GENERAL PUBLIC UTILITIES NUCLEAR CORPORATION

Three Mile Island Nuclear Station

Unit 1

REACTOR CONTAINMENT BUILDING INTEGRATED LEAKAGE RATE TEST REPORT

September, 1993

ILRT Sections Prepared By: D M Walters Date: 11-29-93

LLRT Sections Prepared By: D M Walters Date: 11-29-93

Reviewed By: [signature] Date: 11/30/93

Approved By: [signature] Date: 11/30/93

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1.0 INTRODUCTION AND PURPOSE

The Reactor Building Integrated Leakage Rate "Type A" Test is performed to demonstrate that leakage through the primary reactor containment systems and components penetrating primary reactor containment at the design basis accident pressure of 50.6 psig (P_a) does not exceed the allowable leakage rate specified in the Three Mile Island Nuclear Station Unit 1 Technical Specifications. The allowable leakage is defined by the design basis accident, applied in the safety analysis, in accordance with the exposure guidelines specified by 10 CFR 100.

The purpose of this report is to provide information pertinent to the activities related to the preparation, test performance, and reporting of the Three Mile Island Nuclear Station Unit 1 (TMI-1) Integrated Leakage Rate Test (ILRT). The maximum allowable integrated leakage rate for TMI-1 is 0.10 percent by weight of the mass of air contained within the R.B. when pressurized to 50.6 psig per day (L_a). The measured leakage rate (L_{am}) at the upper 95 percent confidence level is required by 10 CFR 50 Appendix J to be less than 75 percent of the maximum allowable leakage rate. In addition, 10 CFR 50 Appendix J requires that the accuracy of the ILRT be verified by a supplemental test. The supplemental test is acceptable if the difference between the ILRT data and the supplemental test data is within 25 percent of L_a.

The successful periodic Type A and verification tests were performed during the period from September 15, 1993 to September 16, 1993, according to the requirements of the Three Mile Island Nuclear Station Unit 1 Technical Specifications 4.4.1.1, TMI-1 Surveillance Procedure 1303-6.1, and 10CFR50, Appendix J. The test method used was the Absolute Method as described in "ANSI N45.4-1972, "Leakage-Rate Testing of Containment Structures for Nuclear Reactors". The supplemental test was conducted by superimposing a known leakage rate on the existing containment building leakage rate.

Leakage rates were calculated using the Mass Point data analysis technique as described in ANSI/ANS-56.8-1987, "Containment System Leakage Testing Requirements". The test results are reported in accordance with the requirements of 10CFR50, Appendix J, Section V.B.3.

The ILRT was performed at the beginning of the 10R refueling outage prior to any repairs or adjustments to containment isolation barriers. The duration of the ILRT was 24.25 hours. The 95 percent Upper Confidence Level (UCL) leakage rate was determined to be 0.0707 percent by weight per day. The supplemental test was conducted for a period of 4.25 hours and demonstrated a difference between the ILRT data and the supplemental test data of 19.9 percent of L_a. Therefore, the ILRT and supplemental test met the acceptance criteria of 10 CFR 50 Appendix J.

Most of the Local Leak Rate Testing (LLRT) was performed just prior to performing the ILRT. About two thirds of the LLRT was performed during the ILRT pressurization and stabilization periods.

2.0 GENERAL AND TECHNICAL DATA

2.1 General Data

Owner	General Public Utilities Nuclear Corporation
Docket No.:	50-289
Plant	Three Mile Island Nuclear Station Unit 1
Location	Three Mile Island, near the East Shore of the Susquehanna River in Dauphin County, Pennsylvania
Containment Type	Prestressed, post-tensioned reinforced concrete composed of cylindrical walls, a flat foundation mat and a shallow dome roof with a 3/8 inch carbon steel liner
NSSS Supplier, Type	Babcock & Wilcox PWR
Date Test Completed	September 16, 1993

2.2 Technical Data

Containment Net Free Volume	2×10^6 cubic feet
Design Pressure	55.0 psig
Design Temperature	281° F
Calculated Peak Accident Pressure	50.6 psig
Calculated Peak Accident Temperature	289° F

3.0 TEST INSTRUMENTATION

The following is a description of the test instruments which comprise the Integrated Leakage Rate Measurement System. The accuracy, repeatability, and sensitivity of the instrumentation meets the requirements of ANSI/ANS-56.8-1987, "Containment System Leakage Testing Requirements".

3.1 Integrated Leakage Rate Measurement System

1. Absolute Pressure

Quantity	2
Manufacturer	Volumetrics
Type	Precision Pressure Gauge Model PPM -1000
Range	0 - 100 psia
Accuracy	± 0.015% reading plus ± 0.002% Full Scale (± 0.0119 psia)
Repeatability	0.001% Full Scale 0.001 psi
Resolution	0.008% Full Scale 0.008 psi
Sensor Sensitivity Error	0.001 % Full Scale 0.001 psi

2. Drybulb Temperature

Quantity	24
Manufacturer	Yellow Spring Instruments
Type	3-wire 100 ohm platinum resistance temperature detectors (RTDs)
Range	60 - 120° F
Accuracy	± 0.1° F
Sensor Sensitivity Error	0.01° F

3. Dewpoint Temperature

Quantity	10
Manufacturer	Foxboro
Type	Lithium Chloride Dewcell using a 3-wire 100 ohm RTD, Model BD154WB
Range	40 - 100° F dewpoint
Accuracy	±1.5° F
Sensor Sensitivity Error	0.1° F

4. Verification Flow

Quantity	2 (1 primary, 1 backup)
Manufacturer	Volumetrics
Type	Thermal mass flow Model FM10
Range	0 - 15 scfm
Accuracy	± 1% full scale
Sensitivity	± 0.5% full scale

5. Readout Device

Quantity	1
Manufacturer	Volumetrics
Type	Model A-100 with sensor conditioning cards
RTD Repeatability	0.01° F
Dewcell Repeatability	0.01° F
Resolution	
Drybulb Temp	0.001° F
Dewpoint Temp	0.001° F

3.2 Measurement System Arrangement

The measurement system arrangement as installed for the ILRT is shown in Appendix E. The Instrumentation Selection Guide Value is calculated as shown in Appendix F. All instrumentation performed satisfactorily with the exception of two dewcells. Dewcells 1 and 10 exhibited excessive fluctuations which were not evident in the other 8 dewcells. The readings from these two dewcells were recorded, however they were not used in the calculations for the measured leakage rate.

The 24 RTD and 10 dewcell sensors are located at five different levels within the reactor containment building. Within each level, the sensors are located within four different quadrants. This provides more than adequate coverage of the containment and ensures that the sensors are recording representative temperatures in all areas of the containment. The test readings from these sensors show a fairly uniform temperature distribution from the basement elevation at 287 feet to the dome area elevation at 437 feet. The results from this test as well as previous ILRTs at TMI Unit 1 have shown no temperature stratification because:

a. There are very few cubicles inside the Reactor Building

b. There is free communication between all levels of the building and also between cubicles and the Reactor Building.

c. The air inside the Reactor Building is recirculated by the installed ventilation system.

d. Equipment in the Reactor Building, with the exception of the ventilation system fans and required instrumentation, was de-energized during the test. This eliminated any heat producing equipment in the building which could cause local hot spots.

Due to the uniform temperature distribution, all operable RTD's and dewcells were assigned equal weighting factors.

After the ILRT was completed GPUN performed a temperature survey and evaluated the results by EER 93-0434 and concluded relatively uniform temperature distribution.

4.0 TEST SUMMARY

4.1 Test Summary Time-Line

Phase	Time Frame	Duration
Pressurization	From: 1430 on 9/14/93 To: 1345 on 9/15/93	23.25 hours
Stabilization	From: 1345 on 9/15/93 To: 1815 on 9/15/93	4.50 hours
ILRT Test	From: 1830 on 9/15/93 To: 1845 on 9/16/93	24.25 hours
Verification Test	From: 1900 on 9/16/93 To: 2315 on 9/16/93	4.25 hours
Depressurization	From: 0010 on 9/17/93 To: 1000 on 9/17/93	9.83 hours

4.2 Edited Test Log

September 14, 1993

1430 Hr.	Pressurization of containment started.
1815 Hr.	Pressurization rate approx. 2.4 psi/hr.
1935 Hr.	Secured pressurization for reactor building entry. Containment pressure is 27 psia (approx. 12.3 psig).
1945 Hr.	During inside RB inspection, a steady stream of water was noted from RCP coolers. Operations determined that this was not a problem.
1950 Hr.	Pressurization restarted.

September 15, 1993

0500 Hr.	Pressurization rate approx. 2.3 psi/hr.
0530 Hr.	One compressor was shut down for repairs. Pressurization rate dropped to approx. 1.8 psi/hr.
0801 Hr.	Compressor repaired and restarted. Pressurizationrate back to approx. 2.4 psi/hr.

September 15, 1993

0805 Hr.	Industrial Cooler System shut down. Reactor Building recirculation fans will continue to run without cooling water for the ILRT.
1110 Hr.	Target pressure is 51.6 psig. Barometric pressure is approx. 14.58 psia.
1158 Hr.	One compressor shutdown at containment pressure of 64.58 psia.
1218 Hr.	Two additional compressors shutdown at containment pressure of 65.38 psia.
1335 Hr.	Fourth compressor shutdown at containment pressure of 65.98 psia.
1345 Hr.	Isolated pressurization line and secured last compressor. Started stabilization period. Containment pressure at 66.0345 psia (51.4545 psig).
1515 Hr.	Temperature stabilization criteria met.
1830 Hr.	Start of Type A test. Containment pressure at 66.1000 psia (51.52 psig).

September 16, 1993

1845 Hr.	Mass Point UCL L_{am} calculated to be 0.0707 wt%/day. Calculated leakage within 0.75 L_a. End of test. Test duration is 24 hours and 15 minutes.
1850 Hr.	Initiated verification flow. Lo = 6.03 SCFM.
1900 Hr.	Started verification test.
2315 Hr.	Completed verification test. Lc = 0.1487 wt%/day.

September 17, 1993

0010 Hr.	Started depressurization.
1000 Hr.	Depressurization of containment completed.

4.3 Type A Test Results Summary

Test Method	Absolute
Test Pressure	51.5 psig
Mass Point Calculated Leakage Rate (L_{am})	* 0.0684 % wt./day
95 % Upper Confidence Level Leakage Rate (UCL)	* 0.0707 % wt./day

* Does not include penalties for nonstandard alignments and water level changes (Refer to Section 7.0)

The 95 % Upper Confidence Level leakage rate was below the 10 CFR 50 Appendix J criteria of 0.75 L_a.

4.4 Verification Test Results Summary

Mass Point Calculated Leakage Rate (L_{am})	0.0684 % wt./day
Imposed Leak (L_o) (6.03 SCFM)	0.1002 % wt./day
Lower Limit: $L_o + L_{am} - 0.25\ L_a$	0.1436 % wt./day
Composite Leakage (L_c) ($L_c = L_{am\_} + L_o$)◊	0.1487 % wt./day
Upper Limit: $L_o + L_{am} + 0.25\ L_a$	0.1936 % wt./day

◊The computer software determines a composite leakage rate (L_c) based on the sum of the current containment building leakage rate ($L_{am\_}$) and the superimposed leakage rate (L_o). The composite leakage rate must be within the Appendix J Supplemental (Verification) Test Acceptance Criteria of 0.25 L_a. The criteria is mathematically represented by the upper and lower limits listed above.

The composite leakage rate (L_c) of 0.1487 wt.%/day was within the 10 CFR 50 Appendix J criteria of 0.25 L_a.

5.0. TEST DESCRIPTION

Prior to containment pressurization at 1430, on September 14, 1993, site personnel were engaged in prerequisite activities for the conduct of the ILRT. These activities included ILRT procedure review and finalization, system valve lineups, ILRT computer program checkout and linkup to the Volumetrics Data Acquisition System, and ILRT instrumentation calibration, installation and operability checks. The ILRT test procedure was reviewed against the requirements of the TMI-1 Technical Specifications; 10CFR50, Appendix J; and ANSI/ANS-56.8-1987.

The ILRT instrumentation was calibrated prior to the ILRT as recommended by ANSI N45.4-1972, Sections 6.2 and 6.3. Final ILRT instrumentation operability checks and in-situ checks, as specified in ANSI/ANS-56.8-1987, Section 4.2.3.1, were performed in accordance with TMI-1 Maintenance Procedure MP 1430-Y-23 to ensure that all instrumentation was operating correctly. Calibration records for the ILRT instrumentation system components are retained at the plant.

