EXECUTIVE SUMMARY

A Primary Containment Integrated Leakage Rate Test (ILRT) was successfully completed at the Calvert Cliffs Nuclear Power Plant, Unit 1, on June 22, 1982. The test met the requirements set forth in 10CFR50, Appendix J.

Listed below is the summary of the test results for both the mass point and total time data analysis techniques. The actual measured leakage (Lam) and the 95 percent upper confidence limit (UCL), in units of weight percent per day, are compared to the acceptance criteria.

Mass Point	Test Result	Acceptance Criteria
ILRT Lam	0.021	<0.150
ILRT UCL	0.026	<0.150
Verification Test Lam	0.185	0.169 < Lam < 0.269
Total Time		
ILRT Lam	0.023	<0.150
ILRT UCL	0.086	<0.150
Verification Test Lam	0.190	0.171 < Lam < 0.271

The chronological summary of events, summary of plant technical data, and discussion of test results are included in portions of this report.

TABLE OF CONTENTS

I. INTRODUCTION

This report presents data, analysis, and conclusions pertaining to the Calvert Cliffs Nuclear Power Plant Unit 1 Integrated Leakage Rate Test (ILRT) performed in June 1982. The Integrated Leakage Rate Test (Type A) is performed periodically to demonstrate that the combined leakage through the reactor containment and those systems penetrating the containment does not exceed the allowable leakage rate specified in the Plant Technical Specifications.

The successful periodic Type A and supplemental verification tests were performed according to the requirements of the Calvert Cliffs Nuclear Power Plant, Unit 1, Technical Specifications and 10CFR50, Appendix J. The Calvert Cliffs Type A test method is the Absolute Method described in ANSI N45.4-1972, "Leakage Rate Testing of Containment Structures for Nuclear Reactors" and ANSI/ ANS 56.8-1981, "Containment System Leakage Testing Requirements." The leakage rate was calculated using formulas from the above ANSI Standards and BN-TOP-1, Rev. 1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants. Type A and verification test durations were according to the criteria of BN-TOP-1.

A 95% upper confidence level was calculated for leakage rate data as required by Reference 6. This is to ensure a 95% probability that the calculated leakage rate value is within the acceptance limits. All calculations were done with Bechtel's ILRT computer program described in Appendix A.

The temperature and pressure history and the containment air mass variations were plotted by the computer program and are contained in Appendix E.

II. TEST SYNOPSIS

Valve line-ups were conducted on all systems to establish post-accident conditions except for shutdown cooling and three penetrations necessary to conduct the ILRT. The inspection of the containment's accessible interior and exterior surfaces was conducted prior to pressurization. No evidence of structural deterioration was noted which would have affected containment integrity or leak tightness. During the inspection of the exterior of the dome, some surface cracks were observed. The cracks did not extend deeper than one inch nor 1/32 inch wide. The cracks were monitored during the test and no change was noted.

Containment pressurization commenced at 2:09 p.m., June 19, 1982. At 9:00 p.m. air bubbles were noted in the spent fuel pool, and containment pressure was approximately 17 psig. Pressurization was secured and depressurization to below 12 psig was commenced to make a containment entry to inspect the fuel transfer tube drain valve . The drain valve handwheel was missing, so the valve could not be checked shut. A cap was placed on the drain line. The cap was not shown in FSAR or on the P&ID. Evaluation after the ILRT determined that the leakage rate through the drain valve would have been 0.025 weight percent per day if the line had not been capped. Prior to restart of pressurization the plant heating return line was aligned inaccordance with the FSAR. The check valve on the plant heating supply line was suspected to leak, therefore, the test boundary was extended to the upstream gate valve. The Local leak rate test of the check valve measured 0.0004 weight percent per day. Pressurization of containment was restarted at 5:55 a.m. and test pressure was reached at 9:00 p.m. June 20. Containment fans and coolers were secured 30 minutes after securing compressors. The stabilization period was 8.75 hours because of considerable data scatter during the first three hours. Collection of data to determine the integrated leakage rate commenced at

5:45 a.m. June 21 and was completed at 1:45 p.m. The verification flow was initiated, but because of an improper line-up of the rotometer, flow stabilization was not achieved until 1:15 a.m. June 22. The verfication flow test was completed satisfactorily and depressurization of the containment commenced at 7:02 a.m. June 22, 1982. Summary of test phases were as follow:

Test Phase	Time	Duration	Date
Pressurization	14:09 - 22:30	8.5 hr.	June 19
Depressurization to 12 psi	23:00 - 2:00	3	June 19-20
Restart Pressurization	5:55 - 21:00	15	June 20
Stabilization	21:00 - 5:30	8.5	June 20-21
ILRT	5:45 - 13:45	8.0	June 21
Verification Stabilization	14:00 - 1:15	11.25	June 21-22
Verification Test	1:15 - 5:15	4.0	June 22

III. TEST DATA SUMMARY

A. Plant Information

Owner:	Baltimore Gas and Electric Company
Plant:	Calvert Cliffs Nuclear Power Plant Unit 1
Location:	Lusby, Maryland
Containment Type:	Post-tensioned concrete
Date Test Completed:	June 22, 1982

B. Technical Data

1.	Containment Net Free Air Volume	2,000,000 cu ft
2.	Design Pressure	50 psig
3.	Design Temperature	276^{o}F
4.	Calculated Peak Accident Pressure, Pa	50 psig

5.	Containment ILRT Average Temperature Limits	60-120°F

C. Type A Test Criteria

1.	Test Method	Absolute
2.	Leakage Rate Data Analysis Techniques	Total Time per BN-TOP-1 and Mass Point per ANSI/ANS 56.8-1981
3.	Test Pressure	50.0 psig + 0.60 - 0
4.	Maximum Allowable Leakage Rate, La per Technical Specification	0.2%/day
5.	75% of La	0.15%/day

D. Type A Test Result

		From Regression %/day Line (Lam)	At Upper 95% Confidence Limit
1.	Integrated Leakage Rate		
	a. Mass Point Analysis	0.021	0.026
	b. Total Time Analysis	0.023	0.086

2. Adding the leakage rate from the spent fuel transfer tube drain line and the heating supply line check valve results in 0.0254 weight present per day. Adding this amount to the 95% confidence limit for both the mass point and total time results in 0.0514 and 0.1114 weight per day respectively.

E. Verification Test

1.	Imposed flow rate (Li)	12.3 scfm/0.198%/day
2.	Verification Test Results	Leakage Rate, %/day
	a. Mass Point Analysis	0.185
	b. Total Time Analysis	0.190

3. Verification Test Limits	Test Limit, %/day
a. Mass Point Analysis	
(1) Upper Limit (Li + Lam + 0.25 La)	0.269
(2) Lower Limit (Li + Lam - 0.25 La)	0.169
b. Total Time Analysis	
(1) Upper Limit (Li + Lam + 0.25 La)	0.271
(2) Lower Limit (Li + Lam - 0.25 La)	0.169

F. Report Printouts

The Report Printouts of the Type A and verification test calculations are provided for the Mass Point and Total Time Analysis (Appendixes B through F). Stabilization data is also provided (Appendix B).

G. Local Leakage Rate Test Results - Type B and C Tests

1. LLRT Results - The Type B and C leakage tests were conducted prior to the Type A test. The total as left LLRT measurement for Unit I was 16, 225 sccm. This value converts to 0.0094%/day, which is less than the technical specification limit of 0.12%/day. An evaluation of as left compared to as found data is contained in Appendix H.

2. During the ILRT the following penetrations were not in the post accident position. The following is the local leak rate measurement for these penetration.

Penetration	System	As Left
7A	ILRT Instrumentation	3.4
7B	ILRT Instrumentation	9.8
41	Shutdown Cooling Return	751.2
50	ILRT Pressurization	0.6
	Total:	764.8 sccm
	%/day:	.0004

3. Periodic Type B and Type C Test Results Since Last ILRT

Outage Date	LLRT	Acceptance Criteria
7/17/79	53,741 sccm	
12/18/80	151,668 sccm	.6 La =
6/28/82	16,226 sccm	207,744 sccm

H. Integrated Leakage Rate Measurement System

The following instrument system was used:

No Required	Description	Data
1. Absolute Pressure		
2	Precision Pressure Gage Mensor Model 10100-001	Range: 0-100 psia Accuracy: ± 0.02% F.S. Sensitivity: .001 psia Repeatability: .0005% F.S. Calibration Data: 4/15/82
2. Drybulb Temperature		
18	Temperature Sensors Rosemount 100 ohm Platinum Model 78-65-17	Range: 0-150°F Accuracy: ± 0.10°F Sensitivity: .01°F Repeatability: .003°F Calibration Data: 4/14/82
3. Dewpoint Temperature		
6	Dewpoint Detectors Weather Measure Model H-361 DPA	Range: 0-100°F Accuracy: ±0.32°F Sensitivity: ±0.04°F Repeatability: 0.01°F Calibration Data: 6/2/82
4. Flow Meters		
2	Brooks Model 1110-24	Range: 2-20 scfm Accuracy: ±2% F.S. Repeatability: 0.01 scfm Calibration Data: 5/20/82

5. Overall Instrumentation Selection Guide (ISG) Value (from ANSI/ANS 56.8-1981, Appendix G) based on ILRT instrumentation and an eight hour minimum test duration = 0.00765%/day. (Calculations Appendix G)

6. Drybulb and Dewpoint Temperature Sensor Volume Fractions - Table 1

7. RTD junction box locations - Table 2.

I. Information Retained at Plant

The following information is available for review at the Facility:

1. Listing of all containment penetrations, including the total number of like penetrations, penetration size and function.
2. Listing of normal operating instrumentation used for the leakage rate test.
3. Systems lineup (at time of test).
4. A continuous, sequential log of events during the test.
5. Documentation of instrumentation calibration and standards.
6. Data to verify temperature stabilization criteria as established by test procedure (Appendix B).
7. The working copy of test procedure that would include signature sign-off of procedural steps.
8. The procedure and all data from local leakage rate testing of penetrations and valves.
9. Computer printouts of Integrated Leakage Rate Test Data and manual data accumulation along with summary description of computer program.
10. The Quality Assurance audit plan that was used to monitor ILRT.
11. A listing of all test exceptions including changes in containment system boundaries instituted by licensee to conclude successful testing.
12. A review of confidence limits of test results with accompanying computer printouts where applicable.
13. Description of method of leak rate verification of instrument measuring system (super imposed leakage), with calibration information on flowmeters along with calculations that were used to measure the verification leakage rate.

