

FERMI 2

Reactor Containment Building
Integrated Leak Rate Test

Preoperational Test Results
November 1984

Docket No. 50-341
Detroit Edison Co.

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FERMI 2
PCILRT PREOPERATIONAL TEST

FINAL REPORT

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I. Introduction

This report is submitted in accordance with the requirements set forth in Appendix J to 10CFR50 and describes the preoperational primary containment integrated leakage rate test (Type A) which was successfully completed on December 1, 1984.

Fermi 2 is an 1154 MWe boiling water reactor (BWR-4) nuclear power plant located in Monroe County, Michigan. The plant is situated approximately 30 miles south of Detroit, Michigan on the western shore of Lake Erie. The reactor containment structure is a Mark I steel containment constructed by CB&I Co. and completed in 1973. Additional specific plant data may be found in Appendix A to this report.

The preoperational Type A test was performed over a twenty four hour period followed by a four hour verification test. The testing was performed using the absolute test method. Test results were calculated using the mass point and total time analytical techniques as described in ANSI N56.8-1981 and N45.2-1972 respectively. The total time method was used primarily to determine the feasibility of performing short duration (< 24 hours) periodic Type A tests.

The calculated leakage rates (Lam) and upper confidence levels (UCL) were found to be as follows:

<u>Method</u>	<u>Lam</u> <u>%/day</u>	<u>UCL</u> <u>%/day</u>	<u>UCL + Penalties</u> <u>%/day</u>
Mass Point	.250	.251	.254
Total Time	.269	.278	.281

The acceptance criteria requires that the UCL plus any penalties be $\leq .375\%/day$ (i.e. $\leq .75La$). The penalties equaled .003%/day and are described in Appendix G of this report.

Local leak rate testing was performed prior to and following the Type A test. Results of this testing are contained in Appendix I to this report and summarized below:

<u>Test Type</u>	<u>Leakage</u>	<u>Acceptance</u> <u>Criteria</u>
Main Steam Lines	4.16 SCFH	≤ 100 SCFH
Type B + C	990.6 SCFD	≤ 4281.2 SCFD
Hydrostatic	1.017 GPM	≤ 5 GPM

II. TEST SYNOPSIS

The test was performed in essentially five phases:

- A. Pump-up
- B. Stabilization
- C. Test
- D. Verification
- E. Depressurization

Each phase is described below. Figures 1A through 1E show containment pressure, temperature, mass, and total time leakage during various phases of the test.

A. Pump-up Phase

Pressurization of the primary containment system to 56.5 psig $\pm \frac{3}{0}$ was initiated at 1725 hours on 11-29-84. The pressurization rate was maintained at a nominal rate of approximately 5.5 psi per hour. Procedurally, the pressurization rate was to be maintained at a nominal rate of 6 psi per hour. The raw pressurization data is contained in Appendix B. During this test phase, pressurization was stopped at 10 psig for approximately 15 minutes to monitor for gross leakage. When no gross leakage was detected, pressurization continued. The air compressors were secured at 0604 hours on 11-30-84 when a containment pressure of approximately 59.413 psig was attained.

B. Stabilization Phase

The containment stabilization phase began immediately following completion of the pump-up phase. The containment weighted average temperature was monitored hourly and the following stabilization criteria applied:

The containment was considered thermally stable when the rate of change of the weighted average contained air temperature, averaged over the last hour, did not deviate by more than 0.5°F/hr from the average rate of change of the weighted average contained air temperature averaged over the last four hours.

Containment stabilization was declared at 1100 hours on 11-30-84. Appendix C contains the stabilization phase processed test data.

C. Test Phase

The leak rate testing phase began at 1100 hours on 11-30-84 and continued for 24 hours. Containment temperatures, dewpoint temperatures and pressures were recorded by the data acquisition system at 15 minute intervals and automatically transferred to an online computer system that was linked to the acquisition system. The computer system, when requested, would process the raw data and determine containment leakage. Appendix D contains the test phase processed data and test results. In addition, the processed containment weighted average temperature, containment pressure and time were manually input into an offline computer that was being used as a backup to the online computer. Appendix D also includes the test results from the backup computer system.

D. Verification Phase

The verification test phase was initiated at 1215 hours on 12-1-84. A calibrated leak of approximately L_a (5 SCFM) was superimposed on the existing leak. After a one hour stabilization period, containment leakage was measured over a 4 hour period using the same methods employed during the test phase. The verification test results were well within acceptable limits. Appendix E contains the verification test phase processed data and results.

E. Depressurization Phase

Depressurization of the containment commenced at 1925 hours on 12-1-84. Just prior to depressurization, the primary containment monitoring system was placed in operation and tested to fulfill requirements of the preoperational test for that system. The containment was depressurized through the standby gas treatment system at a rate of approximately 6 psi per hour. Depressurization was completed at 0627 hours on 12-2-84.

III. PRESSURIZATION/DEPRESSURIZATION SYSTEMS

The pressurization system is shown schematically on Figure 2A. The system consisted of four 900 SCFM portable, oil free, air compressors, an aftercooler, a filter/dryer and associated piping and instrumentation. Only the filter/dryer, which is located in the reactor building, and associated instrumentation/piping is permanent plant equipment.

The four air compressors and the aftercooler were located outside the west end of the reactor building. Temporary piping was routed from the aftercooler through a reactor building penetration to the inlet of the air filter/dryer. The outlet of the air dryer is routed through a removable spool piece to the containment spray system. The pressurization rate was controlled by throttling valves V5-2518 and/or V5-2545 as necessary. During the test phase, a blank was inserted in one side of the removable spool piece and the upstream pressurization piping vented to atmosphere.

The depressurization system is shown on Figure 2B. Depressurization was through the standby gas treatment system. The depressurization rate was controlled by throttling valve V5-2519.

The pressurization/depressurization rates were limited to a nominal 6 psi/hr with a maximum allowable of 10 psi/hr to prevent damaging the resilient seals in the butterfly valves of the pressurization/depressurization systems.

IV. INSTRUMENTATION SYSTEM

The instrumentation utilized to determine containment leakage during the test and verification phases is listed in Table 1. Tables 2A and 2B list the physical location and weighting factor of each of the dry bulb temperature and dewpoint sensors. Weighting factors were assigned based on the fraction of the containment total free air volume which each sensor monitored. Figure 3 is a schematic diagram of the instrumentation and data acquisition system (DAS). During the test, 26 temperatures, 12 dewpoint temperatures and 2 pressures were monitored using a Volumetrics Model A-100 data acquisition system (DAS).

The DAS scanned the temperature, dewpoint temperature and pressure signals every 15 minutes. The signals were converted to engineering units by the DAS circuitry and transmitted to an on line Volumetrics computer system. The DAS also provided a hard copy of the raw data. A backup DAS was online and available for use at any time.

The Volumetrics online computer system stored the raw data on an 8 inch floppy disk. On demand, the computer would reduce the raw data and calculate the containment leak rate.

The verification test was performed by superimposing a leak equivalent to approximately L_a . The superimposed leak rate was measured using a Fisher and Porter model 10A55 rotometer.

All instrumentation required to meet acceptance criteria was calibrated prior to the test and is traceable to NBS.

An instrumentation error analysis was performed and is included as Appendix H to this report. The instrument selection guide (ISG) was calculated to be 0.00286%/day at the end of the 24 hour test period, well below the .125%/day limit specified in ANSI 56.8-1981. In addition, an accuracy and repeatability error analysis was performed with the following results:

Accuracy: $\pm 0.00769\%$ /day
Repeatability: $\pm 0.00174\%$ /day

These errors are only a small fraction (<3%) of the allowable leakage limit of .375%/day.

V. DATA REDUCTION PROCEDURES

Data reduction was performed using a Volumetrics online computer system and an offline computer. The online system reduced the raw data and calculated leakage rates in accordance with ANSI/ANS 56.8-1981, "Containment System Leakage Testing Requirements".

The offline computer system calculated leakage rates based on ANSI/ANS 56.8-1981 for the mass point analytical technique and BN-TOP-1, Rev. 1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants", for the total time analytical technique. Sample calculations for both the total time and mass point methods are contained in Appendix F to this report. The calculational methods are described below:

A. Data Reduction

1. Average Containment Temperature

The average containment temperature was calculated by multiplying each raw reading by an appropriate weighting factor (Table 2A) and then summing the resultants:

$$\bar{T}_i = \sum_{N=1}^{NT} (T_{Ni}) (WF_N)$$

where \bar{T}_i = Weighted average temperature at time i - °F

T_{Ni} = Reading of temperature sensor N at time i - °F

WF_N = Weighting factor for temperature sensor N - fraction

NT = Number of operable temperature sensors

2. Average Containment Dewpoint Temperature

The average containment dewpoint temperature was calculated by multiplying each raw reading by an appropriate weighting factor (Table 2B) and then summing the resultants:

$$\bar{D}_i = \sum_{N=1}^{ND} (D_{Ni}) (WF_N)$$

where \bar{D}_i = Weighted average dewpoint temperature at time i - °F

D_{Ni} = Reading of dewpoint sensor N at time i - °F

WF_N = Weighting factor for dewpoint sensor N - fraction

ND = Number of operable dewpoint sensors

3. Average Containment Pressure

Two sensor pressure sensors were used throughout the test. True pressures were obtained by adjusting the raw readings using interpolation constants. These constants were supplied by Volumetrics and are listed in Table 3. The true pressure of each sensor was calculated as follows:

$$P_{TJi} = [(P_{RJ})(M_J)] + C_J$$

where P_{TJi} = True pressure for sensor J at time i - Psia

P_{RJi} = Raw reading for sensor J at time i - counts

M_J = Multiplication factor for sensor J

C = Correction constant for sensor J

This correction was performed by the Volumetrics computer software.

Containment average pressure was derived from the arithmetic average of the two true pressures:

$$\bar{P}_i = (P_{T1i} + P_{T2i})/2$$

B. Mass Point Calculations

The mass point analysis was performed by first calculating the mass of dry air in the containment at each data point. A regression analysis was then performed on the mass vs. time data using the method of least squares. The calculated leakage

rate was determined from the statistically derived slope and intercept of the regression line. An upper one-sided 95% confidence level was then applied to the regression analysis based on the Student's t-distribution.

1. Calculated Dry Air Mass

The mass at each data point was calculated using the equation of state for a perfect gas:

$$W_i = (144P_i V) / (RT_i)$$

where P_i = Containment average dry air pressure at time i - Psia

V = Containment free air volume - CF (assumed to remain constant over test duration)

W_i = Mass of air in containment at time i - lbm

R = Gas constant for air =
 $53.35 \frac{\text{ft} \cdot \text{lb}_f}{\text{lbm} \cdot ^\circ\text{R}}$

T_i = Containment weighted average temperature at time i - $^{\circ}\text{R}$
 $(^{\circ}\text{R} = ^{\circ}\text{F} + 459.69)$

The containment average dry air pressure at time i was derived by subtracting the vapor pressure which corresponded to the containment weighted average dewpoint temperature at time i from the containment average total pressure at time i :

$$P_i = \bar{P}_i - P_{vp_i}$$

where \bar{P}_i = Containment average total pressure at time i - Psia

P_{vp_i} = Containment average water vapor pressure at time i - Psia

P_i = Containment average dry air pressure at time i - Psia

2. Regression Analysis

This analysis assumes that the loss of mass from the containment is linear with time. The regression analysis used the method of least squares to determine the best fit straight line through the mass data:

$$\hat{W}_i = At_i + B$$

where \hat{W}_i = Mass of air in containment at elapsed time t_i from beginning of test as calculated by least squares fit analysis - lbm

A = Slope of least squares fit line - lbm/hr

t_i = Elapsed time from start of test - Hours

B = Intercept of least squares fit line - lbm

The slope and intercept were calculated using the following equations:

$$A = \frac{N \sum t_i W_i - \sum W_i \sum t_i}{N \sum t_i^2 - (\sum t_i)^2}$$

$$B = \frac{\sum W_i \sum t_i^2 - \sum t_i W_i \sum t_i}{N \sum t_i^2 - (\sum t_i)^2}$$

The calculated containment leakage rate was then calculated using the following equation:

$$Lam = (-2400) (A) / (B)$$

where Lam = Calculated leakage rate -%/day

3. Upper 95% Confidence Limit - UCL

A one-sided upper 95% confidence limit was calculated for the leakage rate, Lam. The confidence limit indicates that the probability that the value of the calculated leak rate (Lam) will fall below the UCL is 95%.

The UCL was determined as follows:

$$UCL = Lam + [(2400) (T95) (S_A/B)]$$

where S_A = The standard deviation of the slope

B = The intercept of the least squares fit line

$T95$ = 95th percentile of Student's t distribution as defined in ANSI N56.8-1981

Lam = Calculated leak rate - %/day

The standard deviation of the slope (S_A) was determined as follows:

$$S_A = (k) (N)^{\frac{1}{2}}$$

$$\text{where } k = S / [N \sum t_i^2 - (\sum t_i)^2]^{\frac{1}{2}}$$

$$\text{and } S = \left[\frac{\sum (W_i - \hat{W}_i)^2}{(N-2)} \right]^{\frac{1}{2}}$$

N = Number of data points

C. Total Time Calculations

Total time calculations were performed using the method described in ANS-7.60/N45.4-1972, "American National Standard Leakage-Rate Testing of Containment Structures for Nuclear Reactors", and BN-TOP-1, Rev 1, "Testing Criteria For Integrated Leakage Rate Testing Of Primary Containment Structures For Nuclear Power Plants".

A measured leak rate was calculated for each set of data following the initial data set at time $T = 0$. Using the method of least squares, the leak rates were then best fit to a straight line using regression analysis in the same manner that was described for the mass point analysis. A 95% confidence limit was then calculated based on the calculated leakage rate determined by the regression analysis. The calculations were performed as follows:

1. Measured Leakage Rate - M_1

The measured leakage rates were determined

using the same weighted average temperatures and dry air pressures described in the data reduction section:

$$M_i = \frac{2400}{t_i} \left[1 - \frac{T_0 P_i}{P_0 T_i} \right]$$

where M_i = Measured Leak Rate at time t_i - %/day

t_i = Elapsed time from beginning of test - Hours

T_0 = Containment weighted average temperature at beginning of test ($t=0$) - $^{\circ}\text{R}$

T_i = Containment weighted average temperature at time t_i - $^{\circ}\text{R}$

P_0 = Containment average dry air pressure at beginning of test ($t=0$) - Psia

P_i = Containment average dry air pressure at time t_i - Psia

2. Regression Analysis

A regression analysis was performed on the M_i vs. time data in the same manner described in the mass point analysis description.

The equation used was:

$$L_i = B t_i + A$$

where L_i = Calculated leak rate - %/day

B = Slope of least squares fit line - %/day - hour

t_i = Elapsed time from beginning of test - hours

A = Y Intercept of least squares fit line - %/day

The slope and intercept were calculated as follows:

$$B = \frac{N \sum t_i M_i - \sum t_i \sum M_i}{N \sum t_i^2 - (\sum t_i)^2}$$

$$A = \frac{\sum M_i}{N} - B \frac{\sum t_i}{N}$$

N = Number of data points M_i

3. 95% Upper Confidence Limit - UCL

The 95% upper confidence limit was calculated using the following equation:

$$UCL = Lam + T_{95}E$$

where UCL = 95% confidence limit - %/day

Lam = Calculated leakage rate at end of test - %/day

T_{95} = 95th percentile of Student's t distribution

E = Standard deviation

The standard deviation was determined as follows:

$$S^2 = \frac{\sum (M_i - L_i)^2}{N - 2}$$

$$E^2 = S^2 \left[1 + \frac{1}{N} + \frac{(t_p - \bar{t})^2}{\sum (t_i - \bar{t})^2} \right]$$

where N = Number of data points M_i

\bar{t} = Average time interval = $\sum t_i / N$

$$\text{and } E = S \left[1 + \frac{1}{N} + \frac{(t_p - \bar{t})^2}{\sum (t_i - \bar{t})^2} \right]^{\frac{1}{2}}$$

The Volumetrics computer program used the 95th percentile of the Student's t distribution, T_{95} , as described in ANSI N56.8-1981. The offline computer system used the T_{95} described in BN-TOP-1, Rev 1, for elapsed times (t_i) of less than 24 hours and the T_{95} described in ANSI N56.8-1981 for elapsed times of greater than or equal to 24 hours.

VI. RESULTS

A. Twenty Four Hour Test

The maximum allowable leakage rate (L_a) per the Fermi 2 Technical Specifications is 0.5%/day while the overall measured leakage rate must not exceed 0.75 L_a or .375%/day. The overall measured leakage rate is defined as the final calculated 95% upper confidence limit plus any added penalties. The penalties are described in Appendix G to this report and amounted to 0.003%/day additional leakage.

The results of the 24 hour test indicated that the final overall measured leakage rate for both the mass point and total time methods was well within the acceptance criteria:

Volumetric's Computer System

<u>Method</u>	<u>Measured</u>	<u>%/day Calculated</u>	<u>UCL</u>	<u>UCL + Penalties</u>
Mass Point	.241	.250	.251	.254
Total Time	.241	.269	.278	.281
Acceptance Criteria	-	-	-	$\leq .375$

Offline Computer System

Mass Point	.240	.249	.251	.254
Total Time	.240	.275	.290	.293
Acceptance Criteria	-	-	-	$\leq .375$

B. Verification Test

The verification test was performed over a four hour period following a one hour stabilization period. The acceptance criteria for this test as defined in Appendix J to 10CFR50, was that the value of the composite leakage rate (L_c) minus the superimposed leakage rate plus the calculated test leakage rate be greater than or equal to - .25 L_a but less than or equal to + .25 L_a . That is:

$$- 0.125\%/day \leq L_v \leq + 0.125\%/day$$

$$\text{where } L_v = L_c - (L_i - L_{am})$$

All data indicated that the results were within the acceptance criteria:

Volumetrics Computer System

%/day

<u>Method</u>	<u>Lc</u>	<u>Li</u>	<u>Lm</u>	<u>Lv</u>
Mass Point	.675	.506	.250	-0.081
Total Time	.677	.506	.269	-0.098

Offline Computer System

Mass Point	.677	.506	.249	-0.078
Total Time	.663	.506	.275	-0.118

VII. SIGNIFICANT TESTING PROBLEMS

- A. The initial Type B test performed on the drywell personnel air lock failed. Investigation found a wooden block wedged in the door interlocking mechanism. Although inconclusive, the investigation determined that the wood block was installed during construction to defeat the interlocking mechanism. This allowed both the interior and exterior doors to be open at the same time to facilitate drywell entry during this period. The wedge also kept the equalizing valve between the drywell and air lock open, even when both doors were closed, thus preventing pressurization of the air lock during Type B testing. The block was removed and the Type B test successfully performed.
- B. During the initial phase of containment pressurization, it was noticed that the torus pressure instrumentation at the DAS was not responding to the pressure increase. It was determined that the Target Rock one inch solinoid source valve, although indicating open in the control room was closed. The valve was opened and the torus pressure instrumentation began responding. The valve was opened by placing the control switch in the control room in the close position.
- C. During pressurization, the drywell/torus pressure instruments were to be monitored to fulfill a requirement of Appendix E of TMI Task Action Plan Item I.G.1, Generic Letter 83-24. Monitoring was to be performed from 0-10 psig. When pressurization was halted at 10 psig, it was noted that this activity had not taken place due to a communication problem. It was determined by the test director that the test would proceed and the monitoring performed during depressurization.
- D. The Control Room started a condenser pump in order to pump down the main condenser hotwell. Water was discovered draining from the feedwater line A drain. Apparently, while pumping down the hotwell, water leaked past an isolation valve and filled the feedwater piping. Since there was no way to show that water had not gone past the containment isolation valves a penalty for the two feedwater penetrations was added to the type A test results.

- E. One dewcell located in the Torus failed. The weighting factors for the remaining dewcells were recalculated in accordance with established criteria. The leakage rate was calculated using the new weighting factors from the beginning of the test.
- F. The following instrument valving problems were identified:
1. While depressurizing, three instruments were found not responding to the pressure change. Investigation determined that a Target Rock one inch solinoid valve was giving improper control room indication. The valve was repositioned and the instruments responded. (See VII. B above).
 2. A low range drywell pressure instrument did not come on scale during low pressure monitoring. Investigation determined that two instrument tubing valves on the instrument rack were closed, and that the instrument vent was open. The valves were repositioned and the instrument responded.
 3. After the test was completed, further investigation revealed additional instruments that should have been subjected to containment pressure but were not valved in. These instruments were either not included in the valve lineup, valved out during the test, or were signed off as being "In Service" but were not valved in. These instruments, in addition to the drywell pressure sensing instruments, were Type C tested and the results added to the Type A result.

See Appendix G for a summary of the additional leakage added.

- G. Following the PCIIRT an investigation was conducted into the improper control room indication of the two Target Rock valves (E41-F402, E11-F415). With the help of a Target Rock engineering representative it was determined that, although the valves were wired in accordance with the DECo schematic diagram, the polarity across the solenoids was reversed thus inducing reverse operation.

Reverse operation of these valves would isolate divisional instrumentation associated with ECCS and RPS logic. The potential loss of one division reduces the degree of redundancy for a safety related system. Accordingly, a potentially reportable 10 CFR 50.55(e) report (No. 142) was filed with the NRC.

A program has been developed/initiated to verify the wiring and operability of every dual solenoid Target Rock valve on site. Operability will be verified by ensuring the control room indication/demand matches the valves operation (Note: Valve operation will be verified locally by a positive means).