The Three Mile Island Unit 1 ILRT (Integrated Leak Rate Test) was conducted by General Public Utilities Nuclear Corporation personnel and others, in accordance with the requirements of Surveillance Procedure 1303-6.1. The ILRT test procedure was the administrative document used to set up the required plant system prerequisites and initial conditions necessary to conduct an ILRT.

The containment structure itself was isolated (i.e., plant systems penetrating the containment boundary were isolated, via closure of containment isolation valves.) The Decay Heat Removal System was in service to maintain the plant in a safe and stable condition during the test. Portions of fluid systems which under post-accident conditions become extensions of the containment boundary valves were drained and vented. The Penetration Pressurization System was depressurized and manometers were installed in the manifolds to provide a means of leak detection. Equipment within the reactor building, which may be subject to damage, was protected and potential pressure sources were removed or vented. All accessible liner weld channels were vented to the containment atmosphere. The accessible exterior and interior surfaces of the containment were visually inspected in accordance with TMI-1 Surveillance Procedure SP 1301-8.1, "Reactor Building Annual Inspection".

The pressurization system consisted of a group of five diesel driven oil-free air compressors (total capacity of 6,300 scfm), a water-cooled aftercooler, a desiccant type air dryer, and valves.

A fully automated data acquisition system was used to record and monitor ILRT containment-related test parameters, e.g., containment air pressure, drybulb temperatures, and dewpoint temperatures, at fifteen minute intervals. The ILRT computer system consisted of two portable computers and floppy disk drives. The test data was processed via the General Physics ILRT software system computer program.

With test prerequisites and initial conditions satisfied, the containment was pressurized and external inspections of the containment were completed. When the pressure reached 51.5 psig, containment pressurization was stopped and isolated. The containment air mass system was then allowed to thermodynamically stabilize. Once stabilization was attained, the data acquisition system and ILRT computer system recorded the test data and computed the ILRT leakage rate at fifteen minute intervals.

The Type A test and the supplemental verification test were performed according to the requirements of the Three Mile Island Unit 1 Technical Specifications and 10CFR50, 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/ANS-56.8-1987, "Containment System Leakage Testing Requirements".

The ILRT containment leakage rate was then compared to the procedure acceptance criteria limit and verified satisfactory.

Prior to depressurization of the containment, a verification test was completed. The verification test induced a known leakage rate and a calculation was made which verified the test method and the operation of the instrumentation system.

The containment was then slowly depressurized to normal atmospheric conditions and restoration was started.

6.0 TYPE B AND C LOCAL LEAKAGE RATE TEST RESULTS

6.1 Local Leak Rate Test Program

This section addresses the Primary Reactor Containment Local Leak Rate Testing (LLRT) Program. The LLRT program complies with containment leak test requirements set forth in Technical Specification 4.4.1 and 10CFR50, Appendix J.

A summary of local leakage rate tests since the ILRT in January 1990 is included in Appendix G.

6.2 Acceptance Criteria

The combined leakage rate of all penetrations and isolation valves shall not exceed 0.6 L_a (0.060 wt.%/day, 104,846 sccm) at P_a.

7.0 ANALYSIS AND INTERPRETATION

The upper 95% confidence limit (UCL) Mass Point leakage rate calculated during the ILRT were less than the test acceptance criteria of 0.75 L_a (0.075 % wt./day). Additions to the calculated leakage rates must be made to account for penetration paths not exposed to the ILRT pressure and for changes in the net free containment volume due to changes in containment water levels. These additions are discussed below.

7.1. Summary of Type B and C Penalties

Penetration paths not exposed to the ILRT pressure and the corresponding minimum pathway leakage rates are as follows:

Penetration Number	System	LLRT MINPATH LEAKAGE
423	Purge AH-V1C/1D	1794 SCCM

LLRT results based on the above equate to a Type B and C penalty addition of 0.0011 wt.-% per day. This penality was conservatively taken since the purge valve interspace was pressurized during the test, in order to equalize the interspace. Interspace repressurization however was maintained below ILRT pressure to preclude any flow into the Reactor Building.

7.2 Volume Change Corrections

The following volumes were monitored for liquid level changes which would affect the containment net free volume:

VOLUME MONITORED	LEVEL CHANGE (in.)	VOLUME CHANGE (ft3)
Pressurizer	-2.7	23.9
Core Flood Tank B	-0.1	6.8
Containment Sump	0.2	-3.0

Based on the volumes monitored, the containment net free volume increased during the ILRT by 27.7 ft^3. This overall increase in the containment net free volume during the ILRT is conservatively included in the reported containment integrated leakage rate and no other correction is required.

7.3 ILRT Results

The ILRT leakage rate including the required additions is as follows:

Mass Point 95% UCL Leakage Rate	0.0707 % wt./day
Type C Penalties	0.0011 % wt./day
Volume Change	0.0000 % wt./day
Final 95 % UCL Leakage Rate	0.0718 % wt./day

The Final Mass Point 95 % UCL leakage rate is less than the test acceptance criteria value of 0.75 L_a (0.075 % wt./day).

8.0 REFERENCES

A. Three Mile Island Unit 1 Surveillance Procedure, 1303-6.1, "Reactor Building Integrated Leak Rate Test".

B. Three Mile Island Nuclear Station Unit 1 Technical Specifications.

C. Three Mile Island Nuclear Station Unit 1 Updated Final Safety Analysis Report.

D. Code of Federal Regulations, Title 10, Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors".

E. ANSI N45.4-1972, "Leakage-Rate Testing of Containment Structures for Nuclear Reactors".

F. ANSI/ANS-56.8-1987, "Containment System Leakage Testing Requirements".

APPENDIX A

STABILIZATION PHASE DATA

STABLIZATION MODE
OPTIONS

1 - MANUAL DATA ENTRY
2 - PARAMATER GRAPHS
3 - SENSOR PLOTS
4 - REPRINT CURRENT DATA PT
5 - SENSOR DIFFERENTIALS
6 - ANSI STABILIZATION CRITERIA
7 - BN-TOP-1 STAB. CRITERIA
8 - ANSI CRITERIA PRINTOUT
9 - BN-TOP-1 CRITERIA PRINTOUT
P - PASS WORD MENU

SUMMARY
TIME = 1815

# OF DATA POINTS	= 19
MODE DURATION (IN HRS)	= 4.50
TOT TIME MEASURED LEAK	= 0.5124
TOT TIME CALCULATED LEAK	= 0.6102
TOT TIME 95% UCL	= 1.1807
MASS PT LEAK	= 0.5087
MASS PT 95% UCL	= 0.5775

ANSI TEMPERATURE STABLIZATION CRITERIA MET
BN-TOP TEMPERATURE STABLIZATION CRITERIA MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	90.558/ +0.069	AVG PRESS:	65.527 / +0.004
MASS:	642884.88 / -44.250	AVG DEW PRESS:	0.5675/ +0.0025
		TOTAL PRESS:	66.094 / +0.006

STABLE MODE
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TEMPERATURE STABILIZATION UNIT 1						
		ANSI 56.8			BN-TOP-1	
TIME	TEMP	1 HR	4 HR	4HR - 1HR	BN1	BN2
0.00	89.644	0.0000	0.0000	0.0000	0.0000	0.0000
0.25	89.598	0.0000	0.0000	0.0000	0.0000	0.0000
0.50	89.633	0.0000	0.0000	0.0000	0.0000	0.0000
0.75	89.677	0.0000	0.0000	0.0000	0.0000	0.0000
1.00	89.717	0.0735	0.0000	-0.0735	0.0000	0.0000
1.25	89.764	0.1664	0.0000	-0.1664	0.0000	0.0000
1.50	89.836	0.2031	0.0000	-0.2031	0.0000	0.0000
1.75	89.881	0.2035	0.0000	-0.2035	0.0000	0.0000
2.00	89.967	0.2495	0.0000	-0.2495	0.1615	0.0000
2.25	90.032	0.2682	0.0000	-0.2682	0.2173	0.2231
2.50	90.058	0.2220	0.0000	-0.2220	0.2125	-0.0190
2.75	90.145	0.2646	0.0000	-0.2646	0.2340	0.0861
3.00	90.195	0.2288	0.0000	-0.2288	0.2392	0.0206
3.25	90.269	0.2368	0.0000	-0.2368	0.2525	0.0533
3.50	90.319	0.2611	0.0000	-0.2611	0.2415	-0.0439
3.75	90.381	0.2358	0.0000	-0.2358	0.2502	0.0346
4.00	90.436	0.2403	0.1980	-0.0422	0.2345	-0.0626
4.25	90.489	0.2197	0.2228	0.0031	0.2283	-0.0251
4.50	90.558	0.2394	0.2314	-0.0080	0.2503	0.0880

STABLE MODE
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AVERAGE DATA VALUES						
DATE	TIME	RTD	DEW PT.	VAP PRESS	DRY PRESS	MASS
258	0.00	89.644	82.726	0.554	65.481	643503.19
258	0.25	89.598	82.741	0.554	65.476	643514.63
258	0.50	89.633	82.867	0.556	65.469	643404.88
258	0.75	89.677	82.944	0.558	65.466	643320.88
258	1.00	89.717	82.887	0.557	65.468	643294.81
258	1.25	89.764	83.116	0.561	65.466	643216.56
258	1.50	89.836	83.064	0.560	65.470	643169.00
258	1.75	89.881	83.265	0.564	65.469	643112.94
258	2.00	89.967	83.114	0.561	65.476	643080.94
258	2.25	90.032	83.072	0.560	65.482	643061.94
258	2.50	90.058	83.175	0.562	65.484	643055.50
258	2.75	90.145	83.370	0.565	65.487	642973.75
258	3.00	90.195	83.301	0.564	65.494	642984.63
258	3.25	90.269	83.435	0.567	65.497	642932.75
258	3.50	90.319	83.200	0.562	65.508	642979.44
258	3.75	90.381	83.345	0.565	65.511	642934.88
258	4.00	90.436	83.317	0.564	65.517	642933.06
258	4.25	90.489	83.345	0.565	65.523	642929.06
258	4.50	90.558	83.484	0.568	65.527	642884.94

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LEAKAGE RATE SUMMARY UNIT 1						
		TOTAL TIME			MASS/POINT	
DATE	TIME	TTLM	LMCALC	SL	LAM	L95
258	0.00	0.0000	0.0000	0.0000	0.0000	0.0000
258	0.25	-0.1711	0.0000	0.0000	0.0000	0.0000
258	0.50	0.7330	0.7330	0.0000	0.7335	5.1968
258	0.75	0.9065	1.0283	3.9174	0.9793	1.7833
258	1.00	0.7771	1.0141	2.8804	0.9106	1.2936
258	1.25	0.8550	1.0393	2.3843	0.9269	1.1549
258	1.50	0.8308	1.0299	2.1530	0.9103	1.0640
258	1.75	0.8317	1.0182	2.0021	0.8972	1.0087
258	2.00	0.7874	0.9877	1.8869	0.8624	0.9545
258	2.25	0.7314	0.9431	1.7861	0.8136	0.9029
258	2.50	0.6678	0.8881	1.6911	0.7540	0.8494
258	2.75	0.7180	0.8632	1.6144	0.7375	0.8179
258	3.00	0.6445	0.8222	1.5385	0.6981	0.7769
258	3.25	0.6545	0.7932	1.4738	0.6757	0.7466
258	3.50	0.5580	0.7456	1.4044	0.6263	0.7053
258	3.75	0.5652	0.7096	1.3431	0.5943	0.6703
258	4.00	0.5315	0.6731	1.2845	0.5614	0.6361
258	4.25	0.5038	0.6375	1.2288	0.5295	0.6030
258	4.50	0.5124	0.6102	1.1807	0.5087	0.5775

