

MILLSTONE NUCLEAR POWER STATION, UNIT NO. 2

REACTOR CONTAINMENT BUILDING INTEGRATED LEAK RATE TEST

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I. INTRODUCTION

The Type A reactor containment building Integrated Leak Rate Test is performed to demonstrate that leakage through the primary reactor containment and systems, and components penetrating the primary containment, do not exceed the allowable leakage rate specified in the Plant Technical Specifications.

The recent successful periodic Type A and supplemental verification tests were performed according to the requirements of the Millstone Technical Specification, Section 4.6.1.2.a and 10 CFR 50, Appendix J. The test method as required by the Technical Specifications is the absolute method as described in ANSI N45.4-1972, "Leakage Rate Testing of Containment Structures for Nuclear Reactors."

The leakage rate was calculated using formulas from ANSI N45.4-1972 and BN-TOP-1, Rev. 1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants (Total Time)." In addition the leakage rate was calculated by the mass point method using formulas from ANS N274, "Containment System Leakage Testing Requirements," Draft No. 1, Rev. 3 - June 25, 1976 and Draft No. 2, Rev. 3 - November 15, 1978. Two separate computer systems were utilized to calculate the leakage rate. One system was employed by

Bechtel Power Corp. and the other by Northeast Nuclear Energy Company. The NNECo mass point calculations were done in accordance with Draft No. 1 of ANS N274 and the Bechtel calculations were done in accordance with Draft No. 2. The two computer systems yielded identical results when the precision of the computer systems was considered for both the Total Time and Mass Point methods of calculation. The durations of the Type A and verification tests were in accordance with the requirements of BN-TOP-1.

These test results are being reported in accordance with 10 CFR 50, Appendix J, Section V.B.3.

II. CONTAINMENT INTEGRATED LEAK RATE TEST

A. Plant Information

1. General

a. Owner	Northeast Nuclear Energy Company
b. Plant	Millstone Unit 2
c. Location	Waterford, Connecticut
d. Containment Type	Prestressed, post tensioned concrete
e. Nuclear Steam Supply System	Combustion Engineering, PWR
f. Date Test Completed	April 30, 1979

2. Technical Information

a. Containment Net Free

Air Volume 1,920,000 CU. FT.

b. Design Pressure 54 PSIG

c. Design Temperature 120°F

d. Calculated Peak

Accident Pressure,

Pa 54 PSIG

e. Containment ILRT

Average Temperature

Limits 50-120°F

f. Calculated Peak

Accident

Temperature 289°F

B. Integrated Leakage Rate Measurement System

1. Absolute Pressure (1 Channel)

a. Readout: 0-100,000 counts

b. Accuracy: 0.015% of reading

c. Resolution: 0.001% Full Scale

d. Range: 0-100 PSI

e. Instruments (2)

- Texas Instrument Model 145-01 Precision

Pressure Instrument No. 2714 with

Bourdon Capsule, serial number 5974.

- Texas Instrument Model 145-01 Precision
Pressure Instrument No. 2715 with
Bourdon Capsule, serial number 5976.

2. Drybulb Temperature (18 sensors)

- a. Range: 0-350°F
- b. Accuracy: $\pm 0.6^\circ\text{F}$ at 100°F
- c. Repeatability: $\pm 0.1\%$ Full Scale
- d. Instruments (18):
 - Resistance Temperature Detectors - Rosemont
Model 104 AHC

3. Dewpoint Temperature (4 sensors)

- a. Range: 50-150°F
- b. Accuracy: $\pm 0.1^\circ\text{F}$
- c. Repeatability: $\pm 0.1\%$ Full Scale
- d. Instruments:
 - Three Foxboro Model 2701RG Dewcells
 - One Foxboro Model 2717G Dewcell

4. Verification Flow (1 channel)

- a. Range: 4.5-45 SCFM
- b. Accuracy: 1% Full Scale
- c. Repeatability: $\pm 0.3\%$ Full Scale

d. Instrument:

- Wallace-Tiernan Flowmeter Model

Number 5222M22008

NOTE:

- 1) One dewcell was inoperative during the test.
- 2) The Overall Instrument Figure of Merit is used as an acceptance criteria for instrument selection. However, when instruments fail and/or the test duration is less than 24 hours, the figure of merit should be checked to ensure that it is less than 0.25 La or 0.125%/day. For this test the Figure of Merit based on a test duration of 15.25 hours and 3 of 4 dewcells functional was 0.0348%/day, well below the allowed 0.125%/day.
- 3) Sensor locations and volume fractions are listed in Appendix A.

C. Summary of Events

April 28, 1979, 1000 Hours - A tour of the containment was conducted. A survey of the containment air temperature and dewpoint at various locations was

taken with portable instrumentation to ensure that the installed instrumentation was functioning properly. The average of these values was compared to the values of the data acquisition system with the below listed results.

AVERAGE CONTAINMENT TEMPERATURE BY SURVEY:	78°F
AVERAGE CONTAINMENT TEMPERATURE BY THE DATA ACQUISITION SYSTEM:	77°F
AVERAGE CONTAINMENT DEWPOINT TEMPERATURE BY SURVEY:	61.5°F
AVERAGE CONTAINMENT DEWPOINT TEMPERATURE BY THE DATA ACQUISITION SYSTEM:	61.7°F

NOTE: During the survey of the dewpoint temperatures, dewcell ME9772, one of four, was found inoperable. The weighting factors for the three remaining dewcells were accordingly revised within the Data Requisition System.

1145 Hours - The air compressors were started for containment pressurization. [Pressurization continued (except for one 15 minute period at 1515 hours to add oil to the air dryer) until the test pressure of 54.3 PSIG was reached.]

1900 Hours - With the containment pressure at approximately 14.7 PSIG an inspection of all external areas of the containment was conducted to determine if any serious leaks existed which would necessitate securing the containment pressurization. None were found.

NOTE: At 0200 hours on April 29, 1979 clocks were moved ahead one hour to accomodate a shift to Daylight Savings Time.

April 29, 1979,

1300 Hours - One containment air recirculation fan was declared inoperable due to high current as a result of the high containment pressure.

1402 Hours - All compressors were secured with containment pressure at 54.3 PSIG. Data acquisition was started.

1800 Hours - An inspection of all penetration areas external to the containment was conducted to locate any possible leaks or any containment structural deterioration. As a result of this inspection it was decided to place the outside flange back on the ILRT pressurization line. It appeared that the pressurization line isolation valve, 2AC64 (which is not the normal pressure boundary) was leaking by the seat. The usual pressure boundary for this line is a spectacle

flange which cannot be installed during the ILRT. Consequently, a penalty is taken for this penetration, and its leakage as determined by a Local Leak Rate Test is added to the total leakage as measured by the ILRT.