VIII. REFERENCES

- A. Preoperational Test Procedure PRET.T2304.001, Rev. 1, "Primary Integrated Containment Leakage Rate Test", and test results.
- B. American National Standard ANS-7.60/N45.4-1972, "Leakage-Rate Testing of Containment Structures for Nuclear Reactors".
- C. American National Standard ANSI/ANS-56.8-1981, "Containment System Leakage Testing Requirements".
- D. Bechtel Corp. Topical Report BN-TOP-1, Rev. 1, "Testing Criteria For Integrated Leakage Rate Testing of Primary Containment Structures For Nuclear Power Plants".
- E. 10CFR50 Appendix J, "Primary Reactor Containment Leakage Testing For Water-Cooled Power Reactors".

FIGURES

1A, 1B, 1C, 1D, 1E

2A, 2B

3

FIGURE 1A
FERMI II PCILRT
SEQUENCE OF EVENTS

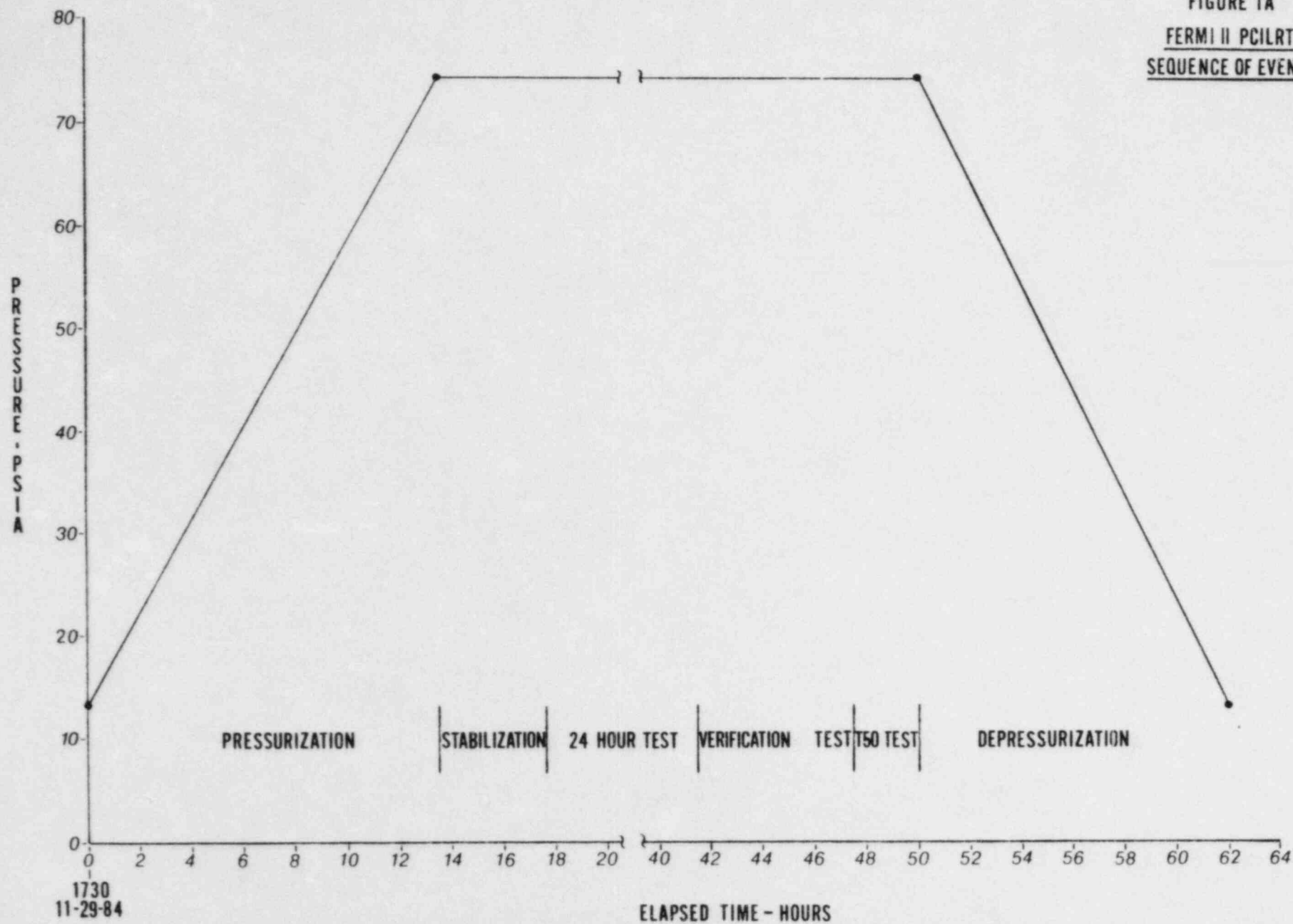


FIGURE 1B
FERMI II PCILRT
CONTAINMENT PRESSURE

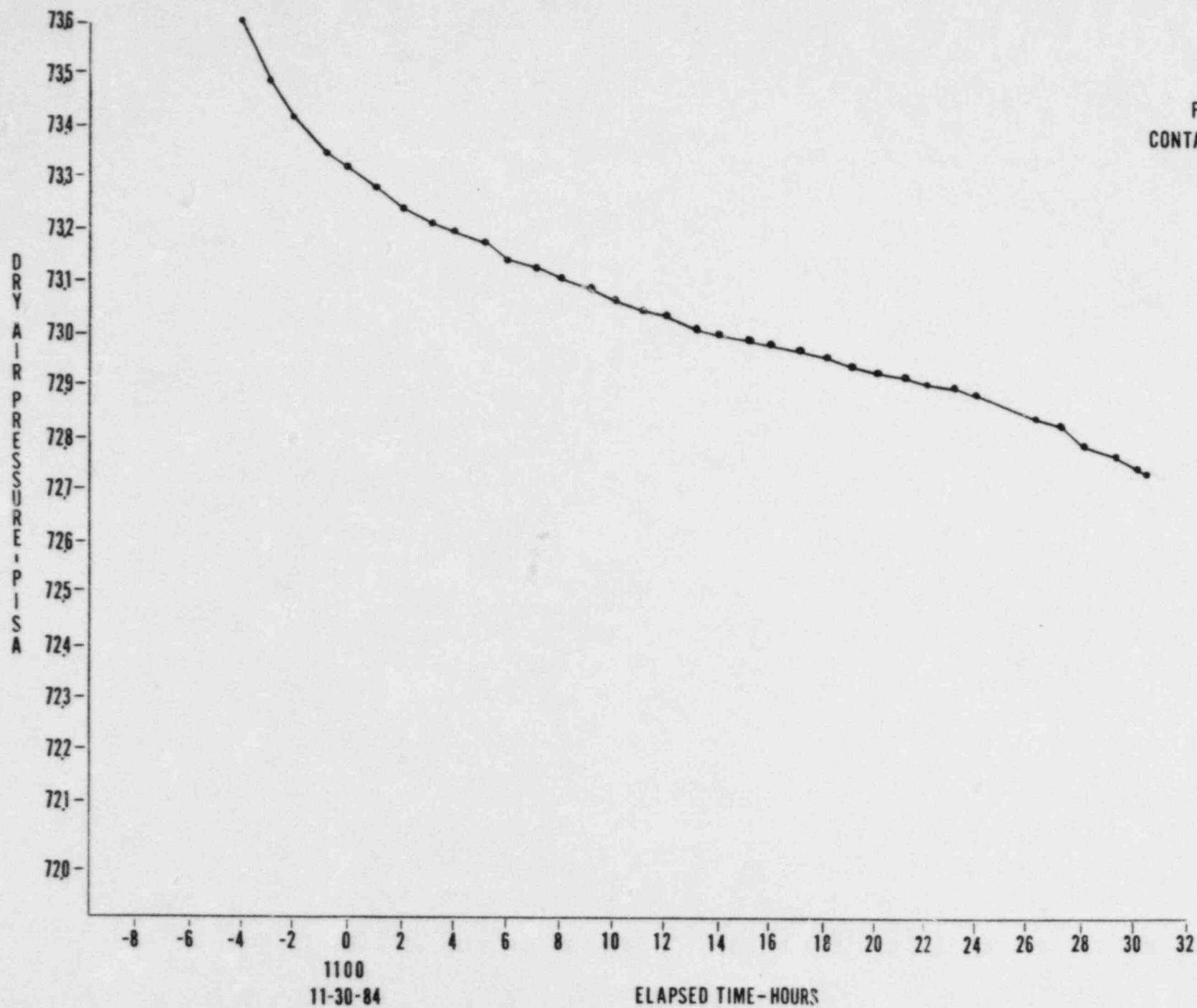


FIGURE 1C
FERMI II PCILRT
CONTAINMENT AVERAGE TEMPERATURE

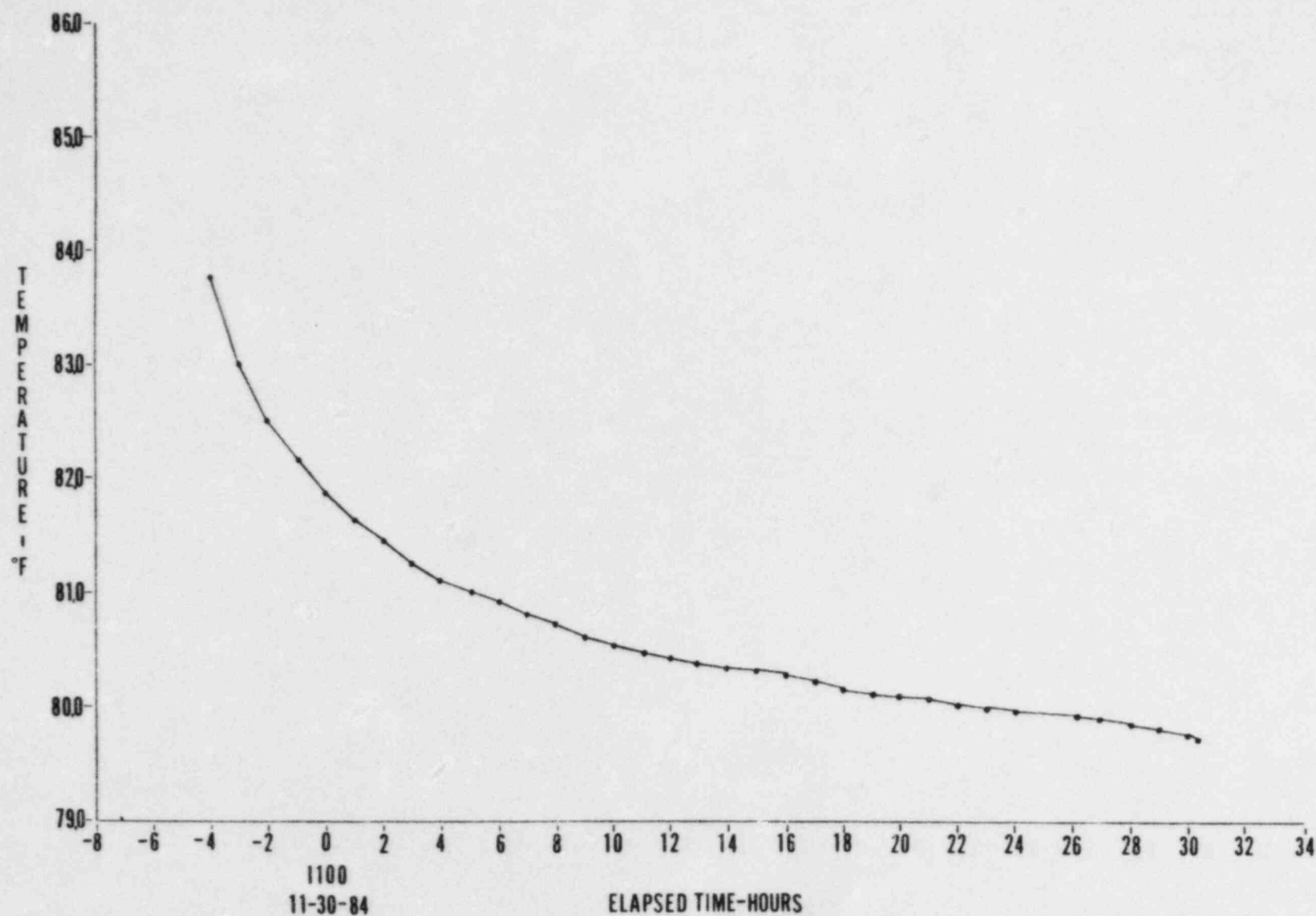


FIGURE 1D
FERMI II PCILRT
CONTAINMENT DRY AIR MASS

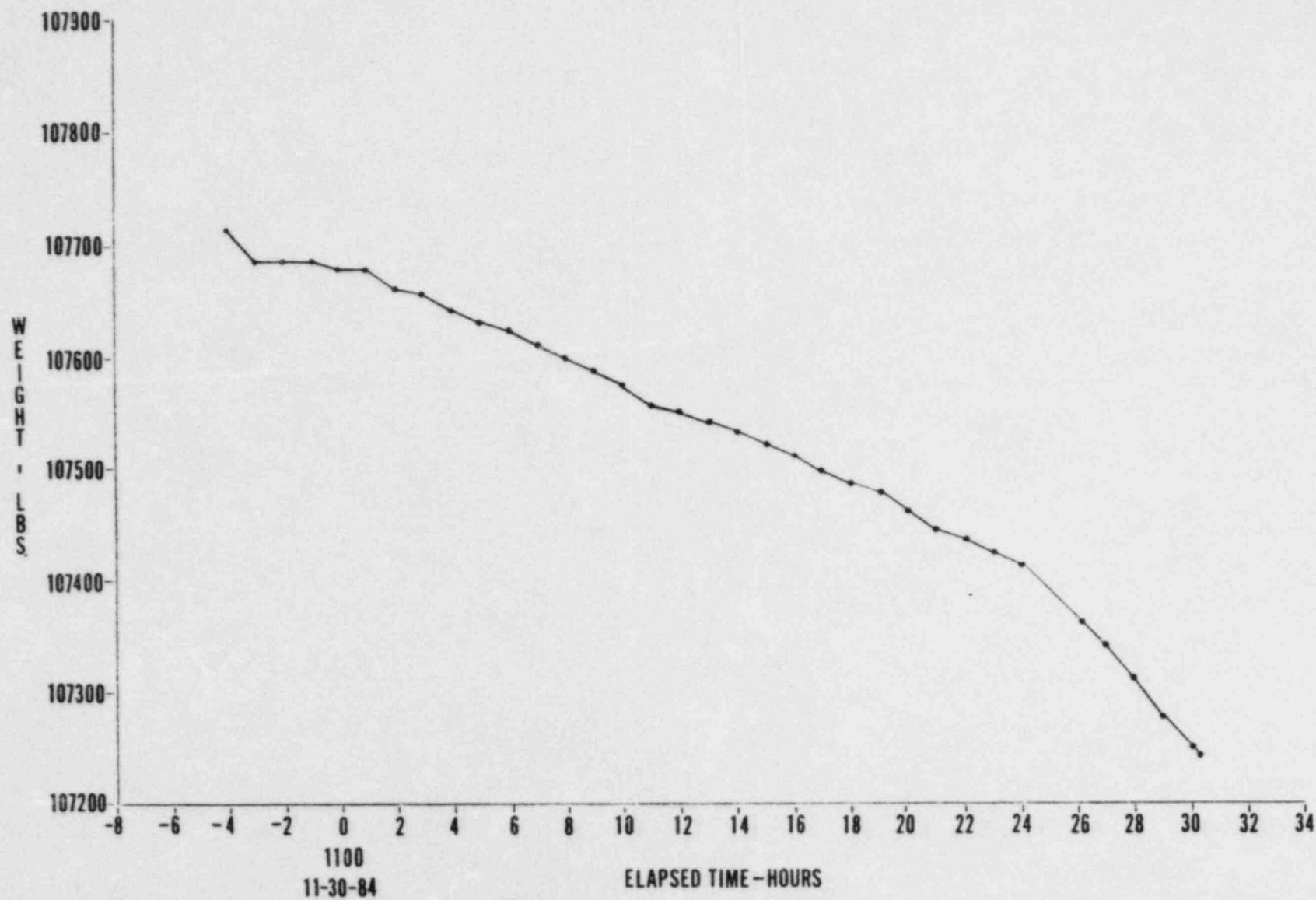


FIGURE 1E

FERMI II PCILRT

TOTAL TIME LEAKAGE RATE

BN-TOP-1

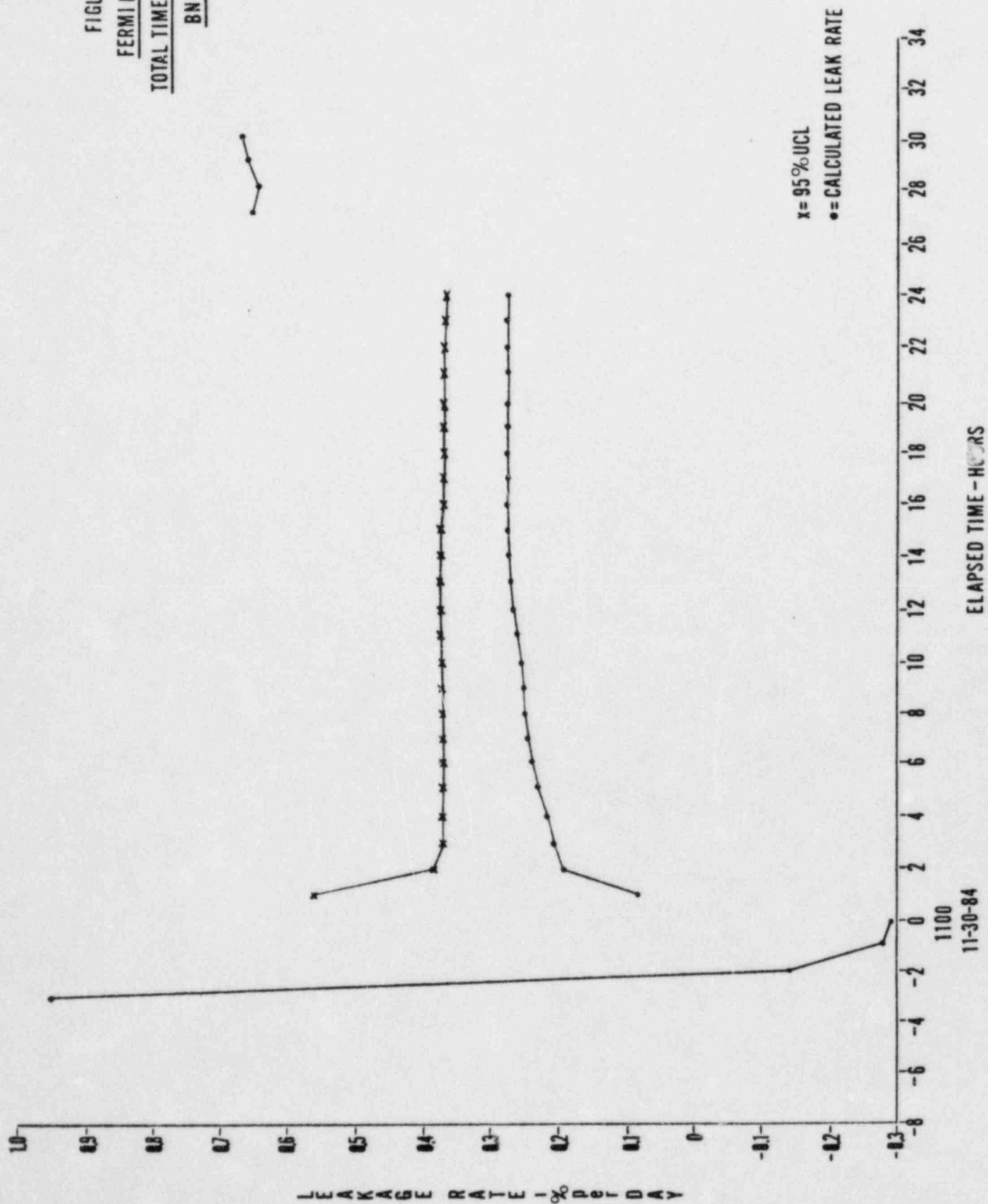


FIGURE 2A
PRESSURIZATION SYSTEM

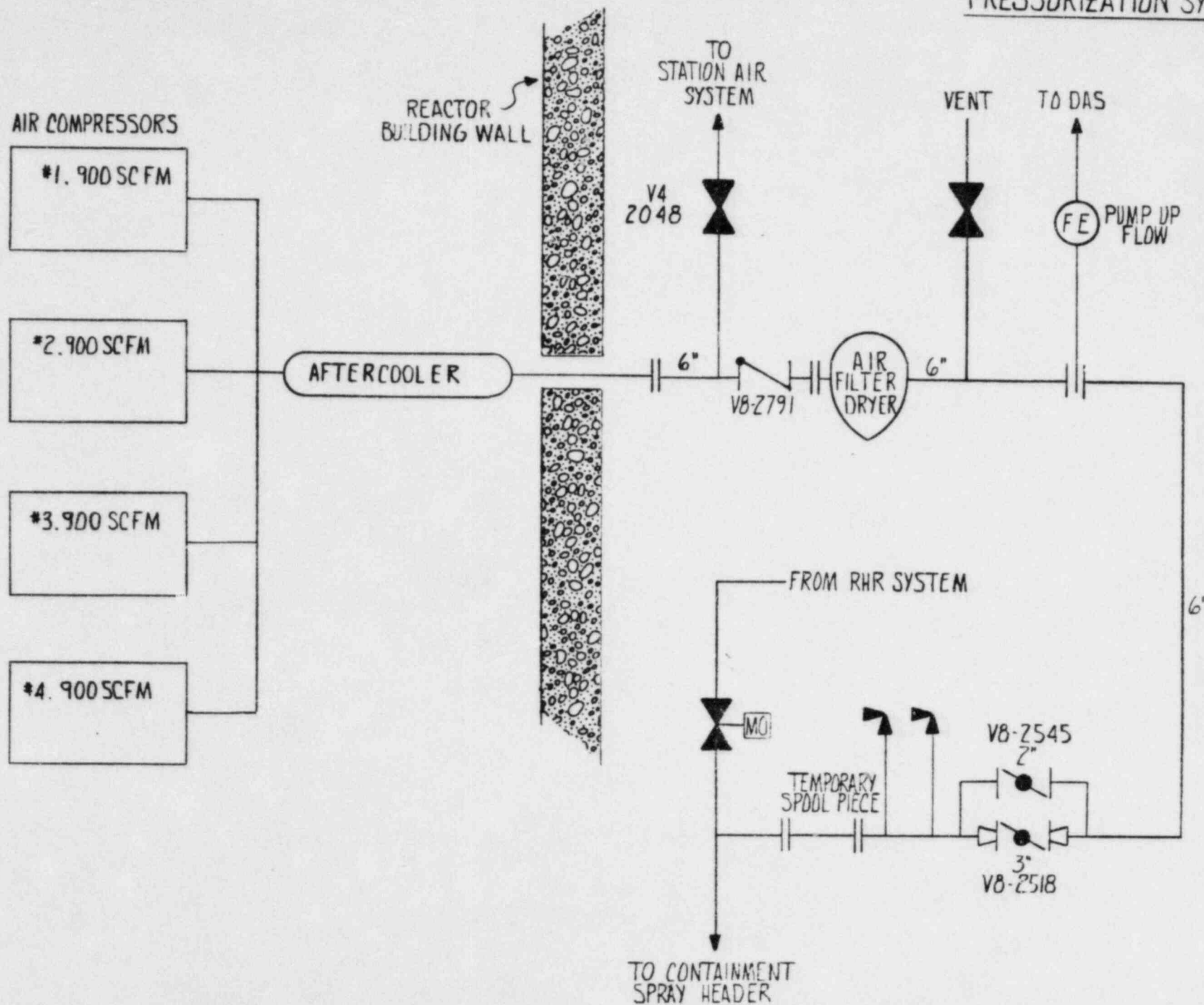


FIGURE 2B
DEPRESSURIZATION SYSTEM

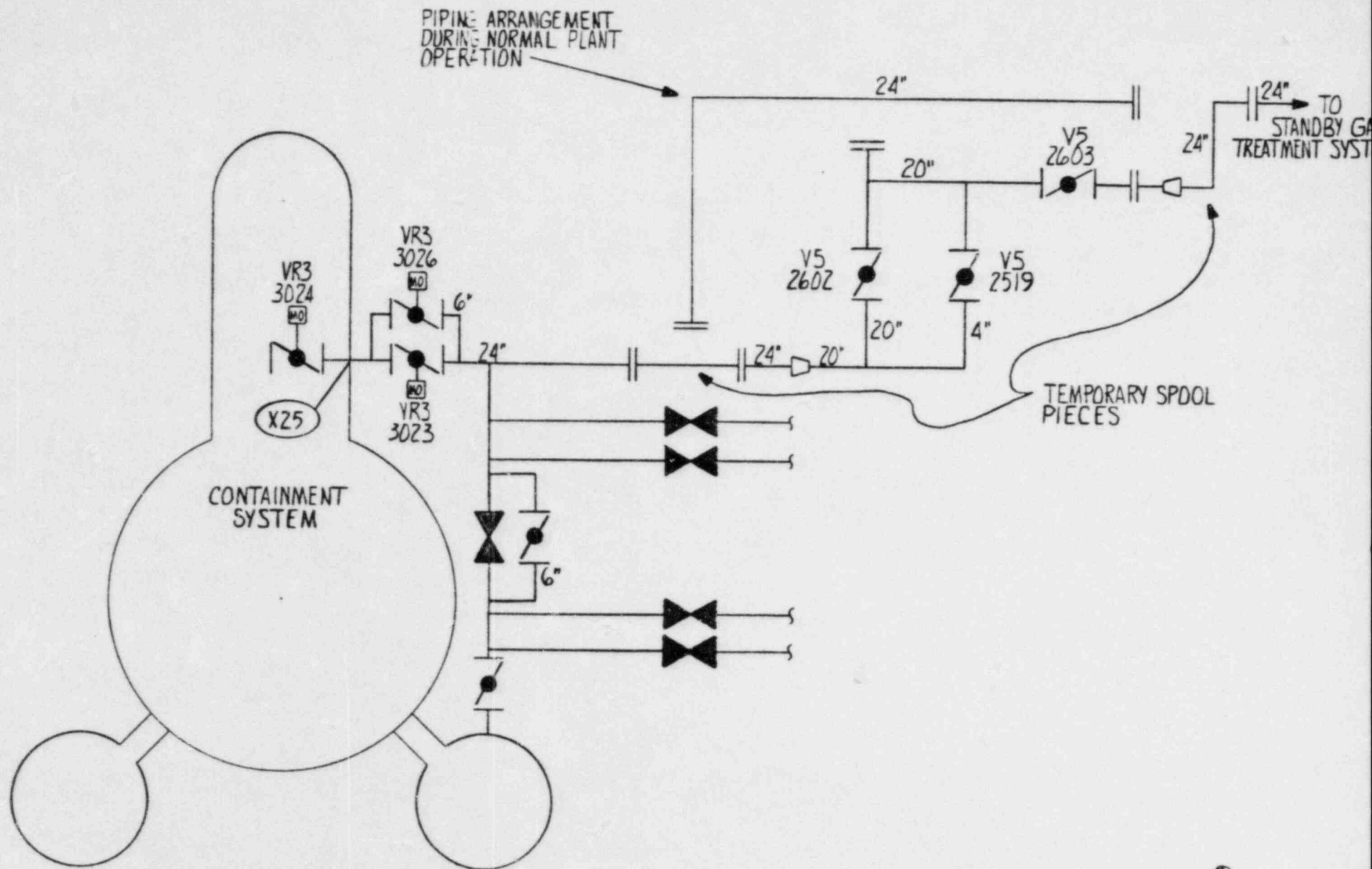
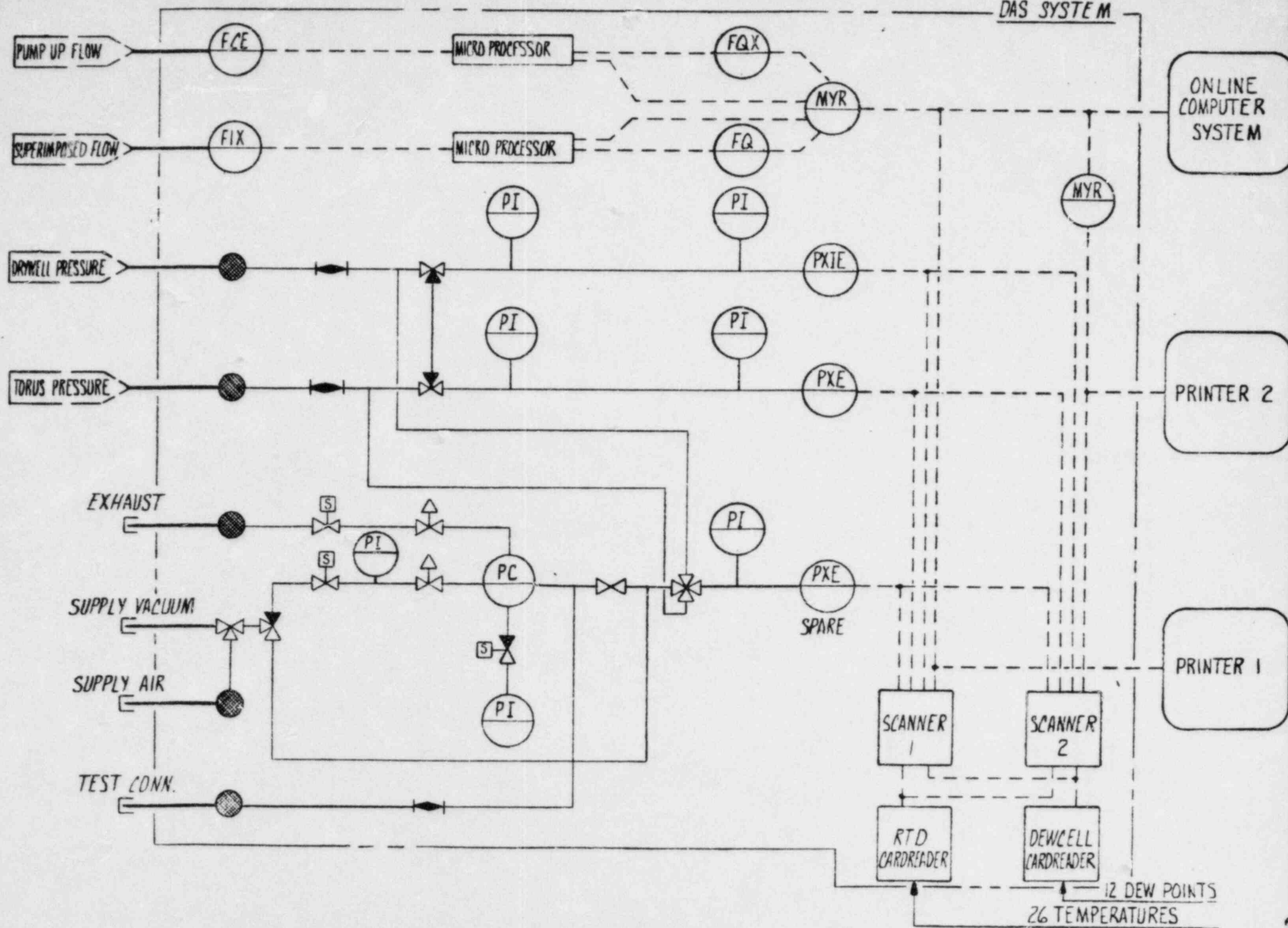


FIGURE 3
DAS SYSTEM



TABLES

1
2A, 2B
3

TABLE 1

INSTRUMENTATION SPECIFICATIONS

<u>INSTRUMENT</u>	<u>MANUFACTURER</u>	<u>MODEL NO.</u>	<u>RANGE</u>	<u>ACCURACY</u>	<u>REPEATABILITY</u>
Pressure Precision Pressure Gauge (2)	Mensor Corp.	100-010-001	0-100 PSIA	$\pm 0.002\%$ FS	0.001 PSIA
Temperature RTD's (26) 100 OHM-Platinum	Rosemount, Inc.	78-65-17	60-120°F	$\pm 0.1^\circ\text{F}$	0.03°F
Dewpoint Temperature Chilled Mirror (12)	EG & G	660	0-212°F	$\pm 0.54^\circ\text{F}$	$\pm 0.1^\circ\text{F}$
Rotometer	Fisher and Porter	10A555	0-12.59SCFM	$\pm 1\%$ FS	-
DAS Real Time Clock	Volumetrics	MM58167	N/A	± 10 sec/day	-

TABLE 2A

DRYBULB TEMPERATURE SENSOR LOCATIONSAND WEIGHTING FACTORS

<u>No.</u>	<u>PIS</u>	<u>Elevation</u> <u>Ft</u>	<u>Azimuth</u> <u>degrees</u>	<u>Volume Fraction</u>
------------	------------	-------------------------------	----------------------------------	------------------------

RTD DRYWELL

1	TEN020A	670	90	0.014476
2	TEN020B	670	270	0.014476
3	TEN021A	642	330	0.014841
4	TEN021B	642	225	0.014841
5	TEN022A	642	125	0.014841
6	TEN022B	642	50	0.014841
7	TEN023A	613	335	0.029676
8	TEN023B	613	250	0.029676
9	TEN024A	618	150	0.029676
10	TEN024B	620	45	0.029676
11	TEN025A	615	225	0.052293
12	TEN025B	615	145	0.052293
13	TEN026A	595	30	0.052293
14	TEN026B	595	325	0.052293
15	TEN027A	580	220	0.020234
16	TEN027B	580	120	0.020234
17	TEN028A	580	60	0.020234
18	TEN028B	580	330	0.020234
19	TEN029A	590	0	0.014534
20	TEN029B	590	180	0.014534

RTD TORUS

21	TEN030A	562	40	0.064158
22	TEN030B	562	335	0.083876
23	TEN031A	562	110	0.088820
24	TEN031B	562	160	0.088820
25	TEN032A	562	250	0.059213
26	TEN032B	562	280	0.088820

TABLE 2B

DEWCELL SENSOR LOCATIONSAND WEIGHTING FACTORS

<u>No.</u>	<u>PIS</u>	<u>Elevation</u> <u>Ft</u>	<u>Azimuth</u> <u>degrees</u>	<u>Volume Fraction</u>
------------	------------	-------------------------------	----------------------------------	------------------------

DEWCELL DRYWELL

1	MMEN040A	670	90	0.014476
2	MMEN040B	670	270	0.014476
3	MMEN041A	615	275	0.089034
4	MMEN041B	615	90	0.089034
5	MMEN042A	600	170	0.104585
6	MMEN042B	595	345	0.104585
7	MMEN043A	580	155	0.055052
8	MMEN043B	570	30	0.055052

DEWCELL TORUS

9	MMEN044A	562	45	0.118426
10	MMEN044B	562	335	0.118426
11	MMEN045A	562	250	0.118426
12	MMEN045B	562	160	0.118426

TABLE 3

VOLUMETRIC

FASO ROLES CALIFORNIA

PRESSURE GAUGE CALIBRATION PROGRAM

CALIBRATION POINT	TRUE PRESSURE	PRESSURE GAUGE 1			PRESSURE GAUGE 2		
		GAUGE READING	MULTIPLICATION FACTOR	CORRECTION CONSTANT	GAUGE READING	MULTIPLICATION FACTOR	CORRECTION CONSTANT
1	0.000	* 0.000			* 0.000		
		*-----<	1.01750	0.000	*-----<	1.00760	0.000
2	5.000	* 4.914			* 4.901		
		*-----<	1.01257	0.022	*-----<	1.00241	0.027
3	10.000	* 9.850			* 9.940		
		*-----<	1.01420	0.010	*-----<	0.99880	0.003
4	15.000	* 14.780			* 14.955		
		*-----<	1.01874	-0.057	*-----<	1.00402	-0.015
5	20.000	* 19.686			* 19.925		
		*-----<	1.01620	-0.008	*-----<	1.00061	0.049
6	25.000	* 24.605			* 24.931		
		*-----<	1.02041	-0.110	*-----<	0.99900	0.094
7	30.000	* 29.508			* 29.930		
		*-----<	1.02229	-0.100	*-----<	1.00160	0.010
8	35.000	* 34.395			* 34.920		
		*-----<	1.01854	-0.037	*-----<	1.00040	0.058
9	40.000	* 39.308			* 39.920		
		*-----<	1.02396	-0.250	*-----<	1.00140	0.019
10	45.000	* 44.191			* 44.910		
		*-----<	1.02337	-0.222	*-----<	0.99600	0.144
11	50.000	* 49.077			* 49.920		
		*-----<	1.02375	-0.243	*-----<	0.99900	0.084
12	55.000	* 53.961			* 54.927		