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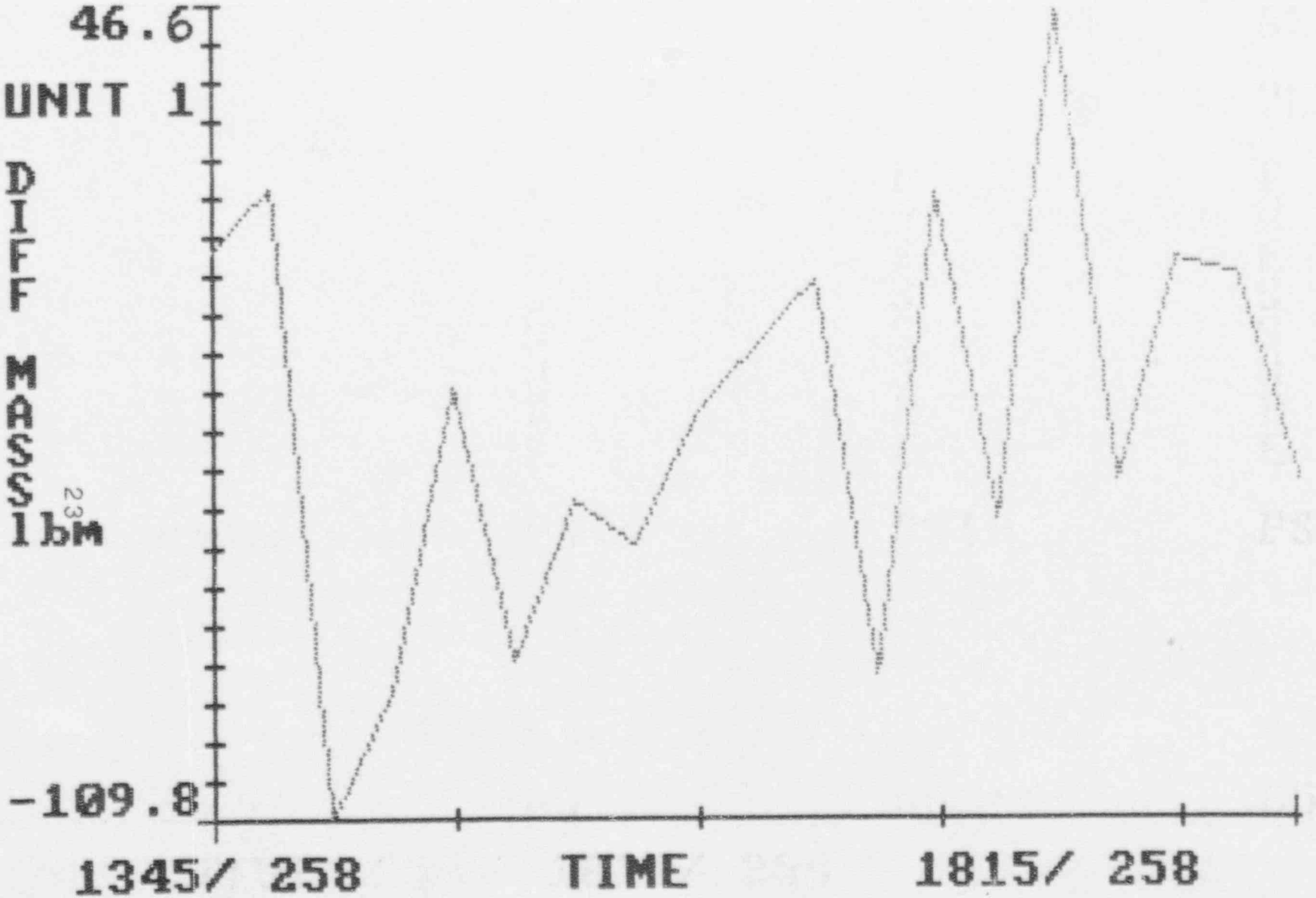
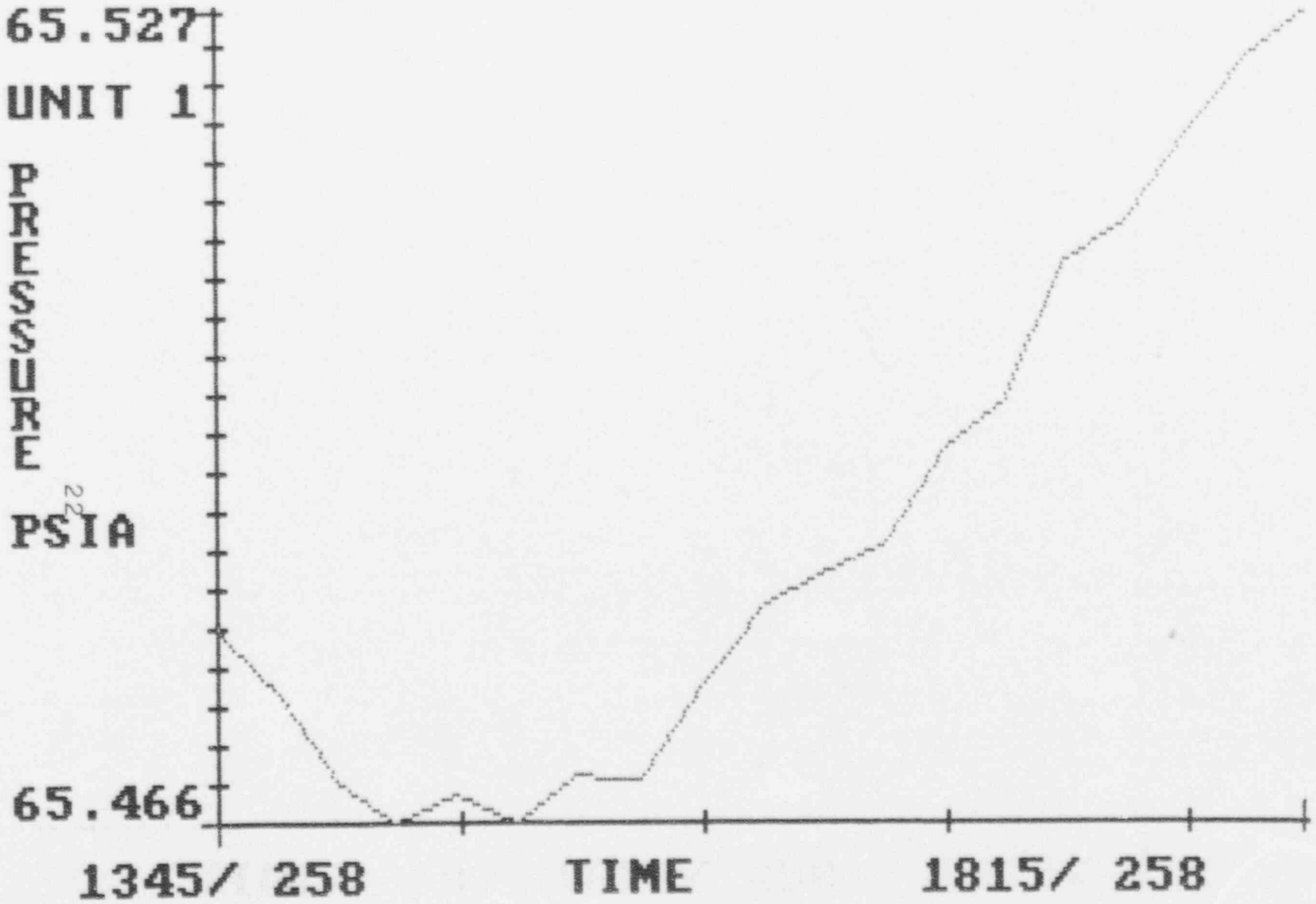
AVERAGE MASS DIFFERENTIAL		
DATE	TIME (HOURS)	MASS DIFFERENTIAL
258	0.00	0.000
258	0.25	11.438
258	0.50	-109.750
258	0.75	-84.000
258	1.00	-26.063
258	1.25	-78.188
258	1.50	-47.625
258	1.75	-56.125
258	2.00	-32.000
258	2.25	-19.000
258	2.50	-6.375
258	2.75	-81.688
258	3.00	10.813
258	3.25	-51.813
258	3.50	46.563
258	3.75	-44.500
258	4.00	-1.750
258	4.25	-4.000
258	4.50	-44.250

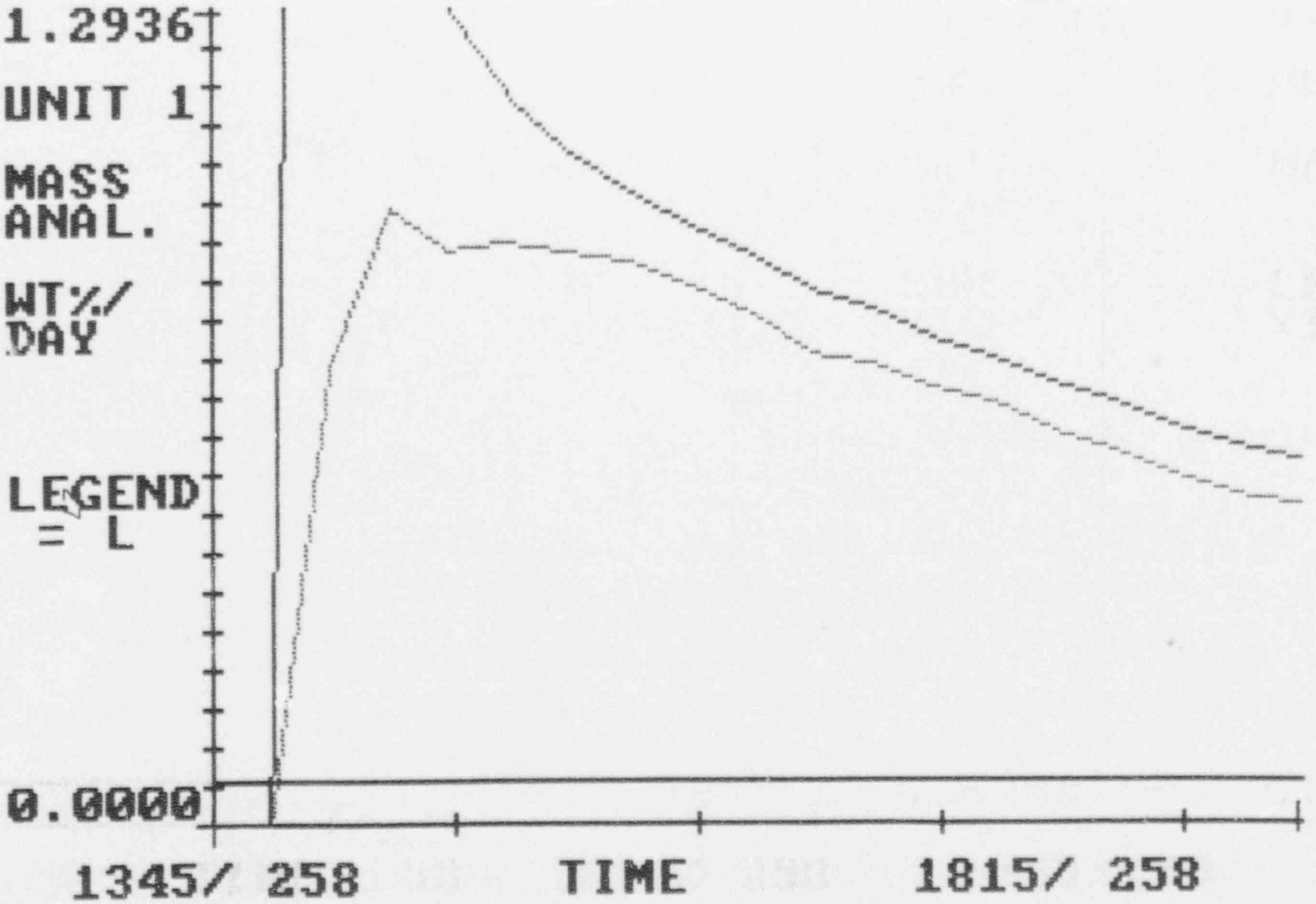
STABILIZATION PERIOD DIFFERIENTIAL MASS VS TIME

