REACTOR CONTAINMENT BUILDING

INTEGRATED LEAKAGE RATE TEST

TYPES A, B, AND C

PERIODIC TEST

VIRGINIA POWER

SURRY NUCLEAR
POWER STATION
UNIT 2

JUNE 1985

Prepared by
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BOSTON, MA

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LIST OF ATTACHMENTS

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 (Type "A").

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].

5. Bechtel Corporation's Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants, BN-TOP-1 Revision 1, November 1, 1972.

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

SECTION 1

PURPOSE

The purpose of this report is to present a description and analysis of the June 1985, Periodic Type A Containment Integrated Leakage Rate Test (CILRT), and summary of the Periodic Types B and C Local Leakage Rate Tests (LLRT's) conducted since September 1983 on Virginia Power's Surry Power Station, Unit No. 2.

This report is submitted as required by 10CFR50, Appendix J, Paragraph V.B. (Reference 1).

SECTION 2

SUMMARY

2.1 TYPE A TEST

On June 8, 1985, pressurization was started at 0145 hours. A fairly constant rate of 4 psig per hour was maintained throughout the pressurization period. The compressors were secured at 1338 hours on June 8, 1985, with a peak instantaneous pressure of 61.557 psia. During the containment pressurization period, the "C" containment air recirculation fan tripped on high current overload at 1050 hours.

At approximately 1750 hours, the average hourly containment temperature satisfied the procedural thermal stabilization criteria. All other containment parameters appeared stabilized at 0100 hours on June 9, 1985.

In order to identify leakage paths, extensive investigations of all penetration areas were conducted throughout the test. These searches revealed only minor packing and body to bonnet leaks.

Observations of the volume-weighted dewpoint temperature trend data, of the individual sensor trend data, and of the moisture sensor panel meters, indicated that MT-LM-200-7 had a contaminated mirror surface. The sensor was successfully rebalanced at approximately 1100 hours on June 9, 1985. The volume-weighted dewpoint temperature at 1040 and 1100 hours (see Attachment 3.3A dewpoint temperature for t = 9.333 and t = 10.000) were artificially high, which resulted in an artificially low containment mass. Rather that calculate an adjusted volume-weighted dewpoint temperature for these two times, which would provide a lower leakage rate, all of the MT-LM-200-7 dewpoint data is used for the official test results (see Attachments 3.3B and 3.3C).

During the CILRT, it was noted that the CILRT program was not always running at 10 minute intervals. The Westinghouse Prodac P250 10-minute average program was determining 10-minutes by counting the number of accumulated scans that should have been collected. The time skewing was random in nature. This time skewing was attributed to the variable system demand. This was conservative in that the reported leakage rate based on the nominal twenty minute duration between data sets would be greater than the actual leakage rate based on the actual time between data sets.

The Type A CILRT was successfully completed with the Nuclear Regulatory Commission's (NRC) concurrence at 1430 hours on June 9, 1985 without any penetrations having to be repaired or isolated during the Type A test period. A superimposed leakage verification test was successfully completed from 1850 hours on June 9, 1985 to 0500 hours on June 10, 1985.

Depressurization of the containment began at 0830 hours on June 10, 1985 and was completed that evening.

2.1.1 CILRT Betterment Program

The following preparation measures were taken to improve the CILRT/LLRT programs and to ensure a successful CILRT.

a) Steam generators were tested and repaired as required to ensure their integrity.

b) Utilization of the LLRT makeup air test method where feasible.

c) Various leakage rate test procedures were thoroughly reviewed and revised.

d) Tighter leakage limits were placed on containment isolation valves.

e) Various containment isolation valves were reworked or replaced as described in Attachment 4A.

f) Daily monitoring of maintenance activities.

g) Developed an extensive leakage investigation plan to be utilized throughout the test.

h) Established a log of pertinent hourly items to be recorded during the test performance (i.e Component Cooling Water and Residual Heat Removal System temperatures, Electrical penetration pressures, Steam Generator pressures, etc.).

2.1.2 Corrective Action

The following corrective actions will be taken:

a) The plant computer CILRT program time skewing will be evaluated for potential software modification.

b) New dewpoint sensors will be purchased and installed for the next CILRT. The backup quartz manometer loop components that malfunctioned will be repaired or replaced.

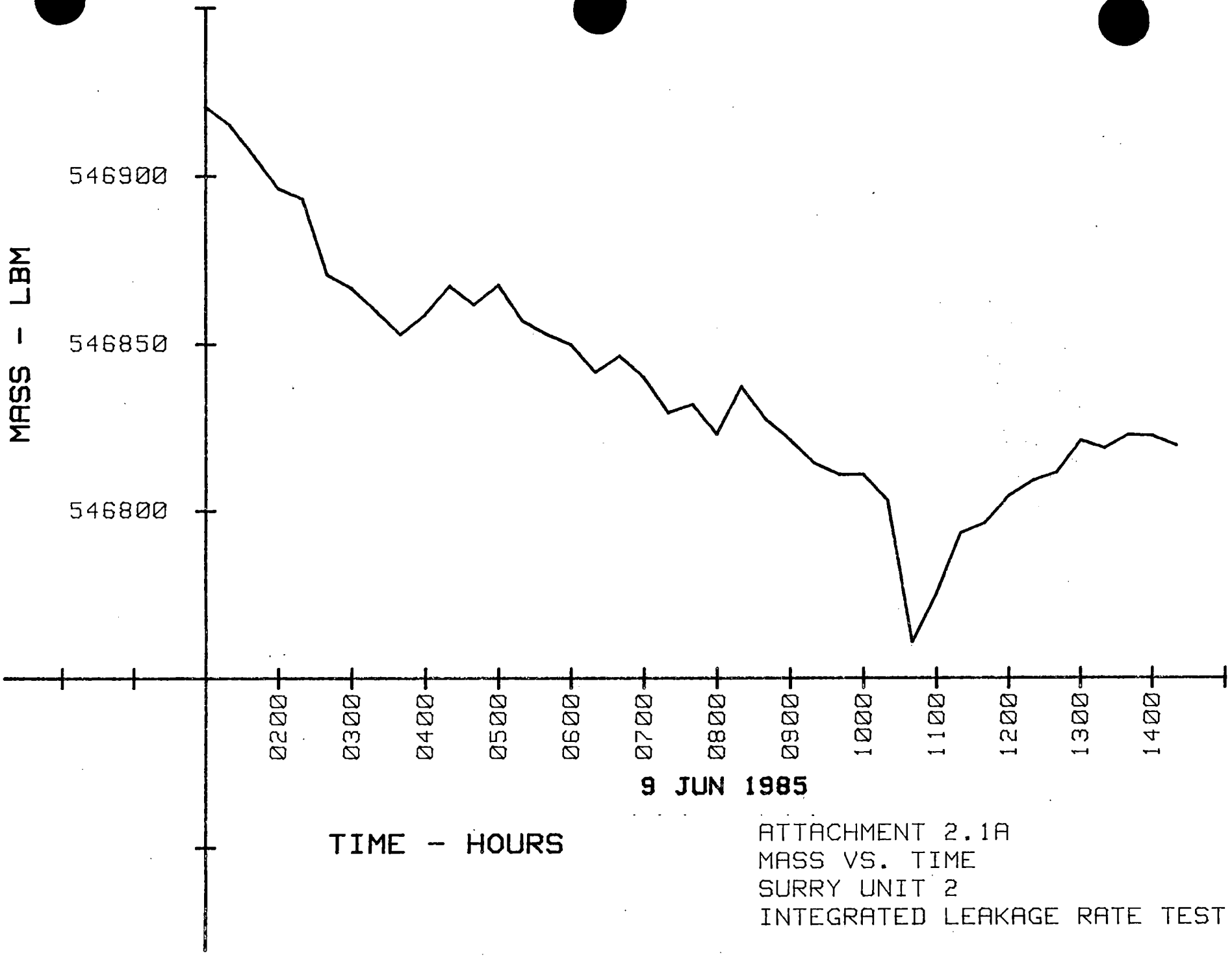
2.1.3 Conclusion

The June 1985 Surry Power Station Unit No. 2 Type A Test is considered a successful test in that it demonstrated the leak-tightness of the containment boundary. The measured leakage rates were well within the plant's maximum allowable leakage rate. The success of this test can be contributed to the plant improvements as previously discussed. Based on these improvements, the upgrades made following the 1983 test, and the success of both the 1983 and the 1985 Type A tests, a letter will be forthcoming requesting that Surry Power Station Unit No. 2 resume a Type A retest schedule as specified by 10CFR50, Appendix J. (See paragraphs III.A.6.(b) and III.D of Reference 1).