		*-----<	1.02291	-0.197	*-----<	0.99900	0.084
13	60.000	* 58.849			* 59.920		
		*-----<	1.01978	-0.013	*-----<	0.99840	0.168
14	65.000	* 63.752			* 64.930		
		*-----<	1.01709	0.159	*-----<	0.99741	0.232
15	70.000	* 68.668			* 69.949		
		*-----<	1.01895	0.031	*-----<	0.99780	0.205
16	75.000	* 73.575			* 74.960		
		*-----<	1.01620	0.229	*-----<	0.99500	0.360
17	80.000	* 78.495			* 79.980		
		*-----<	1.01482	0.342	*-----<	0.99380	0.511
18	85.000	* 83.422			* 85.013		
		*-----<	1.01358	0.445	*-----<	0.99080	0.762
19	90.000	* 88.355			* 90.059		
		*-----<	1.00990	0.770	*-----<	0.99285	0.585
20	95.000	* 93.300			* 95.095		
		*-----<	0.99502	2.150	*-----<	0.97924	1.879
21	100.000	* 96.331			* 100.201		

APPENDIX A

PLANT DATA

APPENDIX A

PLANT DATA

Plant Information

Plant Name	Fermi 2
Owner	Detroit Edison Co.
Docket Number	50-341
Plant Type	BWR-4
Rated Output-Gross	1154 MWe
Location	Monroe Co., MI
Containment Type	Mark I
Date Test Completed	12-2-84

Technical Data

Containment Volume	294630 CF
Maximum Allowable Pressure	62 psig
Design Pressure	56 psig
Design Temperature	340°F
Peak Accident Pressure	56.5 psig
Maximum Allowable Leakage-La	0.5%/day

Instrumentation

No. of Temperature Sensors	26
No. of Dewpoint Sensors	12
No. of Pressure Sensors	2

Test Data

Test Method	Absolute
Data Analysis Techniques	Total Time and Mass Point
Test Pressure	56.5 psig
Allowable Leakage-.75La	.375%/day

APPENDIX B
PUMP-UP DATA

FERMI 2
PCILFT
PUMPUP DATA

① TIME	② ELAPSED TIME-MIN	③ PRESSURE PSIA	④ ΔP PSIA	⑤ 12 x ④ ΔP PSIA	⑥ HR AVE ΔP PSIA	⑦ PUMPUP FLOW SCFM	⑧ ΔP RISE PSIG
18.41:36	0	14.904					
	5	15.187	.283	3.396			
	10	15.460	.283	3.396			
	15	15.728	.268	3.216			
	20	16.063	.335	4.02			
	25	16.602	.539	6.47			
	30	16.994	.392	4.71	4.18		
	35	17.379	.385	4.62			
	40	17.798	.419	5.028	4.34		
	45	18.232	.434	5.208	4.44	1800	
	50	18.562	.430	5.16	4.51		
	55	19.097	.435	5.22	4.57		
	60	19.649	.552	6.62	4.75		
	65	20.200	.551	6.61	5.01	2300	
	70	20.737	.537	6.44	5.28		
	75	21.219	.482	5.78	5.49		
	80	21.689	.470	5.64	5.62	2040	6.99
	85	22.167	.478	5.74	5.57	2040	7.47
	90	22.639	.472	5.66	5.65	2035	7.94
	95	23.103	.464	5.57	5.72	2211	8.20
	100	23.530	.427	5.12	5.73	2140	8.83
	105	23.962	.432	5.18	5.73	2135	9.26
	110	24.395	.433	5.20	5.73	2135	9.70
	115	24.827	.432	5.18	5.73	2140	10.127
Comp off	120	24.964	.137	1.64	5.32	0	
	125	24.939	-0.025	-0.3	4.74	0	
	130	24.929	-0.01	-0.12	4.19	0	
	135	24.924	-0.005	-0.06	3.71	0	
Comp on	140	24.922	-0.002	-0.024	3.23	2160	
	145	25.383	.461	5.53	3.22		
	150	25.837	.454	5.45	3.20		
	155	26.282	.445	5.34	3.18	2140	11.58
	160	26.717	.435	5.22	3.19	2160	12.02
	165	27.155	.438	5.26	3.193	2150	12.46
	170	27.588	.433	5.20	3.193	2150	12.89
	175	28.042	.454	5.448	3.215	2440	13.34
	180	28.579	.537	6.444	3.615	2430	13.88
	185	29.111	.532	6.384	4.172	2440	14.41
	190	29.634	.523	6.276	4.705	2410	14.93
	195	30.163	.529	6.348	5.239	2420	15.46
	200	30.685	.522	6.264	5.763	2425	15.99
	205	31.214	.529	6.348	5.831	2410	16.51
	210	31.738	.524	6.288	5.901	2420	17.04
	215	32.267	.529	6.348	5.985	2410	17.57

FERMI 2
PCILFT
PUMPUP DATA

① TIME	② ELAPSED TIME-MIN	③ PRESSURE PSIA	④ ΔP PSIA	⑤ 12 x ④ ΔP PSIA	⑥ HR AVE Δ ③ PSIA	⑦ PUMPUP FLOW SCFM	⑧ ΔP RISE PSIG
	220	32.790	.523	6.276	6.073	2424	18.09
	225	33.320	.530	6.360	6.165	2425	18.62
	230	33.846	.526	6.312	6.258	2410	19.15
	235	34.374	.528	6.336	6.332	2425	19.67
	240	34.900	.526	6.312	6.321	2418	20.20
	245	35.426	.526	6.312	6.315	2415	20.73
	250	35.950	.524	6.288	6.316	2410	21.25
	255	36.474	.524	6.288	6.311	2410	21.77
	260	37.000	.526	6.312	6.315	2400	22.3
	265	37.524	.524	6.288	6.310	2410	22.82
	270	38.040	.516	6.192	6.302	2260	23.34
	275	38.539	.499	5.988	6.272	2260	23.90
	280	39.042	.503	6.036	6.252	2260	24.34
	285	39.542	.500	6.00	5.696	2260	24.84
	290	40.023	.481	5.772	6.177	2025	25.32
	295	40.494	.471	5.652	6.12	1860	25.794
	300	40.953	.459	5.479	6.05	1900	26.45
	305	41.417	.464	5.568	5.991	1895	26.717
	310	41.878	.461	5.532	5.928	1890	27.178
	315	42.342	.464	5.568	5.868	1895	27.642
	320	42.801	.459	5.508	5.801	1895	28.10
	325	43.267	.460	5.592	5.743	1880	28.56
	330	43.726	.459	5.508	5.686	1885	29.03
	335	44.190	.464	5.568	5.65	2040	29.49
	340	44.670	.480	5.760	5.52	2040	29.97
	345	45.147	.477	5.724	5.60	2040	30.45
	350	45.626	.479	5.748	5.603	2190	30.93
	355	46.122	.496	5.952	5.628	2200	31.42
	360	46.609	.487	5.844	5.656	2220	31.91
	365	47.103	.494	5.928	5.686	2200	32.40
	370	47.596	.493	5.916	5.718	2330	32.89
	375						
	380						
	385	49.143			5.876	2330	34.44
	390	49.653	.510	6.120	5.927	2320	34.95
	395	50.167	.514	6.168	5.977	2350	35.47
	400	50.680	Totalizer 29,875 yd ³				
	405	51.197					
	410	51.707					
	415	52.225	.518	6.216	6.103	2310	37.525
	420	52.734	.509	6.108	6.125	2310	38.034
	425	53.249	.515	6.180	6.146	2321	38.549
	430	53.759	.510	6.120	6.163	2322	39.059
	435	54.275	.516	6.192		2322	39.575