14. Plots presenting ILRT data obtained during the test (Appendix E).

IV. ANALYSIS AND INTERPRETATION

The Integrated Leakage Rate Test results at the upper 95% confidence level, Lam = 0.026%/day (Mass Point analysis) and 0.086%/day (Total Time analysis), satisfy the acceptance criterion. The acceptance criterion is Lam 0.75 La = 0.150%/day, at Pa = 50 psig (-0 psi, + 0.6 psi).

Local Leakage Rate of .0004%/day for penetrations not in post-LOCA lineup is negligible.

TABLE 1

DRYBULB AND DEWPOINT TEMPERATURE SENSOR LOCATIONS

TE No.	Tag No.	Elevation (ft)	Azimuths (degrees)	Distance From Center	Volume Fractions ILRT	Reference Drawing
1	O-TE-5500T	175	0	0	.081	E-292
2	O-TE-5501	154	180	33	.081	E-292
3	O-TE-5502	154	0	33	.081	E-292
4	O-TE-5503	126	90	48	.075	E-292
5	O-TE-5508	115	0	0	.075	E-292
6	O-TE-5511	50	210 (#12 SG)	55	.021	E-290
7	O-TE-5513	104	180	32	.071	E-275-2
8	O-TE-5504	104	0	30	.071	E-292
9	O-TE-5505	75	20	48	.047	E-292
10	O-TE-5506	65	0 (Pool)	0	.042	E-292
11	O-TE-5517	16	180	45	.042	E-298
12	O-TE-5507	50	140	44	.041	E-295-1
13	O-TE-5509	50	85 (#11 SG)	40	.021	E-295-1
14	O-TE-5510	50	330	50	.041	E-295-2
15	O-TE-5512	75	220	44	.047	E-295-2
16	O-TE-5514	16	80	50	.059	E-289
17	O-TE-5515	16	0	48	.045	E-289
18	O-TE-5516	16	270	25	.059	E-289

DEWCELLS

AE No.						
1	O-AE-5518-VP	154	0	33	.224	E-292
2	O-AE-5519	119	180	33	.224	E-292
3	O-AE-5520	75	350	48	.224	E-292
4	O-AE-5521	50	320	40	.124	E-292-2
5	O-AE-5522	16	0	30	.102	E-289
6	O-AE-5523	16	180	45	.102	E-289

TABLE 2

RTD JUNCTION BOX LOCATIONS

Cable Number	RTD No.	Floor Elevation (ft)	Azimuth (degrees)	Box Elevation (ft)
O-TE-5500	1	119	325	120
O-TE-5001	2	119	145	120
O-TE-5502	3	119	325	120
O-TE-5503	4	119	145	120
O-TE-5508	5	69	120	71
O-TE-5504	8	69	10	71
O-TE-5505	9	69	350	71
O-TE-5506	10	69	220	71
O-TE-5513	7	50	180	54
O-TE-5507	12	50	150	54
O-TE-5509	13	50	40	50 (#11 SG)
O-TE-5510	14	50	320	54
O-TE-5511	6	40	240	40 (#12 SG)
O-TE-5512	15	50	210	54
O-TE-5517	11	10	180	16
O-TE-5514	16	10	80	16
O-TE-5515	17	10	0	16
O-TE-5516	18	10	270	16

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V. REFERENCES

1. Calvert Cliffs, Unit 1, Plant Technical Specifications.
2. Calvert Cliffs Procedure STP M-662-1, Integrated Leakage Rate Test, Unit 1 Containment.
3. 10CFR50, Appendix J, Reactor Containment Leakage Testing for Water Cooled Power Reactors.
4. U.S. Nuclear Regulatory Commission Regulatory Guide 1.68, Preoperational and Initial Startup Test Program for Water Cooled Power Reactors.
5. ANSI N45.4-1972, Leakage Rate Testing of Containment Structures for Nuclear Reactors.
6. ANSI/ANS 56.8-1981, Containment System Leakage Testing Requirements.
7. Bechtel Topical Report BN-TOP-1, Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants.

A. Program and Report Description

1. The Bechtel ILRT computer program is used to determine the integrated leakage rate of a nuclear primary containment structure. The program is used to compute leakage rate based on input values of time, free air volume containment atmosphere total pressure, drybulb temperature, and dewpoint temperature (water vapor pressure). Leakage rate is computer using the Absolute Method as defined in ANSI/ANS 56.8-1981, "Containment System Leakage Testing Requirements" and BN-TOP-1, Rev 1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants". The program is designed to allow the user to evaluate containment leakage rate test results at the jobsite during containment leakage testing. Current leakage rate values may be obtained at any time during the testing period using one of two computational methods, yielding three different report printouts.

2. In the first printout, the Total Time Report, leakage rate is computed from initial values of free air volume, containment atmosphere drybulb temperature and partial pressure of dry air, the latest values of the same parameters, and elapsed time. These individually computed leakage rates are statistically averaged using linear regression by the method of least squares. The Total-Time Method is the computational technique upon which the short duration test criteria of BN-TOP-1, Rev 1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plant," are based.

3. The second printout is the Mass Point Report and is based on the Mass-Point Analysis Technique described in ANSI/ANS 56.8-1981, "Containment System Leakage Testing Requirements." The mass of dry air in the containment is computed at each data point (time) using the Equation of State, from current values of containment atmosphere drybulb temperature and partial pressure of dry air. Contained mass is "plotted" versus time and a regression line is fit to the data using the method of least squares. Leakage rate is determined from the statistically derived slope and intercept of the regression line.

4. The third printout, the Trend Report, is a summary of leakage rate values based on Total time and Mass Point computations presented as a fuction of number of data points and elapsed time (test duration). The Trend Report provides all leakage rate values required for comparision to the acceptance criteria of BN-TOP-1 for conduct of a short duration test.

5. The program is written in a high level language and is designed for use on a mini-computer with direct data input from the data acquisition system, or on a mainframe via a remote data terminal. Brief descriptions of program use, formulae used for leakage rate computations, and program logic are provided in the following paragraphs.

B. Explanation of Program

1. The Bechtel ILRT computer program is written, for use by experienced ILRT personnel, to determine containment integrated leakage rates based on the Absolute Method described in ANSI/ANS 56.8-1981 and BN-TOP-1.

2. Information loaded into the program prior to the start of the test:

   a. Number of containment atmosphere drybulb temperature sensors and dewpoint temperature (water vapor pressure) sensors to be used in leakage rate computations for the specific test

   b. Volume fractions assigned to each of the above sensors

   c. Calibration data for above sensor, if required

   d. Calibration data for pressure sensor.

3. Information entered into the program at the start of the test:

   a. Test title

   b. Current test pressure and peak test pressure

   c. Maximum allowable leakage rate at peak test pressure

   d. If the test is a verification test:

      (1) Imposed leakage rate

      (2) Leakage rates determined using the two computational methods described in Paragraph A above during the ILRT.

4. Data received from the data acquistion system during the test, and used to compute leakage rates:

   a. Time and date

   b. Containment atmosphere drybulb temperatures

   c. Containment atmosphere pressure

   d. Containment atmosphere dewpoint temperatures

5. After all data at a given time are received , a Summary of Measured Data report (refer to "Program Logic," Paragraph D, "Data" option command) is printed on the data terminal. The date, containment atmosphere weighted average drybulb temperature, partial pressure of the dry air and water vapor pressure are stored on a data file.

6. If drybulb and dewpoint temperature sensors should fail during the test, the data from the sensor(s) are not used. The volume fractions for the remaining sensors are recomputed and reloaded into the program for use in ensuing leakage rate computations.

C. Leakage Rate Formulae

1. Computation using the Total Time Method:

a. Measured leakage rate, from data:

$$P_1 V_i = W_1 R T_1 \quad (1)$$

$$P_i V_i = W_i R T_i \quad (2)$$

$$L_i = \frac{2400\ (W_1 - W_i)}{\Delta t_i\ W_1} \quad (3)$$

Solving for W_1 and W_i and substituting equations (1) and (2) into (3) yields:

$$L_i = 2400/\Delta t_i (1 - T_1 P_i / T_i P_1) \quad (4)$$

where:

W_1, W_i = Weight of contained mass of dry air at times t_1 and t_i respectively, lbm.

T_1, T_i = Containment atmosphere drybulb temperature at times t_1 and t_i respectively, °R.

P_1, P_i = Partial pressure of the dry air component of the containment atmosphere at times t_1 and t_i respectively, psia.

V_i = Containment free air volume (constant or variable during the test), ft^3.

t_1, t_i = Time at 1^{st} and i^{th} data points respectively, hours.

Δt_i = Elapsed time from t_1 to t_i, hours.

R = Specific gas constant for air = 53.35 ft.lbf/lbm.°R.

L_i = Measured leakage rate computed during time interval t_1 to t_i, %/day.

b. Calculated leakage rate from regression analysis:

$$\overline{L} = a + b\Delta t_N \tag{5}$$

where:

$\overline{L}$ = Calculated leakage rate, %/day, as determined from the regression line.

$$a = \frac{\Sigma L_i(\Sigma \Delta t_i^2) - \Sigma \Delta t_i(\Sigma L_i \Delta t_i)}{N(\Sigma \Delta t_i^2) - (\Sigma \Delta t_i)^2} \tag{6}$$

$$b = \frac{N(\Sigma L_i \Delta t_i) - \Sigma L_i(\Sigma \Delta t_i)}{N(\Sigma \Delta t_i^2) - (\Sigma \Delta t_i)^2} \tag{7}$$

N = Number of data points

$$\Sigma = \sum_{i=1}^{N}$$

c. Calculated leakage rate at the 95% confidence level.

$$\overline{L}_{95} = a + b\Delta t_N + S_{\overline{L}} \tag{8}$$

where:

$\overline{L}_{95}$ = Calculated leakage rate at the 95% confidence level, %/day, at elapsed time Δt_N.