Also at this time Surveillance Procedure 2734C, Tendon End Anchorages and Adjacent Concrete Surfaces, was completed. Section 4.6.1.6.2 of the Technical Specification requires that this inspection be accomplished during the ILRT with the containment at peak pressure.

1835 Hours - The containment stabilization criteria were met and the test commenced.

April 30, 1979,

0300 Hours - A survey of all external areas of the containment was completed with no problems found.

0950 Hours - The Type A ILRT was terminated with a measured leak rate of 0.061% per day with an upper 95% confidence limit of 0.120% per day as determined by the Total Time Method.

1005 Hours - A 30.2 SCFM leak rate was established on the containment to verify the accuracy of the data acquisition system. This leak rate equates to approximately 0.5 weight %/day or La.

1050 Hours - The 30.2 SCFM leak on the containment was stabilized and the verification test was commenced.

1750 Hours - The 30.2 SCFM leak on the containment was secured and the verification test was successfully completed.

1900 Hours - Venting of the
containment was initiated.

May 1, 1979, 1300 Hours - A containment entry
was made at a containment pressure
of 1 PSIG.

D. Test Results

- | | |
|-----------------------------|--|
| 1. Test Method | Absolute |
| 2. Data Analysis Techniques | Total Time per ANSI
N45.4-1972 and BN-TOP-1,
Rev. 1.

NOTE: Mass point analysis
results are also
provided for information
only. |

- | | |
|---|------------|
| 3. Test Pressure | 54 PSIG |
| 4. Maximum Allowable Leakage
Rate La | 0.500%/day |
| 5. 75% of La | 0.375%/day |
| 6. Integrated Leakage Rate | |

Test Results in Weight
% per day (Lam)

	TOTAL TIME	MASS POINT
a) Lam (From regression line analysis)	0.061	0.062

b) Upper 95% Confidence

Limit on Lam	0.120	0.073
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7. Verification Test

Imposed Leakage Rate,	0.481
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Lo, % day

8. Verification Test Results

Total Time - 0.514

in Weight Percent per day.

Mass Point - 0.482

9. Verification Test Limits in

Weight Percent per day.

a) Total Time Analysis

Upper Limit (Lo+Lam+.25 La) 0.672

Lower Limit (Lo+Lam-.25 La) 0.422

b) Mass Point Analysis

Upper Limit (Lo+Lam+.25 La) 0.673

Lower Limit (Lo+Lam-.25 La) 0.423

10. In order to conduct an IRT with a duration of less than 24 hours an additional acceptance criteria must be met as directed by BN-TOP-1, Rev. 1. The Trend Report based on Total Time calculations shall indicate that the magnitude of the calculated leak rate is tending to stabilize at a value less than the maximum allowable leak rate $L(a)$. The magnitude of the calculated leak rate may be increasing slightly as it tends to stabilize. In this case the

average rate of increase of the calculated leak rate shall be determined from the accumulated data over the last five hours or last twenty data points, whichever provides the most points. Using this average rate the calculated leak rate can then be linearly extrapolated to the 24th hour data points. If this extrapolated value of the calculated leak rate exceeds 75% of the maximum allowable leak rate (L_a), then the test must be continued.

- a) Linearly extrapolated value of
the Leak Rate using 20 data
points from 0450-0950 hours
on 4/30/79: 0.135%/Day

NOTE: A plot of leak rate versus time
showing the linearly extrapolated
values is contained in Appendix B.

11. A number of systems were required to remain operational in order to maintain the plant in a safe condition during the ILRT. As a result the containment isolation valves for these systems were not tested by the ILRT. In accordance with Section III A.1.d of Appendix J to 10CFR50 a Type C test was conducted for each of these penetrations. A list of these penetrations and the leak rate determined by the Type C tests are presented below.

PENETRATION NUMBER	VALVES TESTED	VALVE DESCRIPTION	LEAKAGE RATE (%/day)
2	2CH-516	Letdown Isolation	.0000
10	2SI-651/709	Shutdown Cooling	.0004
24	2RB-30.1A	Reactor Building Com- ponent Cooling Water to Containment	.0011
25	2RB-28.1D	Reactor Building Com-	.0001
	2RB-28.2D	ponent Cooling Supply/	
	2RB-28.3D	Return to "D" Contain- ment Air Recirc Cooler	
26	2RB-28.1B	Reactor Building Com-	.0010
	2RB-28.2B	ponent Cooling Supply/	
	2RB-28.3B	Return to "B" Contain- ment Air Recirc Cooler	
27	2RB-28.1A	Reactor Building Com-	.0004
	2RB-28.2A	ponent Cooling Supply/	
	2RB-28.3A	Return to "A" Contain- ment Air Recirc Cooler	
28	2RB-28.1C	Reactor Building Com-	.0003
	2RB-28.2C	ponent Cooling Supply/	
	2RB-28.3C	Return to "C" Contain- ment Air Recirc Cooler	

PENETRATION NUMBER	VALVES TESTED	VALVE DESCRIPTION	LEAKAGE RATE (%/day)
29	2RB-37.2A	Reactor Building Com- ponent Cooling Water Return From The Contain- ment	.0011
53	2RB-30.1B	Reactor Building Com- ponent Cooling Water Supply to the Contain- ment	.0001
54	2RB-37.2B	Reactor Building Com- ponent Cooling Water Return from the Contain- ment	.0004
85	Spectacle Flange	Pressurization Line For The ILRT	.0001
TOTAL LEAKAGE			.0050

When the total leakage from the above listed
penetration is included in the ILRT results
listed in 6 above the leak rate becomes:

	TOTAL TIME	MASS POINT
Leak Rate (%/day)	.066	.067
Upper 95% Confidence		
Limit (%/day)	.125	.078

NOTE: 1. The test data for both the Total Line and the Mass Points Methods is shown in Appendix C. Also included is a plot of temperature versus time and a plot of total mass versus time.

III. LOCAL LEAK RATE TESTING

A. Description of Program

Type B and C Local Leak Rate Testing of containment penetrations as outlined in Appendix J to 10CFR50 is performed in accordance with Section 4.6.1.2.(d, e and f) of the Technical Specifications except for tests involving the containment air lock. The containment air lock is tested in accordance with Section 4.6.1.3 of the Technical Specifications. A description of the local leak rate test equipment is described in section III.B and a listing of individual penetrations is contained in Section III.C.

B. Appendix D shows a diagram of the local leak rate test panel. It should be noted that the range scales for the flow indicators F-1 and F-2 had range scales of 20-250 cc/min and 200-2000 cc/min respectively for the testing conducted in 1976 and 1978. This resulted in minimum flow indications of 20 cc/min

for the low range scale and 200 cc/min for the high range scale. Consequently, the minimum leak rate shown on the data for these years is 20 cc/min. In 1979, however, the meters had range scales of 0-250 cc/min and 250-2500 cc/min as shown in Appendix D. This resulted in a minimum leak rate of 25 cc/min for 1979 test data.

