REACTOR CONTAINMENT BUILDING
INTEGRATED LEAKAGE RATE TEST

TYPES A, B, AND C
PERIODIC TEST

FLORIDA POWER AND LIGHT COMPANY

TURKEY POINT PLANT
UNIT NO. 4

MARCH 1986

PREPARED BY
STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS

TABLE OF CONTENTS

LIST OF ATTACHMENTS

REFERENCES

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

2. Florida Power & Light Turkey Point Plant Operating Procedure 13100.1, Integrated Leakage Rate Test, and 13100.2, Valve Lineup for ILRT.

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 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 March 1986 Periodic Type A Containment Integrated Leakage Rate Test (ILRT), and a summary of the periodic Types B and C Local Leakage Rate Tests conducted since May 1983 on the Florida Power and Light Company's (FP&L) Turkey Point Plant, Unit No. 4.

Stone & Webster Engineering Corporation provided engineering consultation services to FP&L during the performance of this test.

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

SECTION 2

SUMMARY

2.1 TYPE A TEST

Pressurization for the ILRT began at 2356 hours on March 25, 1986. Investigations of all penetration areas for leakage were conducted during the pressurization period and throughout the Type A test. Only minor leakage paths were identified.

Containment pressurization equipment was secured at approximately 0937 hours on March 26, 1986, with a peak instantaneous pressure of 67.148 psia. Temperature, humidity, and pressure data was continuously recorded throughout the entire test period at 15 minute intervals. The temperature stabilization criteria was satisfied at 1915 hours on March 26, 1986.

The Type A test was successfully completed from 1930 hours on March 26, 1986 to 0500 hours on March 27, 1986, with a Mass Point Upper Confidence Limit (UCL-MP) of 0.083594 percent/day and a Total Time Upper Confidence Limit (UCL-TT) of 0.108892 percent/day, (See Section 3.3, Test Results). Both the Mass Point and the Total Time leakage rates were well below the Turkey Point 0.75 L_a acceptance criteria of 0.1875 percent per day.

The Type A test duration was extended by approximately one and one-half hours. This was done to closely monitor the slight change in the mass trend which occurred at approximately midnight of March 26, 1986. Reference the mass and leakage rate graphs of Attachments 3.3D through 3.3F.

A review of Attachment 3.3A indicates that at approximately 2330 hours on March 26, 1986 (which is 4.250 hours after the start of the Type A test), the temperature and pressure trends essentially stabilized. This brought about a very slight change in the mass trend. Once additional data was obtained it was readily determined that a significant break in the trends had not occured. A subsequent review of all the individual sensor readings did not reveal any abnormalities.

The superimposed leakage verification test was started at 0630 hours and was successfully completed at 1115 hours on March 27, 1986. The results of the verification test satisfied the requirements set forth in References 4 and 5, (See Section 3.3, Test Results).

Depressurization of the containment commenced at 1200 hours on March 27, 1986 and was completed in the early evening.

2.2 LOCAL LEAKAGE RATE TESTS (Types B and C)

The Local Leakage Rate Tests (LLRT's) of containment isolation valves and other primary containment penetrations were conducted as required by the methods described in FP&L's Operating Procedure No. 13404.1, "Containment Boundary Isolation Valves - Local Leakage Rate Tests" since the last Unit No. 4 Type A Test performed in May 1983.

Section 4 of this report summarizes the data for the two surveillance periods (1984 and 1986) of LLRT's conducted since the last Type A Test in accordance with Appendix J, 10CFR50, Paragraph V.B.

SECTION 3

TYPE A TEST

3.1 EDITED LOG OF EVENTS

This log was edited from information contained in the Official Log of Events.

March 25, 1986

2356 - Containment pressurization was initiated. Pressurization rate was approximately 6.0 pounds per hour.

March 26, 1986

0300 - Initiated leakage investigation of the penetration area.

0410 - No pressure observed in the Personnel and Emergency Hatch.

0500 - Penetration area leakage investigation completed. Observed various minor leakages on opened vent valves and valve packing. Containment pressure was 44.3 psia. Containment average temperature was approximately 94°F.

0800 - Performed leakage investigation of the penetration area. Same minor leakages were observed.

0900 - Performed leakage investigation of exclusion areas. No leakage was noted.

0937 - Containment pressure was 67.148 psia. Compressors were secured, and the pressurization line was vented.

1315 - The pressure between the purge exhaust and supply valves was increasing. Readings were approximately 2 psig and 28 psig, respectively.

1400 - Performed leakage investigation of the penetration area. Same minor leakages were observed.

1915 - Satisfied the temperature stabilization criteria of the test procedure.

1930 - Commenced the start of the Type A Test.

March 27, 1986

0130 - Performed leakage investigation of the penetration area. Same minor leakages were observed.

0500 - Satisfied Type A criteria for a reduced duration test.

0530 - Superimposed leakage rate was started.

0630 - Superimposed leakage verification test was started.

1115 - Superimposed leakage verification test criteria was satisfied.

1200 - Depressurization of the containment commenced.

3.2 GENERAL TEST DESCRIPTION

3.2.1 Prerequisites

In accordance with the Turkey Point Plant Unit No. 4 ILRT Procedure 13100.1 (Reference 2), the following is a listing of the pertinent prerequisites that were completed and documented prior to containment pressurization:

a. General inspection of the accessible interior and exterior surfaces of the containment structures and components completed.

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

c. All instrumentation required for the test calibrated within six months of the test and functionally verified.

d. All required system valve lineups completed, including closure of containment isolation valves.

e. All required Types B and C local leakage rate testing completed.

f. The Official Log of Events established.

g. Site meteorological data recorded at least three days prior to and during the ILRT (Attachment 3.2A).

h. Temporary containment air recirculation fans installed and tested.

i. ILRT pressurization system properly installed and tested.

j. All ILRT computer software used for test calculations tested and operational.

3.2.2 Equipment and Instrumentation

Pressurization of the containment was achieved by the utilization of a temporary system consisting of ten air compressors manifolded to aftercoolers and refrigerant air dryers. 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 was rated at approximately 11,000 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 22 resistance temperature detectors (RTD's), 10 relative humidity detectors (RHD's), and an absolute pressure quartz manometer. Pertinent data for the test instrumentation is listed in Attachment 3.2B, and the general locations of the RTD's and RHD's are shown in Attachment 3.2C through 3.2F.

A rotometer was used to perform the superimposed leakage verification test.

3.2.3 Data Acquisition System

The Turkey Point Plant Unit No. 4 ILRT sensor data were recorded at approximately 15 minute intervals during the test. A programmable, multichannel data logger was used to scan and record data from 22 RTD's, 10 RHD's, and manometer signal inputs. Data readings of the rotometer were manually recorded.

The ILRT utilized a portable programmable computer to average the test data. Periodically during the test period, weighted average temperature, air pressure, weighted average vapor pressure, and mass values were computed.

3.2.4 Data Resolution System

After the appropriate data had been acquired and averaged, the results were inputted to the Stone & Webster Engineering Corporation's (SWEC) portable computer for leakage rate calculations. For the Turkey Point Plant Unit No. 4 ILRT, 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 relative humidity observations made during the ILRT. 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/lb$_m$ ^{o}R (for air)
T = average containment temperature, ^{o}R
V = containment free volume, 1.55 x 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 is 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 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 confidence interval is the upper confidence limit-mass point (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 relative humidity observations made during the ILRT.

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:

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

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

The calculated 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:

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

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

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

This analysis method was used in conjunction with procedure 13100.1 (Reference 2).

ATTACHMENT 3.2A

SITE METEOROLOGY

Date	Time	Ambient Temperature (°F)	Barometric Pressure (in. Hg)	Wind Velocity (mph)	Wind Direction (azimuth)
3-23-86	1700	69	30.36	11	300
	1800	68	30.37	8	330
	1900	66	30.38	5	335
	2000	66	30.40	10	335
	2100	64	30.40	6	330
	2200	63	30.41	9	330
	2300	62	30.42	12	320
3-24-86	0000	60	30.40	10	315
	0100	58	30.37	12	335
	0200	56	30.37	12	320
	0300	56	30.36	7	325
	0400	56	30.36	11	325
	0500	57	30.37	6	355
	0600	57	30.37	8	325
	0700	57	30.40	12	330
	0800	57	30.44	10	330
	0900	58	30.46	10	330
	1000	61	30.48	5	330
	1100	64	30.48	6	330
	1200	70	30.47	8	40
	1300	72	30.47	10	70
	1400	70	30.42	10	60
	1500	71	30.41	12	63
	1600	72	30.40	7	65
	1700	71	30.41	8	45
	1800	69	30.42	7	45
	1900	65	30.43	8	65
	2000	65	30.43	4	64
	2100	65	30.45	12	63
	2200	65	30.45	5	55
	2300	65	30.45	6	55
3-25-86	0000	66	30.45	5	55
	0100	66	30.42	6	55
	0200	66	30.40	5	60
	0300	66	30.38	6	70
	0400	66	30.36	7	79
	0500	66	30.25	12	90
	0600	66	30.40	12	91
	0700	65	30.41	16	91
	0800	68	30.43	13	90
	0900	71	30.45	12	90
	1000	70	30.33	15	85
	1100	71	30.33	13	90
	1200	73	30.31	13	85
	1300	74	30.30	12	85
	1400	72	30.25	10	75

ATTACHMENT 3.2A (Continued)

