REACTOR CONTAINMENT BUILDING INTEGRATED LEAKAGE RATE TEST

TYPES A, B, AND C PERIODIC TEST

IOWA ELECTRIC LIGHT AND POWER COMPANY
DUANE ARNOLD ENERGY CENTER

DOCKET No. 50-331
OPERATING LICENSE No. DPR-49

DECEMBER 1988

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REFERENCES

1. 10CFR Part 50 , Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, November 15, 1988.

2. STP No. 47A002, Primary Containment Leakage Rate Test, Duane Arnold Energy Center, Surveillance Test Procedure.

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, January 20, 1987.[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.

6. STP No. 47A003, Containment Leak Tightness Test - Type B Penetrations, Duane Arnold Energy Center, Surveillance Test Procedure.

7. STP No. 47A004, Airlock Local Leak Rate Test, Duane Arnold Energy Center, Surveillance Test Procedure.

8. STP No. 47A005, Containment Isolation Valve Leak Tightness Test - Type C Penetrations, Duane Arnold Energy Center, Surveillance Test Procedure.

[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 December 1988 Periodic Type A Primary Containment Integrated Leakage Rate Test (ILRT) and a summary of the Periodic Types B and C Local Leakage Rate Tests (LLRT) conducted since June 1987 at the Duane Arnold Energy Center (DAEC). DAEC is operated by the Iowa Electric Light and Power Company (IE). Specific plant information and technical data is contained in Attachment 1A.

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

ATTACHMENT 1A

TEST DATA SUMMARY

A. Plant Information

Operator	Iowa Electric Light and Power Company
Plant	Duane Arnold Energy Center
Location	Palo, Iowa
Containment Type	Mark I, BWR/4
Docket Number	50-331
Operating License No.	DPR-49
Date Test Completed	December 16, 1988

B. Technical Data

Containment Net Free Air Volume as Tested	205,360 cu. ft.
Drywell Free Air Volume	109,400 cu. ft.
Torus Free Air Volume	95,960 cu. ft.
Design Pressure	56 psig
Calculated Peak Accident Pressure	43 psig
Containment Design Temperature	281 °F
Containment ILRT Average Temperature Limits	40-100 °F

SECTION 2

SUMMARY

2.1 TYPE A TEST

2.1.1 Test Summary

Pressurization for the ILRT began at approximately 2025 hours on December 14, 1988. The air flow was adjusted for optimum compressor cycling and a pressurization rate of approximately 5.7 psi per hour was achieved. Extensive investigations of all penetration areas were conducted throughout the pressurization and the Type A test. Several minor leaks were detected and monitored but no significant leakage was found. At 0330 on December 15, 1988, the CRD pump stop check valves V-17-08 and V-17-10 were closed due to concerns with dropping Reactor Vessel water level.

Containment pressurization was secured at approximately 0403 hours on December 15, 1988. The pressurization piping system was isolated and vented.

At 0815 hours on December 15, 1988, the thermal stabilization criteria of Reference 2 was satisfied. Pressure, temperature and dew point data were continuously recorded throughout the pressurization at 20 minute intervals and throughout the remainder of the test period at 15 minute intervals.

The Type A test was successfully completed at 1615 hours on December 15, 1988 with a Total Time Upper Confidence Limit (UCL-TT) of 0.195644 percent/day and a Mass Point Upper Confidence Limit of 0.159811 percent/day. Both Total Time and Mass Point leakage rates were well below the $0.75L_a$ acceptance criteria.

The Superimposed Verification Test was started at 1800 hours on December 15, 1988 and was successfully completed at 2200 hours on December 15, 1988. The results of the verification test satisfied the requirements of Reference 2 (See Appendix G, page 3).

Shortly after the start of the superimposed verification test, the closure of the CRD pump stop check valves at 0330 on December 15, 1988 was re-evaluated. It was believed that the justification given for this action was subject to challenge. IE decided that an extra leakage rate test would be conducted after the completion of the superimposed leakage verification test to prove that closure of the CRD pump stop check valves did not adversely effect the test results. Conditions for the extra test included securing the superimposed flow and opening the CRD pump check valves. Criteria for the extra test were established prior to the completion of the superimposed leakage verification test. After the superimposed leakage verification test, the containment was allowed to stabilize for about one and a half hours. The extra test was started at 0030 on December 16, 1988 and successfully completed at 0230 on December 16, 1988. The calculated Total Time Leakage rate for the extra test was 0.126602 percent per day. This leakage rate was less than the leakage rate determined

from the Type A test, confirming that closure of the valves did not adversely impact the test.

Depressurization of the containment began at approximately 0430 on December 16, 1988 and was completed at 1100 on December 16, 1988.

2.2 LOCAL LEAKAGE RATE TESTS (Types B and C)

The Local Leakage Rate Tests (LLRT) of containment isolation valves and other containment penetrations were conducted as required by the methods described in the plant surveillance procedures, References 6, 7 and 8, for the Types B and C Tests.

Section 4 of this report summarizes the data for the LLRT conducted since the June 1987 Type A test in accordance with Appendix J, 10CFR50, Paragraph V.B. Also contained in Section 4 of this report is the 1988 LLRT Summary Analysis.

SECTION 3

TYPE A TEST

3.1 EDITED LOG OF EVENTS

This log was edited from information contained in the ILRT Coordinator's Official Type A Log of Events or from Reference 2.

December 14, 1988

0200 Drywell inspection successfully completed.

0445 In situ instrumentation checks complete. Two RTDs and one dewcel were outside of acceptable range.

2025 Commenced pressurizing containment. Pressurization rate is approximately 5.7 psi/hour.

2330 Commenced plant walkdown.

December 15, 1988

0330 Reactor Vessel level was dropping. Closed valves V-17-08 and V-17-10.

0403 Pressurization secured.

0815 Temperature stabilization criteria satisfied. The 0815 data point is the first test data point.

1410 Leak survey revealed two valves V-30-289 and V-30-290 which were open but capped. The caps should have been removed. ILRT results will be adjusted for the penetration 21 Type C leakage rate.

1615 ILRT successfully completed.

1700 Started superimposed flow.

1800 Started superimposed test.

1900 Review of 0330 log entry on the closure of CRD pumps discharge stop check valve. The justification for closing these valves is subject to challenge.

2140 Near the completion of the superimposed test, it was decided to perform an extra test to determine the impact of closing the CRD pumps discharge isolation valves on the Type A leakage rate. The conditions for the extra test involved securing the superimposed leakage, opening the stop check valves, stabilizing for about an hour and then conducting a short leakage test. The criteria for the extra test was established and documented in the log.

2200 Superimposed verification test successfully completed.

2210 Secured verification flow.

2250 Opened valves V-17-08 and V-17-10.

December 16, 1988

0030 Declared start of the extra test to determine the leakage of V-17-08 and V-17-10.

0230 Completed the extra leakage rate test successfully.

0430 Initiated depressurization

1100 Depressurization completed.

3.2 GENERAL TEST DESCRIPTION

3.2.1 Prerequisites

In accordance with Reference 2, the following is a listing of the pertinent prerequisites and other procedural requirements completed and documented prior to containment pressurization:

a. Site meteorological data recorded during the performance of the ILRT (Attachment 3.2A)

b. All required test instrumentation installed and functionally verified within 6 months of the test.

c. Primary containment ventilation system secured.

d. Satisfactory inspection of the primary containment in accordance with Reference 2.

e. Pressurization system lined-up and ready for operation.

f. RCS temperature maintained stable prior to and during the performance of the ILRT.

g. Data acquisition and analysis computer systems used for the test are operational.

h. All required system valve lineups completed.

i. Drywell-to-torus vacuum breakers are blocked open.

j. Restricted plant access plan in effect.

k. An Official Type A Log of Events established and maintained by the ILRT Coordinator.

l. All pressurized components and systems either removed from the containment or vented.

m. Temperature survey satisfactorily performed.

n. All required Types B and C leakage rate testing completed or analyzed for impact on the test.

o. Verification flowmeter installed.

p. Instrument Selection Guide (ISG) calculated.

3.2.2 Equipmeut and Iustrumentatiou

Pressurization of the primary containment was achieved by utilizing a permanent system consisting of two station air compressors with integral aftercoolers. The system included adequate instrumentation and valving to maintain proper monitoring and control of the compressed air quality throughout the pressurization sequence. The capacity of the station air compressors is approximately 2,200 standard cubic feet per minute (SCFM). Air not required to maintain the service air header pressure was supplied to the primary containment through temporary hoses that connected the service air system to the Containment Atmosphere Control System.

The various containment parameters required to calculate containment leakage during the test, were monitored using instrumentation which consisted of 13 resistance temperature detectors, 5 dewpoint temperature sensors, and 3 absolute pressure indicators. Pertinent data for the test instrumentation is listed in Attachment 3.2B, and the general locations of the test instrumentation for both the drywell and the suppression chamber are shown in Attachments 3.2C and 3.2D. Elevations and azimuths are approximate.

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

Instrument Selection Guide (ISG)

Sensor Type	No. of Sensors	Sensitivity Error	System Error
Pressure	3	0.09 psi	0.00 psi
Temperature	13	1.00 °F	0.50 °F
Dewpoint Temp.- Drywell	3	5.00 °F	0.50 °F
- Torus	2	5.00 °F	0.50 °F

Test Duration	8 hrs.
Test Pressure	57.696 psia
Test Temperature	74 °F = 534 °R
Test Dewpoint Temp.	65 °F

$$ISG = \pm \frac{2400}{t}\left[2\left(\frac{EP}{P}\right)^2 + 2\left(\frac{ET}{T}\right)^2 + 2\left(\frac{EP}{P_v}\right)^2\right]^{1/2}$$

ISG $\leq$ 0.25 L_a which equals 0.5% per day since L_a = 2.0% per day

a. EP = error associated with absolute pressure instruments

EP = $0.09/\sqrt{3}$

EP = 0.051962

b. ET = error associated with temperature instruments

ET = 1.118034/ $\sqrt{13}$

ET = 0.310

c. EP_v = error associated with vapor pressure instruments

EP_v = 0.053516/ $\sqrt{5}$

EP_v = 0.023937

Using values established in a,b and c above, calculate ISG.

$$ISG = \pm \frac{2400}{24} \left[2\left(\frac{0.051961}{57.696}\right)^2 + 2\left(\frac{0.310}{534}\right)^2 + 2\left(\frac{0.023937}{57.696}\right)^2 \right]^{1/2}$$

ISG = ± 0.162532 which is less than 0.5%/day (25% of L_a)

3.2.3 Data Acquisition System

A programmable, multichannel data logger was used to scan the data from the 15 resistance temperature detectors and 6 dewpoint temperature sensor input signals. These signals were sent to microcomputers which also recorded the 3 pressure sensor readings. These microcomputers logged data every 15 seconds during the pressurization and throughout the test and provided printed output of the instantaneous data readings every 20 minutes during pressurization and every 15 minutes during the Leakage Rate, Verification and extra tests.

3.2.4 Data Resolution System

The recorded data was manually inputted to a dedicated computer system using Stone & Webster Engineering Corporation's (SWEC) ILRT analysis program for data reduction and leakage rate calculations. The computer program converted the Dewcel Element Temperatures to Dewpoint Temperatures using a polynomial curve fit derived from the Dewcel vendor's test data. The following calculations used the instantaneous values of the ILRT sensors to determine both the Mass Point and Total Time Analysis Method leakage rates.

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 dewpoint temperature observations made during the ILRT. The air mass is computed using the ideal gas law as follows:

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

where:

M = air mass, lbm
P = total pressure, psia
P_v = average vapor pressure, psia
R = 53.35 ft-lbf/lbm°R (for air)
T = average containment temperature, °R
V = containment free volume, 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:

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

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.

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 dewpoint temperature 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:

$$\text{Measured Leakage Rate} = 2400 \frac{(Mi-Mt)}{Mi(\Delta t)} \qquad \text{(Eq. 3)}$$

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:

$$\text{Calculated Leakage Rate} = At + B \qquad \text{(Eq. 4)}$$

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

A confidence interval is calculated using the requirements of Bechtel Topical Report BN-TOP-1, Rev. 1.

The sum of the calculated leakage rate and the confidence interval is the Upper Confidence Limit - Total Time (UCL-TT).

ATTACHMENT 3.2A

SITE METEOROLOGY

Date	Time	Ambient Temperature (Deg F)	Dewpoint Temperature (Deg F)	Barometric Pressure (In. Hg)	General Weather Conditions
December 14, 1988	2015	26.8	19.6	30.2	Good
	2115	24.4	17.4	30.2	Good
	2215	22.5	14.9	30.3	Good
	2315	20.8	9.5	30.3	Good
December 15, 1988	0015	18.5	6.9	30.3	Good
	0115	16.7	7.2	30.4	Good
	0215	15.4	4.8	30.4	Good
	0315	14.4	3.8	30.5	Good
	0415	13.3	3.4	30.5	Good
	0515	13.5	3.1	30.5	Good
	0615	13.5	2.7	30.5	Good
	0715	11.6	0.8	30.6	Good
	0815	10.2	-0.1	30.6	Good
	0915				Note 1
	1015				Note 1
	1115	10.9	-4.8	30.6	Good
	1215	11.4	-3.8	30.6	Good
	1315	12.6	-6.0	30.6	Good
	1415				Note 2
	1515	11.3	-5.5	30.6	Good
	1615	9.8	-6.4	30.7	Good
	1715	8.1	-5.7	30.7	-
	1815	6.9	-4.7	30.7	-
	1915	5.9	-5.4	30.7	-
	2015	4.7	-5.8	30.6	-
	2115	3.1	-5.8	30.6	-
	2215	0.6	-5.1	30.6	-
	2315	-0.5	-5.9	30.6	-
December 16, 1988	0015	-1.1	-5.9	30.6	-
	0115	-1.5	-6.7	30.5	-
	0215	-0.5	-5.7	30.5	-
	0230	-0.5	-4.8	30.5	-

Notes:

1. Computer was down.

2. No data available.

ATTACHMENT 3.2B

INSTRUMENTATION LIST

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

Instrument	Weight Fraction	Computer Point	Zone	Azimuth	Elevation	Range	Accuracy
A. Temperature							
T1	0.154	C0	6	270°	735	32-250°F	±0.5°F
T2	0.154	C1	6	0°	735	32-250°F	±0.5°F
T3**	0.000	C2	6	90°	735	32-250°F	±0.5°F
T4	0.154	C3	6	180°	735	32-250°F	±0.5°F
T5	0.047	C4	4	45°	749	32-150°F	±0.5°F
T6	0.047	C5	4	225°	750	32-150°F	±0.5°F
T7	0.053	C6	3	90°	764	32-150°F	±0.5°F
T8	0.053	C7	3	210°	763	32-150°F	±0.5°F
T9**	0.000	C8	2	20°	786	32-150°F	±0.5°F
T10	0.092	C9	2	150°	786	32-150°F	±0.5°F
T11	0.061	C13	1	345°	828	32-150°F	±0.5°F
T12	0.024	C10	5	Rx CL	750	32-150°F	±0.5°F
T13*	0.046	C14	2	290°	787	32-150°F	±0.5°F
T14*	0.061	C12	1	165°	828	32-150°F	±0.5°F
T15*	0.054	C11	3	315°	766	32-150°F	±0.5°F
B. Dewpoint Temperature							
M1**	0.000	C20	A	340°	809	32-150°F***	±5.0°F
M2	0.260	C21	A	160°	809	32-150°F***	±5.0°F
M3	0.139	C22	B	225°	750	32-150°F***	±5.0°F
M4	0.139	C23	B	45°	749	32-150°F***	±5.0°F
M5	0.231	C24	C	270°	735	32-150°F***	±5.0°F
M6*	0.231	C25	C	90°	735	32-150°F***	±5.0°F

ATTACHMENT 3.2B

INSTRUMENTATION LIST

Instrument	Weight Fraction	Computer Point	Zone	Azimuth	Elevation	Range	Accuracy
C. Pressure							
P1	0.500000	Local	Drywell	-	-	0-100psia	± 0.02% FS
P2	0.500000	Local	Torus	-	-	0-100psia	± 0.02% FS
P3	0.000000	Local	Drywell	-	-	0-100psia	± 0.02% FS
D. Superimposed Leakage Verification Test Flow Instrument							
Rotometer	-	Local	-	-	-	5-19scfm	±1.0%F.S.