- C. A listing of the containment penetrations which are subject to Local Leak Rate Testing is given below.

PENETRATION NUMBER	FUNCTION
1	Primary Makeup Water
2	Letdown
3	Chemical and Volume Control
4	Containment Spray
5	Containment Spray
10	Shutdown Cooling
11	Safety Injection
14	Containment Sump Discharge
21	Primary Coolant Sample
22	#1 Steam Generator Blowdown
23	#2 Steam Generator Blowdown
24	Reactor Building Component Cooling Water

PENETRATION NUMBER

FUNCTION

25	Reactor Building Component Cooling Water
26	Reactor Building Component Cooling Water
27	Reactor Building Component Cooling Water
28	Reactor Building Component Cooling Water
29	Reactor Building Component Cooling Water
30	Reactor Building Component Cooling Water
31	Reactor Building Component Cooling Water
32	Reactor Building Component Cooling Water
33	Reactor Building Component Cooling Water
34	Nitrogen Supply For Safety Injection
35	Liquid Radwaste
37	Instrument Air
38	Station Air
39	Containment Purge
40	Containment Purge
43	Chemical and Volume Control System
51	Gaseous Radwaste
53	Reactor Building Component Cooling Water
54	Reactor Building Component Cooling Water
61	Radiation Monitoring
62	Hydrogen Monitoring
63	ILRT Sample Connections
64	ILRT Sample Connections

PENETRATION NUMBER	FUNCTION
65	#1 Steam Generator Blowdown
67	Refueling Water Purification
68	Refueling Water
72	#2 Steam Generator Blowdown
82	Hydrogen Purge System
83	Hydrogen Purge System
85	Integrated Leak Rate Test Pressurization Path
86	Radiation Monitoring
87	Hydrogen Monitoring
88	Hydrogen Monitoring
89	Hydrogen Monitoring
SEXA5	Electrical Penetration
SEXA6	Electrical Penetration
SEXB2	Electrical Penetration
SEXB4	Electrical Penetration
SEXB5	Electrical Penetration
SEXB6	Electrical Penetration
SEXB7	Electrical Penetration
SEXB8	Electrical Penetration
SEXB9	Electrical Penetration
SEXC1	Electrical Penetration
SEXC3	Electrical Penetration
SEXD1	Electrical Penetration
SEXD3	Electrical Penetration

PENETRATION NUMBER	FUNCTION
SEXD6	Electrical Penetration
SEXD8	Electrical Penetration
SEXD9	Electrical Penetration
SEXE6	Electrical Penetration
SEXE9	Electrical Penetration
SWXB1	Electrical Penetration
SWXB2	Electrical Penetration
SWXB3	Electrical Penetration
SWXB4	Electrical Penetration
SWXB5	Electrical Penetration
SWXB6	Electrical Penetration
SWXB7	Electrical Penetration
SWXB8	Electrical Penetration
SWXB9	Electrical Penetration
SWXC3	Electrical Penetration
SWXC5	Electrical Penetration
SWXD1	Electrical Penetration
SWXD3	Electrical Penetration
SWXD5	Electrical Penetration
SWXD8	Electrical Penetration
SWXD9	Electrical Penetration
SWXE5	Electrical Penetration
SWXE9	Electrical Penetration
SEXA4-1	Electrical Penetration

PENETRATION NUMBER	FUNCTION
SEXA4-2	Electrical Penetration
SEXA4-3	Electrical Penetration
SEXA8-1	Electrical Penetration
SEXA8-2	Electrical Penetration
SEXA8-3	Electrical Penetration
SWXA2-1	Electrical Penetration
SWXA2-2	Electrical Penetration
SWXA2-3	Electrical Penetration
SWXA8-1	Electrical Penetration
SWXA8-2	Electrical Penetration
SWXA8-3	Electrical Penetration
	Equipment Hatch
	Transfer Tube
	Personnel Hatch

- D. 1. A complete listing of individual penetrations and leakages from 1976 through 1978 is shown in Appendix E. The total combined leakage rate of all Type B and Type C penetrations shall not exceed 0.60 La, where La is a leakage rate equal to 0.50 percent by weight of the containment air per 24 hours, at a pressure of 54 PSIG. Thus, the total leakage rate must be less than 0.30 weight percent per day. The total accumulated leakages since the previous Type A test are given below:

<u>YEAR</u>	<u>TOTAL LEAKAGE</u> (weight %/Day)
1976	0.2443
(1)1977	0.1690
1978	.0655
(2)1979	.0410

NOTE (1): Due to an extended outage in the Spring of 1977 to support retubing of the main condensers, additional testing and repair of selected containment penetrations was performed.

NOTE (2): In 1979 several penetrations based on Local Leak Rate Testing required repair. The before repair leakages of these penetrations were not recorded in all cases. As a result the possibility exists that the total accumulated leakage may have exceeded 0.6 La. This situation and the corrective actions which were taken was the subject of Licensee Event Report 79-11/3L-0, Docket Number 050-00336, forwarded on May 18, 1979.

2. In accordance with Section 4.6.1.3.b of the Technical Specification an overall personnel air lock leakage test at 54 PSIG (Pa) is required at least once per 6 month period. The leak rate must be less than or equal to .05 La (.025%/day).

The results of the leak tests since the previous type A test are presented below:

<u>DATE</u>	<u>LEAKAGE</u>
6/7/76	1.3×10^{-5} %/day
1/11/76	1.3×10^{-5} %/day
12/4/76	5.44×10^{-4} %/day
6/19/77	1.35×10^{-5} %/day
12/19/77	(3)
4/10/78	9.758×10^{-3} %/day
10/10/78	(4)
12/21/78	2.034×10^{-2} %/day
4/1/79	1.129×10^{-2} %/day
5/18/79	2.362×10^{-2} %/day

NOTE (3): The surveillance was not performed at this time because the plant was in mode 6, shutdown for refueling, and the test is not required in this condition.

NOTE (4): The surveillance was not performed as required at this time. This was identified by the NRC Office of Inspection and Enforcement in Inspection Report 50-336/78-37 in December 1978, and the surveillance successfully completed on 12/21/78. Plant Incident Report 78-157 which discusses the incident was also prepared.

