

REACTOR CONTAINMENT BUILDING  
INTEGRATED LEAKAGE RATE TEST

DUQUESNE LIGHT COMPANY  
BEAVER VALLEY POWER STATION UNIT NO. 1

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## REFERENCES

1. 10CFR50, Appendix J, Primary Reactor Containment Leakage Testing For Water-Cooled Power Reactors, January 1, 1992.
2. 1BVT 1.47.2, Containment Type A Leak Test, Beaver Valley Power Station Unit No. 1, Issue 2, Revision 4, March 16, 1993.
3. ANSI N45.4, American National Standard, Leakage - Rate Testing of Containment Structures for Nuclear Reactors, March 16, 1972.
4. ANSI/ANS-56.8, Containment System Leakage Testing Requirements, January 20, 1987.



## SECTION 1

### PURPOSE

The purpose of this report is to present a description and analysis of the May 1993 Type A Containment Integrated Leakage Rate Test (ILRT), and a summary of Type B and C Local Leakage Rate Tests (LLRT's) performed since the last periodic ILRT (December 1989) at Duquesne Light Company's Beaver Valley Power Station Unit No. 1 (BVPS 1).

Stone & Webster Engineering Corporation (SWEC) provided test engineering consultation services to Duquesne Light Company during the performance of the 1993 ILRT.

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

## SECTION 2

### SUMMARY

#### 2.1 TYPE A ILRT

##### 2.1.1 Test Summary

Upon completion of all ILRT prerequisites and initial conditions, containment pressurization started at 1521 hours on May 25, 1993 at a fairly constant pressurization rate of 3.0 psi per hour. The compressors were secured at 0603 hours on May 26, 1993 with a peak instantaneous pressure of 57.5134 PSIA.

At 1020 hours on May 26, 1993, the temperature stabilization criteria ( $< 0.5$  °R over last two hours) was satisfied. The ILRT start time was declared to be 1030 hours on May 26, 1993. Initial mass trends indicated an acceptable leakage rate of approximately 9.5 lbm/hr. Penetration area leakage investigations identified no significant leakage.

The ILRT was completed at 1030 hours on May 27, 1993 with a Mass Point Upper Confidence Level of 0.02506 %/day. This leakage rate is below the 0.75 La Acceptance Criteria of 0.075 %/day.

The Superimposed Leakage Verification Test was started at 1230 hours on May 27, 1993 when the stability of all containment parameter trends had recovered from the imposed leakage rate perturbation. At the end of the four hour test period, the Mass Point Analysis Leakage Rate was just outside the  $\pm 0.25$  La limit. The verification test was extended for an additional three hours; however, the measured leakage rate continued to remain outside the  $\pm 0.25$  La limit.

The Actual Containment Leakage Rate was assumed to have been initially over influenced by temperature stabilization; therefore, the ILRT was restarted at 1945 hours on May 27, 1993 due to the improved stability of containment conditions. The ILRT was completed at 1945 hours on May 28, 1993 with a Mass Point Upper Confidence Level of 0.01331 %/day. (See Section 3.3, Test Results). This leakage rate is below the 0.75 La Acceptance Criteria of 0.075 %/day.

The Superimposed Leakage Verification Test was started at 2045 hours on May 28, 1993 when the stability of all the containment parameter trends had recovered from the imposed leakage rate perturbation. The Superimposed Leakage Verification Test was successfully completed at 0045 hours on May 29, 1993 (See Section 3.3, Test Results).

After review of all ILRT test data, containment depressurization started at 0135 hours and was completed at 0900 hours on May 29, 1993.

## 2.2 LOCAL LEAKAGE RATE TESTS (TYPES B AND C)

The Local Leakage Rate Tests (LLRT's) of the containment isolation valves and other containment penetrations were conducted as described in the Beaver Valley Power Station Unit No. 1 surveillance test procedures for Type B and C tests.

In accordance with Appendix J to 10CFR50, Paragraph V.B, data for the Local Leakage Rate Tests are summarized in Section 4 of this report.

## SECTION 3

### INTEGRATED LEAKAGE RATE TEST

#### 3.1 EDITED LOG OF EVENTS

This log was edited from information contained in the ILRT Test Log.

May 25, 1993

- 1510 Prerequisites and Initial Conditions for ILRT completed.
- 1521 Commenced ILRT pressurization.
- 1742 Containment pressure at approximately 19.5 psia. Completed walkdown of all penetration areas. Noted slight increase on pressure gauge installed at penetration No. 90, Containment Purge Exhaust.
- 2003 High Level Seal Water Accumulator Alarm, for Outside Recirculation Spray Pump [1RS-D-2B] cleared.
- 2020 Increased back pressure on Air Dryer to 98.0 psig to reduce moisture content of pressurization air.

May 26, 1993

- 0025 Blew down after cooler and left drain valve throttled open further to reduce moisture content of pressurization air.
- 0430 Containment pressure at approximately 53.0 psia.
- 0603 Secured containment pressurization with a peak instantaneous pressure of 57.51 psia.
- 0615 Commenced ILRT stabilization period.
- 1005 Completed walkdown of all penetration areas. Noted pressure increase on pressure gauges installed at penetrations No. 90 and 91, Containment Purge Supply and Exhaust.
- 1020 Satisfied temperature stabilization criteria ( $<0.5$  °R over last two hours).
- 1030 Declared start of ILRT.
- 1353 Mass trend is acceptable at approximately 9.5 lbm/hr. Mass point upper confidence level of 0.097 percent/day.

- 1555 Completed walkdown of all penetration areas. No significant leakage noted. Penetrations No. 90 and 91 have pressurized to 42.7 and 36.8 psig respectively.
- 1750 Mass trend is acceptable at approximately 7.5 lbm/hr. Mass Point Upper Confidence Level of 0.052 percent/day.

May 27, 1993

- 0145 Mass Point Upper Confidence Level of 0.033 percent/day.
- 0842 Preparing for Superimposed Leakage Verification Test. Mass Point Upper Confidence Level of 0.026 percent/day.
- 1030 Completed ILRT with a Mass Point Upper Confidence Level of 0.025 percent/day.
- 1130 Established a 4.56 SCF/M leakage flow for the Superimposed Leakage Verification Test.
- 1230 Commenced the Superimposed Leakage Verification Test.
- 1630 Superimposed Leakage Verification Test just outside of acceptable limits, will continue to record data.
- 1941 Superimposed Leakage Verification Test still outside of acceptable limits. Decision made to terminate test. Suspect actual containment leak rate is much less than measured and was over influenced by the temperature stabilization of the containment building.
- 1942 Superimposed leak isolated.
- 1945 Restarted the ILRT.

May 28, 1993

- 0613 Containment Leak Rate is trending towards the value measured during the last 12 hours of the initial ILRT. Containment Mass Point Leak Rate is 0.012 percent/day with a Mass Point Upper Confidence Level of 0.022 percent/day.
- 1609 Containment Mass Point Leak Rate is 0.013 percent/day with a Mass Point Upper Confidence Level of 0.016 percent/day.
- 1945 Completed ILRT with a Mass Point Upper Confidence Level of 0.013 percent/day.
- 1950 Established a 4.54 SCF/M leakage flow for the Superimposed Leakage Verification Test.
- 2045 Commenced the Superimposed Leakage Verification Test.

May 29, 1993

0045 Completed Superimposed Leakage Verification Test.  
0135 Commenced containment depressurization.  
0900 Completed containment depressurization.

### 3.2 GENERAL TEST DESCRIPTION

#### 3.2.1 Prerequisites

In accordance with Beaver Valley Power Station Unit 1 ILRT Test Procedure 1BVT 1.47.2, the following is a listing of the pertinent prerequisites completed and documented prior to containment pressurization:

- a. All Type B and C Local Leakage Rate Testing completed.
- b. All test instrumentation calibrated or functionally verified within 6 months of ILRT.
- c. All penetration valve alignments completed.
- d. All ILRT computer software used for data acquisition, and data analysis, tested and operational.
- e. Temporary air compressors and auxiliary equipment checked out and available for pressurization.
- f. All equipment that could be damaged by test pressure, removed or protected.
- g. Portable pressure containing equipment removed from containment.
- h. Depressurized and vented pressure vessels located inside containment.
- i. Completed structural integrity inspection of containment.

#### 3.2.2 Equipment and Instrumentation

Pressurization of the containment was achieved by the utilization of a temporary system consisting of six diesel driven oil free air compressors, a water cooled aftercooler, and a refrigerant air dryer. The system included adequate instrumentation and valving to maintain proper monitoring and control of the compressed air quality throughout the pressurization sequence. The total capacity of the pressurization system was 9000 SCFM. Air was supplied to containment through the Containment Purge System.

The various containment parameters required to calculate containment leakage were monitored using instrumentation which consisted of 16 resistance temperature detectors, 5 dewpoint detectors, and an absolute pressure quartz manometer. Pertinent data for the test instrumentation is listed in Attachment 3.2A.

A test panel consisting of a rotameter, pressure gauge, and a thermometer was used to perform the Superimposed Leakage Verification Test.

### 3.2.3 Data Acquisition System

The data acquisition system used for ILRT was a computer controlled logging system which provided instantaneous raw sensor data.

For the ILRT, the Data Acquisition System monitored the following instrumentation:

<u>Type</u>	<u>No. of Sensors</u>
Temperature Detectors	16
Dewpoint Sensors	5
Quartz Manometer	1

Instantaneous readings for each sensor were collected and printed at 15 minute intervals. Input to the data analysis program was based on these collections. Each data set was time stamped.

### 3.2.4 Data Resolution System

The recorded data was inputted to Stone & Webster Engineering Corporation's computer program for data reduction and leakage rate calculations. The Mass Point Analysis Method was used to determine the containment leakage rate.

#### Absolute Method of Mass Point Analysis

The Absolute Method of Mass Point Analysis consists of calculating the air mass within the containment structure, over the test period, using pressure, temperature, and dewpoint data obtained during the ILRT. The air mass is computed using the ideal gas law as follows:

$$M = \frac{144V(P-P_v)}{RT}$$

Where:

- M = air mass, lbm
- P = total pressure, psia
- P<sub>v</sub> = average vapor pressure, psia
- R = 53.35 ft-lbm/lbm °R (for air)
- T = average containment temperature, °R
- V = containment free volume, 1,760,000 cu. ft.

The leakage rate is then determined by plotting air mass as a function of time, using a least-squares fit to determine the slope,  $A = dM/dT$ . The leakage rate is expressed as a percentage of the air mass lost in 24 hours or symbolically:

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



Where A is the slope of the least-squares curve and B is the y-intercept. The sign convention is such that the leakage out of containment is positive, and the units are in percent/day.

The air mass is calculated and the result is correlated as a function of time by means of a least-squares curve fit of the form:

$$M = At + B$$

A confidence interval is calculated using a Student's T distribution. The sum of the leakage rate and confidence is the Upper Confidence Level.

## ATTACHMENT 3.2A

## INSTRUMENTATION LIST

<u>Instrument</u>	<u>Weight Factor</u>	<u>Range</u>	<u>Zone</u>	<u>Elevation</u>
A. <u>Temperature</u>				
TRB-11M100-01	0.039104	60-100 °F	A	739'
TRB-11M100-02	0.043137	60-100 °F	B	739'
TRB-11M100-03	0.038487	60-100 °F	A	739'
TRB-11M100-04	0.041176	60-100 °F	B	744'
TRB-11M100-05	0.076695	60-100 °F	C	799'
TRB-11M100-06	0.076246	60-100 °F	C	799'
TRB-11M100-07	0.076695	60-100 °F	C	799'
TRB-11M100-08	0.000000	60-100 °F		799'
TRB-11M100-09	0.090756	60-100 °F	D	850'
TRB-11M100-10	0.090756	60-100 °F	D	850'
TRB-11M100-11	0.090756	60-100 °F	D	850'
TRB-11M100-12	0.038207	60-100 °F	F	799'
TRB-11M100-13	0.094846	60-100 °F	E	797'
TRB-11M100-14	0.000000	60-100 °F		799' 6"
TRB-11M100-15	0.000000	60-100 °F		730'
TRB-11M100-16	0.000000	60-100 °F		701' 6"
TRB-11M100-17	0.051746	60-100 °F	G	701' 6"
TRB-11M100-18	0.055108	60-100 °F	G	701' 6"
TRB-11M100-19	0.045490	60-100 °F	F	740' 10"
TRB-11M100-20	0.050794	60-100 °F	G	701' 6"

## ATTACHMENT 3.2A (continued)

## INSTRUMENTATION LIST

<u>Instrument</u>	<u>Weight Factor</u>	<u>Range</u>	<u>Zone</u>	<u>Elevation</u>
B. <u>Dewpoint</u>				
MA-11M100-01	0.125690	0-100 °F	J	825'
MA-11M100-02	0.125690	0-100 °F	J	825'
MA-11M100-03	0.249540	0-100 °F	K	701'
MA-11M100-04	0.249540	0-100 °F	K	701'
MA-11M100-05	0.249540	0-100 °F	K	701'
C. <u>Pressure</u>				
I-I-2.3299	1.000000	0-100 PSIA		
# I-II-2.1399-B	0.000000	0-100 PSIA		
D. <u>Superimposed Leakage Verification Test Flow Instrument</u>				
I-A-1.553 (FI-SL-2)	1.000000	0-8 SCFM		
I-A-1.553 (FI-SL-1)	0.000000	0-8 SCFM		

# Backup quartz manometer, logged locally at same frequency as primary manometer.

# ATTACHMENT 3.2B

## INSTRUMENTATION SELECTION GUIDE

The Instrumentation Selection Guide (ISG) formula is used to determine the ability of an instrumentation system to measure the integrated leakage of the reactor containment system. Instrumentation errors are combined using a root-sum-square formula. The ISG is not added to the value of the calculated leakage rate, but is used for instrument selection and loss of sensor criteria only. Measurement system sensitivity values are used in the ISG formula since it is the change in the containment air mass, not the absolute value in mass, that is used to computer leakage. The following is the information used to calculate the ISG.