FERMI 2
PCILFT
PUMPUP DATA

① TIME	② ELAPSED TIME-MIN	③ PRESSURE PSIA	④ ΔP PSIA	⑤ 12 x ④ ΔP PSIA	⑥ HR AVE ΔP PSIA	⑦ PUMPUP FLOW SCFM	⑧ ΔP RISE PSIG
	440	54.785	.510	6.120		2315	40.085
	445	55.299	.514	6.168	6.156	2331	40.599
	450	55.808	.509	6.108	6.155	2325	41.108
	455	56.313	.505	6.060	6.146	2221	41.613
	460	56.806	.493	5.916	6.126	2230	42.106
	465	57.301	.495	5.940	6.104	2221	42.601
	470	57.797	.496	5.952	6.090	2224	43.097
	475	58.298	.501	6.012	6.073	2228	43.598
	480	58.794	.496	5.952	6.060	2229	44.094
	485	59.293	.499	5.988	6.044	2212	44.593
	490	59.787	.494	5.928	6.028	2204	45.087
	495	60.285	.498	5.976	6.010	2210	45.585
	500	60.778	.493	5.916	5.993	2195	46.078
	505	61.274	.496	5.952	5.975	2200	46.574
	510	61.764	.490	5.880	5.956	2205	47.064
	515	62.260	.496	5.952	5.947	2164	47.560
	520	62.748	.488	5.856	5.942	2189	48.048
	525	63.241	.493	5.916	5.940	2155	48.541
	530	63.728	.487	5.844	5.931	2171	49.028
	535	64.218	.490	5.880	5.920	2154	49.518
	540	64.702	.484	5.808	5.908	2150	50.002
	545	65.191	.489	5.868	5.898	2130	50.491
	550	65.672	.481	5.885		2134	50.972
	555	66.156	.484	5.871		2130	51.456
	560	66.633	.477	5.855		2110	51.933
	565	67.114	.481	5.840		2090	52.414
	570	67.589	.479	5.825		2085	52.889
	575	68.070	.481	5.810		2080	53.370
	580	68.546	.476	5.798		2100	53.846
	585	69.027	.481	5.786		2070	54.327
	590	69.503	.476	5.775		2070	54.803
	595	69.983	.480	5.760	5.765	2072	55.283
	600	70.456	.473	5.676	5.754	2057	55.756
	605	70.935	.479	5.748	5.744	2075	56.235
	610	71.412	.477	5.724	5.740	2059	56.712
	615	71.654	.242	2.904	5.498	0858	56.954
Start 1 min	620	71.875	.221	2.652	5.242	870	
	625	71.922	.047	.564		880	
	630	71.968	.046	.552		882	
	635	72.014				875	
	640	72.060	.046	.552		878	
	645	72.107	.047	.564		879	
	650	72.152	.045	.540		855	57.452
	655	72.197	.045	.540		873	57.497
	660	72.243	.046	.552		852	57.543

FERMI 2
PCILFT
PUMPUP DATA

① TIME	② ELAPSED TIME-MIN	③ PRESSURE PSIA	④ ΔP PSIA	⑤ 12 x ④ ΔP PSIA	⑥ HR AVE $\Delta ③$ PSIA	⑦ PUMPUP FLOW SCFM	⑧ ΔP RISE PSIG
	665	72.283	.045	.540		855	
	670	72.335	.047	.564		879	
	675	72.381	.046	.552		871	57.681
	680	72.428	.047	.564		883	57.728
	685	72.474	.046	.552		890	57.774
	690	72.520	.046	.552		903	57.820
	695	72.567	.047	.564		886	57.867
	700	72.615	.048	.576		876	57.915
	705	72.661	.046	.552		883	57.561
	710	72.709	.048	.576		887	58.009
	715	72.755	.046	.552		869	58.055
	720	72.803	.048	.576		868	58.103
	725	72.848	.045	.540		860	
	730	72.895	.047	.564		860	58.195
	735	72.942	.047	.564		868	
	740	72.989	.047	.564		868	58.289
	745	73.037	.048	.576		858	58.337
	750	73.083				884	
	755	73.130				889	
	760	73.176				876	
	765	73.224	.048	.576		878	
	770	73.270	.046	.552		888	
	775	73.316	.046	.552		848	
	780	73.362	.046	.552		863	58.662
	785	73.408				864	
	790	73.454				849	
	795	73.501				857	
	800	73.548				855	
	805	73.595				847	
	810	73.642				883	
	815	73.689				867	
	820	73.736				880	
	825	73.783				840	
	830	73.830				836	
	835	73.877				851	
	840	73.924				874	
	845	73.971				858	
	850	74.018				853	
	855	74.064				865	
	860	74.083				000	
	865	74.071				000	
	870	74.063				000	
	875	74.055				000	
	880	74.048				000	

FERMI 2
PCILFT
PUMPUP DATA

① TIME	② ELAPSED TIME-MIN	③ PRESSURE PSIA	④ ΔP PSIA	⑤ 12 x ④ ΔP PSIA	⑥ HR AVE Δ ③ PSIA	⑦ PUMPUP FLOW SCFM	⑧ ΔP RISE PSIG
	885	74.042				000	
	890	74.037				000	
	895	74.032				000	
	900	74.029				000	
	905	74.027				000	

APPENDIX C
STABILIZATION DATA

Calculation of Temperature Stabilization

Date/Time Started 0611 11/30/84

(1)	(2)	(3)	(4)	(5)
TIME	TEMP	AVE. ΔT OVER LAST 4 HOURS	AVE. ΔT OVER LAST HOUR	
t	T	$\frac{T_t - T_{t-4}}{4}$	$T_i - T_{t-1}$	⑤ = ③ - ④

HOURS	°F	°R	°R/HR	°R/HR	°R/HR
0	83.95	543.95			
1	83.62	543.62		.33	
2	82.85	542.85		.77	
3	82.39	542.39		.46	
4	82.06	542.06	$\frac{1.89}{4} = .47$.33	.14
5					
6					
7					
8					
9					
10					

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

STARTING DAY - 335

STARTING TIME - 7: 0: 0

STARTING SCAN - SD.156

ENDING SCAN - SD.172

POINT TO POINT

TOTAL TIME

MASS PLOT

SCAN NO.	ELAPSED TIME (HR)	AVERAGE TEMP. (F)	AVERAGE PRESSURE (PSIA)	MEASURED LEAK RATE	CALCULATED LEAK RATE	MEASURED LEAK RATE	CALCULATED LEAK RATE (WEIGHT PERCENT PER DAY)	UPPER CONFIDENCE	MEASURED LEAK RATE	CALCULATED LEAK RATE	UPPER CONFIDENCE
SD.156	0.00	83.67	73.595								
SD.157	0.25	83.62	73.570	0.237E+01	0.237E+01	0.237E+01	0.237E+01	0.000E+00	0.237E+01	0.237E+01	0.000E+00
SD.158	0.50	83.57	73.549	0.190E+01	0.190E+01	0.214E+01	0.214E+01	0.000E+00	0.214E+01	0.214E+01	0.000E+00
SD.159	0.75	83.48	73.526	0.110E+01	0.115E+01	0.179E+01	0.181E+01	0.196E+01	0.179E+01	0.149E+01	0.349E+01
SD.160	1.00	83.04	73.486	-0.249E+01	-0.159E+01	0.720E+00	0.960E+00	0.138E+01	0.720E+00	0.261E+00	0.238E+01
SD.161	1.25	82.85	73.463	-0.458E-01	-0.128E+01	0.567E+00	0.512E+00	0.771E+00	0.567E+00	-0.490E-01	0.102E+01
SD.162	1.50	82.71	73.455	-0.153E+01	-0.185E+01	0.218E+00	0.119E+00	0.323E+00	0.218E+00	-0.349E+00	0.383E+00
SD.163	1.75	82.59	73.434	0.746E+00	-0.109E+01	0.293E+00	-0.535E-01	0.215E+00	0.293E+00	-0.338E+00	0.151E+00
SD.164	2.00	82.49	73.414	0.771E+00	-0.581E+00	0.353E+00	-0.119E+00	0.210E+00	0.353E+00	-0.241E+00	0.127E+00
SD.165	2.25	82.39	73.405	-0.628E+00	-0.765E+00	0.244E+00	-0.191E+00	0.151E+00	0.244E+00	-0.222E+00	0.570E-01
SD.166	2.50	82.30	73.391	0.245E+00	-0.581E+00	0.244E+00	-0.230E+00	0.121E+00	0.244E+00	-0.188E+00	0.340E-01
SD.167	2.75	82.21	73.379	0.904E-01	-0.492E+00	0.230E+00	-0.254E+00	0.101E+00	0.230E+00	-0.156E+00	0.258E-01
SD.168	3.00	82.14	73.367	0.173E+00	-0.398E+00	0.225E+00	-0.266E+00	0.893E-01	0.225E+00	-0.124E+00	0.264E-01
SD.169	3.25	82.06	73.360	-0.411E+00	-0.484E+00	0.176E+00	-0.283E+00	0.664E-01	0.176E+00	-0.115E+00	0.131E-01
SD.170	3.50	81.99	73.350	0.114E-02	-0.441E+00	0.164E+00	-0.294E+00	0.484E-01	0.164E+00	-0.106E+00	0.369E-02
SD.171	3.75	81.93	73.336	0.703E+00	-0.235E+00	0.200E+00	-0.290E+00	0.482E-01	0.200E+00	-0.798E-01	0.180E-01
SD.172	4.00	81.87	73.326	0.318E+00	-0.157E+00	0.207E+00	-0.282E+00	0.517E-01	0.207E+00	-0.532E-01	0.359E-01

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

STARTING DAY - 335

STARTING TIME - 7: 0: 0

STARTING SCAN - 50.156

ENDING SCAN - 50.172

ILRT RESULTS AFTER 4.00 HRS.

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POINT TO POINT	TOTAL TIME	MASS PLOT
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AVERAGE MEASURED LEAK RATES
(WEIGHT PERCENT PER DAY)

LEAK RATE	LEAK RATE	STD.DEV.	LEAK RATE	STD.DEV.
0.207E+00	0.634E+00	0.743E+00	0.634E+00	0.743E+00

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CALCULATED LEAK RATES
(WEIGHT PERCENT PER DAY)

LEAK RATE	LEAK RATE	STD.DEV.	UPPER CON. LIMIT	LEAK RATE	STD.DEV.	UPPER CON. LIMIT
-0.157E+00	-0.282E+00	0.188E+00	0.490E-01	-0.532E-01	0.506E-01	0.359E-01

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APPENDIX D

TEST DATA

VOLUMETRICS
RESULTS

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

STARTING DAY - 335

STARTING TIME - 11: 0: 0

STARTING SCAN - SD.172

ENDING SCAN - SD.268

POINT TO POINT

TOTAL TIME

MASS PLOT

SCAN NO.	ELAPSED TIME (HR)	AVERAGE TEMP. (F)	AVERAGE PRESSURE (PSIA)	MEASURED LEAK RATE	CALCULATED LEAK RATE	MEASURED LEAK RATE	CALCULATED LEAK RATE	UPPER CONFIDENCE (WEIGHT PERCENT PER DAY)	MEASURED LEAK RATE	CALCULATED LEAK RATE	UPPER CONFIDENCE
SD.172	0.00	81.87	73.326								
SD.173	0.25	81.80	73.318	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.119E-01	0.139E-02	0.000E+00
SD.174	0.50	81.75	73.309	0.145E+00	0.145E+00	0.727E-01	0.727E-01	0.000E+00	0.728E-01	0.728E-01	0.000E+00
SD.175	0.75	81.69	73.301	0.595E-01	0.980E-01	0.683E-01	0.811E-01	0.161E+00	0.687E-01	0.102E+00	0.310E+00
SD.176	1.00	81.64	73.294	0.200E-01	0.524E-01	0.559E-01	0.737E-01	0.112E+00	0.561E-01	0.736E-01	0.133E+00
SD.177	1.25	81.59	73.284	0.391E+00	0.255E+00	0.123E+00	0.110E+00	0.137E+00	0.123E+00	0.132E+00	0.215E+00
SD.178	1.50	81.54	73.275	0.213E+00	0.264E+00	0.138E+00	0.136E+00	0.155E+00	0.138E+00	0.158E+00	0.215E+00
SD.179	1.75	81.49	73.268	0.157E+00	0.241E+00	0.141E+00	0.151E+00	0.168E+00	0.141E+00	0.168E+00	0.215E+00
SD.180	2.00	81.45	73.261	0.830E-01	0.195E+00	0.133E+00	0.156E+00	0.174E+00	0.133E+00	0.165E+00	0.195E+00
SD.181	2.25	81.41	73.253	0.279E+00	0.238E+00	0.150E+00	0.165E+00	0.182E+00	0.150E+00	0.171E+00	0.195E+00
SD.182	2.50	81.37	73.246	0.272E+00	0.264E+00	0.162E+00	0.175E+00	0.191E+00	0.162E+00	0.186E+00	0.201E+00
SD.183	2.75	81.33	73.240	0.145E+00	0.241E+00	0.160E+00	0.181E+00	0.197E+00	0.160E+00	0.183E+00	0.200E+00
SD.184	3.00	81.29	73.233	0.223E+00	0.247E+00	0.166E+00	0.187E+00	0.202E+00	0.166E+00	0.187E+00	0.201E+00
SD.185	3.25	81.25	73.226	0.197E+00	0.244E+00	0.168E+00	0.191E+00	0.207E+00	0.168E+00	0.189E+00	0.201E+00
SD.186	3.50	81.22	73.220	0.294E+00	0.266E+00	0.177E+00	0.197E+00	0.212E+00	0.177E+00	0.193E+00	0.205E+00
SD.187	3.75	81.18	73.214	0.162E+00	0.252E+00	0.176E+00	0.200E+00	0.216E+00	0.176E+00	0.195E+00	0.205E+00
SD.188	4.00	81.15	73.205	0.616E+00	0.343E+00	0.203E+00	0.209E+00	0.223E+00	0.203E+00	0.206E+00	0.220E+00
SD.189	4.25	81.12	73.202	-0.220E+00	0.236E+00	0.179E+00	0.211E+00	0.226E+00	0.179E+00	0.205E+00	0.217E+00
SD.190	4.50	81.09	73.194	0.483E+00	0.292E+00	0.196E+00	0.215E+00	0.230E+00	0.196E+00	0.209E+00	0.221E+00
SD.191	4.75	81.06	73.186	0.296E+00	0.302E+00	0.201E+00	0.220E+00	0.234E+00	0.201E+00	0.213E+00	0.225E+00
SD.192	5.00	81.03	73.183	0.106E+00	0.275E+00	0.196E+00	0.223E+00	0.237E+00	0.196E+00	0.215E+00	0.225E+00
SD.193	5.25	81.00	73.177	0.257E+00	0.279E+00	0.199E+00	0.225E+00	0.239E+00	0.199E+00	0.217E+00	0.226E+00
SD.194	5.50	80.97	73.171	0.238E+00	0.278E+00	0.201E+00	0.228E+00	0.242E+00	0.201E+00	0.218E+00	0.227E+00
SD.195	5.75	80.95	73.167	0.114E+00	0.258E+00	0.197E+00	0.229E+00	0.243E+00	0.197E+00	0.219E+00	0.227E+00
SD.196	6.00	80.92	73.162	0.153E+00	0.246E+00	0.195E+00	0.230E+00	0.244E+00	0.195E+00	0.218E+00	0.225E+00
SD.197	6.25	80.89	73.156	0.372E+00	0.269E+00	0.202E+00	0.231E+00	0.246E+00	0.202E+00	0.219E+00	0.225E+00
SD.198	6.50	80.87	73.151	0.202E+00	0.264E+00	0.202E+00	0.232E+00	0.247E+00	0.202E+00	0.219E+00	0.225E+00
SD.199	6.75	80.84	73.143	0.572E+00	0.311E+00	0.216E+00	0.235E+00	0.250E+00	0.216E+00	0.222E+00	0.229E+00
SD.200	7.00	80.82	73.141	-0.187E+00	0.250E+00	0.201E+00	0.236E+00	0.250E+00	0.201E+00	0.222E+00	0.228E+00
SD.201	7.25	80.80	73.134	0.525E+00	0.289E+00	0.213E+00	0.238E+00	0.252E+00	0.213E+00	0.224E+00	0.220E+00
SD.202	7.50	80.78	73.130	0.143E+00	0.275E+00	0.210E+00	0.239E+00	0.253E+00	0.210E+00	0.225E+00	0.230E+00
SD.203	7.75	80.75	73.127	0.864E-01	0.256E+00	0.206E+00	0.240E+00	0.254E+00	0.206E+00	0.225E+00	0.230E+00
SD.204	8.00	80.73	73.121	0.461E+00	0.276E+00	0.212E+00	0.241E+00	0.255E+00	0.212E+00	0.225E+00	0.230E+00
SD.205	8.25	80.71	73.115	0.406E+00	0.295E+00	0.218E+00	0.242E+00	0.256E+00	0.218E+00	0.227E+00	0.232E+00
SD.206	8.50	80.69	73.110	0.291E+00	0.299E+00	0.220E+00	0.244E+00	0.257E+00	0.220E+00	0.229E+00	0.234E+00
SD.207	8.75	80.67	73.106	0.153E+00	0.287E+00	0.218E+00	0.245E+00	0.259E+00	0.218E+00	0.230E+00	0.235E+00
SD.208	9.00	80.67	73.105	0.108E+00	0.272E+00	0.215E+00	0.246E+00	0.259E+00	0.215E+00	0.230E+00	0.235E+00
SD.209	9.25	80.65	73.097	0.576E+00	0.306E+00	0.225E+00	0.248E+00	0.261E+00	0.225E+00	0.232E+00	0.237E+00
SD.210	9.50	80.63	73.094	0.175E+00	0.297E+00	0.224E+00	0.249E+00	0.262E+00	0.224E+00	0.234E+00	0.238E+00
SD.211	9.80	80.60	73.086	0.439E+00	0.315E+00	0.230E+00	0.251E+00	0.264E+00	0.230E+00	0.236E+00	0.240E+00
SD.212	10.00	80.59	73.084	0.131E+00	0.301E+00	0.228E+00	0.252E+00	0.264E+00	0.228E+00	0.237E+00	0.242E+00
SD.213	10.25	80.57	73.079	0.275E+00	0.302E+00	0.230E+00	0.253E+00	0.266E+00	0.230E+00	0.239E+00	0.243E+00
SD.214	10.50	80.56	73.075	0.432E+00	0.317E+00	0.234E+00	0.255E+00	0.267E+00	0.234E+00	0.241E+00	0.245E+00
SD.215	10.75	80.55	73.072	0.360E-01	0.296E+00	0.230E+00	0.256E+00	0.268E+00	0.230E+00	0.241E+00	0.246E+00