3. Section 4.6.1.2.e of the Technical Specifications requires that the combined bypass leakage rate shall be less than or equal to .017 La (.0085 %/day). The total accumulated bypass leakage rates since the previous ILRT are listed below:

<u>YEAR</u>	<u>TOTAL LEAKAGE</u> (%/day)
1976	.00043 %/day
1978	.0010 %/day
1979	.0011 %/day

APPENDIX A

SENSOR VOLUME FRACTIONS

(and Locations)

RTD TE	ELEV (Ft.)	AZ (Deg.)	DIST. FROM £ (Ft.)	VOLUME FRACTION
9769	150	90	12	0.096
8110	105	220	40	0.086
9767	105	40	45	0.087
8111	90	320	60	0.086
8112	90	105	60	0.087
8084	44	5	45	0.058
8108	44	145	60	0.058
8109	44	263	58	0.058
8097	30	125	20	0.016
8098	30	235	20	0.014
8094	20	350	45	0.040
9770	18	220	55	0.040
9771	18	90	50	0.040
8087	3	5	32	0.032
9765	3	240	65	0.032
9766	3	125	65	0.032
8091	-15	330	35	0.069
9768	-18	135	50	0.069

TOTAL 1.000

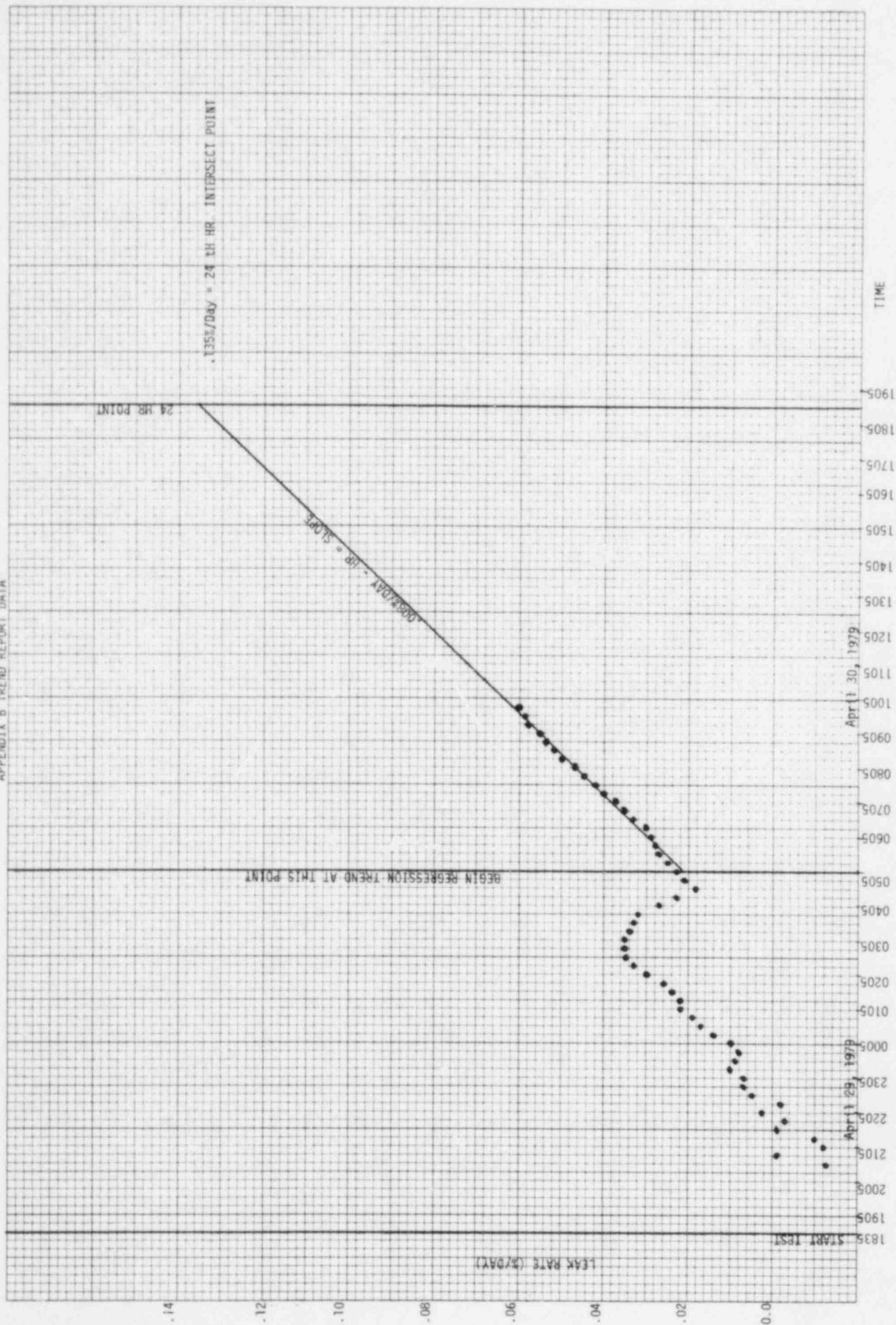
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9772	55	320	60	*0.000
8064	55	105	60	0.616
9773	-20	10	35	0.192
9774	-20	330	35	0.192

TOTAL 1.000

*Instrument failed

APPENDIX B TREND REPORT DATA



APPENDIX C

MILLSTONE UNIT 2 54 PSIG ILRT

LEAKAGE RATE (WEIGHT PERCENT/DAY)
TOTAL-TIME ANALYSISTIME AND DATE AT START OF TEST: 1825 0429
ELAPSED TIME: 15.25 HOURS

TIME	TEMP. (°R)	PRESSURE (PSIA)	MEASURED LEAKAGE RATE
1835	533.765	68.3921	
1850	533.755	68.3903	0.073
1905	533.730	68.3893	-0.118
1920	533.687	68.3837	-0.075
1935	533.682	68.3818	-0.012
1950	533.643	68.3790	-0.071
2005	533.636	68.3753	0.006
2020	533.618	68.3744	-0.023
2035	533.588	68.3683	0.020
2050	533.575	68.3669	0.013
2105	533.531	68.3650	-0.040
2120	533.514	68.3607	-0.010
2135	533.518	68.3592	0.015
2150	533.465	68.3552	-0.017
2205	533.452	68.3508	0.012
2220	533.405	68.3486	-0.025
2235	533.389	68.3417	0.020
2250	533.371	68.3406	0.008
2305	533.353	68.3395	-0.001
2320	533.327	68.3343	0.012
2335	533.296	68.3324	-0.003
2350	533.288	68.3324	-0.009
5	533.262	68.3258	0.012
20	533.263	68.3240	0.023
35	533.267	68.3240	0.025
50	533.228	68.3199	0.019
105	533.237	68.3186	0.032
120	533.229	68.3219	0.008
135	533.230	68.3183	0.026
150	533.204	68.3155	0.023
205	533.253	68.3158	0.050
220	533.204	68.3119	0.038
235	533.193	68.3105	0.036
250	533.172	68.3116	0.019
305	533.135	68.3076	0.016
320	533.119	68.3069	0.010
335	533.140	68.3081	0.015
350	533.105	68.3053	0.008
405	533.031	68.3062	-0.030
420	533.031	68.3063	-0.030

APPENDIX C

MILLSTONE UNIT 2 54 PSIG ILRT

LEAKAGE RATE (WEIGHT PERCENT/DAY)
TOTAL-TIME ANALYSISTIME AND DATE AT START OF TEST: 1985 0429
ELAPSED TIME: 15.25 HOURS

TIME	TEMP. (°R)	PRESSURE (PSIA)	MEASURED LEAKAGE RATE
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(CONTINUED FROM PAGE 1 OF TOTAL-TIME ANALYSIS)

