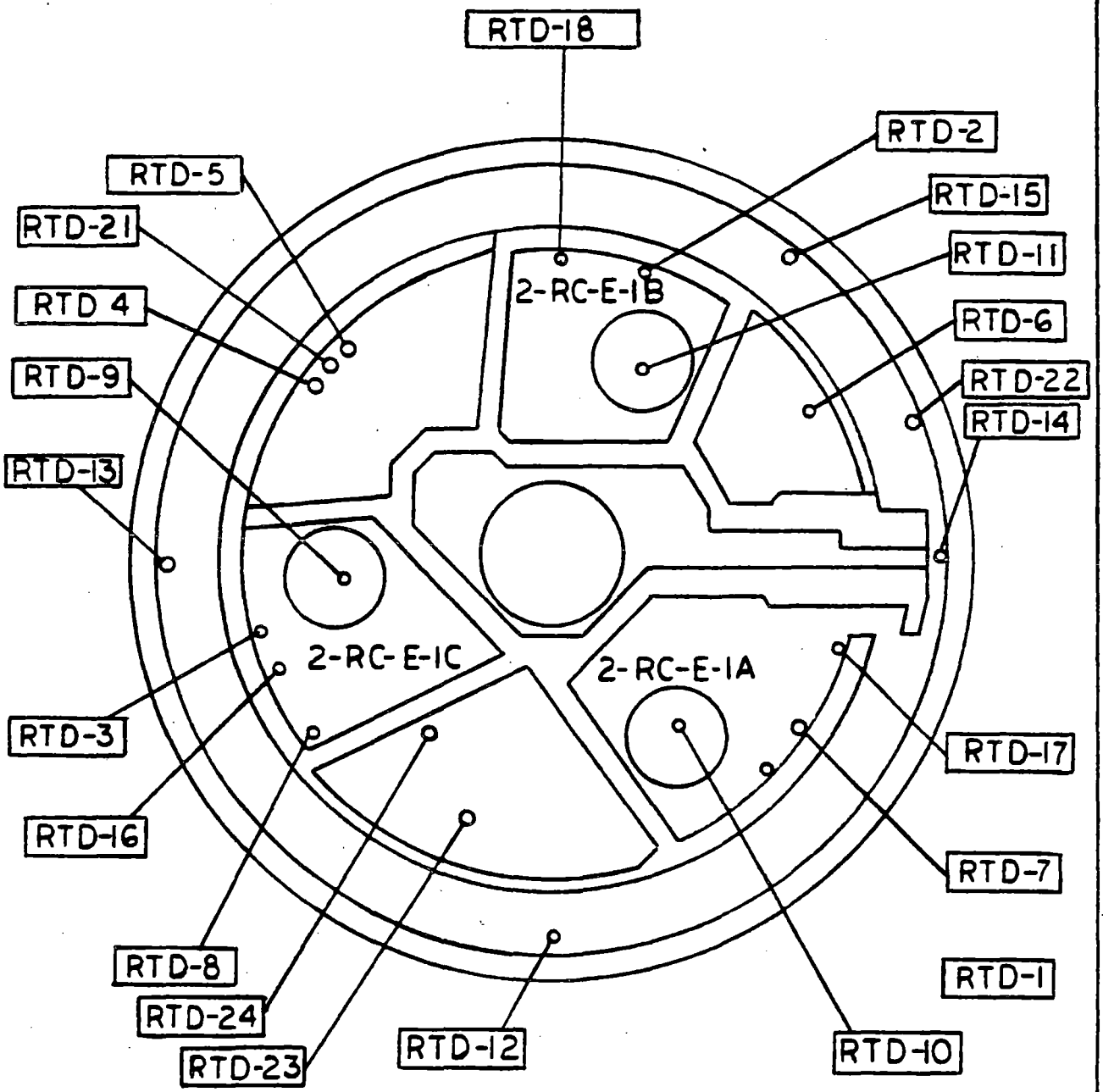
ATTACHMENT 3.2B

INSTRUMENTATION

The following instrumentation was calibrated, and functionally tested no longer than 6 months prior to the performance of this test and in accordance with 10CFR50, Appendix J, and field calibration procedures using instrumentation traceable to the National Bureau of Standards.

Instrument	Weight Factor	Computer Point	Range	Zone	Accuracy	Sensitivity
RTD-LM-200-1	0.02683	T1000A	55-105°F	F	±0.1°F	±0.09°F
RTD-LM-200-2	0.02322	T1001A	55-105°F	F	±0.1°F	±0.09°F
RTD-LM-200-3	0.02427	T1002A	55-105°F	F	±0.1°F	±0.09°F
RTD-LM-200-4	0.01820	T1003A	55-105°F	E	±0.1°F	±0.09°F
RTD-LM-200-5	0.08884	T1004A	55-105°F	B	±0.1°F	±0.09°F
RTD-LM-200-6	0.08884	T1005A	55-105°F	B	±0.1°F	±0.09°F
RTD-LM-200-7	0.08884	T1006A	55-105°F	C	±0.1°F	±0.09°F
RTD-LM-200-8	0.08884	T1007A	55-105°F	C	±0.1°F	±0.09°F
RTD-LM-200-9	0.04975	T1008A	55-105°F	A	±0.1°F	±0.09°F
RTD-LM-200-10	0.04975	T1009A	55-105°F	A	±0.1°F	±0.09°F
RTD-LM-200-11	0.04975	T1010A	55-105°F	A	±0.1°F	±0.09°F
RTD-LM-200-12	0.02460	T1011A	55-105°F	D	±0.1°F	±0.09°F
RTD-LM-200-13	0.02460	T1012A	55-105°F	D	±0.1°F	±0.09°F
RTD-LM-200-14	0.02460	T1013A	55-105°F	E	±0.1°F	±0.09°F
RTD-LM-200-15	0.02460	T4024A	55-105°F	E	±0.1°F	±0.09°F
RTD-LM-200-16	0.04766	T4025A	55-105°F	I	±0.1°F	±0.09°F
RTD-LM-200-17	0.04766	T4026A	55-105°F	I	±0.1°F	±0.09°F
RTD-LM-200-18	0.04766	T4027A	55-105°F	I	±0.1°F	±0.09°F
RTD-LM-200-21	0.03608	T4009A	55-105°F	H	±0.1°F	±0.09°F
RTD-LM-200-22	0.03961	T4020A	55-105°F	H	±0.1°F	±0.09°F
RTD-LM-200-23	0.01782	T4021A	55-105°F	G	±0.1°F	±0.09°F