Notes:

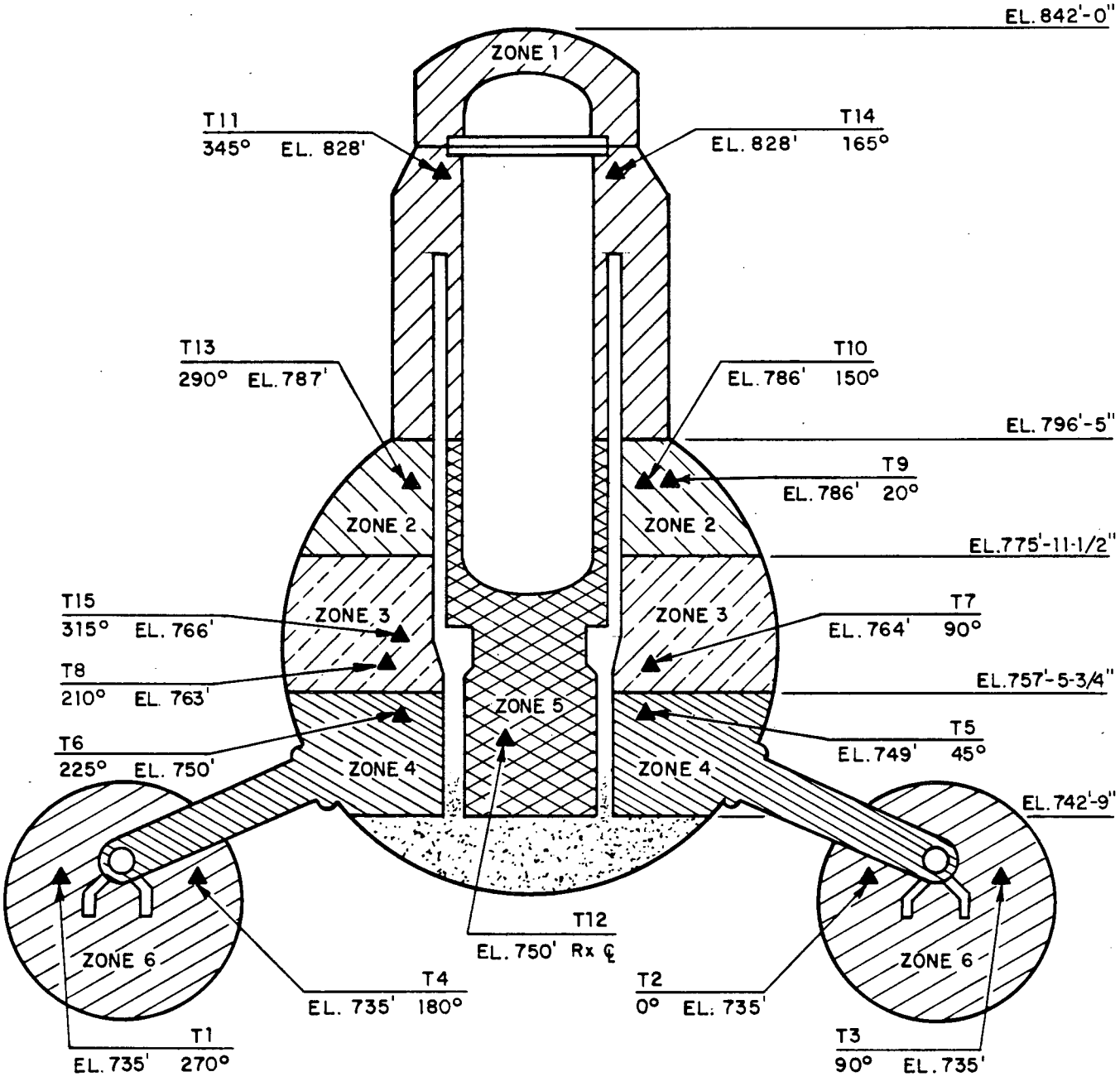
* Temporary RTD and/or Dewpoint Sensors.

** Instruments not used during the test because of in situ tests outside of acceptable range.

*** The Dewcel Element Temperatures (ET) were converted to Dewpoint Temperatures (DPT) by the following polynomial equation:

$$DPT = -1.5923290156E+1 + 3.2150392932E-1*ET + 2.7879779394E-3*ET^2 - 7.1099385788E-6*ET^3$$

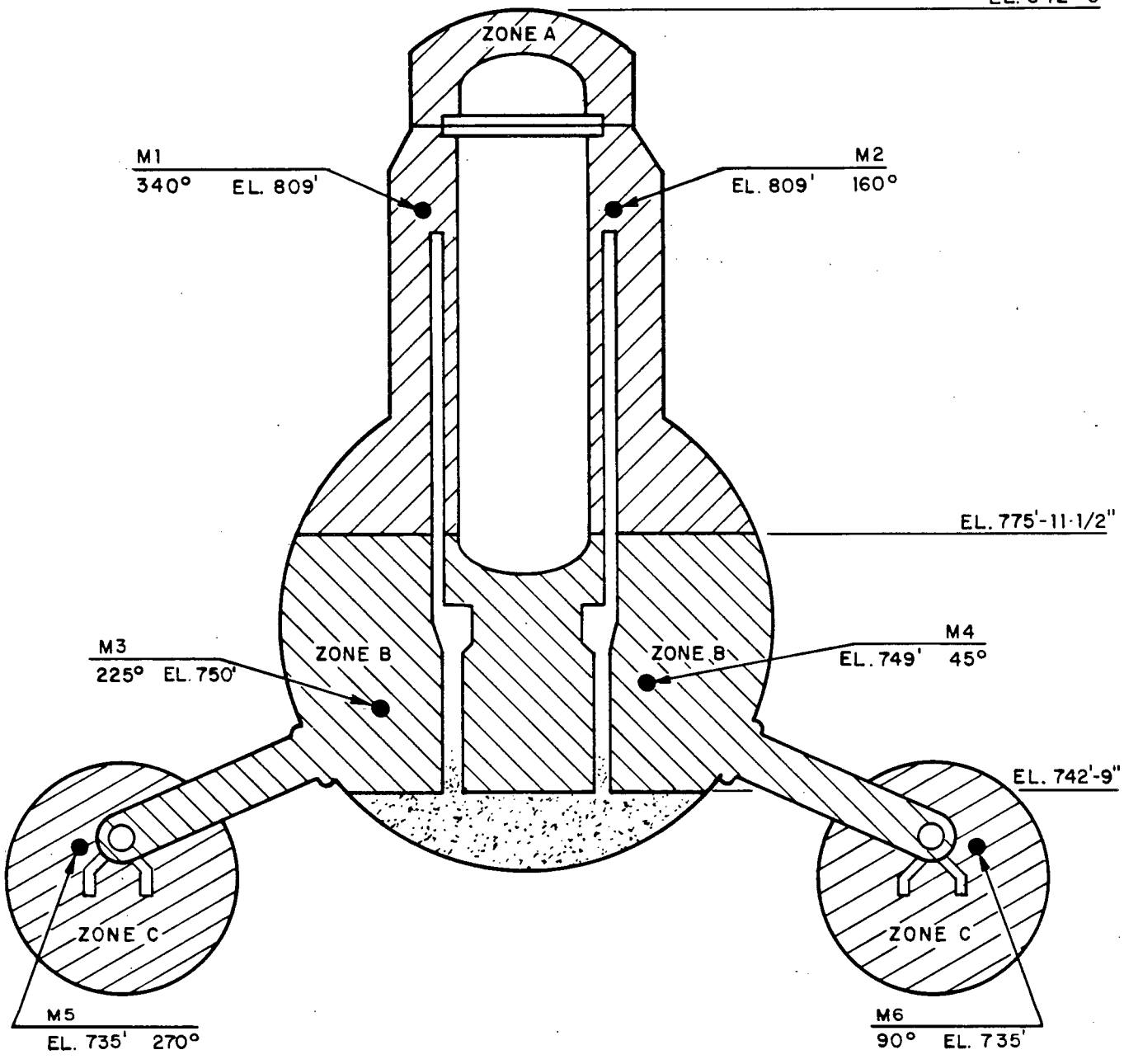
This equation is valid over the range of 51.2 to 83.7 °F Dewpoint Temperature (ET of 121 to 169 °F)



NOTES:

1. ZONE BOUNDARIES ARE APPROXIMATE, REFERENCE DAEC DWG. No. M-156
2. RTD ELEVATIONS AND AZIMUTH POSITIONS ARE APPROXIMATE

ATTACHMENT 3.2C
ILRT TEMPERATURE DETECTOR LOCATIONS
DUANE ARNOLD ENERGY CENTER



NOTES:

1. ZONE BOUNDARIES ARE APPROXIMATE, REFERENCE DAEC DWG. No. M-156
2. DEWPOINT TEMPERATURE SENSOR ELEVATIONS AND AZIMUTH POSITIONS ARE APPROXIMATE

ATTACHMENT 3.2D

ILRT DEWPOINT TEMPERATURE SENSOR LOCATIONS

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3.3 TEST RESULTS

3.3.1 Presentation of Test Results

The test data for the December 1988 ILRT is based on a 8 hour test period starting at 0815 hours on December 15, 1988. The final test results were determined using SWEC's ILRT computer program. The Measured Input Data, Reduced Input Variables, Mass Point Analysis Test Results, Total Time Analysis Test Results, and representative graphs are contained in Attachments 3.3A through 3.3K.

Both the Mass Point and Total Time Analysis Test Results for the ILRT satisfied the procedural acceptance criteria.

The Type A Test instrumentation was verified by the Superimposed Leakage Verification Test Method. The Measured Input Data, Reduced Input Variables, Mass Point Analysis Test Results, Total Time Analysis Test Results, and representative graphs are contained in Attachments 3.3L through 3.3S.

Both the Mass Point and Total Time Analysis Test Results for the Superimposed Leakage Verification Test satisfied the procedural acceptance criteria.

3.3.2 57.696 psia ILRT Results

The 57.696 psia ILRT was conducted in accordance with Reference 2. The results for the ILRT and for the Supplemental Test are shown below.

3.3.2.1 ILRT Results - Mass Point Analysis

	Item		(Percent/Day)
1.	L_{am}, Leakage Rate Calculated		0.155734
2.	UCL, Upper Confidence Level		0.004077
3.	UCL-MP, L_{am} Leakage Rate plus UCL (1&2)		0.159811
4.	Corrections for: (See Sections 3.3.2.4)		
	i. Type B & C Penalties	0.030150	
	ii. Water Levels	0.003108	
	iii. Total Corrections (i. and ii.)		0.033258
5.	Total Reported Type A Leakage Rate (Items 3&4 iii.)		0.193069

Results were within the acceptable limits of 0.75 L_a or 1.5 percent/day.

3.3.2.2 ILRT Results - Total Time Analysis

	Item		(Percent/Day)
1.	L_{am}, Leakage Rate Calculated		0.151511
2.	UCL, Upper Confidence Level		0.044132
3.	UCL-TT, L_{am} Leakage Rate plus UCL (1&2)		0.195644
4.	Corrections for: (See Section 3.3.2.4)		
	i. Type B & C Penalties	0.030150	
	ii. Water Levels	0.003108	
	iii. Total Corrections (i. and ii.)		0.033258
5.	Total Reported Type A Leakage Rate (Items 3&4 iii.)		0.228902

Results were within the acceptable limits of 0.75 L_a or 1.5 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 Reference 2. 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:

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

Where: L_{am} = Type A calculated leakage rate (computer)
(L_{am} - MP = 0.155734 %/day)
(L_{am} - TT = 0.151511 %/day)

L_o = Superimposed leakage rate (rotameter)
(L_o = 1.981938 %/day)

L_a = Maximum allowable leakage rate
(L_a = 2.0 %/day)

L_c = Composite leakage rate (computer)
(L_c - MP = 1.854681 %/day)
(L_o - TT = 1.845804 %/day)

a. Mass Point

$$(0.155734 + 1.981938 - 0.500) \leq 1.854681 \leq (0.155734 + 1.981938 + 0.500)$$

$$(1.637672) \leq 1.854681 \leq (2.637672)$$

b. Total Time

$$(0.151511 + 1.981938 - 0.500) \leq 1.845804 \leq (0.151511 + 1.981938 + 0.500)$$

$$(1.633449) \leq 1.845804 \leq (2.633449)$$

The Superimposed Leakage Verification Test met the requirements set forth in Reference 2.

3.3.2.4 Leakage Penalties Added to Type A Leakage

Penetration leakage to be added since these penetrations were isolated or could not be vented and drained during the Type A test. The leakage assigned is the recorded value for minimum pathway analysis.

i. Type B & C Penalties	Description	Leakage SCCM
X-23A	RBCCW Inlet	1400.
X-23B	RBCCW Inlet	575.
X-24B	RBCCW Outlet	1000.
X-24A	RBCCW Outlet	110.
X-9A	Feedwater	<110.
X-9B	Feedwater	<150.
X-10	RCIC Steam	0.
X-11	HPCI Steam	0.
X-16B	Core Spray	<110.
X-16A	Core Spray	250.
X-32D	N_2 Comp Suction	0.
X-36	CRD Return	125.
X-32E	Recirc. Pump Seal	0.
X-32F	Recirc. Pump Seal	0.
X-40C	Jet Pump	<150.
X-40D	Jet Pump	<90.
X-41	Recirc. Loop Sample	<35.
X-229H	PASS	<240.
X-219	HPCI/RCIC Vac. Br.	410.
X-21	Service Air	25.