SITE METEOROLOGY

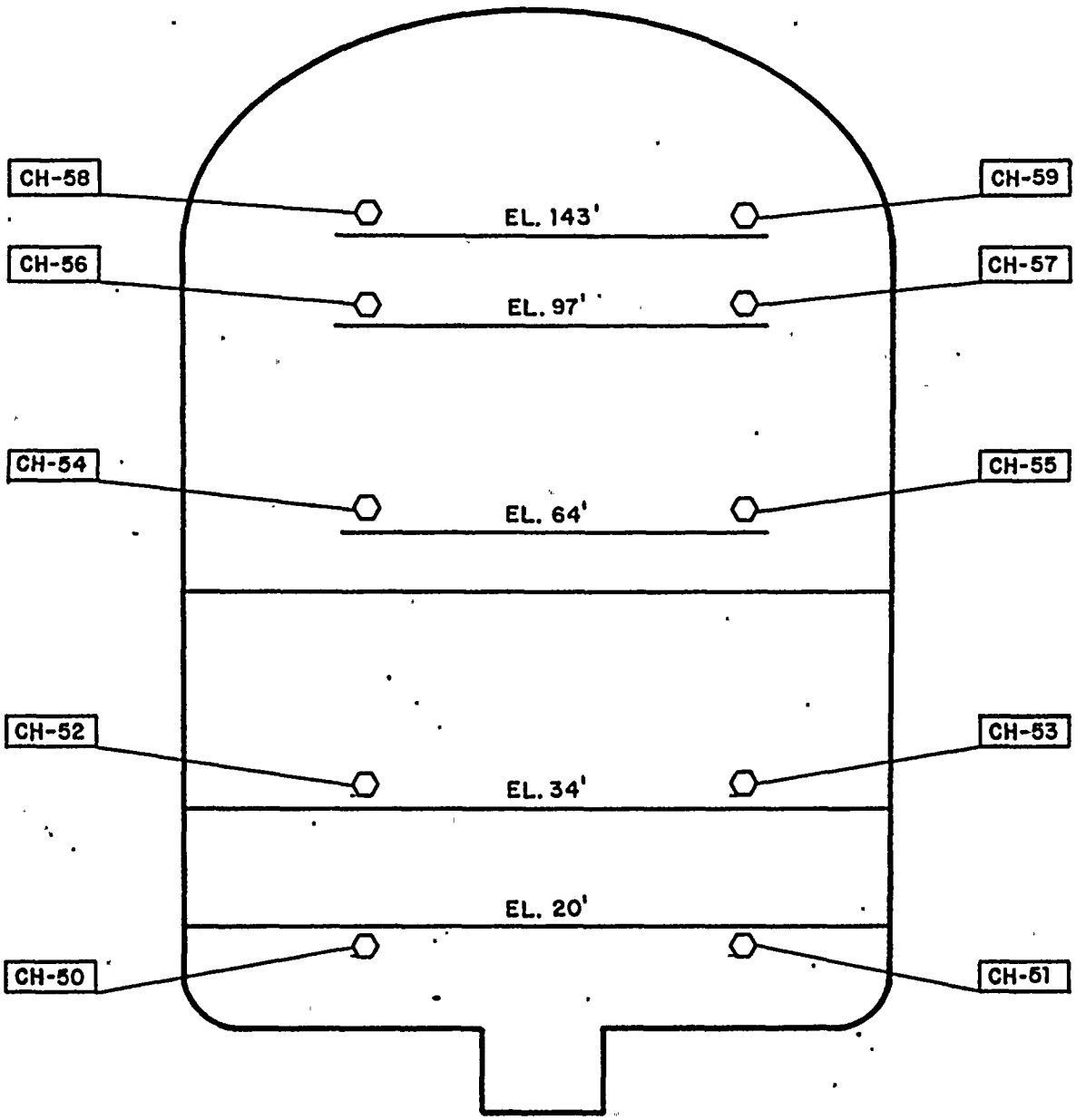
Date	Time	Ambient Temperature (°F)	Barometric Pressure (in. Hg)	Wind Velocity (mph)	Wind Direction (azimuth)
	1500	72	30.24	16	85
	1600	70	30.35	5	98
	1700	68	30.34	10	85
	1800	66	30.33	8	90
	1900	65	30.32	9	70
	2000	67	30.33	11	75
	2100	67	30.34	10	105
	2200	67	30.35	10	105
	2300	67	30.33	10	405
3-26-86	0000	67	30.33	14	415
	0100	67	30.31	8	415
	0200	67	30.29	8	410
	0300	65	30.28	7	410
	0400	65	30.25	7	410
	0500	66	30.15	6	90
	0600	66	30.26	13	404
	0700	67	30.28	4	75
	0800	66	30.29	5	100
	0900	66	30.30	7	110
	1000	67	30.29	11	440
	1100	67	30.28	11	445
	1200	68	30.28	12	450
	1300	73	30.27	13	450
	1400	73	30.25	7	450
	1500	74	30.23	7	450
	1600	74	30.21	10	445
	1700	74	30.19	6	425
	1800	74	30.19	10	440
	1900	72	30.20	15	480
	2000	71	30.21	8	435
	2100	71	30.21	8	435
	2200	71	30.22	11	445
	2300	71	30.22	7	425
3-27-86	0000	72	30.21	7	445
	0100	72	30.20	8	425
	0200	67	30.18	10	55
	0300	66	30.16	7	46
	0400	66	30.14	5	39
	0500	66	30.16	8	55
	0600	65	30.16	4	40
	0700	65	30.16	5	305
	0800	71	30.18	7	300
	0900	72	30.19	3	60
	1000	76	30.19	9	65
	1100	76	30.19	11	75
	1200	78	30.17	10	60

ATTACHMENT 3.2B

INSTRUMENTATION LIST

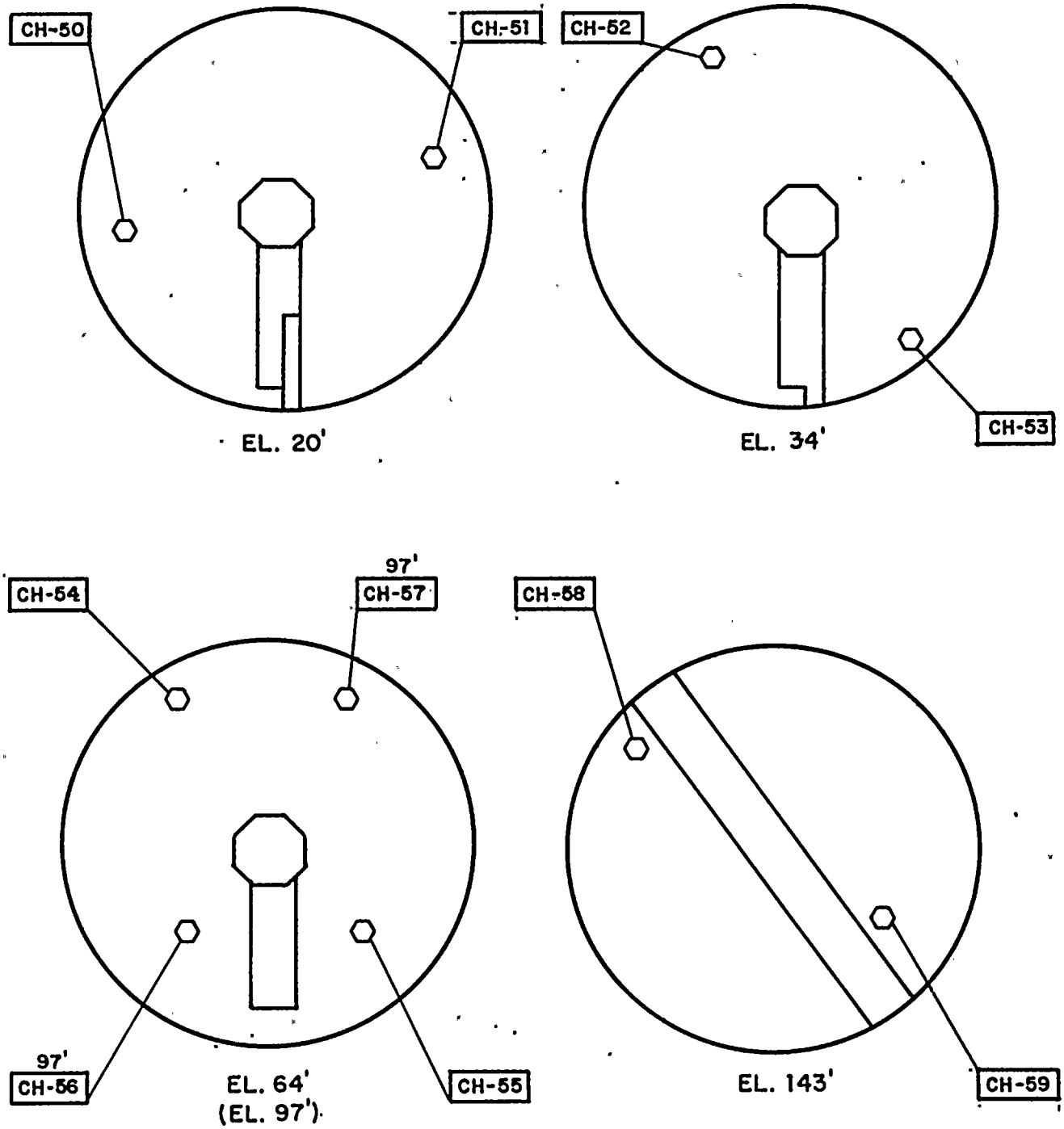
The following instruments were calibrated or functionally verified within 6 months prior to the performance of this test and in accordance with 10CFR50, Appendix J, using instrumentation traceable to the National Bureau of Standards.

Channel	Elevation	Instrument	Weight Factor	Accuracy
CH-9	20'	RTD	0.033	±0.5°F
CH-19	20'	RTD	0.033	±0.5°F
CH-20	20'	RTD	0.033	±0.5°F
CH-12	34'	RTD	0.033	±0.5°F
CH-14	29'	RTD	0.033	±0.5°F
CH-15	34'	RTD	0.033	±0.5°F
CH-1	64'	RTD	0.03	±0.5°F
CH-3	64'	RTD	0.03	±0.5°F
CH-4	64'	RTD	0.03	±0.5°F
CH-5	64'	RTD	0.03	±0.5°F
CH-2	97'	RTD	0.060334	±0.5°F
CH-6	97'	RTD	0.060334	±0.5°F
CH-7	97'	RTD	0.060333	±0.5°F
CH-8	97'	RTD	0.060333	±0.5°F
CH-21	97'	RTD	0.060333	±0.5°F
CH-22	97'	RTD	0.060333	±0.5°F
CH-10	143'	RTD	0.053334	±0.5°F
CH-11	143'	RTD	0.053334	±0.5°F
CH-13	143'	RTD	0.053333	±0.5°F
CH-16	143'	RTD	0.053333	±0.5°F
CH-17	143'	RTD	0.053333	±0.5°F
CH-18	143'	RTD	0.053333	±0.5°F
CH-50	20'	RHD	0.0495	±2.5%RH
CH-51	20'	RHD	0.0495	±2.5%RH
CH-52	34'	RHD	0.0495	±2.5%RH
CH-53	34'	RHD	0.0495	±2.5%RH
CH-54	64'	RHD	0.06	±2.5%RH
CH-55	64'	RHD	0.06	±2.5%RH
CH-56	97'	RHD	0.181	±2.5%RH
CH-57	97'	RHD	0.181	±2.5%RH
CH-58	143'	RHD	0.16	±2.5%RH
CH-59	143'	RHD	0.16	±2.5%RH
CH-80				
TI-145				
0-100 psia				
Quartz		Manometer 1	1.0	±0.001%F.S.
TI-145				
0-100 psia				
Quartz		Manometer 2	N/A	±0.001%F.S.
Rotometer		0-28 scfm @ 50 psig		±1.0%F.S.