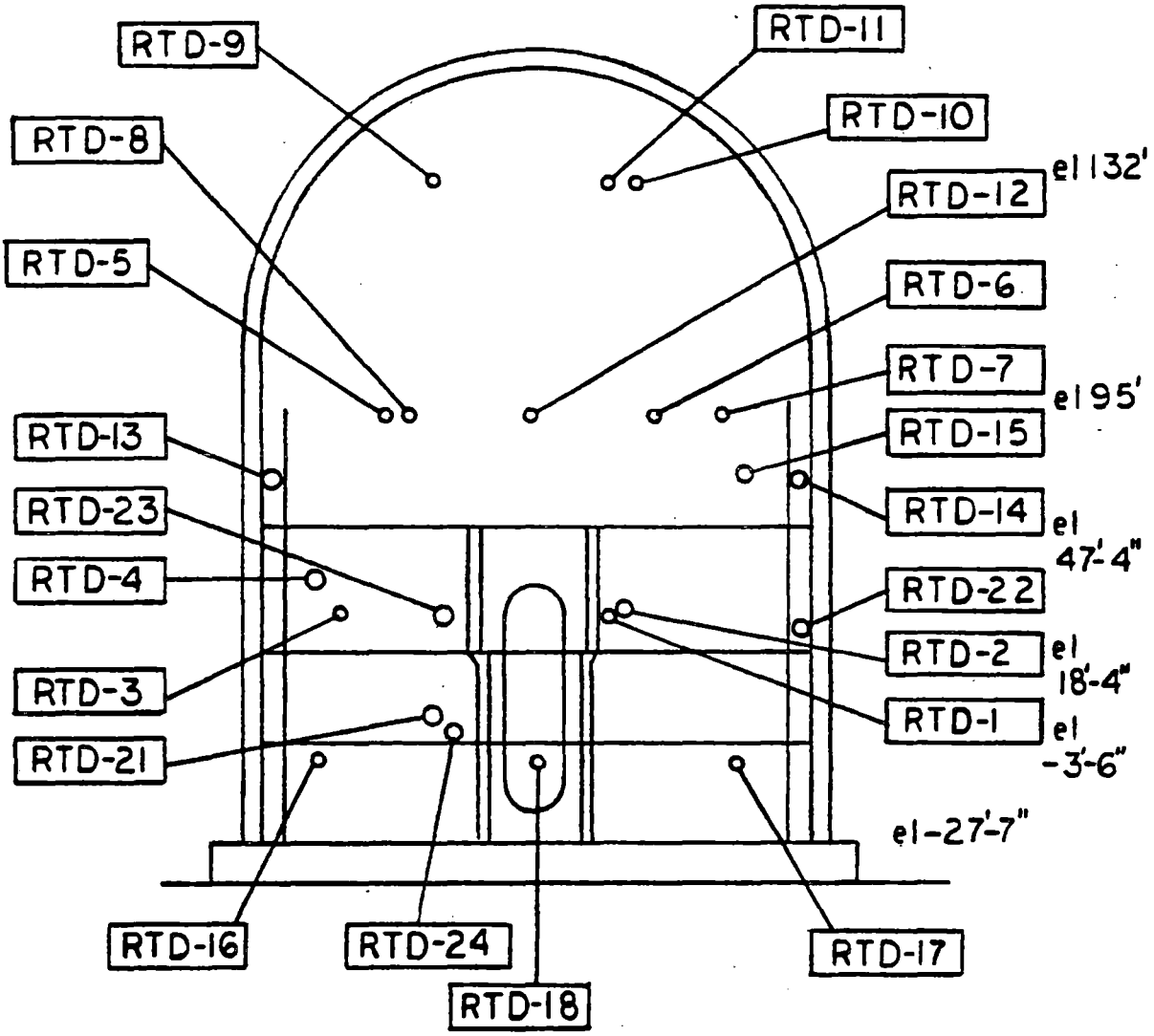
Instrument	Weight Factor	Computer Point	Range	Zone	Accuracy	Sensitivity
RTD-LM-200-24	0.06800	T4022A	55-105°F	G	±0.1°F	±0.09°F
MT-LM-200-6	0.14064	T4039A	-40 to +200°F	K	±0.4°F	±0.05°F
MT-LM-200-7	0.14064	T4040A	-40 to +200°F	K	±0.4°F	±0.05°F
MT-LM-200-8	0.23959	T4041A	-40 to +200°F	L	±0.4°F	±0.05°F
MT-LM-200-9	0.23959	T4042A	-40 to +200°F	L	±0.4°F	±0.05°F
MT-LM-200-10	0.23959	T4043A	-40 to +200°F	L	±0.4°F	±0.05°F
PI-LM-206	0.5	U0962	0-100 psia		±0.030 psia	±0.001%
PI-LM-207	0.5	U0963	0-100 psia		±0.030 psia	±0.001%



PLAN VIEW

NOTES:
1. RTD-1=RTD-LM-200-1 (TYP)
2. RTD-19,20 NOT USED

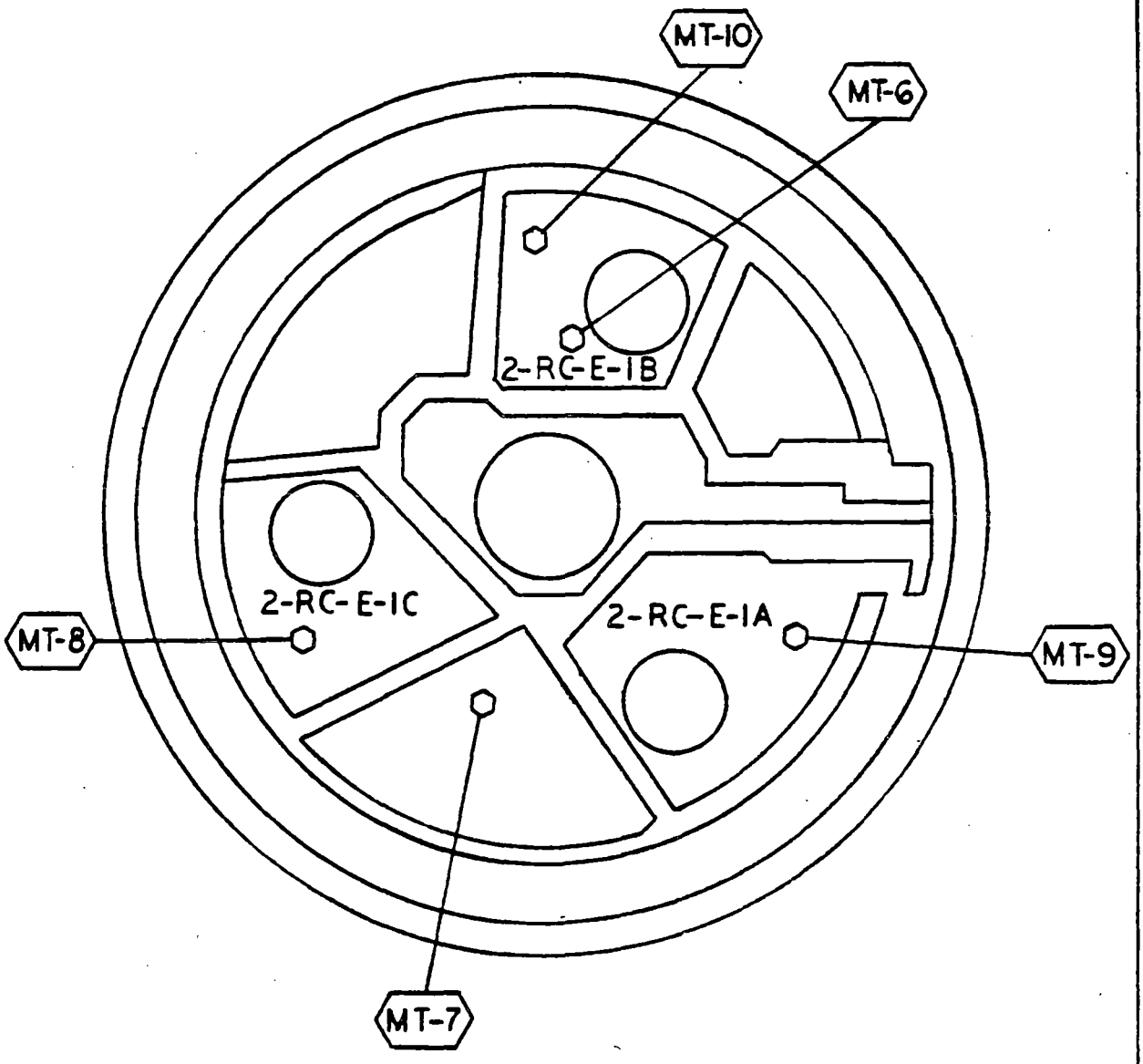
ATTACHMENT 3.2C
INSTRUMENTATION LOCATION
RESISTANCE TEMPERATURE
DETECTORS (RTD)
SURRY POWER STATION-UNIT 2
INTEGRATED LEAK RATE TEST