2.2 LOCAL LEAKAGE RATE TESTS (TYPES B AND C)

The Local Leakage Rate Tests of containment isolation valves and other containment penetrations were conducted as required by the methods described in Virginia Power's station surveillance procedures.

Section 4 of this report summarizes the data for the 1985 surveillance period of Local Leakage Rate Tests conducted since the last Type A Test in accordance with Appendix J, 10CFR50, Paragraph V.B. Also contained in Section 4 of this report, is an "AS-FOUND" LLRT leakage summary analysis for the 1985 surveillance period of LLRT's.



ATTACHMENT 2.1A
MASS VS. TIME
SURRY UNIT 2
INTEGRATED LEAKAGE RATE TEST

SECTION 3

TYPE A TEST

3.1 EDITED LOG OF EVENTS

This log was edited from the Official Log of Events

June 7, 1985

1800 - Commenced recording site meteorology data.

1815 - Commenced final containment inspection.

2010 - Completed final containment inspection, no abnormalities observed.

June 8, 1985

0030 - Completed the local leakage rate test on the personnel hatch.

0130 - Re-intialized the Westinghouse Prodac P250 computer.

0145 - Commenced containment pressurization.

0200 - Notified the NRC that pressurization had begun.

0215 - Computer printers stopped.

0300 - Computer restored.

0405 - Containment pressure 25.0 psia.
Commenced the gross leakage investigation.

0500 - Completed the gross leakage investigation.
No gross leaks revealed.

0830 - Commenced an extensive leakage investigation.

1050 - Lost "C" containment air recirculation fan on high current overload.

1115 - Completed extensive leakage investigation. Observed minor packing leaks on penetrations 15, 47, 53, and 57b.

1338 - Secured containment pressurization with a peak instantaneous pressure of 61.557 psia.

1339 - Re-initialized the Westinghouse Prodac P250 computer.

1350 - Commenced containment stabilization period.

1750 - Satisfied thermal stabilization criteria.

2250 - Observed minor packing leaks and/or body to bonnet leaks on penetrations 33, 43, 44, and 58.

2310 - Removed failed Dewpoint Analyzer No. 10 from program.

June 9, 1985

0100 - Completed stabilization, CILRT started; Notified the NRC.

0150 - Initiated walkdown of Auxiliary Building basement penetration area.

0205 - Initiated walkdown of Fuel Building and Safeguard Building penetration areas.

0230 - Completed walkdown of Fuel Building and Safeguard Building penetration areas. Same minor packing leaks observed.

0320 - Completed walkdown of Auxiliary Building basement penetration area. Minor packing leaks observed.

1100 - Rebalanced Dewpoint Analyzer No. 7 (MT-LM-200-7).

1430 - CILRT completed. Met with the NRC to review acceptance criteria compliance. All criteria met. Health Physics notified of test completion.

1646 - Commenced superimposed leakage verification test stabilization period.

1850 - Commenced superimposed leakage verification test.

June 10, 1985

0500 - Superimposed leakage verification test completed. Health Physics notified of test completion.

0830 - Commenced containment depressurization.

3.2 GENERAL TEST DESCRIPTION

3.2.1 Prerequisites

In accordance with the Surry Power Station Unit No. 2 CILRT procedure, 2-PT-16.3 (Reference 2), the following is a listing of the pertinent 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 structures and components completed.

c. All required Types B and C local leakage 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 are operable.

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

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

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

j. Temporary air compressors and test skid checked out and available for pressurization.

k. All equipment and instrumentation, that could be damaged by test pressure, removed or protected.

l. Containment air recirculation fans adjusted for continuous operation at test pressure (45 psig).

3.2.2 Equipment and Instrumentation

Pressurization of the containment was achieved by the utilization of eight temporary air compressors.

Air was piped through two aftercoolers in parallel and a refrigerated air dryer. The system included adequate instrumentation and valving to maintain proper monitoring and control of the compressed air quality throughout the pressurization sequence. The total capacity of the pressurization system as installed was rated at approximately 9,900 standard cubic feet per minute (SCFM).

The various containment parameters required to calculate containment leakage during the test were monitored using instrumentation which consisted of multiple resistance temperature detectors (RTD's), chilled mirror dew point indicators, and an absolute pressure quartz manometer. Pertinent data for the test instrumentation is listed in Attachment 3.2B, and the general locations of the temperature and moisture sensors are shown in Attachments 3.2C through 3.2F.

A pair of calibrated rotometers were used to perform the superimposed leakage verification test. All test instrumentation with the exception of that used for the superimposed leakage verification test was monitored by the plant computer for data acquisition and averaging.

3.2.3 Data Acquisition System

The Surry Power Station Unit No. 2 CILRT utilized the station's 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 RTD's	20
5 chilled mirrors	20
1 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 had been acquired and averaged, utilizing the P250 plant computer system, the reduced parameters were manually input into Virginia Power's Richmond Computer System for leakage rate calculations.

For the Surry Power Station Unit No. 2 CILRT, both the absolute Method of Mass Point Analysis and Absolute Method of Total Time Analysis were used to determine the leakage rate.

Absolute Method of Mass Point Analysis

The Absolute Method of Mass Point Analysis consists of calculating the air mass within the containment structure, over the test period, using pressure, temperature, and dew point observations made during the CILRT. The air mass is 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 ^{o}R (for air)
T = average containment temperature, ^{o}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 the 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 of such that the leakage out of the containment is positive and the units are in percent/day.

The air mass is calculated and the result is correlated as a function of time by means of a least-squares curve 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 confidence interval is calculated using a Student's T distribution. The sum of the leakage rate and the confidence interval is the upper confidence limit (UCL-MP).

Absolute Method of Total Time Analysis

The Absolute Method of Total Time Analysis consists of calculating air lost from the containment, using pressure, temperature, and dew point observations made 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 that time (Mt) from the initial mass (Mi) and dividing by the initial mass. The measured leakage rate is expressed as a percentage of containment mass lost in 24 hours or symbolically:

$$\text{Measured Leakage Rate} = \frac{Mi - Mt}{Mi\ (\triangle t)}\ (2400) \qquad \text{(Eq. 4)}$$

The sign convention is such that leakage out of the containment is positive and the units are in percent/day.

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

$$\text{Estimated Leakage Rate} = At + B \qquad \text{(Eq. 5)}$$

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

The confidence interval is determined in accordance with the equations of Reference 5. The sum of the estimated leakage rate and the confidence interval is the upper confidence limit - total time (UCL-TT).

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

ATTACHMENT 3.2A

SITE METEOROLOGY

Date	Time	Drybulb Temperature (°F)	Barometric Pressure (in. Hg.)
June 7, 1985	1800	66.2	30.07
	1900	66.2	30.06
	2000	64.4	30.06
	2100	64.4	30.04
	2200	64.4	30.05
	2300	64.4	30.05
	2400	64.4	30.03
June 8, 1985	0100	64.4	30.01
	0200	64.4	30.01
	0300	64.4	29.95
	0400	64.4	29.95
	0500	64.4	30.01
	0600	64.4	29.95
	0700	64.4	29.95
	0800	68.9	29.93
	0900	71.6	29.91
	1000	73.4	29.91
	1100	75.2	29.89
	1200	75.2	29.90
	1300	75.2	29.90
	1400	75.2	29.89
	1500	77.0	29.89
	1600	78.0	29.90
	1700	78.0	29.90
	1800	78.0	29.91
	1900	77.0	29.94
	2000	74.0	29.95
	2100	68.0	29.96
	2200	68.0	29.96
	2300	64.4	29.96
	2400	66.2	29.96
June 9, 1985	0100	68.0	29.94
	0200	62.6	29.96
	0300	62.6	29.95
	0400	62.6	29.93
	0500	66.2	29.95
	0600	66.2	29.95
	0700	66.2	29.97

ATTACHMENT 3.2A (Con't)

SITE METEOROLOGY

Date	Time	Drybulb Temperature (°F)	Barometric Pressure (in. Hg.)
	0800	66.2	29.77
	0900	72.5	29.98
	1000	76.1	29.94
	1100	77.9	29.91
	1200	81.5	29.92
	1300	83.2	29.91
	1400	84.2	29.91
	1500	84.2	29.90
	1600	84.2	29.90
	1700	85.5	29.90
	1800	84.2	29.93
	1900	84.2	29.90
	2000	80.6	29.90
	2100	77.0	29.91
	2200	77.0	29.91
	2300	76.0	29.94
	2400	77.0	29.94
June 10, 1985	0100	77.0	29.93
	0200	75.2	29.91
	0300	73.4	29.90
	0400	73.4	29.90
	0500	73.4	29.91

ATTACHMENT 3.2B

INSTRUMENTATION

The following instrumentation was calibrated and/or functionally verified within 6 months prior to the performance of this test and in accordance with 10CFR50, Appendix J.

