REACTOR CONTAINMENT BUILDING

INTEGRATED LEAK RATE TEST

TYPE A, B, AND C

PERIODIC TEST

VIRGINIA ELECTRIC AND POWER COMPANY

Surry Nuclear

Power Station

Unit No. 1

April 1983

PREPARED BY STONE & WEBSTER ENGINEERING CORPORATION

BOSTON, MASS

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REFERENCES

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

2. 1-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 April 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. 1.

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 0045 hours on April 20, 1983. A pressurization rate of approximately 4.5 psi per hour was maintained throughout the pressurization interval. Initial containment air temperature was approximately 74°F and the initial containment dew point temperature was approximately 65°F.

Containment pressurization was secured at 1131 hours on April 20, 1983, with a peak pressure of 61.385 psia. Containment air temperature and dew point temperature at the start of the stabilization period were approximately 77°F and 68°F respectively.

The temperature stabilization criterion was satisfied at approximately 1604 hours on April 20, 1983. Over the next five hours, temperature increased by approximately 0.5°F. At 2104 hours on April 20, 1983, the containment temperature became stable and showed little change over the next seven hours. During the early morning hours on April 21, 1983, river water temperature dropped approximately 2°F. This temperature drop was passed on to Component Cooling (CC) System which supplies cooling water to the containment air recirculation fan cooling coils and to the Residual Heat Removal (RHR) System heat exchangers. This drop in CC temperature in turn affected containment air temperature causing it to drop approximately 0.3°F over a three hour period. At 0614 hours on April 21, 1983, CC was throttled in an attempt to offset the river water temperature drop. During the test, Unit 2 was shutdown preparing for startup. At the time, the unit was on RHR which caused an increased load on CC. Due to CC being a common system between both units, CC temperature stability was also affected by Unit 2 startup.

The inability to control containment air temperature, with the changes in CC temperature, complicated the determination of the actual leakage rate (See Attachments 2.1A and 2.1B). Throughout the test, personnel performed searches to identify any leakage which might exist. During these investigations no significant sources of leakage were found. It was determined that the temperature effects were artificially inflating the leakage rate.

The reported leakage rate was based on a 28.333 hour test, running from 2104 hours on April 20, 1983, to 0124 hours on April 22, 1983. The calculated leakage rate satisfied the requirements of the procedure. For further discussion and analysis of the leakage calculations, refer to Section 3.3.

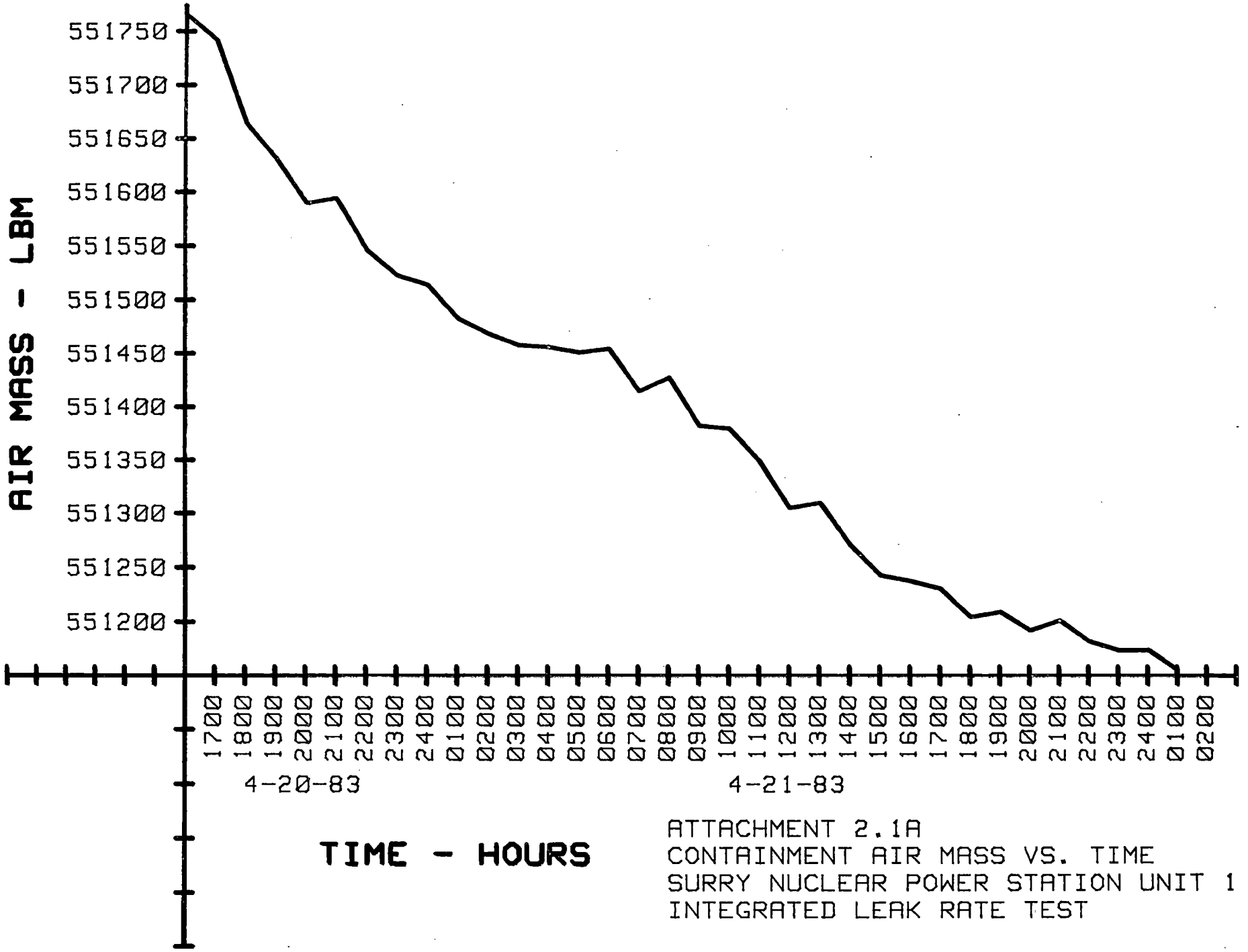
At 0214 hours on April 22, 1983, the mass pump-back verification test started. At 0400 hours, the mass pump-back test was completed. The verification test satisfied the requirements of the procedure.

Depressurization of the containment began at 0600 hours and was completed at 1708 hours on April 22, 1983.

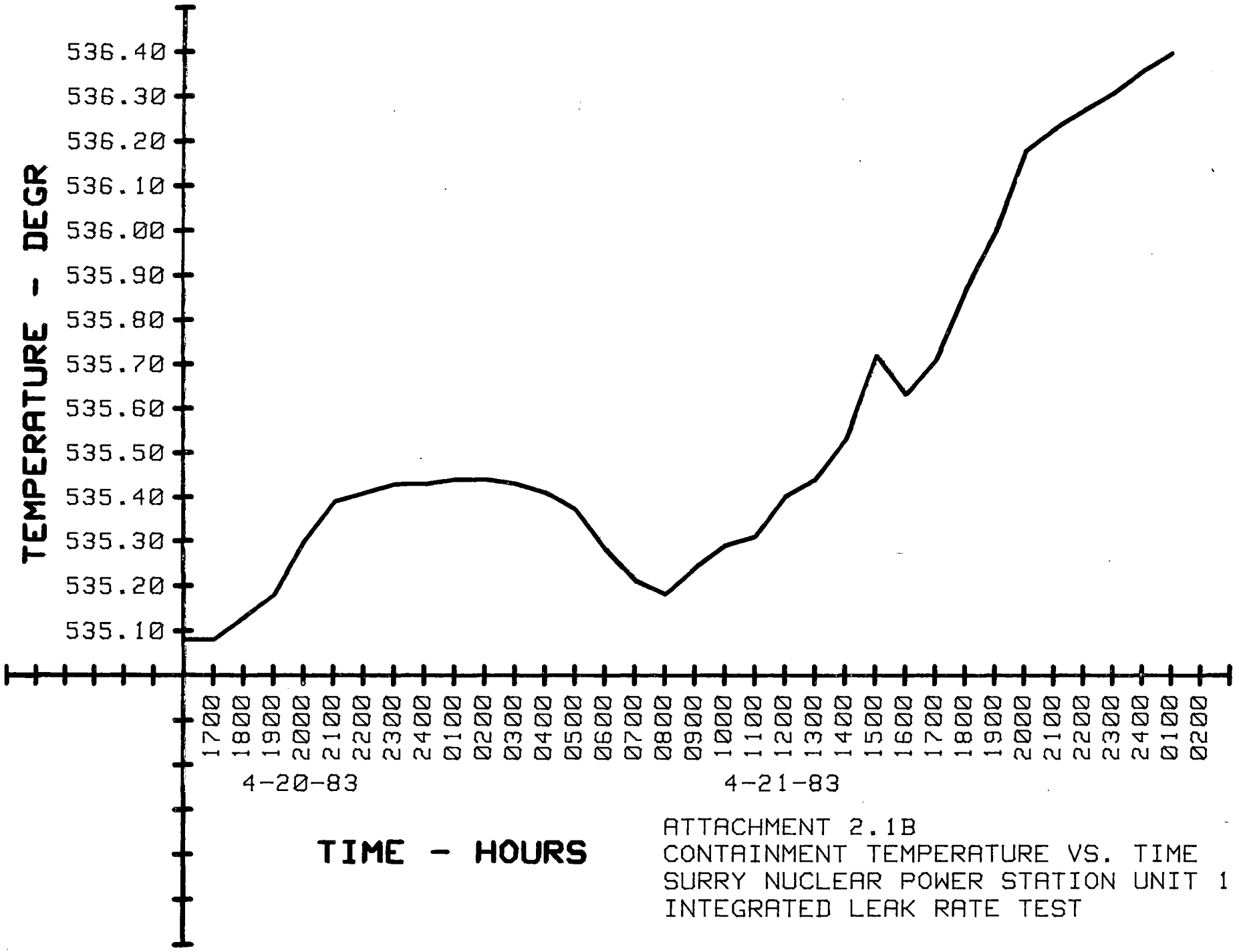
2.2 Local Leak Rate Tests (Types B and C)