435	532.985	68.3036	-0.040
450	533.168	68.3024	0.045
505	533.147	68.3030	0.033
520	533.139	68.3008	0.036
535	533.118	68.2990	0.033
550	533.135	68.2998	0.036
605	533.100	68.2983	0.036
620	533.068	68.2947	0.034
635	533.157	68.2951	0.056
650	533.117	68.2937	0.044
705	533.132	68.2906	0.057
720	533.131	68.2910	0.055
735	533.108	68.2890	0.051
750	533.143	68.2861	0.070
805	533.135	68.2876	0.062
820	533.116	68.2844	0.063
835	533.096	68.2815	0.062
850	533.098	68.2810	0.063
905	533.070	68.2781	0.060
920	533.081	68.2741	0.072
935	533.056	68.2739	0.064
950	532.990	68.2695	0.054

MEAN OF MEASURED LEAKAGE RATES	=	0.018
MAXIMUM ALLOWABLE LEAKAGE RATE	=	0.500
75 % OF MAXIMUM ALLOWABLE LEAKAGE RATE	=	0.375
THE UPPER 95% CONFIDENCE LIMIT	=	0.120
THE CALCULATED LEAKAGE RATE	=	0.061

APPENDIX C

MILLSTONE UNIT 2 ILRT VERIFICATION TEST

LEAKAGE RATE (WEIGHT PERCENT/DAY)
TOTAL-TIME ANALYSISTIME AND DATE AT START OF TEST: 1050 0430
ELAPSED TIME: 7.00 HOURS

TIME	TEMP. (R)	PRESSURE (PSIA)	MEASURED LEAKAGE RATE
1050	533.012	68.2527	
1105	532.995	68.2498	0.102
1120	533.003	68.2431	0.594
1135	533.010	68.2450	0.349
1150	533.027	68.2399	0.518
1205	533.099	68.2390	0.699
1220	533.073	68.2363	0.567
1235	533.084	68.2326	0.589
1250	533.053	68.2299	0.493
1305	533.020	68.2229	0.482
1320	533.060	68.2211	0.531
1335	533.044	68.2164	0.517
1350	533.086	68.2136	0.569
1405	533.029	68.2107	0.478
1420	533.040	68.2070	0.495
1435	533.106	68.2064	0.547
1450	533.061	68.2031	0.491
1505	533.138	68.2032	0.543
1520	533.116	68.1993	0.529
1535	533.121	68.1981	0.507
1550	533.155	68.1942	0.540
1605	533.161	68.1978	0.495
1620	533.167	68.1892	0.533
1635	533.182	68.1874	0.532
1650	533.097	68.1823	0.476
1705	533.100	68.1821	0.461
1720	533.121	68.1762	0.489
1735	533.082	68.1741	0.456
1750	533.089	68.1686	0.472

MEAN OF MEASURED LEAKAGE RATES	=	0.502
VERIFICATION TEST LEAKAGE RATE UPPER LIMIT	=	0.667
VERIFICATION TEST LEAKAGE RATE LOWER LIMIT	=	0.417
THE CALCULATED LEAKAGE RATE	=	0.514

APPENDIX C

MILLSTONE UNIT 2 54 PSIG ILRT

LEAKAGE RATE (WEIGHT PERCENT/DAY)
MASS-POINT ANALYSISTIME AND DATE AT START OF TEST: 1835 0429
ELAPSED TIME: 15.25 HOURS

TIME	TEMP (R)	PRESSURE (PSIA)	CTMT. AIR MASS (LBM)	MASS LOSS (LBM)	TOT. AVG. MASS LOSS (LBM/HR)
1835	533.765	68.3921	664163		
1850	533.755	68.3903	664158	5.0	20.2
1905	533.730	68.3893	664179	-21.4	-32.7
1920	533.687	68.3837	664179	0.9	-20.6
1935	533.682	68.3818	664166	12.2	-3.2
1950	533.643	68.3790	664188	-21.3	-19.7
2005	533.636	68.3753	664160	27.2	1.8
2020	533.618	68.3744	664174	-13.7	-6.3
2035	533.588	68.3683	664152	21.9	5.4
2050	533.575	68.3669	664155	-2.6	3.7
2105	533.531	68.3650	664191	-36.3	-11.2
2120	533.514	68.3607	664170	20.6	-2.7
2135	533.518	68.3592	664151	19.5	4.1
2150	533.465	68.3552	664178	-27.1	-4.6
2205	533.452	68.3508	664151	26.6	3.3
2220	533.405	68.3486	664189	-37.1	-6.8
2235	533.389	68.3417	664141	47.1	5.4
2250	533.371	68.3406	664153	-11.7	2.3
2305	533.353	68.3395	664165	-11.7	-0.4
2320	533.327	68.3343	664147	18.2	3.4
2335	533.296	68.3324	664167	-20.1	-0.8
2350	533.288	68.3324	664177	-10.0	-2.6
5	533.262	68.3258	664145	31.8	3.3
20	533.263	68.3240	664126	18.7	6.4
35	533.267	68.3240	664121	5.0	7.0
50	533.228	68.3199	664130	-8.7	5.3
105	533.237	68.3186	664106	23.9	8.7
120	533.229	68.3219	664148	-42.1	2.2
135	533.230	68.3183	664112	36.2	7.3
150	533.204	68.3155	664117	-5.2	6.3
205	533.253	68.3158	664059	58.1	13.9
220	533.204	68.3119	664082	-23.1	10.4
235	533.193	68.3105	664082	-0.1	10.1
250	533.172	68.3116	664119	-36.9	5.3
305	533.135	68.3076	664126	-7.2	4.3
320	533.119	68.3069	664139	-13.1	2.7
335	533.140	68.3081	664125	14.5	4.2
350	533.105	68.3053	664141	-16.4	2.3
405	533.031	68.3062	664242	-101.0	-8.3
420	533.031	68.3063	664243	-1.0	-8.2
435	532.985	68.3036	664274	-31.1	-11.1
450	533.168	68.3024	664035	239.7	12.5
505	533.147	68.3030	664067	-32.0	9.2
520	533.139	68.3008	664055	11.4	10.0
535	533.118	68.2990	664064	-8.7	9.0
550	533.135	68.2998	664050	13.4	10.0

APPENDIX C

MILLSTONE UNIT 2 54 PSIG ILRT

LEAKAGE RATE (WEIGHT PERCENT/DAY)
MASS-POINT ANALYSISTIME AND DATE AT START OF TEST: 1835 0429
ELAPSED TIME: 15.25 HOURS

TIME	TEMP (°F)	PRESSURE (PSIA)	CTMT. AIR MASS (LBM)	MASS LOSS (LBM)	TOT. AVG. MASS LOSS (LBM/HR)
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(CONTINUED FROM PAGE 1 OF MASS-POINT ANALYSIS)