PROFILE VIEW

NOTES:
1. RTD-1=RTD-LM-200-1 (TYP)
2. RTD-19, 20 NOT USED

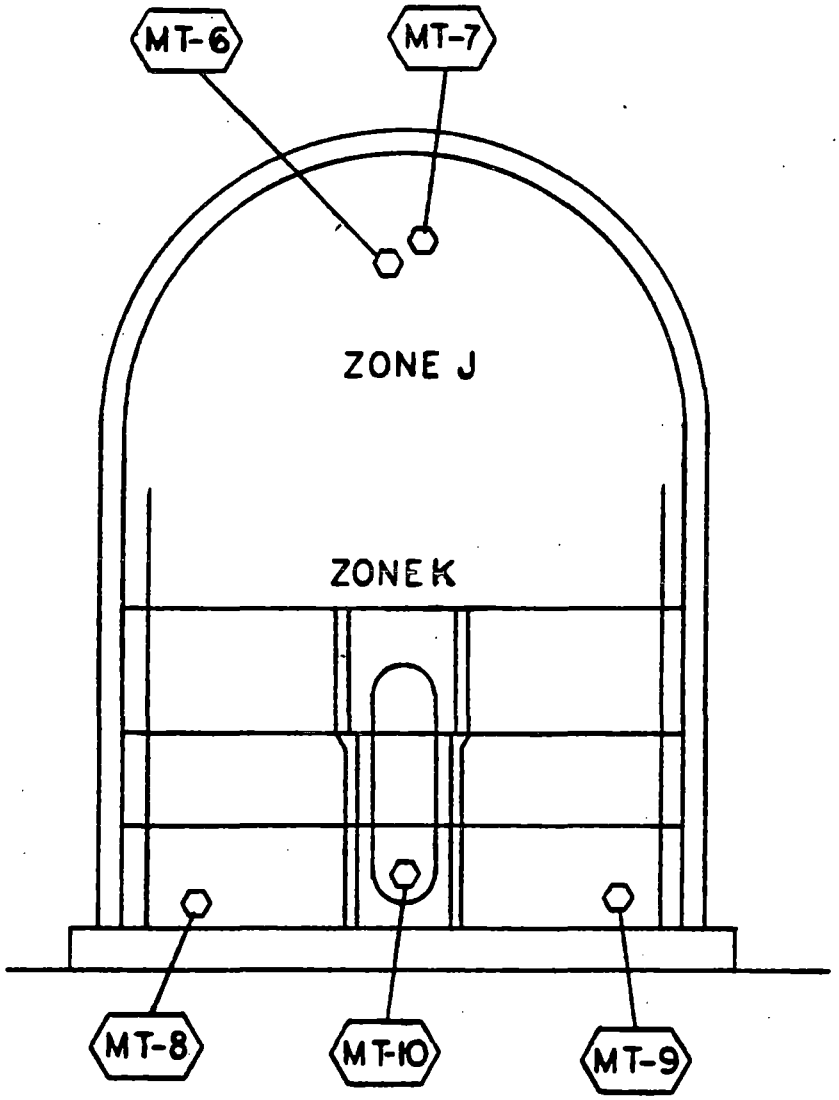
ATTACHMENT 3.2C
INSTRUMENTATION LOCATION
RESISTANCE TEMPERATURE
DETECTORS (RTD)
SURRY POWER STATION-UNIT 2
INTEGRATED LEAK RATE TEST



PLAN VIEW

NOTE:
MT-6 MT-LM-200-6 (TYP)

ATTACHMENT 3.2D
INSTRUMENTATION LOCATION
DEW POINT SENSORS
SURRY POWER STATION-UNIT 2
INTEGRATED LEAK RATE TEST



PROFILE VIEW

NOTE:
MT-6 MT-LM-200-6(TYP)

ATTACHMENT 3.2D
INSTRUMENTATION LOCATION
DEW POINT SENSORS
SURRY POWER STATION-UNIT 2
INTEGRATED LEAK RATE TEST

3.3 TEST RESULTS

3.3.1 Analysis of Test Results

The test data for the period of 1300 hours on September 13, 1983, through 0500 hours on September 14, 1983, were analyzed for the final test results using VEPCO's time sharing computer program. The reduced input data, test results, and representative graphs are contained in Attachments 3.3A through 3.3F.

As discussed in Section 2.1, Type A Test Summary, there were three leakage paths that were contributing to the leakage rate. These leakage paths were as follows:

1. Secondary side leakage (steam generator to the main steam header)

2. The "A" recirculation spray loop

3. The electrical penetration E18

The "A" Recirculation Spray Loop eventually pressurized to approximately test pressure. The piping and components outside containment were inspected for leakage. It is concluded that this was not a major leakage path. The valve lineup for this loop was not changed during the test, so any leakage outside the loop is accounted for in the reported leakage rates.