For $\Delta t_N < 24$

$$S_{\overline{L}} = t_{0}.025;N-2 \left[\Sigma(L_i - \overline{L}_i)^2/(N-2)\right]^{1/2} \times \left[1 + \frac{1}{N} + (\Delta t_N - \overline{\Delta t})^2/\Sigma(\Delta t_i - \overline{\Delta t})^2\right]^{1/2} \tag{9a}$$

where, $t_{0}.025;N-2 = 1.95996 + \frac{2.37226}{N-2} + \frac{2.82250}{(N-2)^2}$;

For $\Delta t_N \geq 24$

$$S_{\overline{L}} = t_{0}.025;N-2 \left[\Sigma(L_i - \overline{L}_i)^2/(N-2)\right]^{1/2} \times \left[\frac{1}{N} + (\Delta t_N - \overline{\Delta t})^2/\Sigma(\Delta t_i - \overline{\Delta t})^2\right]^{1/2} \tag{9b}$$

where, $t_{0}.025;N-2 = \dfrac{1.6449(N-2)^2 + 3.5283(N-2) + 0.85602}{(N-2)^2 + 1.2209(N-2) - 1.5162}$

$\overline{L}_i$ = Calculated leakage rate computed using equation (5) at total elapsed time Δt_i, %/day.

$$\overline{\Delta t} = \frac{\Sigma \Delta t_i}{N}$$

2. Computation using the Mass Point Method

a. Contained mass of dry air from data:

$$W_i = 144 \frac{P_i V_i}{R T_i} \qquad (10)$$

where:

All symbols as previously defined.

b. Calculated leakage rate from regression analysis:

$$\overline{L} = -2400 \frac{b}{a} \qquad (11)$$

where:

$\overline{L}$ = Calculated leakage rate, %/day, as determined from the regression line.

$$a = \frac{\Sigma W_i - b\Sigma\Delta t_i}{N} \qquad (12)$$

$$b = \frac{\Sigma[(W_i - \Sigma W_i/N)\ (\Delta t_i - \overline{\Delta t})]}{\Sigma(\Delta t_i - \overline{\Delta t})^2} \qquad (13)$$

Δt_i = Total elapsed time at time of i^{th} data point, hours

N = Number of data points

W_i = Contained mass of dry air at i^{th} data point, lbm, as computed from equation (10).

$$\Sigma = \sum_{i=1}^{N}$$

$$\overline{\Delta t} = \Sigma\Delta t_i / N$$

c. Calculated leakage rate at the 95% confidence level.

$$\overline{L}_{95} = \frac{-2400}{a} (b + S_b) \qquad (14)$$

where:

$\overline{L}_{95}$ = Calculated leakage rate at the 95% confidence level, %/day.

$$S_b = t_{0}.025;N-2 \left[\frac{\Sigma(W_i - \overline{W_i})^2}{(N-2)\Sigma(\Delta t_i - \overline{\Delta t})^2} \right]^{1/2} \quad (15)$$

where, $t_{0}.025;N-2 = \dfrac{1.6449(N-2)^2 + 3.5283\ (N-2)^2 + 0.85602}{(N-2)^2 + 1.2209\ (N-2) - 1.5162}$

$\overline{W}_i$ = Contained mass of dry air, lbm, computed at the i^{th} data point from the regression equation (16)

$= a + b\Delta t_i$

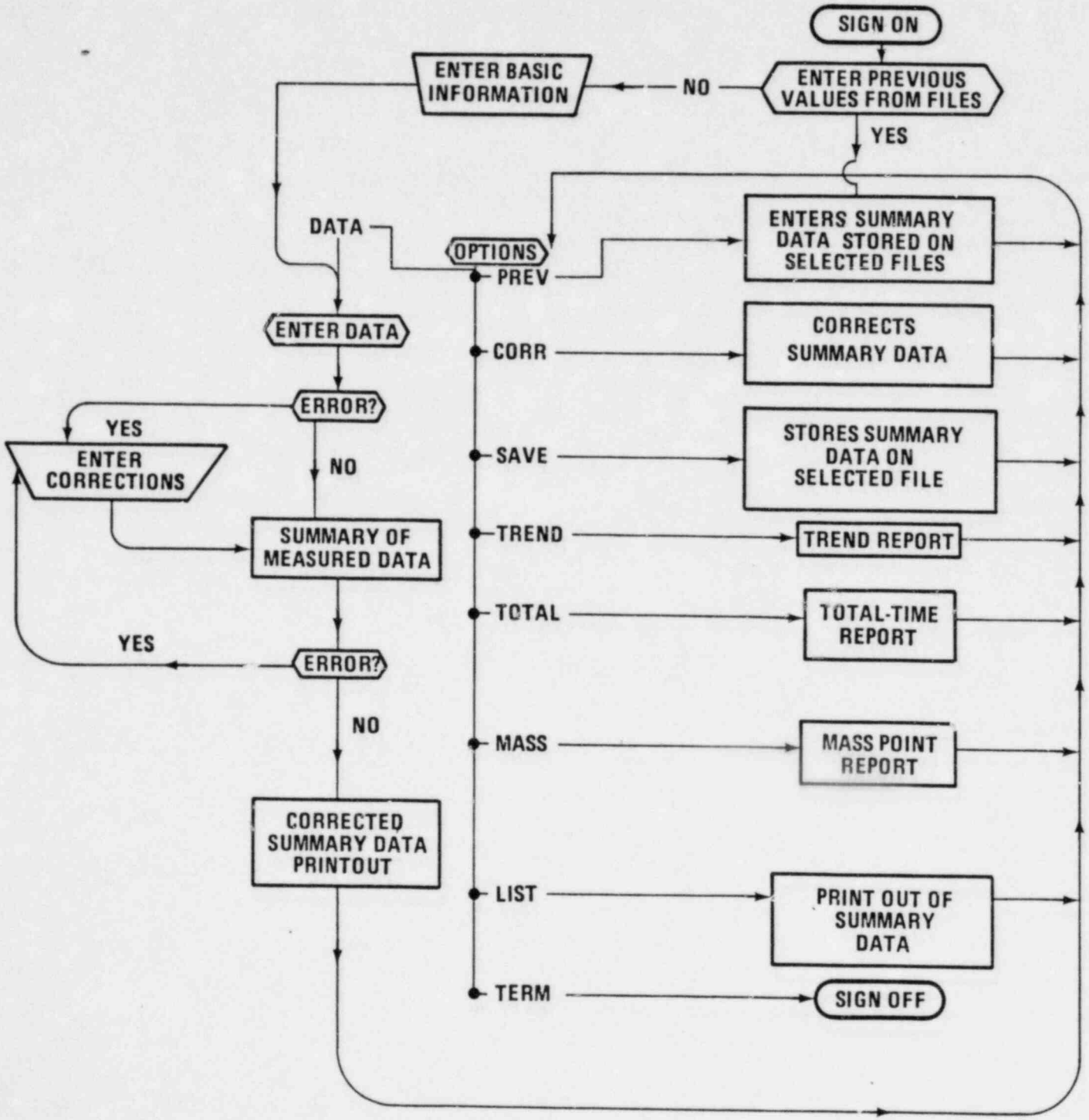
All other symbols are previously defined.

D. Program Logic

1. A flow chart of Bechtel ILRT computer program usage is presented in Figure 1, following. The various user options and a brief description of their associated function are presented below:

OPTION COMMAND	FUNCTION
DATA	Enables operator to enter raw data. When the system requests values of time, volume temperature, pressure and vapor pressure, the user enters the appropriate data. After completing the data entry, a summary is printed out. The user then verifies that the data were entered correctly. If errors are detected, the user will then be given the opportunity to correct the errors. After the user verifies that the data were entered correctly, a Corrected Data Summary Report of time, data, average temperature, partial pressure of dry air, and water vapor pressure is printed.
TREND	Terminal will print out a Trend Report.
TOTAL	Terminal will print out a Total Time Report.
MASS	Terminal will print out a Mass Point Report.
TERM	Enables operator to sign-off temporarily or permanently.
SAVE	Enables operator to store the Data Summary on a file.
PREV	Enables operator to call up an old, previously stored, file.
CORR	Enables operator to correct data stored on a file.
LIST	When used with a given file name, the printer will print out a list of the Summary Data stored on the file.
READ	Enable the computer to receive the next set of raw data from the data acquisition system directly.

BECHTEL CONTAINMENT
INTEGRATED LEAKAGE RATE TEST
COMPUTER PROGRAM FLOW CHART



E. COMPUTER REPORT AND DATA PRINTOUT

MASS POINT REPORT

The Mass Point Report presents leakage rate data (wt%/day) as determined by the Mass Point Method described in the "Computer Program" section of this report. The "Calculated Leakage Rate" is the value determined from the regression analysis. The "Containment Air Mass" values are the masses of dry air in the containment (lbm). These values, determined from the Equation of State, are used in the regression analysis.

TOTAL TIME REPORT

The Total Time Report presents data leakage rate (wt%/day) as determined by the Total Time Method. The "Calculated Leakage Rate" is the value determined from the regression analysis. The "Measured Leakage Rates" are the leakage rate values determined using Total Time calculations used in the above regression analysis.

TREND REPORT

The Trend Report presents leakage rates (as determined by the Mass Point and Total Time methods described in the "Computer Program" section of this report) in percent of the initial contained mass of dry air per day (wt%/day), elapsed time (hours), and number of data points.

SUMMARY DATA REPORT

The Summary Data report presents the actual data used to calculate leakage rates by the various methods described in the "Computer Program" section of this report. The five column headings are TIME, DATE, TEMP, PRESSURE, and VPRS, and contain data defined as follows:

1. TIME: Time in 24-hour notations (hours and minutes).

2. DATE: Calendar date (month and day).

3. TEMP: Containment weighted-average drybulb temperature in absolute units, degrees Rankine (°R).

4. PRESSURE: Partial pressure of the dry air component of the containment atmosphere in absolute units (psia).

5. VPRS: Partial pressure of water vapor of the containment atmosphere in absolute units (psia).

F. SUMMARY OF MEASURED DATA AND SUMMARY OF CORRECTED DATA

The Summary of Measured Data presents the individual containment atmosphere drybulb temperatures, dewpoint temperatures, and absolute total pressure measured at the time and date as indicated and is used to determine the temperature and pressure described in above.

1. TEMP 1 through TEMP N are the drybulb temperatures, where N = No. of RTD's. The values in the right-hand column are temperatures (°F), multiplied by 100, as read from the data acquisition system (DAS). The values in the left-hand column are the corrected temperatures expressed in absolute units (°R).

2. PRES 1 is the total pressure, absolute. The right-hand value, in parentheses, is a number in counts as read from the DAS. This count value is converted to a value in psia by the computer via the instrument's calibration table, counts versus psia. The left-hand column is the absolute total pressure, psia.