Total Type B & C Leakage 4780 SCCM
Total Type B & C Leakage 0.030150 percent/day

ii. Water Level Corrections	Description	Gallons
	Rx Vessel	0.0
	D.W. Equipment Sump	4772.2
	D.W. Floor Sump	0.0
	Torus	0.0

Total Water Level Corrections 4772.2 Gallons
Total Water Level Corrections 0.003108 percent/day

iii Total Corrections	Description	Leakage Percent/Day
Total Type A Corrections (i. and ii.)	Penalties and Corrections	0.033258

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
MEASURED INPUT DATA

12/15/88 08:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
77.454	77.400	76.627	77.029	86.042	85.564	92.826	92.511	103.680	103.130
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.412	95.773	136.590	141.220	106.100	164.23	160.77	159.52	157.36	154.07
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
155.45	77.45	76.63	59.1179	59.1379	59.1984				

12/15/88 08:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
77.361	77.286	76.513	76.905	86.115	85.614	92.844	92.549	103.820	103.290
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.451	95.834	136.740	141.380	106.270	164.25	160.97	159.70	157.47	153.89
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
155.30	77.36	76.51	59.1163	59.1360	59.1970				

12/15/88 08:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
77.236	77.193	76.420	76.811	86.151	85.695	92.871	92.674	104.000	103.470
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.498	95.903	136.800	141.440	106.400	163.82	160.92	159.83	157.55	153.85
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
155.18	77.24	76.42	59.1146	59.1345	59.1953				

12/15/88 09:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
77.150	77.096	76.323	76.721	86.217	85.716	92.903	92.674	104.140	103.630
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.544	95.980	136.870	141.390	106.540	164.13	161.14	159.92	157.82	153.84
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
155.06	77.15	76.32	59.1134	59.1333	59.1942				

12/15/88 09:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
77.062	77.007	76.248	76.645	86.283	85.782	92.926	92.663	104.320	103.740
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.598	96.045	136.870	141.500	106.740	164.05	161.24	160.10	157.78	153.60
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.89	77.06	76.25	59.1123	59.1320	59.1932				

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
MEASURED INPUT DATA

12/15/88 09:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.976	76.933	76.150	76.578	86.337	85.836	92.969	92.728	104.440	103.840
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.641	96.131	136.890	141.560	106.910	164.92	161.27	160.16	157.91	153.61
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.74	76.98	76.15	59.1115	59.1317	59.1925				

12/15/88 09:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.899	76.867	76.073	76.480	86.412	85.890	93.066	92.826	104.590	104.020
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.716	96.197	136.930	141.680	107.030	164.54	161.42	160.30	157.93	153.52
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.63	76.90	76.07	59.1109	59.1305	59.1917				

12/15/88 10:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.824	76.781	76.008	76.445	86.423	85.933	93.098	92.837	104.750	104.220
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.739	96.252	136.960	141.660	107.190	164.77	161.61	160.34	158.05	153.42
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.52	76.82	76.01	59.1107	59.1302	59.1912				

12/15/88 10:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.758	76.726	75.910	76.390	86.500	85.988	93.132	92.892	104.890	104.330
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.825	96.338	137.090	141.690	107.350	164.59	161.40	160.45	158.23	153.41
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.42	76.76	75.91	59.1103	59.1293	59.1905				

12/15/88 10:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.688	76.645	75.862	76.275	86.548	86.026	93.191	92.910	105.040	104.450
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.843	96.399	137.170	141.750	107.480	165.05	161.81	160.60	158.23	153.23
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.36	76.69	75.86	59.1098	59.1299	59.1907				

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
MEASURED INPUT DATA

12/15/88 10:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.617	76.595	75.790	76.247	86.598	86.097	93.229	92.969	105.190	104.610
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.868	96.481	137.200	141.900	107.670	165.58	161.82	160.70	158.34	153.25
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.24	76.62	75.79	59.1102	59.1294	59.1909				

12/15/88 11:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.568	76.536	75.742	76.176	86.648	86.135	93.279	93.062	105.330	104.710
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.972	96.551	137.340	141.860	107.780	165.38	161.95	160.72	158.47	153.16
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.17	76.57	75.74	59.1102	59.1297	59.1910				

12/15/88 11:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.509	76.475	75.692	76.126	86.695	86.206	93.316	93.066	105.470	104.880
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
85.999	96.633	137.360	141.930	107.930	165.33	161.88	160.78	158.60	153.03
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.09	76.51	75.69	59.1105	59.1300	59.1916				

12/15/88 11:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.454	76.420	75.638	76.059	86.727	86.249	93.404	93.121	105.590	105.000
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.076	96.696	137.390	142.020	108.080	165.56	162.36	160.93	158.65	153.04
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
154.02	76.45	75.64	59.1110	59.1312	59.1922				

12/15/88 11:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.400	76.366	75.595	76.027	86.781	86.292	93.436	93.186	105.730	105.110
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.085	96.773	137.430	142.060	108.200	165.63	162.30	160.99	158.73	152.99
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.95	76.40	75.59	59.1117	59.1309	59.1928				

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
MEASURED INPUT DATA

12/15/88 12:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.357	76.323	75.552	75.970	86.836	86.337	93.479	93.207	105.860	105.230
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.140	96.850	137.520	142.090	108.350	165.89	162.71	161.08	158.68	152.92
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.85	76.36	75.55	59.1126	59.1324	59.1935				

12/15/88 12:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.302	76.280	75.497	75.928	86.913	86.392	93.533	93.284	106.000	105.350
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.194	96.905	137.520	142.020	108.520	165.88	162.58	161.21	158.80	152.87
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.80	76.30	75.50	59.1135	59.1329	59.1945				

12/15/88 12:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.250	76.216	75.445	75.864	86.924	86.426	93.579	93.307	106.130	105.450
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.228	96.970	137.620	142.120	108.630	165.58	162.58	161.14	158.92	152.86
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.72	76.25	75.44	59.1143	59.1339	59.1952				

12/15/88 12:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.225	76.194	75.420	75.850	86.988	86.478	93.588	93.295	106.260	105.610
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.260	97.045	137.680	142.170	108.700	166.09	163.03	161.38	159.02	152.76
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.66	76.22	75.42	59.1150	59.1346	59.1961				

12/15/88 13:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.182	76.150	75.409	75.806	87.033	86.532	93.685	93.327	106.380	105.720
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.314	97.120	137.760	142.060	108.850	166.22	162.98	161.41	159.20	152.74
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.64	76.18	75.41	59.1164	59.1357	59.1976				

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
MEASURED INPUT DATA

12/15/88 13:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.139	76.105	75.355	75.763	87.076	86.575	93.708	93.393	106.490	105.870
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.392	97.186	137.850	142.270	109.000	166.31	163.04	161.54	159.17	152.69
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.55	76.14	75.36	59.1176	59.1367	59.1985				

12/15/88 13:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.112	76.069	75.330	75.735	87.126	86.625	93.746	93.506	106.610	105.960
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.430	97.258	137.900	142.270	109.130	166.44	163.01	161.59	159.34	152.66
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.44	76.11	75.33	59.1190	59.1381	59.1998				

12/15/88 13:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.085	76.051	75.300	75.707	87.194	86.684	93.837	93.545	106.740	106.110
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.489	97.349	137.910	142.260	109.280	166.41	163.24	161.79	159.40	152.63
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.41	76.08	75.30	59.1200	59.1392	59.2015				

12/15/88 14:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.046	76.014	75.253	75.668	87.224	86.723	93.844	93.606	106.850	106.240
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.516	97.399	138.000	142.260	109.410	166.71	163.39	161.79	159.39	152.60
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.47	76.05	75.25	59.1214	59.1404	59.2027				

12/15/88 14:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
76.019	75.976	75.237	75.641	87.260	86.761	93.903	93.653	106.980	106.330
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.555	97.480	138.050	142.270	109.490	166.71	163.57	161.86	159.54	152.53
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.37	76.02	75.24	59.1229	59.1420	59.2042				

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
MEASURED INPUT DATA

12/15/88 14:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.992	75.949	75.198	75.613	87.319	86.809	93.930	93.626	107.110	106.450
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.602	97.539	138.160	142.430	109.650	166.77	163.37	162.00	159.58	152.52
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.31	75.99	75.20	59.1244	59.1434	59.2055				

12/15/88 14:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.958	75.926	75.176	75.581	87.353	86.852	93.973	93.690	107.220	106.550
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.645	97.605	138.120	142.350	109.760	167.11	163.26	162.08	159.67	152.50
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.23	75.96	75.18	59.1260	59.1448	59.2071				

12/15/88 15:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.942	75.899	75.160	75.553	87.412	86.902	94.023	93.740	107.370	106.690
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.673	97.675	138.220	142.350	109.870	166.81	163.75	162.13	159.70	152.49
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.23	75.94	75.16	59.1280	59.1463	59.2090				

12/15/88 15:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.910	75.867	75.139	75.521	87.466	86.945	94.077	93.837	107.470	106.760
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.727	97.741	138.240	142.430	109.970	167.33	163.77	162.08	159.92	152.45
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.27	75.91	75.14	59.1294	59.1484	59.2105				

12/15/88 15:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.894	75.851	75.123	75.505	87.505	87.006	94.127	93.876	107.600	106.910
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.800	97.811	138.300	142.440	110.140	167.06	164.01	162.31	160.00	152.40
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.20	75.89	75.12	59.1307	59.1499	59.2121				

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
MEASURED INPUT DATA

12/15/88 15:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.878	75.824	75.117	75.487	87.543	87.042	94.152	93.882	107.690	107.010
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.836	97.882	138.320	142.520	110.290	167.31	163.93	162.41	159.99	152.37
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.13	75.88	75.12	59.1326	59.1515	59.2141				

12/15/88 16:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.849	75.794	75.067	75.459	87.591	87.092	94.211	93.984	107.810	107.140
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.886	97.941	138.380	142.510	110.360	167.34	163.97	162.24	160.19	152.34
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.04	75.85	75.07	59.1340	59.1530	59.2156				

12/15/88 16:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.824	75.770	75.062	75.432	87.641	87.131	94.241	93.980	107.920	107.220
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
86.924	98.002	138.470	142.460	110.440	167.34	164.29	162.54	160.18	152.31
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
153.07	75.82	75.06	59.1359	59.1548	59.2172				

ATTACHMENT 3.3B

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
REDUCED INPUT VARIABLES

Time (hh:mm)	Press. (PSIA)	V.P. (PSI)	Temp. (R)	Dewpoint (F)	Mass (LbM)
08:15	59.128	0.4440	551.124	75.987	59021.99
08:30	59.126	0.4442	551.120	75.997	59020.41
08:45	59.125	0.4440	551.116	75.983	59019.48
09:00	59.123	0.4447	551.104	76.035	59018.79
09:15	59.122	0.4442	551.099	76.001	59018.66
09:30	59.122	0.4442	551.099	76.002	59018.09
09:45	59.121	0.4444	551.111	76.012	59015.77
10:00	59.120	0.4446	551.112	76.027	59015.13
10:15	59.120	0.4442	551.126	76.000	59013.37
10:30	59.120	0.4449	551.118	76.048	59013.57
10:45	59.120	0.4450	551.141	76.053	59010.95
11:00	59.120	0.4452	551.149	76.065	59010.11
11:15	59.120	0.4448	551.160	76.038	59009.62
11:30	59.121	0.4461	551.171	76.130	59007.96
11:45	59.121	0.4459	551.181	76.114	59007.30
12:00	59.123	0.4466	551.195	76.162	59006.35
12:15	59.123	0.4464	551.204	76.147	59006.32
12:30	59.124	0.4462	551.208	76.138	59006.88
12:45	59.125	0.4475	551.231	76.222	59003.87
13:00	59.126	0.4476	551.241	76.227	59003.98
13:15	59.127	0.4475	551.269	76.224	59002.14
13:30	59.129	0.4474	551.288	76.218	59001.64
13:45	59.130	0.4482	551.314	76.272	58999.01
14:00	59.131	0.4487	551.328	76.302	58998.47
14:15	59.132	0.4490	551.341	76.327	58998.19
14:30	59.134	0.4486	551.369	76.298	58997.16
14:45	59.135	0.4483	551.375	76.279	58998.24
15:00	59.137	0.4497	551.401	76.369	58995.93
15:15	59.139	0.4500	551.418	76.389	58995.55
15:30	59.140	0.4507	551.449	76.440	58992.86
15:45	59.142	0.4504	551.469	76.419	58992.78
16:00	59.144	0.4503	551.489	76.410	58992.21
16:15	59.145	0.4515	551.499	76.492	58991.78

ATTACHMENT 3.3C

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
ABSOLUTE TEST METHOD, MASS POINT ANALYSIS TEST RESULTS

Time (hh:mm)	Mass (LbM)	Leakage (PCT./DAY)	Confidence (PCT./DAY)	UCL (PCT./DAY)
08:15	59021.99	0.000000	0.000000	0.000000
08:30	59020.41	0.000000	0.000000	0.000000
08:45	59019.48	0.203669	0.263484	0.467153
09:00	59018.79	0.170824	0.068957	0.239781
09:15	59018.66	0.134604	0.058648	0.193251
09:30	59018.09	0.118087	0.040270	0.158357
09:45	59015.77	0.140057	0.037116	0.177173
10:00	59015.13	0.146242	0.027567	0.173809
10:15	59013.37	0.158436	0.024726	0.183162
10:30	59013.57	0.154216	0.019883	0.174099
10:45	59010.95	0.164240	0.019201	0.183442
11:00	59010.11	0.168959	0.016550	0.185510
11:15	59009.62	0.168878	0.013860	0.182738
11:30	59007.96	0.171739	0.012141	0.183880
11:45	59007.30	0.171963	0.010450	0.182413
12:00	59006.35	0.171746	0.009091	0.180838
12:15	59006.32	0.168326	0.008699	0.177025
12:30	59006.88	0.161383	0.010404	0.171787
12:45	59003.87	0.161584	0.009274	0.170859
13:00	59003.98	0.159174	0.008661	0.167835
13:15	59002.14	0.159214	0.007812	0.167025
13:30	59001.64	0.158312	0.007139	0.165451
13:45	58999.01	0.160558	0.006874	0.167432
14:00	58998.47	0.161550	0.006363	0.167913
14:15	58998.19	0.161262	0.005849	0.167111
14:30	58997.16	0.161088	0.005392	0.166480
14:45	58998.24	0.158277	0.005703	0.163980
15:00	58995.93	0.157636	0.005325	0.162961
15:15	58995.55	0.156453	0.005086	0.161538
15:30	58992.86	0.157308	0.004814	0.162122
15:45	58992.78	0.157133	0.004501	0.161634
16:00	58992.21	0.156623	0.004244	0.160867
16:15	58991.78	0.155734	0.004077	0.159811