	<u>Quartz Manometer</u>	<u>Dewcell Hygrometer</u>	<u>100 OHM Platinum RTD</u>
Sensor Manufacturer	D.H. Instruments	Foxboro	Electric Thermo- meters
Number of Sensors (n)	1	5	16
Parameter Measured	Total Pressure, PSIA (p)	Dew Point, °F (pv)	Temperature °R (T)
Absolute Value	54.7 PSIA	60 °F	530 °R

# ATTACHMENT 3.2B (continued)

## INSTRUMENTATION SELECTION GUIDE

NOTE: From the Steam Tables, at a dew point temperature of 60 °F the equivalent water vapor pressure change is 0.0092 PSIA/°F. Sensor Sensitivity (E), and Repeatability and Resolution (C) for the Hygrometer's were converted to PSIA prior to calculating the total system error (e).

	Quartz Manometer	Dewcell Hygrometer	Platinum RTD
Sensor Sensitivity (E)	0.001	0.5	0.03
Repeatability and Resolution of System Excluding Sensor (C)	0	0.1	0.03
Total System Error (e)	0.001	* 0.002	0.011

$$e = [(E^2 + C^2)/n]^{1/2}$$

The following equation was used to calculate the ISG:

$$ISG = \frac{2400}{t} \left[ 2 \left[ \frac{e_p}{p} \right]^2 + 2 \left[ \frac{e_{pv}}{p} \right]^2 + 2 \left[ \frac{e_T}{T} \right]^2 \right]^{1/2}$$

where:

- t = test duration, Hours
- $e_p$  = system error for pressure, PSIA
- $e_{pv}$  = system error for dewpoint, PSIA
- $e_T$  = system error for temperature, °R

\* This number was converted to equivalent water vapor pressure.

ATTACHMENT 3.2B (continued)

INSTRUMENTATION SELECTION GUIDE

The ISG (24 Hrs) was calculated as follows:

$$ISG = \frac{2400}{24} \left[ 2 \left[ \frac{0.001}{54.7} \right]^2 + 2 \left[ \frac{0.002}{54.7} \right]^2 + 2 \left[ \frac{0.011}{530} \right]^2 \right]^{1/2}$$

$$ISG = \frac{2400}{24} \left[ 6.68E-10 + 2.67E-9 + 8.62E-10 \right]^{1/2}$$

$$ISG = 0.00648 \text{ Pct/Day (Maximum allowable ISG = 0.025 Pct/Day)}$$

Time (t) at the maximum ISG was calculated as follows:

$$t = \frac{2400}{0.025} \left[ 6.68E-10 + 2.67E-9 + 8.62E-10 \right]^{1/2}$$

$$t = 6.22 \text{ Hours}$$

### 3.3 TEST RESULTS

#### 3.3.1 Presentation of Test Results

The test data for the May 1993 ILRT is based on an 24 hour test period starting at 1945 hours on May 27, 1993. The final test results were determined using Stone & Webster Engineering Corporation's ILRT computer program. The Reduced Input Data, Mass Point Analysis Test Results, Superimposed Leakage Verification Test Results, and representative graphs are contained in Attachments 3.3A through 3.3F.

The Mass Point Analysis Test Results for the ILRT satisfied the procedural acceptance criteria.

The ILRT instrumentation was verified by the Superimposed Leakage Verification Test Method. The Mass Point Analysis Test Results for the Superimposed Leakage Verification Test satisfied the procedural acceptance criteria.

### 3.3.2 54.7 PSIA ILRT Results

The ILRT was conducted in accordance with Beaver Valley Power Station Unit No. 1 test procedure 1BVT 1.47.2. The results for the ILRT and for the Supplemental Test are shown below:

#### 3.3.2.1 ILRT Results - Mass Point Analysis

<u>Item</u>	<u>(Percent/Day)</u>
1. Lam, Leakage Rate Calculated	0.011066
2. Confidence Level	0.002247
3. UCL, Lam Leakage Rate plus Confidence Level	0.013313
4. Corrections for: (See Section 3.3.2.3)	
i. Type B Penalties	0.000362
ii. Type C Penalties	0.001282
iii. Water Levels	0.000000
iv. Total Corrections	0.001644
5. Total Reported ILRT Leakage Rate (Items 3 & 4)	0.014957

Results were within the acceptable limits of  $< 0.75 \text{ Ia}$  or  $< 0.075 \text{ Percent/Day}$



### 3.3.2.2 Supplement Test Results

The Supplemental Verification Test was performed using the Superimposed Leakage Verification Test Method in accordance with test procedure 1BVT 1.47.2. The results for the Superimposed Leakage Verification Test are shown below.

1. The Superimposed Leakage Verification Test is acceptable provided  $L_c$  falls within the following range:

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

Where:  $L_{am}$  = Type A calculated leakage (computer)

$$= 0.011066 \text{ Percent/Day}$$

$L_o$  = Superimposed leakage rate developed from rotameter

$$= 0.099824 \text{ Percent/Day}$$

$L_c$  = Composite leakage (computer)

$$= 0.118578$$

#### a. Mass Point

$$\begin{aligned} (0.011066 + 0.099824 - 0.025) &\leq 0.118578 \leq (0.011066 + 0.099824 + 0.025) \\ (0.08589) &\leq 0.118578 \leq (0.13589) \end{aligned}$$

The Superimposed Leakage Verification Test was within the allowable limits.

### 3.3.2.3 Leakage Penalties Added to ILRT Leakage

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

i. <u>Type B Penalties</u>	<u>Description</u>	<u>Leakage (SCF/D)</u>
Electrical	Canisters	12.40
Penetrations	O-Rings	11.30

Total Type B Leakage = 23.70 SCF/D

Total Type B Leakage = 0.000362 Percent/Day

ii. <u>Type C Penalties</u>	<u>Description</u>	<u>Leakage (SCF/D)</u>
Pent #1	Component Cooling Water System	0.47
Pent #2	Component Cooling Water System	1.64
Pent #4	Component Cooling Water System	0.47
Pent #5	Component Cooling Water System	0.47
Pent #8	Component Cooling Water System	0.47
Pent #9	Component Cooling Water System	0.47
Pent #11	Chilled Water System	0.47
Pent #13	Fire Protection System	0.47
Pent #14	Chilled Water System	0.47
Pent #16	Component Cooling Water System	0.47
Pent #17	Component Cooling Water System	0.47
Pent #18	Component Cooling Water System	28.49
Pent #24	RHR System to RWST	14.52
Pent #25	Component Cooling Water System	26.64
Pent #26	Component Cooling Water System	0.94
Pent #27	Component Cooling Water System	0.57
Pent #28	RCS Letdown	0.47
Pent #31	Fire Protection System	0.70
Pent #32	Fire Protection System	0.47
Pent #55-2	Leakage Monitoring System	0.47
Pent #58	Component Cooling System	3.42
Pent #97-1	Reactor Plant Sample System	0.47
Pent #110-1	Pressurizer Dead Weight Tester	0.47

Total Type C Leakage = 83.97 SCF/D

Total Type C Leakage = 0.001282 Percent/Day

iii. Water Level Corrections

Description

Leakage (SCF/D)

Px Vessel

0.0

Cmnt Sump

0.0

Total Water Level Corrections = 0.0 SCF/D

Total Water Level Corrections = 0.0 Percent/Day

#### 3.3.2.4 As Found Containment Condition - LLRT Improvements

In order to account for the affect of Local Leakage Rate Test (LLRT) repairs (made prior to the ILRT) on the "as found" condition of containment, an analysis of LLRT results was performed.

The "as found" minimum pathway leakage rate is reviewed against the "as left" minimum pathway leakage rate for each LLRT penetration. If the penetration minimum pathway leakage rate is reduced because of repairs, maintenance, design changes, etc., then the leakage rate improvement is noted. The total of all these leakage rate improvements is the adjustment to the "as found" containment condition.

The minimum pathway leakage rate for the following LLRT penetrations was reduced as a result of repairs:

PENT NO.	AS FOUND MINIMUM PATHWAY LEAKAGE (SCF/D)	AS LEFT MINIMUM PATHWAY LEAKAGE (SCF/D)	LEAKAGE DIFFERENCE (SCF/D)
8	0.57	0.47	0.10
17	0.94	0.47	0.47
24	15.50	14.52	0.98
26	8.51	0.94	7.57
38	44.70	0.47	44.23
42	52.48	6.55	45.93
47	25.80	2.35	23.45
56.3	0.66	0.47	0.19
64	20.76	0.47	20.29
89	11.81	5.65	6.16

Total Minimum Pathway Leakage Rate Improvement = 149.37 SCF/D

Total Minimum Pathway Leakage Rate Improvement = 0.002281 Percent/Day

Adding this "as found" containment adjustment to the reported ILRT results yields the following results:

	<u>Item</u>	<u>(Percent/Day)</u>
1.	Total Reported ILRT Leakage Rate (See Section 3.3.2.1)	0.014957
2.	As Found Containment Adjustment	0.002281
3.	Total Containment Leakage Rate	0.017238

### 3.3.3 Conclusion

No significant leakage paths were identified during the ILRT. The measured containment leakage rate appears to have been over influenced initially by temperature stabilization during the first half of the leakage rate measurement period. This caused the final ILRT measured leakage rate to be artificially higher than the actual leakage rate, but still acceptable. The Superimposed Leakage Verification Test however was impacted by the improved temperature stabilization.

During the Superimposed Leakage Verification Test a leak of approximately  $1\alpha$  ( $0.1\%$ /Day) is imposed onto containment. Leakage rate measurements are restarted after allowing approximately one hour for stabilization. The resulting measured leakage rate (composite leakage rate) must equal the final measured ILRT leakage rate plus the imposed leakage rate within a margin of  $\pm 0.025\%$ /Day to be acceptable.

Since the final ILRT measured leakage rate used for the verification test was actually greater than the actual containment leakage rate, the resulting composite leakage rate was biased. Subsequent data analysis during the verification test yielded a composite leakage rate which reflected the actual containment leakage rate which was not biased. The resulting composite leakage rate remain just below the lower verification test acceptance limit.

The second ILRT run was started since the actual containment leakage rate was assumed to have been initially over influenced by temperature stabilization during the first ILRT run. During the second ILRT run the measured leakage rate trended to a value of about half of that measured during the first ILRT run. The ILRT was completed with an acceptable leakage rate.

The Superimposed Leakage Verification Test performed after the second ILRT run was within acceptable limits.

Consideration for future ILRT's will be given to possible tightening the temperature stabilization guideline criteria from the present  $< 0.5\text{ }^{\circ}\text{R}$  over last 2 hours to a more stringent criteria.

Data scatter of the two dewcells located in the containment dome significantly influenced the Total Time Upper Confidence Level making a short duration test performed in accordance with Bechtel Topical Report BN-TOP-1 impossible to conduct. Installation of draft eliminators and shielding of the instrument cables will be evaluated for these two dewcells to possibly eliminate the data scatter during future ILRT's.