3. VPRS 1 through VPRS n are the dewpoint temperatures (water vapor pressures), where n = No. of dewpoint sensors. The values in the right-hand column are temperatures (°F), multiplied by 100 as read from the DAS. The values in the left-hand column are the water vapor pressures (psia) from the steam tables for saturated steam corresponding to the dewpoint (saturation) temperatures in the center column.

The Summary of Corrected Data presents corrected temperature and pressure values and calculated air mass determined as follows:

1. TEMPERATURE (°F) is the volume weighted average containment atmosphere drybulb temperature derived from TEMP 1 through TEMP N.

2. CORRECTED PRESSURE (psia) is the partial pressure of the dry air component of the containment atmosphere, absolute. The volume weighted average containment atmosphere water vapor pressure is subtracted from PRES 1, total pressure, yielding the partial pressure of the dry air.

3. VAPOR PRESSURE (psia) is the volume weighted average containment atmosphere water vapor pressure, absolute derived from VPRS 1 through VPRS n.

4. CONTAINMENT AIR MASS (lbm) is the calculated mass of dry air in the containment. The mass of dry air is calculated using the containment free air volume and the above TEMPERATURE and CORRRECTED PRESSURE of the dry air.

PRESSURIZATION AND STABILIZATION DATA

PRES.DAT

CALVERT CLIFFS UNIT 1 ILRT

ALMAX = 0.200 VOL = 2000000.00

VRATET = 0.000 VRATEM = 0.000 VRATEP = 0.000

TIME	DATE	TEMP	PRESSURE	VPRS	VOLUME
1409	619	541.82489	14.258271	0.30981112	2000000.
1430	619	542.97443	15.649601	0.31298816	2000000.
1500	619	543.46808	16.918558	0.31579533	2000000.
1530	619	543.58905	18.188131	0.31798723	2000000.
1600	619	543.66956	19.455442	0.31843758	2000000.
1630	619	542.38464	20.675936	0.31865665	2000000.
1700	619	542.06000	21.922369	0.31972361	2000000.
1730	619	541.85400	23.166958	0.32063529	2000000.
1800	619	541.65887	24.400242	0.32285649	2000000.
1830	619	541.43738	25.635345	0.32266432	2000000.
1900	619	541.31873	26.871767	0.32500181	2000000.
1930	619	541.25751	28.113325	0.32520127	2000000.
2000	619	541.23360	29.353626	0.32665670	2000000.
2030	619	541.28296	30.602953	0.32704791	2000000.
2100	619	541.34454	31.849829	0.32917252	2000000.
2130	619	541.28888	33.088444	0.32855639	2000000.
2200	619	541.11462	34.166656	0.32934442	2000000.
2230	619	540.63647	34.973335	0.33078060	2000000.
2300	619	539.85614	34.901932	0.33296204	2000000.
2330	619	537.36871	33.318569	0.32142857	2000000.
0	620	536.67078	31.636127	0.30887279	2000000.
30	620	536.22406	30.060499	0.29750016	2000000.
100	620	535.79901	28.583633	0.28546113	2000000.
130	620	535.56555	27.201456	0.27203509	2000000.
200	620	536.23969	26.282969	0.26545042	2000000.
230	620	537.15692	26.221363	0.26511797	2000000.
300	620	537.39673	26.222029	0.26644802	2000000.
330	620	537.41681	26.222826	0.26665154	2000000.
400	620	537.34100	26.215868	0.26661631	2000000.
430	620	537.33661	26.214653	0.26783153	2000000.
500	620	537.46918	26.221649	0.26682860	2000000.
530	620	537.61584	26.227486	0.26798639	2000000.
600	620	537.74463	26.231308	0.27015603	2000000.
630	620	539.30658	27.554480	0.27065960	2000000.
700	620	539.75287	28.879910	0.27589741	2000000.
730	620	539.87451	30.190376	0.28062186	2000000.
800	620	540.04425	31.501234	0.28676537	2000000.
830	620	540.14191	32.807030	0.28997204	2000000.
900	620	540.24969	34.107307	0.29169583	2000000.
930	620	540.28583	35.400368	0.29801083	2000000.
1000	620	540.29010	36.695568	0.30197409	2000000.
1030	620	540.25842	37.986351	0.30332792	2000000.
1100	620	540.10895	39.261990	0.30779409	2000000.
1130	620	540.00720	40.540070	0.31073391	2000000.
1200	620	539.93127	41.753403	0.31183249	2000000.
1230	620	539.85992	42.851393	0.31103474	2000000.
1300	620	539.92902	44.134552	0.31946692	2000000.
1330	620	539.99860	45.423702	0.32061779	2000000.
1400	620	540.11328	46.712978	0.32385907	2000000.

PRESSURIZATION AND STABILIZATION DATA

1430	620	540.03271	47.977692	0.32685417	2000000.
1500	620	540.00549	49.241886	0.33096606	2000000.
1530	620	539.91895	50.506725	0.33536217	2000000.
1600	620	539.88391	51.771969	0.33964031	2000000.
1630	620	539.84296	53.043320	0.33982116	2000000.
1700	620	539.84027	54.312752	0.34291733	2000000.
1730	620	539.77667	55.584808	0.33939159	2000000.
1800	620	539.73596	56.847168	0.34128079	2000000.
1830	620	539.60889	58.104233	0.34547189	2000000.
1900	620	539.48126	59.361759	0.35419786	2000000.
1930	620	539.46130	60.631645	0.35060650	2000000.
2000	620	539.33649	61.895237	0.34972703	2000000.
2030	620	539.24170	63.157944	0.35471985	2000000.
2045	620	539.26392	63.793087	0.35592431	2000000.
2100	620	539.19519	64.418358	0.36300439	2000000.

CALVERT CLIFFS UNIT 1 ILRT

TREND REPORT
LEAKAGE RATES (WEIGHT PERCENT/DAY)

TIME AND DATE AT START OF TEST: 545 0621
ELAPSED TIME: 8.00 HOURS

NO. DATA POINTS	ELAPSED TIME	TOTAL-TIME ANALYSIS MEAN	MASS-POINT ANALYSIS CALCULATED	MASS-POINT ANALYSIS CALCULATED	MASS-POINT ANALYSIS 95% UCL
10	2.25	0.051	0.072	0.051	0.086
11	2.50	0.050	0.065	0.045	0.074
12	2.75	0.049	0.059	0.041	0.065
13	3.00	0.048	0.054	0.037	0.057
14	3.25	0.046	0.046	0.030	0.049
15	3.50	0.047	0.048	0.036	0.053
16	3.75	0.046	0.047	0.036	0.051
17	4.00	0.045	0.043	0.032	0.046
18	4.25	0.045	0.042	0.033	0.045
19	4.50	0.043	0.036	0.026	0.039
20	4.75	0.043	0.034	0.025	0.037
21	5.00	0.042	0.033	0.026	0.036
22	5.25	0.042	0.032	0.025	0.035
23	5.50	0.041	0.030	0.023	0.032
24	6.00	0.040	0.028	0.023	0.031
25	6.25	0.040	0.027	0.023	0.030
26	6.50	0.039	0.027	0.024	0.031
27	6.75	0.039	0.026	0.023	0.029
28	7.00	0.039	0.026	0.024	0.030
29	7.25	0.038	0.026	0.024	0.029
30	7.50	0.037	0.024	0.021	0.027
31	7.75	0.037	0.024	0.022	0.027
32	8.00	0.037	0.023	0.021	0.026

CALVERT CLIFFS UNIT 1 ILRT

LEAKAGE RATE (WEIGHT PERCENT/DAY)
MASS-POINT ANALYSIS

TIME AND DATE AT START OF TEST: 545 0621
ELAPSED TIME: 8.00 HOURS

TIME	TEMP (R)	PRESSURE (PSIA)	CTMT. AIR MASS (LBM)	MASS LOSS (LBM)	TOT.AVG. MASS LOSS (LBM/HR)
545	542.900	64.7685	644025.		
600	542.928	64.7722	644028.	-3.1	-12.5
615	542.963	64.7755	644019.	9.0	11.8
630	543.001	64.7799	644017.	1.6	9.9
645	543.035	64.7804	643983.	34.6	42.0
700	543.074	64.7868	643999.	-16.6	20.4
715	543.099	64.7909	644010.	-11.2	9.5
730	543.142	64.7941	643992.	18.6	18.7
745	543.168	64.7980	644000.	-7.9	12.5
800	543.200	64.8018	643999.	0.4	11.3
815	543.225	64.8046	643997.	2.2	11.0
830	543.257	64.8081	643995.	2.4	10.9
845	543.290	64.8122	643996.	-0.9	9.6
900	543.309	64.8152	644004.	-7.9	6.5
915	543.338	64.8157	643974.	29.8	14.5
930	543.357	64.8188	643982.	-8.2	11.4
945	543.391	64.8240	643991.	-11.9	7.7
1000	543.414	64.8251	643978.	16.2	11.0
1015	543.430	64.8300	644007.	-29.2	3.9
1030	543.458	64.8314	643987.	19.7	7.9
1045	543.488	64.8341	643979.	7.8	9.0
1100	543.516	64.8376	643981.	-1.8	8.3
1115	543.534	64.8408	643991.	-9.4	6.2
1145	543.584	64.8452	643976.	15.0	8.2
1200	543.605	64.8479	643977.	-1.6	7.6
1215	543.625	64.8494	643968.	9.0	8.7
1230	543.647	64.8529	643978.	-9.5	6.9
1245	543.669	64.8542	643963.	14.4	8.7
1300	543.683	64.8567	643972.	-8.2	7.3
1315	543.691	64.8598	643994.	-22.6	4.1
1330	543.717	64.8599	643964.	30.4	7.9
1345	543.733	64.8633	643978.	-14.3	5.8

FREE AIR VOLUME USED (MILLIONS OF CU. FT.) = 2.000

REGRESSION LINE
INTERCEPT (LBM) = 644013.
SLOPE (LBM/HR) = -5.5

MAXIMUM ALLOWABLE LEAKAGE RATE = 0.200
75 % OF MAXIMUM ALLOWABLE LEAKAGE RATE = 0.150
THE UPPER 95% CONFIDENCE LIMIT = 0.026
THE CALCULATED LEAKAGE RATE = 0.021

CONT. FREE AIR VOLUME AT TIME 1345 = 2000000.