605	533.100	68.2993	664079	-29.0	7.3
620	533.069	68.2947	664084	-4.9	6.7
635	533.157	68.2951	663977	107.0	15.5
	533.117	68.2937	664014	-36.2	12.2
	533.132	68.2906	663965	48.8	15.9
720	533.131	68.2910	663970	-5.1	15.1
735	533.108	68.2890	663979	-9.2	14.2
750	533.143	68.2861	663907	71.8	19.3
805	533.135	68.2876	663932	-24.5	17.1
820	533.116	68.2844	663924	7.4	17.4
835	533.096	68.2815	663921	3.3	17.3
850	533.098	68.2810	663914	7.3	17.5
905	533.070	68.2781	663920	-6.7	16.7
920	533.091	68.2741	663868	52.6	20.0
935	533.056	68.2739	663897	-29.2	17.7
950	532.990	68.2695	663936	-39.4	14.9

FREE AIR VOLUME USED (MILLIONS OF CU. FT.) = 1.920

REGRESSION LINE

INTERCEPT (LBM)

= 664226

SLOPE (LBM/HR)

= -17.3

MAXIMUM ALLOWABLE LEAKAGE RATE

= 0.500

75 % OF MAXIMUM ALLOWABLE LEAKAGE RATE

= 0.375

THE UPPER 95% CONFIDENCE LIMIT

= 0.073

THE CALCULATED LEAKAGE RATE

= 0.062

APPENDIX C

MILLSTONE UNIT 2 ILRT VERIFICATION TEST

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

TIME AND DATE AT START OF TEST: 1050 0430

ELAPSED TIME: 7.00 HOURS

TIME	TEMP (R)	PRESSURE (PSIA)	CTMT. AIR MASS (LBM)	MASS LOSS (LBM)	TOT. AVG. MASS LOSS (LBM/HR)
1050	533.012	68.2527	663746		
1105	532.995	68.2498	663739	7.0	28.2
1120	533.003	68.2431	663664	75.1	164.3
1135	533.010	68.2450	663673	-9.8	96.5
1150	533.027	68.2399	663603	70.8	143.2
1205	533.099	68.2390	663504	98.4	193.2
1220	533.073	68.2363	663510	-6.1	156.9
1235	533.094	68.2326	663461	49.7	162.9
1250	533.053	68.2299	663473	-12.3	136.4
1305	533.020	68.2229	663446	27.0	133.2
1320	533.060	68.2211	663379	67.3	146.8
1335	533.044	68.2164	663353	25.8	142.8
1350	533.096	68.2136	663273	79.5	157.4
1405	533.029	68.2107	663316	-42.7	132.2
1420	533.040	68.2070	663266	49.7	136.9
1435	533.106	68.2064	663178	87.9	151.3
1450	533.061	68.2031	663202	-23.9	135.8
1505	533.138	68.2032	663108	94.8	150.1
1520	533.116	68.1993	663087	20.3	146.3
1535	533.121	68.1981	663079	8.2	140.3
1550	533.155	68.1942	662999	80.2	149.4
1605	533.161	68.1978	663026	-27.5	137.0
1620	533.167	68.1892	662935	91.1	147.3
1635	533.182	68.1874	662899	36.2	147.2
1650	533.097	68.1823	662955	-56.1	131.7
1705	533.100	68.1921	662949	5.9	127.4
1720	533.121	68.1762	662867	82.7	135.2
1735	533.082	68.1741	662895	-28.6	126.0
1750	533.089	68.1686	662833	62.6	130.4

FREE AIR VOLUME USED (MILLIONS OF CU. FT.) = 1.920

REGRESSION LINE

INTERCEPT (LBM)

= 663723

SLOPE (LBM/HR)

= -133.4

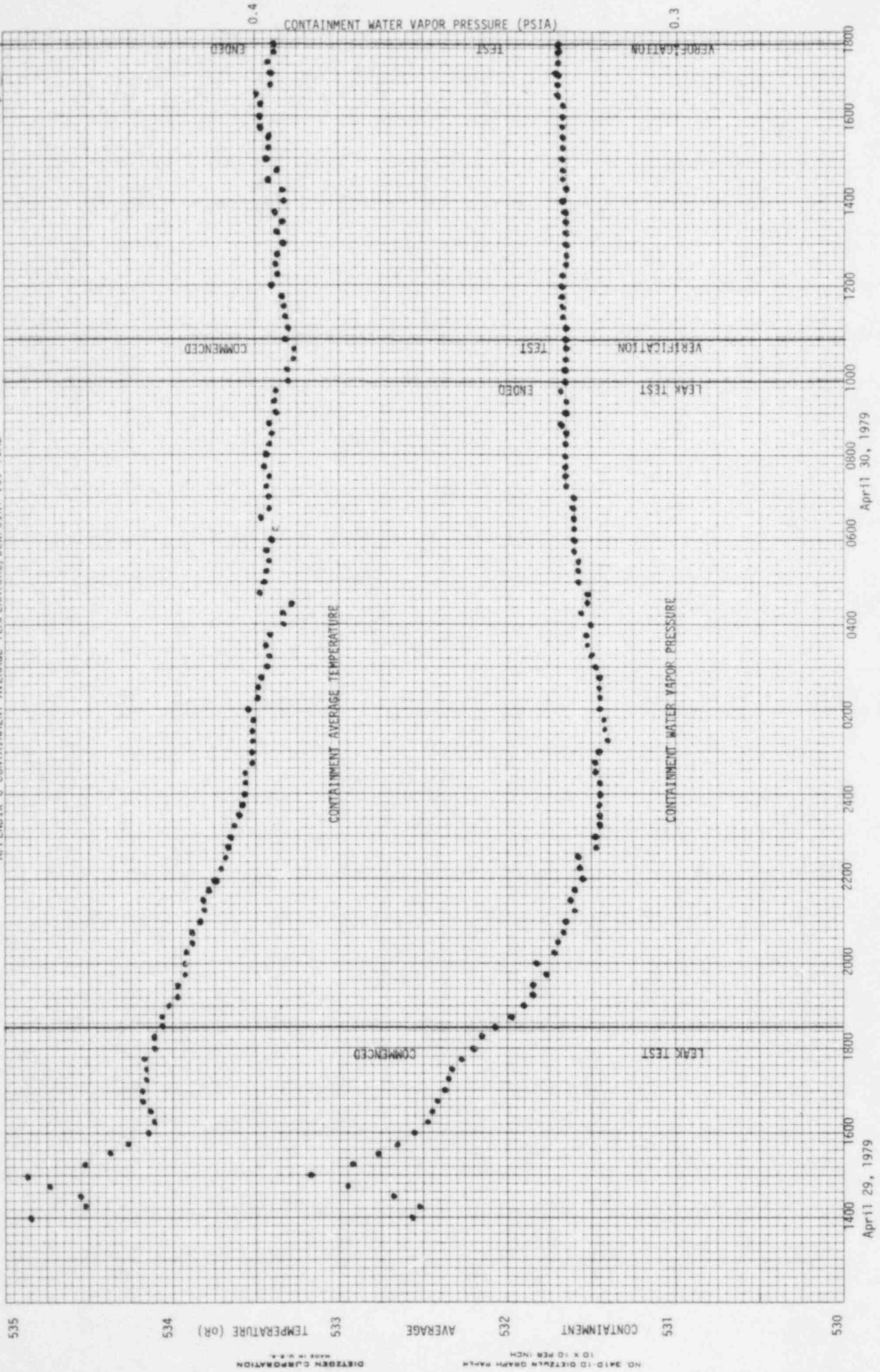
VERIFICATION TEST LEAKAGE RATE UPPER LIMIT = 0.668