ATTACHMENT 3.3A  
 INTEGRATED LEAKAGE RATE TEST  
 FROM 1945 HOURS ON 5/27/93 TO 1945 HOURS ON 5/28/93  
 REDUCED INPUT VARIABLES

Time (hh:mm)	Press. (PSIA)	V.P. (PSI)	Temp. (R)	Dewpoint (F)	Mass (Lbm)
19:45	57.009	0.3864	536.067	71.846	501780.93
20:15	57.010	0.3829	536.080	71.579	501801.74
20:30	57.011	0.3840	536.078	71.660	501807.71
20:45	57.009	0.3848	536.079	71.724	501778.66
21:00	57.007	0.3834	536.083	71.611	501768.93
21:15	57.010	0.3812	536.084	71.446	501819.71
21:30	57.010	0.3788	536.087	71.258	501832.06
21:45	57.011	0.3801	536.081	71.360	501834.58
22:00	57.010	0.3852	536.087	71.750	501775.19
22:15	57.010	0.3828	536.099	71.566	501787.04
22:30	57.010	0.3831	536.096	71.590	501784.93
22:45	57.008	0.3822	536.099	71.523	501777.51
23:00	57.007	0.3817	536.095	71.481	501772.63
23:15	57.009	0.3822	536.104	71.520	501784.55
23:30	57.010	0.3794	536.103	71.304	501815.30
23:45	57.010	0.3778	536.116	71.183	501811.83
00:00	57.010	0.3800	536.112	71.348	501802.49
00:15	57.010	0.3807	536.117	71.405	501786.26
00:30	57.011	0.3809	536.130	71.424	501785.13
00:45	57.010	0.3808	536.128	71.416	501777.59
01:00	57.012	0.3827	536.129	71.557	501776.23
01:15	57.012	0.3793	536.133	71.300	501808.74
01:30	57.011	0.3802	536.137	71.368	501784.76
01:45	57.009	0.3820	536.143	71.507	501747.55
02:00	57.012	0.3778	536.145	71.184	501810.12
02:15	57.013	0.3800	536.147	71.349	501795.06
02:30	57.012	0.3829	536.160	71.575	501750.50
02:45	57.013	0.3806	536.157	71.395	501780.88
03:00	57.013	0.3781	536.164	71.205	501795.62
03:15	57.013	0.3786	536.166	71.244	501793.23
03:30	57.012	0.3789	536.175	71.267	501772.49
03:45	57.015	0.3779	536.175	71.190	501802.56
04:00	57.015	0.3803	536.184	71.378	501775.13
04:15	57.014	0.3796	536.185	71.319	501771.69
04:30	57.014	0.3833	536.178	71.609	501746.01
04:45	57.015	0.3779	536.191	71.185	501792.45
05:00	57.016	0.3800	536.192	71.353	501778.15
05:15	57.015	0.3778	536.201	71.179	501783.19
05:30	57.016	0.3802	536.209	71.367	501761.84
05:45	57.016	0.3771	536.211	71.122	501785.01
06:00	57.016	0.3804	536.208	71.385	501761.22
06:15	57.	0.3785	536.224	71.236	501758.98
06:30	57.018	0.3776	536.215	71.165	501796.13
06:45	57.018	0.3787	536.219	71.252	501782.28
07:00	57.017	0.3815	536.226	71.471	501742.78
07:15	57.015	0.3789	536.228	71.266	501748.48
07:30	57.018	0.3774	536.235	71.150	501781.92
07:45	57.019	0.3768	536.237	71.103	501788.96

ATTACHMENT 3.3A  
 INTEGRATED LEAKAGE RATE TEST  
 FROM 1945 HOURS ON 5/27/93 TO 1945 HOURS ON 5/28/93  
 REDUCED INPUT VARIABLES  
 (continued)

Time (hh:mm)	Press. (PSIA)	V.P. (PSI)	Temp. (R)	Dewpoint (F)	Mass (LBM)
19:45	57.009	0.3864	536.067	71.846	501780.93
20:15	57.010	0.3829	536.080	71.579	501801.74
20:30	57.011	0.3840	536.078	71.660	501807.71
20:45	57.009	0.3848	536.079	71.724	501778.66
21:00	57.007	0.3834	536.083	71.611	501768.93
21:15	57.010	0.3812	536.084	71.446	501819.71
21:30	57.010	0.3788	536.087	71.258	501832.06
21:45	57.011	0.3801	536.081	71.360	501834.58
22:00	57.010	0.3852	536.087	71.750	501775.19
22:15	57.010	0.3828	536.099	71.566	501787.04
22:30	57.010	0.3831	536.096	71.590	501784.93
22:45	57.008	0.3822	536.099	71.523	501777.51
23:00	57.007	0.3817	536.095	71.481	501772.63
23:15	57.009	0.3822	536.104	71.520	501784.55
23:30	57.010	0.3794	536.103	71.304	501815.30
23:45	57.010	0.3778	536.116	71.183	501811.83
00:00	57.010	0.3800	536.112	71.348	501802.49
00:15	57.010	0.3807	536.117	71.405	501786.26
00:30	57.011	0.3809	536.130	71.424	501785.13
00:45	57.010	0.3808	536.128	71.416	501777.59
01:00	57.012	0.3827	536.129	71.557	501776.23
01:15	57.012	0.3793	536.133	71.300	501808.74
01:30	57.011	0.3802	536.137	71.368	501784.76
01:45	57.009	0.3820	536.143	71.507	501747.55
02:00	57.012	0.3778	536.145	71.184	501810.12
02:15	57.013	0.3800	536.147	71.349	501795.06
02:30	57.012	0.3829	536.160	71.575	501750.50
02:45	57.013	0.3806	536.157	71.395	501780.88
03:00	57.013	0.3781	536.164	71.205	501795.62
03:15	57.013	0.3786	536.166	71.244	501793.23
03:30	57.012	0.3789	536.175	71.267	501772.49
03:45	57.015	0.3779	536.175	71.190	501802.56
04:00	57.015	0.3803	536.184	71.378	501775.13
04:15	57.014	0.3796	536.185	71.319	501771.69
04:30	57.014	0.3833	536.178	71.609	501746.01
04:45	57.015	0.3779	536.191	71.185	501792.45
05:00	57.016	0.3800	536.192	71.353	501778.15
05:15	57.015	0.3778	536.201	71.179	501783.19
05:30	57.016	0.3802	536.209	71.367	501761.84
05:45	57.016	0.3771	536.211	71.122	501785.01
06:00	57.016	0.3804	536.208	71.385	501761.22
06:15	57.016	0.3785	536.224	71.236	501758.98
06:30	57.018	0.3776	536.215	71.165	501796.13
06:45	57.018	0.3787	536.219	71.252	501782.28
07:00	57.017	0.3815	536.226	71.471	501742.78
07:15	57.015	0.3789	536.228	71.266	501748.48
07:30	57.018	0.3774	536.235	71.150	501781.92
07:45	57.019	0.3768	536.237	71.103	501788.96

ATTACHMENT 3.3B  
INTEGRATED LEAKAGE RATE TEST  
FROM 1945 HOURS ON 5/27/93 TO 1945 HOURS ON 5/28/93  
ABSOLUTE TEST METHOD, MASS POINT ANALYSIS TEST METHOD

Time (hh:mm)	Mass (Lbm)	Leakage (PCT./DAY)	Confidence (PCT./DAY)	UCL (PCT./DAY)
19:45	501780.93	0.000000	0.000000	0.000000
20:15	501601.74	0.000000	0.000000	0.000000
20:30	501807.71	-0.174833	0.179510	0.004677
20:45	501778.66	-0.023883	0.337232	0.313348
21:00	501768.93	0.052227	0.210209	0.262436
21:15	501819.71	-0.037095	0.181533	0.144438
21:30	501832.06	-0.092309	0.144150	0.051841
21:45	501834.58	-0.114639	0.109467	-0.005172
22:00	501775.19	-0.051201	0.111721	0.060520
22:15	501787.04	-0.025880	0.093038	0.067158
22:30	501784.93	-0.008722	0.077912	0.069190
22:45	501777.51	0.006912	0.066737	0.073649
23:00	501772.63	0.019284	0.057733	0.077016
23:15	501784.55	0.020477	0.049306	0.069784
23:30	501815.30	0.006679	0.044955	0.051634
23:45	501811.83	-0.001402	0.040101	0.038699
00:00	501802.49	-0.003589	0.035362	0.031772
00:15	501786.26	0.000209	0.031598	0.031807
00:30	501785.13	0.003278	0.028384	0.031662
00:45	501777.59	0.007492	0.025851	0.033343
01:00	501776.23	0.010865	0.023595	0.034460
01:15	501808.74	0.006056	0.021954	0.028010
01:30	501784.76	0.007212	0.020049	0.027261
01:45	501747.55	0.015034	0.019947	0.034981
02:00	501810.12	0.010128	0.018969	0.029097
02:15	501795.06	0.008601	0.017556	0.026157
02:30	501750.50	0.013994	0.017096	0.031090
02:45	501780.88	0.013977	0.015859	0.029836
03:00	501795.62	0.011946	0.014887	0.026833
03:15	501793.23	0.010507	0.013955	0.024462
03:30	501772.49	0.011640	0.013091	0.024731
03:45	501802.56	0.009273	0.012483	0.021756
04:00	501775.13	0.010039	0.011742	0.021781
04:15	501771.69	0.010958	0.011080	0.022038
04:30	501746.01	0.013998	0.010857	0.024855
04:45	501792.45	0.012527	0.010348	0.022875
05:00	501778.15	0.012387	0.009784	0.022171
05:15	501783.19	0.011830	0.009280	0.021109
05:30	501761.84	0.012869	0.008857	0.021727
05:45	501785.01	0.012103	0.008443	0.020546
06:00	501761.22	0.012977	0.008073	0.021050
06:15	501758.98	0.013831	0.007730	0.021561
06:30	501796.13	0.012287	0.007519	0.019806
06:45	501782.28	0.011705	0.007196	0.018902
07:00	501742.78	0.013343	0.007056	0.020399
07:15	501748.48	0.014439	0.006830	0.021268
07:30	501781.92	0.013669	0.006579	0.020248
07:45	501788.96	0.012614	0.006386	0.019000



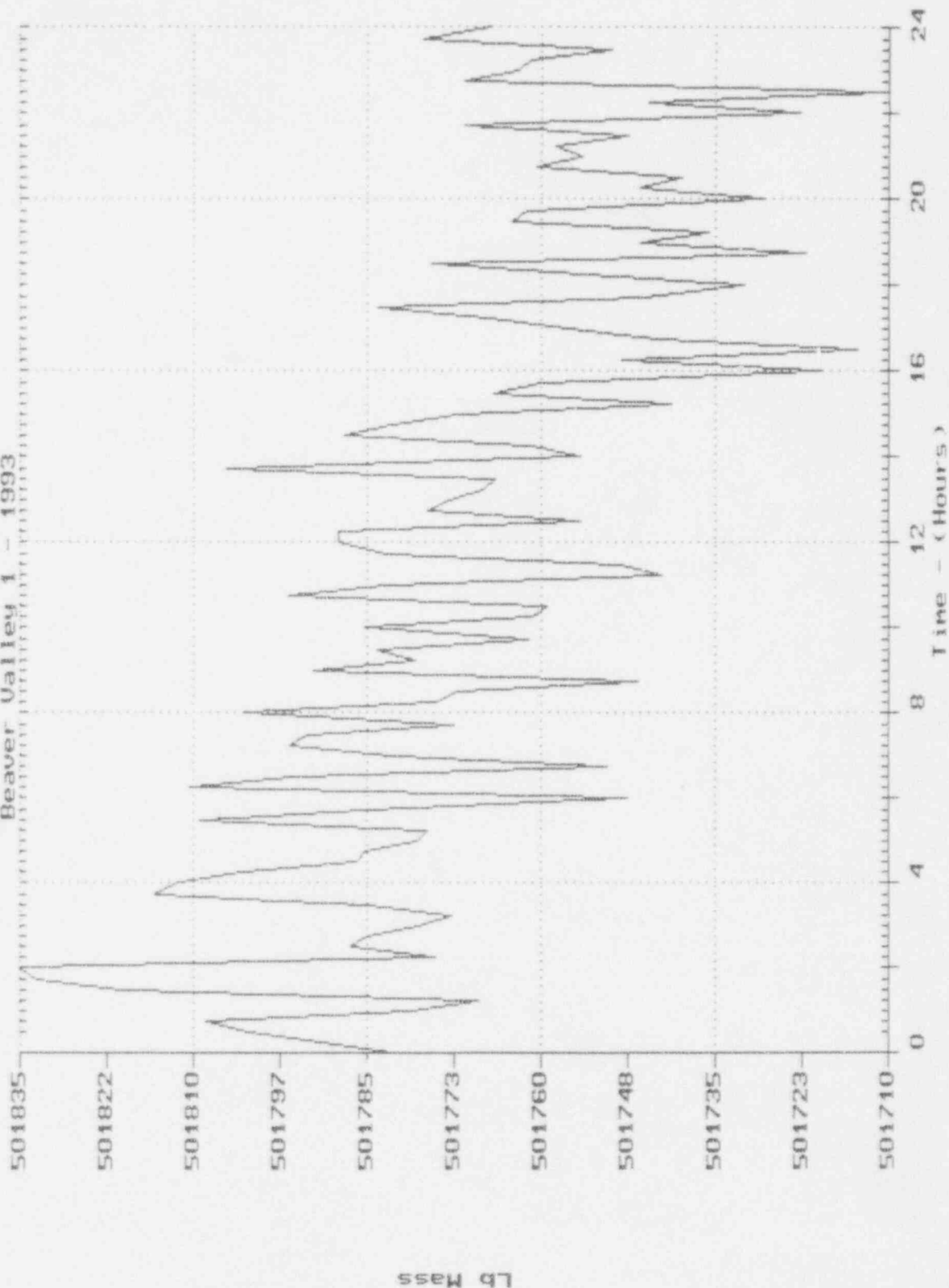
ATTACHMENT 3.3B  
INTEGRATED LEAKAGE RATE TEST  
FROM 1945 HOURS ON 5/27/93 TO 1945 HOURS ON 5/28/93  
ABSOLUTE TEST METHOD, MASS POINT ANALYSIS TEST METHOD  
(continued)