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

STARTING DAY - 335

STARTING TIME - 11: 0: 0

STARTING SCAN - SD.172

ENDING SCAN - SD.268

POINT TO POINT

TOTAL TIME

MASS FLOW

SCAN NO.	ELAPSED TIME (HR)	AVERAGE TEMP. (F)	AVERAGE PRESSURE (PSIA)	MEASURED LEAK RATE	CALCULATED LEAK RATE	MEASURED LEAK RATE	CALCULATED LEAK RATE	UPPER CONFIDENCE	MEASURED LEAK RATE	CALCULATED LEAK RATE	UPPER CONFIDENCE
(WEIGHT PERCENT PER DAY)											
SD.216	11.00	80.50	73.066	0.443E+00	0.312E+00	0.235E+00	0.257E+00	0.269E+00	0.235E+00	0.243E+00	0.248E+00
SD.217	11.25	80.51	73.063	0.133E+00	0.300E+00	0.232E+00	0.258E+00	0.270E+00	0.232E+00	0.244E+00	0.248E+00
SD.218	11.50	80.50	73.060	0.549E+01	0.282E+00	0.227E+00	0.259E+00	0.271E+00	0.228E+00	0.244E+00	0.248E+00
SD.219	11.75	80.48	73.055	0.368E+00	0.291E+00	0.231E+00	0.260E+00	0.271E+00	0.231E+00	0.245E+00	0.249E+00
SD.220	12.00	80.46	73.051	0.293E+00	0.294E+00	0.233E+00	0.261E+00	0.272E+00	0.233E+00	0.245E+00	0.249E+00
SD.221	12.25	80.45	73.047	0.340E+00	0.300E+00	0.235E+00	0.261E+00	0.273E+00	0.235E+00	0.246E+00	0.250E+00
SD.222	12.50	80.43	73.043	0.406E+01	0.282E+00	0.231E+00	0.262E+00	0.273E+00	0.231E+00	0.246E+00	0.250E+00
SD.223	12.75	80.41	73.041	0.292E+01	0.265E+00	0.227E+00	0.262E+00	0.273E+00	0.227E+00	0.246E+00	0.250E+00
SD.224	13.00	80.39	73.035	0.354E+00	0.274E+00	0.230E+00	0.263E+00	0.275E+00	0.230E+00	0.246E+00	0.250E+00
SD.225	13.25	80.39	73.032	0.484E+00	0.290E+00	0.233E+00	0.263E+00	0.274E+00	0.233E+00	0.246E+00	0.250E+00
SD.226	13.50	80.38	73.028	0.229E+00	0.268E+00	0.233E+00	0.263E+00	0.275E+00	0.233E+00	0.247E+00	0.250E+00
SD.227	13.75	80.36	73.025	0.210E+00	0.284E+00	0.233E+00	0.264E+00	0.275E+00	0.233E+00	0.247E+00	0.250E+00
SD.228	14.00	80.35	73.021	0.190E+00	0.279E+00	0.232E+00	0.264E+00	0.275E+00	0.232E+00	0.247E+00	0.250E+00
SD.229	14.25	80.34	73.018	0.314E+00	0.263E+00	0.234E+00	0.264E+00	0.275E+00	0.234E+00	0.247E+00	0.250E+00
SD.230	14.50	80.32	73.012	0.462E+00	0.297E+00	0.238E+00	0.265E+00	0.276E+00	0.238E+00	0.248E+00	0.251E+00
SD.231	14.75	80.31	73.009	0.113E+00	0.287E+00	0.235E+00	0.265E+00	0.276E+00	0.235E+00	0.248E+00	0.251E+00
SD.232	15.00	80.30	73.006	0.320E+00	0.291E+00	0.237E+00	0.266E+00	0.276E+00	0.237E+00	0.248E+00	0.251E+00
SD.233	15.25	80.29	73.002	0.228E+00	0.288E+00	0.237E+00	0.266E+00	0.277E+00	0.237E+00	0.249E+00	0.251E+00
SD.234	15.50	80.27	72.996	0.289E+00	0.290E+00	0.238E+00	0.266E+00	0.277E+00	0.238E+00	0.249E+00	0.251E+00
SD.235	15.75	80.26	72.995	0.332E+00	0.294E+00	0.239E+00	0.267E+00	0.277E+00	0.239E+00	0.249E+00	0.252E+00
SD.236	16.00	80.25	72.993	0.315E+01	0.280E+00	0.236E+00	0.267E+00	0.278E+00	0.236E+00	0.249E+00	0.252E+00
SD.237	16.25	80.24	72.986	0.372E+00	0.287E+00	0.238E+00	0.267E+00	0.278E+00	0.238E+00	0.250E+00	0.252E+00
SD.238	16.50	80.23	72.987	-0.732E+01	0.267E+00	0.233E+00	0.267E+00	0.278E+00	0.233E+00	0.249E+00	0.252E+00
SD.239	16.75	80.22	72.982	0.489E+00	0.281E+00	0.237E+00	0.267E+00	0.278E+00	0.237E+00	0.249E+00	0.252E+00
SD.240	17.00	80.21	72.981	-0.183E+01	0.265E+00	0.233E+00	0.267E+00	0.278E+00	0.233E+00	0.249E+00	0.251E+00
SD.241	17.25	80.20	72.975	0.611E+00	0.285E+00	0.239E+00	0.268E+00	0.278E+00	0.239E+00	0.249E+00	0.252E+00
SD.242	17.50	80.19	72.975	-0.133E+00	0.263E+00	0.233E+00	0.268E+00	0.278E+00	0.233E+00	0.249E+00	0.251E+00
SD.243	17.75	80.18	72.969	0.555E+00	0.280E+00	0.238E+00	0.268E+00	0.278E+00	0.238E+00	0.249E+00	0.251E+00
SD.244	18.00	80.17	72.966	0.243E+00	0.279E+00	0.238E+00	0.268E+00	0.278E+00	0.238E+00	0.249E+00	0.251E+00
SD.245	18.25	80.16	72.961	0.469E+00	0.291E+00	0.241E+00	0.268E+00	0.278E+00	0.241E+00	0.250E+00	0.252E+00
SD.246	18.50	80.15	72.959	0.102E+00	0.282E+00	0.239E+00	0.268E+00	0.279E+00	0.239E+00	0.250E+00	0.252E+00
SD.247	18.75	80.14	72.956	0.125E+00	0.275E+00	0.238E+00	0.269E+00	0.279E+00	0.238E+00	0.250E+00	0.252E+00
SD.248	19.00	80.13	72.953	0.317E+00	0.278E+00	0.239E+00	0.269E+00	0.279E+00	0.239E+00	0.250E+00	0.252E+00
SD.249	19.25	80.12	72.949	0.243E+00	0.277E+00	0.239E+00	0.269E+00	0.279E+00	0.239E+00	0.250E+00	0.252E+00
SD.250	19.50	80.11	72.946	0.307E+00	0.280E+00	0.240E+00	0.269E+00	0.279E+00	0.240E+00	0.250E+00	0.252E+00
SD.251	19.75	80.10	72.943	0.240E+00	0.279E+00	0.240E+00	0.269E+00	0.279E+00	0.240E+00	0.250E+00	0.252E+00
SD.252	20.00	80.09	72.941	0.326E+01	0.268E+00	0.237E+00	0.269E+00	0.279E+00	0.237E+00	0.250E+00	0.252E+00
SD.253	20.25	80.09	72.938	0.401E+00	0.275E+00	0.239E+00	0.269E+00	0.279E+00	0.239E+00	0.250E+00	0.252E+00
SD.254	20.50	80.08	72.934	0.416E+00	0.282E+00	0.241E+00	0.269E+00	0.279E+00	0.241E+00	0.250E+00	0.252E+00
SD.255	20.75	80.07	72.941	-0.116E+01	0.215E+00	0.224E+00	0.268E+00	0.278E+00	0.224E+00	0.249E+00	0.251E+00
SD.256	21.00	80.06	72.927	0.167E+01	0.283E+00	0.241E+00	0.269E+00	0.278E+00	0.241E+00	0.249E+00	0.251E+00
SD.257	21.25	80.05	72.923	0.332E+00	0.286E+00	0.243E+00	0.269E+00	0.279E+00	0.243E+00	0.250E+00	0.252E+00
SD.258	21.50	80.04	72.922	0.715E+01	0.277E+00	0.241E+00	0.269E+00	0.279E+00	0.241E+00	0.250E+00	0.252E+00
SD.259	21.75	80.03	72.919	0.198E+00	0.275E+00	0.240E+00	0.269E+00	0.279E+00	0.240E+00	0.250E+00	0.252E+00

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

STARTING DAY - 335

STARTING TIME - 11: 0: 0

STARTING SCAN - SD.172

ENDING SCAN - SD.268

POINT TO POINT

TOTAL TIME

MASS PLOT

SCAN NO.	ELAPSED TIME (HR)	AVERAGE TEMP. (F)	AVERAGE PRESSURE (PSIA)	MEASURED LEAK RATE	CALCULATED LEAK RATE	MEASURED LEAK RATE	CALCULATED LEAK RATE (WEIGHT PERCENT PER DAY)	UPPER CONFIDENCE	MEASURED LEAK RATE	CALCULATED LEAK RATE	UPPER CONFIDENCE
SD.260	22.00	80.02	72.916	0.233E+00	0.273E+00	0.240E+00	0.269E+00	0.279E+00	0.240E+00	0.250E+00	0.252E+00
SD.261	22.25	80.01	72.913	0.143E+00	0.268E+00	0.239E+00	0.269E+00	0.279E+00	0.239E+00	0.250E+00	0.252E+00
SD.262	22.30	80.01	72.910	0.292E+00	0.270E+00	0.239E+00	0.269E+00	0.278E+00	0.239E+00	0.250E+00	0.251E+00
SD.263	22.75	80.00	72.907	0.298E+00	0.272E+00	0.240E+00	0.269E+00	0.278E+00	0.240E+00	0.250E+00	0.251E+00
SD.264	23.00	79.99	72.903	0.346E+00	0.276E+00	0.241E+00	0.269E+00	0.278E+00	0.241E+00	0.250E+00	0.251E+00
SD.265	23.25	79.98	72.902	0.669E-01	0.268E+00	0.239E+00	0.269E+00	0.278E+00	0.239E+00	0.250E+00	0.251E+00
SD.266	23.50	79.97	72.898	0.244E+00	0.267E+00	0.239E+00	0.269E+00	0.278E+00	0.239E+00	0.250E+00	0.251E+00
SD.267	23.75	79.97	72.896	0.268E+00	0.268E+00	0.240E+00	0.269E+00	0.278E+00	0.240E+00	0.250E+00	0.251E+00
SD.268	24.00	79.96	72.892	0.335E+00	0.271E+00	0.241E+00	0.269E+00	0.278E+00	0.241E+00	0.250E+00	0.251E+00

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

STARTING DAY - 335

STARTING TIME - 11: 0: 0

STARTING SCAN - 50.172

ENDING SCAN - 50.268

ILRT RESULTS AFTER 24.00 HRS.

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POINT TO POINT	TOTAL TIME	MASS PLOT
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	AVERAGE MEASURED LEAK RATES (WEIGHT PERCENT PER DAY)			
LEAK RATE	LEAK RATE	STD.DEV.	LEAK RATE	STD.DEV.
0.241E+00	0.212E+00	0.492E-01	0.212E+00	0.491E-01

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	CALCULATED LEAK RATES (WEIGHT PERCENT PER DAY)					
LEAK RATE	LEAK RATE	STD.DEV.	UPPER CON. LIMIT	LEAK RATE	STD.DEV.	UPPER CON. LIMIT
0.271E+00	0.269E+00	0.556E-02	0.278E+00	0.250E+00	0.849E-03	0.251E+00

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BACK-UP COMPUTER
RESULTS

PRIMARY CONTAINMENT
INTEGRATED LEAK RATE TEST DATA

Appendix D
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FERMI 2 ILRT
11/30/84

POINT NO.	DATE	TIME	PRESSURE PSIA	TEMPERATURE F	WEIGHT LBS	STATUS
1	11/30/84	11/00/00	73.326	81.87	107675.4	G
2	11/30/84	11/15/00	73.318	81.8	107677.6	G
3	11/30/84	11/30/00	73.309	81.75	107674.3	G
4	11/30/84	11/45/00	73.301	81.69	107674.5	G
5	11/30/84	12/00/00	73.294	81.64	107674.1	G
6	11/30/84	12/15/00	73.284	81.59	107669.4	G
7	11/30/84	12/30/00	73.275	81.54	107666.1	G
8	11/30/84	12/45/00	73.268	81.49	107665.8	G
9	11/30/84	13/00/00	73.261	81.45	107663.4	G
10	11/30/84	13/15/00	73.253	81.41	107659.6	G
11	11/30/84	13/30/00	73.246	81.37	107657.3	G
12	11/30/84	13/45/00	73.24	81.33	107656.5	G
13	11/30/84	14/00/00	73.233	81.29	107654.1	G
14	11/30/84	14/15/00	73.226	81.25	107651.8	G
15	11/30/84	14/30/00	73.22	81.22	107648.9	G
16	11/30/84	14/45/00	73.214	81.18	107648.1	G
17	11/30/84	15/00/00	73.205	81.15	107640.8	G
18	11/30/84	15/15/00	73.202	81.12	107642.4	G
19	11/30/84	15/30/00	73.194	81.09	107636.6	G
20	11/30/84	15/45/00	73.188	81.06	107633.7	G
21	11/30/84	16/00/00	73.183	81.03	107632.4	G
22	11/30/84	16/15/00	73.177	81	107629.5	G
23	11/30/84	16/30/00	73.171	80.97	107626.6	G
24	11/30/84	16/45/00	73.167	80.95	107624.7	G
25	11/30/84	17/00/00	73.162	80.92	107623.4	G
26	11/30/84	17/15/00	73.156	80.89	107620.5	G
27	11/30/84	17/30/00	73.151	80.87	107617.1	G
28	11/30/84	17/45/00	73.143	80.84	107611.3	G
29	11/30/84	18/00/00	73.141	80.82	107612.4	G
30	11/30/84	18/15/00	73.134	80.8	107606.1	G
31	11/30/84	18/30/00	73.13	80.78	107604.2	G
32	11/30/84	18/45/00	73.127	80.75	107605.7	G
33	11/30/84	19/00/00	73.121	80.73	107600.9	G
34	11/30/84	19/15/00	73.115	80.71	107596	G
35	11/30/84	19/30/00	73.11	80.69	107592.6	G
36	11/30/84	19/45/00	73.106	80.67	107590.7	G
37	11/30/84	20/00/00	73.105	80.67	107589.3	G
38	11/30/84	20/15/00	73.097	80.65	107581.5	G
39	11/30/84	20/30/00	73.094	80.63	107581	G
40	11/30/84	20/48/00	73.086	80.6	107575.2	G
41	11/30/84	21/00/00	73.084	80.59	107574.3	G
42	11/30/84	21/15/00	73.079	80.57	107570.9	G
43	11/30/84	21/30/00	73.075	80.56	107567	G
44	11/30/84	21/45/00	73.072	80.55	107564.6	G
45	11/30/84	22/00/00	73.066	80.53	107559.7	G
46	11/30/84	22/15/00	73.063	80.51	107559.3	G
47	11/30/84	22/30/00	73.06	80.5	107556.9	G
48	11/30/84	22/45/00	73.055	80.48	107553.5	G
49	11/30/84	23/00/00	73.051	80.46	107551.6	G

POINT NO.	DATE	TIME	PRESSURE PSIA	TEMPERATURE F	WEIGHT LBS	STATUS
50	11/30/84	23/15/00	73.047	80.45	107547.7	G
51	11/30/84	23/30/00	73.043	80.43	107545.8	G
52	11/30/84	23/45/00	73.041	80.41	107546.8	G
53	12/01/84	00/05/00	73.035	80.39	107542	G
54	12/01/84	00/15/00	73.032	80.39	107537.6	G
55	12/01/84	00/30/00	73.028	80.38	107533.7	G
56	12/01/84	00/45/00	73.025	80.36	107533.2	G
57	12/01/84	01/00/00	73.021	80.35	107529.3	G
58	12/01/84	01/15/00	73.018	80.34	107526.9	G
59	12/01/84	01/30/00	73.012	80.32	107522	G
60	12/01/84	01/45/00	73.009	80.31	107519.6	G
61	12/01/84	02/00/00	73.006	80.3	107517.2	G
62	12/01/84	02/15/00	73.002	80.29	107513.3	G
63	12/01/84	02/30/00	72.998	80.27	107511.4	G
64	12/01/84	02/45/00	72.995	80.26	107509	G
65	12/01/84	03/00/00	72.993	80.25	107508	G
66	12/01/84	03/15/00	72.988	80.24	107502.6	G
67	12/01/84	03/30/00	72.987	80.23	107503.1	G
68	12/01/84	03/45/00	72.982	80.22	107497.8	G
69	12/01/84	04/00/00	72.981	80.21	107498.3	G
70	12/01/84	04/15/00	72.975	80.2	107491.4	G
71	12/01/84	04/30/00	72.975	80.19	107493.4	G
72	12/01/84	04/45/00	72.969	80.18	107486.6	G
73	12/01/84	05/00/00	72.966	80.17	107484.2	G
74	12/01/84	05/15/00	72.961	80.16	107478.8	G
75	12/01/84	05/30/00	72.959	80.15	107477.8	G
76	12/01/84	05/45/00	72.956	80.14	107475.4	G
77	12/01/84	06/00/00	72.953	80.13	107473	G
78	12/01/84	06/15/00	72.949	80.12	107469.1	G
79	12/01/84	06/30/00	72.946	80.11	107466.6	G
80	12/01/84	06/45/00	72.943	80.1	107464.2	G
81	12/01/84	07/00/00	72.941	80.09	107463.3	G
82	12/01/84	07/15/00	72.938	80.09	107458.8	G
83	12/01/84	07/30/00	72.934	80.08	107454.9	G
84	12/01/84	07/45/00	72.941	80.07	107467.2	G
85	12/01/84	08/00/00	72.927	80.06	107448.6	G
86	12/01/84	08/15/00	72.923	80.05	107444.7	G
87	12/01/84	08/30/00	72.922	80.04	107445.2	G
88	12/01/84	08/45/00	72.919	80.03	107442.8	G
89	12/01/84	09/00/00	72.916	80.02	107440.4	G
90	12/01/84	09/15/00	72.913	80.01	107437.9	G
91	12/01/84	09/30/00	72.91	80.01	107433.5	G
92	12/01/84	09/45/00	72.907	80	107431.1	G
93	12/01/84	10/00/00	72.903	79.99	107427.2	G
94	12/01/84	10/15/00	72.902	79.98	107427.7	G
95	12/01/84	10/30/00	72.898	79.97	107423.8	G
96	12/01/84	10/45/00	72.896	79.97	107420.8	G
97	12/01/84	11/00/00	72.892	79.96	107416.9	G

PCILRT
PLANT SPECIFIC DATA

Appendix D
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1. PLANT NAME..... FERMI 2 ILRT
2. DATE OF TEST..... 11/30/84
3. CONTAINMENT VOLUME (CUFT).. 294630
4. LEAK RATE LIMIT LA (%/DAY). .5
5. LEAK RATE PENALTY (%/DAY). 0

FCILRT
TREND REPORT
FERMI 2 ILRT
11/30/84

Appendix D
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POINT	TIME	TOTAL TIME			MASS PLOT	
		MEAS.	CALC.	UCL	CALC.	UCL
4	0.75	0.027	0.072	1.120	0.054	0.239
5	1.00	0.028	0.074	0.561	0.050	0.136
6	1.25	0.107	0.120	0.430	0.102	0.184
7	1.50	0.138	0.157	0.395	0.141	0.212
8	1.75	0.123	0.169	0.382	0.148	0.200
9	2.00	0.133	0.179	0.376	0.155	0.195
10	2.25	0.156	0.193	0.374	0.169	0.204
11	2.50	0.161	0.203	0.374	0.178	0.208
12	2.75	0.154	0.207	0.373	0.180	0.204
13	3.00	0.158	0.211	0.372	0.182	0.202
14	3.25	0.162	0.214	0.371	0.183	0.201
15	3.50	0.168	0.217	0.371	0.186	0.202
16	3.75	0.162	0.218	0.369	0.186	0.199
17	4.00	0.193	0.225	0.371	0.195	0.209
18	4.25	0.173	0.226	0.370	0.195	0.208
19	4.50	0.192	0.230	0.371	0.200	0.213
20	4.75	0.195	0.234	0.371	0.205	0.217
21	5.00	0.192	0.237	0.372	0.207	0.219
22	5.25	0.195	0.239	0.372	0.210	0.220
23	5.50	0.198	0.241	0.372	0.212	0.222
24	5.75	0.196	0.243	0.372	0.213	0.222
25	6.00	0.193	0.243	0.372	0.213	0.222
26	6.25	0.196	0.244	0.371	0.214	0.222
27	6.50	0.200	0.245	0.371	0.215	0.222
28	6.75	0.212	0.248	0.372	0.218	0.225
29	7.00	0.201	0.248	0.371	0.218	0.225
30	7.25	0.213	0.250	0.372	0.221	0.228
31	7.50	0.212	0.252	0.372	0.223	0.229
32	7.75	0.200	0.252	0.371	0.222	0.228
33	8.00	0.208	0.252	0.371	0.223	0.229
34	8.25	0.214	0.254	0.371	0.224	0.230
35	8.50	0.217	0.255	0.371	0.226	0.232
36	8.75	0.216	0.256	0.372	0.227	0.233
37	9.00	0.213	0.256	0.371	0.228	0.233
38	9.25	0.226	0.258	0.372	0.230	0.235
39	9.50	0.221	0.259	0.372	0.231	0.237
40	9.80	0.228	0.262	0.373	0.233	0.239
41	10.00	0.225	0.262	0.373	0.235	0.240
42	10.25	0.227	0.263	0.373	0.236	0.241
43	10.50	0.230	0.264	0.373	0.238	0.243
44	10.75	0.230	0.266	0.374	0.239	0.244
45	11.00	0.234	0.267	0.374	0.241	0.246
46	11.25	0.230	0.268	0.374	0.242	0.247
47	11.50	0.230	0.268	0.374	0.242	0.247
48	11.75	0.231	0.269	0.375	0.243	0.248
49	12.00	0.230	0.270	0.375	0.244	0.248
50	12.25	0.232	0.270	0.375	0.244	0.249
51	12.50	0.231	0.271	0.375	0.245	0.249
52	12.75	0.225	0.271	0.374	0.244	0.249
53	13.08	0.227	0.272	0.375	0.244	0.248
54	13.25	0.232	0.271	0.374	0.245	0.249
55	13.50	0.234	0.272	0.374	0.245	0.249