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 June 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.



ATTACHMENT 2.1A
CONTAINMENT AIR MASS VS. TIME
SURRY NUCLEAR POWER STATION UNIT 1
INTEGRATED LEAK RATE TEST



ATTACHMENT 2.1B
CONTAINMENT TEMPERATURE VS. TIME
SURRY NUCLEAR POWER STATION UNIT 1
INTEGRATED LEAK RATE TEST

SECTION 3

TYPE A TEST

3.1 Edited Log of Events

This log was edited from the Official Log of Events.

April 20, 1983

0011 - Completed containment inspection

0045 - Initiated containment pressurization

0330 - Began gross leakage inspection

1131 - Isolated containment pressurization source

April 21, 1983

0614 - Component Cooling temperature had decreased by approximately 2°F

1309 - Unit 1 computer failed causing loss of data - utilized backup data from Unit 2 computer

1500 - Leakage noted from vent on penetration 53

1701 - Quantified penetration 53 leakage at 15 scfh

April 22, 1983

0214 - Initiated mass step change verification test

0400 - Successfully completed verification test

0600 - Began containment depressurization

1708 - Containment depressurization complete

2230 - Containment inspection for pretest deviations complete

3.2 General Test Description

3.2.1 Prerequisites

In accordance with the Surry Unit No. 1 CILRT procedure, 1-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 for 7 days prior to and 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 are input into the plant computer for data acquisition and averaging.

3.2.3 Data Acquisition System

The Surry Unit No. 1 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)
24 RTDs	20
5 chilled mirrors	20
2 quartz manometers	2

Instantaneous values of the CILRT instruments were recorded every 15 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.

ATTACHMENT 3.2A

SITE METEOROLOGY

Date	Time	Barometric Pressure (in. Hg)	Dew Point Temperature (°F)	Dry Bulb Temperature (°F)
04/14/83	0000	30.37	-	55.4
	0400	30.38	-	55.4
	0800	30.38	46	57.0
	1200	30.32	53	68.0
	1600	30.25	54	69
	2000	30.24	51	62.6
04/15/83	0800	30.09	56	64
	1200	30.02	54	74
04/16/83	0800	30.07	37	-
	1200	29.89	38	59
	2000	29.99	35	57.2
04/17/83	0800	30.00	35	51
	1200	29.9	30	60
	2000	29.9	31	53.6
04/18/83	0800	29.87	32	48
	1200	29.83	33	50
	1600	29.81	37	40
	2100	29.72	35	38
04/19/83	0800	29.68	28	41
	1200	29.64	33	49
	1600	29.69	-	-
04/20/83	0145	29.69	37.5	44.6
	0445	29.69	30.0	42.8

ATTACHMENT 3.2A (Cont'd)

Date	Time	Barometric Pressure (in. Hg)	Dew Point Temperature (°F)	Dry Bulb Temperature (°F)
4/20/83	0845	29.72	34.0	45.5
	1245	29.80	26	51
	1645	29.84	33	54
	2045	29.86	35	55.4
	2104 - Begin CILRT Test Period			
	2145	29.86	30	51.8
	2245	29.86	30	51.8
	2345	29.86	30	51.8
04/21/83	0045	29.84	30	46.0
	0145	29.92	30	46.0
	0245	30.03	30	48.2
	0445	30.00	30	41.0
	0545	30.01	30	43.0
	0645	30.00	33	44.0
	0745	30.03	35	46
	0845	30.03	35	48.0
	0945	30.02	33	53
	1045	30.02	34	57
	1145	30.00	35	57
	1245	30.00	33	59
	1345	30.00	33	59
	1445	29.65	35	63
	1545	29.63	34.5	63.5
	1645	29.98	35.0	65

ATTACHMENT 3.2A (Cont'd)

Date	Time	Barometric Pressure (in. Hg)	Dew Point Temperature (°F)	Dry Bulb Temperature (°F)
4/21/83	1745	29.99	35.0	62
	1845	30.00	41	57
	1945	30.05	43	53
	2045	30.02	45	55
	2145	30.02	43	53
	2245	30.02	43	52
	2345	30.04	30	51
04/22/83	0045	30.04	30	51
	0124 - Complete CILRT			