Time (hh:mm)	Mass (Lbm)	Leakage (PCT./DAY)	Confidence (PCT./DAY)	UCL (PCT./DAY)
08:00	501788.88	0.011656	0.006193	0.017849
08:15	501754.31	0.012331	0.005979	0.018310
08:30	501776.25	0.011956	0.005754	0.017710
08:45	501773.04	0.011729	0.005536	0.017265
09:00	501768.25	0.011695	0.005325	0.017020
09:15	501766.55	0.011706	0.005127	0.016832
09:30	501804.97	0.010266	0.005132	0.015397
09:45	501754.45	0.010766	0.004971	0.015737
10:00	501761.35	0.010957	0.004799	0.015755
10:15	501788.16	0.010213	0.004687	0.014900
10:30	501781.23	0.009749	0.004550	0.014299
10:45	501771.84	0.009608	0.004399	0.014007
11:00	501741.49	0.010383	0.004319	0.014702
11:15	501766.69	0.010332	0.004179	0.014511
11:30	501760.08	0.010457	0.004048	0.014505
11:45	501720.19	0.011654	0.004087	0.015741
12:00	501748.52	0.011972	0.003972	0.015944
12:15	501714.67	0.013122	0.004008	0.017129
12:30	501743.13	0.013440	0.003899	0.017339
12:45	501756.28	0.013392	0.003784	0.017176
13:00	501767.43	0.013067	0.003687	0.016754
13:15	501783.26	0.012389	0.003640	0.016029
13:30	501745.08	0.012607	0.003543	0.016151
13:45	501731.01	0.013100	0.003477	0.016577
14:00	501753.92	0.013054	0.003381	0.016435
14:15	501775.76	0.012545	0.003326	0.015871
14:30	501722.26	0.013139	0.003287	0.016426
14:45	501745.68	0.013215	0.003200	0.016416
15:00	501736.17	0.013454	0.003125	0.016579
15:15	501764.25	0.013139	0.003060	0.016199
15:30	501761.99	0.012877	0.002993	0.015869
15:45	501728.50	0.013214	0.002935	0.016149
16:00	501745.75	0.013217	0.002862	0.016079
16:15	501739.90	0.013306	0.002794	0.016100
16:30	501760.46	0.013040	0.002738	0.015778
16:45	501753.92	0.012886	0.002676	0.015563
17:00	501757.98	0.012669	0.002621	0.015291
17:15	501747.62	0.012616	0.002561	0.015176
17:30	501770.89	0.012207	0.002532	0.014739
17:45	501723.10	0.012516	0.002492	0.015008
18:00	501744.56	0.012488	0.002436	0.014924
18:15	501710.49	0.012930	0.002419	0.015349
18:30	501770.83	0.012507	0.002400	0.014907
18:45	501763.34	0.012203	0.002366	0.014569
19:00	501761.31	0.011937	0.002329	0.014266
19:15	501749.91	0.011826	0.002281	0.014107
19:30	501776.84	0.011375	0.002275	0.013649
19:45	501766.94	0.011066	0.002247	0.013313

BEAVER VALLEY POWER STATION UNIT NO. 1  
INTEGRATED LEAKAGE RATE TEST  
ATTACHMENT 3.3C - CUMULATIVE AIR MASS VS TIME

## Total Mass & Allow.

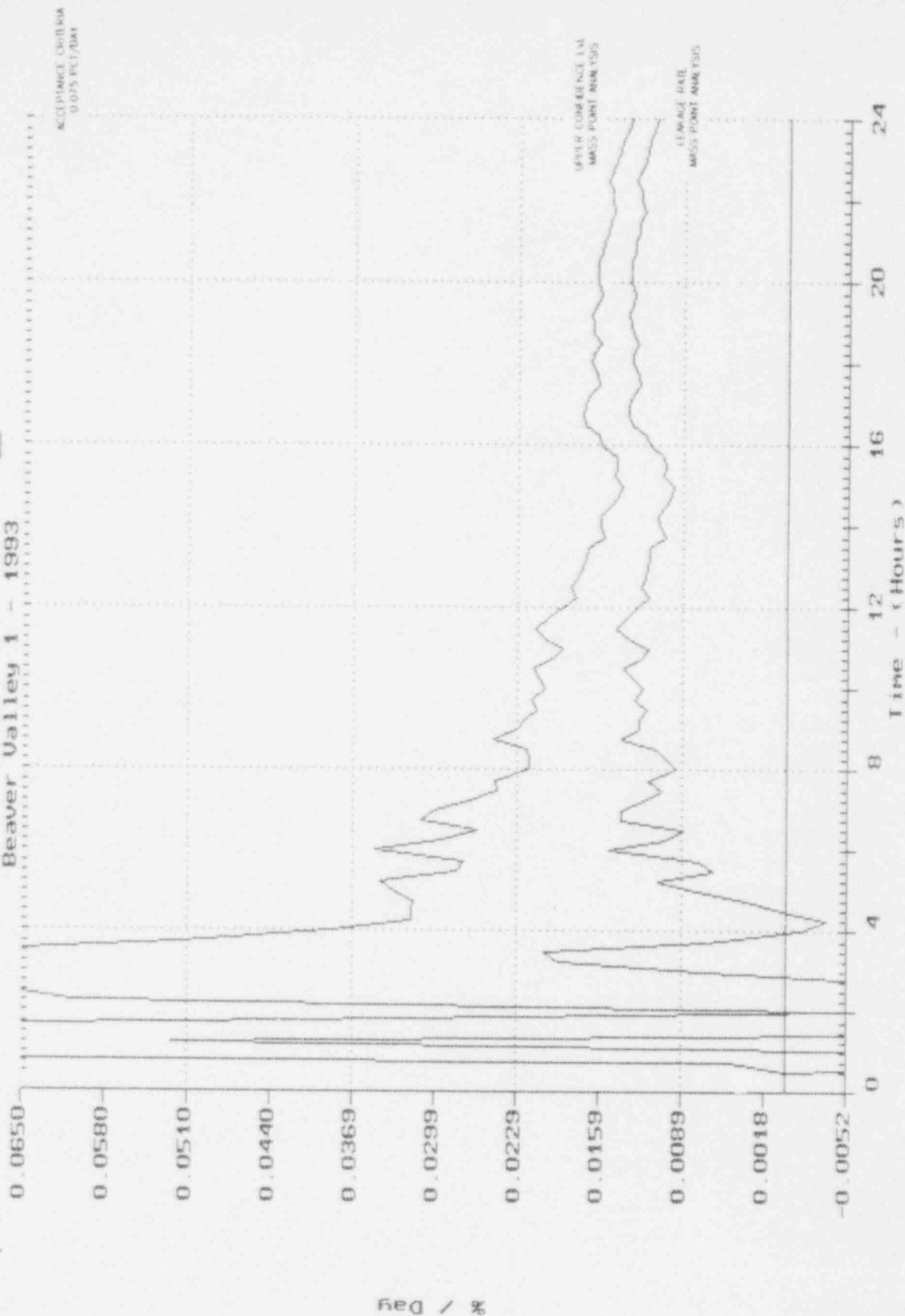
Beaver Valley 1 - 1993



BEAVER VALLEY POWER STATION UNIT NO. 1  
 INTEGRATED LEAKAGE RATE TEST  
 ATTACHMENT 3.3D - CMT LEAKAGE RATE VS TIME

# Mass Point Leakage

Beaver Valley 1 - 1993



ATTACHMENT 3.3E  
 SUPERIMPOSED LEAKAGE VERIFICATION TEST  
 FROM 2045 HOURS ON 5/28/93 TO 0045 HOURS ON 5/29/93  
 REDUCED INPUT VARIABLES

Time (hh:mm)	Press. (PSIA)	V.P. (PSI)	Temp. (R)	Dewpoint (F)	Mass (Lbm)
20:45	57.027	0.3735	536.411	70.842	501731.56
20:50	57.029	0.3734	536.408	70.837	501750.62
20:55	57.028	0.3738	536.407	70.870	501742.66
21:00	57.028	0.3766	536.413	71.085	501710.00
21:05	57.028	0.3783	536.419	71.221	501687.14
21:10	57.027	0.3745	536.416	70.925	501717.44
21:15	57.028	0.3764	536.423	71.068	501702.68
21:20	57.027	0.3738	536.418	70.870	501719.50
21:25	57.026	0.3687	536.421	70.466	501751.94
21:30	57.027	0.3787	536.424	71.254	501671.44
21:35	57.027	0.3762	536.422	71.058	501696.86
21:40	57.028	0.3757	536.431	71.014	501700.97
21:45	57.028	0.3720	536.431	70.726	501728.94
21:50	57.027	0.3751	536.432	70.967	501694.23
21:55	57.029	0.3752	536.435	70.975	501711.57
22:00	57.028	0.3765	536.440	71.076	501683.84
22:05	57.028	0.3756	536.437	71.009	501693.13
22:10	57.027	0.3751	536.437	70.972	501690.29
22:15	57.027	0.3800	536.441	71.348	501643.60
22:20	57.027	0.3740	536.440	70.879	501694.77
22:25	57.025	0.3751	536.441	70.973	501671.71
22:30	57.027	0.3743	536.448	70.907	501690.96
22:35	57.028	0.3704	536.447	70.600	501732.33
22:40	57.027	0.3757	536.453	71.014	501674.26
22:45	57.027	0.3727	536.458	70.779	501694.91
22:50	57.026	0.3760	536.456	71.042	501659.77
22:55	57.029	0.3731	536.458	70.814	501705.43
23:00	57.028	0.3757	536.456	71.020	501673.75
23:05	57.028	0.3765	536.466	71.082	501655.42
23:10	57.027	0.3733	536.465	70.824	501681.03
23:15	57.026	0.3741	536.462	70.890	501672.21
23:20	57.026	0.3742	536.466	70.901	501667.67
23:25	57.026	0.3735	536.470	70.841	501663.11
23:30	57.025	0.3758	536.471	71.023	501639.24
23:35	57.027	0.3715	536.474	70.683	501688.68
23:40	57.027	0.3731	536.476	70.810	501675.77
23:45	57.027	0.3763	536.477	71.066	501640.72
23:50	57.026	0.3758	536.479	71.025	501637.87
23:55	57.027	0.3754	536.480	70.995	501650.61
00:00	57.027	0.3736	536.487	70.855	501658.77
00:05	57.027	0.3731	536.488	70.814	501659.02
00:10	57.026	0.3745	536.486	70.919	501641.63
00:15	57.026	0.3764	536.488	71.067	501623.66
00:20	57.025	0.3718	536.496	70.709	501649.67
00:25	57.025	0.3788	536.495	71.255	501582.85
00:30	57.026	0.3733	536.496	70.829	501644.83
00:35	57.026	0.3742	536.500	70.900	501633.92
00:40	57.027	0.3739	536.498	70.874	501642.15
00:45	57.026	0.3735	536.501	70.846	501633.55

ATTACHMENT 3.3F  
 SUPERIMPOSED LEAKAGE VERIFICATION TEST  
 FROM 2045 HOURS ON 5/28/93 TO 0045 HOURS ON 5/29/93  
 ABSOLUTE TEST METHOD, MASS POINT ANALYSIS TEST METHOD

Time (hh:mm)	Mass (LBM)	Leakage (PCT./DAY)	Confidence (PCT./DAY)	UCL (PCT./DAY)
20:45	501731.56	0.000000	0.000000	0.000000
20:50	501750.62	0.000000	0.000000	0.000000
20:55	501742.66	-0.318537	3.829623	3.511086
21:00	501710.00	0.417021	1.381328	1.798349
21:05	501687.14	0.743077	0.777033	1.520110
21:10	501717.44	0.481666	0.561830	1.043496
21:15	501702.68	0.427468	0.380761	0.808229
21:20	501719.50	0.288791	0.314821	0.603613
21:25	501751.94	0.080689	0.329168	0.409858
21:30	501671.44	0.222404	0.299289	0.521693
21:35	501696.86	0.223266	0.240896	0.464162
21:40	501700.97	0.206097	0.198992	0.405089
21:45	501728.94	0.135990	0.181807	0.317797
21:50	501694.23	0.144975	0.154788	0.299762
21:55	501711.57	0.122297	0.135199	0.257497
22:00	501683.84	0.139544	0.118886	0.258430
22:05	501693.13	0.138181	0.104365	0.242546
22:10	501690.29	0.137664	0.092353	0.230017
22:15	501643.60	0.177434	0.091486	0.268920
22:20	501694.77	0.161914	0.083509	0.245423
22:25	501671.71	0.165517	0.075408	0.240925
22:30	501690.96	0.153157	0.069462	0.222619
22:35	501732.33	0.116278	0.073108	0.189386
22:40	501674.26	0.120052	0.066969	0.187021
22:45	501694.91	0.110938	0.062143	0.173081
22:50	501659.77	0.120060	0.057960	0.178020
22:55	501705.43	0.105547	0.055454	0.161001
23:00	501673.75	0.106587	0.051622	0.158009
23:05	501655.42	0.113947	0.048350	0.162297
23:10	501681.03	0.109713	0.045258	0.154971
23:15	501672.21	0.108645	0.042298	0.150943
23:20	501667.67	0.108629	0.039608	0.148237
23:25	501663.11	0.109432	0.037175	0.146608
23:30	501639.24	0.116460	0.035622	0.152082
23:35	501688.68	0.108281	0.034493	0.142774
23:40	501675.77	0.104241	0.032786	0.137027
23:45	501640.72	0.108963	0.031328	0.140291
23:50	501637.87	0.113200	0.029942	0.143141
23:55	501650.61	0.113568	0.028387	0.141955
00:00	501658.77	0.111755	0.027007	0.138762
00:05	501659.02	0.109755	0.025746	0.135501
00:10	501641.63	0.110981	0.024533	0.135513
00:15	501623.66	0.114962	0.023695	0.138657
00:20	501649.67	0.113551	0.022647	0.136198
00:25	501582.85	0.123108	0.023534	0.146641
00:30	501644.83	0.121258	0.022570	0.143828
00:35	501633.92	0.120976	0.021601	0.142577
00:40	501642.15	0.119214	0.020761	0.139976
00:45	501633.55	0.118578	0.019914	0.138492

## SECTION 4

### LOCAL LEAKAGE RATE TESTS (TYPES B AND C)

Local Leak Rate Testing (LLRT) of containment penetrations is performed on a periodic basis (normally each refueling, but not exceeding 24 months), in accordance with 10 CFR 50 Appendix J and Beaver Valley Power Station #1 Technical Specifications. These LLRT's are performed by pressurizing the required penetrations with air or nitrogen and either measuring leakage across the containment isolation valves boundary (Type C), or across the resilient seals (Type B). The combined leakage rate of containment penetrations subject to LLRT's shall be less than 60 percent Ia, at a minimum test pressure of Pa.