CALVERT CLIFFS UNIT 1 ILRT

LEAKAGE RATE (WEIGHT PERCENT/DAY)
TOTAL-TIME ANALYSIS

TIME AND DATE AT START OF TEST: 545 0621
ELAPSED TIME: 8.00 HOURS

TIME	TEMP. (R)	PRESSURE (PSIA)	MEASURED LEAKAGE RATE
545	542.900	64.7686	
600	542.928	64.7722	-0.048
615	542.963	64.7753	0.043
630	543.001	64.7799	0.036
645	543.033	64.7804	0.156
700	543.074	64.7868	0.076
715	543.099	64.7909	0.035
730	543.142	64.7941	0.070
745	543.168	64.7980	0.046
800	543.200	64.8018	0.042
815	543.225	64.8046	0.041
830	543.257	64.8081	0.040
845	543.290	64.8122	0.036
900	543.309	64.8152	0.024
915	543.338	64.8157	0.054
930	543.357	64.8188	0.042
945	543.391	64.8240	0.029
1000	543.414	64.8251	0.041
1015	543.430	64.8300	0.015
1030	543.458	64.8314	0.029
1045	543.488	64.8341	0.034
1100	543.516	64.8376	0.031
1115	543.534	64.8408	0.023
1145	543.584	64.8452	0.030
1200	543.605	64.8479	0.028
1215	543.625	64.8494	0.032
1230	543.647	64.8529	0.026
1245	543.669	64.8542	0.033
1300	543.683	64.8567	0.027
1315	543.691	64.8598	0.015
1330	543.717	64.8599	0.029
1345	543.733	64.8633	0.022

MEAN OF MEASURED LEAKAGE RATES	=	0.037
MAXIMUM ALLOWABLE LEAKAGE RATE	=	0.200
75 % OF MAXIMUM ALLOWABLE LEAKAGE RATE	=	0.150
THE UPPER 95% CONFIDENCE LIMIT	=	0.086
THE CALCULATED LEAKAGE RATE	=	0.023