ATTACHMENT 3.2B

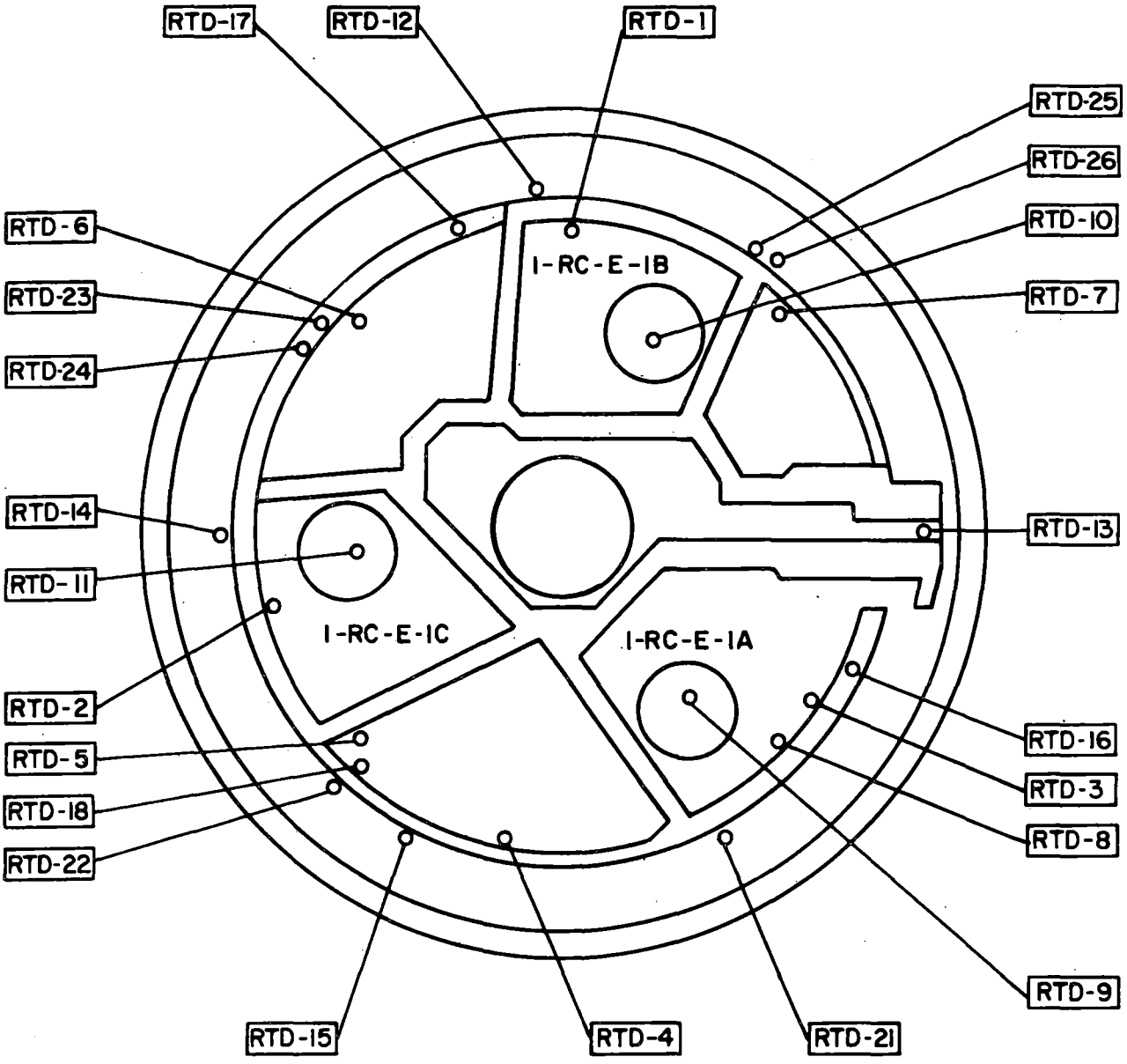
INSTRUMENTATION

The following instrumentation was calibrated, and functionally tested no greater 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-100-1	0.025697	T4019A	55-105°F	F	±0.1°F	±0.09°F
RTD-LM-100-2	0.022766	T4033A	55-105°F	F	±0.1°F	±0.09°F
RTD-LM-100-3	0.025609	T4034A	55-105°F	F	±0.1°F	±0.09°F
RTD-LM-100-4	0.014484	T4035A	55-105°F	E	±0.1°F	±0.09°F
RTD-LM-100-5	0.088892	T4036A	55-105°F	B	±0.1°F	±0.09°F
RTD-LM-100-6	0.088892	T4037A	55-105°F	B	±0.1°F	±0.09°F
RTD-LM-100-7	0.088892	T4038A	55-105°F	C	±0.1°F	±0.09°F
RTD-LM-100-8	0.088892	T4023A	55-105°F	C	±0.1°F	±0.09°F
RTD-LM-100-9	0.049432	Y4010A	55-105°F	A	±0.1°F	±0.09°F
RTD-LM-100-10	0.049432	Y4011A	55-105°F	A	±0.1°F	±0.09°F
RTD-LM-100-11	0.049432	Y4015A	55-105°F	A	±0.1°F	±0.09°F
RTD-LM-100-12	0.024442	Y4019A	55-105°F	D	±0.1°F	±0.09°F
RTD-LM-100-13	0.024442	Y4051A	55-105°F	D	±0.1°F	±0.09°F
RTD-LM-100-14	0.024442	Y4005A	55-105°F	E	±0.1°F	±0.09°F
RTD-LM-100-15	0.024442	T4003A	55-105°F	E	±0.1°F	±0.09°F
RTD-LM-100-16	0.043602	Y4009A	55-105°F	J	±0.1°F	±0.09°F
RTD-LM-100-17	0.043602	T4017A	55-105°F	J	±0.1°F	±0.09°F
RTD-LM-100-18	0.043602	T4018A	55-105°F	J	±0.1°F	±0.09°F
RTD-LM-100-21	0.024296	T4028A	55-105°F	G	±0.1°F	±0.09°F
RTD-LM-100-22	0.053389	T4031A	55-105°F	G	±0.1°F	±0.09°F
RTD-LM-100-23	0.035157	T4032A	55-105°F	H	±0.1°F	±0.09°F

ATTACHMENT 3.2B (Cont'd)

Instrument	Weight Factor	Computer Point	Range	Zone	Accuracy	Sensitivity
RTD-LM-100-24	0.024778	Y4031A	55-105°F	I	±0.1°F	±0.09°F
RTD-LM-100-25	0.021109	N0060A	55-105°F	H	±0.1°F	±0.09°F
RTD-LM-100-26	0.020279	N0062A	55-105°F	I	±0.1°F	±0.09°F
MT-LM-100-6	0.14064	Y4000A	-40 to +200°F	K	±0.4°F	±0.05°F
MT-LM-100-7	0.14064	Y4001A	-40 to +200°F	K	±0.4°F	±0.05°F
MT-LM-100-8	0.23959	Y4002A	-40 to +200°F	L	±0.4°F	±0.05°F
MT-LM-100-9	0.23959	Y4003A	-40 to +200°F	L	±0.4°F	±0.05°F
MT-LM-100-10	0.23959	Y4004A	-40 to +200°F	L	±0.4°F	±0.05°F
PI-LM-106	0.5	U0962	0-100 psia		±0.068 psia	±0.001%
PI-LM-107	0.5	U0963	0-100 psia		±0.068 psia	±0.001%

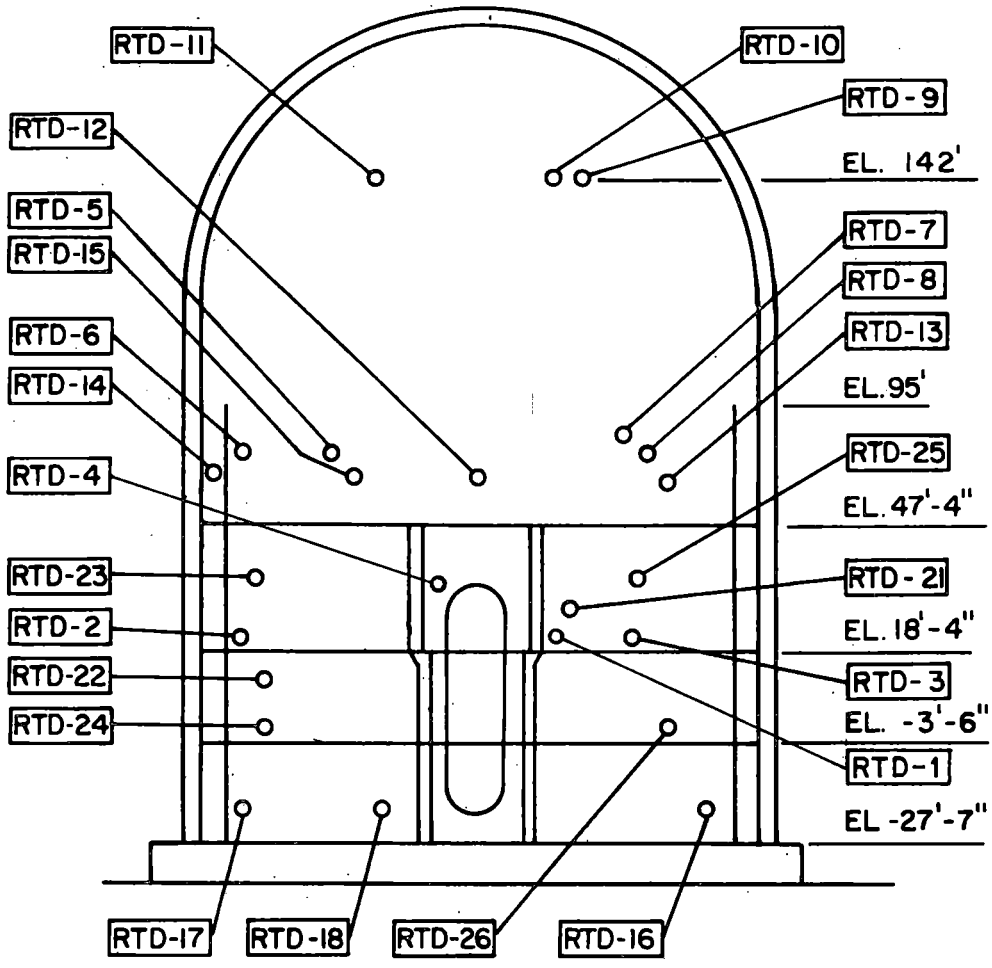


PLAN VIEW

NOTES:

