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MURLEY, T. E. Office of Nuclear Reactor Regulation, Director (Post 870411)

SUBJECT: "Reactor Containment Bldg Integrated Leakage Rate Test, Types
 A, B & C Periodic Test." W/870901 ltr.

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September 1, 1987

NG-87-3096

Dr. Thomas E. Murley, Director
Office of Nuclear Reactor Regulation
Attention: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Duane Arnold Energy Center
Docket No. 50-331
Operating License No. DPR-49
Reactor Containment Building Integrated Leakage
Rate Test and Local Leakage Rate Test Report

File: A-103, T-23i

Dear Dr. Murley:

Transmitted with this letter is the summary technical report for the Duane Arnold Energy Center (DAEC) Reactor Containment Building Integrated Leakage Rate Test conducted during the 1987 refuel outage. Included in the report are the summary results for the Type B and C periodic tests. This report is submitted pursuant to the requirements of 10 CFR Part 50, Appendix J, Section V.B and the DAEC Technical Specifications Sections 6.11.3.d and 4.7.A.2.g.

Should you have any questions regarding the information provided, please contact this office.

Very Truly Yours,



William C. Rothert
Manager, Nuclear Division

WCR/EKK/bj

Attachment: Reactor Containment Building Integrated Leakage Rate Test

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1987 SEP -d V 8 12

APR 1988-02
F. 11

USNRC-DS

1987 SEP -9 A 9 45

**REACTOR CONTAINMENT BUILDING
INTEGRATED LEAKAGE PATE 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**

June 1987

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REFERENCES

1. 10CFR Part 50 , Appendix J, Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, October 22, 1980.
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, February 19, 1981.¹
5. Bechtel Corporation's Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants, BN-TOP-1, Revision 1, November 1, 1972.
6. NRC Letter, dated April 8, 1987, from R. A. Gilbert to L. Liu, "Technical Exemption from the Requirements of Appendix J".
7. Iowa Electric Letter, dated November 14, 1986, from R. W. McGaughy to H. Denton, "Technical Specification Change (RTS-213): Extension of Snubber Surveillance and Local Leak Rate Testing Intervals".
8. NRC Letter, dated January 30, 1987, from R. A. Gilbert to L. Liu, "Amendment 140 to Facility Operating License No. DPR-49".
9. STP No. 47A003, Containment Leak Tightness Test - Type B Penetrations, Duane Arnold Energy Center, Surveillance Test Procedure.
10. STP No. 47A004, Airlock Local Leak Rate Test, Duane Arnold Energy Center, Surveillance Test Procedure.
11. 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 June 1987 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's) conducted since July 1985 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 10CFR Part 50, Appendix J, Paragraph V.B.

ATTACHMENT 1A
TEST DATA SUMMARY

A. Plant Information

Operator	Iowa Electric Light & 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	June 1, 1987

B. Technical Data

- | | |
|--|-----------------|
| 1. Containment Net Free Air Volume as Tested | 218,100 cu. ft. |
| 2. Drywell Free Air Volume | 109,400 cu. ft. |
| 3. Torus Free Air Volume | 108,700 cu. ft. |
| 4. Design Pressure | 56 psig |
| 5. Calculated Peak Accident Pressure | 43 psig |
| 6. Containment Design Temperature | 281 °F |
| 7. 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 0923 hours on May 31, 1987 with a pressurization rate of approximately 6.0 psi per hour. At approximately 1030 hours, the reactor vessel level began increasing. This was attributed to the RHR system "keep-full" side ("A" side), which is at a higher pressure, leaking into the "shutdown cooling" side ("B" side). Later, at approximately 1445 hours, the "keep-full" side of the RHR system was secured.

At about 1100 hours on May 31, 1987, one of the two station air compressors was secured due to it continuously unloading. At approximately 1330 hours, the temporary diesel air compressor was started and the station air compressor was secured. This action was taken due to the diesel air compressor having a higher capacity than the station air compressor. A fairly constant pressurization rate of approximately 4.0 psi per hour was maintained.

Extensive investigations of all penetration areas for leakage were conducted during the pressurization period and throughout the Type A Test. Containment Spray System containment isolation valves MO-1902, 1933, 2000, and 2006 were soap bubble tested in accordance with Reference 6. Only a minor packing leakage was observed on MO-1902. Appropriate corrective action was taken after the completion of the Type A Test.

At approximately 1600 hours on May 31, 1987, the temporary diesel air compressor tripped. One of the station air compressors was then started. At about 1730 hours, the diesel air compressor was put back in service with a fairly constant pressurization rate of 6.0 psi per hour being maintained throughout the remainder of the pressurization period.

Primary containment pressurization equipment was secured at approximately 2005 hours on May 31, 1987 with a peak instantaneous pressure of 58.813 psia. The pressurization piping system was isolated and vented.

At 0015 hours on June 1, 1987, the procedural temperature stabilization criteria of Reference 2 was satisfied. Temperature, dewpoint, and pressure data were continuously recorded throughout the entire test period at 15 minute intervals.

The Type A Test was successfully completed at 0815 hours on June 1, 1987 with a Mass Point Upper Confidence Limit (UCL-MP) of 0.343649 percent/day and a Total Time Upper Confidence Limit (UCL-TT) of 0.432401 percent/day, (See Section 3.3, Test Results). Both the Mass Point and Total Time leakage rates were well below the 0.75 La acceptance criteria.

The Superimposed Leakage Verification Test was started at 0945 hours and was successfully completed at 1345 hours on June 1, 1987. The results of the verification test satisfied the requirements set forth in Reference 2, (See Section 3.3, Test Results).

Depressurization of the primary containment commenced at approximately 1444 hours on June 1, 1987, and was completed at 0800 hours on June 2, 1987.

Effect of the Volume on Test Results

As part of an ongoing review, the containment free air volume value was reduced after the June 1987 Type A Test from 218,100 cubic feet to 205,750 cubic feet. The volume was reduced due to a revision made to the calculation for determining torus free air volume as a function of water level. This lower volume value affects the Supplemental Test Results (See Section 3.3.2.3) and the Leakage Penalties that are added to the Upper Confidence Limit (See Section 3.3.2.4). Although this volume change was judged to be small, the impact on these test results were evaluated. The superimposed leakage verification test plus/minus limits increase by approximately 0.12, but still bound the composite leakage rate by a comfortable margin. The Leakage Penalties increase by less than 0.0015 percent/day.

A revised containment free air volume value will be used on future DAEC Type A Tests.

2.1.2 Conclusion

The June 1987 Duane Arnold Energy Center Type A Test was successfully completed, thus demonstrating the leak-tightness of the primary containment boundary. The Upper Confidence Levels (UCL) were well below the acceptance criteria of 1.5 percent/day as required by DAEC Technical Specification 4.7.A.2.a.8.

2.2 LOCAL LEAKAGE RATE TESTS (Types B and C)

The Local Leakage Rate Tests (LLRTs) of containment isolation valves and other primary containment penetrations were conducted as required by the methods described in the plant surveillance procedures for the Type B and C Tests.

Section 4 of this report summarizes the data for the LLRT's conducted since the July 1985 Type A Test in accordance with Appendix J to 10CFR Part 50, Paragraph V.B. Also contained in Section 4 of this report is the 1987 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, Shift Supervisor's Log, and Operator's Log.

May 30, 1987

- 1130 - Drywell interior inspection completed, no unusual conditions noted.
- 1620 - Performed LLRT on drywell access hatch; results were acceptable.

May 31, 1987

- 0630 - Secured drywell ventilation fans and unit coolers.
- 0738 - Secured CRD pump 1P-209B.
- 0805 - Secured RWCU pump 1P-205A.
- 0909 - Placed station air compressors in service for the ILRT.
- 0923 - Commenced pressurization of the primary containment through valve CV-4318.
- 1020 - Pressurization rate approximately 6.0 psi/hr.
- 1030 - Noticed reactor vessel level increasing due to RHR "A" side (keepfull) leaking into RHR "B" side (shutdown cooling).
- 1050 - Performed a leakage investigation of all accessible penetration areas during the pressurization sequence at 7 psig. No major leakage paths were identified.
- 1100 - Secured one station air compressor. Pressurization rate approximately 4.0 psi/hr.
- 1330 - Started temporary test diesel air compressor and secured station air compressor.
- 1440 - Performed a leakage investigation of all accessible penetration areas during the pressurization sequence at 20 psig. No major leakage paths were identified.
- 1445 - Secured RHR system "A" side (keep-full).

- 1600 - Temporary test diesel air compressor tripped, started one station air compressor.
- 1730 - Started temporary test diesel air compressor. Pressurization rate approximately 6.0 psi/hr.
- 2005 - Secured primary containment pressurization at a peak instantaneous pressure of 58.813 psia.
- 2015 - Vented pressurization penetration and began stabilization period.
- 2300 - Performed a leakage investigation of all accessible penetration areas. Observed minor packing leakage on MO-1902.

June 1, 1987

- 0015 - Satisfied primary containment stabilization criteria and began the ILRT test period.
- 0500 - Performed a leakage investigation of all accessible penetration areas. No major leakage paths were identified.
- 0815 - Successfully completed the ILRT
- 0838 - Initiated a 11.9 scfm flow for the Superimposed Leakage Verification Test.
- 0945 - Commenced the Superimposed Leakage Verification Test.
- 1345 - Successfully completed the Superimposed Leakage Verification Test.
- 1444 - Commenced primary containment depressurization.

June 2, 1987

- 0800 - Completed primary containment depressurization.

3.2 GENERAL TEST DESCRIPTION

3.2.1 Prerequisites

In accordance with the Duane Arnold Energy Center ILRT Procedure STP 47A002, the following is a listing of the pertinent prerequisites completed and documented prior to primary containment pressurization:

- a. Site meteorological data recorded during the performance of the ILRT (Attachment 3.2A).
- b. All required test instrumentation calibrated 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 STP 47A001.
- e. Pressurization system lined-up properly and ready for operation.
- f. RCS temperature maintained stable prior to and during the performance of the ILRT.
- g. Data acquisition and 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 or vented from the primary containment.
- m. Temperature survey satisfactorily performed.
- n. All required Types B and C leakage rate testing completed.
- o. Verification flowmeter installed.

3.2.2 Equipment and Instrumentation

Pressurization of the primary containment was achieved by the utilization of a permanent system consisting of two station air compressors with integral after-coolers and a temporary backup system consisting of one portable diesel air compressor and aftercooler. Both systems were manifolded to 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 2,775 standard cubic feet per minute (SCFM). Air was supplied to the primary containment through the plant's permanent Containment Atmosphere Control System, which includes additional components and instrumentation for monitoring and controlling containment pressurization.

The various containment parameters required to calculate primary containment leakage during the test, were monitored using instrumentation which consisted of 15 resistance temperature detectors, 6 dewpoint temperature sensors, and 2 absolute pressure quartz manometers. 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 suppression chamber are shown in Attachments 3.2C and 3.2D.

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

Instrument Selection Guide (ISG)

<u>Sensor Type</u>	<u>No. of Sensors</u>	<u>Accuracy Error</u>
Pressure	2	± 0.015% F.S.
Temperature	15	± 0.5°F
Dewpoint Temp - Drywell	4	± 5.0°F
- Torus	2	± 0.5°F

Test Length	8 hrs.
Test Pressure	57.696 psia
Test Temperature	80°F = 540°R

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

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

- a. EP = error associated with absolute pressure instruments

$$EP = (0.015\% \times 100) / \sqrt{2}$$

$$EP = 0.010607$$

b. ET = error associated with temperature instruments

$$ET = 0.5/\sqrt{15}$$

$$ET = 0.129100$$

c. EP_v = error associated with vapor pressure instruments

$$EP_v = (5.0 \times 0.01048 \times 4) + (0.5 \times 0.01634 \times 2)/6$$

$$EP_v = 0.037657 \text{ (ave.)}$$

$$EP_v = 0.037657/\sqrt{6}$$

$$EP_v = 0.015374$$

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

$$ISG = \pm \frac{2400}{8} \left[2 \left(\frac{0.010607}{57.696} \right)^2 + 2 \left(\frac{0.129100}{540} \right)^2 + 2 \left(\frac{0.015374}{57.696} \right)^2 \right]^{1/2}$$

ISG = ± 0.170502 which is less than 0.5%/day (25% of L_a)

3.2.3 Data Acquisition System

The Duane Arnold Energy Center ILRT sensor data were recorded at approximately 15 minute intervals during the test. A programable, multichannel data logger was used to scan and record data from the 15 resistance temperature detectors and 6 dewpoint temperature sensor signal inputs, along with manual local recordings of the 2 manometers. Data readings of the rotameter were also manually recorded.

3.2.4 Data Resolution System

The recorded data was inputted to our Engineering Consultant's portable computers for data reduction and leakage rate calculations. The computer program converted the dewpoint sensor millivolt signal to dewpoint temperature. Both the Mass Point and Total Time Analysis Methods 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 dewpoint temperature observations made during the ILRT. The air mass is computed using the ideal gas law as follows:

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

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, ft³

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:

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

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:

$$M = At + B \quad (\text{Eq. 3})$$

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 Students 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:

$$\text{Measured Leakage Rate} = 2400 \frac{(M_i - M_t)}{M_i(\Delta t)} \quad (\text{Eq. 4})$$

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:

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

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

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

<u>Date</u>	<u>Time</u>	<u>Ambient Temp. (DEGF)</u>	<u>Dewpoint Temp. (DEGF)</u>	<u>Barometric Pressure (in. Hg.)</u>	<u>General Weather Conditions</u>
May 31, 1987	1000	71.36	59.58	29.23	Sunny
	1100	73.70	60.28	29.25	Sunny
	1200	74.88	58.40	29.25	Sunny
	1300	78.78	57.72	29.24	Sunny
	1400	79.30	56.98	29.23	Sunny
	1500	81.14	57.50	29.22	Sunny
	1600	82.08	58.02	29.16	Sunny
	1700	81.70	57.78	29.15	Cloudy
	1800	80.46	60.18	29.14	Cloudy
	1900	78.08	64.14	29.13	Cloudy
	2000	73.84	59.80	29.12	Cloudy
	2100	69.82	56.98	29.11	Cloudy
	2200	70.02	56.60	29.12	Cloudy
	2300	68.06	54.08	29.15	Cloudy
June 1, 1987	0000	66.32	54.44	29.14	Cloudy
	0100	66.38	54.58	29.14	Cloudy
	0200	65.28	55.78	29.13	Cloudy
	0300	64.76	57.94	29.13	Cloudy
	0400	63.72	59.38	29.13	Rain
	0500	63.74	59.04	29.14	Cloudy
	0600	64.20	57.14	29.14	Cloudy
	0700	65.56	58.56	29.15	Cloudy
	0800	68.56	59.68	29.17	Cloudy
	0900	68.76	60.28	29.17	Cloudy
	1000	72.14	62.94	29.17	Sunny
	1100	75.10	63.86	29.15	Sunny
	1200	77.88	64.46	29.15	Sunny
	1300	79.60	65.82	29.13	Sunny
	1400	81.18	66.80	29.13	Sunny

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, using instrumentation traceable to the National Bureau of Standards.