FCILRT
TREND REPORT
FERMI 2 ILRT
11/30/84

Appendix D
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POINT	TIME	TOTAL TIME			MASS PLOT	
		MEAS.	CALC.	UCL	CALC.	UCL
56	13.75	0.230	0.272	0.374	0.245	0.249
57	14.00	0.233	0.272	0.374	0.246	0.249
58	14.25	0.232	0.272	0.374	0.246	0.249
59	14.50	0.236	0.273	0.374	0.246	0.250
60	14.75	0.235	0.273	0.374	0.247	0.250
61	15.00	0.235	0.274	0.374	0.247	0.250
62	15.25	0.237	0.274	0.374	0.248	0.251
63	15.50	0.236	0.274	0.374	0.248	0.251
64	15.75	0.236	0.274	0.373	0.248	0.251
65	16.00	0.233	0.274	0.373	0.248	0.251
66	16.25	0.237	0.275	0.373	0.248	0.251
67	16.50	0.233	0.275	0.373	0.248	0.251
68	16.75	0.236	0.275	0.373	0.248	0.251
69	17.00	0.232	0.275	0.372	0.248	0.251
70	17.25	0.238	0.275	0.372	0.249	0.251
71	17.50	0.232	0.275	0.372	0.248	0.251
72	17.75	0.237	0.275	0.372	0.248	0.251
73	18.00	0.237	0.275	0.372	0.249	0.251
74	18.25	0.240	0.275	0.371	0.249	0.251
75	18.50	0.238	0.275	0.371	0.249	0.251
76	18.75	0.238	0.275	0.371	0.249	0.251
77	19.00	0.237	0.275	0.371	0.249	0.251
78	19.25	0.239	0.275	0.371	0.249	0.251
79	19.50	0.239	0.275	0.370	0.250	0.251
80	19.75	0.238	0.276	0.370	0.250	0.251
81	20.00	0.236	0.275	0.370	0.250	0.251
82	20.25	0.238	0.275	0.370	0.250	0.251
83	20.50	0.240	0.276	0.370	0.250	0.251
84	20.75	0.224	0.275	0.369	0.249	0.251
85	21.00	0.241	0.275	0.369	0.249	0.251
86	21.25	0.242	0.275	0.369	0.249	0.251
87	21.50	0.239	0.275	0.368	0.249	0.251
88	21.75	0.238	0.275	0.368	0.249	0.251
89	22.00	0.238	0.275	0.368	0.249	0.251
90	22.25	0.238	0.275	0.368	0.249	0.251
91	22.50	0.240	0.275	0.367	0.249	0.251
92	22.75	0.239	0.275	0.367	0.249	0.251
93	23.00	0.241	0.275	0.367	0.249	0.251
94	23.25	0.237	0.275	0.367	0.249	0.251
95	23.50	0.239	0.275	0.366	0.249	0.251
96	23.75	0.239	0.275	0.366	0.249	0.251
97	24.00	0.240	0.275	0.290	0.249	0.251

PCILRT
MASS POINT ANALYSIS
FERMI 2 ILRT
11/30/84

POINT	TIME HRS	PRESSURE PSIA	TEMPERATURE F	AIR MASS LBS	MASS LOSS LBS	AVE. LOSS LBS/HR
1	0.00	73.3260	81.870	107675.4		
2	0.25	73.3180	81.800	107677.6	-2.2	-8.8
3	0.50	73.3090	81.750	107674.3	3.3	2.2
4	0.75	73.3010	81.690	107674.5	-2.2	1.2
5	1.00	73.2940	81.640	107674.1	0.4	1.3
6	1.25	73.2840	81.590	107669.4	4.7	4.8
7	1.50	73.2750	81.540	107666.1	3.3	6.2
8	1.75	73.2680	81.490	107665.8	0.3	5.4
9	2.00	73.2610	81.450	107663.4	2.4	6.0
10	2.25	73.2530	81.410	107659.6	3.8	7.0
11	2.50	73.2460	81.370	107657.3	2.3	7.2
12	2.75	73.2400	81.330	107656.5	0.8	6.8
13	3.00	73.2330	81.290	107654.1	2.4	7.1
14	3.25	73.2260	81.250	107651.8	2.3	7.2
15	3.50	73.2200	81.220	107648.9	2.9	7.5
16	3.75	73.2140	81.180	107648.1	0.8	7.2
17	4.00	73.2050	81.150	107640.8	7.3	8.6
18	4.25	73.2020	81.120	107642.4	-1.6	7.7
19	4.50	73.1940	81.090	107636.6	5.8	8.6
20	4.75	73.1880	81.060	107633.7	2.9	8.7
21	5.00	73.1830	81.030	107632.4	1.3	8.6
22	5.25	73.1770	81.000	107629.5	2.9	8.7
23	5.50	73.1710	80.970	107626.6	2.9	8.8
24	5.75	73.1670	80.950	107624.7	1.9	8.8
25	6.00	73.1620	80.920	107623.4	1.3	8.6
26	6.25	73.1560	80.890	107620.5	2.9	8.7
27	6.50	73.1510	80.870	107617.1	3.4	8.9
28	6.75	73.1430	80.840	107611.3	5.8	9.4
29	7.00	73.1410	80.820	107612.4	-1.1	9.0
30	7.25	73.1340	80.800	107606.1	6.3	9.5
31	7.50	73.1300	80.780	107604.2	1.9	9.4
32	7.75	73.1270	80.750	107605.7	-1.5	8.9
33	8.00	73.1210	80.730	107600.9	4.8	9.3
34	8.25	73.1150	80.710	107596.0	4.9	9.6
35	8.50	73.1100	80.690	107592.6	3.4	9.7
36	8.75	73.1060	80.670	107590.7	1.9	9.6
37	9.00	73.1050	80.670	107589.3	1.4	9.5
38	9.25	73.0970	80.650	107581.5	7.8	10.1
39	9.50	73.0940	80.630	107581.0	0.5	9.9
40	9.80	73.0860	80.600	107575.2	5.8	10.2
41	10.00	73.0840	80.590	107574.3	0.9	10.1
42	10.25	73.0790	80.570	107570.9	3.4	10.1
43	10.50	73.0750	80.560	107567.0	3.9	10.3
44	10.75	73.0720	80.550	107564.6	2.4	10.3
45	11.00	73.0660	80.530	107559.7	4.9	10.5
46	11.25	73.0630	80.510	107559.3	0.4	10.3
47	11.50	73.0600	80.500	107556.9	2.4	10.3
48	11.75	73.0550	80.480	107553.5	3.4	10.3
49	12.00	73.0510	80.460	107551.6	1.9	10.3

POINT	TIME HRS	PRESSURE PSIA	TEMPERATURE F	AIR MASS LBS	MASS LOSS LBS	AVE. LOSS LBS/HR
50	12.25	73.0470	80.450	107547.7	3.9	10.4
51	12.50	73.0430	80.430	107545.8	1.9	10.3
52	12.75	73.0410	80.410	107546.8	-1.0	10.0
53	13.08	73.0350	80.390	107542.0	4.8	10.1
54	13.25	73.0320	80.390	107537.6	4.4	10.4
55	13.50	73.0280	80.380	107533.7	3.9	10.4
56	13.75	73.0250	80.360	107533.2	0.5	10.3
57	14.00	73.0210	80.350	107529.3	3.9	10.4
58	14.25	73.0180	80.340	107526.9	2.4	10.4
59	14.50	73.0120	80.320	107522.0	4.9	10.5
60	14.75	73.0090	80.310	107519.6	2.4	10.5
61	15.00	73.0060	80.300	107517.2	2.4	10.5
62	15.25	73.0020	80.290	107513.3	3.9	10.6
63	15.50	72.9980	80.270	107511.4	1.9	10.5
64	15.75	72.9950	80.260	107509.0	2.4	10.5
65	16.00	72.9930	80.250	107508.0	1.0	10.4
66	16.25	72.9880	80.240	107502.6	5.4	10.6
67	16.50	72.9870	80.230	107503.1	-1.5	10.4
68	16.75	72.9820	80.220	107497.8	5.3	10.6
69	17.00	72.9810	80.210	107498.3	-1.5	10.4
70	17.25	72.9750	80.200	107491.4	6.9	10.6
71	17.50	72.9750	80.190	107493.4	-2.0	10.4
72	17.75	72.9690	80.180	107486.6	6.8	10.6
73	18.00	72.9660	80.170	107484.2	2.4	10.6
74	18.25	72.9610	80.160	107478.8	5.4	10.7
75	18.50	72.9590	80.150	107477.8	1.0	10.6
76	18.75	72.9560	80.140	107475.4	2.4	10.6
77	19.00	72.9530	80.130	107473.0	2.4	10.6
78	19.25	72.9490	80.120	107469.1	3.9	10.7
79	19.50	72.9460	80.110	107466.6	2.5	10.7
80	19.75	72.9430	80.100	107464.2	2.4	10.6
81	20.00	72.9410	80.090	107463.3	0.9	10.6
82	20.25	72.9380	80.090	107458.8	4.5	10.6
83	20.50	72.9340	80.080	107454.9	3.9	10.7
84	20.75	72.9410	80.070	107467.2	-12.3	10.0
85	21.00	72.9270	80.060	107448.6	18.6	10.8
86	21.25	72.9230	80.050	107444.7	3.9	10.8
87	21.50	72.9220	80.040	107445.2	-1.5	10.7
88	21.75	72.9190	80.030	107442.8	2.4	10.6
89	22.00	72.9160	80.020	107440.4	2.4	10.6
90	22.25	72.9130	80.010	107437.9	2.5	10.6
91	22.50	72.9100	80.010	107433.5	4.4	10.7
92	22.75	72.9070	80.000	107431.1	2.4	10.7
93	23.00	72.9030	79.990	107427.2	3.9	10.7
94	23.25	72.9020	79.980	107427.7	-1.5	10.6
95	23.50	72.8980	79.970	107423.8	3.9	10.7
96	23.75	72.8960	79.970	107420.8	3.0	10.7
97	24.00	72.8920	79.960	107416.9	3.9	10.7

SUMMARY
MASS POINT ANALYSIS

Appendix D
Page 14 of 17

PLANT NAME..... FERMI 2 ILRT
TEST DATE..... 11/30/84
NO. OF POINTS..... 97
SLOPE (LBS/HR)..... -11.187
INTERCEPT (LBS)..... 107686.2
LEAK RATE LIMIT..... (%/DAY).. 0.500
ALLOWABLE LEAKRATE.. (%/DAY).. 0.375
CALCULATED LEAKRATE. (%/DAY).. 0.249
95% UCL..... (%/DAY).. 0.251
TEST DURATION..... (HRS).... 24.00
CONTAINMENT VOLUME (CUFT).... 294630

PCILRT
TOTAL TIME ANALYSIS
FERMI 2 ILRT
11/30/84

POINT	TIME HH/MM/SS	TIME HRS	PRESSURE PSIA	TEMPERATURE F	LEAKRATE %/DAY
1	11/00/00	0.00	73.3260	81.870	0.000
2	11/15/00	0.25	73.3180	81.800	-.193
3	11/30/00	0.50	73.3090	81.750	0.049
4	11/45/00	0.75	73.3010	81.690	0.027
5	12/00/00	1.00	73.2940	81.640	0.028
6	12/15/00	1.25	73.2840	81.590	0.107
7	12/30/00	1.50	73.2750	81.540	0.138
8	12/45/00	1.75	73.2680	81.490	0.123
9	13/00/00	2.00	73.2610	81.450	0.133
10	13/15/00	2.25	73.2530	81.410	0.156
11	13/30/00	2.50	73.2460	81.370	0.161
12	13/45/00	2.75	73.2400	81.330	0.154
13	14/00/00	3.00	73.2330	81.290	0.158
14	14/15/00	3.25	73.2260	81.250	0.162
15	14/30/00	3.50	73.2200	81.220	0.168
16	14/45/00	3.75	73.2140	81.180	0.162
17	15/00/00	4.00	73.2050	81.150	0.193
18	15/15/00	4.25	73.2020	81.120	0.173
19	15/30/00	4.50	73.1940	81.090	0.192
20	15/45/00	4.75	73.1880	81.060	0.195
21	16/00/00	5.00	73.1830	81.030	0.192
22	16/15/00	5.25	73.1770	81.000	0.195
23	16/30/00	5.50	73.1710	80.970	0.198
24	16/45/00	5.75	73.1670	80.950	0.196
25	17/00/00	6.00	73.1620	80.920	0.193
26	17/15/00	6.25	73.1560	80.890	0.196
27	17/30/00	6.50	73.1510	80.870	0.200
28	17/45/00	6.75	73.1430	80.840	0.212
29	18/00/00	7.00	73.1410	80.820	0.201
30	18/15/00	7.25	73.1340	80.800	0.213
31	18/30/00	7.50	73.1300	80.780	0.212
32	18/45/00	7.75	73.1270	80.750	0.200
33	19/00/00	8.00	73.1210	80.730	0.208
34	19/15/00	8.25	73.1150	80.710	0.214
35	19/30/00	8.50	73.1100	80.690	0.217
36	19/45/00	8.75	73.1060	80.670	0.216
37	20/00/00	9.00	73.1050	80.670	0.213
38	20/15/00	9.25	73.0970	80.650	0.226
39	20/30/00	9.50	73.0940	80.630	0.221
40	20/48/00	9.80	73.0860	80.600	0.228
41	21/00/00	10.00	73.0840	80.590	0.225
42	21/15/00	10.25	73.0790	80.570	0.227
43	21/30/00	10.50	73.0750	80.560	0.230
44	21/45/00	10.75	73.0720	80.550	0.230
45	22/00/00	11.00	73.0660	80.530	0.234
46	22/15/00	11.25	73.0630	80.510	0.230
47	22/30/00	11.50	73.0600	80.500	0.230
48	22/45/00	11.75	73.0550	80.480	0.231
49	23/00/00	12.00	73.0510	80.460	0.230

POINT	TIME HH/MM/SS	TIME HRS	PRESSURE PSIA	TEMPERATURE F	LEAKRATE %/DAY
50	23/15/00	12.25	73.0470	80.450	0.232
51	23/30/00	12.50	73.0430	80.430	0.231
52	23/45/00	12.75	73.0410	80.410	0.225
53	00/05/00	13.08	73.0350	80.390	0.227
54	00/15/00	13.25	73.0320	80.390	0.232
55	00/30/00	13.50	73.0280	80.380	0.234
56	00/45/00	13.75	73.0250	80.360	0.230
57	01/00/00	14.00	73.0210	80.350	0.233
58	01/15/00	14.25	73.0180	80.340	0.232
59	01/30/00	14.50	73.0120	80.320	0.236
60	01/45/00	14.75	73.0090	80.310	0.235
61	02/00/00	15.00	73.0060	80.300	0.235
62	02/15/00	15.25	73.0020	80.290	0.237
63	02/30/00	15.50	72.9980	80.270	0.236
64	02/45/00	15.75	72.9950	80.260	0.236
65	03/00/00	16.00	72.9930	80.250	0.233
66	03/15/00	16.25	72.9880	80.240	0.237
67	03/30/00	16.50	72.9870	80.230	0.233
68	03/45/00	16.75	72.9820	80.220	0.236
69	04/00/00	17.00	72.9810	80.210	0.232
70	04/15/00	17.25	72.9750	80.200	0.238
71	04/30/00	17.50	72.9750	80.190	0.232
72	04/45/00	17.75	72.9690	80.180	0.237
73	05/00/00	18.00	72.9660	80.170	0.237
74	05/15/00	18.25	72.9610	80.160	0.240
75	05/30/00	18.50	72.9590	80.150	0.238
76	05/45/00	18.75	72.9560	80.140	0.238
77	06/00/00	19.00	72.9530	80.130	0.237
78	06/15/00	19.25	72.9490	80.120	0.239
79	06/30/00	19.50	72.9460	80.110	0.239
80	06/45/00	19.75	72.9430	80.100	0.238
81	07/00/00	20.00	72.9410	80.090	0.236
82	07/15/00	20.25	72.9380	80.090	0.238
83	07/30/00	20.50	72.9340	80.060	0.240
84	07/45/00	20.75	72.9410	80.070	0.224
85	08/00/00	21.00	72.9270	80.060	0.241
86	08/15/00	21.25	72.9230	80.050	0.242
87	08/30/00	21.50	72.9220	80.040	0.239
88	08/45/00	21.75	72.9190	80.030	0.238
89	09/00/00	22.00	72.9160	80.020	0.238
90	09/15/00	22.25	72.9130	80.010	0.238
91	09/30/00	22.50	72.9100	80.010	0.240
92	09/45/00	22.75	72.9070	80.000	0.239
93	10/00/00	23.00	72.9030	79.990	0.241
94	10/15/00	23.25	72.9020	79.980	0.237
95	10/30/00	23.50	72.8980	79.970	0.239
96	10/45/00	23.75	72.8960	79.970	0.239
97	11/00/00	24.00	72.8920	79.960	0.240

SUMMARY
TOTALTIME ANALYSIS

Appendix D
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PLANT NAME..... FERMI 2 ILRT
TEST DATE..... 11/30/84
NO. OF POINTS..... 96
SLOPE (%/DAY/HR)..... 5.7E-03
INTERCEPT (%/DAY)..... 0.137
24 HR PROJECTION (%/DAY)..... 0.275
MEAN LAST 20 PTS (%/DAY)..... 0.238
LEAK RATE LIMIT (%/DAY)..... 0.500
ALLOWABLE LEAKRATE (%/DAY).... 0.375
CALCULATED LEAKRATE (%/DAY)... 0.275
95% UCL (%/DAY)..... 0.290
TEST DURATION.(HRS)..... 24.000
CONTAINMENT VOLUME (CUFT)..... 294630

APPENDIX E
VERIFICATION DATA

VOLUMETRICS
RESULTS

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

Appendix E
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STARTING DAY - 336

STARTING TIME - 13:15: 0

STARTING SCAN - SD.277

ENDING SCAN - SD.293

POINT TO POINT

TOTAL TIME

MASS PLOT

SCAN NO.	ELAPSED TIME (HR)	AVERAGE TEMP. (F)	AVERAGE PRESSURE (PSIA)	MEASURED LEAK RATE	CALCULATED LEAK RATE	MEASURED LEAK RATE	CALCULATED LEAK RATE (WEIGHT PERCENT PER DAY)	UPPER CONFIDENCE	MEASURED LEAK RATE	CALCULATED LEAK RATE	UPPER CONFIDENCE
SD.277	0.00	79.89	72.848								
SD.278	0.25	79.89	72.842	0.627E+00	0.627E+00	0.627E+00	0.627E+00	0.000E+00	0.627E+00	0.627E+00	0.000E+00
SD.279	0.50	79.88	72.835	0.720E+00	0.720E+00	0.673E+00	0.673E+00	0.000E+00	0.673E+00	0.673E+00	0.000E+00
SD.280	0.75	79.87	72.831	0.488E+00	0.542E+00	0.611E+00	0.630E+00	0.771E+00	0.611E+00	0.600E+00	0.118E+00
SD.281	1.00	79.86	72.823	0.853E+00	0.739E+00	0.672E+00	0.657E+00	0.698E+00	0.672E+00	0.666E+00	0.806E+00
SD.282	1.25	79.86	72.817	0.683E+00	0.723E+00	0.674E+00	0.670E+00	0.695E+00	0.674E+00	0.683E+00	0.751E+00
SD.283	1.50	79.85	72.812	0.635E+00	0.689E+00	0.668E+00	0.673E+00	0.692E+00	0.667E+00	0.680E+00	0.720E+00
SD.284	1.75	79.84	72.807	0.537E+00	0.623E+00	0.649E+00	0.666E+00	0.684E+00	0.649E+00	0.663E+00	0.696E+00
SD.285	2.00	79.84	72.800	0.775E+00	0.681E+00	0.665E+00	0.668E+00	0.683E+00	0.664E+00	0.666E+00	0.690E+00
SD.286	2.25	79.83	72.794	0.703E+00	0.692E+00	0.669E+00	0.671E+00	0.684E+00	0.669E+00	0.670E+00	0.689E+00
SD.287	2.50	79.83	72.788	0.700E+00	0.699E+00	0.672E+00	0.673E+00	0.685E+00	0.672E+00	0.674E+00	0.689E+00
SD.288	2.75	79.82	72.782	0.621E+00	0.678E+00	0.667E+00	0.674E+00	0.684E+00	0.667E+00	0.673E+00	0.685E+00
SD.289	3.00	79.82	72.776	0.700E+00	0.686E+00	0.670E+00	0.675E+00	0.684E+00	0.670E+00	0.674E+00	0.684E+00
SD.290	3.25	79.81	72.770	0.623E+00	0.671E+00	0.666E+00	0.674E+00	0.683E+00	0.666E+00	0.672E+00	0.681E+00
SD.291	3.50	79.80	72.764	0.732E+00	0.687E+00	0.671E+00	0.675E+00	0.684E+00	0.671E+00	0.673E+00	0.680E+00
SD.292	3.75	79.80	72.758	0.749E+00	0.704E+00	0.676E+00	0.677E+00	0.685E+00	0.676E+00	0.676E+00	0.682E+00
SD.293	4.00	79.78	72.751	0.565E+00	0.675E+00	0.669E+00	0.677E+00	0.684E+00	0.669E+00	0.675E+00	0.681E+00

VOLUMETRICS
PASO ROBLES CALIFORNIA
ILRT PROGRAM REPORT

Appendix E
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STARTING DAY - 336

STARTING TIME - 13:15: 0

STARTING SCAN - SD.277

ENDING SCAN - SD.293

ILRT RESULTS AFTER 4.00 HRS.