Additionally LLRT's (Total Volume Type B) are performed for each containment airlock at 6 month intervals in accordance with 10 CFR 50 Appendix J, and Beaver Valley Power Station #1 Technical Specifications.

The attachments for this section are:

<u>Attachment No.</u>	<u>Title</u>
4.1A	Eighth Refueling (4/91 - 6/91) LLRT Data
4.1B	Eighth Refueling (4/91 - 6/91) LLRT Repairs
4.1C	Ninth Refueling (3/93 - 5/93) LLRT Data
4.1D	Ninth Refueling (3/93 - 5/93) LLRT Repairs
4.1E	Eighth and Ninth Fuel Cycle LLRT Data

## ATTACHMENT 4.1A

EIGHTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
1	MOV-1CC-112A2	X		05-03-91	0.47	0.47	1.98
	1CCR-247		X	05-03-91	1.98	1.98	
2	MOV-1CC-112B3	X		04-30-91	0.47	0.47	11.29
	1CCR-252		X	04-30-91	11.29	11.29	
4	MOV-1CC-112A3	X		05-03-91	9.83	9.83	12.45
	1CCR-251		X	05-03-91	12.45	12.45	
5	MOV-1CC-112B2	X		04-30-91	0.47	0.47	5.65
	1CCR-248		X	04-30-91	5.65	5.65	
8	TV-1CC-107D1	X		05-14-91	1.44	1.44	1.44
	TV-1CC-107D2		X	05-14-91	0.62	0.62	
9	TV-1CC-111D1	X		04-18-91	3.28	3.28	3.28
	TV-1CC-111D2		X	04-18-91	0.91	0.91	
11	TV-1CC-110D	X		04-19-91	5.15	5.15	5.15
	TV-1CC-110F1		X	04-19-91	0.49	0.49	
	TV-1CC-110F2		X				
13	1FP-827	X		05-02-91	0.47	0.47	0.70
	TV-1FP-107		X	05-02-91	0.70	0.70	
14	TV-1CC-110E3	X		04-18-91	0.47	0.47	0.47
	TV-1CC-110E2		X	04-18-91	0.47	0.47	
16	TV-1CC-111A2	X		06-05-91	2796	8.90	8.90
	TV-1CC-111A1		X	05-13-91	3.38	3.38	
17	TV-1CC-103B1	X		05-15-91	0.46	0.46	6.74
	TV-1CC-103B		X	05-15-91	6.74	6.74	
TOTAL PENETRATION LEAKAGE SHEET 1 (SCF/D)							58.05

## ATTACHMENT 4.1A (continued)

EIGHTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
18	TV-1CC-103C1	X		05-06-91	0.47	0.47	3.95
	TV-1CC-103C		X	05-06-91	3.95	3.95	
19	MOV-1CH-378	X		05-04-91	17.33	17.33	17.33
	1CH-369	X					
	MOV-1CH-381		X	05-04-91	0.47	0.47	
20	1SI-42	X		05-10-91	3.37	3.37	3.37
	1SI-41		X	05-10-91	0.47	0.47	
24	1RH-14	X		05-04-91	0.49	0.49	4.68
	1RH-16	X		05-04-91	0.47	0.47	
	1RH-15		X	05-07-91	4.68	4.68	
25	TV-1CC-105D1	X		06-09-91	185.93	88.81	88.81
	TV-1CC-105D2		X	05-15-91	55.01	55.01	
26	TV-1CC-107E1	X		05-31-91	18.71	75.42	75.42
	TV-1CC-107E2		X	05-11-91	0.79	0.79	
27	TV-1CC-105E1	X		05-11-91	5.14	5.14	5.14
	TV-1CC-105E2		X	05-11-91	0.56	0.56	
28	TV-1CH-200A	X		05-13-91	6.08	24.23	94.87
	TV-1CH-200B	X					
	TV-1CH-200C	X					
	RV-1CH-203	X		05-13-91	0.47	0.47	
	MOV-1CH-142	X		04-29-91	70.17	70.17	
	TV-1CH-204		X	04-29-91	0.47	0.47	
TOTAL PENETRATION LEAKAGE SHEET 2 (SCF/D)							293.57



## ATTACHMENT 4.1A (continued)

EIGHTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
29	TV-1DG-108A	X		05-04-91	6.56	6.56	6.56
	TV-1DG-108B		X	05-04-91	4.68	4.68	
31	1FP-804	X		05-10-91	> 2820	2.34	2.34
	TV-1FP-105		X	05-01-91	0.47	0.47	
32	1FP-800	X		05-01-91	0.51	0.51	0.51
	TV-1FP-106		X	05-01-91	0.47	0.47	
38	TV-1DA-100A	X		05-17-91	40.70	44.20	44.20
	TV-1DA-100B		X	05-06-91	5.15	5.15	
42	1SA-15	X		04-15-91	17.21	17.21	17.21
	1SA-14		X	05-07-91	52.58	4.28	
43	TV-1CV-102-1	X		04-16-91	0.47	0.47	0.47
	TV-1CV-102		X	04-16-91	0.47	0.47	
44	TV-1CV-101A	X		04-16-91	12.17	12.17	12.17
	TV-1CV-101B		X	04-16-91	9.83	9.83	
45	1RC-72	X		04-17-91	20.70	20.70	20.70
	TV-1RC-519		X	04-17-91	0.47	0.47	
47	11A-91	X		05-07-91	33.25	33.25	33.25
	11A-90		X	05-07-91	1.50	1.47	
48	TV-1DG-109A2	X		05-01-91	0.47	0.47	0.47
	TV-1DG-109A1		X	05-01-91	0.47	0.47	
49	1RC-68	X		05-25-91	210.33	56.30	56.30
	TV-1RC-101		X	05-18-91	0.55	0.55	
TOTAL PENETRATION LEAKAGE SHEET 3 (SCF/D)							194.18

## ATTACHMENT 4.1A (continued)

## EIGHTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
53	TV-1SI-101-2	X		05-09-91	9.52	9.52	17.67
	TV-1SI-101-1		X	05-26-91	80.96	17.67	
55-1	TV-1SS-109A1	X		05-04-91	0.47	0.47	0.47
	TV-1SS-109A2		X	05-04-91	0.47	0.47	
55-2 NOTE 1	TV-1LM-100A1		X	04-15-91	0.47	0.47	0.47
	TV-1LM-100A2		X	04-15-91	0.47	0.47	
55-4	TV-1SS-111A1	X		05-04-91	0.47	0.47	0.47
	TV-1SS-111A2		X	05-04-91	0.47	0.47	
56-1	TV-1SS-100A1	X		05-04-91	0.47	0.47	0.47
	TV-1SS-100A2		X	05-04-91	0.47	0.47	
56-2	TV-1SS-102A1	X		05-11-91	0.47	0.47	0.47
	TV-1SS-102A2		X	05-11-91	0.47	0.47	
56-3	TV-1SS-105A1	X		05-22-91	0.47	0.47	0.47
	TV-1SS-105A2		X	05-22-91	0.47	0.47	
58	TV-1CC-103A1	X		05-08-91	0.47	0.84	14.13
	TV-1CC-103A		X	05-06-91	14.13	14.13	
63	1QS-4	X		04-24-91	0.47	0.47	14.96
	MOV-1QS-101B		X	06-08-91	682.17	14.96	
64	1QS-3	X		04-24-91	6.11	6.11	19.27
	MOV-1QS-101A		X	04-24-91	19.27	19.27	
TOTAL PENETRATION LEAKAGE SHEET 4 (SCF/D)							68.85

NOTE 1 - INCLUDES PENETRATIONS 57-1, 57-2, AND 97-3 WHICH ALSO SHARE THESE CNMT ISOLATION VALVES THROUGH A COMMON 4-WAY VALVE.

## ATTACHMENT 4.1A (continued)

## EIGHTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
70	1RS-101	X		05-22-91	5.17	3.28	3.28
71	1RS-100	X		05-29-91	15.98	1.13	1.13
87	1HY-197		X	04-20-91	1.60	0.66	0.66
	1HY-111		X	04-20-91	28.17	0.47	
88	1HY-196		X	04-17-91	0.70	0.70	0.70
	1HY-110		X	04-17-91	0.70	0.70	
89	1AS-278	X		05-16-91	211.71	20.01	20.01
	TV-1SV-100A		X	04-20-91	7.06	7.06	
90	1VS-D-5-3B	X		04-22-91	9.37	9.37	9.37
	1VS-D-5-3A		X				
91	1VS-D-5-5B	X		04-22-91	4.59	4.59	4.59
	1VS-D-5-5A		X				
	1VS-D-5-6		X				
92	TV-1CV-150C		X	04-17-91	4.70	4.70	23.52
	1HY-102		X	04-17-91	4.70	4.70	
	TV-1CV-150D		X	04-17-91	18.82	18.82	
	1HY-104		X	04-17-91	4.70	4.70	
93	TV-1CV-150B		X	04-16-91	3.29	3.29	4.23
	1HY-101		X	04-16-91	0.47	0.47	
	TV-1CV-150A		X	04-16-91	3.76	3.76	
	1HY-103		X	04-16-91	0.47	0.47	
TOTAL PENETRATION LEAKAGE SHEET 5 (SCF/D)							67.49

## ATTACHMENT 4.1A (continued)

## EIGHTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
94	HCV-1CV-151	X		04-30-91	7.48	7.48	9.37
	HCV-1CV-151-1		X	05-04-91	> 2820	9.37	
95-64	SOV-1HY-102B1	X		04-22-91	0.47	0.47	0.47
	SOV-1HY-102B2		X	04-22-91	0.47	0.47	
95-69	SOV-1HY-103B1	X		04-22-91	0.47	0.47	0.47
	SOV-1HY-103B2		X	04-22-91	0.47	0.47	
95-72	SOV-1HY-104B1	X		04-22-91	0.47	0.47	0.47
	SOV-1HY-104B2		X	04-22-91	0.47	0.47	
97-1	TV-1SS-104A1	X		05-02-91	0.47	0.47	0.47
	TV-1SS-104A2		X	05-02-91	0.47	0.47	
97-2	TV-1SS-103A1	X		05-02-91	0.47	0.47	0.47
	TV-1SS-103A2		X	05-02-91	0.47	0.47	
103	1PC-38	X		04-22-91	0.47	0.47	0.47
	1PC-37		X	04-22-91	0.47	0.47	
104	1PC-9	X		04-20-91	3.77	3.77	3.77
	1PC-10		X	04-20-91	0.47	0.47	
105-2	TV-1SS-112A1	X		05-10-91	3.74	3.74	3.74
	TV-1SS-112A2		X	05-10-91	3.74	3.74	
106	MOV-1SI-842	X		04-23-91	0.47	0.47	0.47
	TV-1SI-889		X	04-23-91	0.47	0.47	
109-44	SOV-1HY-102A1	X		04-22-91	0.47	0.47	0.47
	SOV-1HY-102A2		X	04-22-91	0.47	0.47	
TOTAL PENETRATION LEAKAGE SHEET 6 (SCF/D)							20.64

## ATTACHMENT 4.1A (continued)

EIGHTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
109-49	SOV-1HY-103A1	X		04-22-91	0.47	0.47	0.47
	SOV-1HY-103A2		X	04-22-91	0.47	0.47	
109-52	SOV-1HY-104A1	X		04-22-91	0.47	0.47	0.47
	SOV-1HY-104A2		X	04-22-91	0.47	0.47	
110-1	1RC-277		X	04-23-91	0.47	0.47	0.47
	1RC-278		X	04-23-91	0.47	0.47	
P.A.L.	1VS-169	X		05-08-91	0.47	0.47	(NOTE 2)
	1VS-170	X		05-01-91	0.47	0.47	
	1VS-167		X	05-01-91	0.47	0.47	
	1VS-168		X	05-01-91	0.47	0.47	
TOTAL PENETRATION LEAKAGE SHEET 7 (SCF/D)							1.41

NOTE 2 - THE ASSIGNED PENETRATION LEAKAGE FOR THESE VALVES IS ADDED WITH THE PERSONNEL AIRLOCK OVERALL TYPE B LEAKAGE, AND NOT INCLUDED IN THE TYPE C TOTAL. P.A.L. = PERSONNEL AIRLOCK

TOTAL PENETRATION LEAKAGE SHEET 1	(SCF/D)	58.05
TOTAL PENETRATION LEAKAGE SHEET 2	(SCF/D)	293.57
TOTAL PENETRATION LEAKAGE SHEET 3	(SCF/D)	194.18
TOTAL PENETRATION LEAKAGE SHEET 4	(SCF/D)	68.85
TOTAL PENETRATION LEAKAGE SHEET 5	(SCF/D)	67.49
TOTAL PENETRATION LEAKAGE SHEET 6	(SCF/D)	20.64
TOTAL PENETRATION LEAKAGE SHEET 7	(SCF/D)	1.41
TOTAL CONTAINMENT TYPE C LEAKAGE - SUM OF SHEETS 1 THRU 7 (SCF/D)		704.19

## ATTACHMENT 4.1A (continued)

EIGHTH REFUELING TYPE B AND C TEST RESULTS

PENETRATION	DATE TESTED	AS FOUND LEAKAGE (SCF/D)	AS LEFT LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE
Electrical Penetrations	04-15-91	35.66	22.27	22.27
Fuel Transfer Tube	06-07-91	0.47	13.03	13.03
Penetration #111	04-15-91	0.47	0.47	0.47
Penetration #112	04-15-91	0.47	0.47	0.47
Equipment Hatch Outer Flange	06-10-91	0.47	0.47	0.47
Equipment Hatch Inner Flange	06-12-91	0.48	0.47	0.47
Personnel Airlock	06-05-91	288.59	123.29	123.29
Equipment Hatch Airlock	06-13-91	13.04	7.07	7.07

Total Type 'B' Leakage 167.54 SCF/D

Total Type 'C' Leakage 704.19 SCF/D

Total Type 'B' and 'C' Leakage 871.73 SCF/D

(Acceptance Criteria < 3,929.00 SCF/D [0.6 La])

## ATTACHMENT 4.1B

### EIGHTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

#### Penetration No. 16

The "As-Found" leak test was performed on May 13, 1991. Due to excessive seat leakage, Maintenance Work Request 913397 was initiated for valve TV-1CC-111A2. The valve actuator was first checked by I&C. Following verification of proper actuator operation, Maintenance Work Request 913445 was initiated. The valve seat ring was replaced and the seat was lapped. An "As-Left" leak test was performed on June 5, 1991, with a leakage of 8.90 SCF/D measured.