The electrical penetration E18 was leaking at the flanged connection past the double O-rings. Leakage was at the three o'clock position when facing the penetration assembly. The bolting torque was increased after the completion of the pumpback test in an attempt to quantify leakage using the Type A analysis program. No appreciable change in the leakage rate at the penetration was obtained from torquing. Leakage from this penetration is accounted for in the reported leakage rates.

Leakage through the secondary side resulted in a delay of approximately forty hours. This leakage path is not a path that would exist during the Design Basis Loss-of-Coolant-Accident (DBA LOCA), as the secondary side would always be at a higher pressure than the primary side. During the Type A Test, the main steam system cannot be pressurized to a pressure greater than test pressure (inleakage concerns). Therefore, leakage thru the main steam system had to be either repaired or isolated before commencing with the Type A Test. The isolation of the main steam headers using the water seal and the double valving was enough to choke off this leakage path. This isolation was not a "zero leakage" boundary, so the reported leakage results still include some main steam leakage contributions.

The Absolute Method-Total Time Analysis test results are 0.060643 percent/day. This satisfies the procedural acceptance criteria

of 0.1 percent/day. The Absolute Method-Mass Point Analysis test results are 0.029158 percent/day. This satisfies the procedural acceptance criteria of 0.075 percent/day.

The Type A test calculations were verified by the mass pump back method. The computer calculated air mass was within 0.25LA of the metered mass as shown in Section 3.3.2.3.

3.3.2 CILRT Results

The CILRT was conducted in accordance with Section 5.0 of the surveillance test procedure 2-PT-16.3.

3.3.2.1 Total Time Analysis

Item	(Percent/Day)
1. Leakage rate	0.023354
2. Confidence level	0.036489
3. Type C leakage penalty	0.000800
4. Total	0.060643

3.3.2.2 Mass Point Analysis

Item	(Percent/Day)
1. Leakage rate	0.022939
2. Confidence level	0.005419
3. Type C leakage penalty	0.000800
4. Total	0.029158

3.3.2.3 Mass Step Change (Pumpback)

Item	(LBM)
1. Total measured gas flow into containment	597.5
2. Difference between initial and final computer mass readings	572.62
3. Difference between measured and calculated mass (1-2)	-24.88
4. 0.25 LA verification limit	±138

3.3.2.4 Types B and C Penetration Leakage to be added since these pentrations could not be vented and drained.

Penetration No.	Leakage (SCFH)
20	0
24	1.2
28	0.6
45	0.6
55d	0
57c	0
97b	0
97c	0
101	0
105b	0
105c	0

Total Type B and C	2.4 SCFH
Total Type B and C	0.0008 percent/day

ATTACHMENT 3.3A

CONTAINMENT INTEGRATED LEAK RATE TEST FROM
1300 HOURS ON 9/13/83 TO 0500 ON 9/14/83

INPUT VARIABLES

Time (hr)	Abs. Press. (psia)	Vap. Press. (psia)	Abs. Temp. (°R)	Dewpoint (°F)
1300	61.160	0.4892	547.51	78.92
1320	61.158	0.4878	547.51	78.83
1340	61.157	0.4887	547.50	78.89
1400	61.157	0.4902	547.50	78.98
1420	61.157	0.4895	547.50	78.94
1440	61.156	0.4903	547.50	78.99
1500	61.156	0.4895	547.50	78.94
1520	61.157	0.4887	547.50	78.89
1540	61.155	0.4905	547.49	79.00
1600	61.154	0.4918	547.49	79.08
1620	61.154	0.4934	547.49	79.18
1640	61.154	0.4945	547.49	79.25
1700	61.154	0.4949	547.49	79.27
1720	61.154	0.4953	547.48	79.30
1740	61.154	0.4999	547.49	79.58
1800	61.153	0.5004	547.48	79.61
1820	61.154	0.4962	547.49	79.35
1840	61.153	0.4957	547.48	79.32
1900	61.154	0.4965	547.48	79.37
1920	61.157	0.4973	547.49	79.42
1940	61.159	0.4973	547.50	79.42
2000	61.160	0.4997	547.50	79.57
2020	61.162	0.5032	547.51	79.78
2040	61.161	0.5042	547.51	79.84
2100	61.162	0.4993	547.52	79.54
2120	61.162	0.4999	547.52	79.58
2140	61.161	0.4999	547.51	79.58
2200	61.163	0.5009	547.53	79.64
2220	61.163	0.5001	547.54	79.59
2240	61.164	0.5009	547.55	79.64
2300	61.166	0.5015	547.55	79.68
2320	61.167	0.5022	547.55	79.72
2340	61.168	0.5020	547.57	79.71
0000	61.169	0.5027	547.57	79.75
0020	61.170	0.5027	547.57	79.75
0040	61.170	0.5034	547.58	79.79
0100	61.171	0.5011	547.59	79.65
0120	61.171	0.5009	547.59	79.64
0140	61.171	0.4986	547.59	79.50
0200	61.172	0.5025	547.59	79.74
0220	61.172	0.5030	547.60	79.77
0240	61.172	0.5060	547.60	79.95

ATTACHMENT 3.3A (Cont)

Time (hr)	Abs. Press. (psia)	Vap. Press. (psia)	Abs. Temp. (°R)	Dewpoint (°F)
0300	61.172	0.5029	547.60	79.76
0320	61.171	0.5019	547.60	79.70
0340	61.171	0.5014	547.60	79.67
0400	61.171	0.5024	547.60	79.73
0420	61.171	0.5009	547.60	79.64
0440	61.170	0.5037	547.59	79.81
0500	61.170	0.5039	547.59	79.82