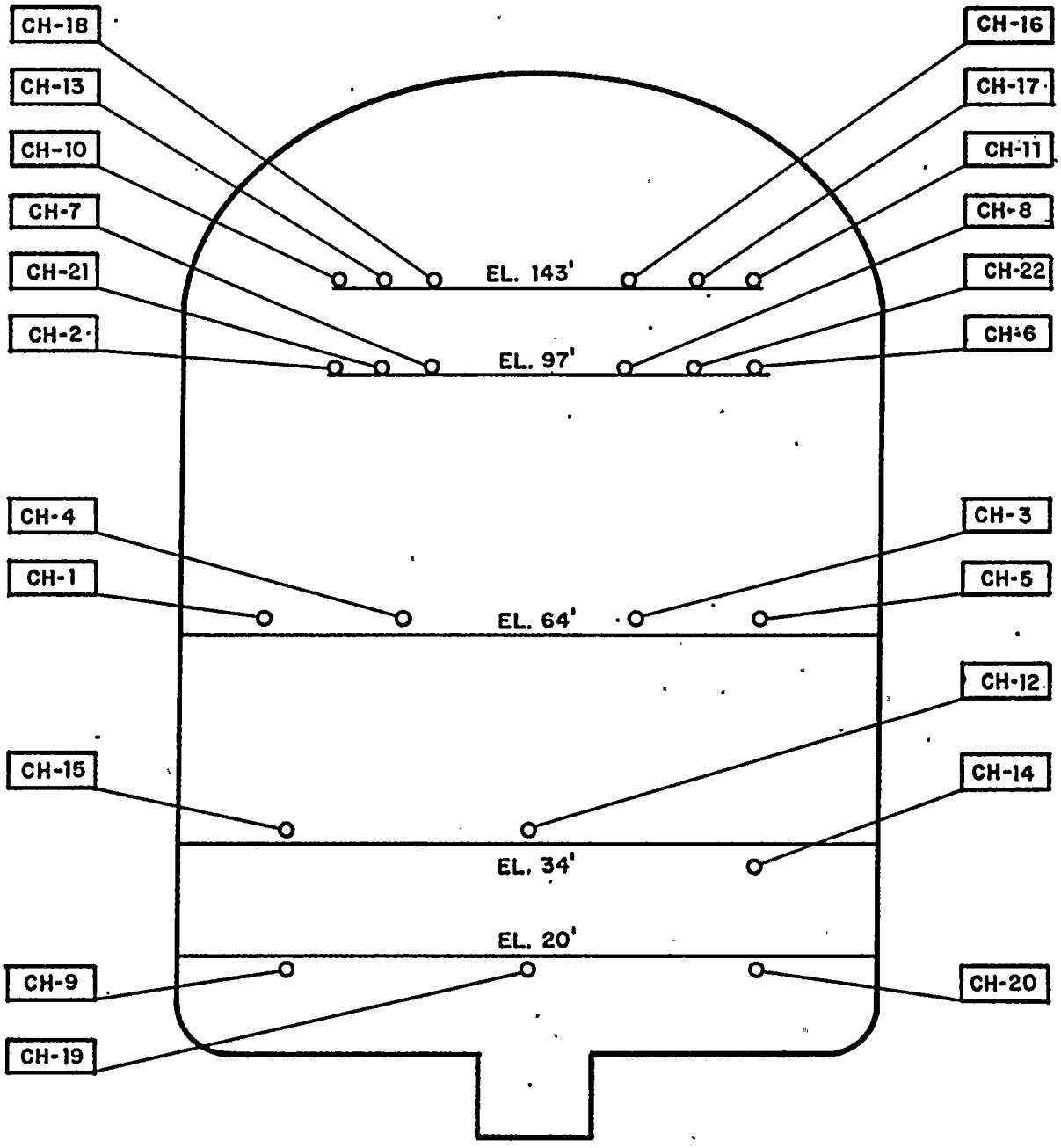
PROFILE VIEW

ATTACHMENT 3.2C
INSTRUMENTATION LOCATION
RELATIVE HUMIDITY
DETECTORS (RHD'S)
TURKEY POINT PLANT- UNIT 4



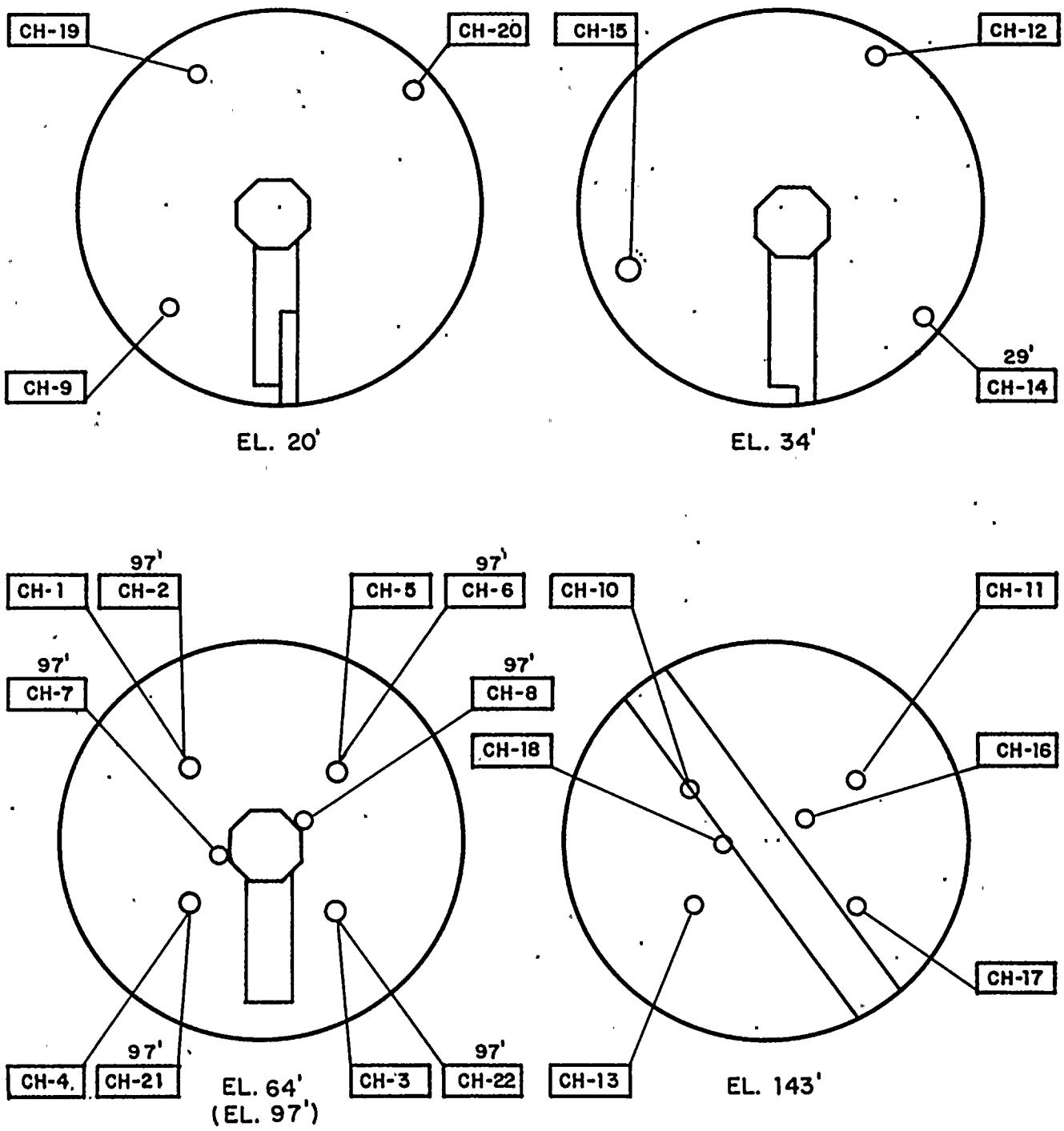
PLAN · VIEW

ATTACHMENT 3.2D
INSTRUMENTATION LOCATION
RELATIVE HUMIDITY
DETECTORS (RHD'S)
TURKEY POINT PLANT-UNIT 4



PROFILE VIEW

ATTACHMENT 3.2E
INSTRUMENTATION LOCATION
RESISTANCE TEMPERATURE
DETECTORS (RTD'S)
TURKEY POINT PLANT-UNIT 4



PLAN VIEW

ATTACHMENT 3.2F
INSTRUMENTATION LOCATION
RESISTANCE TEMPERATURE
DETECTORS (RTD'S)
TURKEY POINT PLANT-UNIT 4

3.3 TEST RESULTS

3.3.1 Presentation of Test Results

The ILRT was conducted in accordance with the Turkey Point Plant Unit No. 4 Operating Procedure 13100.1. The results for the ILRT and for the Superimposed Leakage Verification Test are shown below:

3.3.2 ILRT Results - Mass Point Method

	Percent/Day
1. Leakage Rate Calculated, Lam	0.079923
2. Upper Confidence Level	0.003670
3. Type C Corrections (See 3.3.5)	0.003838
4. Total Reported Type A Leakage Rate	0.087431

Results were within the acceptable limit of 0.1875 percent/day.

3.3.3 ILRT Resuls - Total Time Method

	Percent/Day
1. Leakage Rate Calculated, Lam	0.077245
2. Upper Confidence Level	0.031647
3. Type C Corrections (See 3.3.5)	0.003838
4. Total Reported Type A Leakage Rate	0.112730

Results were within the acceptable limit of 0.1875 percent/day.