<u>Instrument</u>	<u>Weight Factor</u>	<u>Channel</u>	<u>Zone</u>	<u>Azimuth</u>	<u>Elevation</u>	<u>Range</u>	<u>Accuracy</u>
A. <u>Temperature</u>							
T1	0.115	20	6	270	735	32-250F	±0.5F
T2	0.115	21	6	0	735	32-250F	±0.5F
T3	0.116	22	6	90	735	32-250F	±0.5F
T4	0.116	23	6	180	735	32-250F	±0.5F
T5	0.047	24	4	45	755	32-150F	±0.5F
T6	0.047	25	4	225	753	32-150F	±0.5F
T7	0.053	26	3	90	764	32-150F	±0.5F
T8	0.053	27	3	210	763	32-150F	±0.5F
T9	0.046	28	2	20	786	32-150F	±0.5F
T10	0.046	29	2	150	786	32-150F	±0.5F
T11	0.061	30	1	345	828	32-150F	±0.5F
T12	0.024	31	5	330	750	32-150F	±0.5F
T13*	0.046	32	2	290	787	32-150F	±0.5F
T14*	0.061	33	1	165	828	32-150F	±0.5F
T15*	0.054	34	3	315	766	32-150F	±0.5F
B. <u>Dewpoint</u>							
M1	0.130	10	A	340	809	0-100F	±5.0F
M2	0.130	13	A	160	809	0-100F	±5.0F
M3	0.139	11	B	225	753	0-100F	±5.0F
M4	0.139	12	B	45	755	0-100F	±5.0F
M5	0.231	14	C	270	735	0-100F	±5.0F
M6*	0.231	15	C	90	735	0-100F	±5.0F

* Temporary RTD and/or Dewpoint Sensors

ATTACHMENT 3.2B (Cont.)

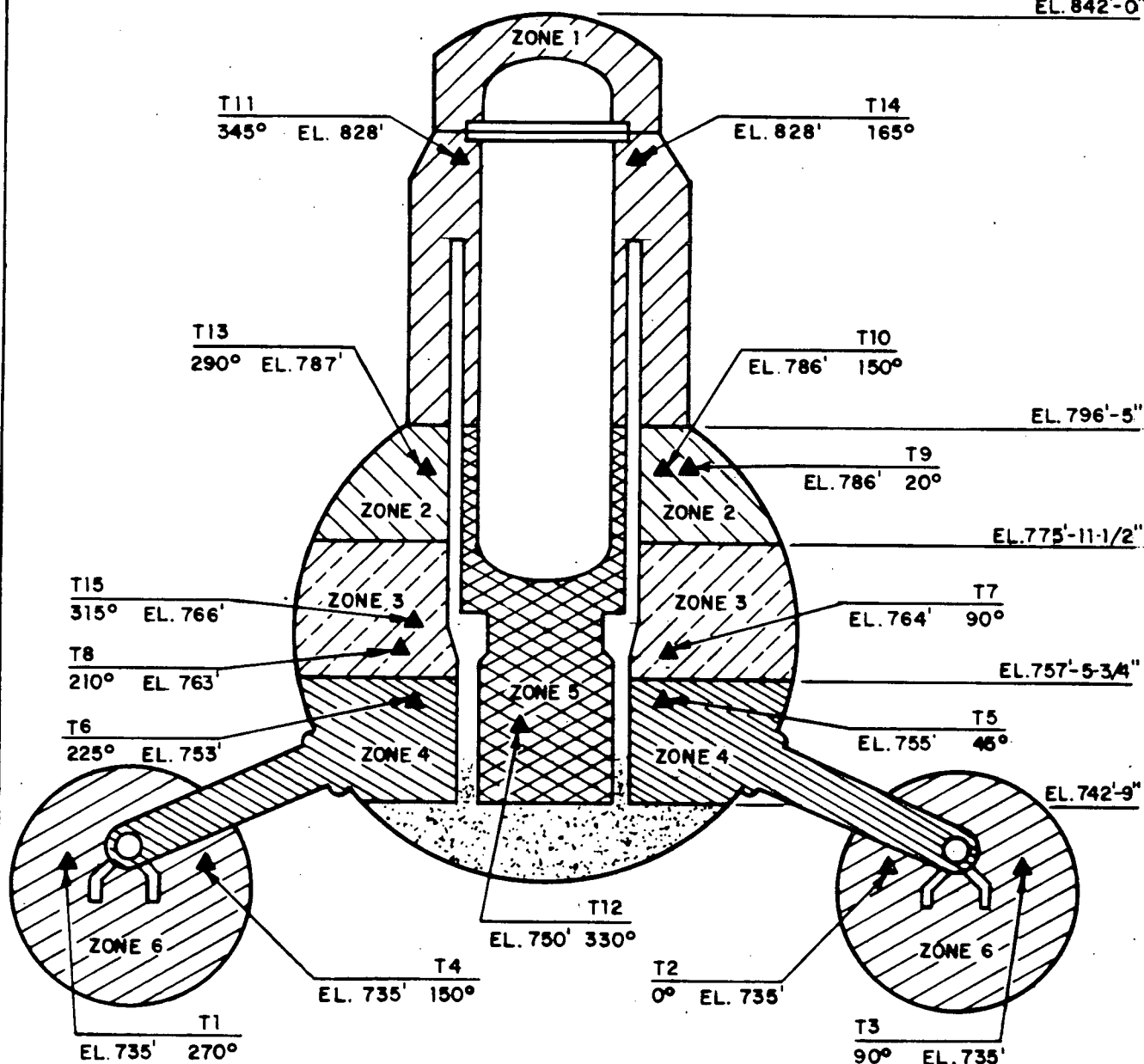
INSTRUMENTATION LIST

<u>Instrument</u>	<u>Weight Factor</u>	<u>Channel</u>	<u>Zone</u>	<u>Azimuth</u>	<u>Elevation</u>	<u>Range</u>	<u>Accuracy</u>
C. <u>Pressure</u>							
P1	0.500	Local	Drywell	-	-	0-100 psia	±0.02%
P2	0.500	Local	Torus	-	-	0-100 psia	±0.02%
D. <u>Superimposed Leakage Verification Test Flow Instrument</u>							
Rotameter	-	Local	Drywell	-	-	5-19 scfm	±1.0% F.S.

Notes:

1. T1 and T3 data readings were also used in place of M5 and M6 respectively, since the torus atmosphere was at saturated conditions.

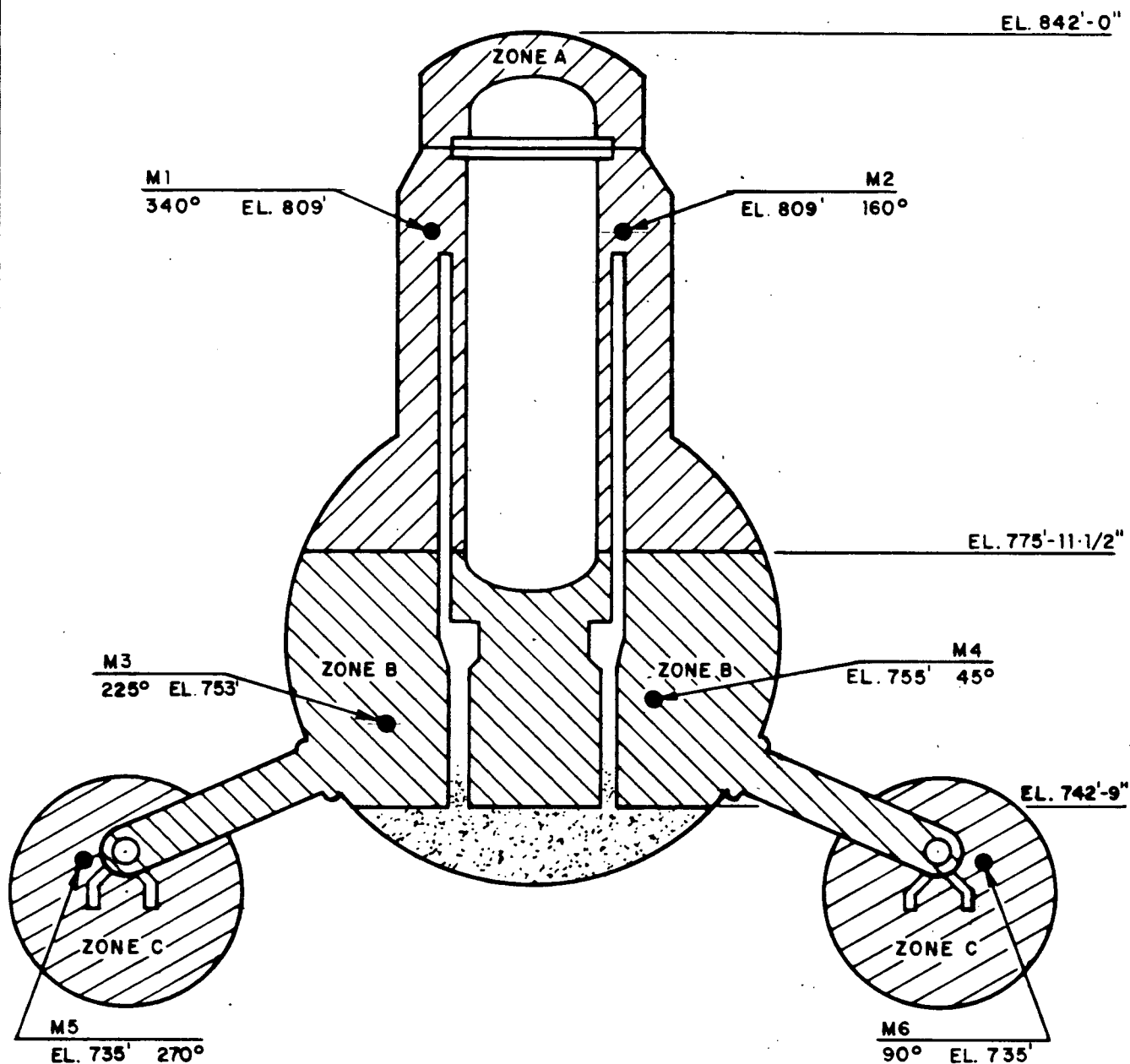
EL. 842'-0"



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
DUANE ARNOLD ENERGY CENTER

3.3

TEST RESULTS

3.3.1 Presentation of Test Results

The test data for the June 1987 ILRT is based on an 8 hour test period starting at 0015 hours on June 1, 1987. The final test results were determined using the 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 the Duane Arnold Energy Center surveillance test procedure STP 47A002. The results for the ILRT and for the Supplemental Test are shown below.

3.3.2.1 ILRT Results - Mass Point Analysis

<u>Item</u>	<u>(Percent/Day)</u>
1. Lam, Leakage Rate Calculated	0.333251
2. UCL, Upper Confidence Level	0.010398
3. UCL-MP, Lam Leakage Rate plus UCL (1&2)	0.343649
4. Corrections for: (See Section 3.3.2.4)	
i. Type B Penalties	0.000000
ii. Type C Penalties	0.022960
iii. Water Levels	0.047412
iv. Total Corrections (i. through iii.)	0.070372
5. Total Reported Type A Leakage Rate (Items 3&4.iv.)	0.414021

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

<u>Item</u>	<u>(Percent/Day)</u>
1. La, Leakage Rate Calculated	0.350787
2. UCL, Upper Confidence Level	0.081614
3. UCL-TT, Lam Leakage Rate plus UCL (1&2)	0.432401
4. Corrections for: (See Section 3.3.2.4)	
i. Type B Penalties	0.000000
ii. Type C Penalties	0.022960
iii. Water Levels	0.047412
iv. Total Corrections (i. through iii.)	0.070372
5. Total Reported Type A Leakage Rate (Items 3&4.iv.)	0.502773

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 surveillance test procedure STP 47A002. 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 (computer)

$$(L_{am} - MP = 0.333251 \text{ \%/day})$$

$$(L_{am} - TT = 0.350787 \text{ \%/day})$$

L_o = Superimposed leakage rate developed from rotameter

$$(L_o = 2.000352 \text{ \%/day})$$

L_a = Maximum allowable leakage rate

$$(L_a = 2.0 \text{ \%/day})$$

L_c = Composite leakage (computer)

$$(L_c - MP = 2.241619 \text{ \%/day})$$

$$(L_c - TT = 2.304634 \text{ \%/day})$$

a. Mass Point

$$(0.333251 + 2.000352 - 0.5) \leq 2.241619 \leq (0.333251 + 2.000352 + 0.5)$$

$$(1.833603) \leq 2.241619 \leq (2.833603)$$

b. Total Time

$$(0.350787 + 2.000352 - 0.5) \leq 2.230463 \leq (0.350787 + 2.000352 + 0.5)$$

$$(1.851139) \leq 2.304634 \leq (2.851139)$$

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. <u>Type B Penalties</u>	<u>Description</u>	<u>Leakage SCCM</u>
	Resilient Seals	0.0
	Total Type B Leakage	0.0 SCCM
	Total Type B Leakage	0.0 percent/day

ii.	<u>Type C Penalties</u>	<u>Description</u>	<u>Leakage SCCM</u>
	X-9A	Feedwater	850
	X-9B	Feedwater	370
	X-10	RCIC STM.	0
	X-11	HPCI STM.	0
	X-16A	Core Spray	<150
	X-16B	Core Spray	<41
	X-23A	RBCCW	155
	X-23B	RBCCW	225
	X-24A	RBCCW	350
	X-24B	RBCCW	70
	X-32D	N ₂ Comp. Suct.	54
	X-32E	Recirc. Pump Seal	0
	X-36	CRD Return	<29.8
	X-40C	Jet Pump	0
	X-40D	Jet Pump	<150
	X-41	Recirc. Loop Sample	80
	X-219	HPCI/RCIC Vac. Bkr.	1300
	X-229H	PASS	<41
Total Type C Leakage <3865.8 SCCM			
Total Type C Leakage <0.022960 percent/day			

iii. <u>Water Level Corrections</u>	<u>Description</u>	<u>Leakage Gallons</u>
	Rx Vessel	0.0
	D.W. Equip. Sump	861
	D.W. Floor Sump	299
	Torus	0.0
	Total Water Level Corrections 1160 Gallons	
	Total Water Level Corrections 0.047412 percent/day	

iv.	<u>Total Corrections</u>	<u>Description</u>	<u>Leakage Percent/Day</u>
	Total Type A Corrections (i. through iii.)	Penalties and Corrections	0.070372

Total Type A Corrections 0.070372 percent/day

ATTACHMENT 3.3A

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87	00:15								
20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
80.150	80.120	80.340	79.510	72.920	70.550	78.250	77.870	87.030	87.450
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.460	71.240	86.630	101.570	77.550	65.350	66.710	63.930	62.550	80.150
15-M06	P1	P2							
80.340	58.559	58.547							

06/01/87	00:30								
20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
80.070	80.050	80.260	79.440	72.910	70.570	78.240	77.870	87.060	87.510
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.540	71.220	86.670	101.610	77.550	65.350	66.590	63.790	62.360	80.070
15-M06	P1	P2							
80.260	58.554	58.542							

06/01/87	00:45								
20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
80.010	79.980	80.200	79.380	72.890	70.560	78.240	77.860	87.090	87.530
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.570	71.160	86.690	101.630	77.540	65.380	66.510	63.380	62.170	80.010
15-M06	P1	P2							
80.200	58.550	58.537							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 01:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.960	79.940	80.140	79.340	72.890	70.470	78.240	77.890	87.140	87.570
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.590	71.170	86.740	101.710	77.550	65.220	66.790	63.580	62.060	79.960
15-M06	P1	P2							
80.140	58.546	58.534							

06/01/87 01:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.910	79.890	80.130	79.290	72.870	70.470	78.250	77.860	87.200	87.640
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.770	71.150	86.800	101.770	77.550	65.470	66.730	63.790	62.250	79.910
15-M06	P1	P2							
80.130	58.543	58.531							

06/01/87 01:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.870	79.850	80.070	79.240	72.880	70.450	78.240	77.870	87.260	87.680
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.740	71.140	86.850	101.790	77.540	65.400	66.590	63.420	62.190	79.870
15-M06	P1	P2							
80.070	58.538	58.528							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 01:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.810	79.810	80.020	79.210	72.770	70.400	78.240	77.870	87.300	87.740
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.870	71.130	86.910	101.780	77.550	65.610	66.690	62.450	62.480	79.810
15-M06	P1	P2							
80.020	58.536	58.525							