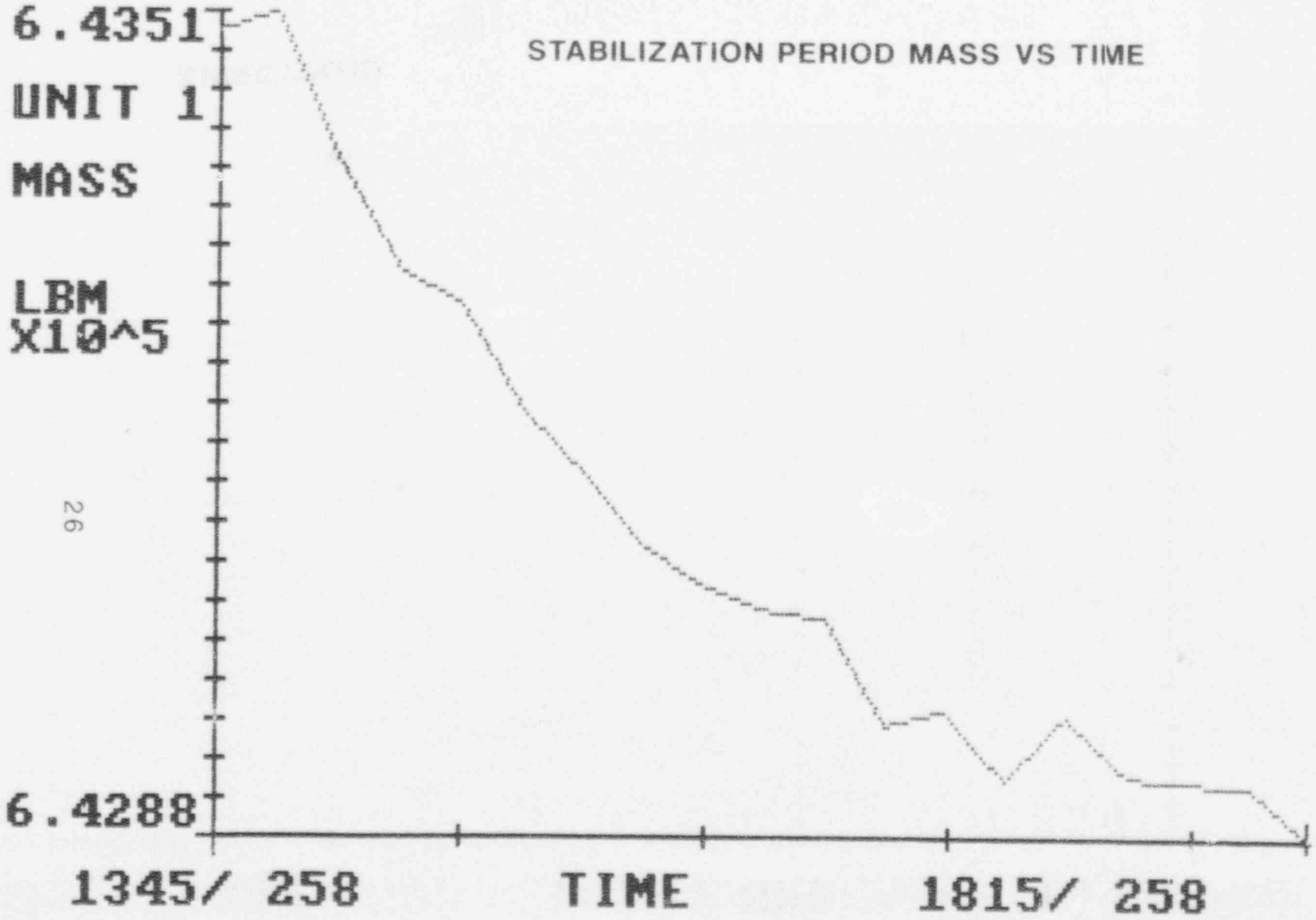


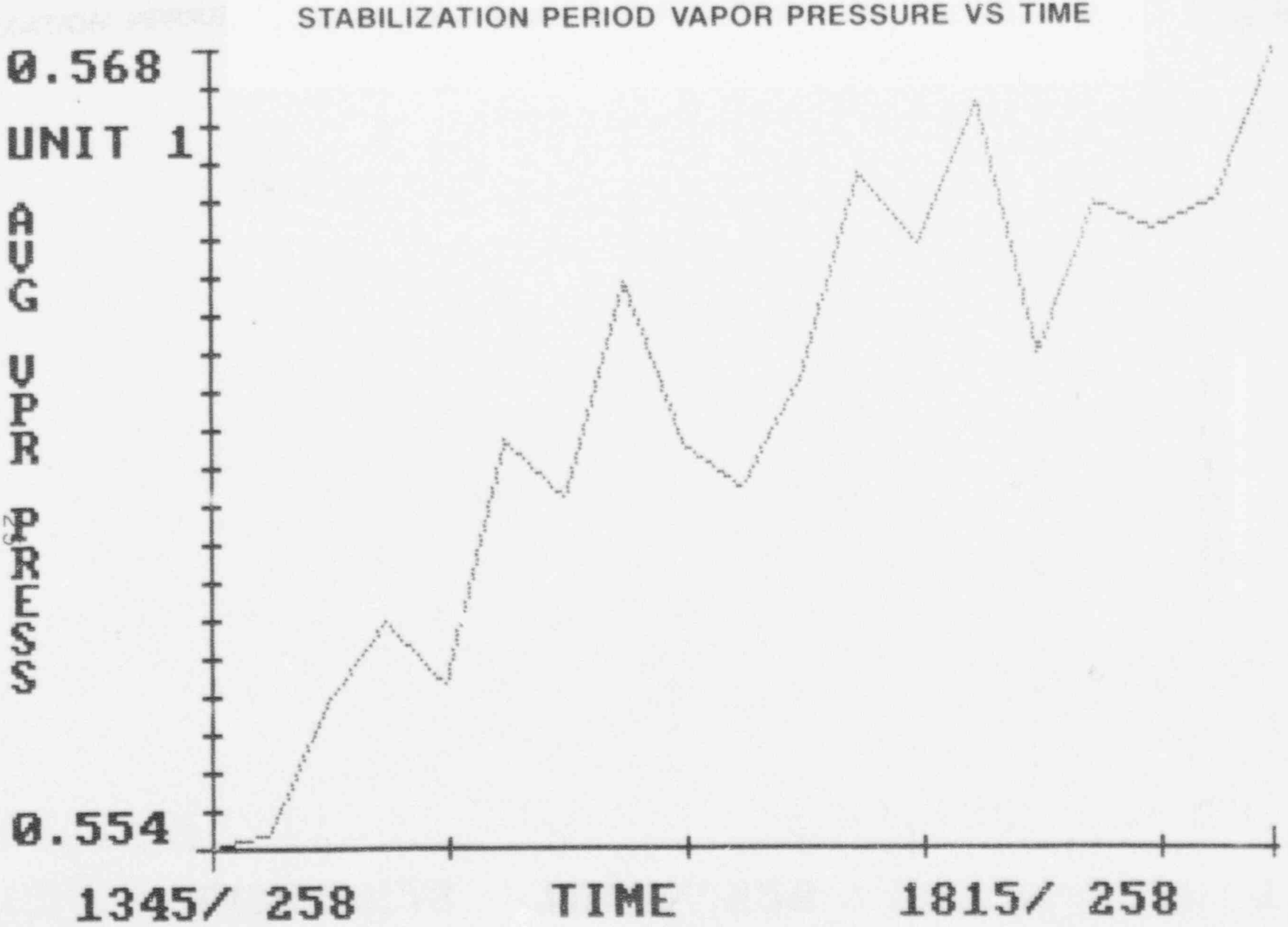
STABILIZATION PERIOD PRESSURE VS TIME

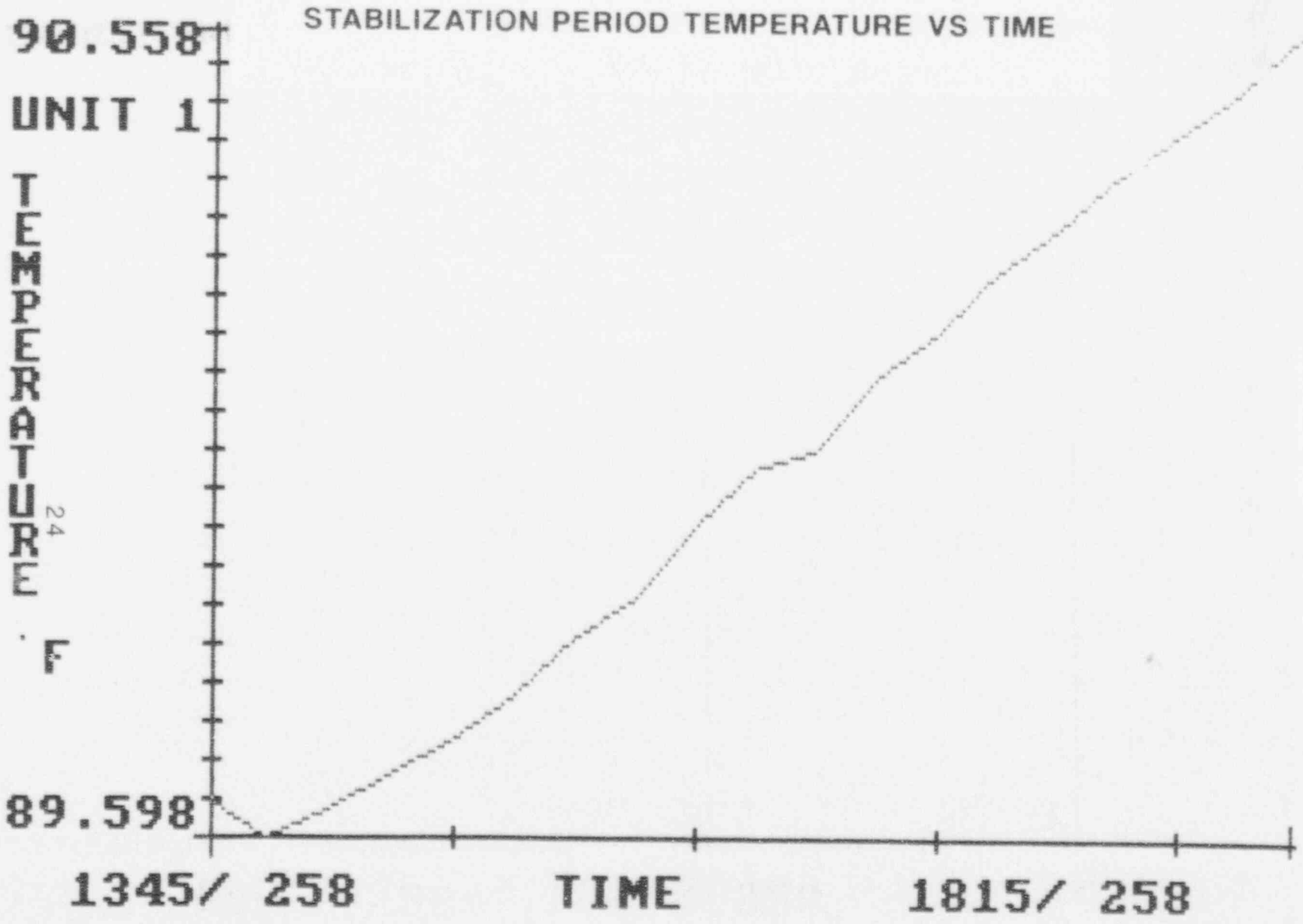


STABILIZATION PERIOD MASS POINT LEAK RATE VS TIME




STABILIZATION PERIOD MASS VS TIME
6.4351
UNIT 1
MASS
LBM
X10^5
6.4288
1345/ 258
TIME
1815/ 258


STABILIZATION PERIOD VAPOR PRESSURE VS TIME
0.568
UNIT 1
AVG VPR PRESS
0.554
1345/ 258
TIME
1815/ 258


STABILIZATION PERIOD TEMPERATURE VS TIME
90.558
UNIT 1
TEMPERATURE F
24
89.598
1345/ 258
TIME
1815/ 258

APPENDIX B

ILRT TEST DATA AND PLOTS

TEST MODE
OPTIONS

1 - MANUAL DATA ENTRY
2 - PARAMETER GRAPHS
3 - SENSOR PLOTS
4 - REPRINT CURRENT DATA PT
5 - SENSOR DIFFERENTIALS
6 - TREND ANALYSIS
P - PASS WORD MENU

SUMMARY
TIME = 1845

# OF DATA POINTS	= 98
MODE DURATION (IN HOURS)	= 24.25
TOT TIME MEASURED LEAK	= 0.0707
TOT TIME CALCULATED LEAK	= 0.0702
TOT TIME 95% UCL	= 0.0849
MASS POINT LEAK	= 0.0684
MASS POINT 95% UCL	= 0.0707
75 La	= .075

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	93.441/ +0.016	AVG PRESS:	65.825 / -0.001
MASS:	642444.06 / -32.500	AVG DEW PRESS:	0.5792/ +0.0026
		TOTAL PRESS:	66.404 / +0.001