3.3.4 Superimposed Leakage Verification Test Results

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

   $(Lam + Lo - 0.25\ La) \leq Lc \leq (Lam + Lo + 0.25\ La)$

   where: Lam = total measured containment leakage rate from ILRT

   Lo = leakage rate imposed on containment using a flow measuring device (percent/day)

   La = maximum allowable leakage rate (0.25 percent/day)

   Lc = composite leakage rate calculated during the verification test

a. Mass Point (See Attachment 3.3G, Page 2 of 3)

$(.079923 + .260691 - .062500) \leq .334008 \leq (.79923 + .260691 + .062500)$

$.278114 \leq .334008 \leq .403114$

b. Total Time (See Attachment 3.3G, Page 3 of 3)

$$(.077245 + .260691 - .062500) \leq .351351 \leq (.077245 + .260691 + .062500)$$

$$.275436 \leq .351351 \leq .400436$$

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

c. Calculation of Lo, percent/day

Lo = 740.04 scfh

La = 709.687 scfh and 0.25 percent/day

$$Lo = (0.25)\ \frac{(740.04)}{(709.687)}$$

Lo = .260691 percent/day

3.3.5 Type C Corrections

1. Type C penalty for not venting or draining in standard cubic centimeters per minute.

Pen. 11		40 ccm
Pen. 24	a,b,c	1130 ccm
	Total	1170 ccm

$$sccm = 1170 \text{ ccm} \times \frac{(49.9 + 14.696)}{14.696} = 5142.71 \text{ sccm}$$

2. Type C penalty in percent/day (See 3.3.2.3 and 3.3.3.3)

La = 11.828 scfm and 0.25 percent/day

5142.71 sccm = 0.181589 scfm

$$\text{Type C Correction} = \frac{0.181589 \text{ (scfm)}}{11.828 \text{ (scfm)}} (0.25) = 0.003838$$

Type C Correction = 0.003838 percent/day

ATTACHMENT 3.3A

INTEGRATED LEAKAGE RATE TEST

FROM 1930 HOURS ON MARCH 26, 1986 TO 0500 HOURS ON MARCH 27, 1986

REDUCED INPUT VARIABLES

Time (hr)	Abs. Pressure (psia)	Vap. Pressure (psia)	Temp. (deg R)	Rel. Humidity (pct)	Mass (lbm)
0.000	66.042	.4434	545.97	71.443	502675.452
.250	66.035	.4430	545.92	71.473	502666.990
.500	66.028	.4424	545.87	71.500	502662.334
.750	66.022	.4420	545.83	71.529	502659.434
1.000	66.016	.4414	545.78	71.554	502663.749
1.250	66.009	.4412	545.74	71.582	502645.619
1.500	66.003	.4406	545.70	71.591	502643.796
1.750	65.996	.4403	545.66	71.623	502629.178
2.000	65.991	.4399	545.62	71.661	502629.810
2.250	65.985	.4394	545.58	71.675	502626.891
2.500	65.981	.4390	545.54	71.696	502634.785
2.750	65.974	.4385	545.50	71.700	502618.750
3.000	65.969	.4382	545.46	71.740	502619.037
3.250	65.964	.4378	545.43	71.763	502616.859
3.500	65.959	.4375	545.40	71.779	502609.757
3.750	65.954	.4371	545.36	71.808	502606.609
4.000	65.949	.4368	545.33	71.838	502602.508
4.250	65.944	.4365	545.30	71.844	502591.344
4.500	65.939	.4364	545.27	71.881	502583.199
4.750	65.934	.4359	545.24	71.885	502576.761
5.000	65.929	.4357	545.21	71.921	502567.823
5.250	65.925	.4354	545.18	71.946	502568.000
5.500	65.921	.4350	545.15	71.934	502563.359
5.750	65.917	.4347	545.12	71.946	502563.063
6.000	65.913	.4347	545.10	71.983	502553.466
6.250	65.909	.4343	545.07	72.009	502554.105
6.500	65.906	.4341	545.04	72.025	502554.788
6.750	62.902	.4338	545.02	72.029	502551.678
7.000	65.899	.4335	544.99	72.050	502552.697
7.250	65.897	.4334	544.97	72.080	502561.556
7.500	65.893	.4332	544.94	72.091	502555.958
7.750	65.889	.4329	544.92	72.101	502549.281
8.000	65.885	.4327	544.90	72.126	502538.827
8.250	65.881	.4325	544.88	72.143	502528.882
8.500	65.878	.4324	544.86	72.158	502527.112
8.750	65.875	.4320	544.83	72.169	502532.891
9.000	65.871	.4319	544.81	72.181	502518.687
9.250	65.867	.4317	544.79	72.207	502511.669
9.500	65.864	.4314	544.77	72.205	502506.973

ATTACHMENT 3.3B

INTEGRATED LEAKAGE RATE TEST

FROM 1930 HOURS ON MARCH 26, 1986 TO 0500 HOURS ON MARCH 27, 1986

ABSOLUTE TEST METHOD, MASS POINT ANALYSIS

Time (hr)	Mass (lbm)	Leakage (pct/day)	95 Pct. Conf. (pct/day)	UCL (pct/day)
0.000	502675.45	0.000000	0.000000	0.000000
.250	502666.99	0.000000	0.000000	0.000000
.500	502662.33	.125269	.179527	.304796
.750	502659.43	.100667	.050088	.150755
1.000	502663.75	.059132	.061023	.120154
1.250	502645.62	.088280	.050944	.139223
1.500	502643.80	.092963	.034482	.127445
1.750	502629.18	.110431	.031597	.142027
2.000	502629.81	.110416	.023863	.134279
2.250	502626.89	.107427	.018958	.126385
2.500	502634.78	.094061	.020808	.114869
2.750	502618.75	.094510	.017124	.111635
3.000	502619.04	.091485	.014679	.106165
3.250	502616.86	.088158	.012937	.101095
3.500	502609.76	.087183	.011177	.098360
3.750	502606.61	.085933	.009803	.095737
4.000	502602.51	.084926	.008665	.093592
4.250	502591.34	.086470	.007824	.094294
4.500	502583.20	.088666	.007313	.095979
4.750	502576.76	.090755	.006885	.097640
5.000	502567.82	.093340	.006725	.100065
5.250	502568.00	.094135	.006148	.100282
5.500	502563.36	.094680	.005625	.100305
5.750	502563.06	.094209	.005166	.099375
6.000	502553.47	.094664	.004764	.099429
6.250	502554.11	.094109	.004424	.098533
6.500	502554.79	.092819	.004282	.097101
6.750	502551.68	.091538	.004166	.095704
7.000	502552.70	.089740	.004258	.093997
7.250	502561.56	.086607	.005021	.091629
7.500	502555.96	.084166	.005268	.089434
7.750	502549.28	.082401	.005227	.087628
8.000	502538.83	.081565	.004973	.086538
8.250	502528.88	.081415	.004678	.086092
8.500	502527.11	.081062	.004420	.085482
8.750	502532.89	.079902	.004321	.084224
9.000	502518.69	.079738	.004087	.083825
9.250	502511.67	.079817	.003870	.083687
9.500	502506.97	.079923	.003670	.083594

ATTACHMENT 3.3C

INTEGRATED LEAKAGE RATE TEST

FROM 1930 HOURS ON MARCH 26, 1986 TO 0500 HOURS ON MARCH 27, 1986

ABSOLUTE TEST METHOD, TOTAL TIME ANALYSIS

Time (hr)	Mass (lbm)	Meas. Leakage (pct/day)	Mean of Meas. Leakage (pct/day)	Calc. Leakage (pct/day)	Confidence (pct/day)	UCL (pct/day)
0.000	502675.45	0.000000	0.000000	0.000000	0.000000	0.00000
.250	502666.99	.161613	0.000000	0.000000	0.000000	0.00000
.500	502662.33	.125268	0.000000	0.000000	0.000000	0.00000
.750	502659.43	.101972	0.000000	.099797	.051600	.15139
1.000	502663.75	.055876	0.000000	.060106	.033316	.09342
1.250	502645.62	.113949	0.000000	.078792	.126159	.20495
1.500	502643.80	.100762	0.000000	.082456	.104960	.18741
1.750	502629.18	.126248	0.000000	.096906	.102131	.19903
2.000	502629.81	.108959	0.000000	.098946	.088976	.18792
2.250	502626.89	.103047	0.000000	.098205	.078919	.17712
2.500	502634.78	.077666	0.000000	.089040	.072446	.16148
2.750	502618.75	.098445	0.000000	.089230	.067064	.15629
3.000	502619.04	.089784	0.000000	.086928	.062196	.14912
3.250	502616.86	.086077	0.000000	.084272	.058161	.14243
3.500	502609.76	.089617	0.000000	.083226	.055002	.13822
3.750	502606.61	.087650	0.000000	.082011	.052260	.13427
4.000	502602.51	.087067	0.000000	.080981	.049919	.13090
4.250	502591.34	.094488	0.000000	.081814	.048474	.13028
4.500	502583.20	.097879	0.000000	.083245	.047441	.13068
4.750	502576.76	.099200	0.000000	.084731	.046501	.13123
5.000	502567.82	.102774	.095635	.086674	.045852	.13252
5.250	502568.00	.097719	.100289	.087444	.044700	.13214
5.500	502563.36	.097307	.097226	.088054	.043585	.13163
5.750	502563.06	.093321	.095705	.087949	.042378	.13032

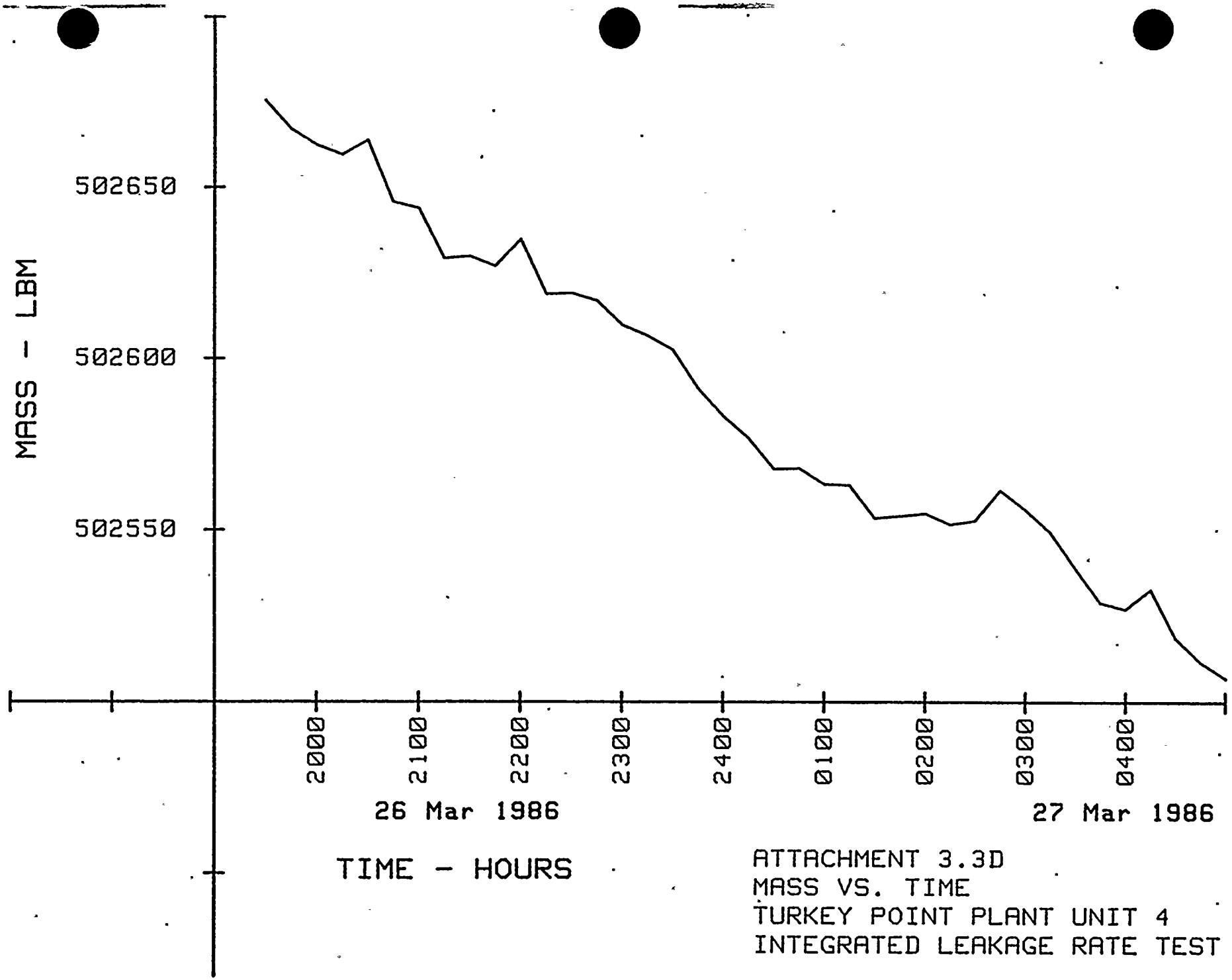
ATTACHMENT 3.3C (Continued)