06/01/87 02:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.750	79.780	79.960	79.170	72.770	70.390	78.240	77.870	87.360	87.780
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.830	71.100	86.950	101.840	77.550	65.480	66.730	63.410	62.520	79.750
15-M06	P1	P2							
79.960	58.534	58.522							

06/01/87 02:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.730	79.730	79.920	79.130	72.790	70.390	78.250	77.880	87.420	87.840
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.000	71.110	87.010	101.840	77.550	65.530	66.670	62.930	62.630	79.730
15-M06	P1	P2							
79.920	58.532	58.518							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 02:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.680	79.710	79.910	79.100	72.770	70.430	78.250	77.880	87.480	87.890
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.980	71.080	87.060	101.900	77.550	65.560	67.020	63.660	62.210	79.680
15-M06	P1	P2							
79.910	58.528	58.516							

06/01/87 02:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.630	79.670	79.850	79.060	72.750	70.360	78.260	77.890	87.530	87.930
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.950	71.070	87.120	101.950	77.550	65.600	66.750	63.190	62.300	79.630
15-M06	P1	P2							
79.850	58.526	58.514							

06/01/87 03:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.610	79.630	79.830	79.030	72.690	70.330	78.260	77.900	87.570	87.970
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
103.950	71.070	87.160	101.990	77.570	65.470	66.800	64.310	62.310	79.610
15-M06	P1	P2							
79.830	58.523	58.511							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 03:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.590	79.620	79.800	79.010	72.710	70.320	78.280	77.910	87.640	88.050
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.040	71.050	87.220	102.020	77.570	65.650	66.860	64.850	62.310	79.590
15-M06	P1	P2							
79.800	58.521	58.508							

06/01/87 03:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.560	79.590	79.780	78.980	72.740	70.310	78.270	77.910	87.680	88.090
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.040	71.030	87.260	102.020	77.580	65.700	67.030	64.820	62.050	79.560
15-M06	P1	P2							
79.780	58.518	58.504							

06/01/87 03:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.530	79.570	79.740	78.950	72.670	70.360	78.280	77.910	87.730	88.120
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.140	71.020	87.310	102.060	77.570	65.490	67.000	63.770	62.550	79.530
15-M06	P1	P2							
79.740	58.515	58.502							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 04:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.500	79.550	79.740	78.940	72.620	70.250	78.280	77.910	87.770	88.160
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.110	71.030	87.360	102.070	77.590	65.490	66.800	63.820	62.250	79.500
15-M06	P1	P2							
79.740	58.514	58.500							

06/01/87 04:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.490	79.540	79.700	78.920	72.650	70.320	78.290	77.910	87.820	88.190
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.100	71.020	87.390	102.120	77.590	65.480	67.110	63.160	62.050	79.490
15-M06	P1	P2							
79.700	58.511	58.498							

06/01/87 04:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.490	79.520	79.680	78.910	72.680	70.280	78.300	77.930	87.850	88.220
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.150	71.020	87.430	102.140	77.590	65.860	66.780	62.790	62.280	79.490
15-M06	P1	P2							
79.680	58.509	58.496							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 04:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.460	79.500	79.670	78.890	72.630	70.250	78.300	77.930	87.880	88.250
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.170	70.990	87.440	102.100	77.600	65.920	67.070	64.130	62.640	79.460
15-M06	P1	P2							
79.670	58.506	58.493							

06/01/87 05:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.450	79.490	79.650	78.880	72.590	70.240	78.310	77.930	87.910	88.300
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.180	71.020	87.480	102.150	77.620	65.800	66.950	64.190	62.600	79.450
15-M06	P1	P2							
79.650	58.504	58.490							

06/01/87 05:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.430	79.460	79.630	78.860	72.660	70.250	78.300	77.930	87.930	88.310
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.230	70.990	87.510	102.180	77.610	65.990	66.860	62.600	62.160	79.430
15-M06	P1	P2							
79.630	58.501	58.488							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 05:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.420	79.460	79.610	78.860	72.620	70.270	78.320	77.940	87.960	88.350
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.260	70.990	87.550	102.190	77.630	65.950	66.890	62.620	62.010	79.420
15-M06	P1	P2							
79.610	58.486	58.484							

06/01/87 05:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.400	79.460	79.590	78.830	72.630	70.180	78.320	77.940	88.010	88.360
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.280	70.990	87.580	102.210	77.620	65.890	67.200	64.580	62.030	79.400
15-M06	P1	P2							
79.590	58.497	58.484							

06/01/87 06:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.390	79.450	79.590	78.820	72.600	70.220	78.320	77.940	88.040	88.400
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.240	71.000	87.620	102.230	77.630	66.020	67.330	63.960	62.790	79.390
15-M06	P1	P2							
79.590	58.496	58.482							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 06:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.370	79.420	79.570	78.810	72.580	70.180	78.330	77.950	88.100	88.450
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.280	70.990	87.660	102.230	77.630	65.830	67.240	65.070	61.970	79.370
15-M06	P1	P2							
79.570	58.495	58.480							

06/01/87 06:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.360	79.410	79.550	78.790	72.620	70.160	78.330	77.950	88.140	88.490
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.290	70.970	87.690	102.270	77.630	66.130	66.980	63.790	61.600	79.360
15-M06	P1	P2							
79.550	58.493	58.478							

06/01/87 06:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.340	79.400	79.540	78.780	72.600	70.190	78.330	77.950	88.160	88.540
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.350	70.950	87.730	102.310	77.620	65.680	67.240	63.200	61.080	79.340
15-M06	P1	P2							
79.540	58.492	58.477							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 07:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.330	79.380	79.530	78.770	72.550	70.130	78.330	77.950	88.210	88.580
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.320	70.960	87.780	102.310	77.630	66.000	67.190	66.390	61.600	79.330
15-M06	P1	P2							
79.530	58.490	58.476							

06/01/87 07:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.320	79.380	79.520	78.770	72.560	70.120	78.340	77.960	88.260	88.640
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.330	70.940	87.830	102.320	77.640	65.880	67.150	64.390	62.380	79.320
15-M06	P1	P2							
79.520	58.488	58.474							

06/01/87 07:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.320	79.380	79.500	78.750	72.540	70.130	78.350	77.960	88.300	88.680
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.360	70.940	87.870	102.350	77.640	66.030	67.360	63.940	61.930	79.320
15-M06	P1	P2							
79.500	58.486	58.472							

ATTACHMENT 3.3A (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT MEASURED INPUT DATA

06/01/87 07:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.320	79.370	79.500	78.750	72.520	70.140	78.360	77.970	88.360	88.720
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.360	70.950	87.920	102.360	77.650	65.930	67.200	63.760	62.650	79.320
15-M06	P1	P2							
79.500	58.484	58.470							

06/01/87 08:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.290	79.360	79.490	78.750	72.590	70.180	78.370	77.980	88.410	88.760
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.370	70.940	87.960	102.380	77.650	65.980	67.110	64.330	62.370	79.290
15-M06	P1	P2							
79.490	58.483	58.469							

06/01/87 08:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.280	79.360	79.490	78.730	72.550	70.140	78.370	77.980	88.450	88.830
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.390	70.930	88.020	102.290	77.660	66.150	67.440	63.240	62.300	79.280
15-M06	P1	P2							
79.490	58.481	58.467							

ATTACHMENT 3.3B

Duane Arnold Energy Center - 1987 ILRT

FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT REDUCED INPUT VARIABLES

<u>Time</u> <u>(hh:mm)</u>	<u>Press</u> <u>(PSIA)</u>	<u>V.P.</u> <u>(PSIA)</u>	<u>Temp.</u> <u>(R)</u>	<u>Dewpoint</u> <u>(F)</u>	<u>Mass</u> <u>(LbM)</u>
00:15	58.553	0.3866	541.946	71.859	63182.96
00:30	58.548	0.3853	541.923	71.761	63181.57
00:45	58.543	0.3838	541.896	71.645	63181.50
01:00	58.540	0.3839	541.884	71.651	63179.03
01:15	58.537	0.3847	541.885	71.715	63174.75
01:30	58.533	0.3833	541.868	71.604	63173.98
01:45	58.531	0.3822	541.853	71.523	63174.10
02:00	58.528	0.3835	541.837	71.622	63171.83
02:15	58.525	0.3826	541.840	71.554	63169.24
02:30	58.522	0.3837	541.837	71.640	63165.13
02:45	58.520	0.3823	541.819	71.529	63166.61
03:00	58.517	0.3841	541.811	71.666	63162.33
03:15	58.514	0.3853	541.819	71.762	63157.27
03:30	58.511	0.3851	541.813	71.742	63154.55
03:45	58.508	0.3834	541.811	71.614	63153.82
04:00	58.507	0.3825	541.802	71.547	63154.15
04:15	58.505	0.3814	541.805	71.459	63152.31
04:30	58.502	0.3811	541.809	71.437	63150.02
04:45	58.499	0.3846	541.798	71.709	63144.26
05:00	58.497	0.3842	541.801	71.673	63141.71
05:15	58.495	0.3806	541.799	71.397	63143.01
05:30	58.485	0.3803	541.805	71.373	63132.40
05:45	58.490	0.3842	541.799	71.674	63134.88
06:00	58.489	0.3848	541.800	71.719	63132.42
06:15	58.487	0.3848	541.798	71.720	63131.06
06:30	58.486	0.3818	541.799	71.490	63131.99
06:45	58.484	0.3795	541.803	71.311	63132.92
07:00	58.483	0.3865	541.797	71.852	63124.34
07:15	58.481	0.3839	541.804	71.650	63124.20
07:30	58.479	0.3829	541.809	71.573	63122.63
07:45	58.477	0.3833	541.816	71.606	63119.11
08:00	58.476	0.3837	541.824	71.634	63116.71
08:15	58.474	0.3824	541.821	71.539	63116.28

ATTACHMENT 3.3C

Duane Arnold Energy Center - 1987 ILRT

FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT ABSOLUTE TEST METHOD, MASS POINT ANALYSIS TEST RESULTS

<u>Time</u> <u>(hh:mm)</u>	<u>Mass</u> <u>(LbM)</u>	<u>Leakage</u> <u>(PCT./DAY)</u>	<u>Confidence</u> <u>(PCT./DAY)</u>	<u>UCL</u> <u>(PCT./DAY)</u>
00:15	63182.96	0.000000	0.000000	0.000000
00:30	63181.57	0.000000	0.000000	0.000000
00:45	63181.50	0.110410	0.492917	0.603327
01:00	63179.03	0.180104	0.140580	0.320684
01:15	63174.75	0.288072	0.160504	0.448576
01:30	63173.98	0.294469	0.095460	0.389929
01:45	63174.10	0.263268	0.073405	0.336673
02:00	63171.83	0.256989	0.053231	0.310220
02:15	63169.24	0.263180	0.040768	0.303948
02:30	63165.13	0.286020	0.040253	0.326273
02:45	63166.61	0.275287	0.034333	0.309620
03:00	63162.33	0.283531	0.029533	0.313064
03:15	63157.27	0.304485	0.032921	0.337406
03:30	63154.55	0.320761	0.032609	0.353370
03:45	63153.82	0.326088	0.028584	0.354672
04:00	63154.15	0.321357	0.025322	0.346679
04:15	63152.31	0.317298	0.022604	0.339902
04:30	63150.02	0.314988	0.020137	0.335125
04:45	63144.26	0.322180	0.019346	0.341526
05:00	63141.71	0.328342	0.018415	0.346757
05:15	63143.01	0.326074	0.016763	0.342837
05:30	63132.40	0.339619	0.020321	0.359940
05:45	63134.88	0.342141	0.018676	0.360817
06:00	63132.42	0.344401	0.017228	0.361629
06:15	63131.06	0.344895	0.015825	0.360720
06:30	63131.99	0.341129	0.015047	0.356176
06:45	63132.92	0.334310	0.015450	0.349760
07:00	63124.34	0.336015	0.014422	0.350437
07:15	63124.20	0.335214	0.013431	0.348645
07:30	63122.63	0.333939	0.012581	0.346520
07:45	63119.11	0.334112	0.011756	0.345868
08:00	63116.71	0.334427	0.011012	0.345439
08:15	63116.28	0.333251	0.010398	0.343649

ATTACHMENT 3.3D

Duane Arnold Energy Center - 1987 ILRT

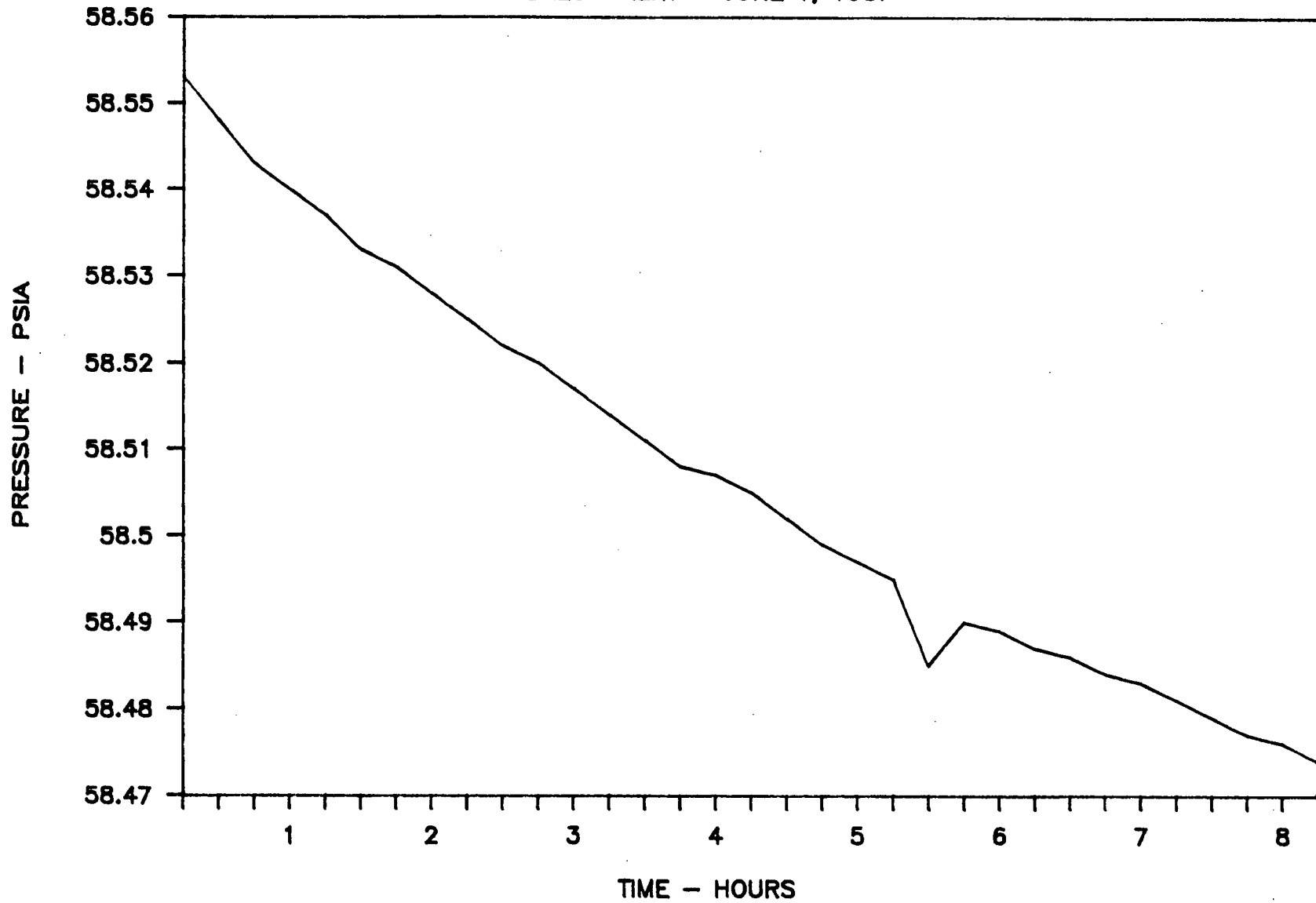
FROM 00:15 HOURS TO 08:15 HOURS ON 06/01/87