Note: Instruments that were assigned a zero weight factor were not used in the leakage rate calculations.

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

ATTACHMENT 3.2B (Con't)

INSTRUMENTATION

Instrument	Weight Factor	Computer Point	Range	Zone	Accuracy	Sensitivity
RTD-LM-200-11	0.04975	T10010A	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
RTD-LM-200-24	0.06800	T4022A	55-105°F	G	±0.1°F	±0.09°F

ATTACHMENT 3.2B (Con't)

INSTRUMENTATION

Instrument	Weight Factor	Computer Point	Range	Zone	Accuracy	Sensitivity
MT-LM-200-6	0.00000	T4039A	-40 to +200°F	K	±0.4°F	±0.05°F
MT-LM-200-7	0.28128	T4040A	-40 to +200°F	K	±0.4°F	±0.05°F
MT-LM-200-8	0.35938	T4041A	-40 to +200°F	L	±0.4°F	±0.05°F
MT-LM-200-9	0.35939	T4042A	-40 to +200°F	L	±0.4°F	±0.05°F
MT-LM-200-10	0.00000	T4043A	-40 to +200°F	L	±0.4°F	±0.05°F
PI-LM-206	1.0	U0962	0-100 psia	-	±0.030 psia	±0.001%
PI-LM-207	0.0	U0963	0-100 psia	-	±0.030 psia	±0.001%
Rotometer	N/A	N/A	0-100%	N/A	±2%F.S.	±1%F.S.
Rotometer	N/A	N/A	0-100%	N/A	±2%F.S.	±1%F.S.

3.3 TEST RESULTS

3.3.1 Presentation of Test Results

The test data for the June 1985 CILRT is based on a 13.333 hour period starting at 1430 hours on June 9, 1985. The final test results were determined using Virginia Power's Richmond CILRT computer program. The reduced input data, Mass Point Analysis test results, Total Time Analysis test results, and representative graphs are contained in Attachments 3.3A through 3.3I.

Both the Mass Point and Total Time Analysis test results for the CILRT satisfied the procedural acceptance criteria.

The Type A test instrumentation was verified by the superimposed leakage verification test method. Both the Mass Point and Total Time Analysis test results for the superimposed leakage verification test satisfied the procedural acceptance criteria.

3.3.2 59.7 psia CILRT Results

The CILRT was conducted in accordance with Section 5.0 of the Surry Power Station Unit No. 2 surveillance test procedure 2-PT-16.3. The results for the CILRT and for the supplemental test are shown below.

3.3.2.1 Mass Point Analysis

Item	(Percent/Day)
1. Lam, leakage rate calculated	0.033978
2. Confidence level	0.005452
3. UCL-MP Lam leakage rate plus confidence level (1 & 2)	0.039430
4. Correction for Type C leakage (See Section 3.3.2.4)	0.000324
5. Total reported Type A leakage rate	0.039754

Results were within the acceptable limit of 0.075 percent/day.

3.3.2.2 Total Time Analysis

Item	(Percent/Day)
1. Lam, leakage rate estimated	0.031148
2. Confidence level	0.029551
3. UCL-TT Lam leakage rate plus confidence level (1 & 2)	0.060699
4. Correction for Type C leakage (See Section 3.3.2.4)	0.000324
5. Total reported Type A leakage rate	0.061023

Results were within the acceptable limit of 0.075 percent/day.

3.3.2.3 Supplemental Test Results

The Supplemental Verification Test was performed using the Superimposed Leakage Verification Test Method in accordance with Attachment 7.16 of surveillance test procedure 2-PT-16.3. The results for the superimposed leakage verification test are shown below.

1. The Superimposed Leakage Verification Test is acceptable provided L_c falls within the following range:

$$(L_{am} + L_o - 0.25L_a) < L_c < (L_{am} + L_o + 0.25\ L_a)$$

where: L_{am} = Type A calculated leakage (computer)
(Lam-MP=0.033978%/day)
(Lam-TT=0.031148%/day)

L_o = Superimposed leakage rate developed from rotometer
(Lo=0.105568%/day)

L_a = Maximum allowable leakage rate
(La=0.1%/day)

L_c = Composite leakage (computer)
(Lc-MP=0.130737%/day)
(Lc-TT=0.124770%/day)

a. Mass Point

$$(0.033978 + 0.105568 - 0.025) < 0.130737 < (0.033978 + 0.105568 + 0.025)$$

$$(0.114546) < 0.130737 < (0.164546)$$

b. Total Time

$$(0.031148 + 0.105568 - 0.025) < 0.124770 < (0.031148 + 0.105568 + 0.025)$$

$$(0.111716) < 0.124770 < (0.161716)$$

The Superimposed Leakage Verification Test met the requirements set forth in References 4 and 5.

3.3.2.4 Types B and C Penetration Leakage

Types B and C penetration leakage to be added since these penetrations could not be vented and drained.

The leakage assigned is the Types B and C recorded value for minimum pathway analysis.

Penetration No.	Description	Leakage (SCFH)
19	Charging	0.0
20	Safety Injection	0.0
24	Residual Heat Removal	0.0
28	Chemical and Volume Control	0.72
32	Gaseous Waste	0.0
38	Aerated Drain	0.145
45	Primary Grade Water	0.0
50	Safety Injection	0.085
55d	Leakage Monitoring	0.0
57c	Leakage Monitoring	0.0
92	Gaseous Waste	0.0
93	Gaseous Waste	0.0
97b	Sample System	0.0185
97c	Leakage Monitoring	0.0
100	Gaseous Waste	0.0
101	Fire Protection	0.0
105b	Leakage Monitoring	0.0
106	Safety Injection	0.0

Total Types B and C leakage 0.9685 SCFH

Total Types B and C Leakage 0.000324 percent/day

ATTACHMENT 3.3A

CONTAINMENT INTEGRATED LEAKAGE RATE TEST

FROM 0100 TO 1430 HOURS ON 6-9-85

INPUT VARIABLES

Time (hrs)	Absolute Pressure (psia)	Dewpoint (^{o}F)	Vapor Pressure (psia)	Absolute Temperature (^{o}R)
0.0	61.316	77.38	0.4650	540.56
0.333	61.316	77.42	0.4656	540.56
0.666	61.314	77.43	0.4658	540.55
1.000	61.310	77.46	0.4662	540.52
1.333	61.305	77.45	0.4661	540.48
1.666	61.301	77.50	0.4668	540.46
1.993	61.298	77.48	0.4665	540.44
2.333	61.295	77.48	0.4665	540.42
2.666	61.291	77.49	0.4667	540.39
3.000	61.287	77.48	0.4665	540.35
3.333	61.286	77.50	0.4668	540.33
3.666	61.286	77.54	0.4675	540.33
4.000	61.287	77.49	0.4667	540.34
4.333	61.285	77.51	0.4670	540.33
4.666	61.282	77.49	0.4667	540.31
5.000	61.277	77.48	0.4665	540.27
5.333	61.273	77.50	0.4668	540.24
5.666	61.271	77.48	0.4665	540.22
6.000	61.269	77.47	0.4664	540.21
6.333	61.267	77.49	0.4667	540.20
6.666	61.266	77.48	0.4665	540.19
7.000	61.265	77.48	0.4665	540.19
7.333	61.265	77.45	0.4661	540.18
7.666	61.265	77.52	0.4672	540.18
8.000	61.264	77.50	0.4668	540.18
8.333	61.264	77.55	0.4676	540.18
8.666	61.263	77.51	0.4670	540.18
9.000	61.263	77.51	0.4670	540.18
9.333	61.265	77.55	0.4676	540.20
9.666	61.268	77.83	0.4720	540.23
10.000	61.273	77.83	0.4720	540.26
10.333	61.278	77.66	0.4693	540.31
10.666	61.283	77.67	0.4695	540.35
11.000	61.290	77.70	0.4699	540.40
11.333	61.299	77.74	0.4706	540.47
11.666	61.307	77.73	0.4704	540.54
12.000	61.318	77.79	0.4713	540.62
12.333	61.329	77.79	0.4713	540.72
12.666	61.341	77.81	0.4716	540.82
13.000	61.353	77.86	0.4724	540.92
13.333	61.366	77.92	0.4734	541.03