1. RTD-1 = RTD-LM-100-1 (TYP)
2. RTD-19, 20 NOT USED
3. INSTRUMENT LOCATIONS SHOWN ARE ONLY APPROXIMATE

ATTACHMENT 3.2C
CILRT TEMPERATURE
DETECTOR LOCATIONS
SURRY NUCLEAR POWER STATION-UNIT 1



PROFILE VIEW

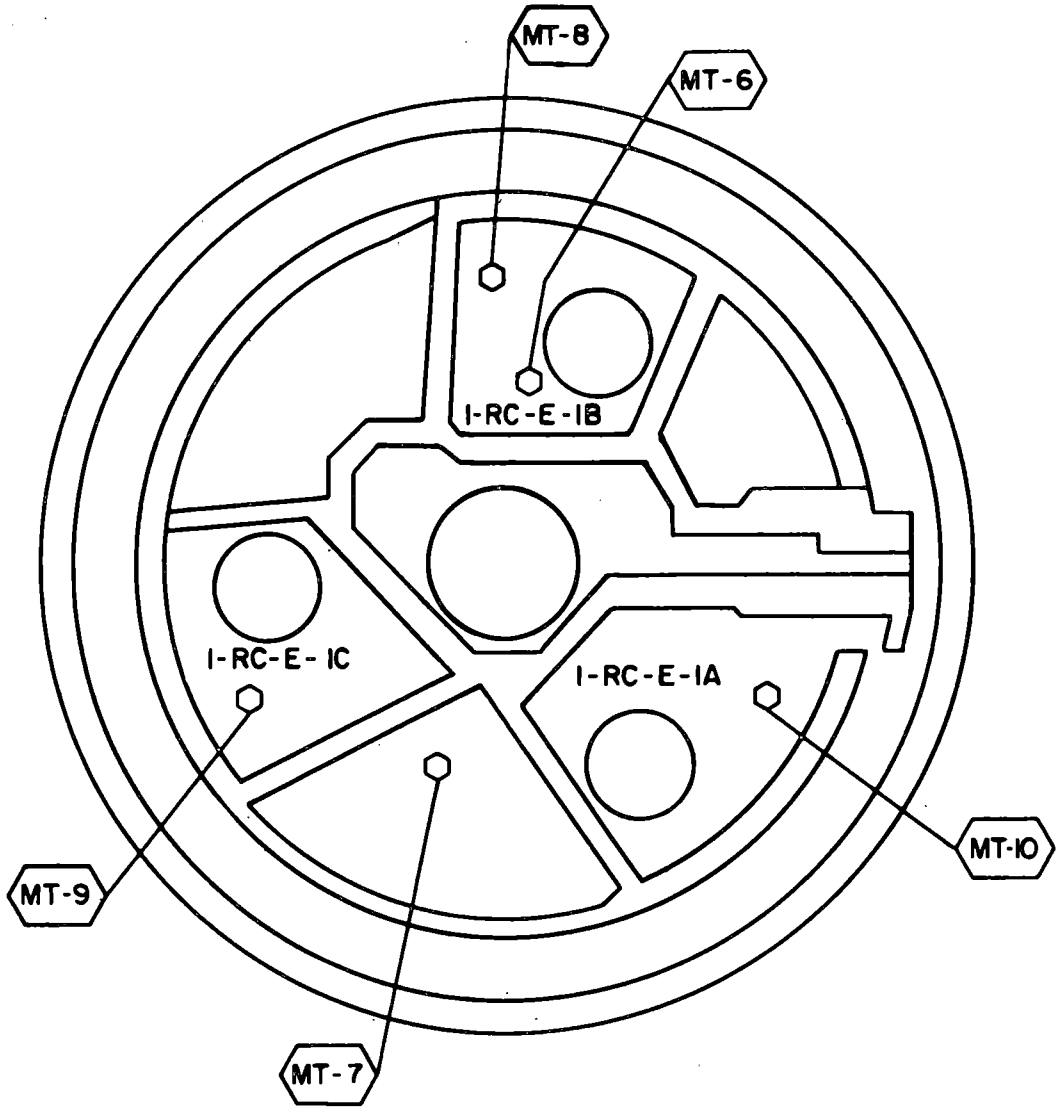
NOTES:

1. RTD-1 = RTD-LM-100-1(TYP)
2. RTD-19, 20 NOT USED
3. INSTRUMENT LOCATIONS SHOWN ARE ONLY APPROXIMATE

ATTACHMENT 3.2C

CILRT TEMPERATURE DETECTOR LOCATIONS

SURRY NUCLEAR POWER STATION-UNIT 1



PLAN VIEW

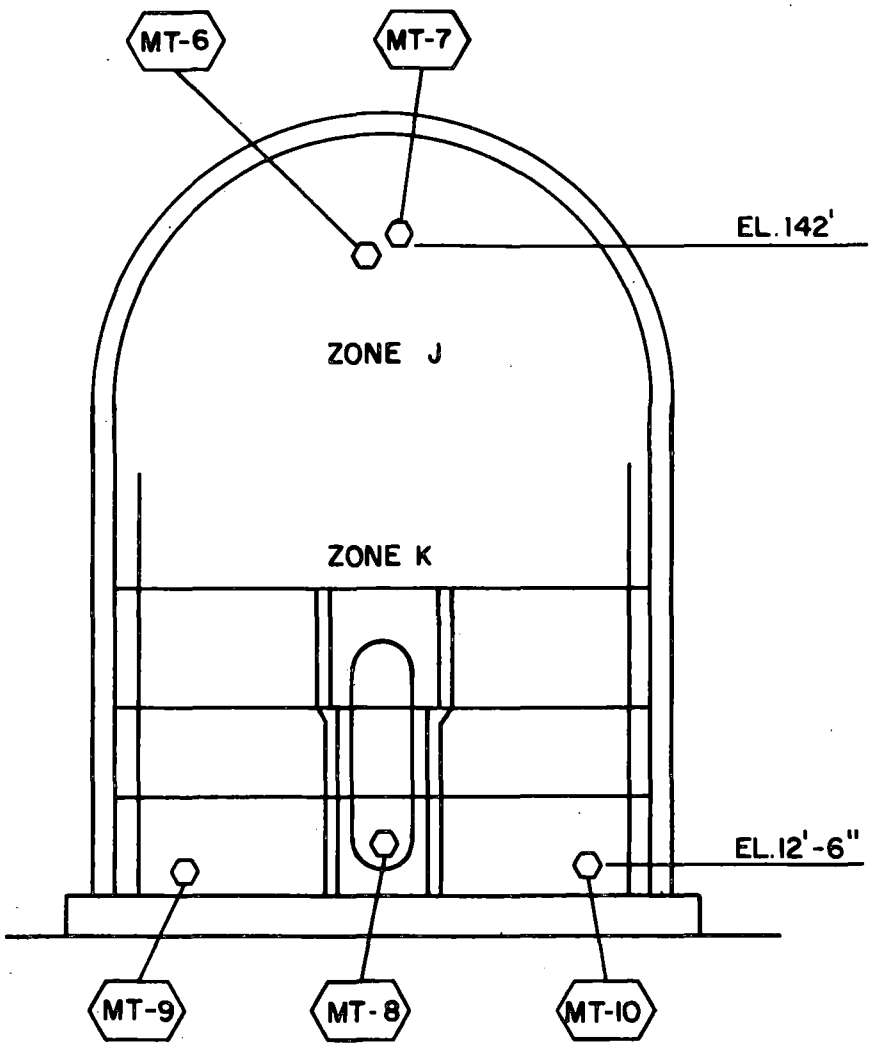
NOTES:

1. MT-6 = MT-LM-100-6 (TYP)
2. INSTRUMENT LOCATIONS SHOWN ARE ONLY APPROXIMATE

ATTACHMENT 3.2D

CILRT DEWPOINT TEMPERATURE SENSOR LOCATIONS

SURRY NUCLEAR POWER STATION - UNIT 1



PROFILE VIEW

NOTES:

1. MT-6 = MT-LM-100-6 (TYP)
2. INSTRUMENT LOCATIONS SHOWN ARE ONLY APPROXIMATE

ATTACHMENT 3.2D
CILRT DEWPOINT TEMPERATURE SENSOR LOCATIONS
SURRY NUCLEAR POWER STATION - UNIT 1

3.3 Test Results

3.3.1 Analysis of Test Results

The test data for the period of 2104 hours on April 20, 1983, through 0124 hours on April 22, 1983, were analyzed for the final test results using VEPCO's time sharing computer program. The reduced input data, mass point analysis results, and the representative graphs are contained in Attachments 3.3A through 3.3E.