ILRT ABSOLUTE TEST METHOD, TOTAL TIME ANALYSIS TEST RESULTS

<u>Time</u> <u>(hh:mm)</u>	<u>Mass</u> <u>(LbM)</u>	<u>Meas.Leak.</u> <u>(PCT./DAY)</u>	<u>Calc.Leak.</u> <u>(PCT./DAY)</u>	<u>Confidence</u> <u>(PCT./DAY)</u>	<u>UCL</u> <u>(PCT./DAY)</u>
00:15	63182.96	0.000000	0.000000	0.000000	0.000000
00:30	63181.57	0.210197	0.000000	0.000000	0.000000
00:45	63181.50	0.110409	0.000000	0.000000	0.000000
01:00	63179.03	0.198935	0.167550	0.744764	0.912314
01:15	63174.75	0.311768	0.266813	0.399350	0.666163
01:30	63173.98	0.272798	0.286133	0.256051	0.542184
01:45	63174.10	0.224318	0.269304	0.221844	0.491148
02:00	63171.83	0.241405	0.266616	0.187638	0.454254
02:15	63169.24	0.260458	0.272285	0.162008	0.434293
02:30	63165.13	0.300868	0.290817	0.143838	0.434655
02:45	63166.61	0.248360	0.284990	0.136656	0.421646
03:00	63162.33	0.284932	0.292098	0.125413	0.417511
03:15	63157.27	0.325194	0.308891	0.117234	0.426125
03:30	63154.55	0.331963	0.323109	0.109863	0.432972
03:45	63153.82	0.316156	0.329691	0.104017	0.433708
04:00	63154.15	0.291741	0.328669	0.102478	0.431147
04:15	63152.31	0.291006	0.327441	0.100997	0.428438
04:30	63150.02	0.294357	0.326962	0.099039	0.426001
04:45	63144.26	0.326632	0.332997	0.095039	0.428036
05:00	63141.71	0.329798	0.338440	0.091546	0.429986
05:15	63143.01	0.303427	0.337933	0.090636	0.428569
05:30	63132.40	0.365755	0.348429	0.088148	0.436577
05:45	63134.88	0.332009	0.351474	0.086032	0.437506
06:00	63132.42	0.333836	0.354251	0.084168	0.438419
06:15	63131.06	0.328559	0.355697	0.082980	0.438677
06:30	63131.99	0.309765	0.354008	0.083747	0.437755
06:45	63132.92	0.292409	0.349917	0.086285	0.436202
07:00	63124.34	0.329873	0.351500	0.084799	0.436299
07:15	63124.20	0.318819	0.351318	0.084168	0.435486
07:30	63122.63	0.316052	0.350723	0.083755	0.434478
07:45	63119.11	0.323355	0.351055	0.082859	0.433914
08:00	63116.71	0.324681	0.351454	0.081962	0.433416
08:15	63116.28	0.316580	0.350787	0.081614	0.432401