INTEGRATED LEAKAGE RATE TEST

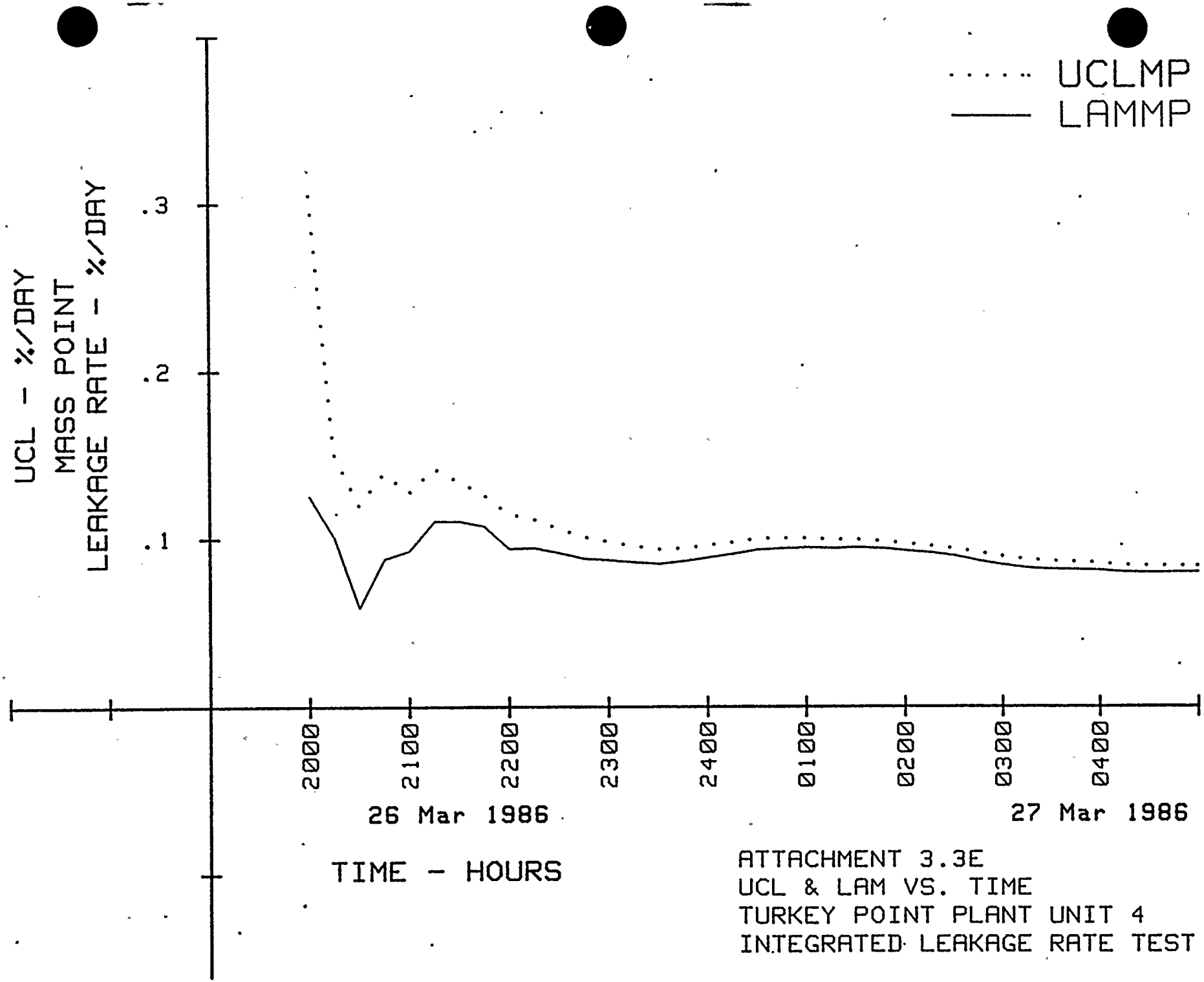
FROM 1930 HOURS ON MARCH 26, 1986 TO 0500 HOURS ON MARCH 27, 1986

ABSOLUTE TEST METHOD, TOTAL TIME ANALYSIS

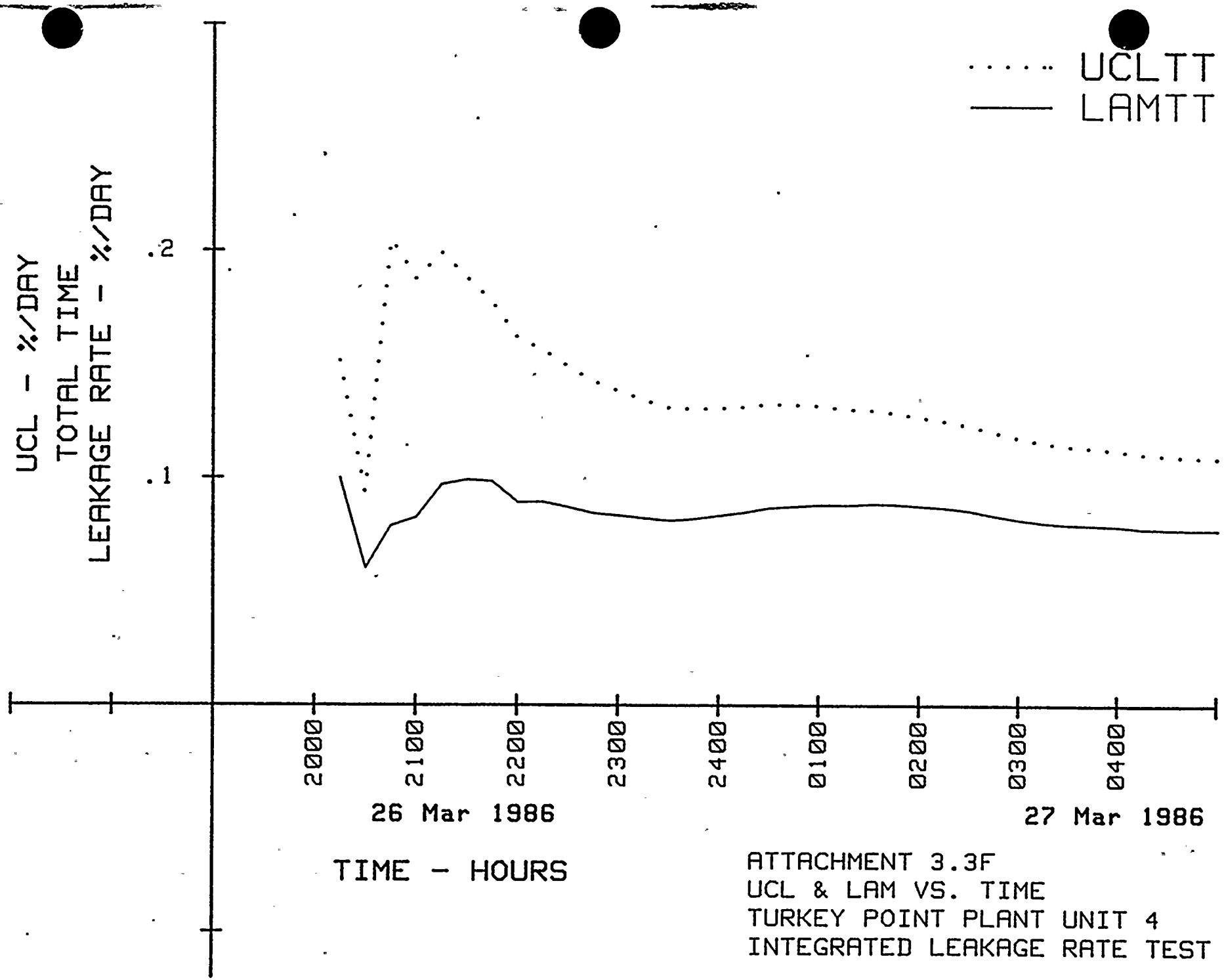
Time (hr)	Mass (lbm)	Meas. Leakage (pct/day)	Mean of Meas. Leakage (pct/day)	Calc. Leakage (pct/day)	Confidence (pct/day)	UCL (pct/day)
6.000	502553.47	.097070	.095472	.088465	.041417	.12988
6.250	502554.11	.092699	.097225	.008270	.040364	.12863
6.500	502554.79	.088632	.096020	.087526	.039333	.12685
6.750	502551.68	.087549	.095390	.086737	.038374	.12511
7.000	502552.70	.083727	.093366	.085539	.037487	.12302
7.250	502561.56	.075006	.091749	.083352	.036841	.12019
7.500	502555.96	.076069	.090464	.081559	.036131	.11769
7.750	502549.28	.077729	.090467	.080179	.035402	.11558
8.000	502538.83	.081539	.089662	.079414	.034712	.11412
8.250	502528.88	.084823	.089426	.079122	.034130	.11325
8.500	502527.11	.083323	.089295	.078703	.033552	.11225
8.750	502532.89	.077789	.088731	.077732	.032955	.11068
9.000	502518.69	.083163	.088518	.077437	.032464	.10990
9.250	502511.67	.084538	.088397	.077323	.032042	.10936
9.500	502506.97	.084673	.087930	.077245	.031647	.10889