VERIFICATION TEST LEAKAGE RATE LOWER LIMIT = 0.418

THE CALCULATED LEAKAGE RATE = 0.482

APPENDIX C. CONTAINMENT AVERAGE TEMPERATURE/DEWPOINT VS. TIME

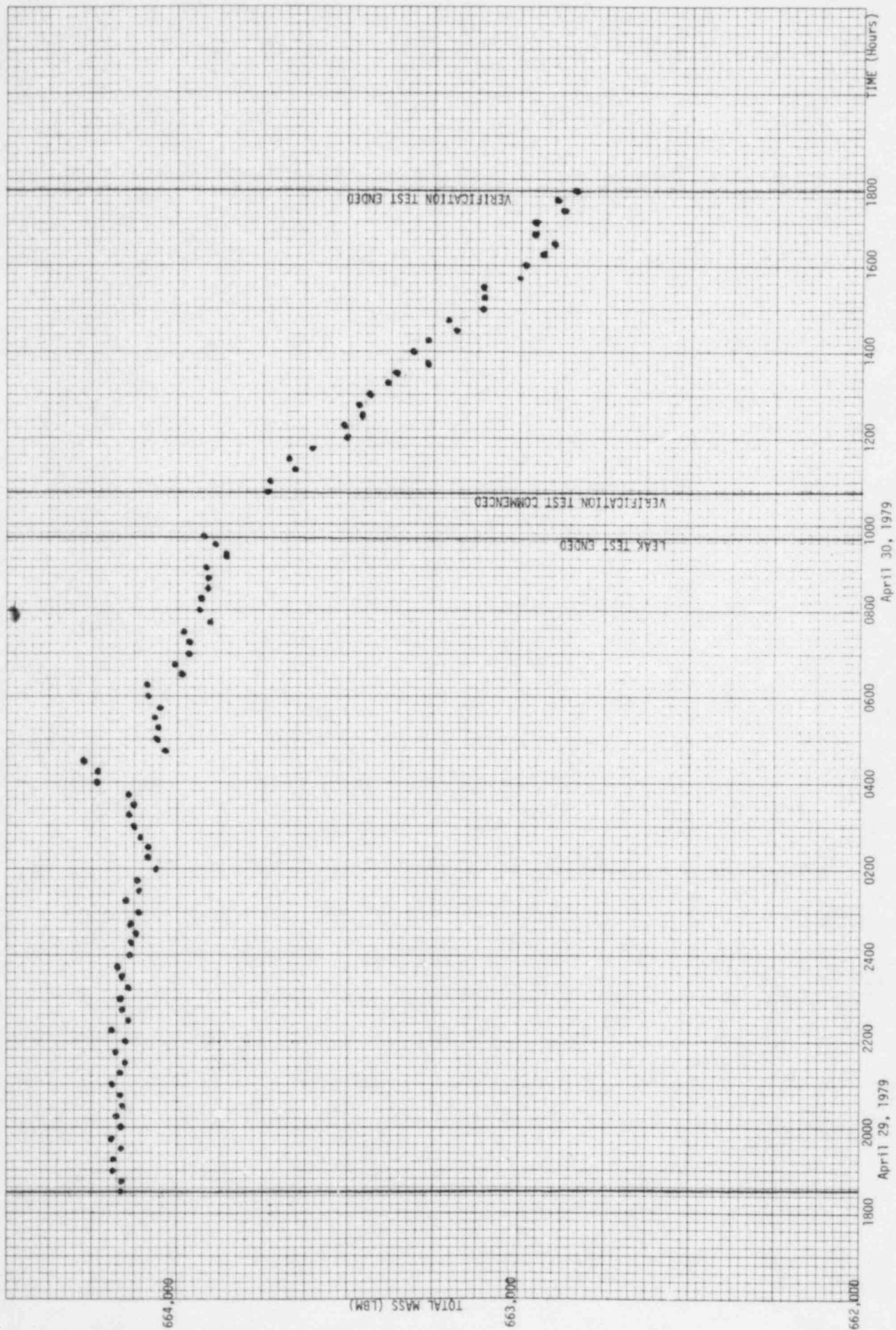
Page C7



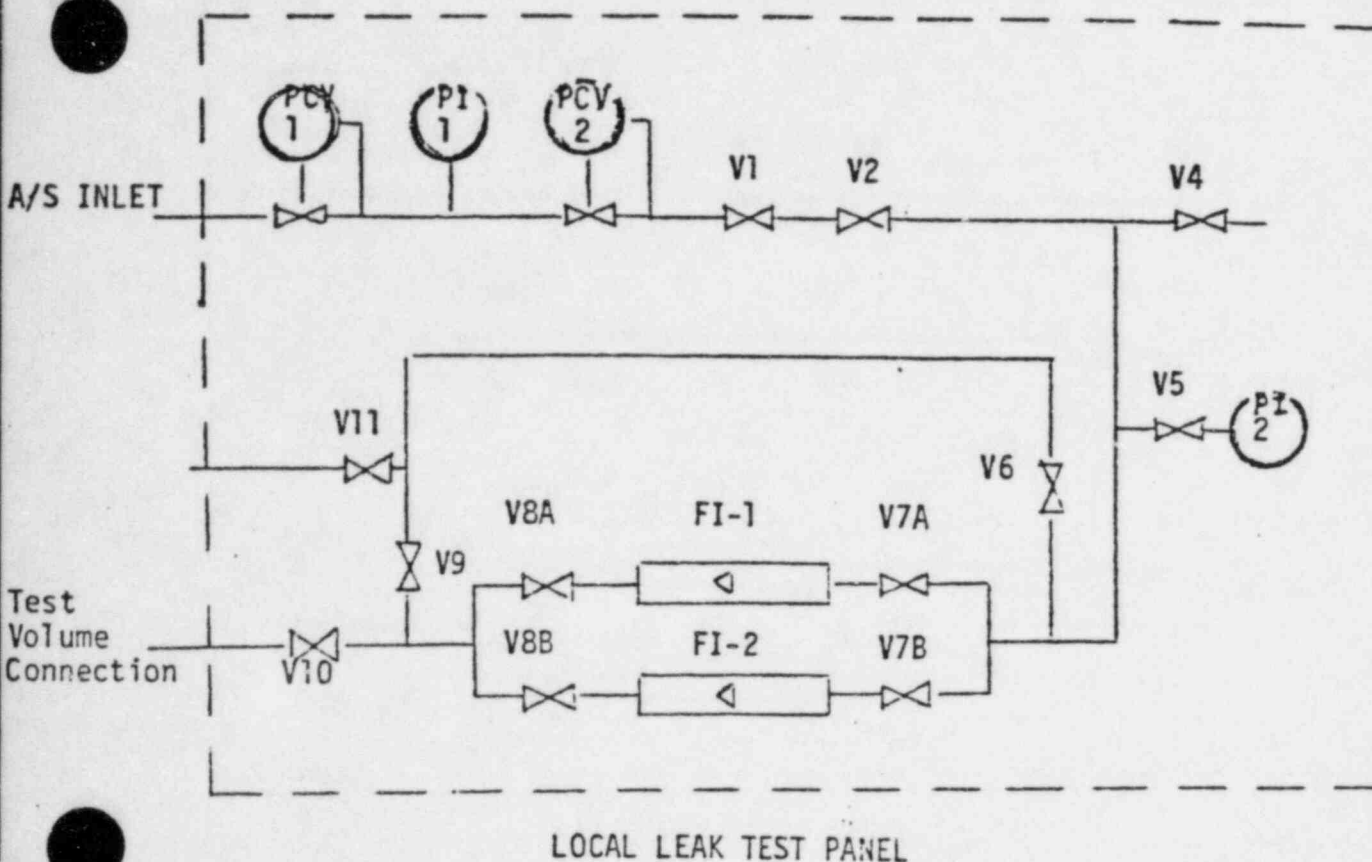
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APPENDIX C - CONTAINMENT MASS VS. TIME



APPENDIX D



INSTR	DESCRIPTION
PCV-1, PCV-2	Pressure Regulator, Range 0-100 psig
PI-1	Pressure Gauge, 0-100 psig, 2 psig increments
PI-2	* Pressure Gauge, Wallace & Tiernan Absolute Pressure Gauge Model 61A-1A-0100, Range 0-100 psia, accuracy 0.1% full scale, sensitivity .01% full scale.
FI-1, FI-2	Flow Indicator, Brooks full view rotameter, model 1370-00F2AAS Dual Scale Measuring Air at 42 psig, 70°F, Scale Range: FI-1 0-250 cc/min, FI-2 250-2500 cc/min.

* Alternate gauge, Heise - range 0-100 psig

APPENDIX E

PENETRATION
NUMBERLEAKAGE RATE (STANDARD CUBIC CENTIMETERS
PER MINUTE - SSCM)

	1976	1977	1978	1979
1	20	-	20	60
2	30	-	25	65
3	20	-	20	25
4	400	-	20	25
5	20	-	20	25
10	750	-	550	25
11	2000	-	500	1386
14	600	-	1400	1550
21	1000	-	850	600
22	20	-	1800	45
23	20	-	1000	991
24	1800	-	1000	1690
25	49,706	-	20	200
26	800	-	2000	1500
27	20	-	20	598
28	272,773	124,406	10633	497
29	850	-	1100	1690
30	TESTED WITH PENETRATION 25			
31	TESTED WITH PENETRATION 26			
32	TESTED WITH PENETRATION 27			
33	TESTED WITH PENETRATION 28			

APPENDIX E

PENETRATION
NUMBERLEAKAGE RATE (STANDARD CUBIC CENTIMETERS
PER MINUTE - SSCM)

	1976	1977	1978	1979
34	750	750	400	350
35	20	-	50	30
37	110	-	40	56
38	20	-	20	129
39	14,418	2657	5442	1200