CONTAINMENT PRESSURE vs. TIME

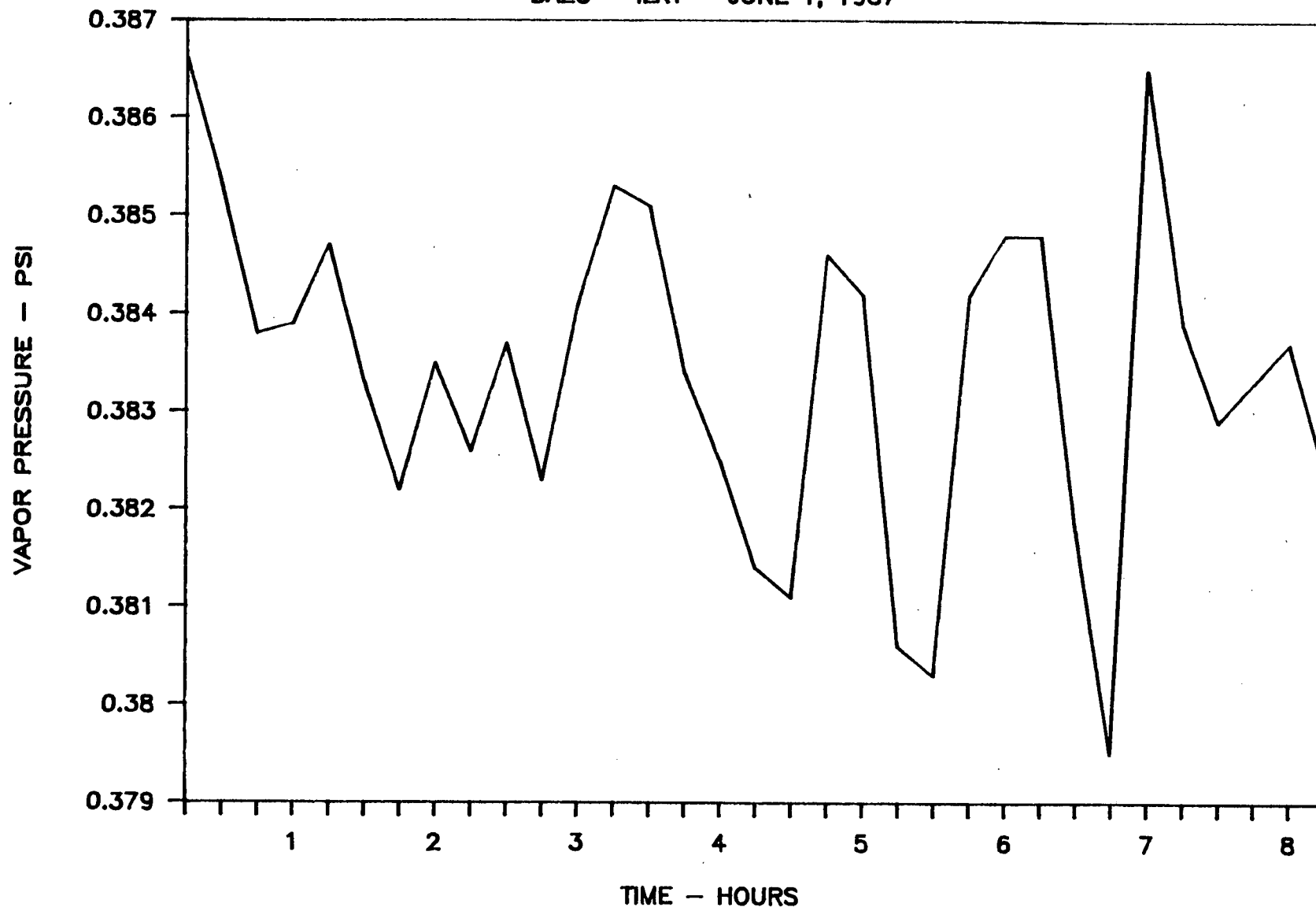
DAEC - ILRT - JUNE 1, 1987



ATTACHMENT 3.3E
GRAPH 1

CONTAINMENT VAPOR PRESSURE vs. TIME

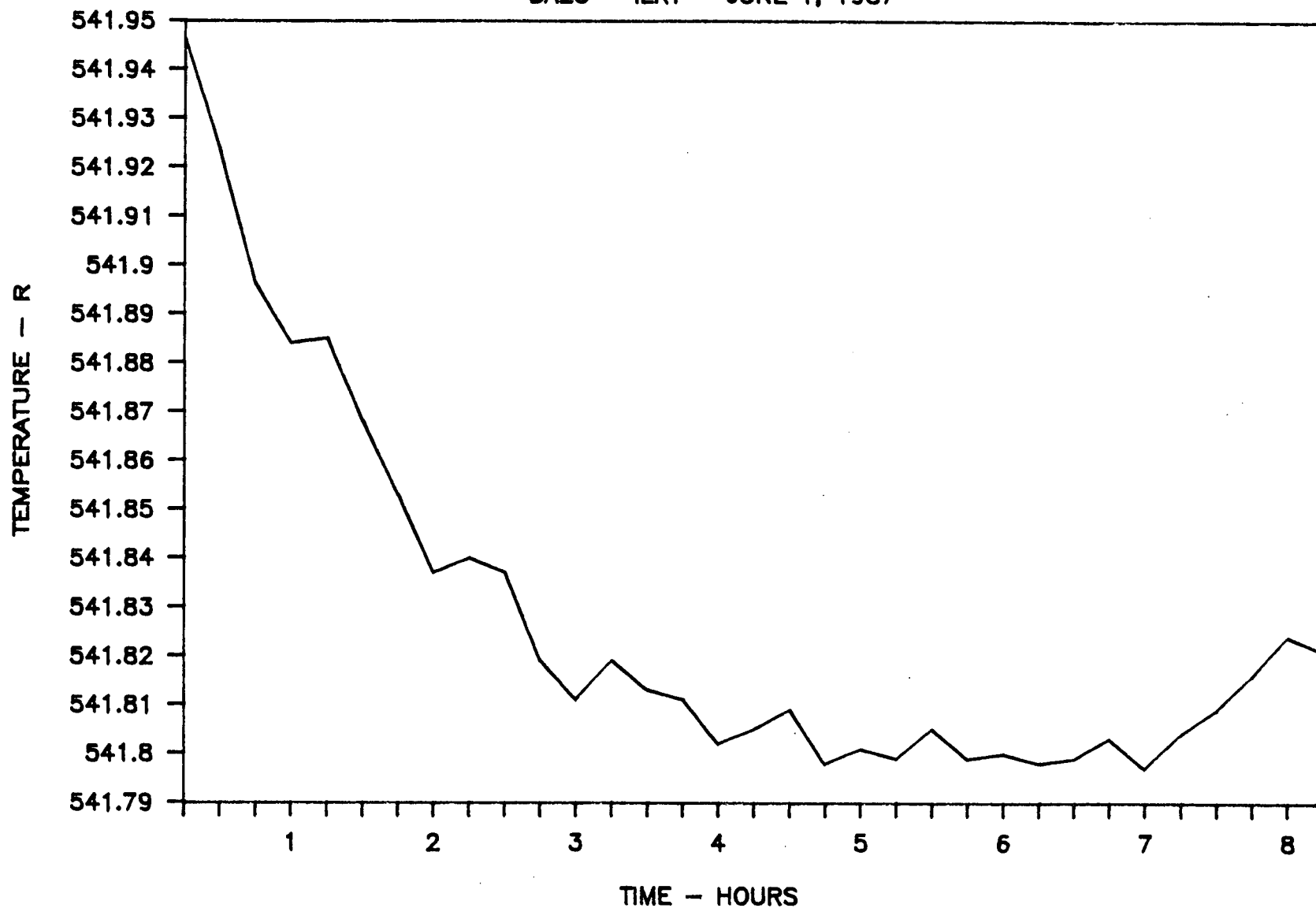
DAEC - ILRT - JUNE 1, 1987



ATTACHMENT 3.3F
GRAPH 2

CONTAINMENT TEMPERATURE vs. TIME

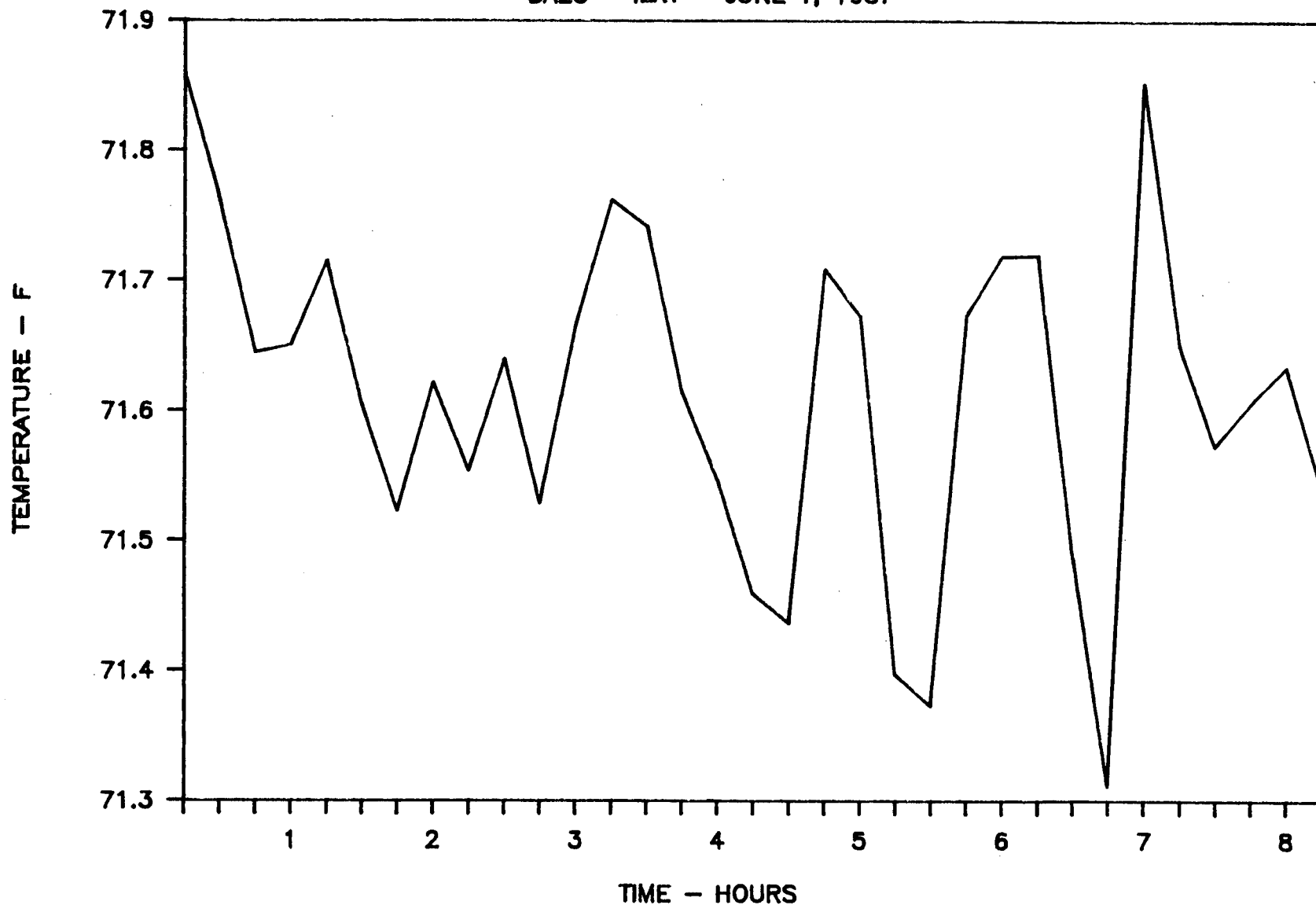
DAEC - ILRT - JUNE 1, 1987



ATTACHMENT 3.3G
GRAPH 3

CONTAINMENT DEWPOINT TEMP. vs. TIME

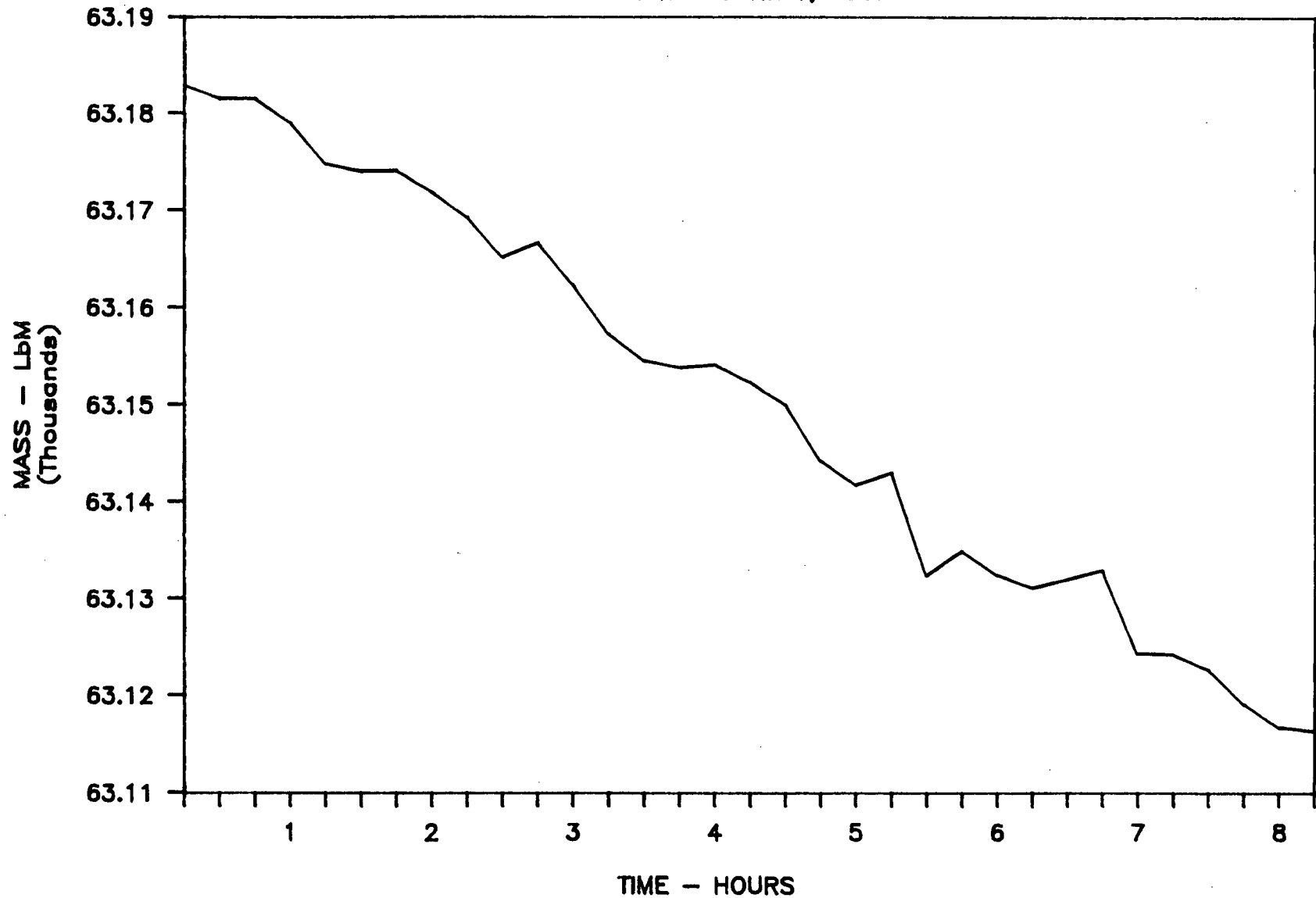
DAEC - ILRT - JUNE 1, 1987



ATTACHMENT 3.3H
GRAPH 4

CONTAINMENT MASS vs. TIME

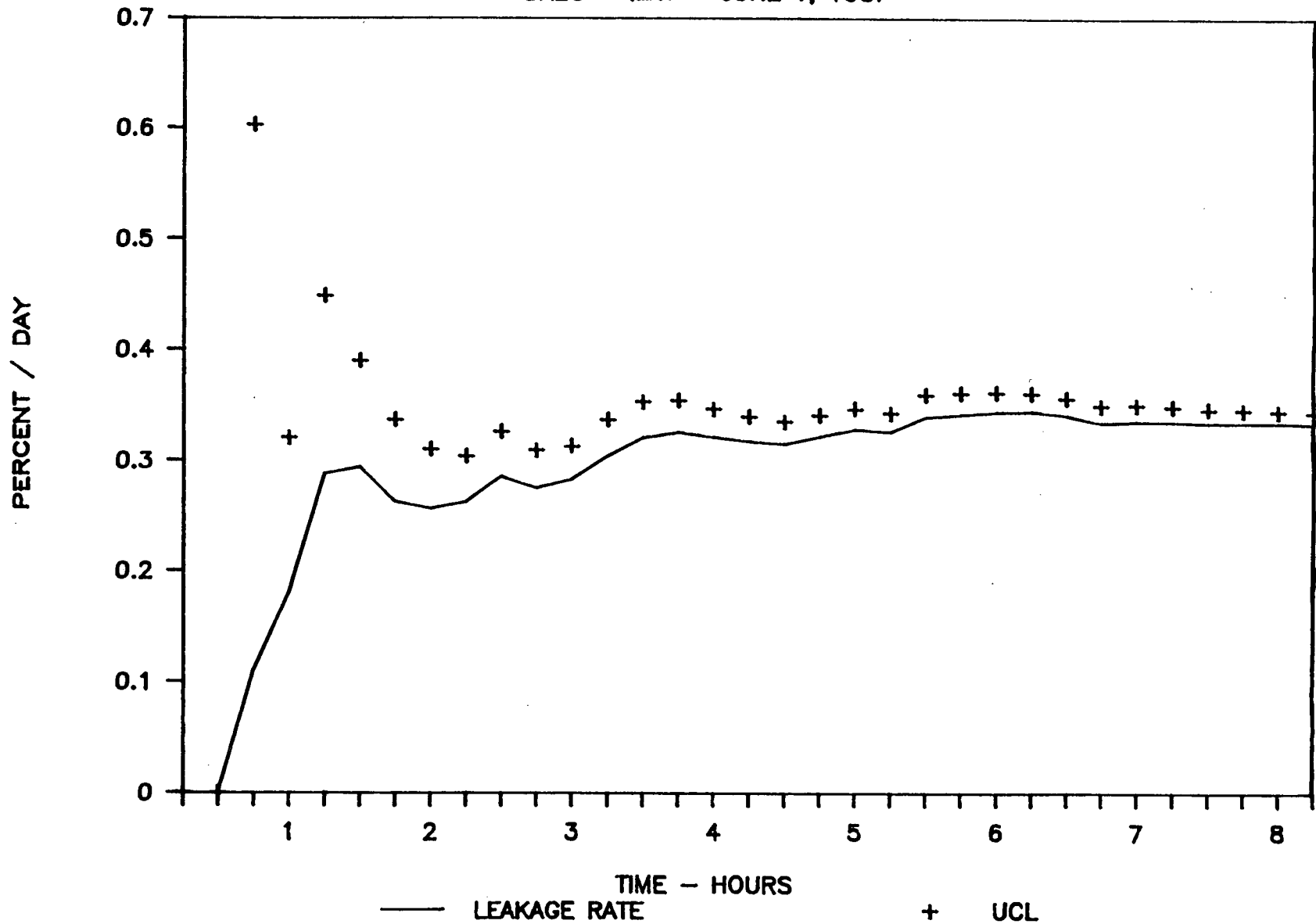
DAEC - ILRT - JUNE 1, 1987



ATTACHMENT 3.3I
GRAPH 5

MASS POINT LEAKAGE & UCL

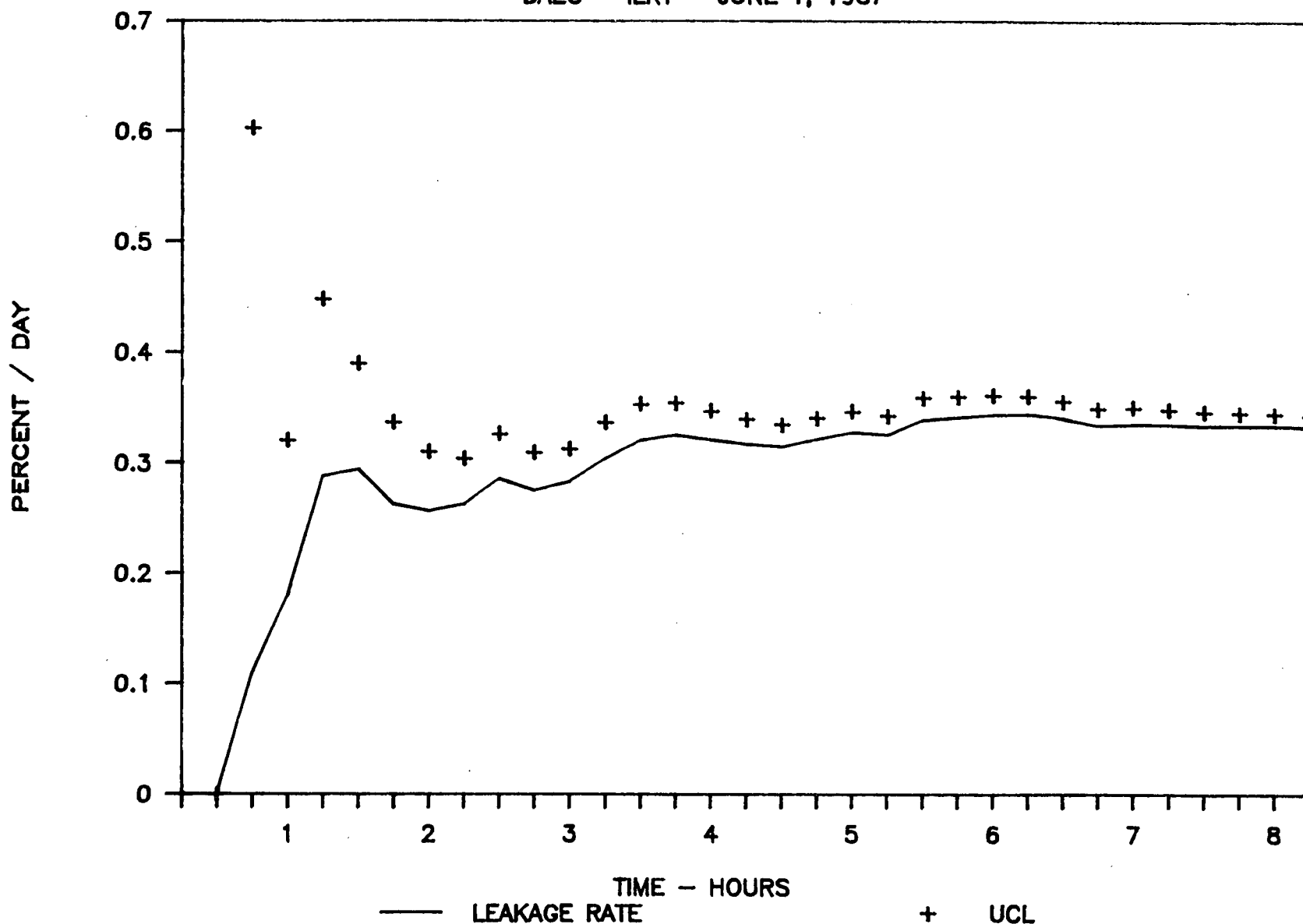
DAEC - ILRT - JUNE 1, 1987



ATTACHMENT 33J
GRAPH 6

TOTAL TIME LEAKAGE & UCL

DAEC - ILRT - JUNE 1, 1987



ATTACHMENT 3.3K
GRAPH 7

ATTACHMENT 3.3L

Duane Arnold Energy Center - 1987 ILRT
FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

VERIFICATION TEST MEASURED INPUT DATA

06/01/87 09:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.210	79.290	79.420	78.670	72.520	70.110	78.390	78.000	88.610	88.980
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.450	70.900	88.190	102.360	77.680	66.420	67.310	64.810	62.000	79.210
15-M06	P1	P2							
79.420	58.417	58.406							

06/01/87 10:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.210	79.290	79.400	78.660	72.520	70.120	78.400	78.000	88.620	88.990
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.480	70.910	88.210	102.370	77.680	66.340	67.200	64.010	62.100	79.210
15-M06	P1	P2							
79.400	58.405	58.393							

06/01/87 10:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.200	79.280	79.400	78.660	72.550	70.130	78.400	78.010	88.670	89.020
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.480	70.890	88.220	102.320	77.680	65.880	67.550	64.360	62.550	79.200
15-M06	P1	P2							
79.400	58.392	58.380							

ATTACHMENT 3.3L (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

VERIFICATION TEST MEASURED INPUT DATA

06/01/87 10:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.200	79.270	79.410	78.650	72.500	70.070	78.400	78.030	88.700	89.060
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.490	70.920	88.250	102.340	77.690	66.000	67.700	66.380	61.420	79.200
15-M06	P1	P2							
79.410	58.379	58.368							

06/01/87 10:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.180	79.260	79.390	78.650	72.500	70.100	78.420	78.030	88.720	89.080
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.500	70.900	88.290	102.380	77.690	66.080	67.140	62.920	62.490	79.180
15-M06	P1	P2							
79.390	58.368	58.355							

06/01/87 11:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.170	79.260	79.380	78.640	72.500	70.060	78.430	78.030	88.780	89.120
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.520	70.910	88.340	102.370	77.700	66.210	67.670	65.050	62.020	79.170
15-M06	P1	P2							
79.380	58.342	58.342							

ATTACHMENT 3.3L (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

VERIFICATION TEST MEASURED INPUT DATA

06/01/87 11:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.170	79.250	79.380	78.640	72.490	70.060	78.430	78.030	88.810	89.150
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.490	70.890	88.350	102.400	77.700	66.150	67.440	62.380	62.160	79.170
15-M06	P1	P2							
79.380	58.325	58.330							

06/01/87 11:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.160	79.250	79.370	78.620	72.500	70.060	78.430	78.030	88.830	89.190
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.510	70.900	88.380	102.370	77.720	66.280	67.470	64.220	62.050	79.160
15-M06	P1	P2							
79.370	58.310	58.315							

06/01/87 11:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.160	79.240	79.360	78.630	72.520	70.070	78.420	78.030	88.810	89.180
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.440	70.880	88.370	102.280	77.700	66.170	67.560	64.180	62.410	79.160
15-M06	P1	P2							
79.360	58.295	58.300							

ATTACHMENT 3.3L (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

VERIFICATION TEST MEASURED INPUT DATA

06/01/87 12:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.160	79.250	79.360	78.640	72.430	70.070	78.440	78.030	88.830	89.190
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.370	70.890	88.380	102.260	77.720	66.190	67.730	63.990	62.420	79.160
15-M06	P1	P2							
79.360	58.282	58.286							

06/01/87 12:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.170	79.240	79.360	78.640	72.470	70.070	78.430	78.030	88.840	89.180
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.340	70.890	88.380	102.230	77.720	66.360	67.380	64.660	61.850	79.170
15-M06	P1	P2							
79.360	58.271	58.277							

06/01/87 12:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.170	79.250	79.360	78.640	72.480	70.010	78.440	78.050	88.860	89.190
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.290	70.900	88.400	102.230	77.720	66.400	67.760	64.970	62.760	79.170
15-M06	P1	P2							
79.360	58.258	58.264							

ATTACHMENT 3.3L (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

VERIFICATION TEST MEASURED INPUT DATA

06/01/87 12:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.150	79.240	79.350	78.640	72.500	70.050	78.450	78.060	88.880	89.210
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.350	70.880	88.420	102.260	77.740	66.230	67.420	64.550	61.900	79.150
15-M06	P1	P2							
79.350	58.247	58.250							

06/01/87 13:00

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.160	79.240	79.350	78.640	72.460	70.070	78.450	78.060	88.900	89.240
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.410	70.900	88.440	102.270	77.740	66.230	67.690	63.370	62.050	79.160
15-M06	P1	P2							
79.350	58.235	58.240							

06/01/87 13:15

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.160	79.230	79.350	78.640	72.470	70.030	78.450	78.070	88.930	89.250
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.400	70.890	88.470	102.320	77.740	66.300	67.310	64.210	62.450	79.160
15-M06	P1	P2							
79.350	58.224	58.227							

ATTACHMENT 3.3L (Cont.)