ILRT SUMMARY DATA

ILRT.DAT

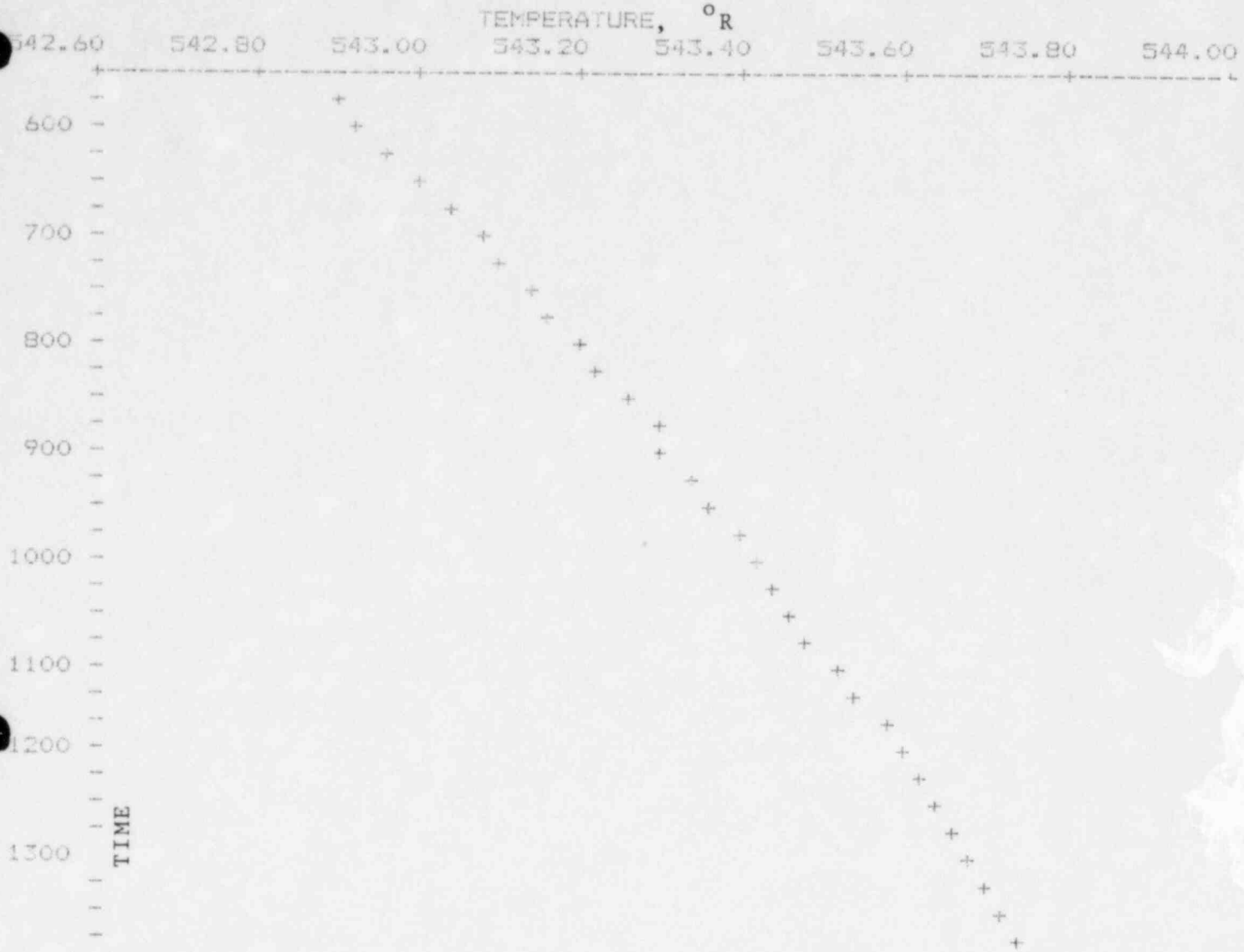
CALVERT CLIFFS UNIT 1 ILRT

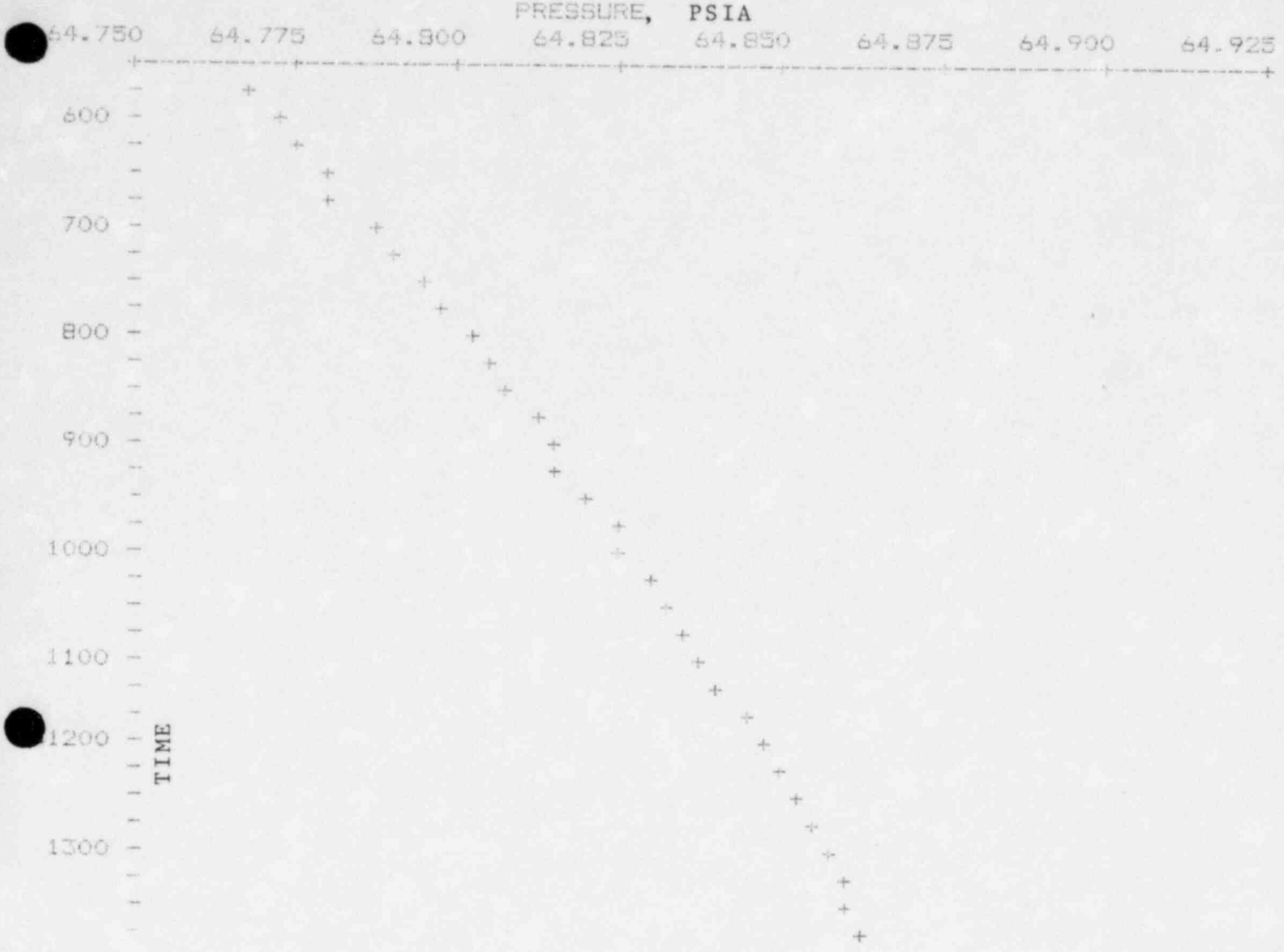
ALMAX = 0.200 VOL = 2000000.00

VRATET = 0.000 VRATEM = 0.000 VRATEP = 0.000

TIME	DATE	TEMP	PRESSURE	VPRS	VOLUME
545	621	542.90045	64.768608	0.36830735	2000000.
600	621	542.92828	64.772247	0.36765021	2000000.
615	621	542.96283	64.775459	0.36842698	2000000.
630	621	543.00116	64.779877	0.36799835	2000000.
645	621	543.03491	64.780426	0.37042356	2000000.
700	621	543.07397	64.786751	0.36907431	2000000.
715	621	543.09918	64.790386	0.36791906	2000000.
730	621	543.14215	64.794144	0.36864588	2000000.
745	621	543.16821	64.798042	0.36772794	2000000.
800	621	543.20026	64.801826	0.36792517	2000000.
815	621	543.22528	64.804596	0.36913458	2000000.
830	621	543.25690	64.808128	0.36739490	2000000.
845	621	543.29022	64.812195	0.36750868	2000000.
900	621	543.30896	64.815224	0.36746165	2000000.
915	621	543.33838	64.815742	0.36893243	2000000.
930	621	543.35699	64.818787	0.36887109	2000000.
945	621	543.39062	64.823997	0.36764628	2000000.
1000	621	543.41364	64.825119	0.36851338	2000000.
1015	621	543.43018	64.830025	0.36858612	2000000.
1030	621	543.45844	64.831413	0.36918768	2000000.
1045	621	543.48767	64.834122	0.36946145	2000000.
1100	621	543.51350	64.837624	0.36894208	2000000.
1115	621	543.53381	64.840752	0.36780632	2000000.
1145	621	543.58356	64.845177	0.36935472	2000000.
1200	621	543.60468	64.847862	0.36865634	2000000.
1215	621	543.62500	64.849380	0.36912441	2000000.
1230	621	543.64661	64.852913	0.36758173	2000000.
1245	621	543.66943	64.854187	0.36929494	2000000.
1300	621	543.68317	64.856651	0.36881652	2000000.
1315	621	543.69073	64.859833	0.36762944	2000000.
1330	621	543.71741	64.859947	0.36950669	2000000.
1345	621	543.73346	64.863297	0.36914332	2000000.