ATTACHMENT 3.3B

CONTAINMENT INTEGRATED LEAKAGE RATE TEST

FROM 0100 TO 1430 HOURS ON 6-9-85

ABSOLUTE TEST METHOD - MASS POINT ANALYSIS

Time (hrs)	Mass (lbm)	Leakage (pct/day)	Confidence (pct/day)	UCL (pct/day)
0.0	546926.41	0.0	0.0	0.0
0.333	546920.88	0.0	0.0	0.0
0.666	546911.64	0.097329	0.120828	0.218157
1.000	546901.89	0.109041	0.027189	0.136230
1.333	546898.80	0.097716	0.019870	0.117586
1.666	546876.15	0.123130	0.033434	0.156564
1.993	546872.19	0.124849	0.022482	0.147331
2.333	546865.46	0.122334	0.016387	0.138721
2.666	546858.47	0.119147	0.012850	0.131997
3.000	546864.37	0.106762	0.016657	0.123419
3.333	546872.85	0.090089	0.022150	0.112239
3.666	546867.30	0.079826	0.021149	0.100975
4.000	546873.11	0.068464	0.021266	0.089730
4.333	546862.47	0.063372	0.018816	0.082189
4.666	546858.51	0.059784	0.016602	0.076386
5.000	546855.42	0.056959	0.014721	0.071680
5.333	546847.04	0.056067	0.012953	0.069021
5.666	546852.08	0.053298	0.011798	0.065095
6.000	546845.60	0.051818	0.010619	0.062437
6.333	546834.96	0.052001	0.009525	0.061526
6.666	546837.47	0.051032	0.008646	0.059678
7.000	546828.48	0.051102	0.007838	0.058940
7.333	546842.76	0.048557	0.007573	0.056131
7.666	546833.05	0.047390	0.007023	0.054413
8.000	546826.84	0.046799	0.006474	0.053273
8.333	546819.89	0.046716	0.005965	0.052682
8.666	546816.45	0.046639	0.005515	0.052154
9.000	546816.45	0.046232	0.005128	0.051360
9.333	546808.64	0.046294	0.004768	0.051062
9.666	546766.20	0.049651	0.005534	0.055184
10.000	546780.80	0.050935	0.005321	0.056256
10.333	546798.91	0.050349	0.005016	0.055365
10.666	546802.00	0.049378	0.004802	0.054180
11.000	546810.16	0.047777	0.004779	0.052556
11.333	546814.66	0.045926	0.004851	0.050777
11.666	546817.15	0.044013	0.004944	0.048957
12.000	546826.71	0.041668	0.005203	0.046871
12.333	546824.42	0.039628	0.005311	0.044939
12.666	547828.31	0.037537	0.005432	0.042969
13.000	546828.01	0.035621	0.005483	0.041104
13.333	546825.17	0.033978	0.005452	0.039430