#### Penetration No. 24

The "As-Found" leak test was performed on May 4, 1991. Due to a body to bonnet leak during operation, Maintenance Work Request 900978 was initiated for valve 1RH-15. The body to bonnet gasket was replaced and the valve was repacked. An "As-Left" leak test was performed on May 7, 1991, with a leakage of 4.68 SCF/D measured.

#### Penetration No. 25

The "As-Found" leak test was performed on May 15, 1991. Due to excessive seat leakage, Maintenance Work Request 913398 was initiated for valve TV-1CC-105D1. The valve actuator was first checked by I&C. Following verification of proper actuator operation, Maintenance Work Request 914014 was initiated. The valve seat ring was replaced and the seat and plug were lapped. An "As-Left" leak test was performed on June 9, 1991, with a leakage of 88.81 SCF/D measured.

#### Penetration No. 26

The "As-Found" leak test was performed on May 11, 1991. Due to valve TV-1CC-107E1 failing OST 1.1.16 "Diaphragm Integrity Test", Maintenance Work Request 910695 was initiated by Operations. A loose stem nut was found to be the cause of the failure and the actuator was re-assembled with a new diaphragm. Following the repair a retest was performed on May 29, 1991. Due to excessive seat leakage, Maintenance Work Request 913760 was initiated. The valve actuator was found out of adjustment and repaired. An "As-Left" leak test was performed on May 31, 1991, with a leakage of 75.42 SCF/D measured.

#### Penetration No. 28

The "As-Found" leak test was performed on April 29, 1991. As a preventive measure, the actuator of valve TV-1CH-200C was rebuilt per Maintenance Work Request 912751. An "As-Left" leak test was performed on May 13, 1991, with a leakage of 24.23 SCF/D measured.

The "As-Found" leak test was performed on April 29, 1991. Due to relief valve RV-1CH-203 suspected of leaking by during operation, Maintenance Work Request 910615 was initiated by Operations. The valve was removed, bench tested satisfactorily and reinstalled. An "As-Left" leak test was performed on May 13, 1991, with a leakage of 0.47 SCF/D measured.

ATTACHMENT 4.1B (continued)

EIGHTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 31

The "As-Found" leak test was performed on May 1, 1991. Due to excessive seat leakage, Maintenance Work Request 913370 was initiated for valve 1FP-804. The valve disc arm set screw had become loose allowing the disc to shift from the center of the seat. Following the repair an "As-Left" leak test was performed on May 10, 1991, with a leakage of 2.34 SCF/D measured.

Penetration No. 38

The "As-Found" leak test was performed May 6, 1991. As a preventive measure, the actuator of valve TV-1DA-100A was rebuilt per Maintenance Work Request 9127531. An "As-Left" leak test was performed on May 17, 1991, with a leakage of 44.20 SCF/D measured.

Penetration No. 42

The "As-Found" leak test was performed on April 15, 1991. Due to excessive seat leakage, Maintenance Work Request 913363 was initiated for valve 1SA-14. The valve wedge was lapped. An "As-Left" leak test was performed on May 7, 1991, with a leakage of 1.47 SCF/D measured.

Penetration No. 47

The "As-Found" leak test was performed on May 7, 1991. Due to excessive packing leakage during operation, Maintenance Work Request 903972 was initiated for valve 1IA-90 prior to the outage. The valve packing was replaced. An "As-Left" leak test was performed on May 7, 1991, with a leakage of 1.47 SCF/D measured.

Penetration No. 49

The "As-Found" leak test was performed on April 20, 1991. Due to excessive seat leakage, Maintenance Work Request 913366 was initiated for check valve 1RC-68. Maintenance Work Request 913 392 was initiated for valve 1RC-69, a penetration boundary valve, which was also contributing to the high leakage measurement. The closing spring was replaced for valve RC-68 and the diaphragm was replaced for valve 1RC-69. An "As-Left" leak test was performed on May 25, 1991, with a leakage of 56.30 SCF/D measured.

An "As-Found" leak test was attempted on April 20, 1991 for valve TV-1RC-101; however, due to a leaking test connection, an accurate leakage rate was not able to be measured. Maintenance Work Request 913365 was initiated to replace the test connection. Following the replacement, an acceptable "As-Left" leak test was performed on May 18, 1991.



ATTACHMENT 4.1B (continued)

EIGHTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 53

The "As-Found" leak test was performed on May 9, 1991. Due to excessive leakage, Maintenance Work Request 913396 was initiated for valve TV-1SI-101-1. The valve seat and plug were cleaned and the valve rebuilt with original parts. An "As-Left" leak test was performed on May 26, 1991, with a leakage of 17.67 SCF/D measured.

Penetration No. 58

The "As-Found" leak test was performed on May 6, 1991. Due to excessive packing leakage, Maintenance Work Request 913607 was initiated for valve TV-1CC-103A1 by Operations. The valve packing was replaced. An "As-Left" leak test was performed on May 8, 1991, with a leakage of 0.84 SCF/D measured.

Penetration No. 63

The "As-Found" leak test was performed on April 24, 1991. Due to excessive seat leakage, Maintenance Work Request 913367 was initiated for valve KOV-1QS-101B. The valve wedge was replaced and lapped to the seats. An "As-Left" leak test was performed on June 8, 1991, with a leakage of 14.96 SCF/D measured.

Penetration No. 70

The "As-Found" leak test was performed on April 18, 1991. Due to recommendations from the valve vendor, check valve IRS-101 was modified per Maintenance Work Request 893246. Following the modification, an "As-Left" leak test was performed on May 22, 1991, with a leakage of 3.28 SCF/D measured.

Penetration No. 71

The "As-Found" leak test was performed on April 18, 1991. Due to recommendations from the valve vendor, check valves IRS-100 was modified per Maintenance Work Request 893245. Following the modification, an "As-Left" leak test was performed on May 29, 1991, with a leakage of 1.13 SCF/D measured.

Penetration No. 87

The "As-Found" leak test was performed on April 17, 1991. Due to excessive seat leakage, Maintenance Work Request 913364 was initiated for valve 1HY-111. The valve body, ball, studs, stem, o-rings, and stem seals were replaced. An "As-Left" leak test was performed on April 20, 1991, with a leakage of 0.47 SCF/D measured. The outboard valve, 1HY-197, was also retested; since the stem seals of valve 1HY-111 were leaking during its "As-Found" leak test.

ATTACHMENT 4.1B (continued)

EIGHTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 89

The "As-Found" leak test was performed on April 20, 1991. Due to recommendations from the valve vendor, check valve 1AS-278 was modified per Maintenance Work Request 894435. Following the modification, an "As-Left" leak test was performed on May 16, 1991, with a leakage of 20.01 SCF/D measured.

Penetration No. 94

The "As-Found" leak test was performed on April 30, 1991. Due to the external stop being bent for valve HCV-1CV-15-1, the valve closed beyond its optimum seating position (butterfly valve). Maintenance Work Request 913391 was initiated to repair the stop. An "As-Left" leak test was performed on May 4, 1991, with a leakage of 9.37 SCF/D measured.

Penetration No. 105-2

The "As-Found" leak test was attempted on May 4, 1991. Due to excessive leakage through the packing of boundary valve TV-1SS-110, Maintenance Work Request 913393 was initiated. Following the repair of valve TV-1SS-110, an "As-Left" leak test was performed on May 10, 1991.

## ATTACHMENT 4.1C

NINTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
1	MOV-1CC-112A2	X		04-29-93	0.47	0.47	3.23
	1CCR-247		X	04-29-93	3.23	3.23	
2	MOV-1CC-112B3	X		05-07-93	0.47	1.64	34.56
	1CCR-252		X	04-27-93	34.56	34.56	
4	MOV-1CC-112A3	X		04-29-93	0.47	0.47	22.68
	1CCR-251		X	04-29-93	22.68	22.68	
5	MOV-1CC-112B2	X		05-02-93	0.47	0.47	3.12
	1CCR-248		X	04-27-93	3.12	3.12	
8	TV-1CC-107D1	X		05-14-93	1.41	0.47	0.57
	TV-1CC-107D2		X	05-14-93	0.57	0.57	
9	TV-1CC-111D1	X		04-06-93	0.47	0.47	0.57
	TV-1CC-111D2		X	04-06-93	0.57	0.57	
11	TV-1CC-110D	X		04-03-93	0.66	0.66	0.66
	TV-1CC-110F1		X	04-03-93	0.47	0.47	
	TV-1CC-110F2		X				
13	1FP-827	X		05-01-93	0.47	0.47	0.47
	TV-1FP-107		X	05-01-93	0.47	0.47	
14	TV-1CC-110E3	X		04-03-93	0.47	0.47	0.47
	TV-1CC-110E2		X	05-21-93	0.47	0.47	
16	TV-1CC-111A2	X		04-26-93	0.47	0.47	10.21
	TV-1CC-111A1		X	04-26-93	10.21	10.21	
17	TV-1CC-103B1	X		05-09-93	0.94	0.47	8.49
	TV-1CC-103B		X	05-08-93	6.24	8.49	
TOTAL PENETRATION LEAKAGE SHEET 1 (SCF/D)							85.03

## ATTACHMENT 4.1C (continued)

NINTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
18	TV-1CC-103C1	X		05-16-93	5.25	35.45	35.45
	TV-1CC-103C		X	05-08-93	29.99	28.49	
19	MOV-1CH-378	X		04-06-93	28.78	28.78	28.78
	1CH-369	X					
	MOV-1CH-381		X	04-06-93	0.47	0.47	
20	LSI-42	X		04-12-93	1.88	1.88	1.88
	LSI-41		X	04-12-93	0.47	0.47	
24	LRH-14	X		04-30-93	0.49	0.49	15.5
	LRH-16	X		05-03-93	704.4	14.03	
	LRH-15		X	04-30-93	15.5	15.5	
25	TV-1CC-105D1	X		05-04-93	399.89	26.64	46.85
	TV-1CC-105D2		X	05-04-93	1.99	46.85	
26	TV-1CC-107E1	X		04-17-93	79.9	0.94	10.2
	TV-1CC-107E2		X	04-17-93	8.51	10.2	
27	TV-1CC-105E1	X		04-25-93	5.64	33.9	33.9
	TV-1CC-105E2		X	04-25-93	0.57	0.57	
28	TV-1CH-200A	X		05-08-93	93.9	0.47	1.41
	TV-1CH-200B	X					
	TV-1CH-200C	X					
	RV-1CH-203	X		04-26-93	0.47	0.47	
	MOV-1CH-142	X		05-19-93	385.1	0.47	
	TV-1CH-204		X	04-26-93	0.47	0.47	
TOTAL PENETRATION LEAKAGE SHEET 2 (SCF/D)							173.97

## ATTACHMENT 4.1C (continued)

## NINTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
29	TV-1DG-108A	X		04-08-93	9.41	9.41	9.41
	TV-1DG-108B		X	04-08-93	8.47	8.47	
31	1FP-804	X		05-01-93	0.70	0.70	0.70
	TV-1FP-105		X	05-01-93	0.70	0.70	
32	1FP-800	X		05-14-93	0.47	3.41	3.41
	TV-1FP-106		X	04-30-93	0.47	0.47	
38	TV-1DA-100A	X		05-17-93	207.00	0.47	4.30
	TV-1DA-100B		X	05-05-93	44.70	4.30	
42	1SA-15	X		05-03-93	52.48	21.52	21.52
	1SA-14		X	05-03-93	114.51	6.55	
43	TV-1CV-102-1	X		03-31-93	0.47	0.47	0.47
	TV-1CV-102		X	03-31-93	0.47	0.47	
44	TV-1CV-101A		X	03-31-93	0.47	0.47	0.47
	TV-1CV-101B		X	03-31-03	0.47	0.47	
45	1RC-72	X		04-16-93	2.82	2.82	2.82
	TV-1RC-519		X	04-16-93	0.47	0.47	
47	1IA-91	X		04-30-93	25.80	25.80	25.80
	1IA-90		X	05-18-93	234.57	2.35	
48	TV-1DG-109A2	X		04-07-93	2.12	2.12	3.29
	TV-1DG-109A1		X	04-07-93	3.29	3.29	
49	1RC-68	X		05-03-93	117.60	13.55	13.55
	TV-1RC-101		X	04-01-93	0.52	0.52	
TOTAL PENETRATION LEAKAGE SHEET 3 (SCF/D)							85.74