TEST MODE
Page 1

AVERAGE DATA VALUES						
DATE	TIME	RTD	DEW PT.	VAP PRESS	DRY PRESS	MASS
258	0.00	90.619	83.305	0.564	65.536	642903.44
258	0.25	90.655	83.332	0.565	65.541	642912.31
258	0.50	90.721	83.408	0.566	65.546	642882.00
258	0.75	90.767	83.136	0.561	65.556	642931.63
258	1.00	90.834	83.544	0.569	65.555	642835.69
258	1.25	90.888	83.651	0.571	65.559	642814.63
258	1.50	90.938	83.488	0.568	65.567	642839.25
258	1.75	90.985	83.570	0.569	65.571	642824.25
258	2.00	91.025	83.410	0.566	65.580	642860.69
258	2.25	91.076	83.479	0.567	65.584	642839.00
258	2.50	91.115	83.540	0.569	65.588	642831.00
258	2.75	91.169	83.543	0.569	65.593	642820.56
258	3.00	91.212	83.553	0.569	65.598	642817.19
258	3.25	91.275	83.697	0.571	65.600	642765.00
258	3.50	91.310	83.499	0.568	65.608	642807.81
258	3.75	91.348	83.575	0.569	65.612	642797.00
258	4.00	91.392	83.615	0.570	65.616	642783.00
258	4.25	91.427	83.537	0.568	65.622	642802.44
258	4.50	91.484	83.490	0.568	65.627	642786.31
258	4.75	91.516	83.610	0.570	65.629	642774.56
258	5.00	91.559	83.630	0.570	65.634	642767.75
258	5.25	91.597	83.772	0.573	65.636	642740.81
259	5.50	91.631	83.648	0.571	65.642	642765.38
259	5.75	91.671	83.530	0.568	65.649	642780.56
259	6.00	91.708	83.750	0.572	65.648	642735.25
259	6.25	91.750	83.651	0.571	65.655	642747.88
259	6.50	91.780	83.722	0.572	65.657	642740.50
259	6.75	91.825	83.749	0.572	65.661	642720.31
259	7.00	91.859	83.688	0.571	65.666	642729.81
259	7.25	91.903	83.706	0.572	65.669	642712.06
259	7.50	91.937	83.834	0.574	65.670	642685.63
259	7.75	91.972	83.894	0.575	65.673	642671.75
259	8.00	92.009	83.712	0.572	65.680	642697.19
259	8.25	92.038	83.806	0.573	65.682	642679.81
259	8.50	92.076	83.840	0.574	65.685	642667.38
259	8.75	92.111	83.806	0.573	65.689	642663.19
259	9.00	92.132	83.799	0.573	65.693	642674.81
259	9.25	92.172	83.765	0.573	65.697	642666.63
259	9.50	92.203	83.690	0.571	65.702	642681.00
259	9.75	92.225	83.859	0.574	65.702	642655.94

TEST MODE
Page 2

AVERAGE DATA VALUES						
DATE	TIME	RTD	DEW PT.	VAP PRESS	DRY PRESS	MASS
259	10.00	92.247	83.876	0.575	65.705	642658.00
259	10.25	92.290	83.945	0.576	65.706	642626.31
259	10.50	92.320	83.890	0.575	65.711	642632.88
259	10.75	92.341	83.886	0.575	65.714	642640.69
259	11.00	92.374	83.827	0.574	65.718	642640.81
259	11.25	92.412	83.814	0.574	65.721	642631.00
259	11.50	92.447	83.765	0.573	65.725	642625.69
259	11.75	92.465	83.967	0.576	65.725	642599.81
259	12.00	92.495	83.858	0.574	65.729	642610.31
259	12.25	92.520	83.860	0.574	65.732	642610.94
259	12.50	92.553	83.919	0.576	65.734	642588.50
259	12.75	92.568	83.783	0.573	65.739	642621.13
259	13.00	92.593	83.876	0.575	65.740	642600.94
259	13.25	92.620	83.770	0.573	65.744	642613.81
259	13.50	92.648	83.930	0.576	65.745	642582.75
259	13.75	92.672	83.817	0.574	65.749	642600.44
259	14.00	92.686	83.994	0.577	65.748	642576.06
259	14.25	92.711	83.869	0.575	65.754	642597.00
259	14.50	92.739	83.867	0.575	65.756	642591.19
259	14.75	92.769	83.886	0.575	65.758	642576.63
259	15.00	92.790	83.974	0.577	65.759	642559.00
259	15.25	92.812	84.054	0.578	65.760	642540.25
259	15.50	92.831	84.046	0.578	65.762	642544.31
259	15.75	92.845	84.034	0.578	65.765	642551.25
259	16.00	92.868	83.999	0.577	65.768	642553.56
259	16.25	92.888	84.178	0.580	65.767	642521.00
259	16.50	92.908	83.834	0.574	65.775	642579.88
259	16.75	92.930	84.039	0.578	65.774	642538.06
259	17.00	92.959	84.018	0.577	65.776	642531.25
259	17.25	92.978	83.896	0.575	65.781	642551.63
259	17.50	92.996	84.066	0.578	65.780	642519.56
259	17.75	93.021	83.997	0.577	65.783	642522.19
259	18.00	93.039	84.119	0.579	65.783	642499.44
259	18.25	93.056	83.930	0.576	65.788	642533.44
259	18.50	93.074	83.935	0.576	65.790	642529.25
259	18.75	93.092	83.940	0.576	65.792	642526.25
259	19.00	93.108	83.972	0.576	65.793	642519.75
259	19.25	93.124	84.110	0.579	65.792	642494.06
259	19.50	93.145	84.224	0.581	65.792	642466.75
259	19.75	93.158	84.233	0.581	65.794	642468.00

TEST MODE
Page 3

AVERAGE DATA VALUES						
DATE	TIME	RTD	DEW PT.	VAP PRESS	DRY PRESS	MASS
259	20.00	93.179	84.056	0.578	65.799	642494.69
259	20.25	93.200	84.074	0.578	65.800	642485.38
259	20.50	93.215	84.158	0.580	65.801	642470.50
259	20.75	93.232	84.085	0.579	65.804	642483.38
259	21.00	93.247	84.157	0.580	65.804	642470.94
259	21.25	93.271	84.072	0.578	65.808	642476.25
259	21.50	93.282	84.109	0.579	65.809	642473.69
259	21.75	93.303	84.114	0.579	65.810	642464.06
259	22.00	93.326	84.154	0.580	65.811	642447.69
259	22.25	93.327	84.193	0.581	65.812	642452.19
259	22.50	93.335	84.029	0.578	65.817	642489.13
259	22.75	93.359	83.984	0.577	65.819	642485.38
259	23.00	93.381	84.017	0.577	65.820	642466.88
259	23.25	93.385	84.017	0.577	65.822	642478.00
259	23.50	93.403	84.045	0.578	65.823	642466.38
259	23.75	93.405	84.178	0.580	65.821	642449.88
259	24.00	93.426	83.977	0.577	65.826	642476.56
259	24.25	93.441	84.116	0.579	65.825	642444.06

TEST MODE
Three Mile Island UNIT 1 Page 1

LEAKAGE RATE SUMMARY UNIT 1						
		TOTAL TIME			MASS/POINT	
DATE	TIME	TTLM	LMCALC	SL	LAM	L95
258	0.00	0.0000	0.0000	0.0000	0.0000	0.0000
258	0.25	-0.1318	0.0000	0.0000	0.0000	0.0000
258	0.50	0.1598	0.1598	0.0000	0.1593	1.6045
258	0.75	-0.1403	-0.0416	2.2986	-0.0799	0.3860
258	1.00	0.2530	0.1634	1.1996	0.1738	0.5812
258	1.25	0.2653	0.2587	0.9122	0.2673	0.5345
258	1.50	0.1598	0.2492	0.7873	0.2316	0.4147
258	1.75	0.1689	0.2451	0.7082	0.2162	0.3488
258	2.00	0.0799	0.2035	0.6445	0.1584	0.2769
258	2.25	0.1070	0.1851	0.5885	0.1384	0.2337
258	2.50	0.1082	0.1721	0.5437	0.1260	0.2037
258	2.75	0.1126	0.1636	0.5082	0.1200	0.1843
258	3.00	0.1074	0.1555	0.4780	0.1139	0.1680
258	3.25	0.1590	0.1632	0.4647	0.1296	0.1783
258	3.50	0.1020	0.1543	0.4413	0.1204	0.1633
258	3.75	0.1060	0.1480	0.4217	0.1152	0.1530
258	4.00	0.1124	0.1443	0.4058	0.1135	0.1467
258	4.25	0.0887	0.1361	0.3880	0.1052	0.1357
258	4.50	0.0972	0.1311	0.3735	0.1013	0.1288
258	4.75	0.1013	0.1276	0.3613	0.0997	0.1244
258	5.00	0.1013	0.1247	0.3504	0.0981	0.1204
258	5.25	0.1156	0.1247	0.3429	0.1011	0.1215
259	5.50	0.0937	0.1209	0.3328	0.0980	0.1169
259	5.75	0.0798	0.1154	0.3218	0.0925	0.1106
259	6.00	0.1047	0.1146	0.3152	0.0936	0.1103
259	6.25	0.0930	0.1121	0.3075	0.0919	0.1073
259	6.50	0.0936	0.1099	0.3005	0.0908	0.1051
259	6.75	0.1013	0.1091	0.2951	0.0913	0.1046
259	7.00	0.0926	0.1073	0.2890	0.0904	0.1028
259	7.25	0.0986	0.1064	0.2841	0.0906	0.1021
259	7.50	0.1085	0.1069	0.2808	0.0927	0.1037
259	7.75	0.1116	0.1077	0.2780	0.0951	0.1056
259	8.00	0.0963	0.1065	0.2736	0.0945	0.1044
259	8.25	0.1012	0.1061	0.2699	0.0948	0.1041
259	8.50	0.1037	0.1060	0.2668	0.0956	0.1044
259	8.75	0.1025	0.1057	0.2637	0.0960	0.1043
259	9.00	0.0948	0.1047	0.2600	0.0952	0.1031
259	9.25	0.0956	0.1039	0.2566	0.0947	0.1022
259	9.50	0.0874	0.1022	0.2526	0.0929	0.1001
259	9.75	0.0948	0.1015	0.2495	0.0925	0.0994

TEST MODE
Three Mile Island UNIT 1 Page 2

LEAKAGE RATE SUMMARY UNIT 1						
		TOTAL TIME			MASS/POINT	
DATE	TIME	TTLM	LMCALC	SL*	LAM	L95
259	10.00	0.0916	0.1005	0.2463	0.0917	0.0984
259	10.25	0.1009	0.1005	0.2442	0.0925	0.0988
259	10.50	0.0962	0.1000	0.2417	0.0924	0.0984
259	10.75	0.0913	0.0992	0.2388	0.0917	0.0975
259	11.00	0.0891	0.0982	0.2360	0.0906	0.0962
259	11.25	0.0904	0.0974	0.2334	0.0900	0.0954
259	11.50	0.0902	0.0966	0.2309	0.0895	0.0946
259	11.75	0.0965	0.0964	0.2290	0.0898	0.0947
259	12.00	0.0912	0.0958	0.2268	0.0893	0.0941
259	12.25	0.0892	0.0951	0.2245	0.0888	0.0934
259	12.50	0.0941	0.0948	0.2227	0.0889	0.0933
259	12.75	0.0827	0.0937	0.2202	0.0877	0.0921
259	13.00	0.0869	0.0930	0.2181	0.0870	0.0913
259	13.25	0.0816	0.0919	0.2156	0.0858	0.0901
259	13.50	0.0887	0.0914	0.2138	0.0855	0.0897
259	13.75	0.0823	0.0905	0.2117	0.0847	0.0887
259	14.00	0.0873	0.0900	0.2099	0.0844	0.0883
259	14.25	0.0803	0.0890	0.2078	0.0834	0.0873
259	14.50	0.0804	0.0882	0.2057	0.0825	0.0864
259	14.75	0.0827	0.0875	0.2039	0.0819	0.0856
259	15.00	0.0857	0.0870	0.2024	0.0817	0.0853
259	15.25	0.0889	0.0868	0.2011	0.0817	0.0852
259	15.50	0.0865	0.0865	0.1997	0.0817	0.0851
259	15.75	0.0835	0.0860	0.1982	0.0812	0.0846
259	16.00	0.0816	0.0854	0.1966	0.0807	0.0840
259	16.25	0.0879	0.0852	0.1954	0.0808	0.0840
259	16.50	0.0732	0.0841	0.1935	0.0796	0.0829
259	16.75	0.0814	0.0836	0.1920	0.0793	0.0825
259	17.00	0.0817	0.0832	0.1907	0.0790	0.0821
259	17.25	0.0761	0.0824	0.1891	0.0782	0.0813
259	17.50	0.0819	0.0820	0.1878	0.0780	0.0810
259	17.75	0.0802	0.0816	0.1865	0.0777	0.0807
259	18.00	0.0838	0.0813	0.1855	0.0777	0.0806
259	18.25	0.0757	0.0807	0.1840	0.0770	0.0799
259	18.50	0.0755	0.0800	0.1826	0.0764	0.0793
259	18.75	0.0751	0.0794	0.1812	0.0759	0.0787
259	19.00	0.0754	0.0788	0.1799	0.0753	0.0782
259	19.25	0.0794	0.0785	0.1788	0.0751	0.0779
259	19.50	0.0836	0.0783	0.1780	0.0753	0.0780
259	19.75	0.0823	0.0782	0.1771	0.0753	0.0780