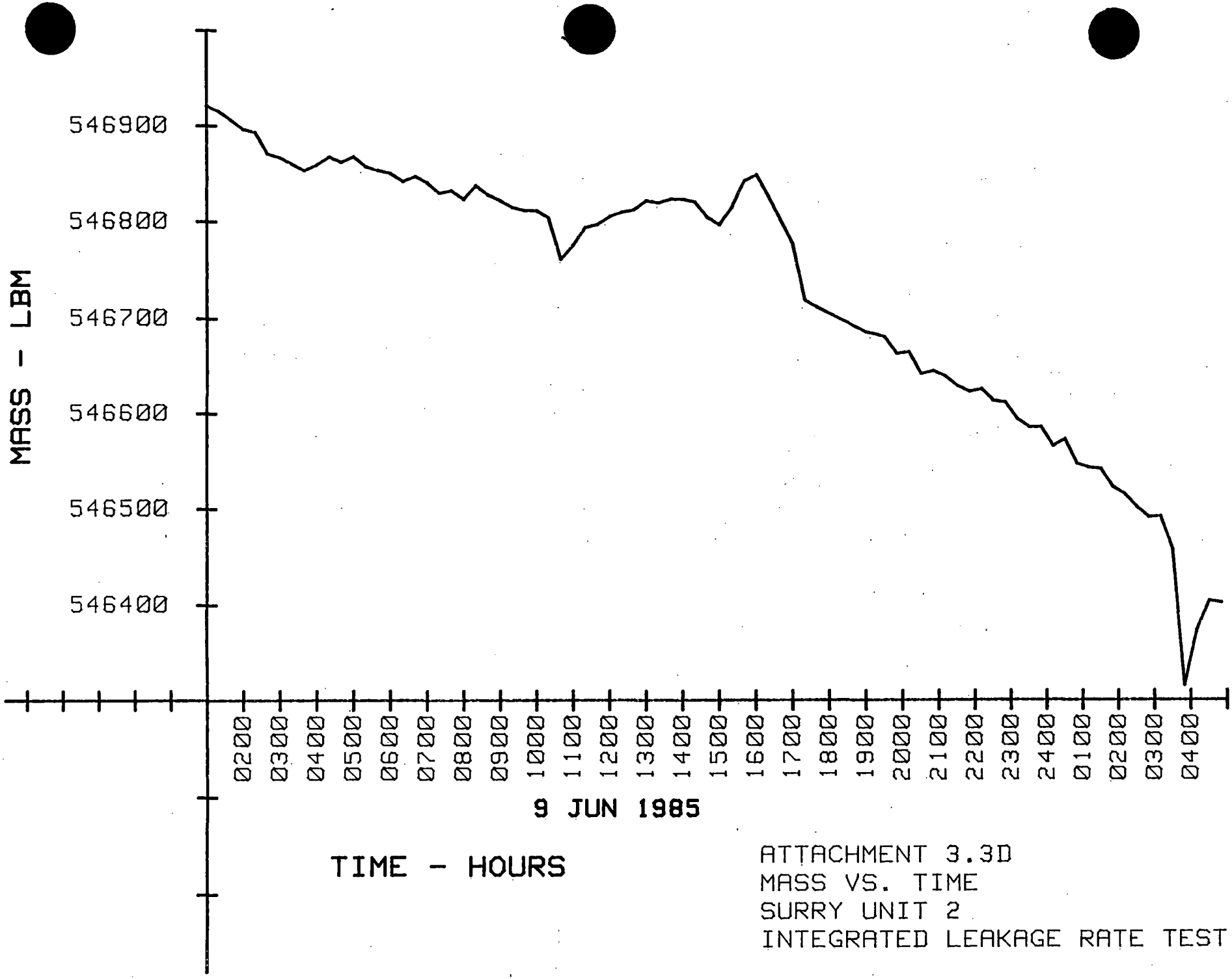
ATTACHMENT 3.3C

CONTAINMENT INTEGRATED LEAKAGE RATE TEST

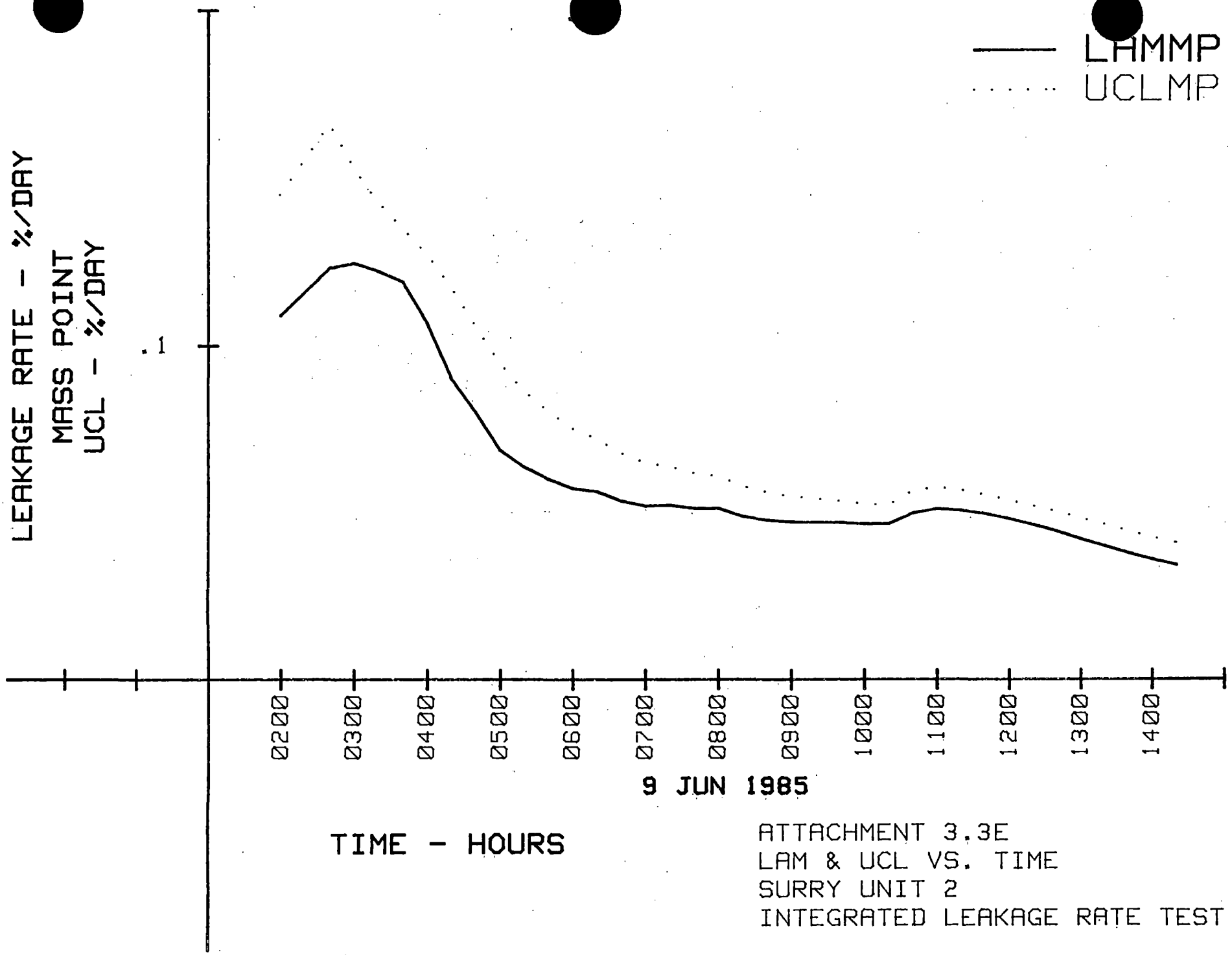
FROM 0100 TO 1430 HOURS ON 6-9-85

ABSOLUTE TEST METHOD - TOTAL TIME ANALYSIS

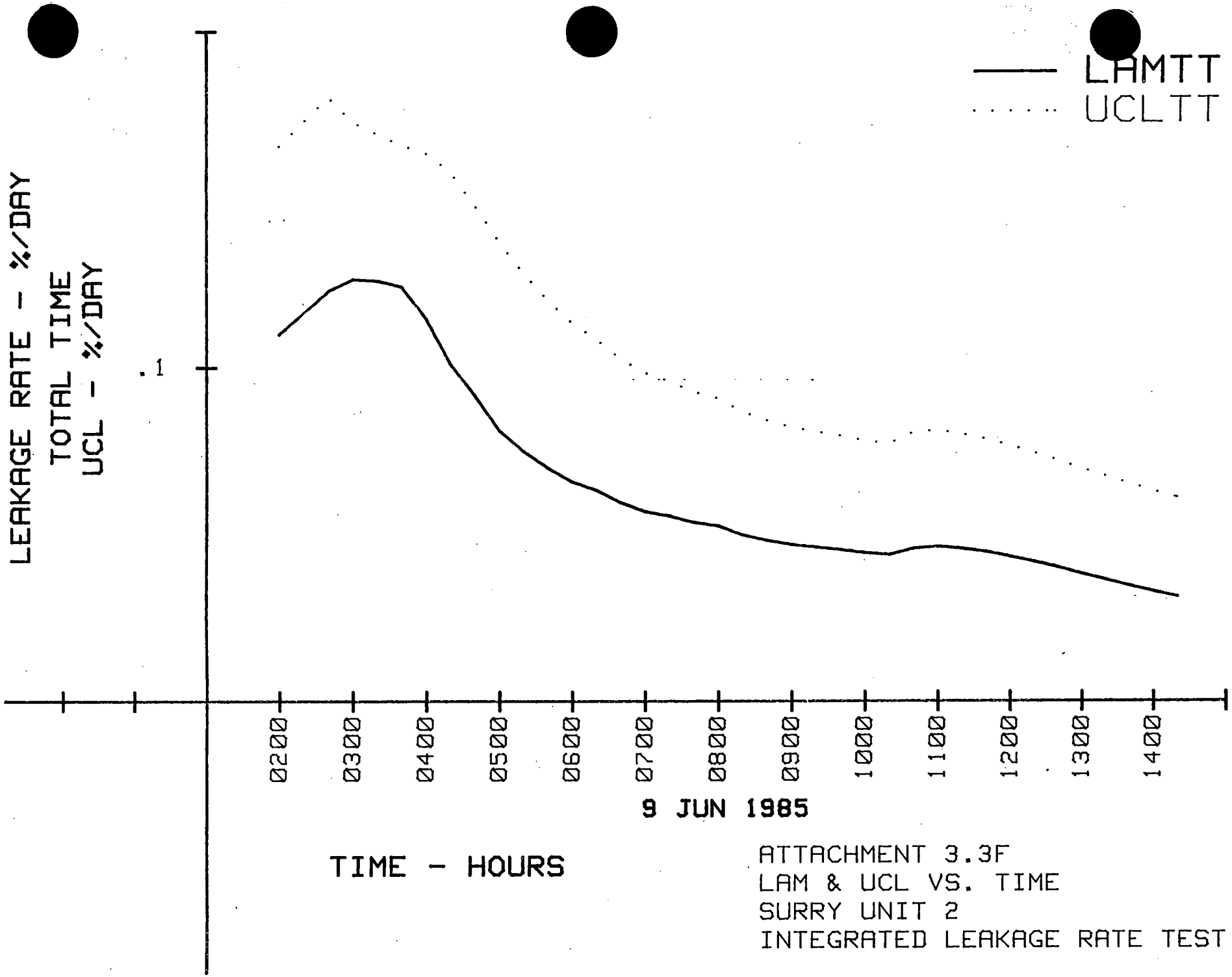
Time (hrs)	Mass (lbm)	Measured Leakage (pct/day)	Estimate Leakage (pct/day)	Confidence (pct/day)	UCL (pct/day)
0.0	546926.41	0.0	0.0	0.0	0.0
0.333	546920.88	0.072872	0.0	0.0	0.0
0.666	546911.64	0.097329	0.0	0.0	0.0
1.000	546901.89	0.107619	0.109985	0.056247	0.166232
1.333	546898.80	0.090894	0.101831	0.073821	0.175652
1.666	546876.15	0.132382	0.122727	0.057709	0.180436
1.993	546872.19	0.119378	0.126271	0.046533	0.172804
2.333	546865.46	0.114643	0.125869	0.043620	0.169489
2.666	546858.47	0.111829	0.124050	0.041931	0.165981
3.000	546864.37	0.090745	0.114682	0.048804	0.163485
3.333	546872.85	0.070518	0.101127	0.056694	0.156821
3.666	546867.30	0.070758	0.091507	0.056293	0.147800
4.000	546873.11	0.058477	0.080832	0.056349	0.137181
4.333	546862.47	0.064755	0.074577	0.053373	0.127951
4.666	546858.51	0.063857	0.069607	0.050465	0.120072
5.000	546855.42	0.062303	0.065408	0.047846	0.113253
5.333	546847.04	0.065308	0.062835	0.045558	0.108393
5.666	546852.08	0.057572	0.059165	0.043537	0.102703
6.000	546845.60	0.059105	0.056543	0.041774	0.098317
6.333	546834.96	0.063369	0.055283	0.040483	0.095766
6.666	546837.47	0.058547	0.053400	0.039150	0.092550
7.000	546828.48	0.061392	0.052371	0.038186	0.090557
7.333	546842.76	0.050058	0.049633	0.036976	0.086609
7.666	546833.05	0.053440	0.047895	0.035992	0.083886
8.000	546826.84	0.054620	0.046625	0.035216	0.081841
8.333	546819.89	0.056093	0.045801	0.034655	0.080456
8.666	546816.45	0.055680	0.045065	0.034162	0.079226
9.000	546816.45	0.053613	0.044164	0.033627	0.077792
9.333	546808.64	0.055373	0.043654	0.033285	0.076939
9.666	546766.20	0.072734	0.045511	0.034774	0.080285
10.000	546780.80	0.063896	0.046065	0.034921	0.080986
10.333	546798.91	0.054146	0.045393	0.034407	0.079800
10.666	546802.00	0.051886	0.044464	0.033843	0.078307
11.000	546810.16	0.046377	0.043093	0.033224	0.076317
11.333	546814.66	0.043271	0.041537	0.032619	0.074156
11.666	546817.15	0.041100	0.039917	0.032042	0.071959
12.000	546826.71	0.036460	0.037971	0.031496	0.069467
12.333	546824.42	0.036291	0.036213	0.030972	0.067184
12.666	546828.31	0.033986	0.034399	0.030472	0.064871
13.000	546828.01	0.033216	0.032683	0.029996	0.062679
13.333	546825.17	0.033321	0.031148	0.029551	0.060699