In order to evaluate the effect of the component cooling (CC) water temperature fluctuations on the containment air temperature and therefore on the reported leakage rate, the Type A test period has been divided into three distinct time periods. These time periods, or regions, are identified on the containment air temperature and air mass plots contained on Attachments 3.3C and 3.3D. The regions are as follows:

Region I - Depicts trend data from 2104 hours on April 20, 1983, to 0804 hours on April 21, 1983.

Region II - Depicts trend data from 0804 hours on April 21, 1983, to 1504 hours on April 21, 1983.

Region III - Depicts trend data from 1504 hours on April 21, 1983, to 0104 hours on April 22, 1983.

The regions were determined primarily by observing the magnitude and algebraic sign of the slope of the containment air temperature plot. The temperature curve could easily be divided into more regions (as many as six) based entirely on slope, however three regions are sufficient to demonstrate the CC effect on the leakage rate.

The leakage rate of each region is summarized below:

Region	Leakage rate (%/day)
I	0.066
II	0.116
III	0.038

This leakage rate is based on the total mass loss during each interval with a conversion to percent per day. The likelihood of obtaining an extended time period with an essentially constant temperature slope (due to Unit 2 Startup) was doubtful. Thus, the decision was made to use the entire twenty-eight hours as the reported leakage rate realizing that the actual leakage rate would be much lower.

The Absolute Method of Mass Point Analysis results for the reported containment leakage rate are 0.068774 percent per day. This satisfies the procedural acceptance criteria of 0.072 percent per day which is 0.075 percent per day less the Type C penalty for valves on systems not vented to the containment. The results, including corrections for Type B and C leakage, are outlined in Section 3.3.2.

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 3.3.3.

3.3.2 59.7 psia CILRT Results

The 59.7 psia CILRT was conducted in accordance with Section 5.0 of periodic test procedure 1-PT-16.3

	%/Day
1. Measured Leakage Rate, Lam	0.066756
2. 95 Percent Confidence Level	0.002018
3. Leakage Penalties:	

	%/DAY	
i. Measured Type B Leakage	0.0	
ii. Measured Type C Leakage	0.003	
ii. Total Leakage added to CILRT results (i + ii)	0.003	
4. Lam Leakage with confidence Level and penalties (1 + 2 + 3ii)		0.071774

Results of the CILRT are acceptable as the measured leakage rate, with confidence level and required penalties, is below the procedural criteria of 0.075 percent per day.

3.3.3 Verification Test Results

The supplemental verification test was performed using the Mass Pump Back Method in accordance with Section 5.0 of 1-PT-16.3.

a. Total measured gas flow into containment	546	lbm
b. Difference between initial and final computer air mass readings	479	lbm
c. Difference between measured gas and calculated gas (a-b)	67	lbm
d. 0.25 La verification limit	136	lbm

Results of the Mass Step Change Verification Test are acceptable as the difference between the verification test data and the Type A test data is within 0.25 La.

ATTACHMENT 3.3A

CONTAINMENT INTEGRATED LEAK RATE TEST
From 2104 Hours on 4/20/83 to 0124 Hours on 4/22/83

INPUT VARIABLES

Time (hr)	Abs. Press. (psia)	Vap. Press. (psia)	Abs. Temp. (°R)	Dewpoint (°F)
2104	61.128	0.3446	535.39	68.49
2204	61.126	0.3457	535.41	68.58
2304	61.127	0.3470	535.43	68.69
0004	61.127	0.3480	535.43	68.77
0104	61.126	0.3493	535.44	68.88
0204	61.126	0.3508	535.44	69.01
0304	61.125	0.3522	535.43	69.12
0404	61.124	0.3536	535.41	69.24
0504	61.120	0.3547	535.37	69.33
0604	61.112	0.3565	535.28	69.48
0704	61.101	0.3579	535.21	69.59
0804	61.101	0.3598	535.18	69.75
0904	61.105	0.3621	535.24	69.93
1004	61.112	0.3637	535.29	70.06
1104	61.113	0.3658	535.31	70.23
1204	61.120	0.3674	535.40	70.36
1304	61.127	0.3693	535.44	70.51
1404	61.135	0.3714	535.53	70.68
1504	61.156	0.3740	535.72	70.88
1604	61.147	0.3757	535.63	71.02

ATTACHMENT 3.3A (Cont'd)

Time (hr)	Abs. Press. (psia)	Vap. Press. (psia)	Abs. Temp. (°R)	Dewpoint (°F)
1704	61.158	0.3784	535.71	71.23
1804	61.176	0.3811	535.87	71.44
1904	61.194	0.3839	536.00	71.65
2004	61.215	0.3863	536.18	71.84
2104	61.225	0.3896	536.23	72.09
2204	61.230	0.3923	536.27	72.29
2304	61.236	0.3947	536.31	72.47
0004	61.244	0.3969	536.36	72.64
0104	61.249	0.3995	536.40	72.83
0124	61.253	0.4004	536.41	72.90

ATTACHMENT 3.3B

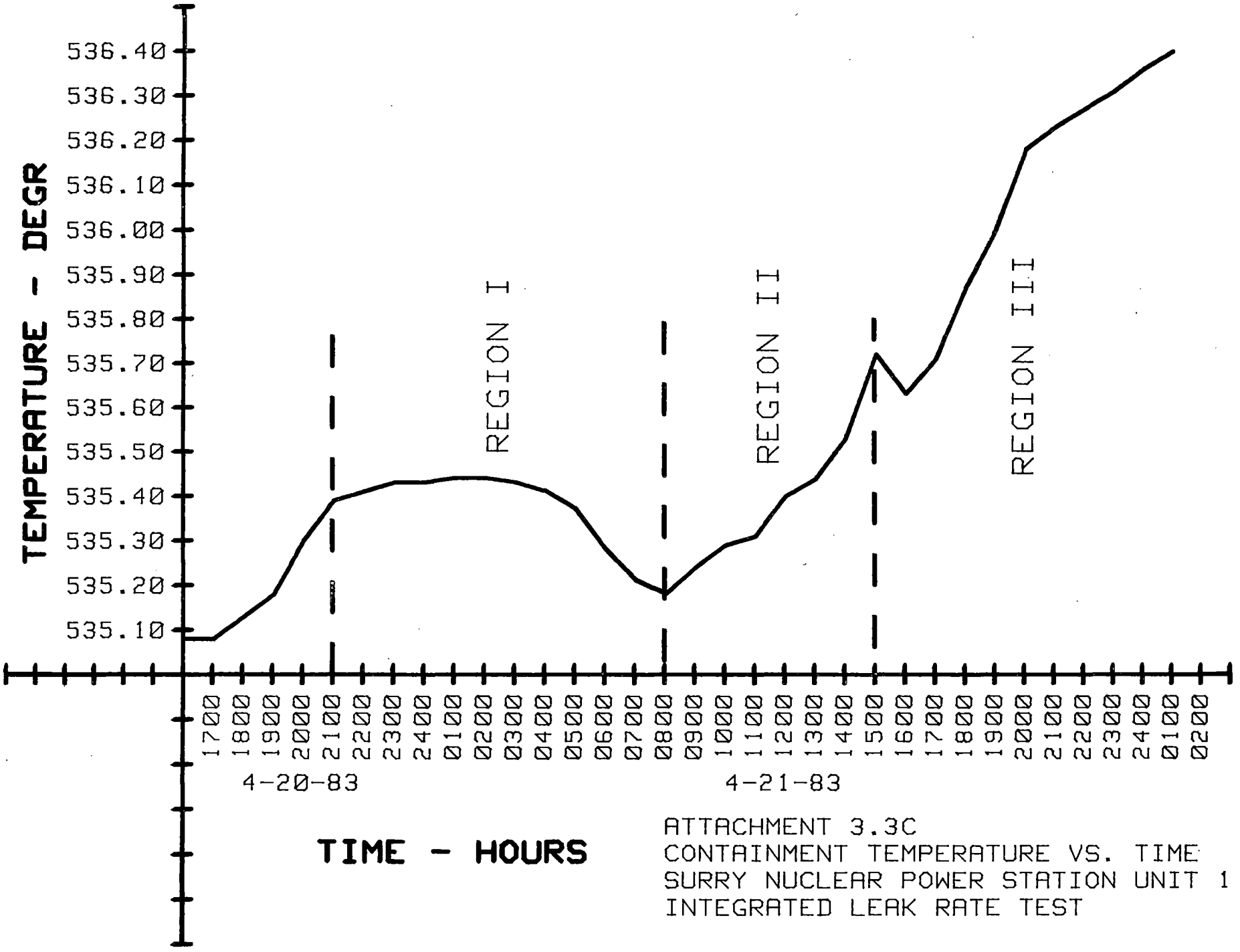
CONTAINMENT INTEGRATED LEAK RATE TEST
From 2104 Hours on 04/20/83 to 0124 Hours on 04/22/83