Duane Arnold Energy Center - 1987 ILRT
FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

VERIFICATION TEST MEASURED INPUT DATA

06/01/87 13:30

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.160	79.230	79.350	78.640	72.460	70.070	78.470	78.080	88.970	89.270
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.500	70.880	88.510	102.360	77.760	66.210	67.410	63.620	62.220	79.160
15-M06	P1	P2							
79.350	58.211	58.215							

06/01/87 13:45

20-T01	21-T02	22-T03	23-T04	24-T05	25-T06	26-T07	27-T08	28-T09	29-T10
79.150	79.230	79.350	78.620	72.470	70.120	78.470	78.080	89.020	89.340
30-T11	31-T12	32-T13	33-T14	34-T15	10-M01	11-M03	12-M04	13-M02	14-M05
104.590	70.910	88.550	102.430	77.770	66.350	67.540	65.610	62.780	79.150
15-M06	P1	P2							
79.350	58.200	58.203							

ATTACHMENT 3.3M

Duane Arnold Energy Center - 1987 ILRT

FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

SUPERIMPOSED LEAKAGE VERIFICATION TEST

REDUCED INPUT VARIABLES

<u>Time</u> <u>(hh:mm)</u>	<u>Press.</u> <u>(PSIA)</u>	<u>V.P.</u> <u>(PSIA)</u>	<u>Temp.</u> <u>(R)</u>	<u>Dewpoint</u> <u>(F)</u>	<u>Mass</u> <u>(LbM)</u>
09:45	58.412	0.3845	541.818	71.703	63046.41
10:00	58.399	0.3829	541.819	71.574	63034.44
10:15	58.386	0.3841	541.820	71.668	63018.89
10:30	58.373	0.3863	541.822	71.841	63002.63
10:45	58.361	0.3809	541.825	71.422	62995.19
11:00	58.342	0.3851	541.828	71.743	62969.11
11:15	58.328	0.3800	541.829	71.350	62958.77
11:30	58.313	0.3833	541.830	71.608	62938.78
11:45	58.297	0.3838	541.817	71.645	62923.43
12:00	58.284	0.3838	541.814	71.647	62909.08
12:15	58.274	0.3837	541.812	71.641	62898.52
12:30	58.261	0.3866	541.812	71.861	62881.29
12:45	58.248	0.3834	541.820	71.614	62870.30
13:00	58.237	0.3820	541.828	71.510	62858.92
13:15	58.225	0.3837	541.831	71.635	62843.77
13:30	58.213	0.3822	541.847	71.525	62829.84
13:45	58.202	0.3872	541.864	71.908	62809.95

ATTACHMENT 3.3N

Duane Arnold Energy Center - 1987 ILRT

FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

SUPERIMPOSED LEAKAGE VERIFICATION TEST

ABSOLUTE TEST METHOD, MASS POINT ANALYSIS TEST RESULTS

<u>Time</u> <u>(hh:mm)</u>	<u>Mass</u> <u>(LbM)</u>	<u>Leakage</u> <u>(PCT./DAY)</u>	<u>Confidence</u> <u>(PCT./DAY)</u>	<u>UCL</u> <u>(PCT./DAY)</u>
09:45	63046.41	0.000000	0.000000	0.000000
10:00	63034.44	0.000000	0.000000	0.000000
10:15	63018.89	2.095636	1.343004	3.438639
10:30	63002.63	2.236951	0.316703	2.553654
10:45	62995.19	2.044311	0.300038	2.344349
11:00	62969.11	2.264409	0.324116	2.588525
11:15	62958.77	2.269104	0.216694	2.485798
11:30	62938.78	2.335631	0.172730	2.508361
11:45	62923.43	2.366786	0.134833	2.501618
12:00	62909.08	2.372704	0.105762	2.478466
12:15	62898.52	2.341206	0.091432	2.432637
12:30	62881.29	2.333900	0.075607	2.409507
12:45	62870.30	2.307712	0.068902	2.376614
13:00	62858.92	2.274838	0.067643	2.342481
13:15	62843.77	2.254290	0.061890	2.316181
13:30	62829.84	2.237598	0.056446	2.294044
13:45	62809.95	2.241619	0.049715	2.291333

ATTACHMENT 3.3P

Duane Arnold Energy Center - 1987 ILRT

FROM 09:45 HOURS TO 13:45 HOURS ON 06/01/87

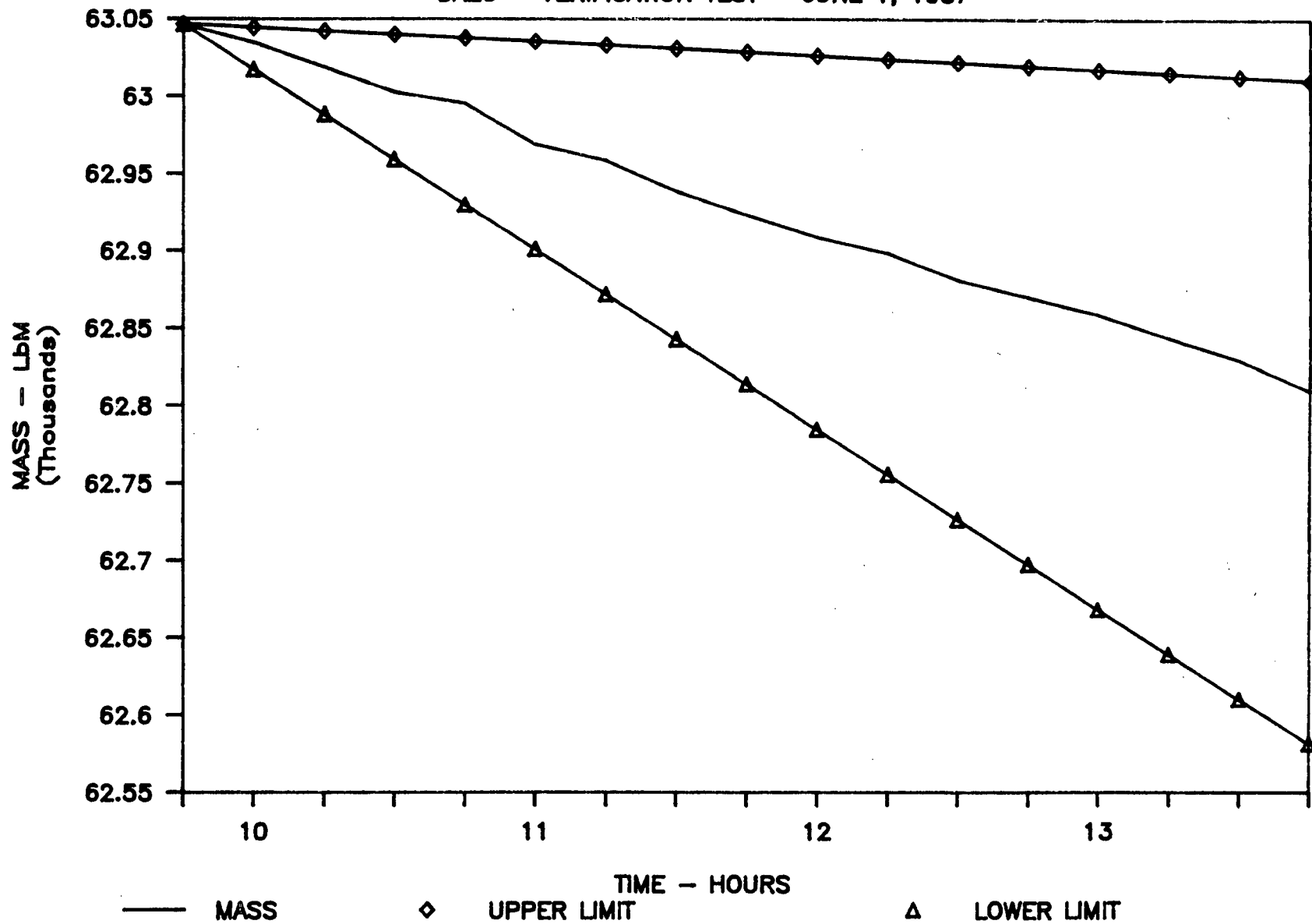
SUPERIMPOSED LEAKAGE VERIFICATION TEST

ABSOLUTE TEST METHOD, TOTAL TIME ANALYSIS TEST RESULTS

<u>Time</u> <u>(hh:mm)</u>	<u>Mass</u> <u>(LbM)</u>	<u>Meas.Leak.</u> <u>(PCT./DAY)</u>	<u>Calc.Leak.</u> <u>(PCT./DAY)</u>	<u>Confidence</u> <u>(PCT./DAY)</u>	<u>UCL</u> <u>(PCT./DAY)</u>
09:45	63046.41	0.000000	0.000000	0.000000	0.000000
10:00	63034.44	1.823770	0.000000	0.000000	0.000000
10:15	63018.89	2.095655	0.000000	0.000000	0.000000
10:30	63002.63	2.222489	2.246664	0.573666	2.820330
10:45	62995.19	1.949925	2.098755	0.987570	3.086324
11:00	62969.11	2.354109	2.272179	0.686562	2.958740
11:15	62958.77	2.224162	2.290596	0.541685	2.832282
11:30	62938.78	2.341343	2.352495	0.443748	2.796244
11:45	62923.43	2.340851	2.388088	0.387642	2.775730
12:00	62909.08	2.323482	2.402624	0.358380	2.761004
12:15	62898.52	2.251960	2.385991	0.359214	2.745205
12:30	62881.29	2.285785	2.383383	0.344563	2.727945
12:45	62870.30	2.234716	2.365233	0.342652	2.707886
13:00	62858.92	2.196102	2.340028	0.344378	2.684405
13:15	62843.77	2.204071	2.321982	0.338234	2.660216
13:30	62829.84	2.198512	2.305971	0.330689	2.636660
13:45	62809.95	2.250342	2.304634	0.317079	2.621712