ATTACHMENT 3.3B

CONTAINMENT INTEGRATED LEAK RATE TEST

FROM 1300 HOURS ON 9/13/83 TO 0500 HOURS ON 9/14/83

ABSOLUTE TEST METHOD - TOTAL TIME ANALYSIS

Time (Hrs)	Mass (Lbm)	Measure Leakage (Pct/day)	Estimate Leakage (Pct/day)	Confidence (Pct/day)	UCL (Pct/day)
0.0	538384.69	0.0	0.0	0.0	0.0
0.333	538379.76	0.066015	0.0	0.0	0.0
0.667	538372.18	0.083627	0.0	0.0	0.0
1.000	538359.34	0.113011	0.111034	0.046832	0.157866
1.333	538365.05	0.065684	0.086351	0.134999	0.221350
1.667	538349.04	0.095343	0.092889	0.085533	0.178421
2.000	538356.18	0.063557	0.079466	0.075186	0.154652
2.333	538372.18	0.023909	0.053308	0.082762	0.136069
2.667	538348.57	0.060380	0.052414	0.072069	0.124484
3.000	538328.25	0.083873	0.060920	0.070598	0.131518
3.333	538313.90	0.094680	0.070633	0.069608	0.140241
3.667	538303.84	0.098293	0.078772	0.066965	0.145737
4.000	538300.96	0.093319	0.083293	0.062775	0.146068
4.333	538306.47	0.080479	0.083155	0.058726	0.141881
4.667	538256.11	0.122819	0.093918	0.060127	0.154045
5.000	538252.71	0.117674	0.101073	0.058336	0.159409
5.333	538289.42	0.079636	0.098049	0.057077	0.155126
5.667	538294.71	0.070784	0.093651	0.056736	0.150386
6.000	538296.37	0.065624	0.088960	0.056480	0.145439
6.333	538305.93	0.055442	0.083078	0.056974	0.140052
6.667	538313.85	0.047371	0.076657	0.057649	0.134307
7.000	538300.98	0.053313	0.072305	0.056766	0.129071
7.333	538278.30	0.064680	0.070549	0.055062	0.125612
7.667	538260.65	0.072124	0.070271	0.053424	0.123695
8.000	538303.42	0.045289	0.065840	0.052989	0.118828
8.333	538297.61	0.046587	0.062210	0.052155	0.114365
8.667	538298.57	0.044299	0.058727	0.051305	0.110031
9.000	538287.93	0.047930	0.056206	0.050204	0.106410
9.333	538285.37	0.047443	0.053941	0.049123	0.103064
9.667	538277.14	0.049598	0.052237	0.048040	0.100276
10.000	538289.06	0.042632	0.049863	0.047116	0.096979
10.333	538292.10	0.039946	0.047486	0.046257	0.093693
10.667	538282.77	0.042594	0.045596	0.045358	0.090954
11.000	538285.81	0.040074	0.043676	0.044516	0.088182
11.333	538294.68	0.035407	0.041441	0.043763	0.085204
11.667	538279.01	0.040382	0.039982	0.042985	0.082967
12.000	538298.47	0.032031	0.037793	0.042304	0.080097
12.333	538299.93	0.030640	0.035678	0.041644	0.077322
12.667	538320.26	0.022676	0.032961	0.041152	0.074113
13.000	538294.22	0.031023	0.031326	0.040508	0.071835
13.333	538280.01	0.034999	0.030232	0.039930	0.070163

ATTACHMENT 3.3B (Cont)

Time (Hrs)	Mass (Lbm)	Measure Leakage (Pct/day)	Estimate Leakage (Pct/day)	Confidence (Pct/day)	UCL (Pct/day)
13.667	538253.65	0.042742	0.029971	0.039603	0.069574
14.000	538281.47	0.032867	0.028844	0.039061	0.067905
14.333	538281.36	0.032140	0.027758	0.038545	0.066303
14.667	538285.73	0.030079	0.026586	0.038040	0.064626
15.000	538276.98	0.032011	0.025688	0.037597	0.063285
15.333	538290.10	0.027503	0.024493	0.037125	0.061618
15.667	538266.25	0.033701	0.023905	0.036797	0.060702
16.000	538264.79	0.033407	0.023354	0.036489	0.059842

ATTACHMENT 3.3C

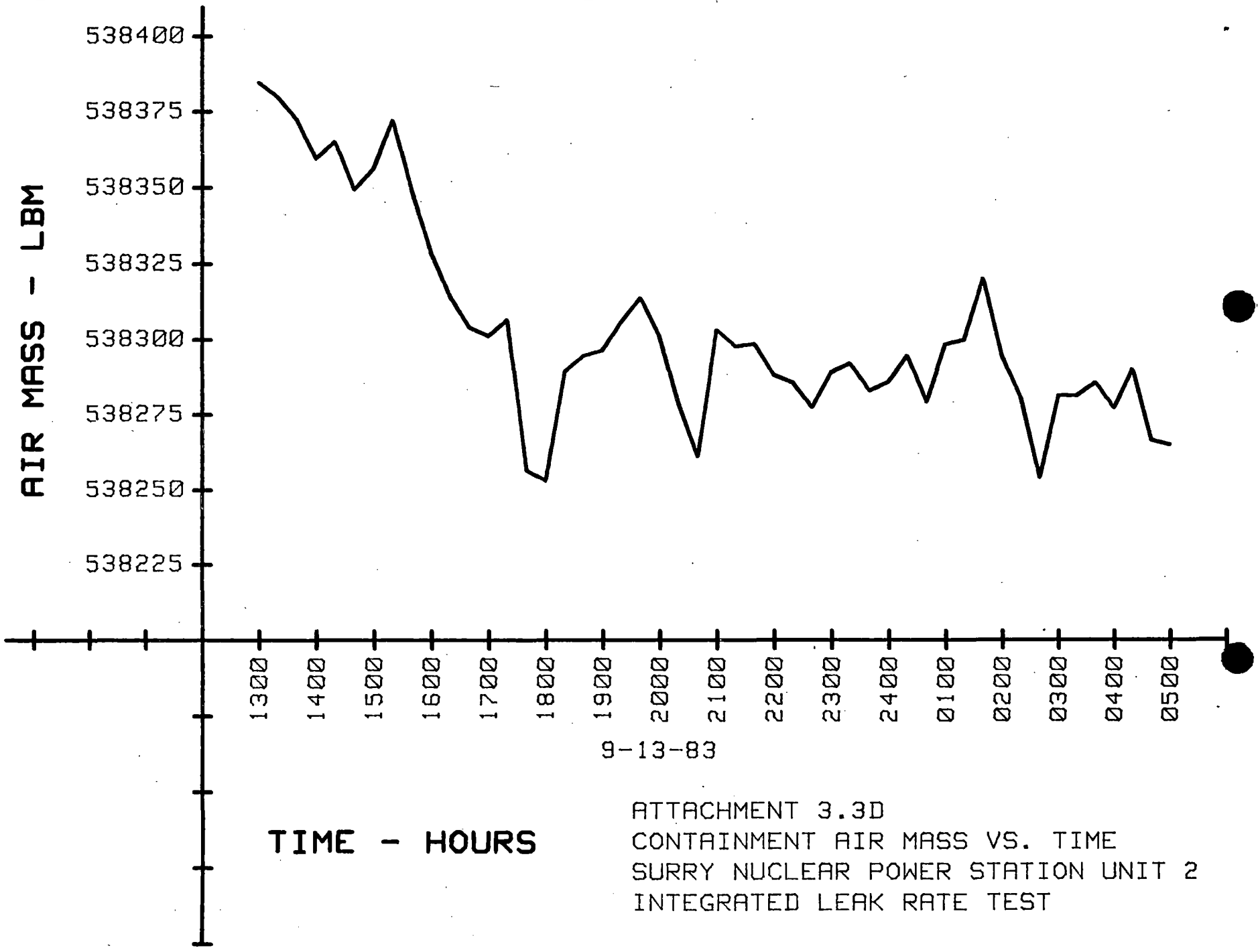
CONTAINMENT INTEGRATED LEAK RATE TEST FROM
1300 HRS ON 9/13/83 TO 0500 HOURS ON 9/14/83