ABSOLUTE METHOD TEST RESULTS

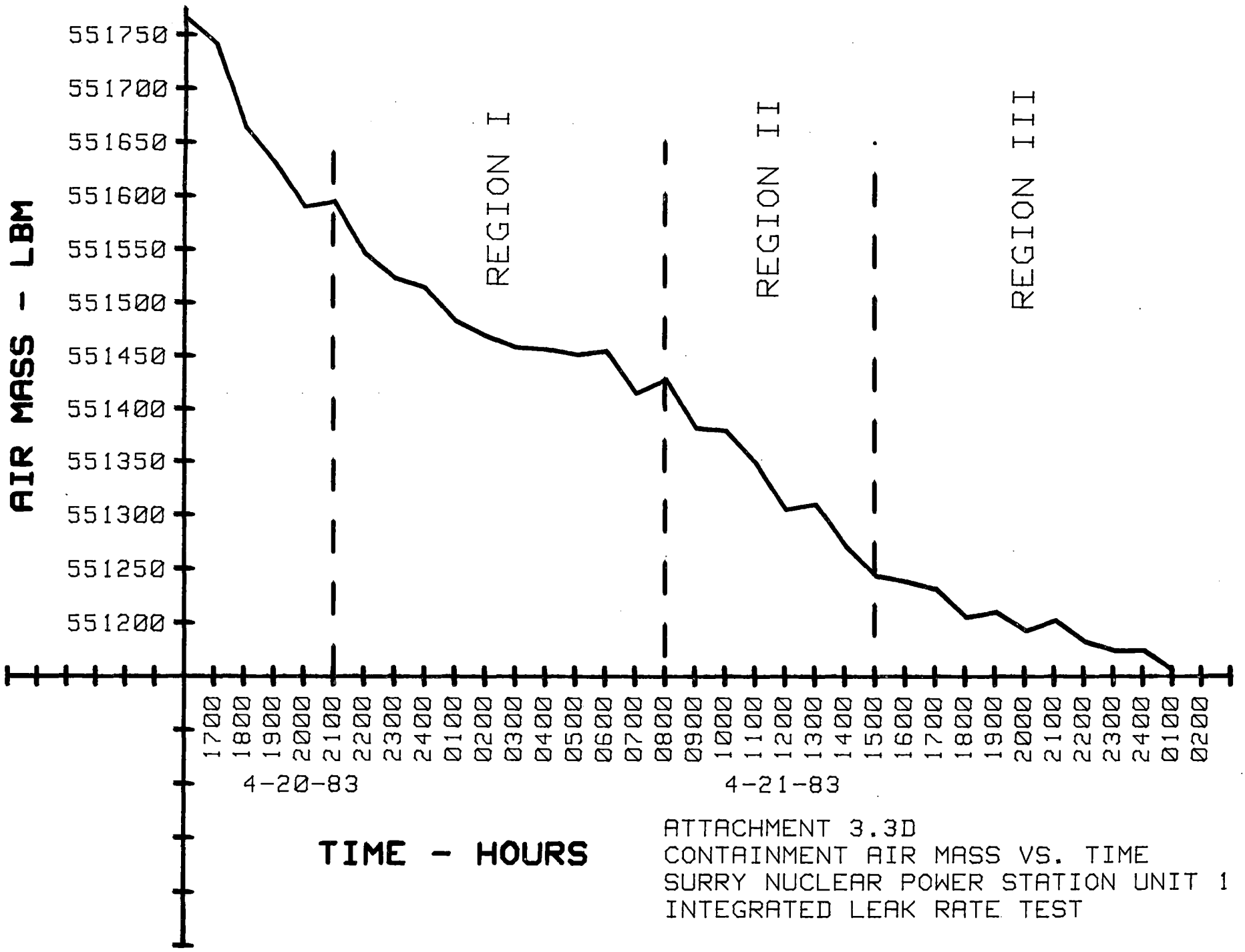
Time (hr)	Mass of Air (lbm)	Leak Rate (pct/day)	95 Pct Conf. (pct/day)	UCL (pct/day)
2104	551 593.9	0.0	0.0	0.0
2204	551 545.5	0.189 185	0.418 751	0.607 936
2304	551 522.1	0.106 698	0.085 213	0.191 911
0004	551 513.5	0.078 012	0.039 328	0.117 340
0104	551 482.2	0.080 739	0.022 483	0.103 222
0204	551 468.0	0.082 631	0.014 495	0.097 127
0304	551 457.2	0.079 034	0.010 231	0.089 265
0404	551 455.6	0.071 137	0.008 549	0.079 686
0504	551 450.6	0.064 107	0.007 596	0.071 703
0604	551 454.1	0.056 804	0.007 263	0.064 067
0704	551 414.2	0.058 645	0.006 016	0.064 660
0804	551 427.3	0.055 811	0.005 264	0.061 075
0904	551 381.7	0.056 973	0.004 542	0.061 516
1004	551 379.1	0.057 272	0.003 883	0.061 154
1104	551 348.4	0.055 899	0.004 006	0.059 905
1204	551 304.5	0.059 160	0.004 011	0.063 171
1304	551 309.8	0.062 242	0.003 910	0.066 152
1404	551 270.3	0.066 031	0.004 021	0.070 053
1504	551 242.2	0.068 476	0.003 876	0.072 351
1604	551 237.0	0.069 919	0.003 604	0.073 523
1704	551 230.1	0.070 295	0.003 279	0.073 575

ATTACHMENT 3.3B (Cont'd)

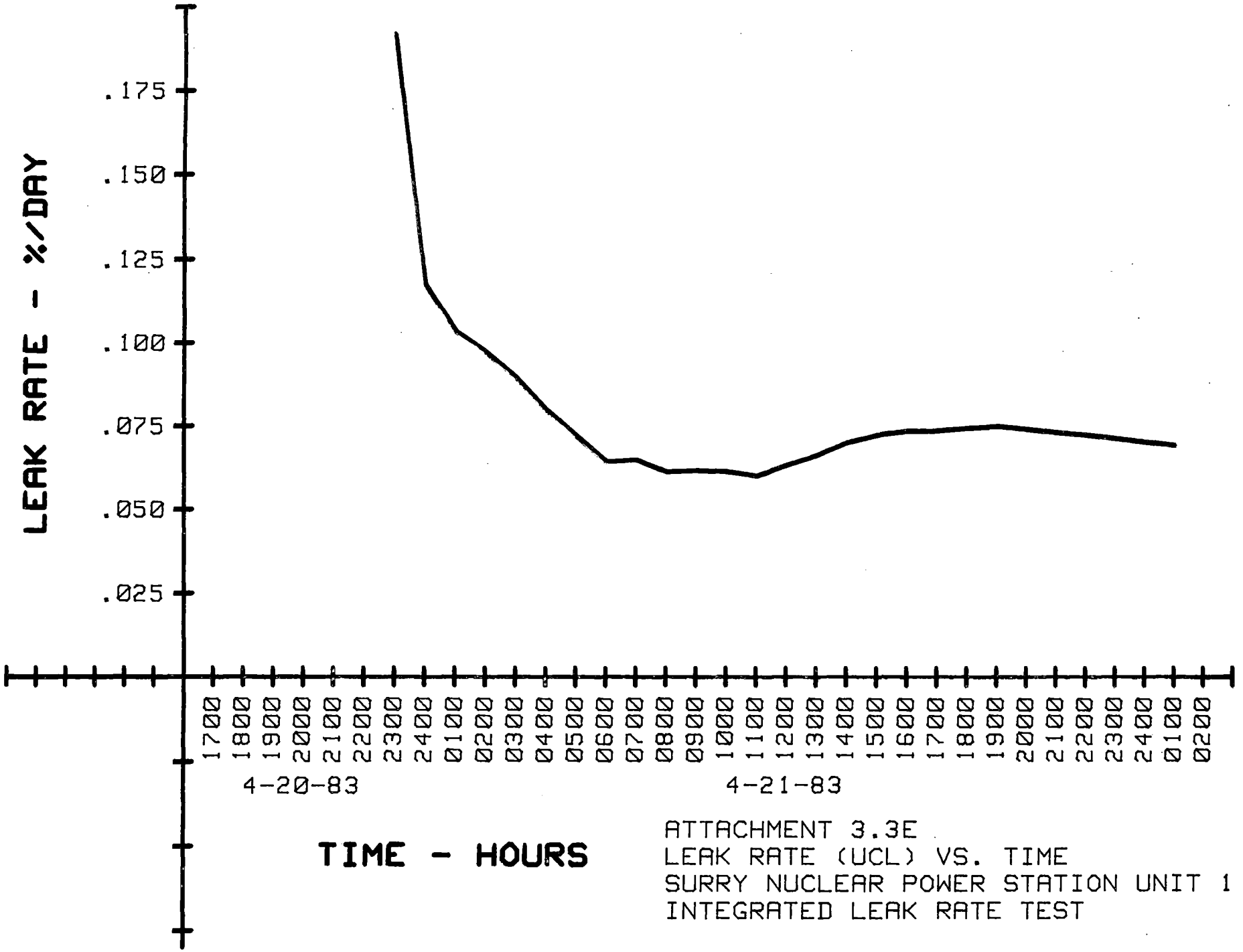
Time (hr)	Mass of Air (lbm)	Leak Rate (pct/day)	95 Pct Conf. (pct/day)	UCL (pct/day)
1804	551 204.2	0.071 385	0.003 038	0.074 423
1904	551 209.0	0.072 122	0.002 819	0.074 942
2004	551 191.8	0.071 508	0.002 611	0.074 120
2104	551 201.2	0.070 676	0.002 444	0.073 120
2204	551 181.5	0.070 103	0.002 275	0.072 379
2304	551 173.1	0.069 157	0.002 165	0.071 322
0004	551 173.6	0.068 180	0.002 088	0.070 269
0104	551 154.7	0.067 270	0.002 004	0.069 274
0124	551 172.1	0.066 756	0.002 018	0.068 774