ATTACHMENT 3.3D
MASS VS. TIME
TURKEY POINT PLANT UNIT 4
INTEGRATED LEAKAGE RATE TEST



ATTACHMENT 3.3E
UCL & LAM VS. TIME
TURKEY POINT PLANT UNIT 4
INTEGRATED LEAKAGE RATE TEST



ATTACHMENT 3.3F
UCL & LAM VS. TIME
TURKEY POINT PLANT UNIT 4
INTEGRATED LEAKAGE RATE TEST

ATTACHMENT 3.3G

SUPERIMPOSED LEAKAGE VERIFICATION TEST

FROM 0630 TO 1115 HOURS ON MARCH 27, 1986

REDUCED INPUT VARIABLES

Time (hr)	Abs. Pressure (psia)	Vap. Pressure (psia)	Temp. (deg R)	Rel. Humidity (pct)	Mass (lbm)
0.000	65.835	.4303	544.64	72.313	502412.458
.250	65.831	.4300	544.62	72.314	502403.787
.500	65.826	.4297	544.59	72.312	502389.856
.750	65.822	.4295	544.57	72.338	502378.923
1.000	65.817	.4294	544.55	72.355	502358.479
1.250	65.812	.4292	544.54	72.369	502339.129
1.500	65.809	.4290	544.52	72.371	502334.462
1.750	65.803	.4290	544.51	72.387	502298.584
2.000	65.798	.4286	544.49	72.391	502281.909
2.250	65.794	.4286	544.47	72.421	502264.392
2.500	65.789	.4284	544.45	72.422	502244.555
2.750	65.785	.4282	544.43	72.429	502232.782
3.000	65.781	.4281	544.42	72.430	502212.780
3.250	65.776	.4280	544.40	72.469	502193.781
3.500	65.772	.4278	544.39	72.475	502179.505
3.750	65.768	.4276	544.37	72.492	502165.831
4.000	65.763	.4273	544.36	72.467	502143.262
4.250	65.759	.4272	544.34	72.484	502127.174
4.500	65.755	.4271	544.33	72.510	502110.399
4.750	65.751	.4270	544.31	72.521	502091.440

ATTACHMENT 3.3G (Continued)

SUPERIMPOSED LEAKAGE VERIFICATION TEST

FROM 0630 TO 1150 HOURS ON MARCH 27, 1986

ABSOLUTE TEST METHOD, MASS POINT ANALYSIS

Time (hr)	Mass (lbm)	Leakage (pct/day)	95 Pct. Conf. (pct/day)	UCL (pct/day)
0.000	502412.46	0.000000	0.000000	0.000000
.250	502403.79	0.000000	0.000000	0.000000
.500	502389.86	.215946	.248265	.464210
.750	502378.92	.218854	.038499	.257353
1.000	502358.48	.253794	.050720	.304513
1.250	502339.13	.280338	.044399	.324737
1.500	502334.46	.269337	.032317	.301654
1.750	502298.58	.299436	.040987	.340422
2.000	502281.91	.314760	.035202	.349963
2.250	502264.39	.323649	.029168	.352818
2.500	502244.55	.331016	.024738	.355754
2.750	502232.78	.331186	.020352	.351538
3.000	502212.78	.332970	.017144	.350113
3.250	502193.78	.334950	.014711	.349661
3.500	502179.50	.334682	.012662	.347345
3.750	502165.83	.332885	.011163	.344048
4.000	502143.26	.333579	.009824	.343403
4.250	502127.17	.334092	.008709	.342800
4.500	502110.40	.333808	.007752	.341561
4.750	502091.44	.334008	.006958	.340966

ATTACHMENT 3.3G (Continued)

SUPERIMPOSED LEAKAGE VERIFICATION TEST

FROM 0630 TO 1115 HOURS ON MARCH 27, 1986

ABSOLUTE TEST METHOD, TOTAL TIME ANALYSIS

Time (hr)	Mass (lbm)	Meas. Leakage (pct/day)	Mean of Meas. Leakage (pct/day)	Calc. Leakage (pct/day)	Confidence (pct/day)	UCL (pct/day)
0.000	502412.46	0.000000	0.000000	0.000000	0.000000	0.00000
.250	502403.79	.165686	0.000000	0.000000	0.000000	0.00000
.500	502389.86	.215946	0.000000	0.000000	0.000000	0.00000
.750	502378.92	.213593	0.000000	.222362	.208078	.43044
1.000	502358.48	.257857	0.000000	.254395	.079509	.33390
1.250	502339.13	.280232	0.000000	.280864	.050156	.33101
1.500	502334.46	.248389	0.000000	.276758	.078880	.35563
1.750	502298.58	.310841	0.000000	.302541	.066412	.36895
2.000	502281.91	.311815	0.000000	.318218	.057829	.37604
2.250	502264.39	.314358	0.000000	.328790	.054584	.38337
2.500	502244.55	.320827	0.000000	.337683	.053037	.39072
2.750	502232.78	.312110	0.000000	.340717	.057072	.39778
3.000	502212.78	.317951	0.000000	.344212	.058509	.40272
3.250	502193.78	.321418	0.000000	.347411	.059273	.40668
3.500	502179.50	.317945	0.000000	.348647	.061187	.40983
3.750	502165.83	.314167	0.000000	.348415	.063604	.41201
4.000	502143.26	.321484	0.000000	.349652	.063849	.41350
4.250	502127.17	.322282	0.000000	.350610	.064010	.41462
4.500	502110.40	.320650	0.000000	.350872	.064453	.41532
4.750	502091.44	.322839	0.000000	.351351	.064473	.41582

SECTION 4

LOCAL LEAKAGE RATE TESTS (TYPES B AND C)

Section 4 summarizes the LLRT data which has been obtained from periodic testing performed since the May 1983 Type A ILRT. Pre-repair data are provided for surveillance testing performed in 1984 and 1986. These LLRT's were performed by pressurizing the listed penetrations with either air or nitrogen and measuring the leakage across the containment isolation valves (Type C) or resilient seals (Type B). Each penetration's leakage rate can be obtained from site reference material.

If the pre-repair and post-repair leakages are the same then no repair was performed. Also, it should be noted that certain penetrations had multiple LLRT's performed as indicated in Attachments 4A and 4B.

The acceptance criteria for Types B and C testing are in accordance with 10CFR50, Appendix J. The combined "as-left" leakage rate for all penetrations and valves subject to Type B and C tests in 1984 and 1986 were well below the acceptance criteria of less than 0.60 La.

The data contained in this section are summarized below:

Attachment	Title
4A	1986 Local Leakage Rate Test Data
4B	1984 Local Leakage Rate Test Data
4C	1986 Local Leakage Rate Test Summary Analysis

ATTACHMENT 4A

1986 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
5 PRT to Gas Analyzer	C	CV-516 (OSC) SV-6385 (OSC)	<25 <25	<25 <25	
6 Nitrogen to PRT	C	CK-518 (ISC) CK-519 (ISC)	70,000 540	170 540	CK-518 - Cleaned and lapped seat.
7 PW to PRT and RCP Standpipes	C	CV-519A (OSC) CV-519B (ISC) CV-522A (ISC) CV-522B (ISC) CV-522C (ISC)	<25 Combination	<25 Combination	
			<30 Combination	<30 Combination	Pen. 7 - Replaced valve diaphragms.
			<30 Combination	<30 Combination	Pen. 7 - Replaced valve diaphragms.
8 PRZ Steam Samples	C	CV-951 (ISC) CV-956A (OSC)	450 <30	450 <30	CV-956A - Cleaned and lapped.
9 PRZ Liquid Samples	C	CV-953 (ISC) CV-956B (OSC)	33,500 <20	<30 <20	CV-953 - Cleaned and lapped seat.

ATTACHMENT 4A (Continued)

1986 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
10 RCDT and PRT Vent and Nitrogen to RCDT	C	CV-4658B (OSC)	<30	<30	
		PCV-3-1014 (OSC)	875	875	
		CV-4658A (OSC)	Combination	Combination	
11 Alternate Low Head SI to Loops	C	MOV-872 (OSC)	40	40	
14 Letdown to Nonregenerative Heat Exchanger	C	CV-200A (ISC)	<30	<30	
		CV-200B (ISC)	Combination	Combination	
		CV-200C (ISC)			
		CV-204 (OSC)	50	50	
15 Charging to Regenerative Heat Exchanger	C	CK-312C (ISC)	<30	<30	
		HCV-121 (OSC)	<30	<30	
		V-333 (OSC)	Combination	Combination	
16 PACVS, Hydrogen Removal	C	HV-3-2 (OSC)	<30	<30	
		HV-3-1 (OSC)	Combination	Combination	
		PAHM-002A (OSC)			
17 SI Test Line	C	V-895V (OSC)	<30	<30	
19A Containment Spray A	C	CK-890A (OSC)	<30	<30	
			8,750		CK-890A - Inspected valve internals.
			2,800	1,400	CK-890A - Cleaned and lapped seat.

ATTACHMENT 4A (Continued)

1986 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
		MOV-880A (OSC)	<30	<30	
19B Containment Spray B	C	CK-890B (OSC)	300	300	
			1,500	600	CK-890B - Inspected valve internals and cleaned and lapped seat.
		MOV-880B (OSC)	<30	<30	
20 A and B Hot Leg Sample	C	SV-6427A (ISC)	<30	<30	
		SV-6427B (ISC)	550	550	
		SV-6428 (OSC)	<30	<30	
23 Containment Sump to WHT	C	CV-2822 (OSC)	150	150	
		CV-2821 (OSC)	400	400	
24A Seal Water Injection to A RCP	C	CK-298A (ISC)	800	800	
24B Seal Water Injection to B RCP	C	CK-298B (ISC)	<30	<30	
24C Seal Water Injection to C RCP	C	CK-298C (ISC)	300	300	
25 RCP Seal Water Return	C	MOV-381 (OSC)	<30	<30	
		MOV-6386 (ISC)	1,600	1,000	MOV-6386 - Adjusted limit switch.