ATTACHMENT 3.3D
MASS VS. TIME
SURRY UNIT 2
INTEGRATED LEAKAGE RATE TEST



ATTACHMENT 3.3E
LAM & UCL VS. TIME
SURRY UNIT 2
INTEGRATED LEAKAGE RATE TEST



ATTACHMENT 3.3F
LAM & UCL VS. TIME
SURRY UNIT 2
INTEGRATED LEAKAGE RATE TEST

ATTACHMENT 3.3G

CONTAINMENT INTEGRATED LEAKAGE RATE TEST

SUPERIMPOSED LEAKAGE VERIFICATION TEST

FROM 1850 HOURS ON 6-9-85 TO 0500 HOURS ON 6-10-85

INPUT VARIABLES

Time (hrs)	Absolute Pressure (psia)	Dewpoint (^{o}F)	Vapor Pressure (psia)	Absolute Temperature (^{o}R)
0.0	61.460	78.49	0.4823	541.92
0.333	61.463	78.49	0.4823	541.95
0.666	61.467	78.51	0.4827	542.00
1.000	61.472	78.60	0.4841	542.03
1.333	61.476	78.59	0.4839	542.09
1.666	61.481	78.60	0.4841	542.13
2.000	61.485	78.61	0.4842	542.17
2.333	61.489	78.65	0.4849	542.21
2.666	61.493	78.66	0.4850	542.25
3.000	61.497	78.68	0.4854	542.28
3.333	61.502	78.73	0.4852	543.33
3.666	61.506	78.78	0.4870	542.36
4.000	61.510	78.80	0.4873	542.41
4.333	61.514	78.83	0.4878	542.45
4.666	61.519	78.79	0.4871	542.50
5.000	61.524	78.89	0.4887	542.55
5.333	61.529	78.87	0.4884	542.59
5.666	61.534	78.94	0.4895	542.65
6.000	61.539	78.93	0.4894	542.70
6.333	61.544	78.97	0.4900	542.74
6.666	61.548	79.00	0.4905	542.79
7.000	61.552	79.02	0.4908	542.83
7.333	61.556	79.08	0.4918	542.87
7.666	61.559	79.06	0.4915	542.91
8.000	61.562	79.10	0.4921	542.93
8.333	61.565	79.12	0.4924	542.97
8.666	61.568	79.16	0.4931	543.01
9.000	61.534	79.01	0.4907	542.87
9.333	61.515	79.03	0.4910	542.64
9.666	61.515	79.03	0.4910	542.61

ATTACHMENT 3.3H
CONTAINMENT INTEGRATED LEAKAGE RATE TEST
SUPERIMPOSED LEAKAGE VERIFICATION TEST

FROM 1850 HOURS ON 6-9-85 TO 0500 HOURS ON 6-10-85

ABSOLUTE TEST METHOD - MASS POINT ANALYSIS

Time (hrs)	Mass (lbm)	Leakage (pct/day)	Confidence (pct/day)	UCL (pct/day)
0.0	546689.41	0.0	0.0	0.0
0.333	546689.05	0.0	0.0	0.0
0.666	546668.62	0.137040	0.457690	0.594730
1.000	546670.36	0.098225	0.096328	0.194553
1.333	546647.13	0.132047	0.063991	0.196038
1.666	546650.18	0.117125	0.042148	0.159274
2.000	546644.26	0.107561	0.030281	0.137842
2.333	546634.07	0.105815	0.021853	0.127669
2.666	546628.16	0.103144	0.016762	0.119907
3.000	546630.89	0.094178	0.016274	0.110452
3.333	546618.14	0.092649	0.013198	0.105848
3.666	546616.57	0.089001	0.011510	0.100511
4.000	546599.15	0.091422	0.009960	0.101382
4.333	546590.36	0.093640	0.008767	0.102406
4.666	546590.50	0.092696	0.007605	0.100302
5.000	546570.55	0.095813	0.007335	0.103148
5.333	546577.90	0.094177	0.006648	0.100825
5.666	546552.17	0.097323	0.006683	0.104007
6.000	546548.01	0.098900	0.006163	0.105063
6.333	546546.73	0.098878	0.005527	0.104405
6.666	546527.87	0.100805	0.005344	0.106149
7.000	546520.51	0.102203	0.005041	0.107244
7.333	546507.38	0.104037	0.004939	0.108976
7.666	546496.85	0.105796	0.004843	0.110639
8.000	546497.79	0.106073	0.004454	0.110528
8.333	546481.48	0.107221	0.004258	0.111479
8.666	546462.28	0.109282	0.004433	0.113721
9.000	546320.59	0.123922	0.014986	0.138908
9.333	546379.15	0.129558	0.014994	0.144551
9.666	546409.36	0.130737	0.014023	0.144761

ATTACHMENT 3.3I
CONTAINMENT INTEGRATED LEAKAGE RATE TEST
SUPERIMPOSED LEAKAGE VERIFICATION TEST

FROM 1850 HOURS ON 6-9-85 TO 0500 HOURS ON 6-10-85

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	546689.41	0.0	0.0	0.0	0.0
0.333	546686.05	0.044397	0.0	0.0	0.0
0.666	546668.62	0.137040	0.0	0.0	0.0
1.000	546670.36	0.083659	0.107970	0.577828	0.685798
1.333	546647.13	0.139264	0.135743	0.212997	0.348740
1.666	546650.18	0.103392	0.125577	0.155481	0.281058
2.000	546644.26	0.099103	0.117437	0.125329	0.242766
2.333	546634.07	0.104144	0.114753	0.104474	0.219227
2.666	546628.16	0.100872	0.111532	0.091130	0.202662
3.000	546630.89	0.085634	0.103536	0.083990	0.187525
3.333	546618.14	0.093881	0.100824	0.076225	0.177049
3.666	546616.57	0.087229	0.096754	0.070536	0.167290
4.000	546599.15	0.099071	0.097253	0.065380	0.162633
4.333	546590.36	0.100357	0.097989	0.061148	0.159137
4.666	546590.50	0.093063	0.096683	0.057641	0.154324
5.000	546570.55	0.104365	0.098393	0.054774	0.153167
5.333	546577.90	0.091796	0.096893	0.052245	0.149138
5.666	546552.17	0.106340	0.098819	0.050177	0.148996
6.000	546548.01	0.103459	0.099806	0.048165	0.147971
6.333	546546.73	0.098906	0.099733	0.046317	0.146050
6.666	546527.87	0.106389	0.101059	0.044767	0.145826
7.000	546520.51	0.105926	0.102091	0.043317	0.145408
7.333	546507.38	0.108976	0.103481	0.042054	0.145535
7.666	546496.85	0.110273	0.104875	0.040897	0.145772
8.000	546497.79	0.105155	0.105269	0.039738	0.145007
8.333	546481.48	0.109543	0.106263	0.038703	0.144966
8.666	546462.28	0.115061	0.107923	0.037872	0.145795
9.000	546320.59	0.179905	0.118464	0.047057	0.165521
9.333	546379.15	0.145942	0.123125	0.047151	0.170276
9.666	546409.36	0.127194	0.124770	0.046109	0.170879

SECTION 4

LOCAL LEAKAGE RATE TESTS (TYPES B AND C)

Section 4 summarizes the Local Leakage Rate Test (LLRT) data which has been obtained from periodic testing performed since the September 1983 Type A Test.