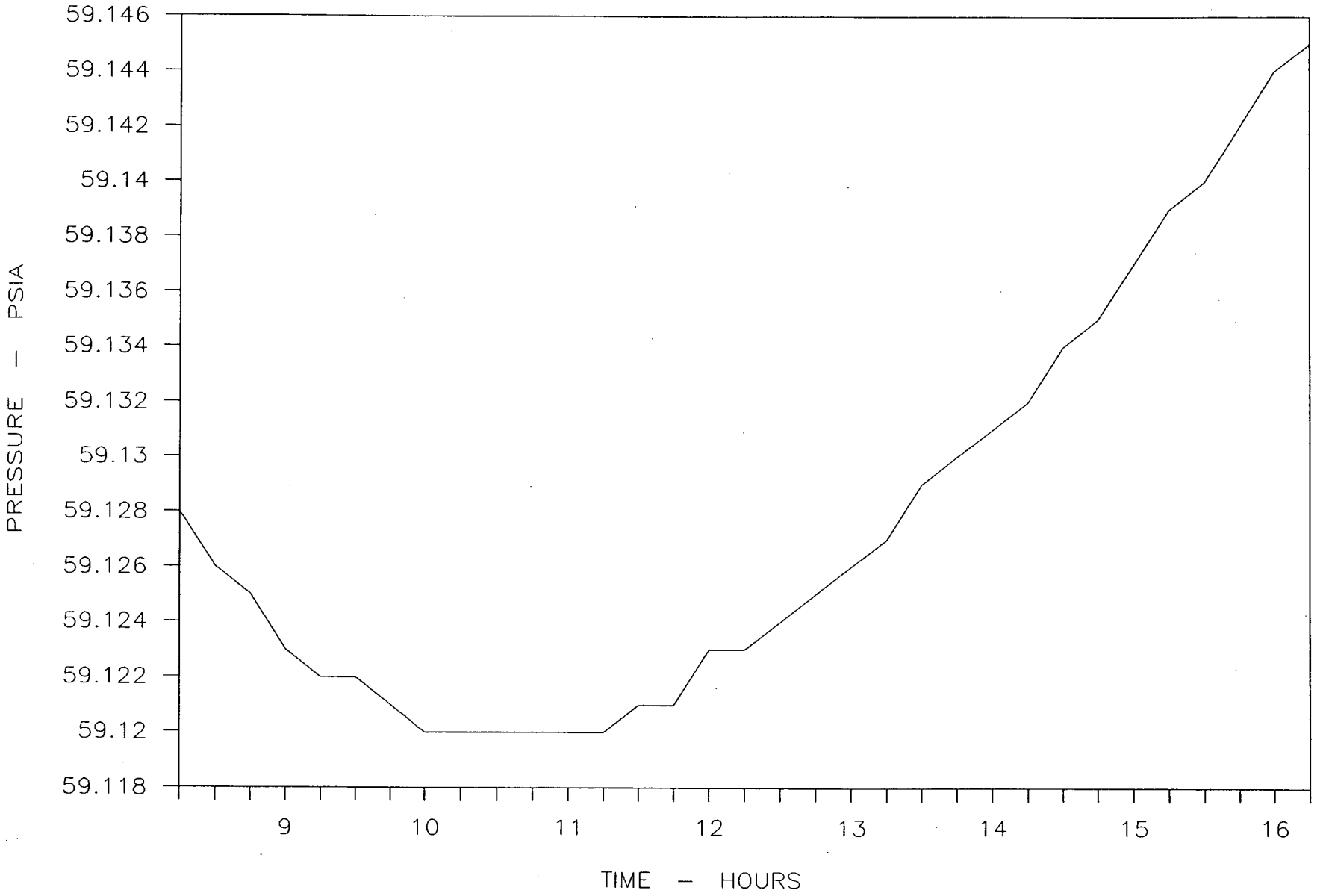
ATTACHMENT 3.3D

Duane Arnold Energy Center - 1988 ILRT
FROM 08:15 HOURS TO 16:15 HOURS ON 12/15/88
ABSOLUTE TEST METHOD, TOTAL TIME ANALYSIS TEST RESULTS

Time (hh:mm)	Mass (LbM)	Meas.Leak. (PCT./DAY)	Calc.Leak. (PCT./DAY)	Confidence (PCT./DAY)	UCL (PCT./DAY)
08:15	59021.99	0.000000	0.000000	0.000000	0.000000
08:30	59020.41	0.257009	0.000000	0.000000	0.000000
08:45	59019.48	0.203669	0.000000	0.000000	0.000000
09:00	59018.79	0.173101	0.169305	0.090062	0.259367
09:15	59018.66	0.135467	0.133032	0.036593	0.169626
09:30	59018.09	0.126659	0.113400	0.052275	0.165676
09:45	59015.77	0.168581	0.126643	0.109686	0.236328
10:00	59015.13	0.159418	0.130980	0.104520	0.235500
10:15	59013.37	0.175223	0.140885	0.104242	0.245128
10:30	59013.57	0.152114	0.139082	0.093758	0.232840
10:45	59010.95	0.179444	0.147579	0.092413	0.239992
11:00	59010.11	0.175546	0.152616	0.087995	0.240611
11:15	59009.62	0.167581	0.154113	0.082535	0.236648
11:30	59007.96	0.175522	0.157528	0.078756	0.236283
11:45	59007.30	0.170577	0.158965	0.074748	0.233712
12:00	59006.35	0.169563	0.159906	0.071164	0.231070
12:15	59006.32	0.159269	0.158357	0.067714	0.226071
12:30	59006.88	0.144569	0.153978	0.065012	0.218989
12:45	59003.87	0.163701	0.154356	0.062623	0.216979
13:00	59003.98	0.154166	0.152852	0.060223	0.213075
13:15	59002.14	0.161440	0.152985	0.058281	0.211266
13:30	59001.64	0.157595	0.152449	0.056396	0.208845
13:45	58999.01	0.169887	0.154113	0.055303	0.209416
14:00	58998.47	0.166275	0.154975	0.053987	0.208961
14:15	58998.19	0.161292	0.154958	0.052559	0.207517
14:30	58997.16	0.161540	0.155000	0.051249	0.206250
14:45	58998.24	0.148563	0.153170	0.049987	0.203157
15:00	58995.93	0.156990	0.152765	0.048807	0.201572
15:15	58995.55	0.153565	0.151962	0.047672	0.199635
15:30	58992.86	0.163376	0.152553	0.046860	0.199414
15:45	58992.78	0.158355	0.152456	0.045928	0.198384
16:00	58992.21	0.156235	0.152122	0.045017	0.197138
16:15	58991.78	0.153525	0.151511	0.044132	0.195644