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POINT TO POINT                                TOTAL TIME                                MASS PLOT
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AVERAGE MEASURED LEAK RATES
(WEIGHT PERCENT PER DAY)

LEAK RATE	LEAK RATE	STD.DEV.	LEAK RATE	STD.DEV.
0.669E+00	0.662E+00	0.167E+00	0.662E+00	0.167E+00

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CALCULATED LEAK RATES
(WEIGHT PERCENT PER DAY)

LEAK RATE	LEAK RATE	STD.DEV.	UPPER CON. LIMIT	LEAK RATE	STD.DEV.	UPPER CON. LIMIT
0.675E+00	0.677E+00	0.425E-02	0.684E+00	0.675E+00	0.332E-02	0.681E+00

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BACK-UP COMPUTER
RESULTS

PRIMARY CONTAINMENT
INTEGRATED LEAK RATE TEST DATA

Appendix E
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FERMI 2 VERIFICATION
11/30/84

POINT NO.	DATE	TIME	PRESSURE PSIA	TEMPERATURE F	WEIGHT LBS	STATUS
1	12/01/84	13/15/00	72.848	79.89	107366	G
2	12/01/84	13/30/00	72.842	79.89	107357.2	G
3	12/01/84	13/45/00	72.835	79.88	107348.8	G
4	12/01/84	14/00/00	72.831	79.87	107344.9	G
5	12/01/84	14/15/00	72.823	79.86	107335.1	G
6	12/01/84	14/30/00	72.817	79.86	107326.3	G
7	12/01/84	14/45/00	72.812	79.85	107320.9	G
8	12/01/84	15/00/00	72.807	79.84	107315.5	G
9	12/01/84	15/15/00	72.8	79.84	107305.2	G
10	12/01/84	15/30/00	72.794	79.83	107298.4	G
11	12/01/84	15/45/00	72.788	79.83	107289.5	G
12	12/01/84	16/00/00	72.782	79.82	107282.7	G
13	12/01/84	16/15/00	72.776	79.82	107273.8	G
14	12/01/84	16/30/00	72.77	79.81	107267	G
15	12/01/84	16/45/00	72.764	79.8	107260.1	G
16	12/01/84	17/00/00	72.758	79.8	107251.3	G
17	12/01/84	17/15/00	72.751	79.78	107244.9	G

FCILRT
PLANT SPECIFIC DATA

Appendix E
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1. PLANT NAME..... FERMI 2 VERIFICATION
2. DATE OF TEST..... 11/30/84
3. CONTAINMENT VOLUME (CUFT).. 294630
4. LEAK RATE LIMIT LA (%/DAY). 1
5. LEAK RATE PENALTY (%/DAY). 0

PCILRT
TREND REPORT
FERMI 2 VERIFICATION
11/30/84

Appendix E
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POINT	TIME	TOTAL TIME			MASS PLOT	
		MEAS.	CALC.	UCL	CALC.	UCL
4	0.75	0.628	0.647	1.110	0.640	0.858
5	1.00	0.690	0.653	0.948	0.662	0.767
6	1.25	0.710	0.670	0.904	0.686	0.756
7	1.50	0.672	0.660	0.839	0.673	0.722
8	1.75	0.645	0.642	0.789	0.652	0.694
9	2.00	0.680	0.646	0.782	0.660	0.693
10	2.25	0.672	0.647	0.772	0.661	0.687
11	2.50	0.684	0.652	0.771	0.668	0.690
12	2.75	0.678	0.654	0.765	0.670	0.688
13	3.00	0.687	0.658	0.765	0.675	0.691
14	3.25	0.681	0.660	0.762	0.676	0.690
15	3.50	0.676	0.660	0.757	0.676	0.687
16	3.75	0.684	0.663	0.756	0.678	0.689
17	4.00	0.677	0.663	0.752	0.677	0.686

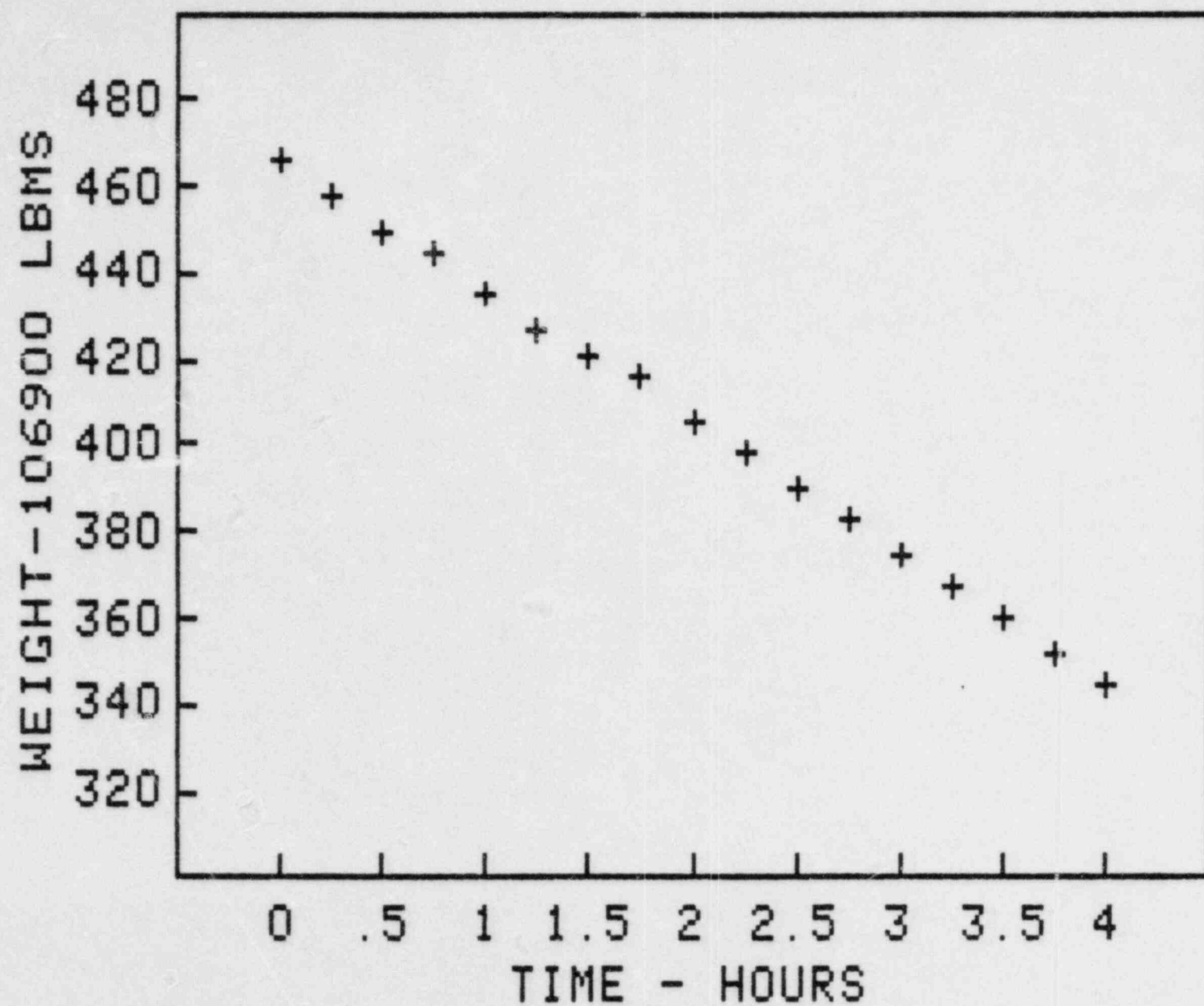
PCILRT
MASS POINT ANALYSIS
FERMI 2 VERIFICATION
11/30/84

POINT	TIME HRS	PRESSURE PSIA	TEMPERATURE F	AIR MASS LBS	MASS LOSS LBS	AVE. LOSS LBS/HR
1	0.00	72.8480	79.890	107366.0		
2	0.25	72.8420	79.890	107357.2	8.8	35.2
3	0.50	72.8350	79.880	107348.8	8.4	34.4
4	0.75	72.8310	79.870	107344.9	3.9	28.1
5	1.00	72.8230	79.860	107335.1	9.8	30.9
6	1.25	72.8170	79.860	107326.3	8.8	31.7
7	1.50	72.8120	79.850	107320.9	5.4	30.0
8	1.75	72.8070	79.840	107315.5	5.4	28.8
9	2.00	72.8000	79.840	107305.2	10.3	30.4
10	2.25	72.7940	79.830	107298.4	6.8	30.0
11	2.50	72.7880	79.830	107289.5	8.9	30.6
12	2.75	72.7820	79.820	107282.7	6.8	30.2
13	3.00	72.7760	79.820	107273.8	8.9	30.7
14	3.25	72.7700	79.810	107267.0	6.8	30.4
15	3.50	72.7640	79.800	107260.1	6.9	30.2
16	3.75	72.7580	79.800	107251.3	8.8	30.5
17	4.00	72.7510	79.780	107244.9	6.4	30.2

SUMMARY
MASS POINT ANALYSIS

Appendix E
Page 10 of 14

PLANT NAME.....	FERMI 2 VERIFICATION
TEST DATE.....	11/30/84
NO. OF POINTS.....	17
SLOPE (LBS/HR).....	-30.281
INTERCEPT (LBS).....	107365.7
LEAK RATE LIMIT..... (%/DAY) ..	1.000
ALLOWABLE LEAKRATE.. (%/DAY) ..	0.750
CALCULATED LEAKRATE. (%/DAY) ..	0.677
95% UCL..... (%/DAY) ..	0.686
TEST DURATION..... (HRS) ..	4.00
CONTAINMENT VOLUME (CUFT)....	294630



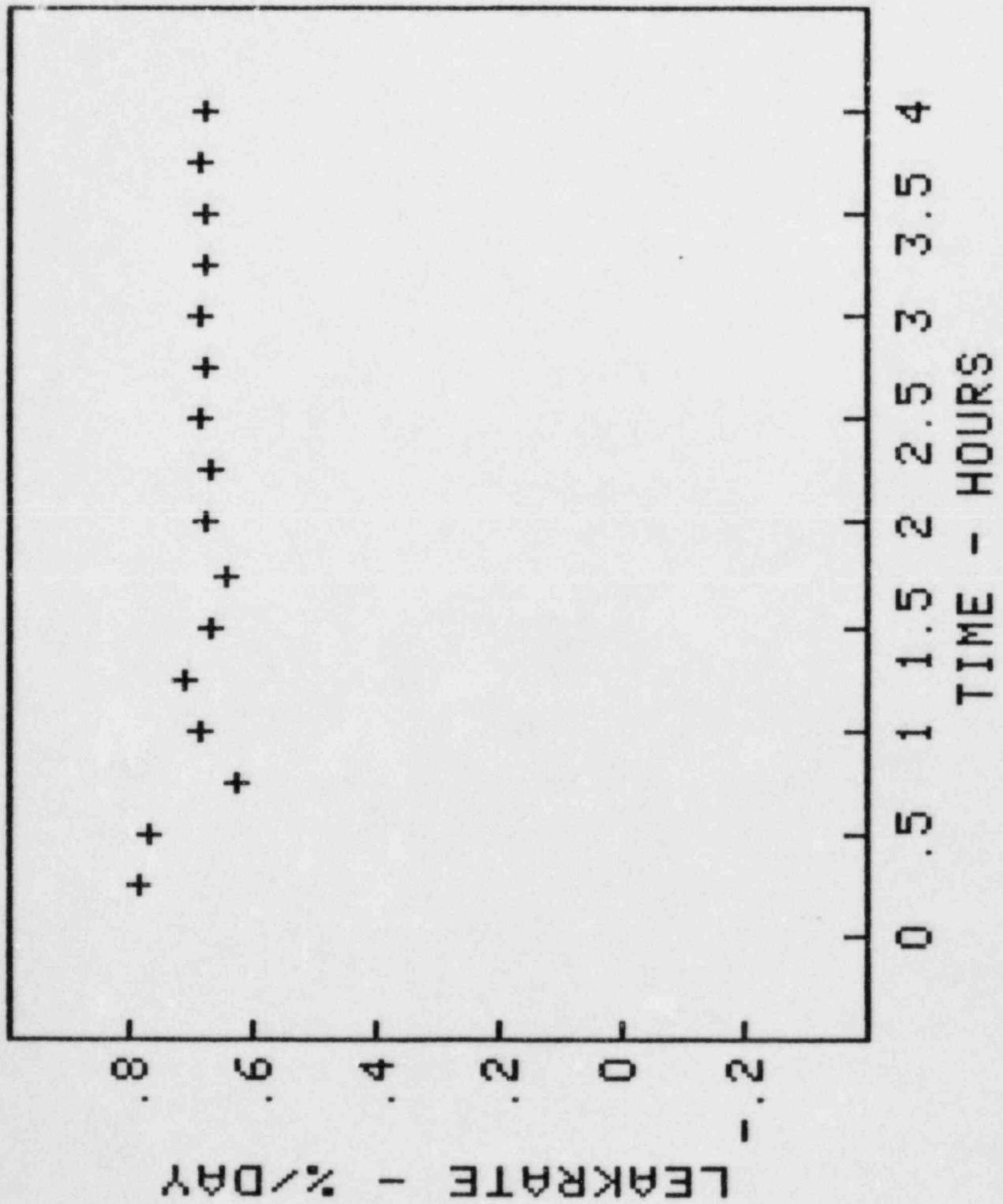
PLILRT
TOTAL TIME ANALYSIS
FERMI 2 VERIFICATION
11/30/84

POINT	TIME HH/MM/SS	TIME HRS	PRESSURE PSIA	TEMPERATURE F	LEAKRATE %/DAY
1	13/15/00	0.00	72.8480	79.890	0.000
2	13/30/00	0.25	72.8420	79.890	0.790
3	13/45/00	0.50	72.8350	79.880	0.768
4	14/00/00	0.75	72.8310	79.870	0.628
5	14/15/00	1.00	72.8230	79.860	0.690
6	14/30/00	1.25	72.8170	79.860	0.710
7	14/45/00	1.50	72.8120	79.850	0.672
8	15/00/00	1.75	72.8070	79.840	0.645
9	15/15/00	2.00	72.8000	79.840	0.680
10	15/30/00	2.25	72.7940	79.830	0.672
11	15/45/00	2.50	72.7880	79.830	0.684
12	16/00/00	2.75	72.7820	79.820	0.678
13	16/15/00	3.00	72.7760	79.820	0.687
14	16/30/00	3.25	72.7700	79.810	0.681
15	16/45/00	3.50	72.7640	79.800	0.676
16	17/00/00	3.75	72.7580	79.800	0.684
17	17/15/00	4.00	72.7510	79.780	0.677

SUMMARY
TOTALTIME ANALYSIS

Appendix E
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PLANT NAME.....	FERMI 2 VERIFICATION
TEST DATE.....	11/30/84
NO. OF POINTS.....	16
SLOPE (%/DAY/HR).....	-.013
INTERCEPT (%/DAY).....	0.718
24 HR PROJECTION (%/DAY).....	0.663
MEAN LAST 20 PTS (%/DAY).....	999.000
LEAK RATE LIMIT (%/DAY).....	1.000
ALLOWABLE LEAKRATE (%/DAY)....	0.750
CALCULATED LEAKRATE (%/DAY)...	0.663
95% UCL (%/DAY).....	0.752
TEST DURATION. (HRS).....	4.000
CONTAINMENT VOLUME (CUFT).....	294630



APPENDIX F
SAMPLE CALCULATIONS

APPENDIX F

SAMPLE CALCULATIONS

I. TOTAL TIME METHOD

Reference BN-TOP-1

$$M_i = \frac{2400}{\Delta t} \left[1 - \frac{T_o P_i}{P_o T_i} \right]$$

$$L_i = Bt_i + A$$

SCAN	t-HRs	T-°F	P-Psia	MLR
172	0	81.87	73.326	-
173	.25	81.80	73.318	-0.1935
174	.50	81.75	73.309	0.0493
175	.75	81.69	73.301	0.0274
176	1.00	81.64	73.294	0.0281
177	1.25	81.59	73.284	0.1071
178	1.50	81.54	73.275	0.1380
179	1.75	81.49	73.268	0.1226
180	2.00	81.45	73.261	0.1332
181	2.25	81.41	73.253	0.1560
182	2.50	81.37	73.246	0.1612

N	t _i	M _i	t _i M _i	t _i ²
1	.25	-0.1935	-0.0484	0.0625
2	.50	0.0493	0.0247	0.2500
3	.75	0.0274	0.0206	0.5625
4	1.00	0.0281	0.0281	1.0000
5	1.25	0.1071	0.1339	1.5625
6	1.50	0.1380	0.2070	2.2500
7	1.75	0.1226	0.2146	3.0625
8	2.00	0.1332	0.2664	4.0000
9	2.25	0.1560	0.3510	5.0625
10	2.50	0.1612	0.4030	6.2500
	13.75	0.7294	1.6008	24.0625

$$\bar{M} = \sum M_i / N = .7294 / 10$$

$$\bar{M} = 0.07294$$

$$\bar{t} = \sum t_i / N = 13.75 / 10$$

$$\bar{t} = 1.375$$

SLOPE

$$B = \frac{N \sum t_i M_i - \sum t_i \sum M_i}{N \sum t_i^2 - (\sum t_i)^2} = \frac{(10)(1.6008) - (13.75)(.7294)}{(10)(24.0625) - (13.75)^2}$$

$$B = 0.11595$$

INTERCEPT

$$A = \bar{M} - B\bar{t} = 0.07294 - (.11595)(1.375)$$

$$A = -0.08649$$

$$L_i = Bt_i + A = 0.11595t_i + (-0.08649)$$

N	t_i	M_i	L_i	$M_i - L_i$	$(M_i - L_i)^2$	$(t_i - \bar{t})^2$
1	.25	-0.1935	-0.0575	-0.136	0.01850	1.26563
2	.50	0.0493	-0.0285	0.07780	0.00605	0.76563
3	.75	0.0274	0.00046	0.02694	0.00073	0.39063
4	1.00	0.0281	0.02945	-0.00135	1.8225×10^{-6}	0.14063
5	1.25	0.1071	0.05844	0.04866	0.00237	0.01563
6	1.50	0.1380	0.08743	0.05057	0.00256	0.01563
7	1.75	0.1226	0.11641	0.00619	0.00004	0.14063
8	2.00	0.1332	0.14540	0.01220	0.00015	0.39063
9	2.25	0.1560	0.17439	-0.01839	0.00034	0.76563
10	<u>2.50</u>	<u>0.1612</u>	0.20338	-0.04218	<u>0.00178</u>	<u>1.26563</u>
	13.75	0.7294			0.0325218	5.15625

STANDARD DEVIATION

$$S^2 = \sum (M_i - L_i)^2 / N - 2$$

$$S^2 = 0.03252 / 8 = 4.065 \times 10^{-3}$$

$$S = 6.3759 \times 10^{-2}$$

$$T_{95} = 1.95996 + 2.37226/8 + 2.8225/(8)^2$$

$$T_{95} = 2.30059$$

$$U = S \left[1 + \frac{1}{N} + \frac{(t_p - \bar{t})^2}{(t_i - \bar{t})^2} \right]^{\frac{1}{2}}$$

$$U = S \left[1 + 1/10 = \frac{(2.5 - 1.375)^2}{5.15625} \right]^{\frac{1}{2}}$$

$$= 6.3759 \times 10^{-2} (1.15994)$$

$$= 7.39568 \times 10^{-2}$$

$$T_{95}U = (2.30059)(7.39568 \times 10^{-2}) = .170144$$

UPPER CONFIDENCE LIMIT

BN-TOP-1

$$\begin{aligned} \text{UCL} &= \text{Lam} + T_{95}\sigma \\ &= 0.20338 + .170144 \\ &= 0.3735 \end{aligned}$$

ANSI 56.8

$$T_{95} = \frac{(1.6449)(8) + 3.5283 + 0.85602/8}{8+1.2209 - 1.5163/8} = 1.8596$$

$$\begin{aligned} \text{UCL} &= .20338 + (1.8596)(7.39568 \times 10^{-2}) \\ &= .20338 + .1375 \\ &= .341 \end{aligned}$$

II. MASS POINT METHOD

W_i = weight of contained dry air - lbm

$$W_i = (144P_i V) / (RT_i)$$

$$V = 294630 \text{ lbm}$$

$$R = 53.35 \text{ ft-lbf/lbm} - ^\circ\text{R}$$

$$T = ^\circ\text{R} = ^\circ\text{F} + 459.69$$

P - Psia

<u>N</u>	<u>t_i</u>	<u>W_i</u>	<u>t_i^2</u>	<u>$t_i W_i$</u>
1	0	107675.4	0	0
2	.25	107677.6	0.0625	26919.4
3	.50	107674.3	0.2500	53837.15
4	.75	107674.5	0.5625	80755.91
5	1.00	107674.1	1.0000	107674.1
6	1.25	107669.4	1.5625	134586.75
7	1.50	107666.1	2.2500	161499.15
8	1.75	107665.8	3.0625	188415.15
9	2.00	107663.4	4.0000	215326.8
10	2.25	107659.6	5.0625	242234.1
11	2.50	107657.3	6.2500	269143.25
	13.75	1184357.5	24.0625	1480391.8

$$N = 11$$

SLOPE

$$A = \frac{N \sum t_i W_i - \sum W_i \sum t_i}{N \sum t_i^2 - (\sum t_i)^2}$$

$$A = \frac{(11)(1480391.8) - (1184357.5)(13.75)}{(11)(24.0625) - (13.75)^2}$$

$$A = \frac{-606.238}{75.625} = -8.01637$$

INTERCEPT

$$B = \frac{\sum W_i \sum t_i^2 - \sum t_i W_i \sum t_i}{N \sum t_i^2 - (\sum t_i)^2}$$

$$B = \frac{(1184357.5)(24.0625) - (1480391.8)(13.75)}{(11)(24.0625) - (13.75)^2}$$

$$B = \frac{8143215.6}{75.625} = 107678.88$$

LEAK RATE - Lam

$$\text{Lam} = (-2400)(A)/B$$

$$\text{Lam} = (-2400)(-8.01637)/(107678.88)$$

$$\text{Lam} = 0.1787$$

$$\hat{W}_i = -8.01637t_i + 107678.88$$

UPPER CONFIDENCE LIMIT - UCL

<u>N</u>	<u>t_i</u>	<u>W_i</u>	<u>\hat{W}_i</u>	<u>$(\hat{W}_i - W_i)^2$</u>
1	0	107675.4	107678.88	12.1104
2	.25	107677.6	107676.88	0.5184
3	.50	107674.3	107674.88	0.3364
4	.75	107674.5	107672.87	2.6569
5	1.00	107674.1	107670.87	10.4329
6	1.25	107669.4	107668.86	0.2916
7	1.50	107666.1	107666.86	0.5776
8	1.75	107665.8	107664.86	0.8836
9	2.00	107663.4	107662.85	0.3025
10	2.25	107659.6	107660.85	1.5625
11	2.50	107657.3	107658.84	2.3716
				<u>32.0444</u>

$$S^2 = \frac{\sum (W_i - \hat{W}_i)^2}{N-2} = \frac{32.0444}{9} = 3.560$$

$$S = 1.887$$

$$K = \frac{S}{[N \sum t_i^2 - (\sum t)^2]^{\frac{1}{2}}} = \frac{1.887}{(75.625)^{\frac{1}{2}}} = 0.217$$

$$S_A = K(N)^{\frac{1}{2}} = 0.217(11)^{\frac{1}{2}} = 0.720$$

$$S_B = K [\sum t_i^2]^{\frac{1}{2}} = (0.217)(24.0625)^{\frac{1}{2}} = 1.0645$$

$$S_{AB} = K^2 [-\sum t_i] = (0.217)^2(-13.75) = -0.6475$$

$$N = 11$$

$$T_{95} = \frac{(1.6449)(N-2) + 3.5283}{(N-2) + 1.2209 - (1.5163/N-2)} = \frac{(0.85602/N-2)}{(N-2) + 1.2209 - (1.5163/N-2)} = 1.833$$

$$a = B^2 - T_{95}^2 S_B^2 = (107678.88)^2 - (1.833)^2 (1.0645)^2$$

$$a = 1.1594741 \times 10^{10}$$

$$b = AB - T_{95}^2 S_{AB} = (-8.01637)(107678.88) - (1.833)^2(-0.6475)$$

$$b = -863191.57$$

$$c = A^2 - T_{95}^2 S_A^2 = 62.5204$$

$$UCL = 2400 b - (b^2 - ac)^{\frac{1}{2}} / a$$

$$= -2400 \frac{-863191.57 - ((863191.57)^2 - (1.1594741 \times 10^{10})(62.5204))}{1.1594741 \times 10^{10}}$$

$$UCL = 0.2081$$

$$UCL \text{ (Approx)} = Lam + (2400)(T_{95})(S_A)/B$$

$$= 0.1787 + (2400)(1.833)(0.720)/107678.88$$

$$= 0.1787 + 0.02942$$

$$= 0.2081$$

APPENDIX G

PENALTIES

APPENDIX G

PCILRT PENALTIES

The requirements for performing a PCILRT include placing the primary containment system in as close to post-accident conditions as possible. Any deviations to the post-accident lineup must be accounted for in the test results. This is accomplished by adding to the final 95% upper confidence limit (UCL) of the calculated leakage rate, the postulated additional leakage that would have occurred if the test lineup had been exactly post-accident. This additional leakage is referred to as a penalty in the preoperational test procedure. Where possible, penalties are determined by Type B and C local testing and adding the minimum path leakage to the test results. Penalties must be determined for:

1. Any system which is required to be operable and filled during the test to support the test or for plant safety which would be expected to be inoperable, drained and subjected to accident pressure;
2. Any system which is unintentionally placed in and left in an incorrect configuration during the test;
3. Any system which is intentionally or unintentionally isolated from test pressure which would be expected to be subjected to accident pressure;
4. Any isolation valve or penetration not subjected to test pressure which would be subjected to accident pressure;
5. Any change in containment volume.