ABSOLUTE TEST METHOD - MASS POINT ANALYSIS

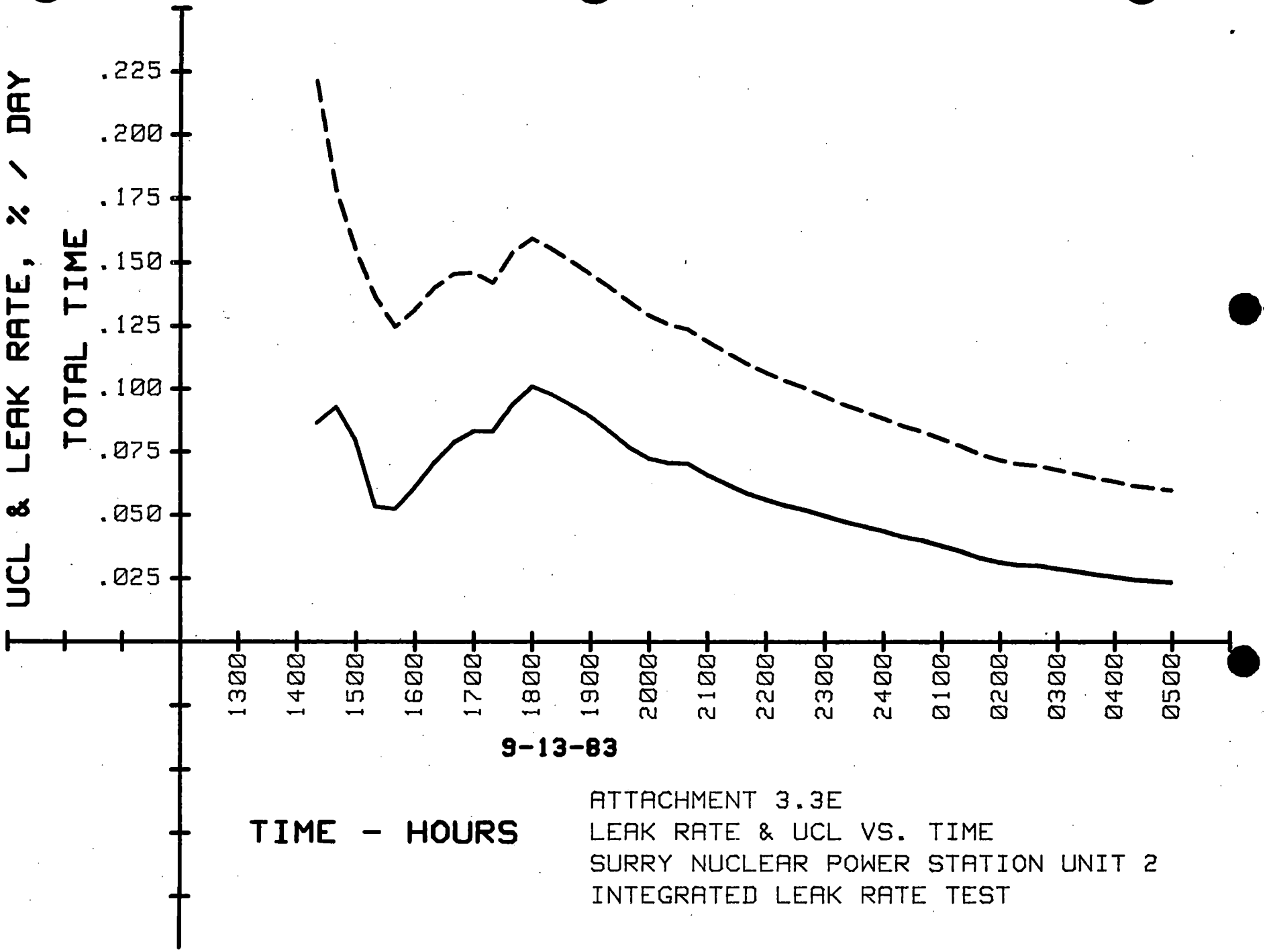
Time (hrs)	Mass (lbm)	Leakage (Pct/day)	Confidence (Pct/day)	UCL (Pct/day)
0.0	538384.69	0.0	0.0	0.0
0.333	538379.76	0.0	0.0	0.0
0.667	538372.18	0.083635	0.086876	0.170511
1.000	538359.34	0.111823	0.049737	0.161561
1.333	538365.05	0.079859	0.049183	0.129041
1.667	538349.04	0.089881	0.031646	0.121526
2.000	538356.18	0.073611	0.028385	0.101997
2.333	538372.18	0.042874	0.040079	0.082953
2.667	538348.57	0.046712	0.030556	0.077268
3.000	538328.25	0.060942	0.028387	0.089329
3.333	538313.90	0.074655	0.027071	0.101726
3.667	538303.84	0.084870	0.024701	0.109571
4.000	538300.96	0.089517	0.021239	0.110756
4.333	538306.47	0.087778	0.018140	0.105918
4.667	538256.11	0.101285	0.020840	0.122125
5.000	538252.71	0.109093	0.019788	0.128882
5.333	538289.42	0.102689	0.018541	0.121230
5.667	538294.71	0.095148	0.018081	0.113230
6.000	538296.37	0.087901	0.017682	0.105583
6.333	538305.93	0.079540	0.017933	0.097473
6.667	538313.85	0.070939	0.018313	0.089252
7.000	538300.98	0.065681	0.017408	0.083089
7.333	538278.30	0.064264	0.015917	0.080181
7.667	538260.65	0.064889	0.014571	0.079460
8.000	538303.42	0.059498	0.014402	0.073901
8.333	538297.61	0.055415	0.013869	0.069284
8.667	538298.57	0.051632	0.013352	0.064983
9.000	538287.93	0.049274	0.012594	0.061868
9.333	538285.37	0.047268	0.011874	0.059142
9.667	538277.14	0.046041	0.011133	0.057174
10.000	538289.06	0.043795	0.010632	0.054427
10.333	538292.10	0.041465	0.010215	0.051680
10.667	538282.77	0.039978	0.009695	0.049674
11.000	538285.81	0.038333	0.009256	0.047590
11.333	538294.68	0.036207	0.008963	0.045170
11.667	538279.01	0.035197	0.008515	0.043712
12.000	538298.47	0.033081	0.008309	0.041389
12.333	538299.93	0.031069	0.008106	0.039175
12.667	538320.26	0.028186	0.008182	0.036367
13.000	538294.22	0.026885	0.007870	0.034754
13.333	538280.01	0.026334	0.007500	0.033834
13.667	538253.65	0.026941	0.007163	0.034104