ATTACHMENT 4A (Continued)

1986 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
29 Instrument Air Supply	C	CK-336 (ISC) CK-340A (ISC)	400 750	400 750	
30 Breathing Air	C	CK-201 (ISC) CV-6165 (OSC)	<30 800	<30 800	
31 RCDT to Gas Analyzer	C	CV-4659B (OSC) CV-4659A (OSC)	<30 Combination	<30 Combination	
32 Containment Air Sample Return	C	CK-11-003 (ISC)	47,500	700	CK-11-003 - Cleaned and lapped seat.
		SV-2912 (OSC) PAHM-001A, B (OSC)	650 Combination	650 Combination	
33 Containment Air Sample	C	SV-2913 (OSC) SV-2911 (OS)	<30 <30	<30 <30	
34 Service Air	C	CK-205 (ISC) V-204 (OSC) HV-17 (OSC)	145,000 600 Combination	600 600 Combination	CK-205 - Cleaned and lapped seat.
35 Containment Purge Inlet	C	PV-2600 (OSC) PV-2601 (ISC)	23,000 Combination	1,500 Combination	PV-2600, 2601 - Adjusted seats.
			170,000 Combination	1,800 Combination	PV-2600, 2601 - Adjusted seats.

ATTACHMENT 4A (Continued)

1986 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
36 Containment Purge Outlet	C	PV-2602 (OSC) PV-2603 (ISC)	>190,000 Combination	700 Combination	PV-2603 - Adjusted seat.
			150,000 Combination	550 Combination	PV-2603 - Adjusted seat.
37 Spare	C	Cap 10-879	<30 <30	<30 <30	
38 Electrical Cannisters	B	Cannisters	350	350	Pen. 38 - The repair value is the total of all electrical penetrations.
39 Fuel Transfer Tube Flange	B	O-Ring and Body	120	120	
40 Equipment Access Hatch	B	O-Ring and Body	<30	<30	
41 Personnel Air Lock	B	O-Ring and Body	4,500	4,500	
42 Nitrogen to Accumulators	C	ST-CK-945E (ISC)	1,600 3,600	1,600 1,900	CK-945E - Cleaned and lapped seat.
		CV-855 (OSC)	600	600	
47 Primary Water Supply to Wash Header	C	CK-10-567 (OSC) V-582 (ISC)	170,000 Combination		CK-567 - Cleaned and lapped seat.

ATTACHMENT 4A (Continued)

1986 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
			180,000 Combination	2,200 Combination	CK-567 - Cleaned and lapped seat.
49 Emergency Air Lock	C	O-Ring and Body	720	720	
51 PACVS	C	HV-4-3,4 (OSC) PAHM-4-002B (OSC)	<30 Combination	<30 Combination	
52 RCDT Pump Discharge	C	CV-4668B (OSC) CV-4668A (OSC)	<30 Combination	<30 Combination	
54A Containment Recir. Sump to RHR Pump A	C	MOV-861A (OSC) MOV-860A (OSC)	<30 Combination	<30 Combination	
54B Containment Recir. Sump to RHR Pump B	C	MOV-861B (OSC) MOV-860B (OSC)	100 Combination	100 Combination	
55 Accumulator Sampling	C	CV-955C (ISC) CV-955D (ISC)	<30 11,000	<30 120	CV-955D - Cleaned and lapped seat.
		CV-955E (ISC) CV-956D (OSC)	40 15,500	40 <30	CV-956D - Cleaned and lapped seat.
				<30	CV-956D - Replaced valve internals.

ATTACHMENT 4A (Continued)

1986 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
56 Spare	C	Cap	<30	<30	
61A Spare	C	V-2027 (OSC)	<30	<30	
61B Deadweight Tester to PT	C	V-2023 (ISC) V-2024 (OSC)	<30 <30	<30 <30	
63 Instrument Air Blead	C	CV-2819 (ISC) CV-2826 (OSC)	150 700	150 700	
65A Containment Air Test Air In-Out	B	Flange 'E' (OSC) (ISC)	1,600 Combination	<30 Combination	Pen. 65A - Tightened outbd. flange.
65B Containment Air Test Pressure	B, C	V-2025 (OSC) Flange (ISC)	<30 Combination	<30 Combination	
65C Containment Air Test Leakage Flow	B, C	V-2026 (OSC) Flange (ISC)	<30 Combination	<30 Combination	

ATTACHMENT 4B

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
5 PRT to Gas Analyzer	C	CV-516 (OSC)	<30	<30	
		SV-6385 (OSC)	<30	<30	
6 Nitrogen to PRT	C	CK-518 (ISC)	1,250	1,400	CK-518 - Cleaned and lapped seat.
		CK-519 (ISC)	3,000	750	CK-519 - Cleaned and lapped seat.
7 PW to PRT and RCP Standpipes	C	CV-519A (OSC) CV-519B (ISC) CV-522A (ISC) CV-522B (ISC) CV-522C (ISC)	<30 Combination	<30 Combination	
8 PRZ Steam Samples	C	CV-951 (ISC)	<30 48,000	<30 450	CV-951 - Retest performed after hydro, cleaned and lapped seat.
		CV-956A (OSC)	400 18,000	240 250 3,600	CV-956A - Cleaned and lapped seat. Tubing modification on containment boundary.
9 PRZ Liquid Samples	C	CV-953 (ISC)	170	170 300	CV-953 - Retest performed after hydro.

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
		CV-956B (OSC)	50	50	
				<30	CV-956B - Retest performed after hydro.
10 RCDT and PRT Vent and Nitrogen to RCDT	C	CV-4658B (OSC)	<30	<30	
		PCV-3-1014 (OSC)	30,000	<20	CV-4658A - Cleaned and lapped seat.
		CV-4658A (OSC)	Combination	Combination	
11 Alternate Low Head SI to Loops	C	MOV-872 (OSC)	>52,000	<30	MOV-872 - Cleaned and lapped seat.
				1,900	MOV-872 - Greased valve operator.
14 Letdown to Nonregenerative Heat Exchanger	C	CV-200A (ISC)	700	700	
		CV-200B (ISC)	Combination	Combination	
		CV-200C (ISC)			
		CV-204 (OSC)	<30	<30	
15 Charging to Regenerative Heat Exchanger	C	CK-312C (ISC)	<30	<30	
		HCV-121 (OSC)	220	220	
		V-333 (OSC)	Combination	Combination	
16 PACVS, Hydrogen Removal	C	HV-3-2 (OSC)	<30	<30	
		HV-3-1 (OSC)	Combination	Combination	
		PAHM-002A (OSC)			
17 SI Test Line	C	V-895V (OSC)	<30	<30	

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
19A Containment Spray A	C	CK-890A (OSC)	80	1,400	CK-890A - Inspected valve internals.
		MOV-880A (OSC)	<30	90	MOV-880A - Greased valve operator.
19B Containment Spray B	C	CK-890B (OSC)	<30	350	CK-890B - Inspected valve internals.
		MOV-880B (OSC)	<30	100	MOV-880B - Greased valve operator.
20 A and B Hot Leg Sample	C	SV-6427A (ISC)	<30	400	SV-6427A - Retest performed after hydro.
		SV-6427B (ISC)	150	<30	SV-6427B - Retest performed after hydro.
		SV-6428 (OSC)	<30	50	SV-6428 - Retest performed after hydro.
23 Containment Sump to WHT	C	CV-2822 (OSC)	>52,000	800	CV-2822 - Cleaned and lapped seat.
		CV-2821 (OSC)	<30	<30	

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
24A Seal Water Injection to A RCP	C	CK-298A (ISC)	<30	<30	
24B Seal Water Injection to B RCP	C	CK-298B (ISC)	<30	<30	
24C Seal Water Injection to C RCP	C	CK-298C (ISC)	<30	<30	
25 RCP Seal Water Return	C	MOV-381 (OSC) MOV-6386 (ISC)	1,150 <30	1,150 <30	
29 Instrument Air Supply	C	CK-336 (ISC) CK-340A (ISC)	950 950	950 950	
30 Breathing Air	C	CK-201 (ISC) CV-6165 (OSC)	<30 <30	<30 <30	
31 RCDT to Gas Analyzer	C	CV-4659B (OSC) CV-4659A (OSC)	<30 Combination	<30 Combination	
32 Containment Air Sample Return	C	CK-11 -003 (ISC)	40,000	1,000	CK-11-003 - Cleaned and lapped seat.
		SV-2912 (OSC) PAHM-001A, B (OSC)	100 Combination	100 Combination	

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
33 Containment Air Sample	C	SV-2913 (OSC) SV-2911 (OSC)	100 275	100 275	
34 Service Air	C	CK-205 (ISC)	11,000	850	CK-205 - Cleaned and lapped seat.
		V-204 (OSC) HV-17 (OSC)	150 Combination	<30 Combination	
35 Containment Purge Inlet	C	PV-2600 (OSC) PV-2601 (ISC)	>52,000 Combination		PV-2600 & 2601 - Adjusted seats.
				3,000 Combination	PV-2600 & 2601 - Replaced seals and seats.
			>52,000 Combination		PV-2600 & 2601 - Adjusted seats.
				9,000 Combination	PV-2600 & 2601 - Retest only.
				13,500 Combination	PV-2600 & 2601 - Retest only.

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
				12,500 Combination	PV-2600 & 2601 - Retest only.
				14,200 Combination	PV-2600 & 2601 - Retest only.
				12,000 Combination	PV-2600 & 2601 - Retest only.
				29,000 Combination	PV-2600 & 2601 - Retest only.
				10,000 Combination	
36 Containment Purge Outlet	C	PV-2602 (OSC) PV-2603 (ISC)	>52,000 Combination		PV-2602 & 2603 - Adjusted seats.
				700 Combination	PV-2602 & 2603 - Retest only.
			24,000 Combination		PV-2602 & 2603 - Adjusted seats.
				350 Combination	PV-2602 & 2603 - Retest only.

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
				200 Combination	PV-2602 & 2603 - Retest only.
				1,500 Combination	PV-2602 & 2603 - Retest only.
				1,400 Combination	PV-2602 & 2603 - Retest only.
				500 Combination	PV-2602 & 2603 - Retest only.
				3,500 Combination	PV-2602 & 2603 - Retest only.
				500 Combination	
37 Spare	C	Cap V-10-879	<30 <30	<30 <30	
38 Electrical Cannisters	B	Cannisters	<330	<330	Penetration 38 - Total of all electrical penetrations.
39 Fuel Transfer Tube Flange	B	O-Ring and Body	450	450	

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
40 Equipment Access Hatch	B	O-Ring and Body	< 30	< 30	
				< 30	
				< 30	
				< 30	
				< 30	
41 Personnel Air Lock	B	O-Ring and Body	5,900	5,900	
			3,500	8,700	Personnel Airlock - Repaired reach rods.
			4,600	4,600	
			3,000	3,000	
			6,800	2,500	Personnel Airlock - Repaired reach rods.
42 Nitrogen to Accumulators	C	ST-CK-945E (ISC)	4,400		CK-945E - Cleaned and lapped seat.
			35,000		CK-945E - Cleaned and lapped seat.
			4,200		CK-945E - Cleaned and lapped seat.
			5,000	500	CK-945E - Replaced valve.
		CV-855 (OSC)	600	600	
				400	CV-855 - Retest performed after hydro.