ATTACHMENT 3.3C
CONTAINMENT TEMPERATURE VS. TIME
SURRY NUCLEAR POWER STATION UNIT 1
INTEGRATED LEAK RATE TEST



ATTACHMENT 3.3D
CONTAINMENT AIR MASS VS. TIME
SURRY NUCLEAR POWER STATION UNIT 1
INTEGRATED LEAK RATE TEST



ATTACHMENT 3.3E
LEAK RATE (UCL) VS. TIME
SURRY NUCLEAR POWER STATION UNIT 1
INTEGRATED LEAK RATE TEST

SECTION 4

LOCAL LEAK RATE TEST (TYPE B AND C)

Attachment 4A summarizes the Local Leak Rate Test (LLRT) data that was established to support the overall containment leakage testing program. Attachment 4B summarizes the leakage penalties added to the Type A overall leakage for systems that were either isolated or not vented and drained during the Type A Test. These LLRTs were performed by pressurizing the listed penetrations and either measuring leakage across the containment isolation valves (Type C) or across the resilient seals (Type B).

The acceptance criteria for Type B and C testing is in accordance with 10CFR50, Appendix J (Reference LER 83-018). The combined leakage rate for all penetrations and valves, subject to Type B and C tests, is well below the acceptable leakage rate of 0.6 La or 165 scfh.

ATTACHMENT 4A

LOCAL LEAK RATE TEST DATA

Penetration		Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh), Date	Postrepair Leakage (scfh), Date	MR No., Date, Repair
7	Safety Injection	C	1-SI-150 MOV-1867C MOV-1867D	0.0 (4-11-83) 0.0 (4-11-83) 0.0 (4-11-83)	0.0 0.0 0.0	NA
15	Charging	C	1-CH-309 MOV-1289A	0.0 (3-19-83) 0.7 (3-19-83)	0.0 0.7	NA
19	Charging	C	MOV-1381	0.0 (2-24-83)	0.0	NA
20	Safety Injection	C	1-SI-32	0.0 (2-23-83)	0.0	NA
21	Safety Injection	C	MOV-1842	0.0 (2-15-83)	0.0	NA
23	Safety Injection	C	MOV-1869B	0.0 (2-11-83)	0.0	NA
24	Residual Heat Removal	C	MOV-RH-100	1.9 (2-16-83)	1.9	NA
28	Chemical and Volume Control	C	HCV-1200 A,B,C TV-1204	4.6 (3-29-83) 0.0 (4-1-83)	4.6 0.0	NA
32	Gaseous Waste	C	TV-GW-106 TV-GW-107	0.0 (3-28-83) 0.0 (3-28-83)	0.0 0.0	NA
33	Gaseous Drains	C	TV-DG-108A	15.0 (3-18-83)	1.4 (4-11-83)	S1303182021 (4-7-83) Replaced seat, Lapped seat and plug, Replaced gasket set, cleaned valve
			TV-DG-108B	2.75 (3-18-83)	0.0 (4-9-83)	S1303182023 (6-7-83) Lapped plug and seat, Adjusted stroke
38	Aerated Drain	C	TV-DA-100A	>98 (4-7-83)	0.0 (4-13-83)	S1304072121 (4-8-83) Replaced seat ring and plug
			TV-DA-100B	>98 (4-7-83)	5.5 (4-16-83)	S1304072123 (4-8-83) Replaced gauge and plug, seat ring, stem, and diaphragm
42	Service Air	C	1-SA-60 1-SA-62	0.0 (2-21-83) 0.0 (2-21-83)	0.0 0.0	NA

ATTACHMENT 4A (Cont'd)

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh), Date	Postrepair Leakage (scfh), Date	MR No., Date, Repair
43 Air Monitoring	C	1-RM-3	>8 (3-28-83)	1.7 (4-9-83)	S1303282229 (3-30-83) Replaced pivot shaft, lapped disc and seat
		TV-RM-100A	0.0 (3-28-83)	0.0	NA
44 Air Monitoring	C	TV-RM-100B TV-RM-100C	0.0 (3-28-83) 0.0 (3-28-83)	0.0 0.0	NA
45 Primary Grade Water	C	1-RC-160 TV-1519A	1.8 (3-31-83) 0.0 (3-31-83)	1.8 0.0	NA
46 Charging	C	FCV-1160	>98 (2-16-83)	0.0 (4-8-83)	S1302160745 (3-24-83) Replaced stem, plug and gauge assembly, gaskets S1304050803 (4-7-83) Lapped seat and plug, Replaced gasket, Cleaned valve
47 Instrument Air	C	1-IA-446 1-IA-939 TV-IA-100	0.0 (3-25-83) 0.0 (3-25-83) >135 (3-25-83)	0.0 0.0 0.0 (4-4-83)	NA NA S1303250611 (3-31-83) Overhauled valve
48 Vent and Drain	C	TV-VG-109A TV-VG-109B	0.6 (3-15-83) 30 (3-15-83)	0.6 0.0 (3-22-83)	S1303150801 (3-18-83) Cleaned valve, Replaced O-ring and gasket
50 Safety Injection	C	TV-SI-101A TV-SI-101B	0.6 (3-11-83) 0.0 (3-11-83)	0.6 0.0	NA
51 Service Water	C	1-SW-206 1-SW-208	1.4 (3-2-83) 0.0 (3-2-83)	1.4 0.0	NA
53 Safety Injection	C	1-SI-234 TV-SI-100	0.85 (3-21-83) 0.0 (3-21-83)	0.85 0.0	NA
54 Primary Vent	C	1-VA-1 1-VA-6	0.0 (2-21-83) 0.0 (2-21-83)	0.0 0.0	NA
55A Leakage Monitoring	C	TV-LM-100E TV-LM-100F	0.0 (2-14-83) 0.0 (2-14-83)	0.0 0.0	NA
55D Sample System	C	TV-SS-104A TV-SS-104B	0.055 (4-8-83) 0.0 (4-2-83)	0.055 0.0	NA

ATTACHMENT 4A (Cont'd)