TEST MODE
Three Mile Island UNIT 1 Page 3

LEAKAGE RATE SUMMARY UNIT 1						
		TOTAL TIME			MASS/POINT	
DATE	TIME	TTLM	LMCALC	SL	LAM	L95
259	20.00	0.0763	0.0777	0.1760	0.0750	0.0776
259	20.25	0.0771	0.0773	0.1749	0.0746	0.0772
259	20.50	0.0789	0.0770	0.1739	0.0746	0.0770
259	20.75	0.0756	0.0765	0.1728	0.0741	0.0766
259	21.00	0.0769	0.0762	0.1718	0.0739	0.0763
259	21.25	0.0750	0.0758	0.1708	0.0736	0.0760
259	21.50	0.0746	0.0753	0.1698	0.0732	0.0755
259	21.75	0.0754	0.0750	0.1688	0.0729	0.0752
259	22.00	0.0773	0.0747	0.1679	0.0728	0.0751
259	22.25	0.0757	0.0744	0.1670	0.0725	0.0748
259	22.50	0.0687	0.0738	0.1659	0.0719	0.0742
259	22.75	0.0686	0.0732	0.1647	0.0712	0.0735
259	23.00	0.0709	0.0727	0.1637	0.0708	0.0731
259	23.25	0.0683	0.0721	0.1626	0.0702	0.0725
259	23.50	0.0694	0.0716	0.1616	0.0697	0.0720
259	23.75	0.0713	0.0712	0.1607	0.0694	0.0716
259	24.00	0.0664	0.0706	0.0854	0.0687	0.0710
259	24.25	0.0707	0.0702	0.0849	0.0684	0.0707

TEST MODE
Three Mile Island UNIT 1 Page 1

LEAKAGE RATE TREND SUMMARY UNIT 1

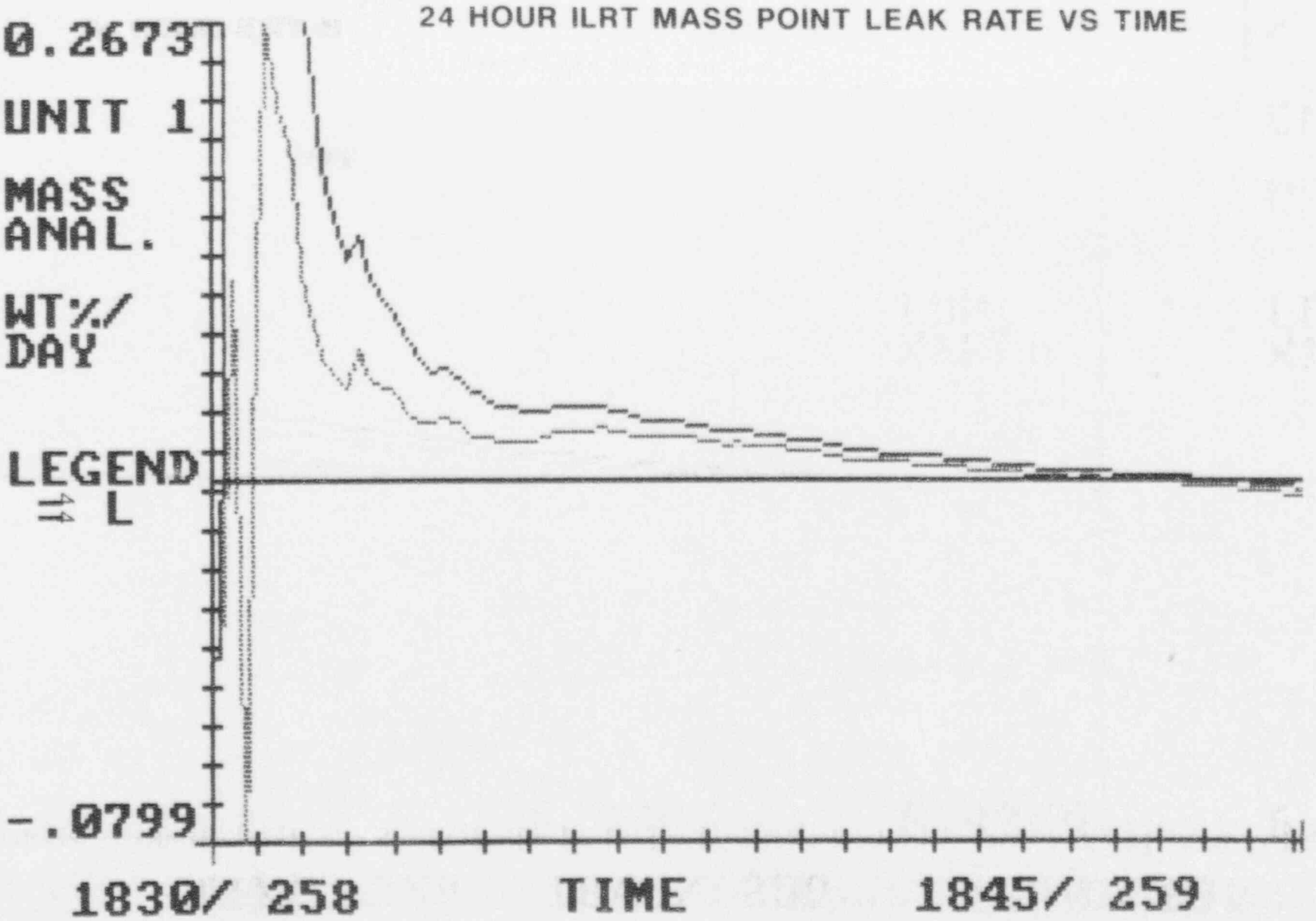
		TOTAL TIME			MASS POINT	
DATE	TIME	TTLM	LMCALC	CHANGE	LAM	CHANGE
258	0.25	-0.1318	0.0000	0.0000	0.0000	0.0000
258	0.50	0.1598	0.1598	0.1598	0.1593	0.1593
258	0.75	-0.1403	-0.0416	-0.2015	-0.0799	-0.2392
258	1.00	0.2530	0.1634	0.2050	0.1738	0.2537
258	1.25	0.2653	0.2587	0.0953	0.2673	0.0935
258	1.50	0.1598	0.2492	-0.0095	0.2316	-0.0358
258	1.75	0.1689	0.2451	-0.0041	0.2162	-0.0154
258	2.00	0.0799	0.2035	-0.0416	0.1584	-0.0578
258	2.25	0.1070	0.1851	-0.0184	0.1384	-0.0200
258	2.50	0.1082	0.1721	-0.0130	0.1260	-0.0125
258	2.75	0.1126	0.1636	-0.0085	0.1200	-0.0060
258	3.00	0.1074	0.1555	-0.0081	0.1139	-0.0061
258	3.25	0.1590	0.1632	0.0077	0.1296	0.0157
258	3.50	0.1020	0.1543	-0.0089	0.1204	-0.0093
258	3.75	0.1060	0.1480	-0.0063	0.1152	-0.0051
258	4.00	0.1124	0.1443	-0.0037	0.1135	-0.0017
258	4.25	0.0887	0.1361	-0.0082	0.1052	-0.0083
258	4.50	0.0972	0.1311	-0.0051	0.1013	-0.0039
258	4.75	0.1013	0.1276	-0.0035	0.0997	-0.0016
258	5.00	0.1013	0.1247	-0.0029	0.0981	-0.0016
258	5.25	0.1156	0.1247	0.0000	0.1011	0.0029
258	5.50	0.0937	0.1209	-0.0037	0.0980	-0.0030
259	5.75	0.0798	0.1154	-0.0055	0.0925	-0.0055
259	6.00	0.1047	0.1146	-0.0009	0.0936	0.0011
259	6.25	0.0930	0.1121	-0.0025	0.0919	-0.0017
259	6.50	0.0936	0.1099	-0.0021	0.0908	-0.0011
259	6.75	0.1013	0.1091	-0.0008	0.0913	0.0006
259	7.00	0.0926	0.1073	-0.0019	0.0904	-0.0009
259	7.25	0.0986	0.1064	-0.0009	0.0906	0.0002
259	7.50	0.1085	0.1069	0.0005	0.0927	0.0021
259	7.75	0.1116	0.1077	0.0008	0.0951	0.0024
259	8.00	0.0963	0.1065	-0.0011	0.0945	-0.0006
259	8.25	0.1012	0.1061	-0.0004	0.0948	0.0004
259	8.50	0.1037	0.1060	-0.0001	0.0956	0.0008
259	8.75	0.1025	0.1057	-0.0002	0.0960	0.0004
259	9.00	0.0948	0.1047	-0.0010	0.0952	-0.0008
259	9.25	0.0956	0.1039	-0.0009	0.0947	-0.0006
259	9.50	0.0874	0.1022	-0.0016	0.0929	-0.0018
259	9.75	0.0948	0.1015	-0.0007	0.0925	-0.0003
259	10.00	0.0916	0.1005	-0.0010	0.0917	-0.0008