ILRT

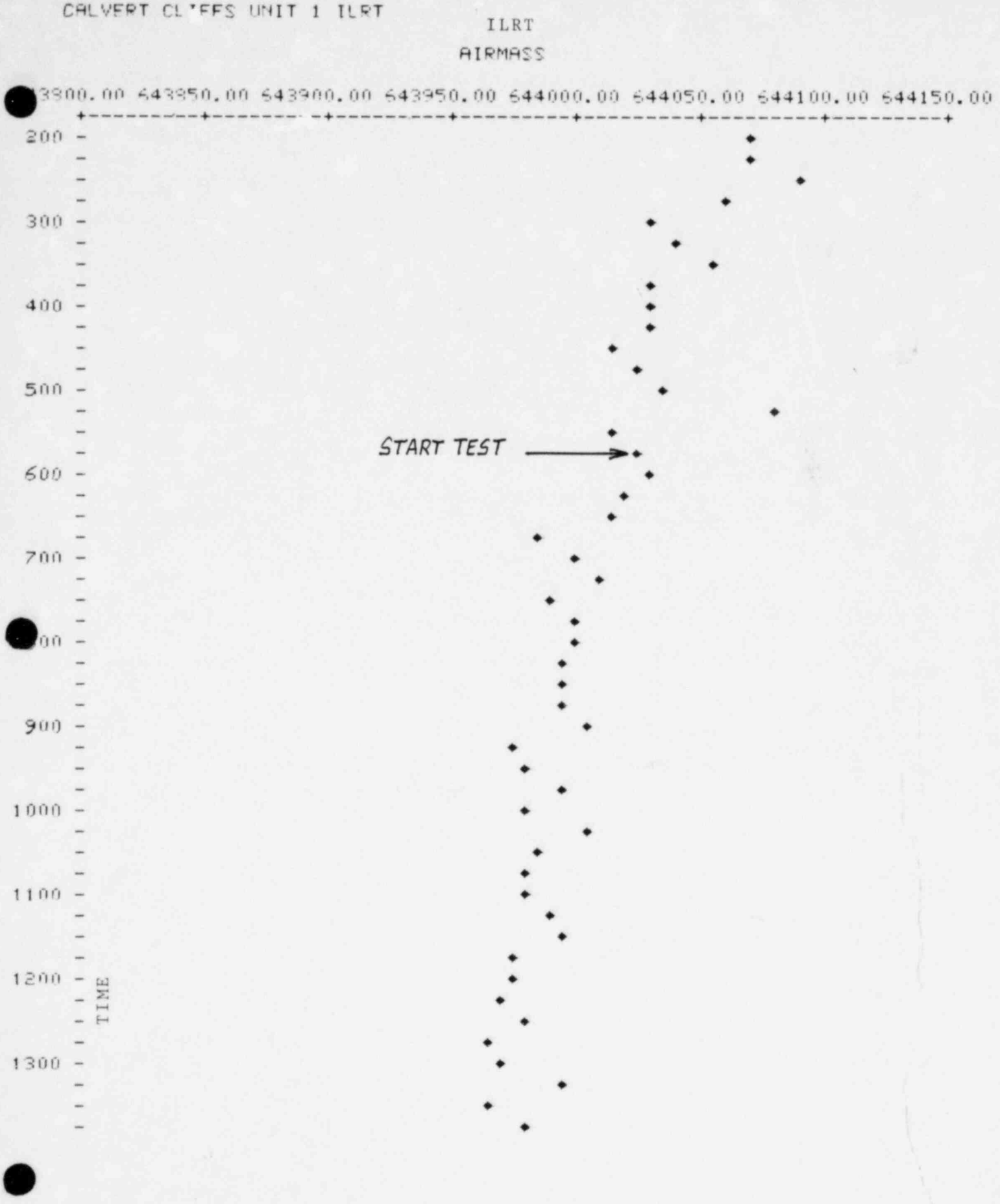

TEMPERATURE, °R
542.60
542.80
543.00
543.20
543.40
543.60
543.80
544.00
600
700
800
900
1000
1100
1200
1300
TIME


ILRT
PRESSURE, PSIA
64.750
64.775
64.800
64.825
64.850
64.875
64.900
64.925
600
700
800
900
1000
1100
1200
1300
TIME

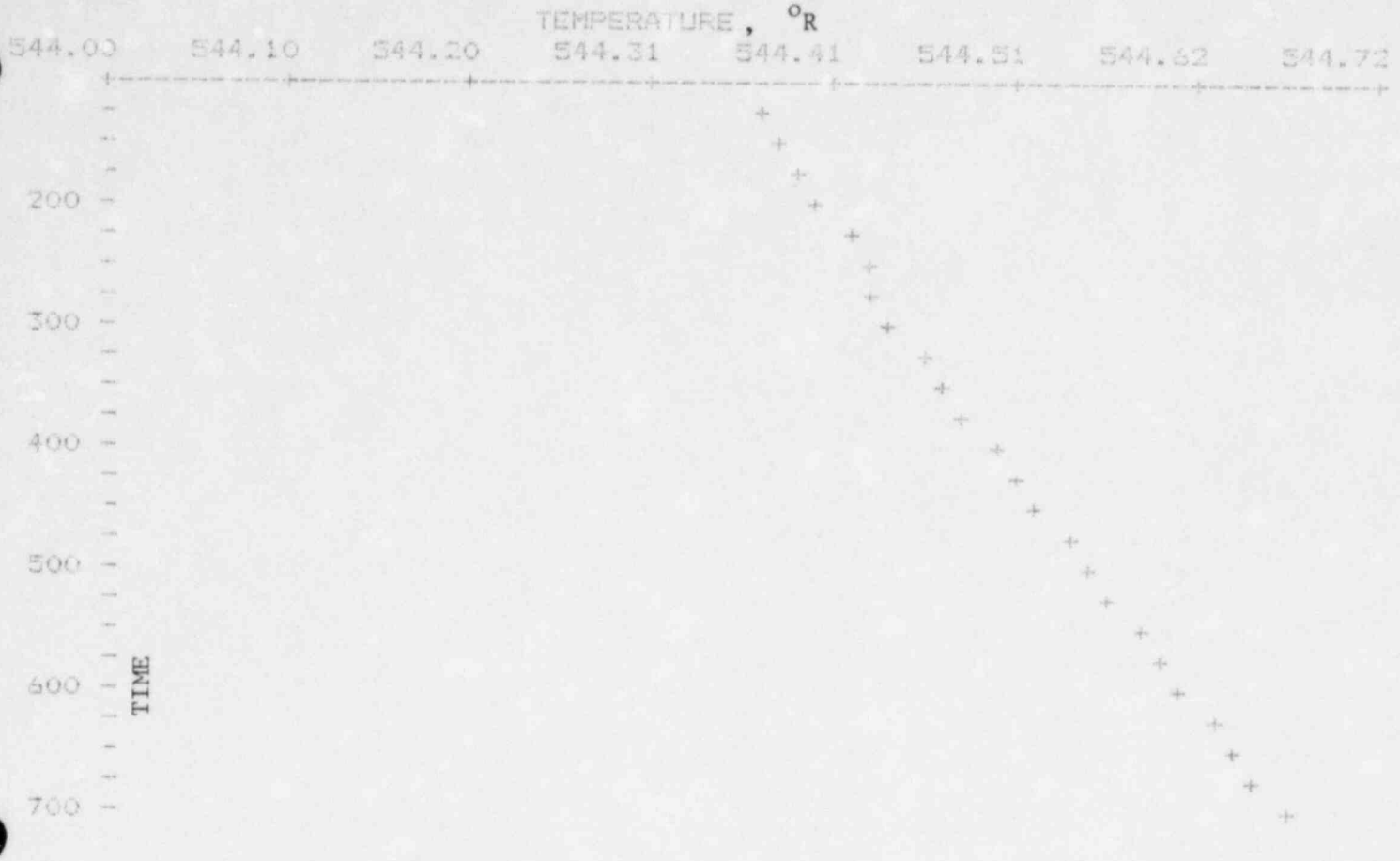
ILRT


VAPOR PRESSURE, PSIA
0.3650
0.3660
0.3670
0.3680
0.3690
0.3700
0.3710
600
700
800
900
1000
1100
1200
1300
TIME

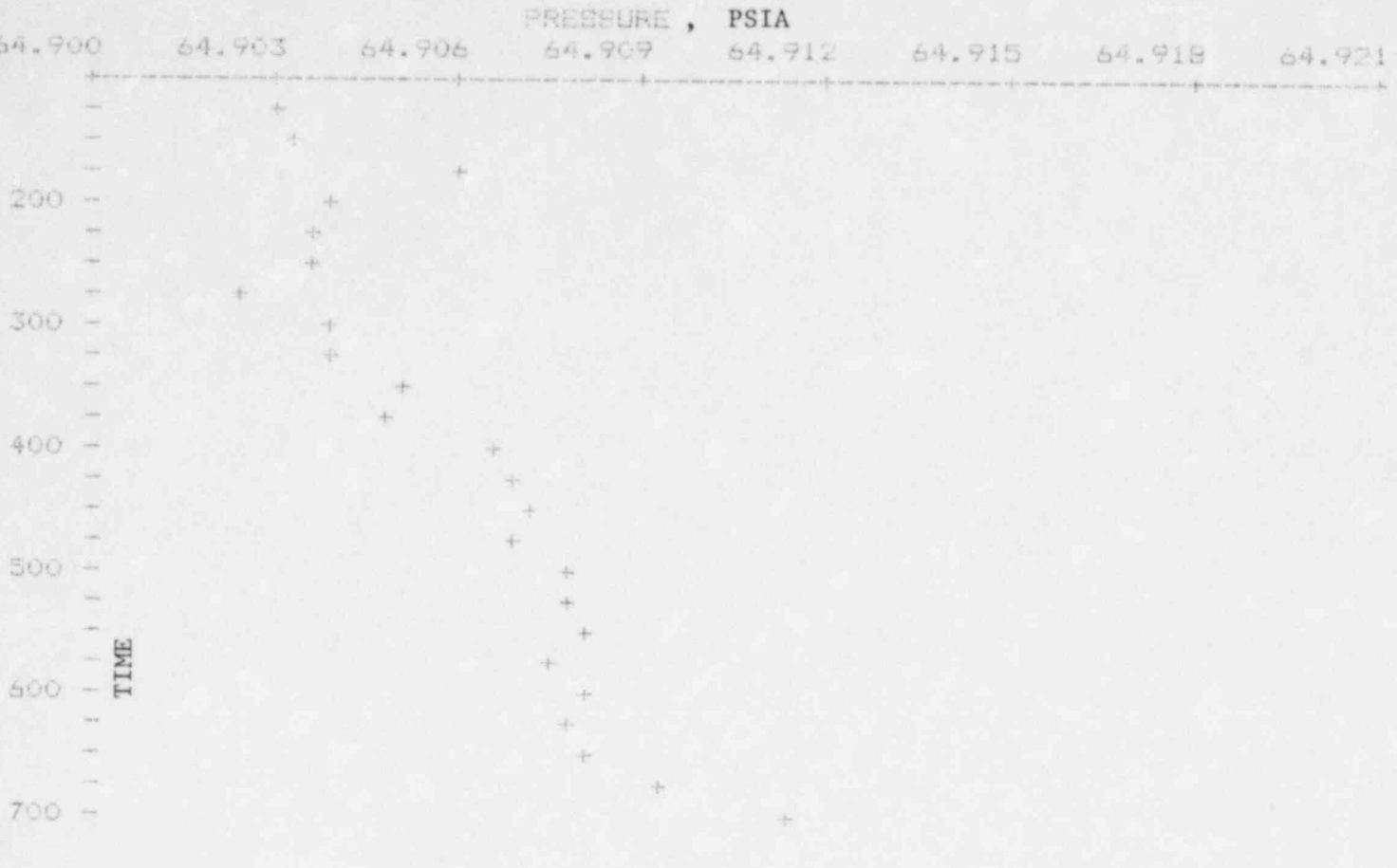
CALVERT CL'FFS UNIT 1 ILRT

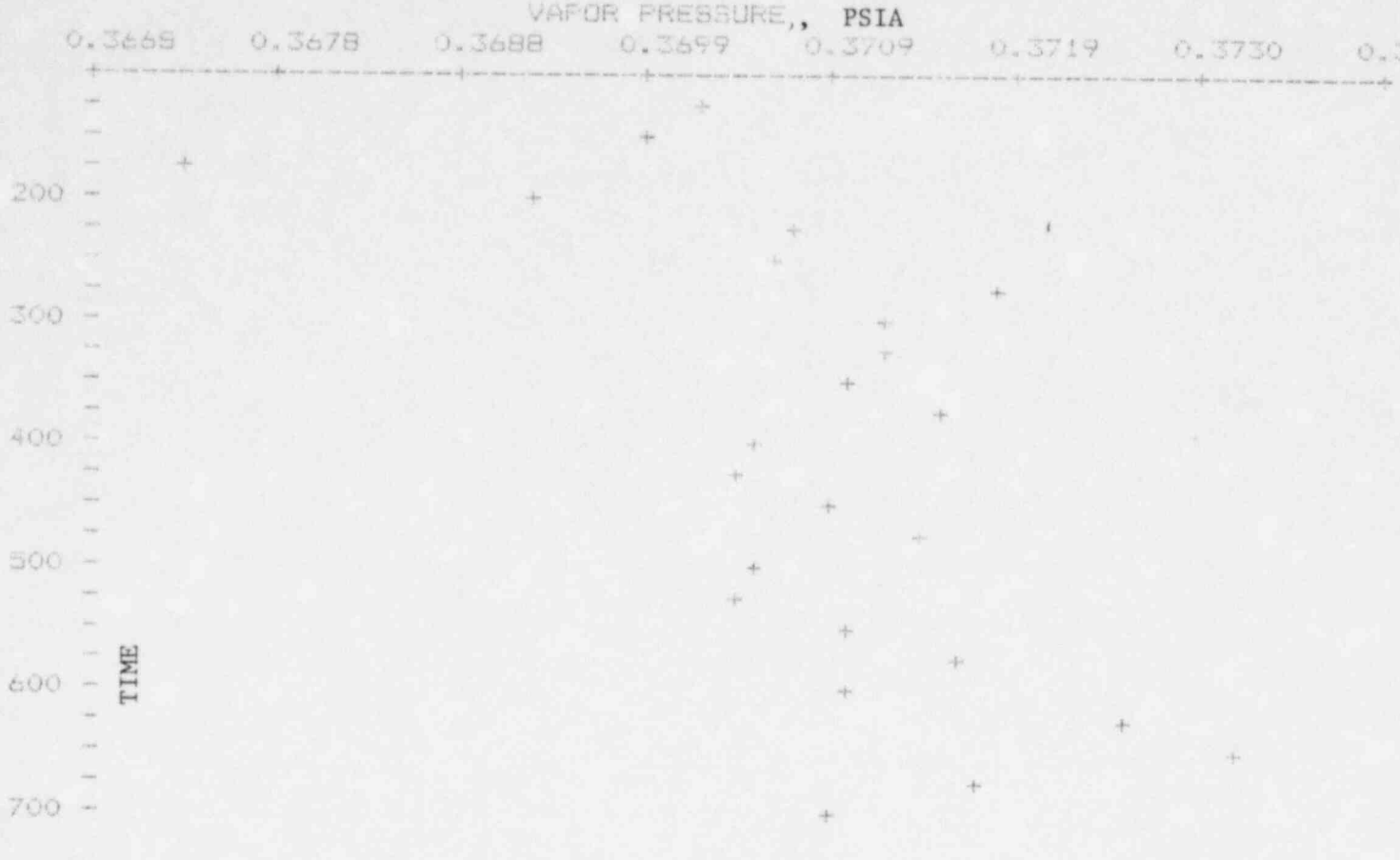


VERIFICATION



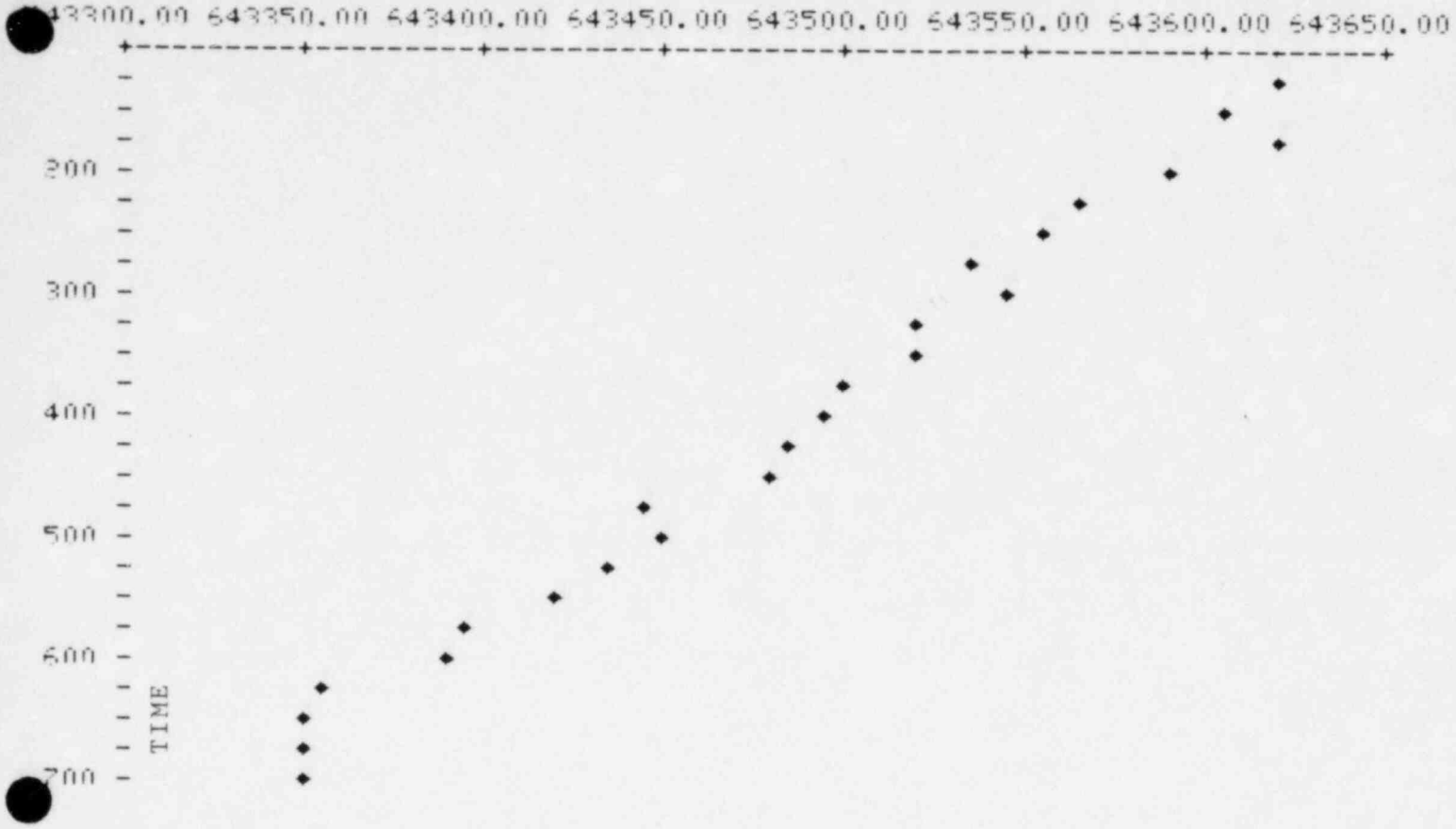
VERIFICATION




VAPOR PRESSURE,, PSIA
0.3668
0.3678
0.3688
0.3699
0.3709
0.3719
0.3730
0.374
200
300
400
500
600
700
TIME

CALVERT CLIFFS UNIT 1 VERIFICATION

VERIFICATION AIRMASS



CALVERT CLIFFS UNIT 1 VERIFICATION

LEAKAGE RATE (WEIGHT PERCENT/DAY)
MASS-POINT ANALYSIS

TIME AND DATE AT START OF TEST: 115 0622
ELAPSED TIME: 4.00 HOURS

TIME	TEMP (R)	PRESSURE (PSIA)	CTMT. AIR MASS (LBM)	MASS LOSS (LBM)	TOT.AVG. MASS LOSS (LBM/HR)
115	544.370	64.9030	643619.		
130	544.384	64.9034	643605.	14.2	56.8
145	544.393	64.9059	643621.	-15.5	-2.6
200	544.403	64.9039	643589.	31.4	40.2
215	544.418	64.9035	643567.	22.6	52.8
230	544.428	64.9036	643556.	10.5	50.6
245	544.433	64.9023	643537.	18.9	54.8
300	544.442	64.9040	643543.	-5.9	43.6
315	544.461	64.9040	643521.	21.8	49.0
330	544.474	64.9052	643518.	3.7	45.2
345	544.484	64.9047	643501.	16.8	47.4
400	544.505	64.9067	643497.	4.4	44.7
415	544.515	64.9068	643486.	10.9	44.6
430	544.525	64.9073	643478.	7.3	43.4
445	544.547	64.9068	643447.	31.8	49.4
500	544.551	64.9077	643452.	-5.6	44.6
515	544.566	64.9078	643435.	16.6	46.0

FREE AIR VOLUME USED (MILLIONS OF CU. FT.) = 2.000

REGRESSION LINE
INTERCEPT (LBM) = 643621.
SLOPE (LBM/HR) = -46.5

VERIFICATION TEST LEAKAGE RATE UPPER LIMIT = 0.269
VERIFICATION TEST LEAKAGE RATE LOWER LIMIT = 0.169
THE CALCULATED LEAKAGE RATE = 0.174

CONT. FREE AIR VOLUME AT TIME 515 = 2000000.

CALVERT CLIFFS UNIT 1 VERIFICATION

LEAKAGE RATE (WEIGHT PERCENT/DAY)
TOTAL-TIME ANALYSIS

TIME AND DATE AT START OF TEST: 115 0622
ELAPSED TIME: 4.00 HOURS

TIME	TEMP. (R)	PRESSURE (PSIA)	MEASURED LEAKAGE RATE
115	544.370	64.9030	
130	544.384	64.9034	0.212
145	544.393	64.9039	-0.010
200	544.403	64.9039	0.150
215	544.418	64.9035	0.197
230	544.428	64.9036	0.189
245	544.433	64.9023	0.204
300	544.442	64.9040	0.163
315	544.461	64.9040	0.193
330	544.474	64.9052	0.169
345	544.484	64.9047	0.177
400	544.503	64.9067	0.167
415	544.515	64.9068	0.166
430	544.525	64.9071	0.162
445	544.547	64.9063	0.184
500	544.551	64.9077	0.166
515	544.566	64.9078	0.172

MEAN OF MEASURED LEAKAGE RATES = 0.186

VERIFICATION TEST LEAKAGE RATE UPPER LIMIT = 0.271
VERIFICATION TEST LEAKAGE RATE LOWER LIMIT = 0.171
THE CALCULATED LEAKAGE RATE = 0.181

VERIFICATION SUMMARY DATA

VERF.D4H

CALVERT CLIFFS UNIT 1 VERIFICATION

ALMAX = 0.200 VOL = 2000000.00

VRATET = 0.221 VRATEM = 0.219 VRATEP = 0.198

TIME	DATE	TEMP	PRESSURE	VPRS	VOLUME
115	622	544.36957	64.903023	0.37020940	2000000.
130	622	544.38446	64.903366	0.36986855	2000000.
145	622	544.39294	64.905945	0.36728704	2000000.
200	622	544.40263	64.903931	0.36930203	2000000.
215	622	544.41827	64.903511	0.37071612	2000000.
230	622	544.42834	64.903648	0.37058637	2000000.
245	622	544.43335	64.902336	0.37189103	2000000.
300	622	544.44202	64.903969	0.37125409	2000000.
315	622	544.46051	64.903976	0.37124801	2000000.
330	622	544.47375	64.905182	0.37103820	2000000.
345	622	544.48383	64.904694	0.37152770	2000000.
400	622	544.50458	64.906723	0.37049419	2000000.
415	622	544.51453	64.906799	0.37041539	2000000.
430	622	544.52509	64.907333	0.37087336	2000000.
445	622	544.54730	64.906769	0.37143805	2000000.
500	622	544.55066	64.907730	0.37047243	2000000.
515	622	544.56361	64.907837	0.37037212	2000000.

ISG CALCULATIONS

A. Test Parameters

La	= .2%/day	leakage rate
P	= 65.2 psia	containment pressure