40	76,890	-	52,674	1400
43	20	20	200	110
51	200		800	299
53	23		140	200
54	92		240	600
61	20		20	90
62	55		230	110
63	20		20	25
64	20		20	25
65	TESTED WITH PENETRATION 22			
67	20		75	25
68	20		20	30
72	TESTED WITH PENETRATION 23			
82	20		60	26
83	1700		600	25
85	20		90	100

APPENDIX E

PENETRATION
NUMBERLEAKAGE RATE (STANDARD CUBIC CENTIMETERS
PER MINUTE - SSCM)

	1976	1977	1978	1979
86	20		230	40
87	20		75	1244
88	20		20	25
89	20		20	25
SEXA5	20		1331	2458
SEXA6	20		20	25
SEXB2	20		1800	1580
SEXB4	20		20	25
SEXB5	20		20	25
SEXB6	20		20	2412
SEXB7	20		20	25
SEXB8	20		20	25
SEXB9	20		68	50
SEXC1	20		20	25
SEXC3	20		20	25
SEXD1	20		20	25
SEXD3	20		20	25
SEXD6	20		20	25
SEXD8	20		48	25
SEXD9	20		30	50
SEXE6	20		95	60

APPENDIX E

 PENETRATION
NUMBER

 LEAKAGE RATE (STANDARD CUBIC CENTIMETERS
PER MINUTE - SSCM)

	1976	1977	1978	1979
SEXE9	20		20	25
SWXB1	20		20	25
SWXB2	20		20	25
SWXB3	20		20	119
SWXB4	20		20	25
SWXB5	20		2250	25
SWXB6	20		20	25
SWXB7	20	-	200	207
SWXB8	20	-	20	295
SWXB9	20	-	20	25
SWXC3	250	-	20	25
SWXC5	350	-	20	25
SWXD1	20	-	20	25
SWXD3	20	-	20	25
SWXD5	20	-	20	25
SWXD8	20	20	20	25
SWXD9	20	-	20	25
SWXE5	20	-	2431	169
SWXE9	20	-	20	25
SEXA4-1	20	-	20	25
SEXA4-2	20	-	20	25

APPENDIX E

PENETRATION
NUMBERLEAKAGE RATE (STANDARD CUBIC CENTIMETERS
PER MINUTE - SSCM)

	1976	1977	1978	1979
SEXA4-3	20	-	20	25
SEXA8-1	20	-	20	25
SEXA8-2	20	-	20	25
SEXA8-3	20	-	20	25
SWXA2-1	20	-	20	25
SWXA2-2	20	-	20	25
SWXA2-3	20	-	20	25
SWXA8-1	20	-	20	25
SWXA8-2	20	-	20	25
SWXA8-3	20	-	20	25
EQUIPMENT HATCH	20	20	20	25
TRANSFER TUBE	20	20	240	90