## ATTACHMENT 4.1C (continued)

NINTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
53	TV-1SI-101-2	X		04-09-93	11.98	11.98	11.98
	TV-1SI-101-1		X	04-09-93	9.11	9.11	
55-1	TV-1SS-109A1	X		05-09-93	0.47	0.47	0.47
	TV-1SS-109A2		X	05-09-93	0.47	0.47	
55-2 NOTE 1	TV-1LM-100A1		X	03-29-93	0.47	0.47	0.47
	TV-1LM-100A2		X	03-29-93	0.47	0.47	
55-4	TV-1SS-111A1	X		04-16-93	0.47	0.47	0.47
	TV-1SS-111A2		X	04-16-93	0.47	0.47	
56-1	TV-1SS-100A1	X		04-16-93	0.47	0.47	0.47
	TV-1SS-100A2		X	04-16-93	0.47	0.47	
56-2	TV-1SS-102A1	X		04-04-93	0.47	0.47	0.47
	TV-1SS-102A2		X	05-14-93	0.47	0.47	
56-3	TV-1SS-105A1	X		05-14-93	0.66	0.47	0.47
	TV-1SS-105A2		X	05-14-93	0.66	0.47	
58	TV-1CC-103A1	X		05-07-93	2.35	3.42	4.98
	TV-1CC-103A		X	05-07-93	5.39	4.98	
63	1QS-4	X		04-15-93	0.47	0.47	17.89
	MOV-1QS-101B		X	05-18-93	0.47	17.89	
64	1QS-3	X		04-15-93	20.76	0.47	0.47
	MOV-1QS-101A		X	05-15-93	21.7	0.47	
TOTAL PENETRATION LEAKAGE SHEET 4 (SCF/D)							38.14

NOTE 1 - INCLUDES PENETRATIONS 57-1, 57-2, AND 97-3 WHICH ALSO SHARE THESE CMT ISOLATION VALVES THROUGH A COMMON 4-WAY VALVE.

## ATTACHMENT 4.1C (continued)

NINTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
70	1RS-101	X		04-07-93	0.47	0.47	0.47
71	1RS-100	X		04-08-93	0.47	0.47	0.47
87	1HY-197		X	04-04-93	1.65	1.65	1.65
	1HY-111		X	04-04-93	0.47	0.47	
88	1HY-196		X	04-04-93	0.71	0.71	0.71
	1HY-110		X	04-04-93	0.71	0.71	
89	1AS-278	X		04-15-93	>2266.8	18.84	18.84
	TV-LSV-100A		X	04-15-93	11.81	5.65	
90	1VS-D-5-3B	X		04-08-93	23.03	23.03	23.03
	1VS-D-5-3A		X				
91	1VS-D-5-5B	X		04-04-93	7.04	7.04	7.04
	1VS-D-5-5A		X				
	1VS-D-5-6		X				
92	TV-1CV-150C		X	04-01-93	13.18	13.18	34.38
	1HY-102		X	04-01-93	12.71	12.71	
	TV-1CV-150D		X	04-01-93	21.67	21.67	
	1HY-104		X	04-01-93	12.71	12.71	
93	TV-1CV-150B		X	04-01-93	9.42	9.42	18.84
	1HY-101		X	04-01-93	9.42	9.42	
	TV-1CV-150A		X	04-01-93	9.42	9.42	
	1HY-103		X	04-01-93	9.42	9.42	
TOTAL PENETRATION LEAKAGE SHEET 5 (SCF/D)							103.43

## ATTACHMENT 4.1C (continued)

NINTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (3CF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
94	HCV-1CV-151	X		04-13-93	12.27	12.27	13.21
	HCV-1CV-151-1		X	04-13-93	13.21	13.21	
95-64	SOV-1HY-102B1	X		04-08-93	0.47	0.47	0.47
	SOV-1HY-102B2		X	04-08-93	0.47	0.47	
95-69	SOV-1HY-103B1	X		04-08-93	0.47	0.47	0.47
	SOV-1HY-103B2		X	04-08-93	0.47	0.47	
95-72	SOV-1HY-104B1	X		04-08-93	0.47	0.47	0.47
	SOV-1HY-104B2		X	04-08-93	0.47	0.47	
97-1	TV-1SS-104A1	X		04-16-93	0.47	0.47	0.47
	TV-1SS-104A2		X	04-16-93	0.47	0.47	
97-2	TV-1SS-103A1	X		05-14-93	0.47	0.47	0.47
	TV-1SS-103A2		X	05-14-93	0.47	0.47	
103	LPC-38	X		04-05-93	0.47	0.47	0.47
	LPC-37		X	04-05-93	0.47	0.47	
104	LPC-9	X		04-05-93	6.6	6.6	6.6
	LPC-10		X	04-05-93	0.47	0.47	
105-2	TV-1SS-112A1	X		04-16-93	0.47	0.47	0.47
	TV-1SS-112A2		X	04-16-93	0.47	0.47	
106	MOV-1SI-842	X		04-01-93	0.47	0.47	0.47
	TV-1SI-889		X	04-01-93	0.47	0.47	
109-44	SOV-1HY-102A1	X		04-08-93	0.47	0.47	0.47
	SOV-1HY-102A2		X	04-08-93	0.47	0.47	
TOTAL PENETRATION LEAKAGE SHEET 6 (SCF/D)							24.04



## ATTACHMENT 4.1C (continued)

NINTH REFUELING TYPE C TEST RESULTS

PENT NO.	VALVE MARK NO.	CONTAINMENT		DATE TESTED	AS FOUND VALVE LEAKAGE (SCF/D)	AS LEFT VALVE LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE (SCF/D)
		IN	OUT				
109-49	SOV-1HY-103A1	X		04-08-93	0.47	0.47	0.47
	SOV-1HY-103A2		X	04-08-93	0.47	0.47	
109-52	SOV-1HY-104A1	X		04-08-93	0.47	0.47	0.47
	SOV-1HY-104A2		X	04-08-93	0.47	0.47	
110-1	1RC-277		X	04-13-93	0.47	0.47	0.47
	1RC-278		X	04-13-93	0.47	0.47	
P.A.L.	1VS-169	X		04-07-93	0.47	0.47	(NOTE 2)
	1VS-170	X		04-07-93	0.47	0.47	
	1VS-167		X	04-07-93	0.47	0.47	
	1VS-168		X	04-07-93	0.47	0.47	
TOTAL PENETRATION LEAKAGE SHEET 7 (SCF/D)							1.41

NOTE 2 - THE ASSIGNED PENETRATION LEAKAGE FOR THESE VALVES IS ADDED WITH THE PERSONNEL AIRLOCK OVERALL TYPE B LEAKAGE, AND NOT INCLUDED IN THE TYPE C TOTAL. P.A.L. = PERSONNEL AIRLOCK

TOTAL PENETRATION LEAKAGE SHEET 1	(SCF/D)	85.03
TOTAL PENETRATION LEAKAGE SHEET 2	(SCF/D)	173.97
TOTAL PENETRATION LEAKAGE SHEET 3	(SCF/D)	85.74
TOTAL PENETRATION LEAKAGE SHEET 4	(SCF/D)	38.14
TOTAL PENETRATION LEAKAGE SHEET 5	(SCF/D)	105.43
TOTAL PENETRATION LEAKAGE SHEET 6	(SCF/D)	24.04
TOTAL PENETRATION LEAKAGE SHEET 7	(SCF/D)	1.41
TOTAL CONTAINMENT TYPE C LEAKAGE - SUM OF SHEETS 1 THRU 7 (SCF/D)		513.76

## ATTACHMENT 4.1C (continued)

## NINTH REFUELING TYPE B AND C TEST RESULTS

PENETRATION	DATE TESTED	AS FOUND LEAKAGE (SCF/D)	AS LEFT LEAKAGE (SCF/D)	ASSIGNED PENETRATION LEAKAGE
Electrical Penetrations	03-28-93	27.3	23.7	23.7
Fuel Transfer Tube	05-20-93	13.03	8.13	8.13
Penetration #111	03-28-93	0.46	0.46	0.46
Penetration #112	03-28-93	3.91	3.91	3.91
Equipment Hatch Outer Flange	05-23-93	0.47	0.47	0.47
Equipment Hatch Inner Flange	05-24-93	0.48	0.47	0.47
Personnel Airlock	05-24-93	35.88	53.48	53.48
Equipment Hatch Airlock	05-24-93	0.47	19.78	19.78

Total Type 'B' Leakage 110.4 SCF/D

Total Type 'C' Leakage 513.76 SCF/D

Total Type 'B' and 'C' Leakage 624.16 SCF/D

(Acceptance Criteria < 3,929.00 SCF/D [0.6 La])

## ATTACHMENT 4.1D

### NINTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

#### Penetration No. 2

The "As-Found" leak test was performed on April 27, 1993. The valve operator for MOV-10C-112B3 was Statically and Dynamically MOVATS Tested per Maintenance Work Request 13426. Following the completion of the Static MOVATS Test an "As-Left" leak test was performed on May 7, 1993, with a leakage of 1.64 SCF/D measured. No adjustments were required to be made to the valve operator following the completion of the Dynamic MOVATS Test.

#### Penetration No. 5

The "As-Found" leak test was performed on April 27, 1993. The valve operator for MOV-10C-112B2 was Statically and Dynamically MOVATS Tested per Maintenance Work Request 13425. Following the completion of the Static MOVATS Test an "As-Left" leak test was performed on May 2, 1993, with a leakage of 0.47 SCF/D measured. No adjustments were required to be made to the valve operator following the completion of the Dynamic MOVATS Test.

#### Penetration No. 8

The "As-Found" leak test was performed on March 30, 1993. As a preventative measure, the diaphragms were replaced for valves TV-10C-107D1 and TV-10C-107D2 per Maintenance Work Requests 12662 and 12663 respectively. An "As-Left" leak test was performed on May 14, 1993, with a leakage of 0.47 SCF/D measured for TV-10C-107D1 and 0.57 SCF/D measured for TV-10C-107D2.

#### Penetration No. 14

The "As-Found" leak test was performed on April 3, 1993. During the performance of OST 1.1.16, valve TV-10C-110E2 would not remain open for the required 5 minutes after isolating the instrument air to the valve operator. The diaphragm was replaced per Maintenance Work Request 20014. An "As-Left" leak test was performed on May 21, 1993, with a leakage of 0.47 SCF/D measured.

#### Penetration No. 17

The "As-Found" leak test was performed on April 28, 1993. As a preventative measure, the diaphragms were replaced for valves TV-10C-103B and TV-10C-103B1 per Maintenance Work Requests 12666 and 12648 respectively. An "As-Left" leak test was performed on May 8, 1993, for TV-10C-103B with a leakage of 8.49 SCF/D measured and on May 9, 1993, for TV-10C-103B1 with a leakage of 0.47 SCF/D measured.

ATTACHMENT 4.1D (continued)

NINTH REFUELING LOCAL LEAKAGE RATE TEST REPAIR

Penetration No. 18

The "As-Found" leak test was performed on April 28, 1993. As a preventative measure, the diaphragms were replaced for valves TV-1CC-103C and TV-1CC-103C1 per Maintenance Work Requests 12650 and 12651 respectively. An "As-Left" leak test was performed on May 8, 1993, for TV-1CC-103C with a leakage of 28.49 SCF/D measured and on May 16, 1993, for TV-1CC-103C1 with a leakage of 35.45 SCF/D measured.

Penetration No. 24

The "As-Found" leak test was performed on April 30, 1993. Due to excessive seat leakage, Maintenance Work Request 19560 was initiated for valve 1RH-16. The stem nut was found to be loose causing the valve to leak by. The valve was disassembled, cleaned, and reassembled. Following the repair an "As-Left" leak test was performed on May 3, 1993, with a leakage of 14.03 SCF/D measured.

Penetration No. 25

The "As-Found" leak test was performed on March 30, 1993. Due to excessive seat leakage Maintenance Work Request 18536 was initiated for valve TV-1CC-105D1. The seats were determined to have the wrong taper causing the valve to leak by. The valve internals were machined to the correct taper. Also as a preventative measure, the diaphragms were replaced for valves TV-1CC-105D1 and TV-1CC-105D2 per Maintenance Work Requests 12655 and 12656 respectively. Following the repairs an "As-left" leak test was performed on May 4, 1993, with a leakage of 26.64 SCF/D measured for TV-1CC-105D1 and a leakage of 46.85 SCF/D measured for TV-1CC-105D2.

Penetration No. 26

The "As-Found" leak test was performed on March 31, 1993. As a preventative measure, the diaphragms were replaced for valves TV-1CC-107E1 and TV-1CC-107E2 per Maintenance Work Requests 12657 and 12665 respectively. An "As-Left" leak test was performed on April 17, 1993, with a leakge of 0.94 SCF/D measured for TV-1CC-107E1 and 10.20 SCF/D measured for TV-1CC-107E2.