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
47 Primary Water Supply Wash Header	C	CK-10-567 (OSC) V-582 (ISC)	2,000 Combination	240 Combination	CK-10-567 - Cleaned and lapped seat.
49 Emergency Air Lock	B	O-Ring and Body	400 750	400 750	
51 PACV's	C	HV-4-3,4 (OSC) PAHM-4-002B (OSC)	<30 Combination	<30 Combination	
52 RCDT Pump Discharge	C	CV-4668B (OSC)	<20 Combination	<20 Combination	
		CV-4668A (OSC)	<20 Combination	<20 Combination	CV-4668A & B - Retest performed after hydro.
54A Containment Recirc. Sump to RHR Pump A	C	MOV-861A (OSC) MOV-860A (OSC)	40 Combination	40 Combination	
			<30 Combination	<30 Combination	MOV-860A & 861A - Greased valve operator.
54B Containment Recirc. Sump to RHR Pump B	C	MOV-861B (OSC)	2,200 Combination	2,200 Combination	
		MOV-860B (OSC)	130 Combination	130 Combination	MOV-860B & 861B - Greased valve operator.
55 Accumulator Sampling	C	CV-955C (ISC)	50 <30	50 <30	CV-955C - Retest performed after hydro.

ATTACHMENT 4B (Continued)

1984 LOCAL LEAKAGE RATE TEST DATA

Penetration No.	Type Test	Equipment/Valves Tested	Pre-Repair Leakage (cc/min)	Post-Repair Leakage (cc/min)	Repair/Notes
		CV-955D (ISC)	<30	<30	
			<30	<30	CV-955D - Retest performed after hydro.
		CV-955E (ISC)	<30	<30	
			<30	<30	CV-955E - Retest performed after hydro.
		CV-956D (OSC)	<30	<30	
			<30	<30	CV-956D - Retest performed after hydro.
61B Deadweight Tester to PT	C	V-2023 (ISC) V-2024 (OSC)	<30 <30	<30 <30	
63 Instrument Air Bleed	C	CV-2819 (ISC) CV-2826 (OSC)	300 950	300 950	
65A Containment Air Test Air In-Out	B	Flange 'E' (OSC) (ISC)	5,000 Combination	130 Combination	Pen. 65A - Tightened outbd. flange.
65B Containment Air Test Pressure	B, C	V-2025 (OSC) Flange (ISC)	<30 Combination	<30 Combination	
65C Containment Air Test Leakage Flow	B, C	V-2026 (OSC) Flange (ISC)	<30 Combination	<30 Combination	

ATTACHMENT 4C

1986 LLRT SUMMARY ANALYSIS

The pre-repair LLRT, the repair, and the post-repair LLRT for each boundary, or penetration, was reviewed. The net leakage contribution for each penetration was determined using the following criteria:

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

2. The leakage equivalent is the difference between the pre-repair and the post-repair LLRT results.

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

4. The leakage equivalent assessed to a penetration may be reduced due to the safety related service of the system associated with the penetration(s). Justification for this reduction will be provided with the analysis.

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

6. If the "As-Left" leakage of a repaired valve is lower than the "As-Left" leakage of a valve that didn't require a repair, then the penetration net equivalent leakage is the difference between the "As-Left" leakages.

7. For series valves tested together, the penetration net equivalent leakage is half the total leakage when both valves are repaired at the same time (prior to performing another test).

8. When the summation of the leakage equivalent and the leakage measured during a successful Type A test is greater than 0.75 L_a the penetration(s) with excessive leakage(s) shall be analyzed under a corrective action program.

ATTACHMENT (Continued)

1986 LLRT SUMMARY ANALYSIS

Pen. No.	Valve	Loc.	"As-Found" (ccm).	"As-Left" (ccm)	Pen. Net	Remarks
5 - PRT to	CV-516	OSC	< 25	< 25	0	
Gas Analyzer	SV-6385	OSC	< 25	< 25		
6 - Nitrogen to PRT	CK-518	ISC	70,000	170	370	
RCP Standpipes	CK-519	ISC	540	540		
7 - PW to PRT and	CV-519A,B	OSC/ISC	< 25	< 30	0	Combination
RCP Standpipes	CV-522A,B,C	ISC				
8 - PRZ Steam	CV-951	ISC	450	450	0	
Samples	CV-956A	OSC	< 30	< 30		
9 - PRZ Liquid	CV-953	ISC	33,500	< 30	0	
Samples	CV-956B	OSC	< 20	< 20		
10 - RCDT and PRT	PCV-3-1014	OSC	875	875	0	Combination
Vent and Nitrogen	CV-4658A	OSC				
to RCDT	CV-4658B	OSC	< 30	< 30		
11 - Alternate Low	MOV-872	OSC	40	40	0	
Head SI to Loops						
14 - Letdown to	CV200A,B,C	ISC	< 30	< 30	0	Combination
Nonregenerative	CV204	OSC	50	50		
Heat Exchanger						
15 - Charging to	CK-312C	ISC	< 30	< 30	0	
Regenerative	V-333, HCV-121	OSC	< 30	< 30		Combination
Heat Exchanger						
16 - PACV's, Hydrogen	HV-3-1,2	OSC	< 30	< 30	0	Combination
Removal	PAHM-002A	OSC				
17 - SI Test Line	V-895V	OSC	< 30	< 30	0	
19A - Containment	CK-890A	OSC	< 30	1,400	0	
Spray A	MOV-880A	OSC	< 30	< 30		
19B - Containment	CK-890B	OSC	300	600	0	
Spray B	MOV-880B	OSC	< 30	< 30		

ATTACHMENT (Continued)

1986 LLRT SUMMARY ANALYSIS

Pen. No.	Valve	Loc.	"As-Found" (ccm)	"As-Left" (ccm)	Pen. Net	Remarks
20 - A and B Hot Leg Sample	SV-6427A	ISC	<30	<30	0	
	SV-6427B	ISC	550	550		
	SV-6428	OSC	<30	<30		
23 - Containment Sump to WHT	CV-2821	OSC	400	400	0	
	CV-2822	OSC	150	150		
24A,B,C, - RCP Seal Inject.	CK-298A	ISC	800	800	0	
	CK-298B	ISC	<30	<30		
	CK-298C	ISC	300	300		
25 - RCP Seal Water Return	MOV-6386	ISC	1,600	1,000	0	
	MOV-381	OSC	<30	<30		
29 - Instrument Air Supply	ST-CK-340A	ISC	750	750	0	
	CK-336	ISC	400	400		
30 - Breathing Air	CK-201	ISC	<30	<30	0	
	CV-6165	OSC	800	800		
31 - RCDT to Gas Analyzer	CV-4659A,B	OSC	<30	<30	0	Combination
32 - Containment Air Sample Return	CK-11-003	ISC	47,500	700	0	
	SV-2912,	OSC				
	PAHM-001A,B	OSC	650	650		Combination
33 - Containment Air Sample	SV-2911	OSC	<30	<30	0	
	SV-2913	OSC	<30	<30		
34 - Service Air	CK-205	ISC	145,000	600	0	
	HV-17, V-204	OSC	600	600		Combination
35 - Containment Purge Inlet	PV-2601	ISC	23,000	1,800	10,600	See Note 1
	PV-2600	OSC				Combination
36 - Containment Purge Outlet	PV-2603	ISC	>190,000	550	0	See Note 2, Only re-worked PV-2603.
	PV-2602	OSC				Combination

ATTACHMENT (Continued)

1986 LLRT SUMMARY ANALYSIS

Pen. No.	Valve	Loc.	"As-Found" (ccm)	"As-Left" (ccm)	Pen. Net	Remarks
37 - Spare	CAP		<30	<30	0	
	10-879		<30	<30		
38 - Electrical Cannisters			350	350	0	
39 - Fuel Transfer Tube Flange			120	120	0	
40 - Equipment Hatch			30	30	0	
41 - Personnel Air Lock			4,500	4,500	0	
42 - Nitrogen to Accumulators	ST-CK-945E	ISC	1,600	1,900	0	
	CV-855	OSC	600	600		
47 - Primary Water Supply to Wash Header	CK-10-567	OSC	170,000	2,200	0	Only re-worked CK-10-567. Combination
	V-582	ISC				
49 - Emergency Air Lock	Annulus		720	720	0	
51 - PACV's	HV-4-3, HV-4-4	OSC	<30	<30	0	Combination
	PAHM-4-002B	OSC				
52 - RCDT Pump Discharge	CV-4668A,B	OSC	<30	<30	0	Combination
54A - Cont. Recirc. Sump to RHR Pump A	MOV-860A	OSC	<30	<30	0	Combination
	MOV-861A					
54B - Cont. Recirc. Sump to RHR Pump B	MOV-860B	OSC	100	100	0	Combination
	MOV-861B					
55 - Accumulator Sampling	CV-955C	ISC	<30	<30		
	CV-955D	ISC	11,000	120	10,880	
	CV-955E	ISC	40	40		
	CV-956D	OSC	15,500	<30		

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ATTACHMENT (Continued)

1986 LLRT SUMMARY ANALYSIS

Pen. No.	Valve	Loc.	"As-Found" (ccm)	"As-Left" (ccm)	Pen. Net	Remarks
56 - Spare	CAP		30	30	0	
61A - Spare	V-2027	OSC	30	30	0	
61B - Deadweight	V-2023	ISC	30	30	0	
Tester to PT	V-2024	OSC	30	30		
63 - Instrument Air	CV-2819	ISC	150	150	0	
Bleed	CV-2826	OSC	700	700		
65A - Containment Air	Flange	OSC	1,600	30	0	Only outbd. flange repaired.
Test Air In-Out		ISC				
65B - Containment Air	V-2025	OSC	30	30	0	Combination
Test Pressure	Flange	ISC				
65C - Containment Air	V-2026	OSC	30	30	0	Combination
Test Pressure	Flange	ISC				

NOTES:

1. Since both valves were reworked at the same time, one-half of the total leakage (As-Found minus As-Left) is conservatively assigned to this penetration. If piece-wise maintenance had been performed, as was done on Penetration 36, a smaller net equivalent leakage might have resulted.

2. Greater than represents the largest flowmeter used for the 1986 LLRT program. See Penetration 36.

CONCLUSION

The net equivalent leakage is 21,850 ccm, or 0.071860 percent/day.