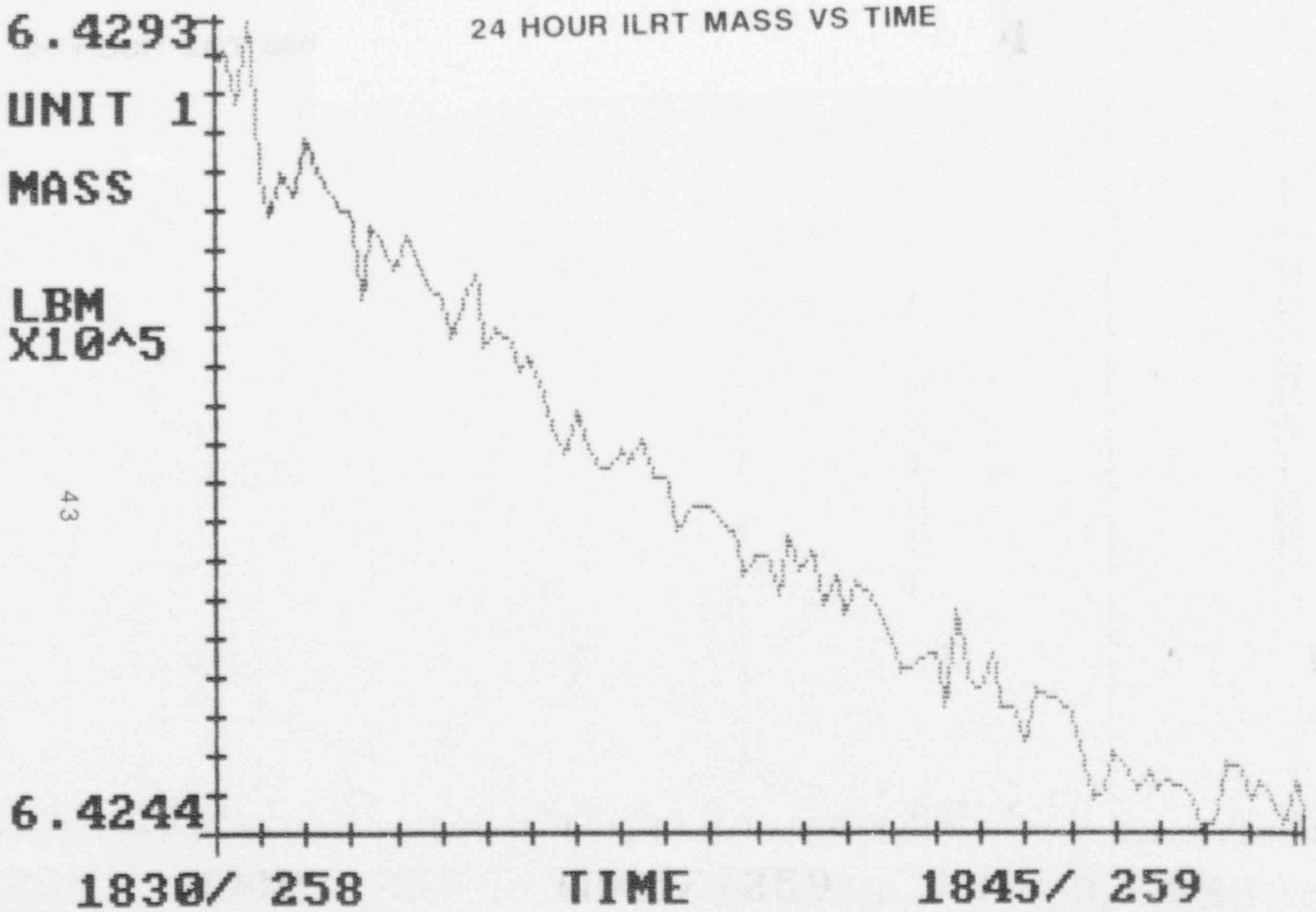
LEAKAGE RATE TREND SUMMARY UNIT 1

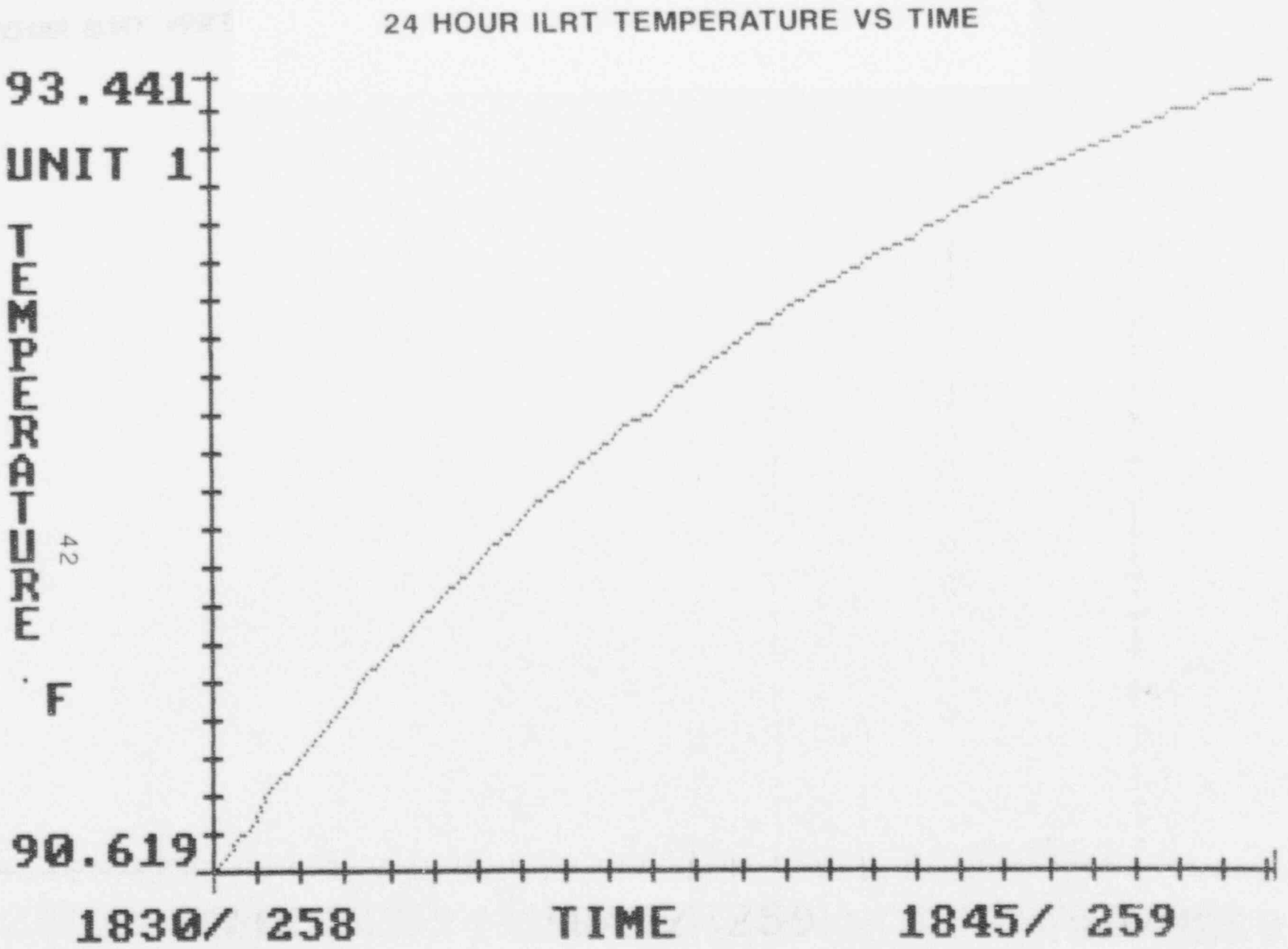
		TOTAL TIME			MASS POINT	
DATE	TIME	TTLM	LMCALC	CHANGE	LAM	CHANGE
259	10.25	0.1009	0.1005	-0.0000	0.0925	0.0008
259	10.50	0.0962	0.1000	-0.0005	0.0924	-0.0002
259	10.75	0.0913	0.0992	-0.0009	0.0917	-0.0007
259	11.00	0.0891	0.0982	-0.0010	0.0906	-0.0011
259	11.25	0.0904	0.0974	-0.0008	0.0900	-0.0006
259	11.50	0.0902	0.0966	-0.0008	0.0895	-0.0006
259	11.75	0.0965	0.0964	-0.0002	0.0898	0.0003
259	12.00	0.0912	0.0958	-0.0006	0.0893	-0.0005
259	12.25	0.0892	0.0951	-0.0007	0.0888	-0.0005
259	12.50	0.0941	0.0948	-0.0003	0.0889	0.0001
259	12.75	0.0827	0.0937	-0.0011	0.0877	-0.0012
259	13.00	0.0869	0.0930	-0.0007	0.0870	-0.0007
259	13.25	0.0816	0.0919	-0.0011	0.0858	-0.0012
259	13.50	0.0887	0.0914	-0.0005	0.0855	-0.0003
259	13.75	0.0823	0.0905	-0.0009	0.0847	-0.0009
259	14.00	0.0873	0.0900	-0.0005	0.0844	-0.0003
259	14.25	0.0803	0.0890	-0.0010	0.0834	-0.0010
259	14.50	0.0804	0.0882	-0.0009	0.0825	-0.0008
259	14.75	0.0827	0.0875	-0.0007	0.0819	-0.0007
259	15.00	0.0857	0.0870	-0.0004	0.0817	-0.0002
259	15.25	0.0889	0.0868	-0.0002	0.0817	0.0000
259	15.50	0.0865	0.0865	-0.0003	0.0817	-0.0000
259	15.75	0.0835	0.0860	-0.0005	0.0812	-0.0004
259	16.00	0.0816	0.0854	-0.0006	0.0807	-0.0005
259	16.25	0.0879	0.0852	-0.0002	0.0808	0.0001
259	16.50	0.0732	0.0841	-0.0010	0.0796	-0.0011
259	16.75	0.0814	0.0836	-0.0005	0.0793	-0.0003
259	17.00	0.0817	0.0832	-0.0005	0.0790	-0.0004
259	17.25	0.0761	0.0824	-0.0008	0.0782	-0.0007
259	17.50	0.0819	0.0820	-0.0004	0.0780	-0.0002
259	17.75	0.0802	0.0816	-0.0005	0.0777	-0.0003
259	18.00	0.0838	0.0813	-0.0002	0.0777	0.0000
259	18.25	0.0757	0.0807	-0.0007	0.0770	-0.0007
259	18.50	0.0755	0.0800	-0.0006	0.0764	-0.0006
259	18.75	0.0751	0.0794	-0.0006	0.0759	-0.0005
259	19.00	0.0754	0.0788	-0.0006	0.0753	-0.0005
259	19.25	0.0794	0.0785	-0.0004	0.0751	-0.0002
259	19.50	0.0836	0.0783	-0.0001	0.0753	0.0002
259	19.75	0.0823	0.0782	-0.0002	0.0753	0.0000
259	20.00	0.0763	0.0777	-0.0005	0.0750	-0.0004

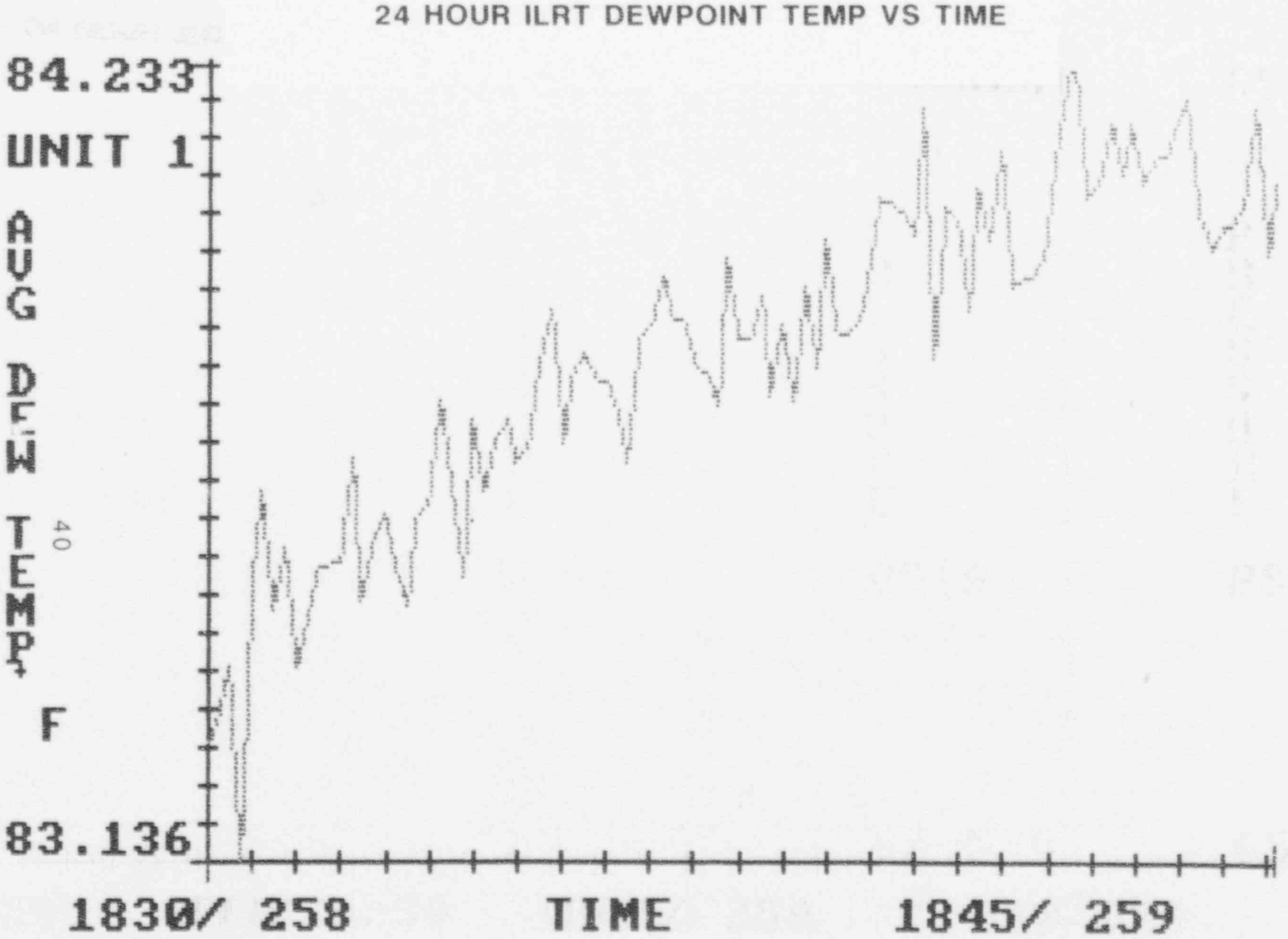
LEAKAGE RATE TREND SUMMARY UNIT 1						
		TOTAL TIME			MASS POINT	
DATE	TIME	TTLM	LMCALC	CHANGE	LAM	CHANGE
259	20.25	0.0771	0.0773	-0.0004	0.0746	-0.0003
259	20.50	0.0789	0.0770	-0.0003	0.0746	-0.0001
259	20.75	0.0756	0.0765	-0.0004	0.0741	-0.0004
259	21.00	0.0769	0.0762	-0.0004	0.0739	-0.0002
259	21.25	0.0750	0.0758	-0.0004	0.0736	-0.0003
259	21.50	0.0746	0.0753	-0.0004	0.0732	-0.0004
259	21.75	0.0754	0.0750	-0.0004	0.0729	-0.0003
259	22.00	0.0773	0.0747	-0.0003	0.0728	-0.0001
259	22.25	0.0757	0.0744	-0.0003	0.0725	-0.0003
259	22.50	0.0687	0.0738	-0.0006	0.0719	-0.0007
259	22.75	0.0686	0.0732	-0.0006	0.0712	-0.0007
259	23.00	0.0709	0.0727	-0.0005	0.0708	-0.0005
259	23.25	0.0683	0.0721	-0.0006	0.0702	-0.0006
259	23.50	0.0694	0.0716	-0.0005	0.0697	-0.0005
259	23.75	0.0713	0.0712	-0.0004	0.0694	-0.0003
259	24.00	0.0664	0.0706	-0.0006	0.0687	-0.0006
259	24.25	0.0707	0.0702	-0.0004	0.0684	-0.0003