T	= 543 °R	weighted average absolute temperature
T_{dp}	= 60°F	dewpoint
t	= 8 hr.	test duration

B. Instrument Parameters

1. Total Absolute Pressure

No. of sensors:	1
Range:	0-100 psia
Sensitivity error (EP):	.001
Repeatability error (ε_p):	0.0005

$$e_p = \pm \sqrt{\frac{(EP)^2 + (\varepsilon P)^2}{\text{No. of Sensors}}} = \sqrt{\frac{.000001 + .00000025}{1}} = 0.001118 \text{ psia}$$

2. Water Vapor Pressure

No. of sensors:	6
Sensitivity error (E):	.04°F
Repeatability error (ε):	.01°F
Dewpoint temperature:	70.2°F
Vapor pressure:	.365134 psia

$$E_{PV} = \pm (.04)\ (.01257) = 5.028 \times 10^{-4}$$

$$\varepsilon_{PV} = \pm (.01)\ (.01257) = 1.257 \times 10^{-4}$$

$$e_{PV} = \pm \sqrt{\frac{(E_{PV})^2 + (\varepsilon_{PV})^2}{\text{No. of sensors}}} =$$

$$\pm \sqrt{\frac{5.028 \times 10^{-4})^2 + (1.257 \times 10^{-4})^2}{6}} = .000211587$$

3. Temperature

No. of sensors:	18
Sensitivity error (E):	.01°F
Repeatability error (ε):	.003°F

$$e_T = \sqrt{\frac{(E_T)^2 + (\varepsilon_T)^2}{\text{No. of sensors}}} = \sqrt{\frac{.0001 + .000009}{18}} = .0024608$$

$$ISG = \frac{2400}{8}\sqrt{2\left(\frac{eP}{P}\right)^2 + 2\left(\frac{epv}{P}\right)^2 + 2\left(\frac{et}{T}\right)^2} =$$

$$ISG = \pm \frac{2400}{8}\sqrt{2\left(\frac{1.118 \times 10^{-3}}{65.2}\right)^2 + 2\left(\frac{2.1158 \times 10^{-4}}{65.2}\right)^2 + 2\left(\frac{2.4608 \times 10^{-3}}{543}\right)^2} =$$

$$= \pm \underline{0.00765 \text{ \%/day}}$$

. 25 La = (.25) (.2) = .05 > .00765

Reference: ANSI/ANS-56.8-1981, Appendix G

APPENDIX H

LOCAL LEAKAGE RATE TESTING EVALUATION

During refueling outages, local leakage rate testing (LLRT) is commenced at the beginning of the outage and completed in approximately six to eight weeks. The ILRT, if scheduled for that outage, is conducted after the completion of the LLRT.

During the LLRT repairs and adjustments are made to some system which may change that penetrations leak rate. The term "As Found" indicates the leak rate before repairs and adjustment and the term "As Left" is the leak rate after repairs and adjustments. An evaluation of difference between "As Found" and "As Left" can give some indication of what the ILRT results would be if conducted prior to repairs and adjustments.

Table 1 is a comparison of this data. Units of measured leak rate are standard cubic centimeters per minute (sccm). "OS" is the isolation valve outside containment and "IS" the inside isolation valve. In the "Difference" column "+" indicates add to ILRT results since leak rate decreased after repairs and adjustments, with a "-" indicating the opposite.

TABLE 1

Penetration	Valve	"As Found"	"As Left"	Difference
23	OS	280	169.3	+110.7
47C	OS	54	54	
	IS	19.9	2.7	+17.2
49B	OS	33.4	33.4	0.0
	IS	2.07	1.9	+0.2
49C	OS	54	54	
	IS	2.76	0.5	+2.3
47D	OS	49.3	49.3	
	IS	40.78	1.6	+39.2
11 S/G	Manways	100	706	
		120	501	-987.0

Total: 817.4 sccm

During the Unit 1 1980 outage the total LLRT results was 151,668 sccm. Of this total, 116,042 sccm was attributed to four electrical penetrations. These electrical penetrations (ZWB8,ZWC3,ZEC2, and ZEC7) were replaced during the 1982 outage prior to the ILRT. No as left leakage rate data exists and the 1980 outage measurement is used as the as found data.

Four control valve had repairs and adjustments made prior to local leak rate testing. Using the previous outage's as left data as the as found data, the leak rate was reduced by 95 sccm for the four valves.

After adding these three categories together, the total difference between as found and as left data was +115,319.6 sccm, which converts to .067 wt%/day. Adding this amount to the upper 95% confidence limit for both the total time and Mass Point results, the total is 0.153 wt%/day and 0.093 wt%/day respectively. Therefore, Unit 1 containment leak rate did not exceed the technical specification limit of 0.2 wt%/day at the end of the last fuel cycle.