ATTACHMENT 3.3C (Cont)

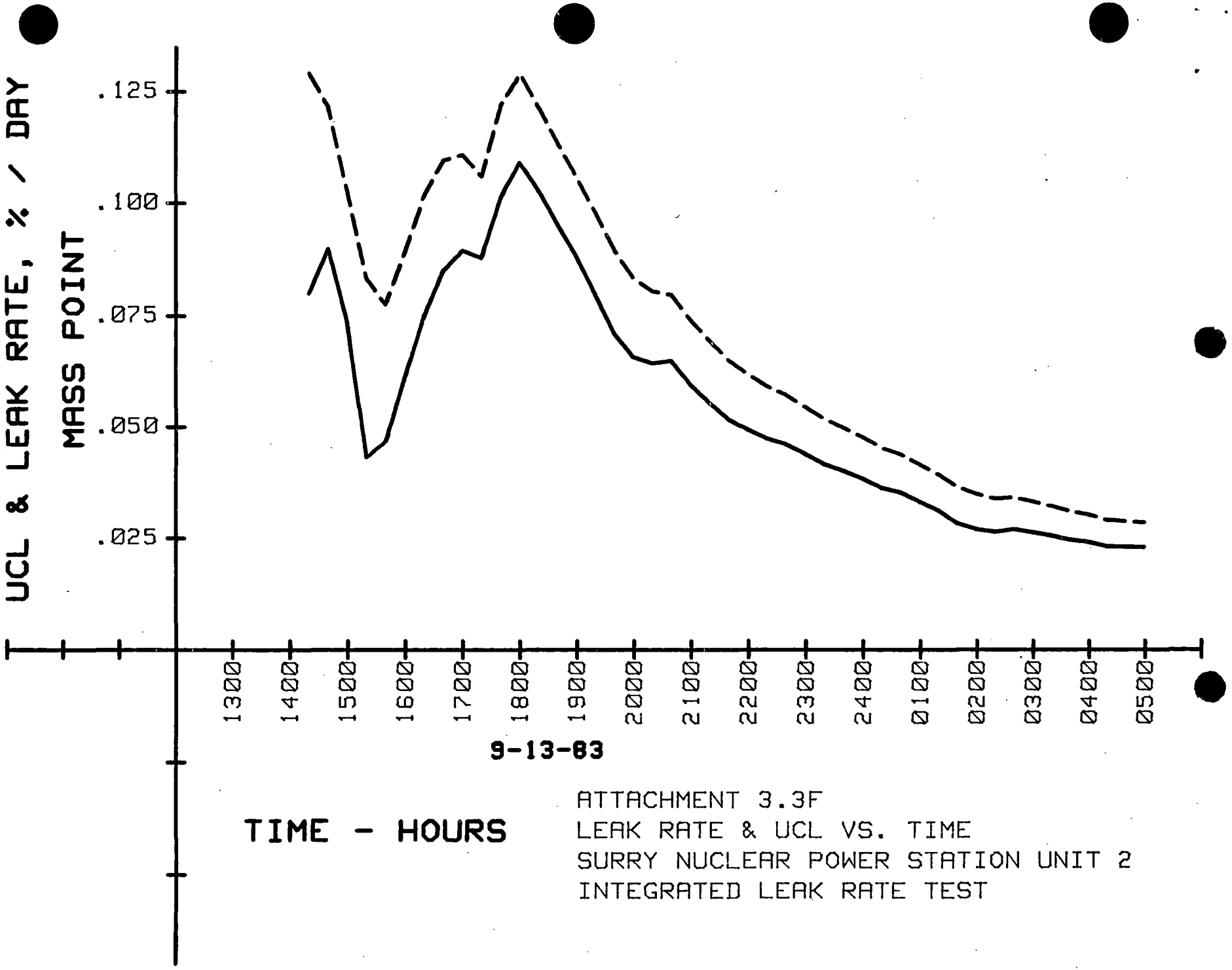
Time (hrs)	Mass (lbm)	Leakage (Pct/day)	Confidence (Pct/day)	UCL (Pct/day)
14.000	538281.47	0.026203	0.006863	0.033066
14.333	538281.36	0.025486	0.006584	0.032070
14.667	538285.73	0.024617	0.006344	0.030961
15.000	538276.98	0.024113	0.006085	0.030198
15.333	538290.10	0.023140	0.005899	0.029039
15.667	538266.25	0.023038	0.005652	0.028689
16.000	538264.79	0.022939	0.005419	0.028359



ATTACHMENT 3.3D
CONTAINMENT AIR MASS VS. TIME
SURRY NUCLEAR POWER STATION UNIT 2
INTEGRATED LEAK RATE TEST



ATTACHMENT 3.3E
LEAK RATE & UCL VS. TIME
SURRY NUCLEAR POWER STATION UNIT 2
INTEGRATED LEAK RATE TEST



ATTACHMENT 3.3F
LEAK RATE & UCL VS. TIME
SURRY NUCLEAR POWER STATION UNIT 2
INTEGRATED LEAK RATE TEST

SECTION 4

LOCAL LEAK RATE TESTS (TYPE B AND C)

Section 4 analyzes the Local Leak Rate Test (LLRT) data performed since the December 1981 Type A Test. This analysis is comprised of LLRT Penetration Data (see Attachment 4A).

Multiple penetration designations have been reassigned in accordance with VEPCO drawings 11448-FV-1A and 11448-FV-1R. These designations are as follows:

Alphanumeric Designation	Old Designation	New Designation
XXXA	Upper Left	Upper Left
XXXB	Upper Right	Lower Left
XXXC	Lower Right	Upper Right
XXXD	Lower Left	Lower Right

The penetrations, as designated above the XXX's, that were affected are 55, 56, 57, 97, and 105. Those penetrations not listed in Attachment 4B, such as 55A, are spares.

The combined "as-left" leakage rate for all the valves and penetrations subject to Type B and C testing is well below the acceptance criteria of less than 0.60LA. See Attachment 4A.