CONTAINMENT MASS vs. TIME

DAEC - VERIFICATION TEST - JUNE 1, 1987

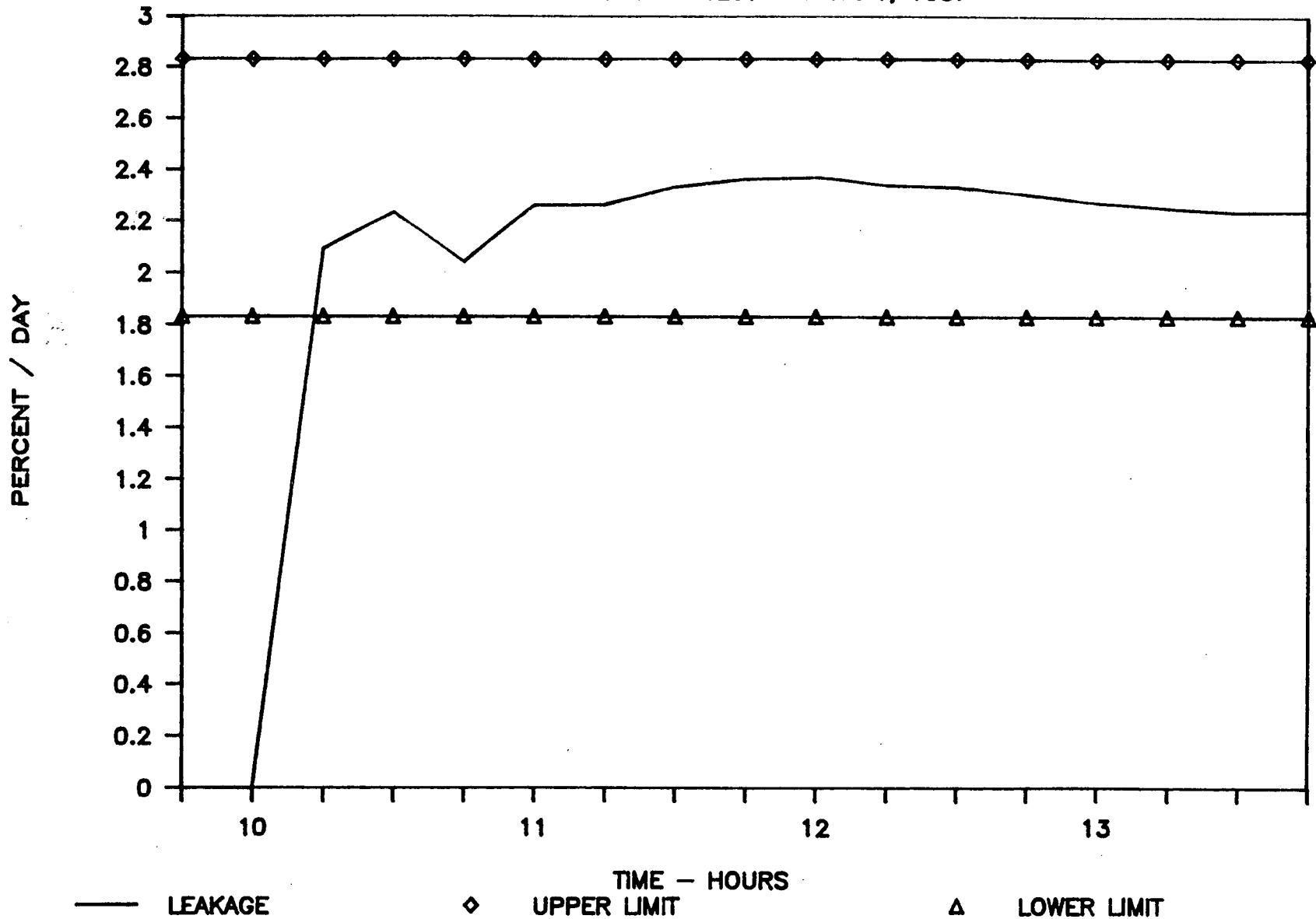


GRAPH 8

ALL INFORMATION CONTAINED HEREIN IS UNCLASSIFIED

LEAKAGE RATE vs. TIME - MASS POINT

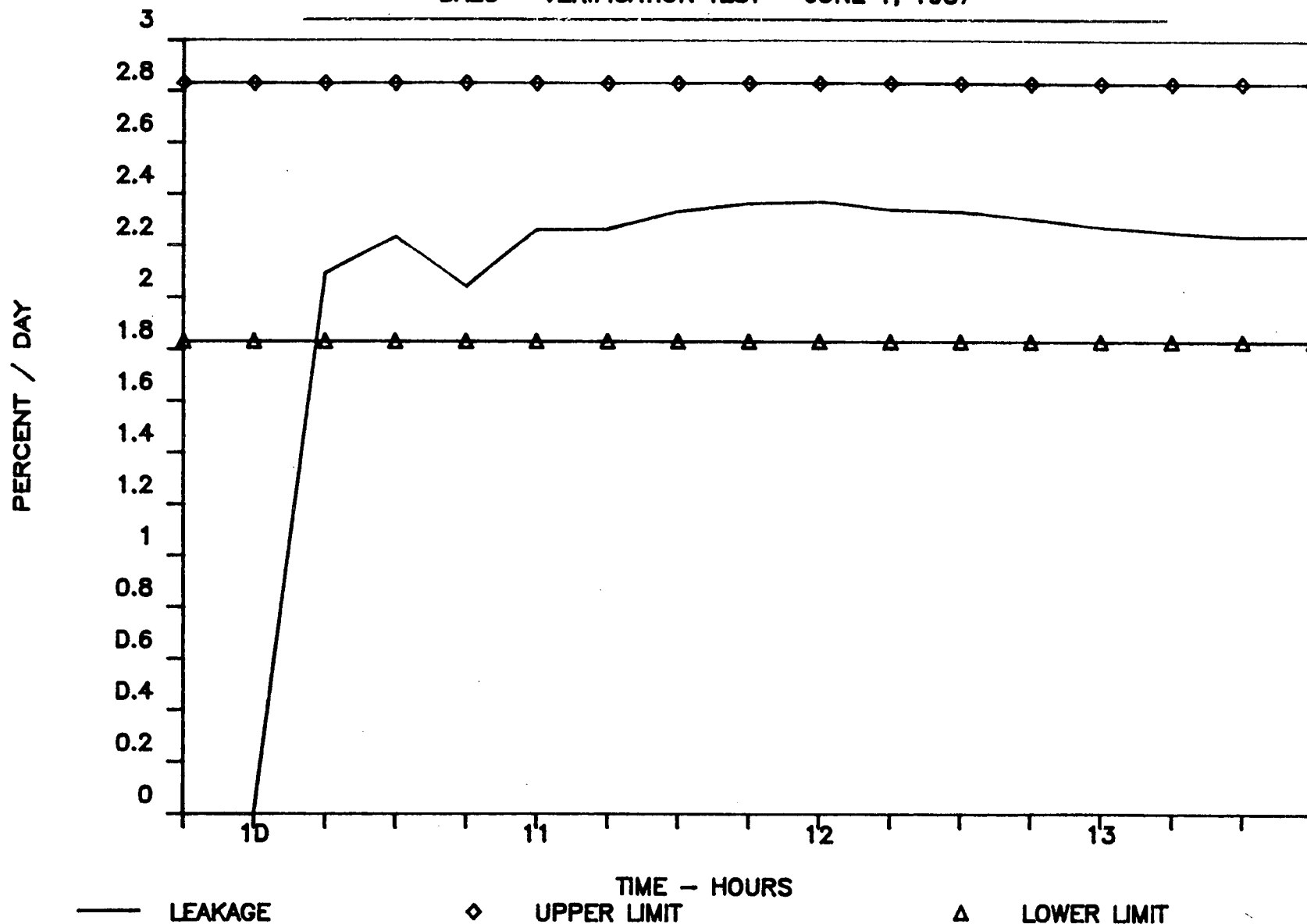
DAEC - VERIFICATION TEST - JUNE 1, 1987



ATTACHMENT 3.3R
GRAPH 9

LEAKAGE RATE vs. TIME - TOTAL TIME

DAEC - VERIFICATION TEST - JUNE 1, 1987



ATTACHMENT 3.3S
GRAPH 10

SECTION 4

LOCAL LEAKAGE RATE TESTS (TYPES B AND C)

Attachment 4A summarizes the results of the Local Leakage Rate Test's (LLRT's) data which has been obtained from periodic testing performed since the July 1985 Periodic Type A Test. Maintenance data is provided for surveillance testing performed in 1987. The leakage rates that are listed in Attachment 4A are individual valve measurements, unless otherwise noted. 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 1987 DAEC Refueling Outage to assess the "as-found" containment leakage condition.

The acceptance criteria for Types B and C testing are in accordance with 10CFR Part 50, Appendix J. The combined "as-left" leakage rate for all penetrations and valves, subject to Types B and C tests, is well below the acceptance criteria of less than $0.60 L_a$.

IE asked for a relief request to the DAEC Technical Specification per Reference 7. In part, the proposed change extended by approximately 10 weeks the two year Types B and C testing interval for the containment isolation valves and penetrations. The request was made on a one-time only basis to prevent premature reactor shutdown until the scheduled start of the 1987 Refuel Outage and the potential need for a similar extension to reach the scheduled 1988 Refuel Outage. The NRC approved the request per Reference 8. As a condition of the approval, the NRC requested that DAEC test all containment isolation valves that had a leakage history and that were capable of being tested while at power. Test results for those valves that were tested at power are documented in Attachment 4A and are indicated under the Repair/Notes column. The next required test period for all Types B and C tests are scheduled for the 1988 Refuel Outage or two years from the Post-Repair test dates.

The data contained in this section are summarized below:

<u>Attachment No.</u>	<u>Title</u>
4A	1987 Local Leakage Rate Test Data
4B	1987 Local Leakage Rate Test Summary Analysis

ATTACHMENT 4A
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
<u>Testable Gaskets (Type B)</u>						
X-1	Drywell Personnel Airlock	B	Airlock	7,307/04-04-86	7,307/04-04-86	
				9,621/06-11-86	9,621/06-11-86	
				5,141/06-16-86	5,141/06-16-86	
				5,450/10-03-86	5,450/10-03-86	
				7,683/10-07-86	7,683/10-07-86	
				8,490/10-17-86	8,490/10-17-86	
				7,612/12-21-86	7,612/12-21-86	
				6,909/05-30-87	6,909/05-30-87	
				8,748/06-25-87	8,748/06-25-87	
				6,411/06-29-87	6,411/06-29-87	
X-1	Drywell Airlock Hatch	B	Gaskets	<125/03-23-87	<125/03-23-87	
				<135/05-27-87	<135/05-27-87	
X-2	Equipment Access Hatch	B	Gaskets	0/03-13-87	0/05-27-87	
X-4	Drywell Head Access Hatch	B	Gaskets	0/04-08-87	0/04-08-87	
X-6	CRD Removal Hatch	B	Gaskets	0/03-12-87	0/05-29-87	
X-35A	TIP Drive	B	Gaskets	0/03-30-87	0/03-30-87	
X-35B	TIP Drive	B	Gaskets	0/03-30-87	0/03-30-87	
X-35C	TIP Drive	B	Gaskets	0/03-30-87	0/03-30-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-35D	TIP Purge Line	B	Gaskets	0/03-30-87	0/03-30-87	
X-53	Spare	B	Gaskets	0/03-25-87	0/03-25-87	
	Drywell Head	B	Gaskets	0/03-13-87 0/05-27-87	0/03-13-87 0/05-27-87	
X-58A	Stabilizer Access Port	B	Gaskets	1,850/03-19-87	0/04-08-87	X-58A - Replaced "O" rings.
X-58B	Stabilizer Access Port	B	Gaskets	0/03-19-87	0/03-19-87	
X-58C	Stabilizer Access Port	B	Gaskets	0/03-19-87	0/03-19-87	
X-58D	Stabilizer Access Port	B	Gaskets	0/03-19-87	0/03-19-87	
X-58E	Stabilizer Access Port	B	Gaskets	0/03-19-87	0/03-19-87	
X-58F	Stabilizer Access Port	B	Gaskets	0/03-19-87	0/03-19-87	
X-58G	Stabilizer Access Port	B	Gaskets	0/03-19-87	0/03-19-87	
X-58H	Stabilizer Access Port	B	Gaskets	0/03-19-87	0/03-19-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
N-200A	Torus Access Hatch - South	B	Gaskets	0/03-27-87 0/05-29-87 <41/06-05-87	0/03-27-87 0/05-29-87 <41/06-05-87	
N-200B	Torus Access Hatch - North	B	Gaskets	0/03-27-87	0/03-27-87	
<u>Electrical Canisters (Type B)</u>						
X-100B	Neutron Monitoring	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-100C	Neutron monitoring	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-100E	Neutron Monitoring	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-100F	Neutron Monitoring	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-100G	RPV Vibration Monitoring	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-101A	Recirc. Pump Power	B	Elect. Pen.	0/03-21-87	0/03-21-87	
X-101C	Recirc. Pump Power	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-103	Thermocouples	B	Elect. Pen.	0/03-27-87	0/03-27-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-104A	CRD Rod Position Ind.	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-104B	CRD Rod Position Ind.	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-104C	CRD Rod Position Ind.	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-104D	CRD Rod Position Ind.	B	Elect. Pen.	0/03-27-87	0/03-27-87	
X-105B	Power & Control	B	Elect. Pen.	0/03-21-87	<200/05-19-87	
X-105D	Power & Control	B	Elect. Pen.	<135/03-27-87	<135/03-27-87	
X-106A	Power & Control	B	Elect. Pen.	0/03-21-87	<200/05-19-87	
X-106C	Power & Control	B	Elect. Pen.	0/03-27-87	0/03-27-87	
N-230B	Vacuum Breaker Cables	B	Elect. Pen.	<40/03-27-87	<40/03-27-87	
<u>Flange "O" rings (Type B)</u>						
X-25	Drywell Purge Outlet CV-4302	B	"O" rings	0/03-27-87	1,200/04-15-87	
X-26	Drywell Purge Outlet CV-4307	B	"O" rings	<150/03-19-87	0/05-22-87	
N-220	Torus Purge Supply CV-4308	B	"O" rings	0/03-19-87	0/05-22-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
N-205	Torus Purge Outlet CV-4300	B	"O" rings	0/03-18-87	0/05-22-87	
N-213A	Torus Drain Line Flange - South	B	"O" rings	<40/03-27-87	<40/03-27-87	
N-213B	Torus Drain Line Flange - North	B	"O" rings	0/03-26-87	0/03-26-87	
N-231	RB/Torus Vacuum Breaker CV-4304	B	"O" rings	0/03-27-87	0/04-16-87	
N-231	RB/Torus Vacuum Breaker CV-4305	B	"O" rings	0/03-27-87	0/05-22-87	

Expansion Bellows (Type B)

X-7A	Steam to Turbine	B	Bellows	0/03-24-87	0/03-24-87	
X-7B	Steam to Turbine	B	Bellows	0/03-24-87	0/03-24-87	
X-7C	Steam to Turbine	B	Bellows	0/03-24-87	0/03-24-87	
X-7D	Steam to Turbine	B	Bellows	150/03-24-87	150/03-24-87	
X-9A	RPV Feedwater	B	Bellows	0/03-25-87	0/03-25-87	
X-9B	RPV Feedwater	B	Bellows	<150/03-25-87	<150/03-25-87	
X-10	Steam to RCIC Turbine	B	Bellows	<150/03-25-87	<150/03-25-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-11	Steam to HPCI Turbine	B	Bellows	0/03-24-87	0/03-24-87	
X-12	Shutdown Pump Supply RHR	B	Bellows	0/03-25-87	0/03-25-87	
X-13A	RHR Pump Discharge	B	Bellows	0/03-25-87	0/03-25-87	
X-13B	RHR Pump Discharge	B	Bellows	0/03-25-87	0/03-25-87	
X-15	RWCU Supply	B	Bellows	0/03-25-87	0/03-25-87	
X-16A	Core Spray Pump Discharge	B	Bellows	0/03-25-87	0/03-25-87	
X-16B	Core Spray Pump Discharge	B	Bellows	<150/03-28-87	<150/03-28-87	
X-17	RPV Head Spray	B	Bellows	<150/03-28-87	<150/03-28-87	
N-201A	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	
N-201B	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	
N-201C	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	
N-201D	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	
N-201E	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	
N-201F	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	
N-201G	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
N-201H	Vent Line	B	Bellows	0/03-28-87	0/03-28-87	
N-213A	Torus Drain Line Bellows - Inbd (South)	B	Bellows	0/03-27-87	0/03-27-87	
N-213A	Torus Drain Line Bellows - Outbd (South)	B	Bellows	<40/03-27-87	<40/03-27-87	
N-213B	Torus Drain Line Bellows - Inbd (North)	B	Bellows	<40/03-26-87	<40/03-26-87	
N-213B	Torus Drain Line Bellows - Outbd (North)	B	Bellows	<40/03-26-87	<40/03-26-87	
<u>LLRT's (Type C)</u>						
X-7A	"A" Main Steam Line	C	CV-4412 (IPC) CV-4413 (OPC)	0/03-15-87 10,200/03-14-87	610/05-24-87 (Combined)	CV-4412-Replaced stem, junk ring, packing and reworked seats. CV-4413 - Replaced junk ring, packing, spring guide bolts, gland, reworked seats & realigned valve.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-7B	"B" Main Steam Line	C	CV-4415(IPC) CV-4416(OPC)	215,795/03-15-87 23,000/03-14-87	1,600/05-25-87 (Combined)	CV-4415 - Disc and piston oversized. Replaced junk ring, packing and reworked seats. CV-4416 - Adjusted packing.
X-7C	"C" Main Steam Line	C	CV-4418(IPC) CV-4419(OPC)	36,500/03-15-87 0/03-14-87	275/05-24-87 (Combined)	CV-4418 - Disc and piston oversized. Replaced junk ring, stem, packing and reworked seats. CV-4419 - Replaced junk ring, packing, reworked seats and overhauled operator. Erosion areas repaired in 1985 have been arrested.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested(Notes 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-7D	"D" Main Steam Line	C	CV-4420(IPC) CV-4421(OPC)	0/03-15-87 2,200/03-14-87	0/03-15-87 2,200/03-14-87	CV-4420 - Adjusted packing. CV-4421 - Replaced packing and overhauled operator.
X-8	Steam Drain	C	MO-4423(IPC)	24,000/03-15-87	0/05-30-87	MO-4423 - Replaced wedge.
			MO-4424(OPC)	7,100/03-15-87	270/05-30-87	MO-4424 - Replaced wedge, lapped wedge & seats.
X-9A	Feedwater	C	V-14-3(IPC)	Note 2/03-16-87	850/03-31-87	V-14-3 - Cleaned valve internals and bearing surfaces. Machined actuator shaft.
			MO-4441(OPC) MO-2312(OPC)	51,000/03-16-87 (Combined)	3,450/05-26-87 (Combined)	MO-4441 - Replaced packing. MO-2312 - MOVATS testing & replaced motor.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-9B	Feedwater	C	V-14-1 (IPC)	Note 2/03-17-87	9,350/05-16-87	V-14-1 - Cleaned valve internals and bearing surfaces. Machined hinge pins.
			MO-4442 (OPC)	Note 2/03-17-87	370/05-19-87	MO-4442 - Replaced packing.
			MO-2740 (OPC)	(Combined)	(Combined)	
			MO-2512 (OPC)			MO-2740 - Replaced spring pack and bearings.
						MO-2512 - MOVATS testing & adjusted torque switch.
X-10	RCIC Condensate Return	C	CV-2410 (IPC)	450/03-20-87	450/03-20-87	
			CV-2411 (OPC)	390/03-20-87	390/03-20-87	
X-10	RCIC Steam	C	MO-2400 (IPC)	0/03-16-87	0/05-31-87	MO-2400 - MOVATS testing, added packing and overhauled operator.
			MO-2401 (OPC)	2,300/03-16-87	325/05-31-87	MO-2401 - MOVATS testing, replaced spring pack and overhauled operator.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-11	HPCI Condensate Return	C	CV-2211 (IPC) CV-2212 (OPC)	4,300/03-20-87 3,890/03-20-87	0/05-21-87 0/05-21-87	X-11 - Repaired boundary valve CV-2206.
X-11	HPCI Steam	C	MO-2238 (IPC)	580/03-15-87	0/05-30-87	MO-2238 - MOVATS testing.
			MO-2239 (OPC)	-	3,250/10-03-86	MO-2239 - Lapped seat and disc.
				0/03-15-87	305/05-30-87	MO-2239 - MOVATS testing.
X-15	Reactor Water Cleanup	C	MO-2700 (IPC) MO-2701 (OPC)	1,050/04-07-87 560/04-07-87	1,050/04-07-87 560/04-07-87	MO-2700 - MOVATS testing.
X-16A	Core Spray	C	MO-2117 (IPC) MO-2115 (OPC)	<150/03-21-87 >500K/03-21-87	<150/03-21-87 175/04-02-87	MO-2115 - Adjusted torque switch.
X-16B	Core Spray	C	MO-2137 (IPC)	<990/04-04-87	150/05-04-87	MO-2137 - Replaced gearbox grease and adjusted limit switch.
			MO-2135 (OPC)	14,500/04-04-87	<41/05-20-87	MO-2135 - Replaced spring pack and adjusted limit switch.
X-19	Drywell Drain	C	CV-3704 (IPC) CV-3705 (OPC)	<200/03-25-87 335/03-25-87	<200/03-25-87 335/03-25-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested(Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-20	Demin. Water	C	V-09-111(IPC) V-09-65(OPC)	<135/03-24-87 <135/03-24-87	<135/03-24-87 <135/03-24-87	
X-21	Service Air	C	Blind Flange(IPC) V-30-287(OPC)	0/05-06-87 (Combined)	0/05-06-87 (Combined)	
X-22, X-229A	N ₂ Comp. Discharge	C	V-43-214(IPC) CV-4371C(OPC) CV-4371A(OPC)	2,400/03-23-87 200/03-22-87 325/03-22-87	2,400/03-23-87 200/03-22-87 325/03-22-87	
X-23A	Drywell Cooling Water Supply	C	CV-5718A(OPC) V-57-77(OPC)	310/03-25-87 (Combined)	310/03-25-87 (Combined)	
X-23B	Drywell Cooling Water Supply	C	CV-5718B(OPC) V-57-78(OPC)	7,000/04-14-87 (Combined)	450/05-13-87 (Combined)	CV-5718B - Cleaned valve internals and replaced packing.
X-24A	Drywell Cooling Water Return	C	CV-5704A(OPC) V-57-75(OPC)	700/03-24-87 (Combined)	700/03-24-87 (Combined)	
X-24B	Drywell Cooling Water Return	C	CV-5704B(OPC) V-57-76(OPC)	140/04-14-87 (Combined)	140/04-14-87 (Combined)	
X-25	Drywell Purge Outlet	C	CV-4302(OPC) CV-4303(OPC)	850/03-12-87 (Combined)	1,700/04-15-87 (Combined)	CV-4302 - Replaced "T" rings and "O" rings CV-4303 - Replaced "T" rings and "O" rings.
			CV-4310(OPC)	325/03-12-87	325/03-12-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-26	Drywell Purge	C	CV-4306(OPC)	-	210/02-06-87	See Note 4
X-220	Supply		CV-4307(OPC)		(Combined)	
			CV-4308(OPC)			
				475/03-19-87 (Combined)	76/05-22-87 (Combined)	CV-4306,4307,4308 - Replaced "T" rings and "O" rings.
X-26, X-220	Drywell and Torus Makeup	C	CV-4311(OPC)	26,500/03-19-87	3,650/05-26-87	CV-4311 - Lapped wedge and seats. Replaced packing and adjusted operator.
			CV-4312(OPC)	-	1,900/02-06-87	See Note 4
				1,700/03-19-87	685/05-26-87	CV-4312 - Replaced packing.
			CV-4313(OPC)	-	535/02-06-87	See Note 4
				180/03-19-87	1,550/05-24-87	CV-4313 - Replaced packing.
X-32D	N ₂ Comp. Suction	C	CV-4378A(IPC)	63/03-25-87	63/03-25-87	
			CV-4378B(OPC)	54/03-25-87	54/03-25-87	
X-32E	Recirc. Pump A Seal	C	V-17-96(IPC)	550/03-21-87	550/03-21-87	
			CV-1804B(OPC)	0/03-21-87	0/03-21-87	
X-32F	Recirc. Pump B Seal	C	V-17-83(IPC)	0/03-21-87	0/03-21-87	CV-1804A - Replaced
			CV-1804A(OPC)	2,750/03-21-87	550/05-27-87	valve and packing.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested(Notes)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-35A	TIP Check	C	Ck. Vlv.(OPC)	550/04-28-87	550/04-28-87	
X-35B	TIP Ball	C	Ball Vlv.(OPC)	0/04-24-87	0/04-28-87	
X-35C	TIP Ball	C	Ball Vlv.(OPC)	- 0/04-24-87	0/03-18-86 <150/04-28-87	
X-35D	TIP Ball	C	Ball Vlv. (OPC)	- 0/04-24-87	0/04-05-86 0/04-28-87	
X-36	CRD Return	C	V-17-53(IPC) V-17-52(OPC)	<30/03-23-87 <30/03-23-87	<30/03-23-87 <30/03-23-87	See Note 3
X-39A	Drywell Spray	C	MO-2000(OPC)	0/05-30-87	0/05-30-87	
X-39A	CAD Supply	C	SV-4332A(IPC)	- 600/03-25-87	<135/02-05-87 450/05-28-87	See Note 4 SV-4332A - Replaced "O" rings.
			SV-4332B(OPC)	- 610/03-25-87	<135/02-05-87 <150/05-29-87	See Note 4 SV-4332B - Replaced "O" rings.
X-39B	Drywell Spray	C	MO-1902(OPC)	500/05-25-87	500/05-25-87	
X-39B	CAD Supply	C	SV-4331A(IPC)	- <41/03-26-87	0/02-09-87 <400/05-28-87	See Note 4 SV-4331A - Replaced "O" rings.
			SV-4331B(OPC)	- <41/03-26-87	<125/02-09-87 <390/05-28-87	See Note 4 SV-4331B - Replaced "O" rings and cleaned internals.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-40C	Jet Pump Coolant Sample	C	SV-4594B(IPC)	-	0/10-03-86	SV-4594B - Installed valve.
				62/03-23-87	62/03-23-87	
			SV-4595B(OPC)	-	2,300/10-03-86	SV-4595B - Installed valve.
				-	0/12-19-86	SV-4595B - Replaced disc.
				0/03-23-87	0/03-23-87	
X-40D	Jet Pump Coolant Sample	C	SV-4594A(IPC)	-	0/10-03-86	SV-4594A - Installed valve.
				<150/03-22-87	<150/03-22-87	
			SV-4595A(OPC)	-	0/10-03-86	SV-4595A - Installed valve.
				<150/03-22-87	<150/03-22-87	
X-41	Recirc. Loop Sample	C	CV-4639(IPC) CV-4640(OPC)	3,034/03-27-87 (Combined)	<240/05-29-87 160/05-29-87	CV-4639 - Replaced diaphragm and packing.
						CV-4640 - Replaced disc & stem union and lapped seat.
X-42	Standby Liquid Control	C	V-26-9(IPC)	900/05-21-87	900/05-21-87	V-26-9 - Flushed valve.
			V-26-8(OPC)	2,400/04-20-87	2,400/05-20-87	