CONTAINMENT PRESSURE vs. TIME

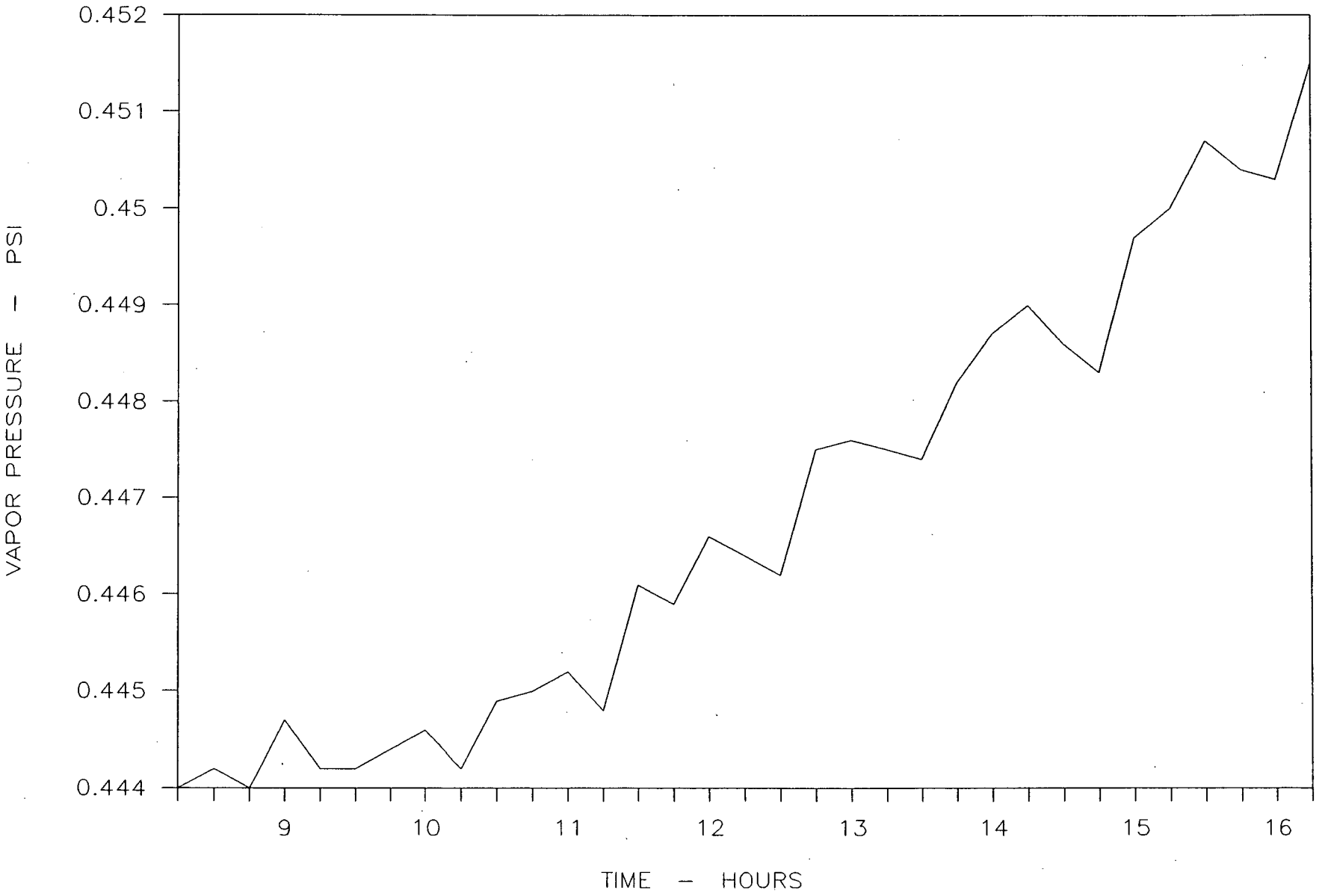
DAEC – ILRT – DECEMBER 1988



ATTACHMENT 3.3E
GRAPH 1

CONTAINMENT VAPOR PRESSURE vs. TIME

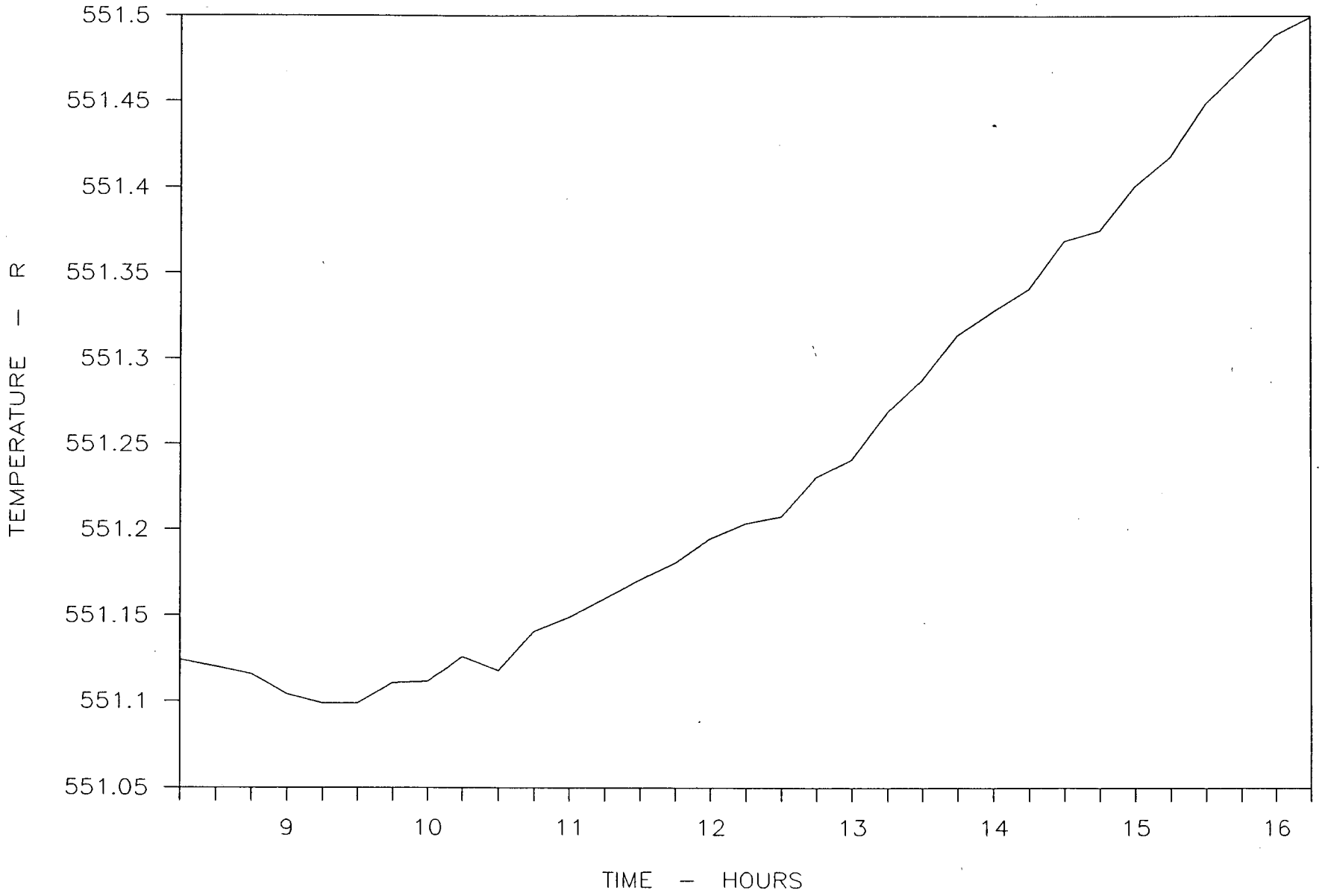
DAEC – ILRT – DECEMBER 1988



ATTACHMENT 3.3F
GRAPH 2

CONTAINMENT TEMPERATURE vs. TIME

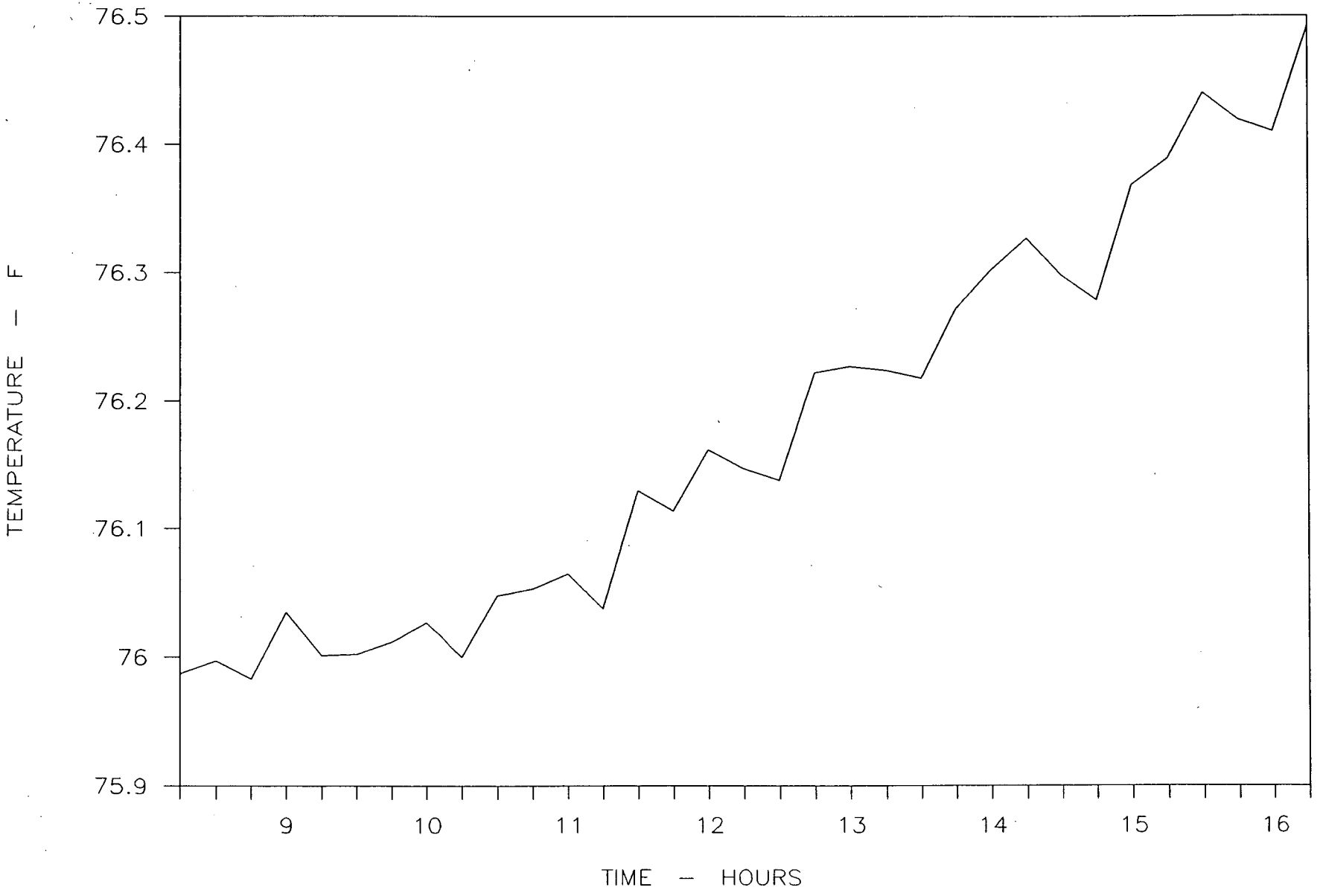
DAEC – ILRT – DECEMBER 1988



ATTACHMENT 3.3G
GRAPH 3

CONTAINMENT DEWPOINT TEMP. vs. TIME

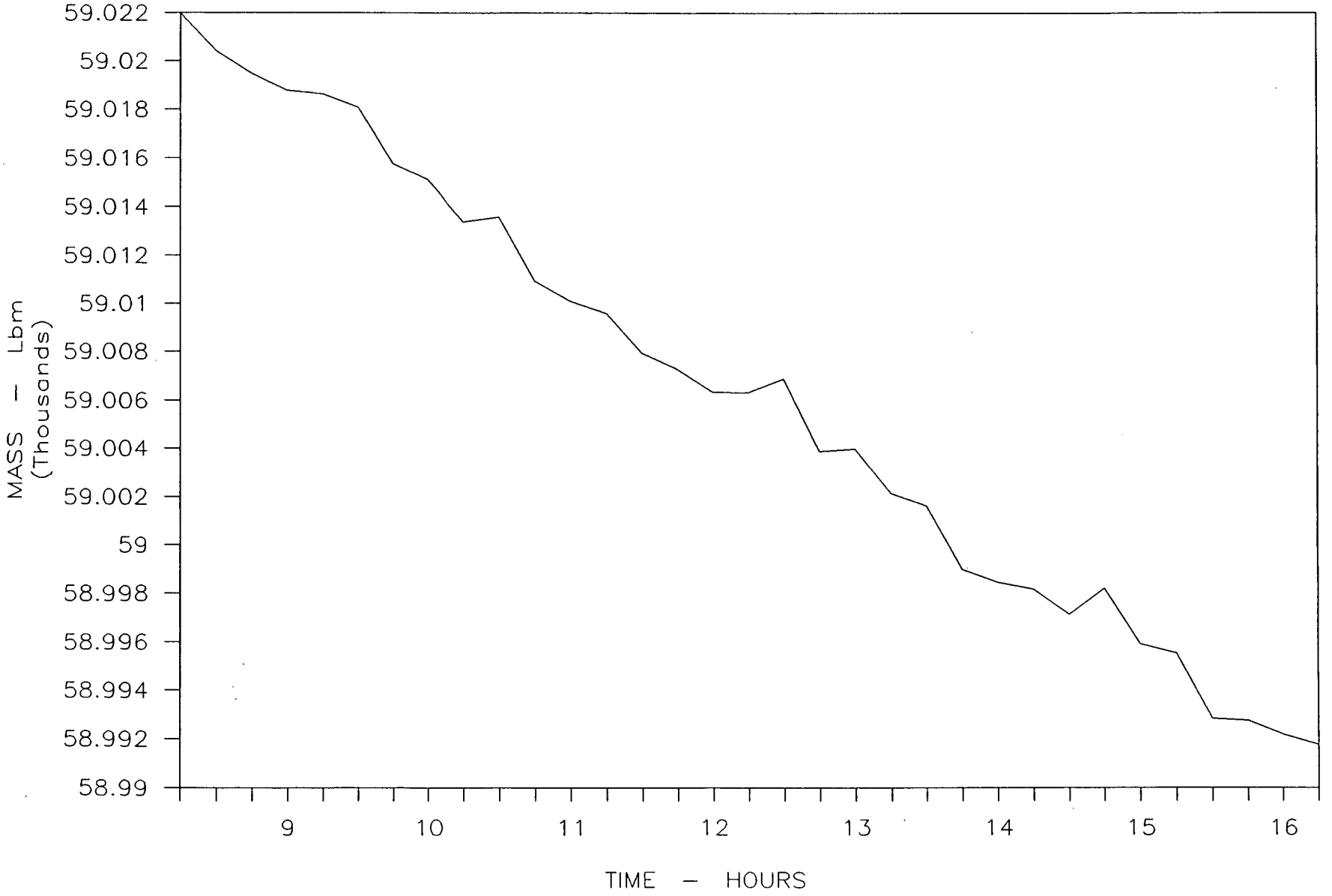
DAEC – ILRT – DECEMBER 1988



ATTACHMENT 3.3H
GRAPH 4

CONTAINMENT MASS vs. TIME

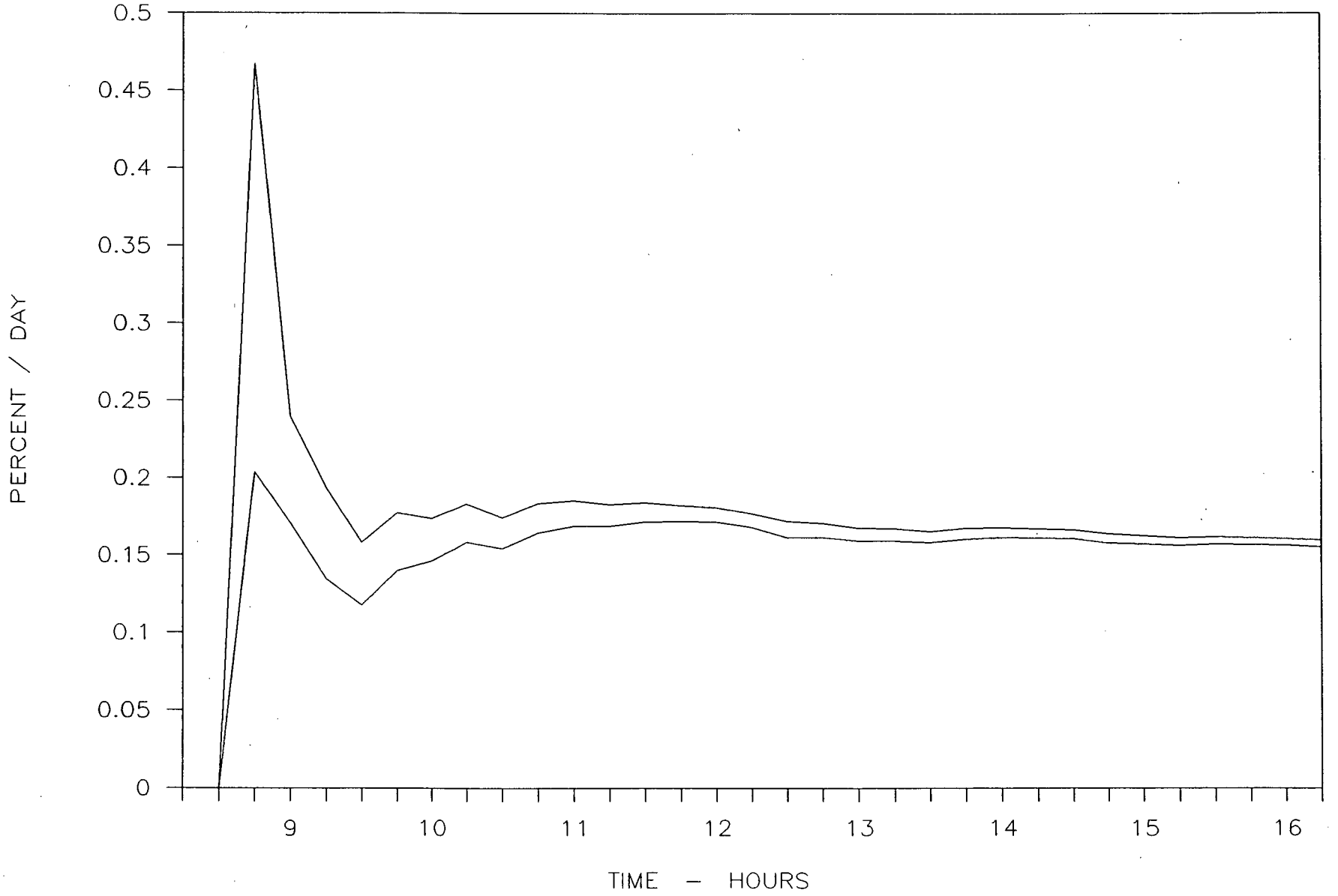
DAEC – ILRT – DECEMBER 1988



ATTACHMENT 3.3I
GRAPH 5

MASS POINT LEAKAGE & UCL

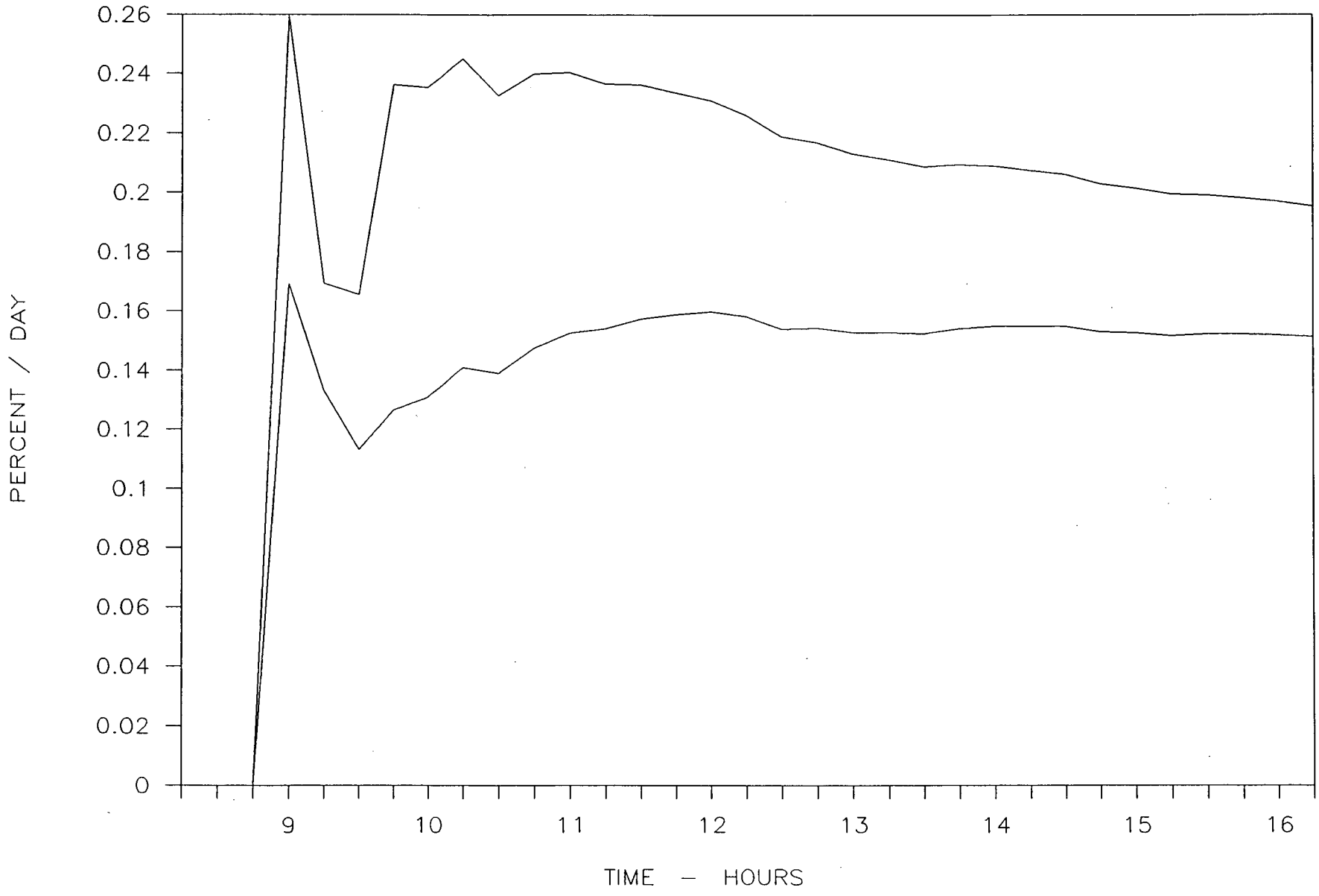
DAEC – ILRT – DECEMBER 1988



ATTACHMENT 3.3J
GRAPH 6

TOTAL TIME LEAKAGE & UCL

DAEC – ILRT – DECEMBER 1988



ATTACHMENT 3.3K
GRAPH 7

ATTACHMENT 3.3L

Duane Arnold Energy Center - 1988 ILRT
FROM 18:00 HOURS TO 22:00 HOURS ON 12/15/88
VERIFICATION TEST MEASURED INPUT DATA

12/15/88 18:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.665	75.622	74.906	75.273	87.940	87.396	94.529	94.191	108.670	107.990
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.201	98.453	138.770	142.610	111.260	167.77	164.75	162.97	160.63	152.18
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.84	75.67	74.91	59.1035	59.1222	59.1848				

12/15/88 18:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.643	75.599	74.883	75.250	87.972	87.439	94.560	94.245	108.780	108.080
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.221	98.508	138.800	142.820	111.370	167.96	165.08	163.10	160.63	152.17
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.79	75.64	74.88	59.0946	59.1136	59.1764				

12/15/88 18:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.618	75.584	74.888	75.222	88.022	87.477	94.587	94.327	108.860	108.180
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.283	98.578	138.880	142.740	111.500	168.32	164.44	163.04	160.68	152.12
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.75	75.62	74.89	59.0854	59.1048	59.1673				

12/15/88 18:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.627	75.572	74.867	75.222	88.065	87.521	94.631	94.361	108.990	108.310
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.337	98.644	138.870	142.780	111.580	167.82	164.86	163.21	160.77	152.10
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.77	75.63	74.87	59.0772	59.0962	59.1589				

12/15/88 19:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.595	75.552	74.845	75.190	88.096	87.564	94.653	94.361	109.090	108.420
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.357	98.698	138.990	142.930	111.670	167.88	165.16	163.01	160.91	152.09
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.69	75.59	74.84	59.0685	59.0875	59.1499				

ATTACHMENT 3.3L

Duane Arnold Energy Center - 1988 ILRT
FROM 18:00 HOURS TO 22:00 HOURS ON 12/15/88
VERIFICATION TEST MEASURED INPUT DATA

12/15/88 19:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.579	75.525	74.838	75.183	88.146	87.614	94.712	94.420	109.180	108.520
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.385	98.757	138.970	142.850	111.750	168.36	165.35	163.09	160.95	152.04
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.68	75.58	74.84	59.0602	59.0788	59.1415				

12/15/88 19:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.563	75.529	74.813	75.167	88.205	87.652	94.773	94.490	109.270	108.590
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.457	98.818	139.040	142.830	111.870	168.85	165.11	163.37	161.06	152.05
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.68	75.56	74.81	59.0511	59.0698	59.1329				

12/15/88 19:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.545	75.513	74.806	75.151	88.232	87.688	94.767	94.474	109.360	108.710
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.471	98.886	139.030	142.990	112.000	168.69	165.37	163.36	161.15	152.07
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.67	75.55	74.81	59.0427	59.0614	59.1241				