ATTACHMENT 4.1D (continued)

NINTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 27

The "As-Found" leak test was performed on March 30, 1993. As a preventative measure, the diaphragms were replaced for valves TV-10C-105E1 and TV-10C-105E2 per Maintenance Work Requests 12657 and 12658 respectively. An "As-Left" leak test was performed on April 25, 1993, with a leakage of 33.90 SCF/D measured for TV-10C-105E1 and 0.57 SCF/D measured for TV-10C-105E2.

Penetration No. 28

The "As-Found" leak test was performed on April 26, 1993. As a preventative measure, the diaphragm was replaced for valve TV-1CH-200B per Maintenance Work Request 12649. An "As-Left" leak test was performed on May 4, 1993, for valve TV-1CH-200B, which is tested in parallel with valves TV-1CH-200A and TV-1CH-200C, but the penetration was unable to be pressurized. Further investigation with a stethoscope indicated that valve TV-1CH-200C was possibly leaking by. Maintenance Work Request 19672 was written to repair valve TV-1CH-200C. The actuator drive nut for TV-1CH-200C was found to have unscrewed itself from the threads on the valve bonnet. The drive nut was tightened and the actuator adjusted. An "As-Left" leak test was performed on May 6, 1993 but the penetration was still unable to be pressurized. Maintenance Work Requests 19686 and 19706 were written to inspect valves TV-1CH-200B and TV-1CH-200C. The valve plugs were removed and cleaned for both valves and the valves reassembled. Following the repairs an "As-Left" leak test was performed on May 8, 1993, with a leakage of 0.47 SCF/D measured.

The "As-Found" leak test was performed on April 26, 1993. Due to excessive seat leakage Maintenance Work Request 19457 was initiated for valve MOV-1CH-142. The valve was found with a bent stem and the plug in poor condition. The valve stem and plug were replaced. Following the repairs an "As-Left" leak test was performed on May 19, 1993 with a leakage of 0.47 SCF/D measured.

Penetration No. 32

The "As-Found" leak test was performed on April 30, 1993. During the performance of the leak test it was discovered that Check Valve 1FP-800 would not close when fully opened from the weight of its weight arms. Maintenance Work Request 19580 was written to repair Check Valve 1FP-800. The shaft o-rings and bushing were replaced and all parts cleaned. Following the repair an "As-Left" leak test was performed on May 14, 1993, with a leakage of 3.41 SCF/D measured.

ATTACHMENT 4.1D (continued)

NINTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 38

The "As-Found" leak test was performed on April 17, 1993. Maintenance Work Request 3263 had previously been written for valve TV-1DA-100A due to excessive leakage suspected. The valve appeared to be in good condition; however, the valve actuator spring was at the end of its adjustment. The actuator spring was replaced during reassembly. Following the repair an "As-Left" leak test was performed on May 17, 1993, with a leakage of 0.47 SCF/D measured.

The "As-Found" leak test was performed on April 17, 1993. Due to excessive leakage Maintenance Work Request 19218 was written to repair valve TV-1DA-100B. A tie wrap was found in the valve and the seat was damaged in two places. The valve was cleaned and the seat replaced. Following the repair an "As-Left" leak test was performed on May 5, 1993, with a leakage of 4.30 SCF/D measured.

Penetration No. 42

The "As-Found" leak test was performed on March 29, 1991. Due to excessive force required to close valve 1SA-14 Maintenance Work Request 911039 was written during the previous fuel cycle. The valve was replaced with a new valve. Following the replacement an "As-Left" leak test was performed on May 3, 1993, with a leakage of 6.55 SCF/D measured.

The "As-Found" leak test was performed on March 29, 1993. Due to excessive leakage Maintenance Work Request 18474 was written for Check Valve 1SA-15. The valve was disassembled, the internals cleaned and the disc and seat lapped. Following the repair an "As-Left" leak test was performed on May 3, 1993, with a leakage of 21.52 SCF/D measured.

Penetration No. 47

The "As-Found" leak test was performed on April 30, 1993. Due to excessive force required to close valve 1IA-90 using the reach rod Maintenance Work Request 19578 was written. The valve packing was replaced. Following the repair an "As-Left" leak test was performed on May 18, 1993, with a leakage of 2.35 SCF/D measured.

ATTACHMENT 4.1D (continued)

NINTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 49

The "As-Found" leak test was performed on April 1, 1993. Due to excessive seat leakage measured during this and previous outages, Maintenance Work Request 12994 was written to replace check valve 1RC-68. The check valve was replaced with a new soft seat style valve. Following the replacement an "As-Left" leak test was performed on May 3, 1993, with a leakage of 13.55 SCF/D measured.

Penetration No. 55-1

The "As-Found" leak test was performed on April 15, 1993. Due to packing leakage Maintenance Work Request 9161 was written during the previous fuel cycle for valve TV-1SS-109A1. The valve packing was replaced. Following the repair an "As-Left" leak test was performed on May 9, 1993, with a leakage of 0.47 SCF/D measured for both TV-1SS-109A1 and TV-1SS-109A2.

Penetration No. 56-2

The "As-Found" leak test was performed on April 4, 1993. Due to a 10 CFR 20 Notice from the valve's manufacture, Maintenance Work Request 12500 was written to replace the closing spring and spirol pin with parts made from upgraded material. Following the repair an "As-Left" leak test was performed on May 14, 1993, with a leakage of 0.47 SCF/D measured.

Penetration No. 56-3

The "As-Found" leak test was performed on April 18, 1993. During the performance of the leak test, open indication was not obtained for valve TV-1SS-105A2. Maintenance Work Request 19219 was previously written to replace the valve limit switches and top hat. Following the replacement of the limit switches and top hat an "As-Left" leak test was performed on May 14, 1993, with a leakage of 0.47 SCF/D measured for both TV-1SS-105A1 TV-1SS-105A2.

Penetration No. 58

The "As-Found" leak test was performed on April 26, 1993. As a preventative measure, the diaphragms were replaced for valves TV-1CC-103A and TV-1CC-103A1 per Maintenance Work Requests 12667 and 12668 respectively. An "As-Left" leak test was performed on May 7, 1993, with a leakage of 4.98 SCF/D measured for TV-1CC-103A and 3.42 SCF/D measured for TV-1CC-103A1.



ATTACHMENT 4.1D (continued)

NINTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 63

The "As-Found" leak test was performed on April 2, 1993. The valve operator for MOV-1QS-101B was Statically MOVATS Tested per Maintenance Work Request 10161. Following the completion of the Static MOVATS Test an "As-Left" leak test was performed on May 18, 1993, with a leakage of 17.89 SCF/D measured.

The "As-Found" leak test was performed on April 2, 1993. As a preventative measure, the shaft o-rings for 1QS-4 were replaced and lubricated per Maintenance Work Request 16364. Following the repair an "As-Left" leak test was performed on April 15, 1993, with a leakage of 0.47 SCF/D measured.

Penetration No. 64

The "As-Found" leak test was performed on April 2, 1993. Due to a reduced voltage concern, the motor pinion and worm gears were replaced per Maintenance Work Request 19187. Following the replacement of the gears a Static MOVATS Test was performed. An "As-Left" leak test was performed on May 15, 1993, with a leakage of 0.47 SCF/D measured.

The "As-Found" leak test was performed on April 2, 1993. During the performance of the leak test it was discovered that Check Valve 1QS-3 would not close when fully opened from the weight of its weight arms. As a preventative measure, Maintenance Work Request 16363 was previously written to replace the o-rings and lubricate the shaft of Check Valve 1QS-3. The shaft o-rings were cleaned and lubricated. Following the repair an "As-Left" leak test was performed on April 15, 1993, with a leakage of 0.47 SCF/D measured.

Penetration No. 71

The "As-Found" leak test was performed on April 6, 1993. As a preventative measure, the shaft o-rings for Check Valve 1RS-100 were replaced and lubricated per Maintenance Work Request 16365. Following the repair an "As-Left" leak test was performed on April 8, 1993, with a leakage of 0.47 SCF/D measured.



ATTACHMENT 4.1D

NINTH REFUELING LOCAL LEAKAGE RATE TEST REPAIRS

Penetration No. 89

The "As-Found" leak test was performed on April 5, 1993. Due to excessive leakage for Check Valve 1AS-278 Maintenance Work Request 18784 was written. Dirt and a gummy substance was found on the valve seat. The valve seating surfaces were cleaned. An "As-Left" leak test was performed on April 15, 1993 with a leakage of 18.84 SCF/D measured. Valve TV-1SV-100A was also retested since some of the "As-Found" leakage was contributed to packing leakage on Check Valve 1AS-278. The "As-Left" leak test was performed on April 15, 1993 with a leakage of 5.65 SCF/D measured.

Penetration No. 97-2

The "As-Found" leak test was performed on April 16, 1991. Due to previously identified packing leaks on TV-1SS-103A1 and TV-1SS-103A2 Maintenance Work Requests 18626 and 15571 were written. The packing was replaced on both valves and the "As-Left" leak test was performed on May 14, 1993, with a leakage of 0.47 SCF/D measured for both valves.

ATTACHMENT 4.1E

EIGHTH AND NINTH FUEL CYCLE LOCAL LEAKAGE RATE TEST DATA

I. Eighth Fuel Cycle LLRT Data

A. Type B Tests

1. Airlock Total Volume Type B Tests

- a. Personnel Airlock [PH-P-1] (5-22-90) ----- 142.10 SCF/D

Corrective Action(s) Outer door breech ring limit switch  
adjusted to permit additional travel in  
the closed position.

- b. Equipment Hatch Airlock [PH-P-2] (5-23-90) -- 12.82 SCF/D

Corrective Action(s) - None

- c. Personnel Airlock [PH-P-1] (11-13-90) ----- 288.59 SCF/D

Corrective Action(s) Outer door breech ring limit switch  
adjusted to permit additional travel in  
the closed position.

- d. Equipment Hatch Airlock [PH-P-2] (11-13-90) -- 13.04 SCF/D

Corrective Action(s) None

B. Type C Tests

1. Penetration No. 28 [RV-1CH-203] (1-19-90) ----- 0.48 SCF/D

Corrective Action(s) Relief valve was suspected of leaking  
by. The relief valve was replaced with  
a new relief valve per Maintenance Work  
Request 900538.

ATTACHMENT 4.1E (continued)

EIGHTH AND NINTH FUEL CYCLE LOCAL LEAKAGE RATE TEST DATA

II. Ninth Fuel Cycle LLRT Data

A. Type B Tests

1. Airlock Total Volume Type I Tests

- a. Personnel Airlock [PH-P-1] (9-21-91) ----- 90.77 SCF/D  
Corrective Action(s) The sight glass was replaced per  
Maintenance Work Request 913762; due to  
a chip near the sealing surface.
- b. Equipment Hatch Airlock [PH-P-2] (9-23-91) ----- 42.62 SCF/D  
Corrective Action(s) None
- c. Personnel Airlock [PH-P-1] (3-3-92) ----- 34.69 SCF/D  
Corrective Action(s) None
- d. Equipment Hatch Airlock [PH-P-2] (3-4-92) ----- 2.87 SCF/D  
Corrective Action(s) None
- e. Personnel Airlock [PH-P-1] (8-25-92) ----- 41.91 SCF/D  
Corrective Action(s) None
- f. Equipment Hatch Airlock [PH-P-2] (8-26-92) ----- 5.14 SCF/D  
Corrective Action(s) None
- g. Equipment Hatch (10-24-92) ----- 0.47 SCF/D  
Corrective Action(s) None
- h. Equipment Hatch Airlock [PH-P-2] (10-25-92) ----- 0.47 SCF/D  
Corrective Action(s) None
- i. Equipment Hatch Inner Flange (10-25-92) ----- 0.48 SCF/D  
Corrective Action(s) None
- j. Personnel Airlock [PH-P-1] (2-17-93) ----- 35.88 SCF/D  
Corrective Action(s) None

ATTACHMENT 4.1E (continued)

EIGHTH AND NINTH FUEL CYCLE LOCAL LEAKAGE RATE TEST DATA

B. Type C Tests

1. Penetration No. 28 [RV-1CH-203] (11-19-91) ----- 0.47 SCF/D  
Corrective Action(s) Relief valve [RV-1CH-203] was suspected of leaking by. The relief valve was replaced with a new relief valve per Maintenance Work Request 911343.
2. Penetration No. 105-2 [TV-1SS-112A2] (2-28-92) ----- 0.47 SCF/D  
Corrective Action(s) The valve was repacked per Maintenance Work Request 5781.
3. Penetration No. 55-1 [TV-1SS-109A2] (2-29-92) ----- 0.47 SCF/D  
Corrective Action(s) The valve was repacked per Maintenance Work Request 7257 and the valve actuator was repaired per Maintenance Work Request 5184.
4. Penetration No. 56-2 [TV-1SS-102A1] (10-24-92) ----- 0.47 SCF/D  
Corrective Action(s) The actuator spring and spirol pin were replaced per Valcor's 10CFR21 Notice (Maintenance Work Request 12499).

NOTE: BVPS #1 administratively limits Type B leakage of each airlock to 5% La (327 SCF/D). Total Type B and C leakage (excluding airlocks) is administratively limited to 50% La to account for airlock retests.