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh), Date	Postrepair Leakage (scfh), Date	MR No., Date, Repair
56B Sample System	C	TV-SS-106A TV-SS-106B	1.0 (4-2-83) 0.0 (4-6-83)	1.0 0.0	NA
56C Sample System	C	TV-SS-100A TV-SS-100B	0.0 (4-2-83) 0.8 (4-2-83)	0.0 0.8	NA
56D Sample System	C	TV-SS-102A TV-SS-102B	0.0 (4-2-83) 0.0 (4-12-83)	0.0 0.0	NA
57A Leakage Monitoring	C	TV-LM-100G TV-LM-100H	0.0 (2-14-83) 0.0 (2-14-83)	0.0 0.0	NA
57C Sample System	C	TV-SS-101A TV-SS-101B	0.0 (4-2-83) 0.088 (4-2-83)	0.0 0.088	NA
57D Drain System	C	TV-DA-103A	0.0 (2-23-83)	0.0	S1302232331 (2-28-83) Adjusted packing
		TV-DA-103B	0.0 (2-23-83)	0.0	S1302232333 (2-28-83) Adjusted packing
58 Instrument Air	C	2-IA-446	0.6 (2-22-83)	0.6	S1302222231 (3-22-83) Tightened coupling between valve and piping
		1-IA-938	0.5 (2-22-83)	0.5	S1302222232 (3-22-83) Tightened coupling between valve and piping S1302222233 (3-16-83) Replaced flange gasket
60 Safety Injection	C	MOV-1890A	0.0 (2-9-83)	0.0	NA
61 Safety Injection	C	MOV-1890C MOV-1864A MOV-1864B	0.0 (2-10-83) 0.0 (2-10-83) 0.0 (2-10-83)	0.0 0.0 0.0	NA
62 Safety Injection	C	MOV-1890B	8.0 (2-9-83)	8.0	NA

ATTACHMENT 4A (Cont'd)

Penetration		Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh), Date	Postrepair Leakage (scfh), Date	MR No., Date, Repair
63	Containment Spray	C	1-CS-24 MOV-CS-101C,D	0.0 (3-8-83) 1.4 (3-8-83)	0.0 1.4	NA S1303082311 (3-30-83) Repacked valve packing gland S1303082309 (3-30-83) Replaced flange gaskets S1303082305 (3-30-83) Cleaned and inspected flange surfaces
64	Containment Spray	C	1-CS-13 MOV-CS-101A,B	0.0 (3-9-83) 1.6 (3-19-83)	0.0 1.6	NA
66	Recirculation Spray	C	MOV-RS-155B	>135 (3-23-83)	0.0 (3-26-83)	S1303231959 (3-25-83) Adjusted mechanical stops
67	Safety Injection	C	MOV-1860B	0.0 (3-17-83)	0.0	NA
68	Safety Injection	C	MOV-1860A	0.0 (3-17-83)	0.0	NA
69	Recirculation Spray	C	MOV-RS-155A	>135 (3-23-83)	0.0 (3-26-83)	S1303231957 (3-25-83) Adjusted mechanical stops
70	Recirculation Spray	C	1-RS-11 MOV-RS-156B	0.0 (3-5-83) 0.0 (3-7-83)	0.0 0.0	NA
71	Recirculation Spray	C	1-RS-17	>135 (3-5-83)	0.0 (4-12-83)	S1303051701 (3-10-83) Cleaned valve and replaced seating rubber
			MOV-RS-156A	0.0 (3-10-83)	0.0	NA
89	Air Ejector Discharge	C	1-VP-12 TV-SV-102A	1.3 (3-8-83) 14.7 (3-10-83)	1.3 0.0 (4-14-83)	NA S1304050801 (4-6-83) Repaired stem disk, Adjusted limits S1303101504 (3-21-83) Lapped seat and plug, Replaced gasket, Cleaned valve
90	Ventilation	C	MOV-VS-100C,D	1.2 (4-12-83)	1.2	NA
91	Ventilation	C	MOV-VS-100A	>135 (4-9-83)	0.0 (4-14-83)	S1304091805 (4-12-83) Cleaned valve
			MOV-VS-100B MOV-VS-102	0.0 (4-14-83) 0.0 (4-14-83)	0.0 0.0	NA NA

ATTACHMENT 4A (Cont'd)

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh), Date	Postrepair Leakage (scfh), Date	MR No., Date, Repair
92 Containment Vacuum	C	TV-GW-100	0.0 (4-1-83)	0.0	NA
		TV-GW-101	0.0 (4-1-83)	0.0	NA
		TV-CV-150C	26 (3-11-83)	1.1 (3-26-83)	S1303110903 (3-18-83) Replaced gauge, gaskets, and ring; Lapped seat and plug; Cleaned valve
		TV-CV-150D	115 (3-11-83)	0.5 (3-26-83)	S1303110901 (3-18-83) Replaced gauge, gaskets, and ring; Lapped seat and plug; Cleaned valve
93 Containment Vacuum	C	TV-GW-104	0.0 (4-1-83)	0.0	NA
		TV-GW-105	0.0 (4-1-83)	0.0	NA
		TV-CV-150A	14 (3-16-83)	0.0 (3-25-83)	S1303162057 (3-23-83) Lapped plug and seat
		TV-CV-150B	10 (3-28-83)	0.0 (3-30-83)	S1303281113 (3-29-83) Lapped plug and seat
94 Containment Vacuum	C	HCV-CV-100	0.9 (2-21-83)	0.9	NA
		1-CV-2	>74 (2-21-83)	1.2 (3-24-83)	S1302212317 (3-22-83) Cleaned disc and seal; General valve cleanup
97A Leakage Monitoring	C	TV-LM-100A	0.0 (2-14-83)	0.0	NA
		TV-LM-100B	0.0 (2-14-83)	0.0	
97D Sample System	C	TV-SS-103A	0.0 (4-11-83)	0.0	NA
		TV-SS-103B	0.0 (4-8-83)	0.0	
100 Gaseous Waste	C	TV-GW-102	0.0 (3-28-83)	0.0	NA
		TV-GW-103	0.0 (3-28-83)	0.0	
101 Fire Protection	C	1-FP-151	0.0 (4-5-83)	0.0	NA
		1-FP-152	0.0 (4-5-83)	0.0	
103 Reactor Cavity Purification	C	1-RL-3	0.0 (2-23-83)	0.0	NA
		1-RL-5	0.0 (2-23-83)	0.0	
104 Reactor Cavity Purification	C	1-RL-13	0.0 (2-23-83)	0.0	NA
		1-RL-15	0.0 (2-23-83)	0.0	
105A Post Accident Sampling	C	TV-GW-111A	0.0 (4-15-83)	0.0	S1302061820 (2-7-83) Replaced coil on valve actuator
		TV-GW-111B	0.0 (4-15-83)	0.0	NA
105D Leakage Monitoring	C	TV-LM-100C	0.0 (2-14-83)	0.0	NA
		TV-LM-100D	0.0 (2-14-83)	0.0	

ATTACHMENT 4A (Cont'd)

Penetration	Type Test	Equipment/Valves Tested	Prerepair Leakage (scfh), Date	Postrepair Leakage (scfh), Date	MR No., Date, Repair
106 Safety Injection	C	1-SI-73	0.0 (2-22-83)	0.0	NA
112 Instrument Air	C	TV-IA-101A TV-IA-101B	0.8 (3-31-83) 0.0 (3-31-83)	0.0 0.0	NA
113 Safety Injection	C	1-SI-174 MOV-1869A	0.0 (2-15-83) 0.0 (2-15-83)	0.0 0.0	NA
Personnel Air Lock	B	O-ring	3.2 (5-4-83)	0.0	NA
Equipment Hatch	B	O-ring	0.0 (4-19-83)	0.0	NA
Fuel Transfer Tube	B	O-ring	1.381 (4-8-83)	1.381	NA
Emergency Air Lock	B	O-ring	0.8 (4-19-83)	0.8	NA

All electrical penetrations and other Type B penetrations were tested prior to performance of the CILRT with a combined leakage of 0.21534 scfh.

ATTACHMENT 4B

LEAKAGE PENALTIES ADDED TO TYPE A LEAKAGE

Penetration		Type Test	Equipment/Valves Tested	Leakage (Scf/hour)	Remarks
20	Safety Injection	C	1-SI-32	0.0	Isolated during Type A Test
24	Residual Heat Removal	C	MOV-RH-100	1.9	Water Filled during Type A Test
28	Chemical and Volume Control	C	HCV-1200A, B, C TV-1204	4.6	Isolated during Type A Test
45	Primary Grade Water	C	1-RC-160 TV-1519A	1.8	Isolated during Type A Test
55A	Leakage Monitoring	C	TV-LM-100E TV-LM-100F	0.0	In use during Type A Test
57A	Leakage Monitoring	C	TV-LM-100G TV-LM-100H	0.0	In use during Type A Test
97A	Leakage Monitoring	C	TV-LM-100A TV-LM-100B	0.0	In use during Type A Test
101	Fire Protection	C	1-FP-151 1-FP-152	0.0	Isolated during Type A Test
105D	Leakage Monitoring	C	TV-LM-100C TV-LM-100D	0.0	In use during Type A Test