12/15/88 20:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.541	75.486	74.790	75.135	88.271	87.738	94.805	94.533	109.480	108.820
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.532	98.947	139.100	143.020	112.080	168.78	165.35	163.36	161.11	152.02
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.74	75.54	74.79	59.0341	59.0526	59.1155				

12/15/88 20:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.529	75.475	74.790	75.124	88.337	87.781	94.860	94.544	109.570	108.880
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.575	99.013	139.200	143.000	112.210	168.88	165.38	163.61	161.20	152.00
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.62	75.53	74.79	59.0253	59.0445	59.1069				

ATTACHMENT 3.3L

Duane Arnold Energy Center - 1988 ILRT
FROM 18:00 HOURS TO 22:00 HOURS ON 12/15/88
VERIFICATION TEST MEASURED INPUT DATA

12/15/88 20:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.509	75.475	74.770	75.112	88.348	87.827	94.903	94.676	109.670	108.990
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.598	99.068	139.180	143.090	112.280	168.98	165.54	163.53	161.35	152.00
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.60	75.51	74.77	59.0165	59.0354	59.0979				

12/15/88 20:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.497	75.454	74.758	75.101	88.414	87.858	94.968	94.676	109.760	109.070
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.618	99.122	139.230	143.130	112.340	168.94	165.73	163.72	161.39	152.01
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.63	75.50	74.76	59.0079	59.0267	59.0897				

12/15/88 21:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.470	75.436	74.740	75.073	88.427	87.886	94.973	94.724	109.860	109.180
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.657	99.170	139.290	143.100	112.450	169.09	165.69	163.77	161.43	151.98
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.56	75.47	74.74	58.9993	59.0182	59.0810				

12/15/88 21:15

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.475	75.432	74.736	75.080	88.500	87.945	95.023	94.762	109.960	109.310
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.706	99.242	139.370	143.170	112.530	168.94	165.83	163.64	161.43	151.94
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.48	75.47	74.74	58.9909	59.0092	59.0724				

12/15/88 21:30

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.459	75.405	74.720	75.061	88.536	87.983	95.059	94.755	110.060	109.390
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.743	99.301	139.370	143.190	112.660	169.03	165.61	163.88	161.58	151.96
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.52	75.46	74.72	58.9820	59.0007	59.0638				

ATTACHMENT 3.3L

Duane Arnold Energy Center - 1988 ILRT
FROM 18:00 HOURS TO 22:00 HOURS ON 12/15/88
VERIFICATION TEST MEASURED INPUT DATA

12/15/88 21:45

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.443	75.409	74.715	75.045	88.586	88.022	95.100	94.860	110.150	109.480
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.804	99.360	139.490	143.180	112.770	169.38	166.01	163.94	161.59	151.93
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.49	75.44	74.72	58.9734	58.9921	59.0553				

12/15/88 22:00

RTD 1	RTD 2	RTD 3	RTD 4	RTD 5	RTD 6	RTD 7	RTD 8	RTD 9	RTD 10
75.443	75.400	74.715	75.036	88.597	88.053	95.154	94.848	110.240	109.570
RTD 11	RTD 12	RTD 13	RTD 14	RTD 15	DC 1	DC 2	DC 3	DC 4	DC 5
87.827	99.426	139.480	143.170	112.860	169.47	166.23	163.87	161.66	151.93
DC 6	RTD 1	RTD 3	PRESS 1	PRESS 2	PRESS 3				
152.45	75.44	74.72	58.9648	58.9840	59.0467				

ATTACHMENT 3.3M

Duane Arnold Energy Center - 1988 ILRT
FROM 18:00 HOURS TO 22:00 HOURS ON 12/15/88
VERIFICATION TEST REDUCED INPUT VARIABLES

Time (hh:mm)	Press. (PSIA)	V.P. (PSI)	Temp. (R)	Dewpoint (F)	Mass (LbM)
18:00	59.113	0.4531	551.632	76.596	58943.33
18:15	59.104	0.4540	551.657	76.655	58930.95
18:30	59.095	0.4521	551.676	76.530	58921.84
18:45	59.087	0.4535	551.704	76.627	58908.87
19:00	59.078	0.4540	551.726	76.659	58897.35
19:15	59.070	0.4545	551.740	76.693	58886.84
19:30	59.060	0.4545	551.765	76.689	58875.06
19:45	59.052	0.4553	551.787	76.743	58863.54
20:00	59.043	0.4552	551.811	76.739	58852.25
20:15	59.035	0.4555	551.834	76.754	58841.14
20:30	59.026	0.4559	551.860	76.785	58828.88
20:45	59.017	0.4568	551.878	76.845	58817.33
21:00	59.009	0.4566	551.890	76.830	58807.68
21:15	59.000	0.4565	551.930	76.824	58794.82
21:30	58.991	0.4566	551.942	76.831	58784.64
21:45	58.983	0.4576	551.972	76.897	58771.80
22:00	58.974	0.4581	551.988	76.929	58761.25

ATTACHMENT 3.3N

Duane Arnold Energy Center - 1988 ILRT
FROM 18:00 HOURS TO 22:00 HOURS ON 12/15/88
ABSOLUTE TEST METHOD, MASS POINT ANALYSIS TEST RESULTS
VERIFICATION TEST

Time (hh:mm)	Mass (LbM)	Leakage (PCT./DAY)	Confidence (PCT./DAY)	UCL (PCT./DAY)
18:00	58943.33	0.000000	0.000000	0.000000
18:15	58930.95	0.000000	0.000000	0.000000
18:30	58921.84	1.749963	1.312447	3.062410
18:45	58908.87	1.832031	0.245316	2.077347
19:00	58897.35	1.857540	0.118531	1.976071
19:15	58886.84	1.843928	0.072227	1.916156
19:30	58875.06	1.847081	0.048413	1.895494
19:45	58863.54	1.850772	0.035044	1.885816
20:00	58852.25	1.851683	0.026485	1.878168
20:15	58841.14	1.849889	0.020827	1.870716
20:30	58828.88	1.855538	0.017799	1.873337
20:45	58817.33	1.859783	0.015302	1.875085
21:00	58807.68	1.852900	0.014670	1.867570
21:15	58794.82	1.855456	0.012742	1.868198
21:30	58784.64	1.852162	0.011471	1.863634
21:45	58771.80	1.855234	0.010455	1.865689
22:00	58761.25	1.854681	0.009194	1.863876

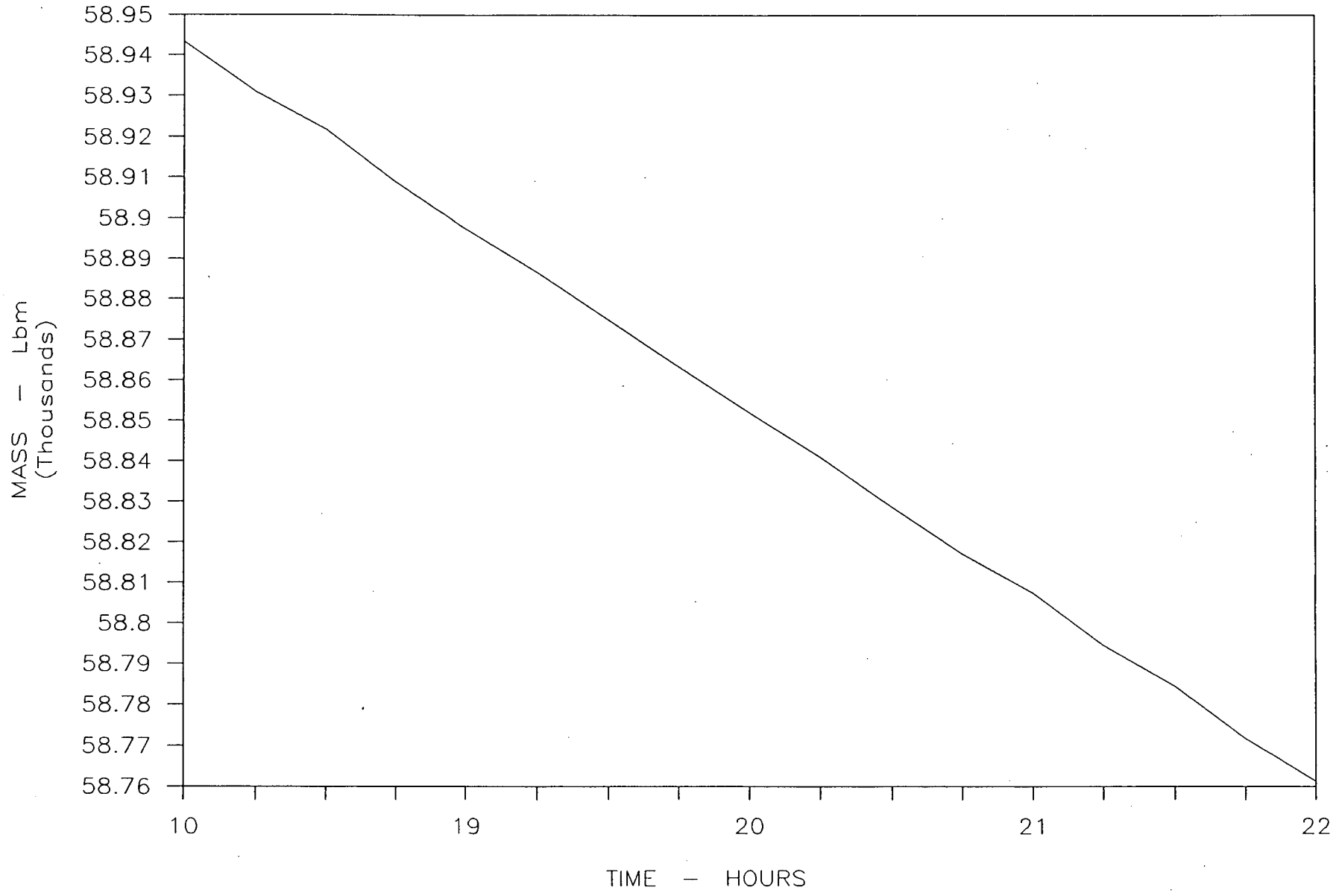
ATTACHMENT 3.3P

Duane Arnold Energy Center - 1988 ILRT
FROM 18:00 HOURS TO 22:00 HOURS ON 12/15/88
ABSOLUTE TEST METHOD, TOTAL TIME ANALYSIS TEST RESULTS
VERIFICATION TEST

Time (hh:mm)	Mass (LbM)	Meas.Leak. (PCT./DAY)	Calc.Leak. (PCT./DAY)	Confidence (PCT./DAY)	UCL (PCT./DAY)
18:00	58943.33	0.000000	0.000000	0.000000	0.000000
18:15	58930.95	2.015640	0.000000	0.000000	0.000000
18:30	58921.84	1.749947	0.000000	0.000000	0.000000
18:45	58908.87	1.870666	1.806264	1.528234	3.334497
19:00	58897.35	1.872378	1.830797	0.621687	2.452484
19:15	58886.84	1.840144	1.824043	0.395901	2.219943
19:30	58875.06	1.853243	1.828454	0.304112	2.132566
19:45	58863.54	1.856440	1.833187	0.252673	2.085860
20:00	58852.25	1.854208	1.835664	0.218655	2.054319
20:15	58841.14	1.849327	1.835773	0.194130	2.029904
20:30	58828.88	1.863971	1.841150	0.177205	2.018355
20:45	58817.33	1.865537	1.845660	0.163663	2.009323
21:00	58807.68	1.841158	1.841906	0.151640	1.993546
21:15	58794.82	1.860603	1.844518	0.142451	1.986969
21:30	58784.64	1.846068	1.842873	0.134132	1.977005
21:45	58771.80	1.862431	1.845607	0.127662	1.973268
22:00	58761.25	1.853492	1.845804	0.121594	1.967398