ATTACHMENT 4A

LOCAL LEAK RATE TEST PENETRATION DATA

Penetration		Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh),	Postrepair Leakage (scfh),	MR No., Repair
7	Safety Injection	C	2-SI-150 MOV-2867C MOV-2867D	0.1 0.0 0.0	0.0 0.0 0.0	
15	Charging	C	2-CH-309 MOV-2289A	0.0 0.0	0.0 0.0	
19	Charging	C	MOV-2381	0.0	0.0	
20	Safety Injection	C	2-SI-32	0.0	0.0	
21	Safety Injection	C	MOV-2842	0.0	0.0	
23	Safety Injection	C	MOV-2869B	0.0	0.0	
24	Residual Heat Removal	C	MOV-RH-200	1.2	1.2	
28	Chemical and Volume Control	C	HCV-2200 A,B,C TV-2204	>40 0.0	0.6 0.0	S2307110656 lapped seat, new gaskets S2307110655 Reworked plug and cage S2307110654 Reworked plug and cage
32	Gaseous Waste	C	TV-GW-203 TV-GW-202	0.0 0.0	0.0 0.0	
33	Gaseous Drains	C	TV-DG-208A TV-DG-208B	0.5 0.0	0.0 0.0	
38	Aerated Drain	C	TV-DA-200A TV-DA-200B	>40 >40	4.1 3.0	S2307120532 Grind plug and seat
42	Service Air	C	2-SA-81 2-SA-82	0.0 0.0	0.0 0.0	
43	Air	C NA	2-RM-3 TV-RM-200A	3.0 0.0	3.0 0.0	S2307080602 Grind seat on flapper
44	Air Monitoring	C	TV-RM-200B TV-RM-200C	0.0 0.0	0.0 0.0	

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh),	Postrepair Leakage (scfh),	MR No., Repair
45 Primary Grade Water	C	2-RC-160	0.6	0.0	
		TV-2519A	0.0	0.0	
46 Charging	C	FCV-2160	>40	0.0	
47 Instrument Air	C	2-IA-864	1.1	0.0	
		2-IA-704	1.9	0.0	S2307081046 Lapped seat and replaced gasket
		TV-IA-200	0.0	0.0	
48 Vent and Drain	C	TV-VG-209A	0.0	0.0	
		TV-VG-209B	0.0	0.0	
50 Safety Injection	C	TV-SI-201A	>40	0.0	
		TV-SI-201B	0.0	0.0	
51 Service Water	C	2-SW-206	0.0	0.0	
		2-SW-208	0.0	0.0	
53 Safety Injection	C	2-SI-234	0.0	0.0	
		TV-SI-200	0.0	0.0	
54 Primary Vent	C	2-VA-1	0.0	0.0	
		2-VA-9	0.0	0.0	
55D Leakage Monitoring	C	TV-LM-200G	0.0	0.0	
		TV-LM-200H	0.0	0.0	
56A Sample System	C	TV-SS-206A	0.0	0.0	
		TV-SS-206B	0.0	0.0	
56B Sample System	C	TV-SS-202A	0.0	0.0	
		TV-SS-202B	1.6	0.0	
56D Sample System	C	TV-SS-200A	0.0	0.0	
		TV-SS-200B	0.0	0.0	
57A Leakage Monitoring	C	TV-LM-100G	0.0	0.0	
		TV-LM-100H	0.0	0.0	
57B Drain System	C	TV-DA-203A	0.0	0.0	
		TV-DA-203B			
57C Leakage Monitoring	C	TV-LM-200E	0.0	0.0	
		TV-LM-200F	0.0	0.0	

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh),	Postrepair Leakage (scfh),	MR No., Repair
57D Sample System	C	TV-SS-204A	0.0	0.0	
		TV-SS-204B	0.0	0.0	
58 Instrument Air	C	2-IA-868	0.0	0.0	
		1-IA-704	0.0	0.0	
60 Safety Injection	C	MOV-2890A	0.0	0.0	
61 Safety Injection	C	MOV-2890C	0.0	0.0	
62 Safety Injection	C	MOV-2890B	0.0	0.0	
63 Containment Spray	C	2-CS-24	0.0	0.0	
		MOV-CS-201C,D	0.0	0.0	
64 Containment Spray	C	2-CS-13	0.0	0.0	
		MOV-CS-201A,B	0.0	0.0	
66 Recirculation Spray	C	MOV-RS-255B	1.0	1.0	
67 Safety Injection	C	MOV-2860B	0.0	0.0	
68 Safety Injection	C	MOV-2860A	1.4	1.4	
69 Recirculation Spray	C	MOV-RS-255A	>40	0.0	S2307300730 Adjusted valve stroke
70 Recirculation Spray	C	2-RS-11	0.0	0.0	
		MOV-RS-256B	0.0	0.0	
71 Recirculation Spray	C	1-RS-17	0.0	0.0	
		MOV-RS-256A	0.0	0.0	
89 Air Ejector Discharge	C	2-VP-12	0.0	0.0	
		TV-SV-202A	0.0	0.0	
90 Ventilation	C	MOV-VS-200C	0.0	0.0	
		MOV-VS-200D, 201	0.6	0.6	

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh),	Postrepair Leakage (scfh),	MR No., Repair
91 Ventilation	C	MOV-VS-200A	0.0	0.0	
		MOV-VS-200B, 202	1,35	1.35	
92 Containment Vacuum	C	TV-GW-204	0.0	0.0	
		TV-GW-205	0.0	0.0	
		TV-CV-250C	12.0	0.0	
		TV-CV-250D	7.0	0.0	
93 Containment Vacuum	C	TV-GW-200	0.0	0.0	
		TV-GW-201	0.0	0.0	
		TV-CV-250A	0.8	0.0	
		TV-CV-250B	>40	0.0	S2307030023 Lapped seat
94 Containment Vacuum	C	HCV-CV-200	0.3	0.0	
		2-CV-2	0.5	0.0	
97B Sample System	C	TV-SS-203A	0.0	0.0	
		TV-SS-203B	0.0	0.0	
97C Leakage Monitoring	C	TV-LM-200A	0.0	0.0	
		TV-LM-200B	0.0	0.0	
100 Gaseous Waste	C	TV-GW-206	0.0	0.0	
		TV-GW-207	0.0	0.0	
101 Fire Protection	C	2-FP-151	0.0	0.0	
		2-FP-152	0.0	0.0	
103 Reactor Cavity Purification	C	2-RL-3	0.0	0.0	
		2-RL-5	0.0	0.0	
104 Reactor Cavity Purification	C	2-RL-13	0.0	0.0	
		2-RL-15	0.0	0.0	
105B Leakage Monitoring	C	TV-LM-200C	0.0	0.0	
		TV-LM-200D	0.0	0.0	
105C Post Accident Sampling	C	TV-GW-211A	0.0	0.0	
		TV-GW-211B	0.0	0.0	
106 Safety Injection	C	2-SI-73	0.0	0.0	

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh),	Postrepair Leakage (scfh),	MR No., Repair
112 Instrument Air	C	TV-IA-201A TV-IA-201B	0.0 0.0	0.0 0.0	
113 Safety Injection	C	2-SI-174 MOV-2869A	0.0 0.0	0.0 0.0	
Personnel Air Lock	B	O-ring	0.0	0.0	
Equipment Hatch	B	O-ring	0.0	0.0	
Fuel Transfer Tube	B	O-ring	3.1	3.1	
Emergency Air Lock	B	O-ring	0.0	0.0	

All electrical penetrations and other Type B penetrations were tested prior to performance of the CILRT with a combined leakage of 0.052 scfh.