LLRT procedural changes were made during this refueling period to utilize the makeup air test method, where feasible, instead of the downstream test method. The makeup air test method consists of pressurizing the test volume with air or nitrogen. The makeup air required to maintain the test pressure is directly measured using a flowmeter. All leakage is conservatively assigned to the isolation valve unless shown otherwise.

These LLRT's were performed using the makeup air test method by pressurizing the listed penetrations with air or nitrogen and measuring leakage across the respective containment isolation boundary.

Also during this surveillance period, tighter leakage limits were imposed on containment isolation valves to minimize the "as-left" local leakage rates. Attachment 4A states the repair details for the affected containment valves. Penetration leakage rate can be obtained from site reference material.

The acceptance criteria for Types B and C testing is in accordance with 10CFR50, Appendix J. The combined "as-left" leakage rate for all penetrations and valves, subject to Types B and C tests, were well below the acceptance criteria of less than 0.6 L_a.

As requested by the Nuclear Regulatory Commission, Section 4 also contains an analysis of the containment penetrations that were repaired during the 1985 Surry Unit No. 2 Refueling Outage to assess the "as-found" containment leakage condition. The details of this analysis are shown in Attachment 4B.

The data contained in this section is summarized below:

Attachment No.	Title
4A	1985 Local Leakage Rate Penetration Data
4B	1985 "AS-FOUND" LLRT Leakage Summary Analysis

ATTACHMENT 4A

1985 LOCAL LEAKAGE RATE TEST PENETRATION DATA

Penetration No.		Type Test	Equipment/Valves Tested	Pre-repair Leakage (scfh)	Post-repair Leakage (scfh)	W.O. No./Repair
7	Safety Injection	C	2-SI-150 MOV-2867C MOV-2867D	72.0 (combined)	3.30 (combined)	017810 MOV-2867C
15	Charging	C	2-CH-309 MOV-2289A	0.29 0.48	0.29 0.48	
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	3.20	0.0	MOV-2842
23	Safety Injection	C	MOV-2869B	0.24	0.24	
24	Residual Heat Removal	C	MOV-RH-200	0.0	0.0	
28	Chemical and Volume Control	C	HCV-2200 A, B, C TV-2204	>220.0 (combined) 2.89	0.72 (combined) 1.50	002833 HCV-2200A replaced stem, plug, and gage. 001983 HCV-2200B replaced internals and stem. 002832 HCV-2200C replaced internals and stem. 018634 TV-2204 lapped seat and disc.
32	Gaseous Waste	C	TV-GW-203 TV-GW-202	0.0 0.0	0.0 0.0	

Penetration No.	Type Test	Equipment/Valves Tested	Pre-repair Leakage (scfh)	Post-repair Leakage (scfh)	W.O. No./Repair
33 Gaseous Drains	C	TV-DG-208A	101.0 0.115	0.0 0.115	018106 TV-DG-208A lapped seat and plug. 019807 TV-DG-208A adjusted packing.
38 Aerated Drain	C	TV-DA-200A TV-DA-200B	20.80 >188.0	0.145 0.182	017991 TV-DA-200A lapped seat and plug. 019673 TV-DA-200B lapped seat and plug.
42 Service Air	C	2-SA-81 2-SA-82	0.0 0.0	0.0 0.0	
43 Rad Monitoring	C NA	2-RM-3 TV-RM-200A	1.96 0.068	0.013 0.068	017979 2-RM-3 lapped seat and disc.
44 Rad Monitoring	C	TV-RM-200B TV-RM-200C	0.0 0.0	0.0 0.0	
45 Primary Grade Water	C	2-RC-160 TV-2519A	0.0 0.0	0.0 0.0	
46 Charging	C	FCV-2160	1.3	0.25	020478 FCV-2160 adjusted packing and stroke.
47 Instrument Air	C	2-IA-864 2-IA-704 TV-IA-200	12.23 0.0 0.0169	0.027 0.0 0.0169	017945 2-IA-864 lapped seat and disc.
48 Vent and Drain	C	TV-VG-209A TV-VG-209B	0.0 0.0	0.0 0.0	

ATTACHMENT 4A (CON'T)

Penetration No.		Type Test	Equipment/Valves Tested	Pre-repair Leakage (scfh)	Post-repair Leakage (scfh)	W.O. No./Repair
50	Safety Injection	C	TV-SI-201A	0.52	0.085	017842 TV-SI0201A lapped seat and disc.
			TV-SI-201B	-	0.35	019674 TV-SI-201B lapped seat.
51	Service Water	C	2-SW-206	0.0	0.0	
			2-SW-208	0.023	0.023	
53	Safety Injection	C	2-SI-304	0.0	0.0	
			TV-SI-200	1.70	0.0416	017893 TV-SI-200 lapped seat.
54	Primary Vent	C	2-VA-1	0.0	0.0	
			2-VA-9	0.0	0.0	
55D	Leakage Monitoring	C	TV-LM-200E	0.0	0.0	
			TV-LM-200F	0.0	0.0	
56A	Sample System	C	TV-SS-206A	3.35	0.027	017729 TV-SS-206A Installed new valve.
			TV-SS-206B	2.80	0.0074	TV-SS-2068
56B	Sample System	C	TV-SS-202A	0.165	0.034	017728 TV-SS-202A Installed new valve.
			TV-SS-202B	0.313	0.075	017727 TV-SS-202B Installed new valve.
56D	Sample System	C	TV-SS-200A	1.5	0.0	017769 TV-SS-200A replaced stem tip.
			TV-SS-200B	1.2	0.112	017770 TV-SS-200B replaced plug.
57A	Sample System	C	TV-22-201A	0.74	0.00	017771 TV-SS-201A replaced stem tip. 019581 TV-SS0201A replaced o-ring and rupture diaphram.
			TV-SS-201B	4.50	0.03	017772 TV-SS-201B lapped seat and replaced plug.
57B	Drain System	C	TV-DA-203A	0.0	0.0	
			TV-DA-203B	0.0	0.0	

Penetration No.		Type Test	Equipment/Valves Tested	Pre-repair Leakage (scfh)	Post-repair Leakage (scfh)	W.O. No./Repair
57C	Leakage Monitoring	C	TV-LM-200G	0.0	0.0	
			TV-LM-200H	0.0	0.0	
57D	Sample System	C	TV-SS-204A	0.0	0.0	
			TV-SS-204B	5.86	0.10	017812 TV-SS-204B lapped seat and replaced plug, bellows, and o-rings.
58	Instrument Air	C	2-IA-868	0.966	0.0	017946 2-IA-868 lapped seat and disc.
			1-IA-704	0.0	0.0	
60	Safety Injection	C	MOV-2890A	5.2	5.2	
61	Safety Injection	C	MOV-2890C	1.3	1.3	
62	Safety Injection	C	MOV-2890B	0.0	0.0	
63	Containment Spray	C	2-CS-24	1.0	1.0	
			MOV-CS-201C,D	1.0 (combined)	0.48 (combined)	MOV-CS-201C,D adjusted torque switch.
64	Containment Spray	C	2-CS-13	1.0	1.0	
			MOV-CS-201A,B	1.3 (combined)	0.0 (combined)	MOV-CS-201A,B adjusted torque switch.
66, 67	Recirculation Spray	C	MOV-RS-255A,B	0.0 (combined)	0.69 (combined)	018728 MOV-RS-255A reworked actuator. 018727 MOV-RS-255B reworked actuator.