CONTAINMENT MASS vs. TIME

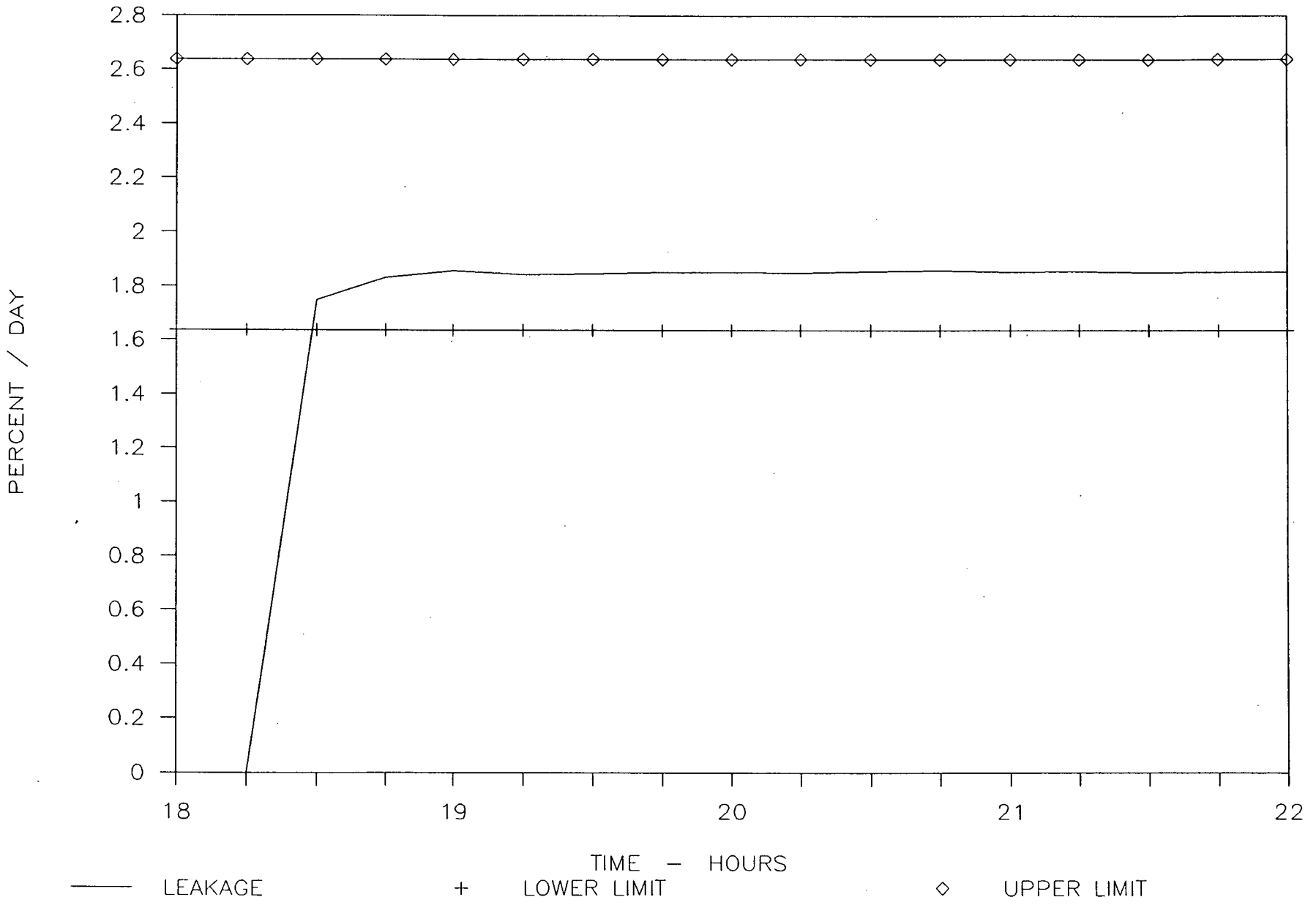
DAEC – VERIF. TEST – DECEMBER 1988



ATTACHMENT 3.3Q
GRAPH 8

MASS POINT LEAKAGE RATE vs. TIME

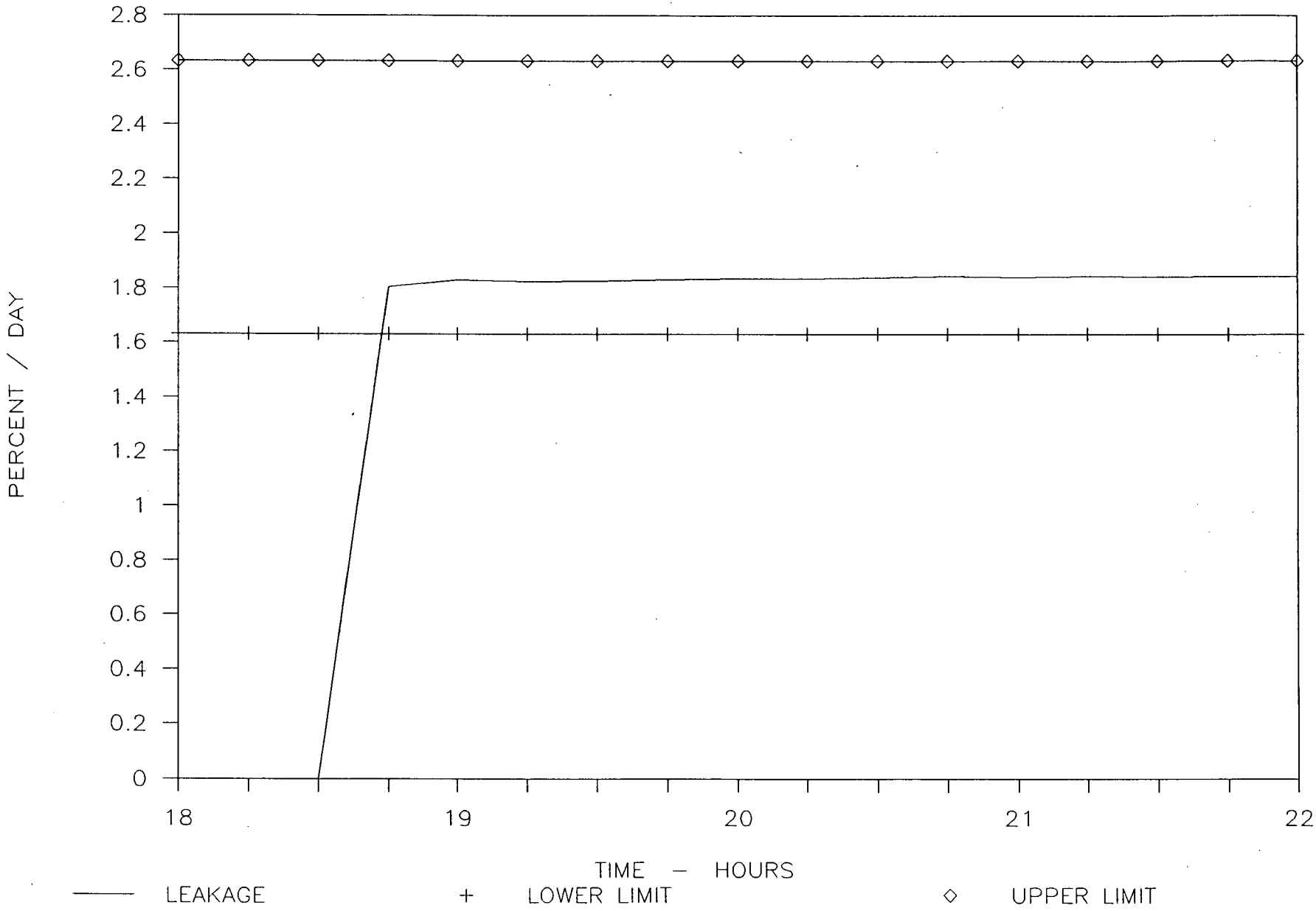
DAEC – VERIF. TEST – DECEMBER 1988



ATTACHMENT 3.3R
GRAPH 9

TOTAL TIME LEAKAGE RATE vs. TIME

DAEC – VERIF. TEST – DECEMBER 1988



ATTACHMENT 3.3S
GRAPH 10

SECTION 4

LOCAL LEAKAGE RATE TESTS (TYPES B AND C)

Section 4 summarizes the results of the Local Leakage Rate Test's (LLRT's) data which has been obtained from periodic testing performed since the June 1987 Periodic Type A test. Maintenance data is provided for surveillance testing performed in 1988. Each penetration's leakage rate can be obtained from site reference material.

Attachment 4B contains an analysis of the containment penetrations that were repaired during the 1988 Refueling Outage to assess the as found containment condition.

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 Types B and C tests in 1988, were well below the acceptance criteria of less than $0.60L_a$.

The data contained in this section are summarized below:

Attachment No.	Title
4A	1988 Local Leakage Rate Test Data
4B	1988 Local Leakage Rate Test Summary Analysis.

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
	Testable Gaskets (Type B)					
X-1	Drywell Personnel Airlock	B	Airlock	6441/06-04-88 7572/08-26-88 4197/12-14-88 1235/12-23-88	6441/06-04-88 7572/08-26-88 4197/12-14-88 1235/12-23-88	
X-1	Drywell Airlock Hatch	B	Gaskets	<150/10-13-88	<150/10-13-88	
X-2	Equipment Access Hatch	B	Gaskets	0/10-01-88	380/12-12-88	Replaced O-Rings
X-4	Drywell Head Access Hatch	B	Gaskets	<25/10-13-88	<25/10-13-88	
X-6	CRD Removal Hatch	B	Gaskets	0/09-30-88	0/12-14-88	Replaced O-Rings
X-35A	TIP Drive	B	Gaskets	0/10-27-88	0/10-27-88	
X-35B	TIP Drive	B	Gaskets	0/10-27-88	0/10-27-88	
X-35C	TIP Drive	B	Gaskets	0/10-27-88	0/10-27-88	
X-35D	TIP Purge Line	B	Gaskets	0/10-27-88	0/10-27-88	
X-53	Spare	B	Gaskets	0/09-29-88	0/11-17-88	Replaced O-Rings
	Drywell Head	B	Gaskets	<18/09-30-88	0/12-02-88	Replaced O-Rings
X-58A	Stabilizer Access Port	B	Gaskets	240/10-17-88	240/10-17-88	
X-58B	Stabilizer Access Port	B	Gaskets	<240/10-17-88	<240/10-17-88	
X-58C	Stabilizer Access Port	B	Gaskets	<240/10-17-88	<240/10-17-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-58D	Stabilizer Access Port	B	Gaskets	2475/10-17-88	<200/11-12-88	Replaced O-Rings
X-58E	Stabilizer Access Port	B	Gaskets	<240/10-17-88	<240/10-17-88	
X-58F	Stabilizer Access Port	B	Gaskets	<240/10-17-88	<240/10-17-88	
X-58G	Stabilizer Access Port	B	Gaskets	<240/10-17-88	<240/10-17-88	
X-58H	Stabilizer Access Port	B	Gaskets	285/11-12-88	<200/10-17-88	Replaced O-Rings
N-200A	Torus Access Hatch - South	B	Gaskets	0/09-29-88	25/11-21-88	Replaced O-Rings
N-200B	Torus Access Hatch - North	B	Gaskets	0/09-29-88	0/12-17-88	Replaced O-Rings
	Electrical Canisters (Type B)					
X-100B	Neutron Monitoring	B	Electrical Pen.	0/10-14-88	0/10-14-88	
X-100C	Neutron Monitoring	B	Electrical Pen.	0/10-14-88	0/10-14-88	
X-100E	Neutron Monitoring	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-100F	Neutron Monitoring	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-100G	RPV Vibration Monitoring	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-101A	Recirc. Pump Power	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-101C	Recirc. Pump Power	B	Electrical Pen.	<80/10-14-88	<80/10-14-88	
X-103	Thermocouple	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-104A	CRD Rod Position Indication	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-104B	CRD Rod Position Indication	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-104C	CRD Rod Position Indication	B	Electrical Pen.	0/10-14-88	0/10-14-88	
X-104D	CRD Rod Position Indication	B	Electrical Pen.	0/10-14-88	0/10-14-88	
X-105B	Power & Control	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-105D	Power & Control	B	Electrical Pen.	<80/10-14-88	<80/10-14-88	
X-106A	Power & Control	B	Electrical Pen.	<150/10-13-88	<150/10-13-88	
X-106C	Power & Control	B	Electrical Pen.	<80/10-14-88	<80/10-14-88	
N-230B	Vacuum Breaker Cables	B	Electrical Pen.	<110/10-13-88	<110/10-13-88	
	Flange O-Rings (Type B)					
X-25	Drywell Purge Outlet	B	CV-4302	1150/09-30-88	1550/10-26-88	Replaced Test Fitting
X-26	Drywell Purge Outlet	B	CV-4307	0/10-08-88	0/10-08-88	
N-220	Torus Purge Supply	B	CV-4308	0/10-08-88	0/10-08-88	
N-205	Torus Purge Outlet	B	CV-4300	<110/10-11-88	<110/10-11-88	
N-213A	Torus Drain Line Flange - South	B	Flange	<240/10-14-88	<240/10-14-88	
N-213B	Torus Drain Line Flange - North	B	Flange	<110/10-13-88	<110/10-13-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
N-231	RB/Torus Vacuum Breaker	B	CV-4304	<110/10-11-88	<110/10-11-88	
N-231	RB/Torus Vacuum Breaker	B	CV-4305	<110/10-11-88	<110/10-11-88	
	Expansion Bellows (Type B)					
X-7A	Steam to Turbine	B	Bellows	<110/10-08-88	<110/10-08-88	
X-7B	Steam to Turbine	B	Bellows	0/10-08-88	0/10-08-88	
X-7C	Steam to Turbine	B	Bellows	<150/10-08-88	<150/10-08-88	
X-7D	Steam to Turbine	B	Bellows	<110/10-08-88	<110/10-08-88	
X-9A	RPV Feedwater	B	Bellows	<110/10-08-88	<110/10-08-88	
X-9B	RPV Feedwater	B	Bellows	<150/10-08-88	<150/10-08-88	
X-10	Steam to RCIC Turbine	B	Bellows	0/10-08-88	0/10-08-88	
X-11	Steam to HPCI Turbine	B	Bellows	0/10-08-88	0/10-08-88	
X-12	Shutdown Pump Supply RHR	B	Bellows	<240/10-15-88	<240/10-15-88	
X-13A	RHR Pump Discharge	B	Bellows	<240/10-15-88	<240/10-15-88	
X-13B	RHR Pump Discharge	B	Bellows	<240/10-15-88	<240/10-15-88	
X-15	RWCU Supply	B	Bellows	<110/10-25-88	<110/10-25-88	
X-16A	Core Spray Pump Discharge	B	Bellows	<110/10-15-88	<110/10-15-88	
X-16B	Core Spray Pump Discharge	B	Bellows	0/10-13-88	0/10-13-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-17	RPV Head Spray	B	Bellows	<100/10-17-88	<100/10-17-88	
N-201A	Vent Line	B	Bellows	<240/10-13-88	<240/10-13-88	
N-201B	Vent Line	B	Bellows	<250/10-13-88	<250/10-13-88	
N-201C	Vent Line	B	Bellows	<240/10-13-88	<240/10-13-88	
N-201D	Vent Line	B	Bellows	<250/10-13-88	<250/10-13-88	
N-201E	Vent Line	B	Bellows	<110/10-13-88	<110/10-13-88	
N-201F	Vent Line	B	Bellows	<110/10-13-88	<110/10-13-88	
N-201G	Vent Line	B	Bellows	<110/10-13-88	<110/10-13-88	
N-201H	Vent Line	B	Bellows	<110/10-13-88	<110/10-13-88	
N-213A	Torus Drain Line Bellows - Inboard (South)	B	Bellows	<240/10-14-88	<240/10-14-88	
N-213A	Torus Drain Line Bellows - Outboard (South)	B	Bellows	<240/10-14-88	<240/10-14-88	
N-213B	Torus Drain Line Bellows - Inboard (North)	B	Bellows	<110/10-14-88	<110/10-14-88	
N-213B	Torus Drain Line Bellows - Outboard (North)	B	Bellows	<110/10-13-88	<110/10-13-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
	Valve Bonnets (Type B)					
X-39A	Drywell Spray	B	MO-2000	<110/09-30-88	<110/09-30-88	
X-39B	Drywell Spray	B	MO-1902	<200/09-30-88	<200/09-30-88	
N-211A	Torus Spray	B	MO-1933	<100/09-30-88	<100/09-30-88	
N-211B	Torus Spray	B	MO-2006	<110/09-30-88	<110/09-30-88	
	Shaft Stem Seals (Type B)					
X-26	Drywell Purge Supply	B	CV-4307	22,000/10-08-88	<150/10-29-88	Replaced O-Rings
N-220	Torus Purge Supply	B	CV-4308	2,680/10-08-88	0/10-29-88	Replaced O-Rings

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
	Local Leakage Rate Tests (Type C)					
X-7A	"A" Main Steam Line	C	CV-4412(IPC)	17,000/10-02-88	350/12-03-88	Internals oversized, replaced stem and reworked seats
			CV-4413(OPC)	351,160/10-01-88	(Combined)	Internals oversized, valve re-bored, reworked seats, spring guide replaced, three springs replaced, stem replaced
X-7B	"B" Main Steam Line	C	CV-4415(IPC)	6,300/10-02-88	750/12-10-88	Internals replaced, reworked seats, replaced stem and torqued packing
			CV-4416(OPC)	<80/10-01-88	(Combined)	
X-7C	"C" Main Steam Line	C	CV-4418(IPC)	700/10-02-88	1310/12-10-88	Dressed and repacked
			CV-4419(OPC)	6,200/10-01-88	890/12-14-88	Valve re-bored, internals oversized, stem replaced, reworked seats, pilot seat in disk re-machined and stem disk machined

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-7D	"D" Main Steam Line	C	CV-4420(IPC)	19,000/10-02-88	<95/12-03-88	Internals replaced and machined, seats reworked and packing adjusted
			CV-4421(OPC)	0/10-02-88	(Combined)	Piston and disk oversized
X-8	Steam Drain	C	MO-4423(IPC)	0/10-03-88	0/10-03-88	
			MO-4424(OPC)	14,000/10-03-88	<150/12-20-88	Wedge machined, seat narrowed, repacked valve, MOVATS tested
X-9A	Feedwater	C	V-14-3(IPC)	384,500/10-05-88	<110/12-09-88	Soft seat installed and stuffing box conversion per DCP-1422
			MO-4441(OPC)	2,000/10-05-88	925/12-20-88	Replaced packing and installed live loading
			MO-2312(OPC)	(Combined)	(Combined)	MOVATS testing, new motor installed; cleaned and machined valve, reset limit switch