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
X-46F	CAM Return	C	SV-8105B(IPC) SV-8106B(OPC)	0/03-26-87 0/03-26-87	0/03-26-87 0/03-26-87	
X-48	Drywell Drain Discharge	C	CV-3728(IPC) CV-3729(OPC)	0/03-23-87 0/03-23-87	0/03-23-87 0/03-23-87	
X-50B	CAM Supply	C	SV-8101A(IPC) SV-8102A(OPC)	0/03-26-87 <150/03-26-87	0/03-26-87 <150/03-26-87	
X-50D	CAM Supply	C	SV-8105A(IPC) SV-8106A(OPC)	0/03-26-87 0/03-26-87	0/03-26-87 0/03-26-87	
X-50E	CAM Supply	C	SV-8103A(IPC) SV-8104A(OPC)	<150/03-26-87 <150/03-26-87	<150/03-26-87 <150/03-26-87	
X-54	CCW Return	C	MO-4841A(OPC)	93/03-23-87	93/03-23-87	
X-55	CCW Supply	C	MO-4841B(OPC)	0/03-23-87	0/03-23-87	
X-56C	CAM Supply	C	SV-8101B(IPC) SV-8102B(OPC)	0/03-26-87 0/03-26-87	0/03-26-87 0/03-26-87	
X-56D	CAM Supply	C	SV-8103B(IPC)	- <41/03-26-87	0/02-05-87 <41/03-26-87	See Note 4
			SV-8104B(OPC)	- <41/03-26-87	0/02-05-87 <41/03-26-87	See Note 4

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
N-205	Torus Exhaust Outlet	C	CV-4300 (OPC)	475/03-18-87	<41/05-21-87	CV-4300 , 4301- Replaced "T" rings and "O" rings.
			CV-4301 (OPC)	(Combined)	(Combined)	
			CV-4309 (OPC)	-	920/09-04-86	CV-4309 - Realigned actuator.
				425/03-18-87	3,200/05-27-87	CV-4309 - Lapped seats & disc and adjusted fit for T-Head to disc.
N-211A	Torus Spray	C	MO-1933 (OPC)	2,400/05-25-87	2,400/05-25-87	
N-211A	CAD Supply	C	SV-4333A (IPC)	-	<125/02-09-87	See Note 4
				<200/03-25-87	250/05-28-87	SV-4333A - Replaced "O" rings.
			SV-4333B (OPC)	-	<125/02-09-87	See Note 4
				<200/03-25-87	285/05-28-87	SV-4333B - Replaced "O" rings.
N-211B	Torus Spray	C	MO-2006 (OPC)	2,200/05-30-87	2,200/05-30-87	
N-211B	CAD Supply	C	SV-4334A (IPC)	-	380/02-10-87	See Note 4
				260/03-25-87	1,780/05-29-87	SV-4334A - Replaced "O" rings.
			SV-4334B (OPC)	-	370/02-10-87	See Note 4
				205/03-25-87	1,160/05-29-87	SV-4334B - Replaced "O" rings.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
N-212	RCIC Turbine Exhaust	C	V-24-8 (IPC) V-24-23 (OPC)	359/03-19-87 (Combined)	79/05-08-87 (Combined)	See Note 3 V-24-23 - Replaced disc nut and reworked dowel pin.
N-212	RCIC Turbine Ex. Vac. Breaker	C	V-24-46 (IPC) V-24-47 (OPC)	1,175/03-21-87 1,175/03-21-87	1,175/03-21-87 1,175/03-21-87	
N-214	HPCI Turbine Exhaust	C	V-22-17 (IPC) V-22-16 (OPC)	3,906/03-19-87 (Combined)	1,217/05-11-87 (Combined)	See Note 3 V-22-16 - Reworked dowel pin.
N-214	HPCI Turbine Ex. Vac. Breaker	C	V-22-63 (IPC) V-22-64 (OPC)	700/03-21-87 650/03-21-87	730/06-12-87 650/03-21-87	
N-219	HPCI/RCIC Exhaust	C	MO-2290B (IPC) MO-2290A (OPC)	1,500/03-20-87 1,500/03-20-87	1,300/05-18-87 1,500/03-20-87	MO-2290B - MOVATS testing. MO-2290A - MOVATS testing.
N-222	HPCI Condensate Return	C	V-22-22 (IPC) V-22-21 (OPC)	0/03-20-87 (Combined)	0/03-20-87 (Combined)	See Note 3

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested (Note 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
N-229B	CAM Supply	C	SV-8107A(IPC) SV-8108A(OPC)	<41/03-27-87 0/03-27-87	0/05-29-87 0/05-29-87	SV-8107A, 8108A - Replaced "O" rings.
N-229C	CAM Return	C	SV-8109A(IPC)	-	500/02-09-87	See Note 4
				67/03-28-87	<135/05-29-87	SV-8109A - Replaced "O" rings.
			SV-8110A(OPC)	-	500/02-09-87	See Note 4
				67/03-28-87	<135/05-29-87	SV-8110A - Replaced "O" rings.
N-229F	CAM Return	C	SV-8109B(IPC) SV-8110B(OPC)	0/03-27-87 0/03-27-87	<135/05-29-87 <135/05-29-87	SV-8109B, 8110B - Replaced "O" rings.
N-229G	CAM Supply	C	SV-8107B(IPC)	<42/03-27-87	0/05-29-87	SV-8107B - Replaced "O" rings, sleeve, and piston.
			SV-8108B(OPC)	0/03-27-87	0/05-29-87	SV-8108B - Replaced "O" rings.
N-229H	PASS Sample Return	C	SV-8772A(IPC) SV-8772B(OPC)	<41/03-27-87 <41/03-27-87	<41/03-27-87 <41/03-27-87	
N-231	Vacuum Breaker	C	CV-4304(IPC) V-43-169(OPC)	-	6,000/02-05-87 (Combined)	See Note 4
				7,050/03-19-87 (Combined)	<1,375/04-16-87 (Combined)	CV-4304 - Replaced "T" rings and "O" rings.

ATTACHMENT 4A (Cont.)
1987 LOCAL LEAKAGE RATE TEST DATA

<u>Pen. Number</u>	<u>System</u>	<u>Type Test</u>	<u>Equipment/Valve Tested(Notes 1)</u>	<u>Pre-Repair Leakage/Date (SCCM)</u>	<u>Post-Repair Leakage/Date (SCCM)</u>	<u>Repair/Notes</u>
N-231	Vacuum Breaker	C	CV-4305 (IPC) V-43-168 (OPC)	340/03-18-87 (Combined)	<135/05-19-87 (Combined)	CV-4305 - Replaced "T" rings and "O" rings.

Notes:

1. (IPC) Inside Primary Containment
(OPC) Outside Primary Containment
2. Unable to measure leakage with available test equipment.
3. These valves were tested utilizing water as the test medium. The test results are in cc/min.
4. "2 yr. Interval", Tested in accordance with References 7 and 8.

ATTACHMENT 4B

1987 LOCAL LEAKAGE RATE TEST 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 net equivalent leakage for the penetration is the lowest of the inside or outside valve grouping (e.g., simulates minimum pathway leakage).
5. 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.
6. 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).
7. 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 corrective action program.

ATTACHMENT 4B (Cont.)
1987 LOCAL LEAKAGE RATE TEST SUMMARY ANALYSIS

<u>Pen. Number</u>	<u>System</u>	<u>Inside</u>	<u>Outside</u>	<u>Net (SCCM)</u>	<u>Remarks</u>
X-7A	"A" Main Steam Line	0	9,895	0	
X-7B	"B" Main Steam Line	214,995	22,200	22,200	
X-7C	"C" Main Steam Line	36,362.5	0	0	
X-8	Steam Drain	24,000	6,830	6,830	
X-9A	Feedwater	Note 1	47,550	47,550	
X-9B	Feedwater	Note 1	Note 1	Note 1	
X-10	RCIC Steam	0	1,975	0	
X-11	HPCI Steam	580	0	0	
X-16A	Core Spray	0	>500,000	0	
X-16B	Core Spray	<840	14,459	<840	
X-23B	Drywell Cooling Water Supply		0	0	Combination Test - Only one valve reworked.

ATTACHMENT 4B (Cont.)
1987 LOCAL LEAKAGE RATE TEST SUMMARY ANALYSIS

<u>Pen. Number</u>	<u>System</u>	<u>Inside</u>	<u>Outside</u>	<u>Net (SCCM)</u>	<u>Remarks</u>
X-26, X-220	Drywell Purge Supply		199.5	199.5	Combination Test - All valves reworked.
X-26, X-220	Drywell and Torus Makeup		1,880	1,880	
X-32F	Recirc. Pump B Seal	0	2,200	0	
X-39A	CAD Supply	150	460	150	
X-41	Recirc. Loop Sample	1,277	1,357	1,277	See Note 2
X-58A	Stabilizer Access Port		1,850	1,850	
X-205	Torus Exhaust Outlet		217	217	See Note 3
X-219	HPCI/RCIC Exhaust	200	0	0	
X-229B	CAM Supply	<41	0	0	
X-229G	CAM Supply	<42	0	0	
X-231	Vacuum Breaker		0	0	

ATTACHMENT 4B (Cont.)
1987 LOCAL LEAKAGE RATE TEST SUMMARY ANALYSIS

Notes:

1. Unable to measure leakage with available test equipment.
2. Both valves were repaired. As found for each valve is one half the combination test.
3. Minimum path is CV-4300 (one-half combination) or CV-4301 (one-half combination plus CV-4309).