Penetration No.	Type Test	Equipment/Valves Tested	Pre-repair Leakage (scfh)	Post-repair Leakage (scfh)	W.O. No./Repair
68, 69 Safety Injection	C	MOV-2860A,B	5.0 (combined)	5.0 (combined)	
70 Recirculation Spray	C	2-RS-11	0.9	0.9	
		MOV-RS-256B	0.5	3.78	019525 MOV-RS-256B replaced limitorque pin.
71 Recirculation Sray	C	2-RS-17	0.0	0.0	
		MOV-RS-256A	3.84	1.63	019229 MOV-RS-256A reworked actuator.
89 Air Ejector Discharge	C	2-VP-12	8.72	0.43	0188894 2-VP-12 lapped seat and disc.
		TV-SV-202A	0.0	0.0	
90 Ventilation	C	MOV-VS-200C	8.6	0.461	020178 MOV-VS-200D replaced gasket.
		MOV-VS-200D, 201	(combined)	(combined)	020418 MOV-VS-201 checked torque switch.
91 Ventilation	C	MOV-VS-200A	2.30	2.0	No work performed, retest only.
		MOV-VS-200B, 202	(combined)	(combined)	
92 Containment Vacuum	C	TV-GW-204	0.0	0.0	
		TV-GW-205	0.0	0.0	
		TV-CV-250C	3.10	0.29	017894 TV-CV-250C lapped seat and plug.
		TV-CV-250D	1.50	0.29	TV-CV-250D
93 Containment Vacuum	C	TV-GW-200	0.0	0.0	
		TV-GW-201	0.0	0.0	
		TV-CV-250A	13.20	0.082	017591 TV-CV-250A lapped seat and plug.
		TV-CV-250B	5.10	0.18	017590 TV-CV-250B lapped seat and plug.
94 Containment Vacuum	C	HCV-CV-200	0.20	0.20	
		2-CV-2	0.083	0.083	

Penetration No.	Type Test	Equipment/Valves Tested	Pre-repair Leakage (scfh)	Post-repair Leakage (scfh)	W.O. No./Repair
97B Sample System	C	TV-SS-203A TV-SS-203B	0.0185 0.0452	0.0185 0.0452	
97C Leakage Monitoring	C	TV-LM-200A TV-LM-200B	0.0 0.0	0.0 0.0	
100 Gaseous Waste	C	TV-GW206 TV-GW-207	0.0 0.0	0.0 0.0	
101 Fire Protection	C	2-FP-151 2-FP-152	0.0 1.5	0.0 0.0	018575 2-FP-152 lapped seat.
103 Reactor Cavity Purification	C	2-RL-3 2-RL-5	0.0 (combined)	0.0 (combined)	
104 Reactor Cavity Purification	C	2-RL-13 2-RL-15	0.0 0.0	0.0 0.0	
105B Leakage Monitoring	C	TV-LM200C TV-LM-200D	0.0 0.0	0.0 0.0	
105C Post Accident Sampling	C	TV-GW-211A TV-GW-211B	0.0 0.0	0.0 0.0	
106 Safety Injection	C	2-SI-73	0.0	0.0	

Penetration No.	Type Test	Equipment/Valves Tested	Pre-repair Leakage (scfh)	Post-repair Leakage (scfh)	W.O. No./Repair
112 Instrument Air	C	TV-IA-201A TV-IA-201B	0.0 0.0	0.0 0.0	
113 Safety Injection	C	S-SI-174 MOV-2869A	2.1 (combined)	0.58 (combined)	
Personnel Air Lock	B	O-ring	5.8	5.8	
Equipment Hatch	B	O-ring	0.0	0.0	
Fuel Transfer Tube	B	O-ring	0.0	0.0	
Emergency Air Lock	B	O-ring	2.5	2.5	

All electrical penetrations were tested prior to the performance of the CILRT with a combined total leakage of 0.00437 scfh.

ATTACHMENT 4B

1985 "AS-FOUND" LLRT LEAKAGE SUMMARY ANALYSIS

Specific penetrations were repaired during the 1985 Surry Power Station Unit No. 2 refueling outage.

The effect of each Local Leakage Rate Test (LLRT) repair was analyzed to predict the outcome of the Type A Test if it were performed prior to the repairs. Each penetration is reviewed using the following selection criteria:

a. A leakage equivalent to the repair improvement achieved on each valve in the penetration is calculated.

b. The leakage equivalent is the difference between the "as-found" and the "as-left" results.

c. If a repair was not performed, a zero leakage is assessed to the valve.

d. The leakage equivalent assessed to a penetrations may be reduced due to the safety-related service of the penetration. Justification for these type of penetrations will be provided for this reduction.

e. The net equivalent leakage for the penetration is the lowest of the inside or outside valve grouping (e.g. simulates minimum pathway leakage).

f. The net leakage equivalent is added to the Type A results of Sections 3.3.2.1 and 3.3.2.2.

g. If the results of the "as-found" Type A are less than 0.1 percent/day, containment integrity before repairs has been demonstrated.

ATTACHMENT 4B (CON'T)
1985 "AS-FOUND" LLRT LEAKAGE SUMMARY ANALYSIS

Penetration No.	Inside (SCFH)	Outside (SCFH)	Net (SCFH)	Remarks
7 Safety Injection	-	68.7	0	See Note 1
21 Safety Injection	-	3.2	0.0	See Note 1
28 Chemical & Vol C	>220.0	1.39	1.39	See Note 2
33 Gaseous Drains	101.0	0.0	0.0	
38 Aerated Drains	20.655	>188.0	20.655	See Note 2
43 Rad. Monitoring	1.947	0.0	0.0	
46 Charging	-	1.05	0.0	See Note 1
47 Instrument Air	12.203	0.0	0.0	
50 Safety Injection	0.435		0.435	See Note 3
53 Safety Injection	0.0	1.6584	0.0	
56A Liquid Sample	3.323	2.7926	2.7926	
56B Liquid Sample	0.131	0.238	0.131	
56D Liquid Sample	1.5	1.088	1.088	
57A Sample System	0.74	4.47	0.74	
57D Sample System	0.0	5.76	0.0	
58 Instrument Air	0.966	0.0	0.0	
63 Cont. Spray	0.0	0.52	0.0	
64 Cont. Spray	0.0	1.3	0.0	
71 Recirc. Spray	0.0	2.21	0.0	
89 Air Ejec. Dsch.	8.29	0.0	0.0	
90 Ventilation	0.0	8.139	0.0	See Note 4
91 Ventilation	0.3	0.3	0.3	
92 Cont. Vacuum	-	1.21	1.21	
93 Cont. Vacuum	-	4.92	4.92	
101 Fire Protection	-	1.52	0.0	See Note 1
113 Safety Injection	-	1.52	0.0	See Note 1

ATTACHMENT 4B (Con't)

1985 "AS-FOUND" LLRT LEAKAGE SUMMARY ANALYSIS

Methods were applied, as described in (f) and (g) above, with the results listed below.

CILRT Results

1.	Net Equivalent	33.662 SCFH
2.	"AS-FOUND" Type A-MP	(Percent/Day)
	a. Mass Point Analysis from 3.3.2.1	0.039754
	b. Net Equivalent Leakage	0.011049
	c. "AS-FOUND" Type A- Mass Point Analysis	0.050803
3.	"AS-FOUND" Type A - TT	(Percent/Day)
	a. Total Time Analysis From 3.3.2.2	0.061023
	b. Net Equivalent Leakage	0.011049
	c. "AS-FOUND" Type A- Total Time Analysis	0.072072

ATTACHMENT 4B (Con't)

1985 "AS-FOUND" LLRT LEAKAGE SUMMARY ANALYSIS

CONCLUSION:

The "As-Found" Type A results for the Mass Point and Total Time Analysis indicates that the results are less than 0.075 percent/day.

NOTES:

1. This line is from the charging pump header and is used to fill/supply the loops. The charging pumps are used as the high head safety injection pumps. The chemical and volume control system valves, piping, and components have been designed to permit essentially zero leakage. Periodic surveillance is performed to verify leakage is within specifications. Reference Surry UFSAR, Section 6.2.3.10, External Recirculation Loop Leakage.

2. Greater than represents the largest flowmeter used for the 1985 LLRT program.

3. "As-Found" LLRT data was not obtained for valve TV-SI-201B. The net leakage results for this penetration is conservative, such that, if the leakage for this valve was higher than the inside valve, minimum pathway is being utilized. If the leakage for this valve was less than the inside valve, the higher leakage for the penetration was assessed.

4. This penetration is tested between valves. Inside valve MOV-VS-200C was not repaired, thus a net equivalent leakage of zero.