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As fouud leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-9B	Feedwater	C	V-14-1(IPC)	371,845/10-20-88	<150/12-02-88	Soft seat installed and stuffing box conversion per DCP-1422
			MO-4442(OPC)	132,000/10-20-88	3000/12-13-88	Replaced packing and installed live loading, repaired position indicator
			MO-2740(OPC)	(Combined)	(Combined)	Repacked and installed live loading, VOTES testing
			MO-2512(OPC)	(Combined)	(combined)	VOTES testing, MOVATS testing, replaced motor and adjusted torque switch
X-10	RCIC Condensate Return	C	CV-2410(IPC)	0/10-11-88	0/10-11-88	
			CV-2411(OPC)	0/10-11-88	0/11-26-88	Replaced packing
X-10	RCIC Steam	C	MO-2400(IPC)	0/10-03-88	0/10-03-88	MOVATS testing
			CV-2401(OPC)	1,500/10-03-88	2,950/12-12-88	MOVATS & VOTES testing, torque switch adjusted, repacked valve and installed live loading
X-11	HPCI Condensate Return	C	CV-2211(IPC)	1,400/10-11-88	445/12-07-88	Replaced valve
			CV-2212(OPC)	265/10-11-88	500/12-07-88	Replaced valve

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-11	HPCI Steam	C	MO-2238(IPC)	0/10-04-88	0/12-14-88	Valve disassembled, wedge has cracks on stellite seat, MOVATS testing
			CV-2239(OPC)	460/10-04-88	220/12-05-88	MOVATS testing, grease in limit switch was changed and valve repacked
X-15	Reactor Water Cleanup	C	MO-2700(IPC)	1,500/08-26-88 1,050/10-21-88	1,500/08-26-88 1,050/10-21-88	Torque Switch replaced
			MO-2701(OPC)	<250/10-21-88	<800/11-09-88	VOTES tested, replaced the EQ qualified limit switches set, repacked valve
X-16A	Core Spray	C	MO-2117(IPC)	2,200/10-06-88	250/11-28-88	VOTES tested, flushed LS assembly
			MO-2115(OPC)	<110/10-06-88	1,000/11-28-88	Replaced motor, rebuilt operator VOTES tested replaced the EQ qualified limit switches set, repacked valve
X-16B	Core Spray	C	MO-2137(IPC)	<150/11-05-88	<110/12-06-88	Operator overhauled, torque switch balanced
			MO-2135(OPC)	185/11-05-88	185/11-05-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-19	Drywell Drain	C	CV-3704(IPC)	19,000/10-12-88	1,575/12-09-88	Machined wedge, lapped valve seats, and repacked
			CV-3705(OPC)	550/10-12-88	550/10-12-88	
X-20	Demineralized Water	C	V-09-111(IPC)	<240/10-18-88	<240/10-18-88	
			V-09-65(OPC)	<240/10-18-88	<240/10-18-88	
X-21	Service Air	C	Blind Flange(IPC)	25/11-27-88	25/11-27-88	
			V-30-287(OPC)	(Combined)	(Combined)	
X-22, N-229A	N_2 Compressor Discharge	C	V-43-214(IPC)	630/10-12-88	630/10-12-88	
			CV-4371C(OPC)	290/10-12-88	290/10-12-88	
			CV-4371A(OPC)	775/10-12-88	775/10-12-88	
X-23A	Drywell Cooling Water Supply	C	CV-5718A(IPC)	1,400/10-10-88	1,400/10-10-88	
			V-57-77(OPC)	(Combined)	(Combined)	
X-23B	Drywell Cooling Water Supply	C	CV-5718B(IPC)	14,000/11-18-88	575/12-07-88	Cleaned valve seat and replaced packing
			V-57-78(OPC)	(Combined)	(Combined)	
X-24A	Drywell Cooling Water Return	C	CV-5704A(IPC)	<110/10-10-88	<110/10-10-88	
			V-57-75(OPC)	(Combined)	(Combined)	
X-24B	Drywell Cooling Water Return	C	CV-5704B(IPC)	1,000/11-18-88	1,000/11-18-88	
			V-57-76(OPC)	(Combined)	(Combined)	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-25	Drywell Purge Outlet	C	CV-4302(IPC)	8,850/09-30-88	7,700/12-07-88	Replaced two test connection fittings O-Rings on stem seal, pneumatic valve replaced
			CV-4303(OPC)	(Combined)	(Combined)	
			CV-4310(OPC)	6,250/09-30-88	6,250/09-30-88	
X-26, N-220	Drywell Purge Supply	C	CV-4306(IPC)	275/10-08-88	275/10-08-88	
			CV-4307(OPC)	(Combined)	(Combined)	
			CV-4308(OPC)	(Combined)	(Combined)	
X-26, N-220	Drywell and Torus Makeup	C	CV-4311(IPC)	5,950/10-05-88	250/11-25-88	Lapped seat and narrowed width of seat on downstream side, replaced springs
			CV-4312(OPC)	2,250/10-05-88	1,000/11-15-88	
			CV-4313(OPC)	610/10-07-88	610/10-07-88	
X-32D	N_2 Compressor Suction	C	CV-4378A(IPC)	0/10-14-88	0/10-14-88	
			CV-4378B(OPC)	0/10-14-88	0/10-14-88	
X-32E	Recirc. Pump A Seal	C	V-17-96(IPC)	<150/10-05-88	<150/10-05-88	
			CV-1804B(OPC)	0/10-05-88	0/10-05-88	
X-32F	Recirc. Pump B Seal	C	V-17-83(IPC)	0/10-05-88	0/10-05-88	
			CV-1804A(OPC)	5,400/10-04-88	220/12-12-88	Replaced stem and seat, lapped seat and repacked valve
X-35A	TIP Check	C	Check Valve(OPC)	720/10-27-88	720/10-27-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-35B	TIP Ball	C	Ball Valve(OPC)	0/10-27-88	0/10-28-88	
X-35C	TIP Ball	C	Ball Valve(OPC)	0/10-27-88	0/10-28-88	
X-35D	TIP Ball	C	Ball Valve(OPC)	0/10-27-88	0/10-28-88	
X-36	CRD Return	C	V-17-53(IPC) V-17-52(OPC)	125/10-25-88 <172/10-25-88	125/10-25-88 <172/10-25-88	See Note 2 See Note 2
X-39A	CAD Supply	C	SV-4332A(IPC) SV-4332B(OPC)	<110/10-12-88 <110/10-12-88	<110/10-12-88 <110/10-12-88	
X-39B	CAD Supply	C	SV-4331A(IPC) SV-4331B(OPC)	<110/10-11-88 (See Note 3)/03/16/88 <110/10-11-88	<110/10-11-88 <130/03-16-88 <110/10-11-88	 Replaced retainer ring and O-Rings
X-40C	Jet Pump Coolant Sample	C	SV-4594B(IPC) SV-4595B(OPC)	<150/10-10-88 <150/10-10-88	<150/10-10-88 <150/10-10-88	
X-40D	Jet Pump Coolant Sample	C	SV-4594A(IPC) SV-4595A(OPC)	<90/10-08-88 <90/10-08-88	<90/10-08-88 <90/10-08-88	
X-41A	Recirc. Loop Sample	C	CV-4639(IPC) CV-4640(OPC)	<35/10-14-88 <110/10-14-88	<35/10-14-88 <110/10-14-88	
X-42	Standby Liquid Control	C	V-26-9(IPC) V-26-8(OPC)	420/11-05-88 3,400/11-05-88	420/11-05-88 1,400/11-07-88	 Valve was cleaned and lapped
X-46F	CAM Return	C	SV-8105B(IPC) SV-8106B(OPC)	0/10-13-88 0/10-13-88	0/10-13-88 0/10-13-88	
X-48	Drywell Drain Discharge	C	CV-3728(IPC) CV-3729(OPC)	<150/10-14-88 <150/10-14-88	<150/10-14-88 <150/10-14-88	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
X-50B	CAM Supply	C	SV-8101A(IPC)	<110/10-12-88	<110/10-12-88	
			SV-8102A(OPC)	0/10-12-88	0/10-12-88	
X-50D	CAM Supply	C	SV-8105A(IPC)	<110/10-12-88	<110/10-12-88	
			SV-8106A(OPC)	<110/10-12-88	<110/10-12-88	
X-50E	CAM Supply	C	SV-8103A(IPC)	<110/10-12-88	<110/10-12-88	
			SV-8104A(OPC)	<110/10-12-88	<110/10-12-88	
X-54	CCW Return	C	MO-4841A(IPC)	250/10-07-88	250/10-07-88	
X-55	CCW Supply	C	MO-4841B(OPC)	0/10-08-88	0/10-08-88	
X-56C	CAM Supply	C	SV-8101B(IPC)	<240/10-13-88	<240/10-13-88	
			SV-8102B(OPC)	0/10-13-88	0/10-13-88	
X-56D	CAM Supply	C	SV-8103B(IPC)	<240/10-13-88	<240/10-13-88	
			SV-8104B(OPC)	<240/10-13-88	<240/10-13-88	
N-205	Torus Exhaust Outlet	C	CV-4300(IPC)	420/10-12-88	285/12-08-88	Cleaned Miller air plate and replaced sub plate seal
			CV-4301(OPC)	(Combined)	(Combined)	
			CV-4309(OPC)	13,000/10-11-88	13,000/10-11-88	
N-211A	CAD Supply	C	SV-4333A(IPC)	3,450/10-11-88	3,450/10-11-88	
			SV-4333B(OPC)	2,750/10-11-88	2,750/10-11-88	
N-211B	CAD Supply	C	SV-4334A(IPC)	315/10-12-88	315/10-12-88	
			SV-4334B(OPC)	310/10-12-88	310/10-12-88	
N-212	RCIC Turbine Exhaust	C	V-24-8(IPC)	76/10-09-88	76/10-09-88	See Note 2
			V-24-23(OPC)	(Combined)	(Combined)	

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
N-212	RCIC Turbine Exhaust Vacuum Breaker	C	V-24-46(IPC)	420/10-08-88	420/10-08-88	
			V-24-47(OPC)	120/10-08-88	120/10-08-88	
N-214	HPCI Turbine Exhaust	C	V-22-17(IPC) V-22-16(OPC)	8,048/11-14-88 (Combined)	8,048/11-14-88 (Combined)	See Note 2
N-214	HPCI Turbine Exhaust Vacuum Breaker	C	V-22-63(IPC)	725/10-08-88	725/10-08-88	
			V-22-64(OPC)	520/10-08-88	520/10-08-88	
N-219	HPCI/RCIC Exhaust	C	MO-2290B(IPC) MO-2290A(OPC)	430/10-11-88 150/10-11-88	430/10-11-88 410/12-09-88	Replaced torque switch, cleaned valve and lapped wedge, MOVATS testing
N-222	HPCI Condensate Return	C	V-22-22(IPC) V-22-21(OPC)	0/10-10-88 (Combined)	0/10-10-88 (combined)	See Note 2
N-229B	CAM Supply	C	SV-8107A(IPC)	<240/10-12-88	<25/11-17-88	Replaced O-Rings and coil assembly
			SV-8108A(OPC)	<240/10-12-88	<25/11-17-88	Replaced O-Rings and coil assembly
N-229C	CAM Return	C	SV-8109A(IPC) SV-8110A(OPC)	260/10-12-88 260/10-12-88	76/11-17-88 80/11-17-88	Rebuilt valve Rebuilt valve
N-229F	CAM Return	C	SV-8109B(IPC) SV-8110B(OPC)	<110/10-13-88 <110/10-13-88	32/11-17-88 28/11-17-88	Rebuilt valve Rebuilt valve
N-229G	CAM Supply	C	SV-8107B(IPC) SV-8108B(OPC)	<240/10-13-88 <240/10-13-88	0/11-17-88 0/11-17-88	Rebuilt valve Rebuilt valve

ATTACHMENT 4A
1988 LOCAL LEAKAGE RATE TEST DATA

Pen No.	System Name	Test Type	Equipment/ Valves (Note 1)	As found leakage (SCCM) / date	As left leakage (SCCM) / date	Remarks
N-229H	PASS Sample Return	C	SV-8772A(IPC) SV-8772B(OPC)	<240/10-13-88 <240/10-13-88	<240/10-13-88 <240/10-13-88	
N-231	Vacuum Breaker	C	CV-4304(IPC) V-43-169(OPC)	650/10-11-88 (Combined)	<150/11-30-88 (combined)	Adjusted regulators and replaced Miller 310 valve
N-231	Vacuum Breaker	C	CV-4305(IPC) V-43-168(OPC)	180/10-12-88 (Combined)	180/10-12-88 (combined)	

Notes:

1. (IPC) Inside Reactor Containment
   (OPC) Outside Reactor Containment

2. These valves were tested with water as the test medium. The test results are in cc/min.

3. Unable to measure the leakage rate because the valve would not close.

ATTACHMENT 4B
1988 LOCAL LEAKAGE RATE SUMMARY ANALYSIS

The as found LLRT, the repair, and the as left 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 as found and the as left leakage rates.

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). The inside barrier may be inside the containment or the innermost barrier of the two barriers outside the containment. See Attachment 4A.

6. No repair improvement credit is taken if the as left leakage rate is higher than the as found leakage rate. Only those penetrations where repairs were performed are included in this attachment.

7. If the as left leakage rate of a repaired valve is lower than the as left leakage rate of a valve that didn't require a repair, then the penetration net equivalent leakage is the difference between the as left leakage rates, or the repair improvement of the reworked valve.

8. For series valves tested together (i.e. combination test), the penetration net equivalent leakage is half the difference between the as found and the as left leakage rates when both valves are repaired at the same time (prior to performing another test).

9. When the summation of the leakage equivalent and the leakage measured during a successful Type A test is greater than L_a, the penetration(s) with excessive leakage(s) shall be analyzed under a failure analysis program.

10. All leakage rate values are in SCCM.

Conclusions:

The resulting net equivalent leakage of 178,171 SCCM or 1.123683 percent/day indicates that the as found ILRT test results determined by analysis are below the plant's maximum allowable leakage rate of 2.0 percent/day.

ATTACHMENT 4B
1988 LOCAL LEAKAGE RATE SUMMARY ANALYSIS

Pen Num.	System	Inside	Outside	Net	Notes
X-53	Drywell Head	-	18	18	
X-58D	Stabilizer Access Port	-	2,275	2,275	
X-58H	Stabilizer Access Port	-	85	85	
X-26	Drywell Purge Supply	-	21,850	21,850	
N-220	Torus Purge Supply	-	2,680	2,680	
X-7A	Main Steam	16,825	350,985	16,825	
X-7B	Main Steam	5,550	0	0	
X-7C	Main Steam	0	5310	0	
X-7D	Main Steam	18,905	0	0	
X-8	Steam Drain	0	13,850	0	
X-9A	Feedwater	384,390	1075	1075	
X-9B	Feedwater	371,695	129,000	129,000	
X-11	HPCI Steam	0	240	0	
X-11	HPCI Cond. Return	955	0	0	
X-16A	Core Spray	1,950	0	0	
X-16B	Core Spray	40	0	40	
X-19	Drywell Drain	17,425	0	0	
X-23B	Drywell Cooling Water Supply	13,425	575	575	Comb. Test
X-25	Drywell Purge Outlet	-	1,150	1,150	Comb. Test
X-26, N-220	Drywell & Torus Makeup	5700	1,250	1,250	
X-32F	Recirc. Pump B Seal	0	5,180	0	
X-42	Standby Liquid Control	0	2,000	0	
N-205	Torus Exhaust Outlet	-	135	135	Comb. Test
N-229B	CAM Supply	215	215	215	
N-229C	CAM Return	184	180	180	
N-229F	CAM Return	78	82	78	
N-229G	CAM Supply	240	240	240	
N-231	Vacuum Breaker	-	500	500	Comb. Test