The additional leakage which was added to the 95% upper confidence limit corresponding to each of the penalty situations described above is as follows:

- 1.a Both divisions of the emergency equipment cooling water system were operable and filled during the test to supply cooling water to the drywell coolers during the pump-up phase. This system could be drained and subjected to accident pressure during an accident. The system includes four drywell penetrations:

<u>Penetration</u>	<u>Leakage</u>
X-23	1.119 SCFD
X-24	1.119 SCFD

X-34A	1.119 SCFD
X-34B	<u>5.49</u> SCFD
TOTAL	8.847 SCFD

- 1.b The drywell equipment and floor drain sump systems remained operable and filled during the test. These systems could be drained and subjected to accident pressure during an accident. These systems use one drywell penetration each:

<u>Penetration</u>	<u>Leakage</u>
X-18	3.48 SCFD
X-19	<u>1.119</u> SCFD
TOTAL	4.599 SCFD

- 2.a During the test, operations started a condenser pump to lower the hotwell water level. This operation caused condensate to leak past the feedwater system block valves, filling the feedwater system. Water was found draining from the feedwater line drains. Since there was no way of showing that the volume between the feedwater isolation check valves was not filled, a penalty was taken for these penetrations.

<u>Penetration</u>	<u>Leakage</u>
X-9A	1.12 SCFD
X-9B	<u>1.12</u> SCFD
TOTAL	2.24 SCFD

- 3.a Several instrumentation racks were found to be valved out following the test and were not subjected to test pressure as required. These racks were locally tested and had a combined leakage of 13.51 SCFD.
- 3.b Isolation valve T48-F451 remained closed during the test when it should have been open. The instrumentation associated with this penetration was locally tested and had a leakage rate of 3.024 SCFD.

4. Several Type B and C tests were not completed prior to the Type A test. These were locally tested following the Type A test with the following results:

<u>Item</u>	<u>Leakage</u>
X210A - Testable flange	1.119 SCFD
X39B - Testable flange	<u>1.119</u> SCFD
TOTAL	2.238 SCFD

5. During the twenty four hour test period, the water levels in the reactor vessel, torus and floor drain sumps changed slightly. The change indicated a containment volume change corresponding to a decrease of approximately 5.79 CF. This corresponds to a leakage penalty of 0.00196%/day.

Summary

The total penalty which was added to the 95% upper confidence level was determined as follows:

<u>Penalty Category</u>	<u>Leakage (SCFD)</u>
1.a	8.847
1.b	4.599
2.a	2.240
3.a	13.510
3.b	3.024
4	2.238
5	<u>5.790</u>
TOTAL	40.248

$$\text{Containment Volume(SCF) at } P_a = 294630\text{CF} \times \frac{71.2}{14.7} = 1427051.4$$

$$\text{Penalty} = 100 \times 40.248/1427051.4 \text{ \%/day}$$

$$= 0.00282 \text{ \%/day}$$

APPENDIX H
ERROR ANALYSIS

APPENDIX H

INSTRUMENT ERROR ANALYSIS

A. Instrument Parameters Including DAS

<u>Pressure:</u>	Accuracy:	$\pm 0.01\%$	RDG
		$\pm 0.002\%$	FS
	Sensitivity:	0.001	PSI
	Repeatability:	0.001	PSI
	Resolution:	0.001	PSI
<u>Temperature:</u>	Accuracy:	± 0.1	$^{\circ}\text{F}$
	Sensitivity:	0.01	$^{\circ}\text{F}$
	Repeatability:	0.01	$^{\circ}\text{F}$
	Resolution:	0.01	$^{\circ}\text{F}$
<u>Dewpoint:</u>	Accuracy:	± 0.54	$^{\circ}\text{F}$
	Sensitivity:	0.1	$^{\circ}\text{F}$
	Repeatability:	0.1	$^{\circ}\text{F}$
	Resolution:	0.01	$^{\circ}\text{F}$

B. Instrument Selection Guide - ISG

1. Total Absolute Pressure
No. of Sensors = 2
Range 0 - 100 Psia

Sensor Sensitivity (E)	= 0.001 Psi
Resolution	= 0.001 Psi
Repeatability	= 0.001 Psi
Measurement System Error (f)	= 0.0014142

The error associated with a measurement of change in pressure e_p is:

$$\begin{aligned}
 e_p &= \pm \frac{[(E_p)^2 + (f_p)^2]^{\frac{1}{2}}}{(\text{No. of Sensors})^{\frac{1}{2}}} \\
 &= \pm \frac{[(.001)^2 + (0.0014142)^2]^{\frac{1}{2}}}{(2)^{\frac{1}{2}}} \\
 &= \pm 0.00122474 \text{ Psi}
 \end{aligned}$$

2. Water Vapor Pressure
No. of Sensors = 11

Sensor Sensitivity (E)	= 0.1 $^{\circ}\text{F}$
Resolution	= 0.01 $^{\circ}\text{F}$
Repeatability	= 0.1 $^{\circ}\text{F}$
Measurement System Error (f)	= 0.1004988 $^{\circ}\text{F}$

The average dewpoint temperature during the test was approximately 78°F. The equivalent water vapor pressure change at this temperature is approximately 0.0159°Psia/°F. The error associated with measurement of change in temperature e_{pv} is:

$$\begin{aligned} E_{pv} &= 0.1^{\circ}\text{F}(0.0159\text{Psia}/^{\circ}\text{F}) = 0.00159\text{Psia} \\ f_{pv} &= 0.1004988^{\circ}\text{F}(0.0159\text{Psia}/^{\circ}\text{F}) = 0.00159793\text{Psia} \\ e_{pv} &= \pm \frac{[(E_{pv})^2 + (f_{pv})^2]^{\frac{1}{2}}}{(\text{No. of Sensors})^{\frac{1}{2}}} \\ &= \pm \frac{[(0.00159)^2 + (.00159793)^2]^{\frac{1}{2}}}{(11)^{\frac{1}{2}}} \\ &= \pm 0.000679671 \text{ Psi} \end{aligned}$$

3. Temperature
No. of Sensors = 26

$$\begin{aligned} \text{Sensor Sensitivity (E)} &= \pm 0.01^{\circ}\text{F} = 0.01^{\circ}\text{R} \\ \text{Resolution} &= 0.01^{\circ}\text{F} \\ \text{Repeatability} &= 0.01^{\circ}\text{F} \\ \text{Measurement System Error (f)} &= 0.014142^{\circ}\text{R} \end{aligned}$$

The error associated with measurement of change in temperature e_T is:

$$\begin{aligned} e_T &= \pm \frac{[(E_T)^2 + (f_T)^2]^{\frac{1}{2}}}{(\text{No. of Sensors})^{\frac{1}{2}}} \\ &= \pm \frac{[(.01)^2 + (0.014142)^2]^{\frac{1}{2}}}{(26)^{\frac{1}{2}}} \\ &= \pm 0.003396809^{\circ}\text{R} \end{aligned}$$

4. ISG

$$\text{ISG} = \pm \frac{2400}{t} \left[2\left(\frac{e_P}{P}\right)^2 + 2\left(\frac{e_{pv}}{P}\right)^2 + 2\left(\frac{e_T}{T}\right)^2 \right]^{\frac{1}{2}}$$

Test Parameters at end of Test

$$\begin{aligned} P &= 72.892 \text{ Psia} \\ T &= 539.65^{\circ}\text{R} \\ T_{dp} &= 78^{\circ}\text{F} \\ t &= 24 \text{ Hours} \end{aligned}$$

$$ISG = \pm \frac{2400}{24} \left[2 \left(\frac{0.00122474}{72.892} \right)^2 + 2 \left(\frac{0.000679671}{72.892} \right)^2 + 2 \left(\frac{0.003396809}{539.65^{\circ R}} \right)^2 \right]^{\frac{1}{2}}$$

$$ISG = 0.00286\%/Day$$

The ANSI requirement that the ISG be $\leq .25La$ (i.e. $\leq .125$) is satisfied.

C. Accuracy Error Analysis

The error e_M in measured leak rate in weight percent per day is given by:

$$e_M = \pm \frac{2400}{\Delta t} \left[2 \left(\frac{e_p}{P} \right)^2 + 2 \left(\frac{e_T}{T} \right)^2 \right]^{\frac{1}{2}}$$

Where: e_p = the error in pressure which accounts for the error in the total pressure measurement system; both total absolute pressure and water vapor pressure

$$i.e. e_p = \left[(e_{p_T})^2 + (e_{p_V})^2 \right]^{\frac{1}{2}}$$

e_{p_T} = instrument accuracy error/(No. of instruments) $^{\frac{1}{2}}$ = error in total absolute pressure in psia

e_{p_V} = instrument accuracy error/(No. of instruments) $^{\frac{1}{2}}$ = error in water vapor pressure (dewpoint) in psia

e_T = instrument accuracy error/(No. of instruments) $^{\frac{1}{2}}$ = error in temperature, $^{\circ R}$

Δt = duration of test = 24 hours

Substituting the following instrument accuracy values into above equations yields:

Pressure instrument accuracy = $\pm 0.002\%$ of full scale
Scale 0 - 100 psia

Temperature instrument accuracy = $\pm 0.1^{\circ}\text{F}$

Dewpoint instrument accuracy = $\pm 0.54^{\circ}\text{F}$

$$\begin{aligned} e_{P_T} &= \pm (0.002\%) (\text{Full scale}) / (2)^{\frac{1}{2}} && \text{2 is no. of primary pressure sensors} \\ &= \pm \frac{0.002}{100} (100) / (2)^{\frac{1}{2}} && \text{Full scale} = 100 \text{ Psia} \\ &= \pm 0.001414 \text{ Psia} \end{aligned}$$

$$e_{P_V} = \pm \frac{0.54^{\circ}\text{F}}{(11)^{\frac{1}{2}}} = \pm 0.1628 \quad 11 \text{ sensors}$$

At dewpoint temperature of 78°F , the equivalent water vapor pressure change is $0.0159 \text{ Psia}/^{\circ}\text{F}$.

$$e_{P_V} \text{ for } \pm .1628^{\circ}\text{F} = \pm .1628 \times 0.0159 = \pm 0.00259 \text{ Psia}$$

With values of e_{P_T} and e_{P_V} , determine e_p by substituting values in formula for e_p .

$$\begin{aligned} e_p &= \pm \left[(0.001414)^2 + (0.00259)^2 \right]^{\frac{1}{2}} \\ &= \pm 0.00295 \end{aligned}$$

$$\text{and } e_T = \frac{0.1^{\circ}\text{F}}{(26)^{\frac{1}{2}}} = \frac{0.1^{\circ}\text{R}}{(26)^{\frac{1}{2}}} = \pm 0.0196^{\circ}\text{R} \quad 26 \text{ sensors}$$

$$\begin{aligned} e_M &= \pm 100 \left[2 \left(\frac{0.00295}{72.9} \right)^2 + 2 \left(\frac{0.0196}{459.7+80} \right)^2 \right]^{\frac{1}{2}} \\ &= \pm 100 \left[2 \left(\frac{0.00295}{72.9} \right)^2 + 2 \left(\frac{0.0196}{539.69} \right)^2 \right]^{\frac{1}{2}} \\ &= \pm 0.00769 \text{ Weight percent/day} \end{aligned}$$

D. Repeatability Error Analysis

Using the same formulas as before the repeatability error is substituted for the accuracy error.

$$e_{P_T} = \pm \frac{0.001 \text{ Psi}}{(2)^{\frac{1}{2}}} = \pm 0.000707 \text{ Psia}$$

Repeatability =
0.001 Psi from Page
1 of this calc and
2 being primary
press. sensors

$$e_{pv} = \pm \frac{0.1^{\circ}\text{F}}{(11)^{\frac{1}{2}}} = \pm 0.0302^{\circ}\text{F}$$

Repeatability for
dewpoint sensor =
0.1[°]F and # of
sensors being 11

At dewpoint temperature of 78[°]F, the equivalent
water vapor pressure change is 0.0159 Psia/[°]F.

$$e_{pv} = \pm 0.0302^{\circ}\text{F} \times 0.0159 \text{ Psia}/^{\circ}\text{F} = \pm 0.000480 \text{ Psia}$$

$$e_p = \pm \left[(0.000707)^2 + (0.000480)^2 \right]^{\frac{1}{2}}$$

$$= \pm 0.000855 \text{ Psia}$$

$$\text{also } e_T = \pm \frac{0.01^{\circ}\text{F}}{(26)^{\frac{1}{2}}} = \pm \frac{0.01^{\circ}\text{R}}{(26)^{\frac{1}{2}}}$$

Repeatability for
temp. sensor =
0.01[°]F and # of
sensors = 26

$$e_M = \pm 100 \left[2 \left(\frac{0.000855}{72.9} \right)^2 + 2 \left(\frac{0.00196}{539.69} \right)^2 \right]^{\frac{1}{2}}$$

$$= \pm 0.00174 \text{ Weight percent/day}$$

APPENDIX I

LOCAL LEAK RATE TEST RESULTS

TYPE C - AIR

<u>MSIV's</u>	
PENETRATION#	TYPE "C" TOTAL LEAKAGE SCFD
X 7A	42.67
X 7B	15.76
X 7C	1.119
X 7D	40.48
<u>AIR TESTS</u>	
X 7D	1.119
X 8	3.579
X 9A	9.256
X 9B	10.019
X 10	2.238
X 11	11.029
X 12	9.569
X 13A	58.47
X 13B	48.349
X 15	1.119
X 16A	11.12
X 16B	8.399
X 17	20.52
X 18	11.21
X 19	7.239
X 20	1.119
X 21	2.339
X 22	9.65
X 23	4.749
X 24	2.695

TYPE C - AIR

<u>AIR TEST</u>	<u>TYPE "C"</u>
<u>PENETRATION</u>	<u>TOTAL LEAKAGE SCFD</u>
X 25	7.02
X 26	56.8
X 27b	3.357
X 27a	9.305
X 27c	
X 27d	
X 27e	
X 27f	
X 28Cf	1.79
X 29Aa	2.93
X 29Bb	1.119
X 29Bc	3.356
X 29Be	1.119
X 31B	3.71
X 34A	2.238
X 34B	22.32
X 35C	1.119
X 35B	1.119
X 35D	1.119
X 35E	1.119
X 35F	1.119
X 35G	1.119
X 36	7.83
X 39A	2.238
X 39B	59.99

TYPE C - AIR

AIR TEST PENETRATION	TYPE "C" TOTAL LEAKAGE SCFD
X 40Dd	1.119
X 42	5.009
X 43	6.459
X 44	10.679
X 47a	1.119
X 47b	1.119
X 47C	3.045
X 47e	1.119
X 48a	12.20
X 48b	
X 48c	
X 48d	
X 48e	
X 48f	3.966
X 49a	2.238
X 51a	2.238
X 204A	5.64
X 204B	2.74
X 204C	4.78
X 204D	2.64
X 204M	1.119
X 204E	2.64
X 204F	3.40
X 204G	3.20
X 204H	9.79

TYPE C - AIR

<u>AIR TEST</u>	
<u>PENETRATION</u>	<u>TYPE "C"</u> <u>TOTAL LEAKAGE SCFD</u>
X 204J	1.119
X 204K	1.119
X 204L	1.27
X 205A	54.68
X 205B	6.92
X 205C	2.22
X 205D	11.342
X 206A	11.4426
X 206D	1.577
X 211A	11.27
X 211B	1.119
X 212/214/220	50.987
X 215	6.307
X 218	8.006
X 219	15.34
X 230	3.916
X 231	3.408
X 37/38	40.3
X 221/X 222	2.238
TOTAL TYPE C LEAKAGE (AIR)	746.4623 SCFD

TYPE C - WATER

<u>WATER TEST</u>	TYPE "C"
PENETRATION	TOTAL LEAKAGE ML/Min
X 206B	0
X 206C	0
X 206E	0
X 206F	0
X 210A	45.56
X 210B	258.34
X 213A	104.40
X 213B	99.76
X 223A	30.16
X 223B	440.8
X 223C	294.64
X 223D	1329.72
X 224A	30.16
X 224B	262.16
X 225	668.16
X 226	37.12
X 227A	80.24
X 227B	168.6
TOTAL WATER LEAKAGE	3849.82 ML/Min

TYPE B - AIR

<u>AIR TEST</u>	<u>TYPE "B"</u>
<u>PENETRATION</u>	<u>TOTAL LEAKAGE SCFD</u>
X 100A	1.74
X 100B	2.5936
X 100C	1.119
X 100E	1.119
X 100F	1.39
X 100G	2.33
X 101A	1.119
X 101B	1.119
X 101C	1.119
X 101D	1.76
X 101E	1.119
X 101F	1.119
X 102A	1.119
X 102B	1.119
X 102C	1.119
X 102D	1.119
X 103A	1.119
X 103B	1.119
X 104A	1.119
X 104B	1.119
X 104C	1.15
X 104D	1.119
X 104E	1.119
X 104F	1.119
X 105A	1.119

TYPE B - AIR

<u>AIR TEST</u>	<u>TYPE "B"</u>
<u>PENETRATION</u>	<u>TOTAL LEAKAGE SCFD</u>
X 105D	1.119
X 106A	1.119
X 106B	1.119
X 209A	1.119
X 209C	1.119
X 228A	1.119
X 228B	1.119
X 228C	1.119
X 228D	1.119
X 001A	1.119
X 001B	1.22
X 002	117.758
X 003	1.119
X 006	1.119
X 200A	1.119
X 200B	1.119
DSM 1	1.119
DSM 2	1.119
DSM 3	1.119
DSM 4	1.119
DSM 5	1.119
DSM 6	1.119
DSM 7	1.119
DSM 8	1.119
X 007A	1.119

TYPE B - AIR

<u>AIR TEST</u>	<u>TYPE "B"</u>
<u>PENETRATION</u>	<u>TOTAL LEAKAGE SCFD</u>
X 007B	1.119
X 007C	1.119
X 007D	1.119
X 008	1.119
X 009A	1.119
X 009B	1.119
X 010	1.119
X 011	1.119
X 012	1.119
X 013A	1.119
X 013B	1.119
X 016A	1.119
X 016B	1.119
X 017	1.119
X 043	1.119
X 35A	1.119
X 35B	1.119
X 35C	1.119
X 35D	1.119
X 35E	1.119
X 35F	1.119
X 35G	1.119
X 39B	2.238
X 205C	1.119
X 205D	1.119

TYPE B - AIR

<u>AIR TEST</u>	TYPE "B"
<u>PENETRATION</u>	<u>TOTAL LEAKAGE SCFD</u>
X 201A	1.119
A 201B	1.119
X 201C	1.119
X 201D	1.119
X 201E	1.119
X 201F	1.119
X 201G	1.119
X 201H	1.119
X 210A	5.637
X 210B	6.714
X 218	2.238
X 227A	3.357
X 227B	3.357
X 213A	2.238
X 213B	2.238
X 223D	1.119
X 223B	1.119
X 223C	1.119
X 223A	1.119