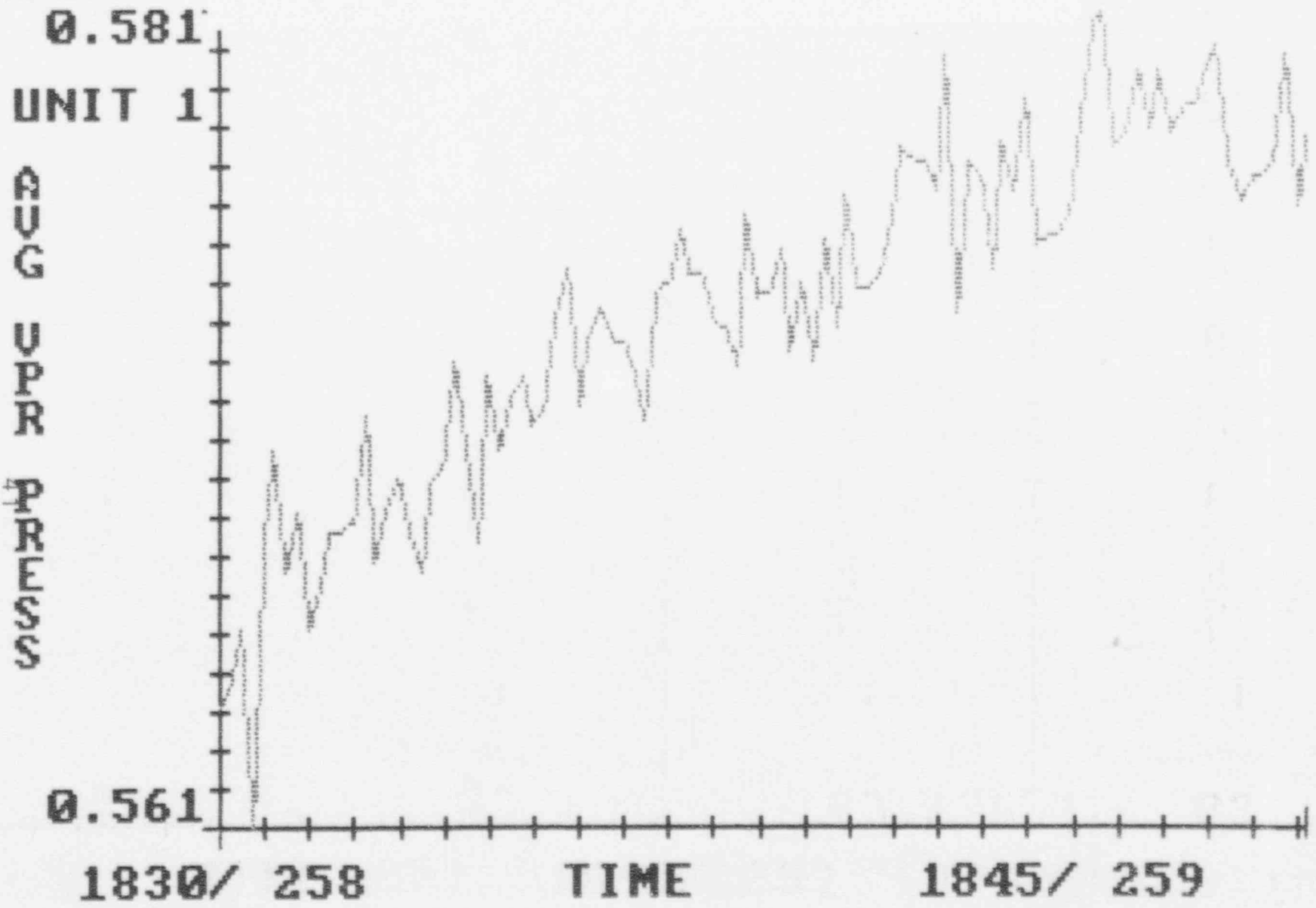
20 POINT MEAN TOTAL TIME CALCULATED LEAKAGE = 7.458624E-02
20 POINT MEAN TOTAL TIME MEASURED LEAKAGE = 7.415611E-02
20 POINT MEAN MASS POINT LEAKAGE = 7.241055E-02
MASS POINT INTERCEPT = 642855.4
MASS POINT SLOPE =-18.3333

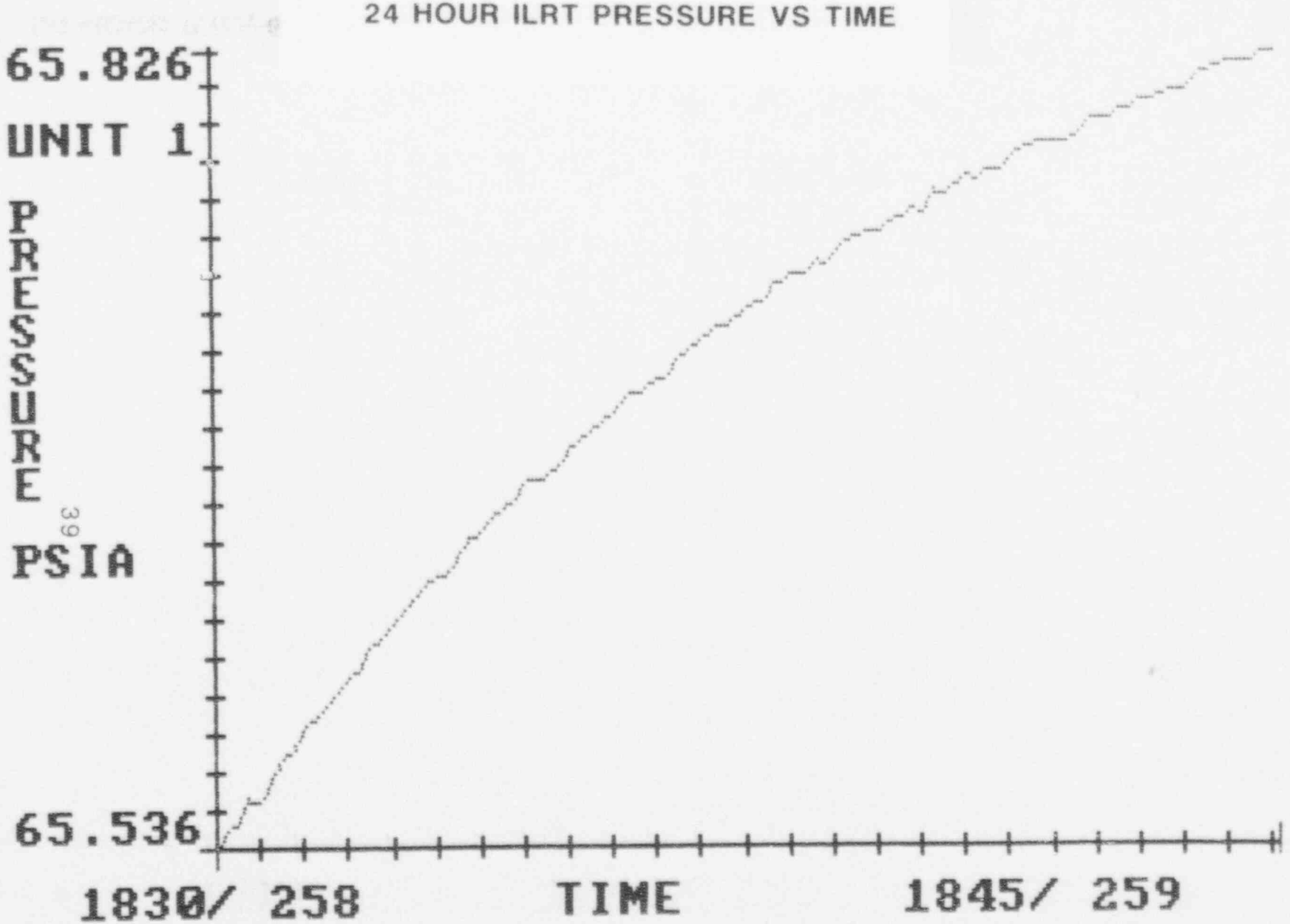

24 HOUR ILRT MASS POINT LEAK RATE VS TIME
0.2673
UNIT 1
MASS
ANAL.
WT%/
DAY
LEGEND
11 L
-.0799
1830/ 258
TIME
1845/ 259


24 HOUR ILRT MASS VS TIME
6.4293
UNIT 1
MASS
LBM
X10^5
6.4244
1830/ 258
TIME
1845/ 259


24 HOUR ILRT TEMPERATURE VS TIME
93.441
UNIT 1
TEMPERATURE
F
42
90.619
1830/ 258
TIME
1845/ 259


24 HOUR ILRT DEWPOINT TEMP VS TIME
84.233
UNIT 1
AVG DEW TEMP
40
F
83.136
1830/ 258
TIME
1845/ 259


24 HOUR ILRT VAPOR PRESSURE VS TIME
0.581
UNIT 1
AVG VPR PRESS
0.561
1830/ 258
TIME
1845/ 259


24 HOUR ILRT PRESSURE VS TIME
65.826
UNIT 1
PRESSURE
PSIA
65.536
1830/ 258
TIME
1845/ 259

APPENDIX C

VERIFICATION TEST DATA AND PLOTS

VERIFICATION MODE
OPTIONS

1 - MANUAL DATA ENTRY
2 - PARAMETER GRAPHS
3 - SENSOR PLOTS
4 - REPRINT CURRENT DATA PT
5 - SENSOR DIFFERENTIALS
6 - TREND ANALYSIS
P - PASS WORD MENU

SUMMARY
TIME = 2315

# OF DATA POINTS =	18
MODE DURATION (IN HOURS) =	4.25
TOT TIME MEASURED LEAK =	0.1248
TOT TIME CALCULATED LEAK =	0.1604
MASS PT LEAK =	0.1487
IMPOSED LEAK =	0.1002
TOT TIME UPPER LIMIT =	0.1954
TOT TIME LOWER LIMIT =	0.1454
MASS PT UPPER LIMIT =	0.1936
MASS PT LOWER LIMIT =	0.1436

TOT TIME VERIFICATION CRITERIA HAS BEEN MET
MASS PT VERIFICATION CRITERIA HAS BEEN MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	93.646/ +0.010	AVG PRESS:	65.833 / +0.000
MASS:	642283.44 / -6.375	AVG DEW PRESS:	0.5783/ -0.0003
		TOTAL PRESS:	66.411 / +0.000

VERF MODE
Page 1

AVERAGE DATA VALUES						
DATE	TIME	RTD	DEW PT.	VAP PRESS	DRY PRESS	MASS
259	0.00	93.455	84.194	0.581	65.825	642425.44
259	0.25	93.460	84.262	0.582	65.824	642414.00
259	0.50	93.480	83.897	0.575	65.831	642460.81
259	0.75	93.484	84.037	0.578	65.829	642434.00
259	1.00	93.502	84.020	0.577	65.830	642422.69
259	1.25	93.510	84.128	0.579	65.828	642397.00
259	1.50	93.528	84.022	0.577	65.831	642399.81
259	1.75	93.525	84.099	0.579	65.829	642392.19
259	2.00	93.551	83.912	0.575	65.833	642400.56
259	2.25	93.559	84.201	0.581	65.828	642340.75
259	2.50	93.577	84.098	0.579	65.831	642343.88
259	2.75	93.581	84.009	0.577	65.832	642355.38
259	3.00	93.587	84.128	0.579	65.831	642331.13
259	3.25	93.597	84.206	0.581	65.829	642307.25
259	3.50	93.619	84.054	0.578	65.832	642312.31
259	3.75	93.627	84.083	0.579	65.832	642297.94
259	4.00	93.636	84.085	0.579	65.832	642289.81
259	4.25	93.646	84.070	0.578	65.833	642283.44

VERF MODE
Three Mile Island UNIT 1 Page 1

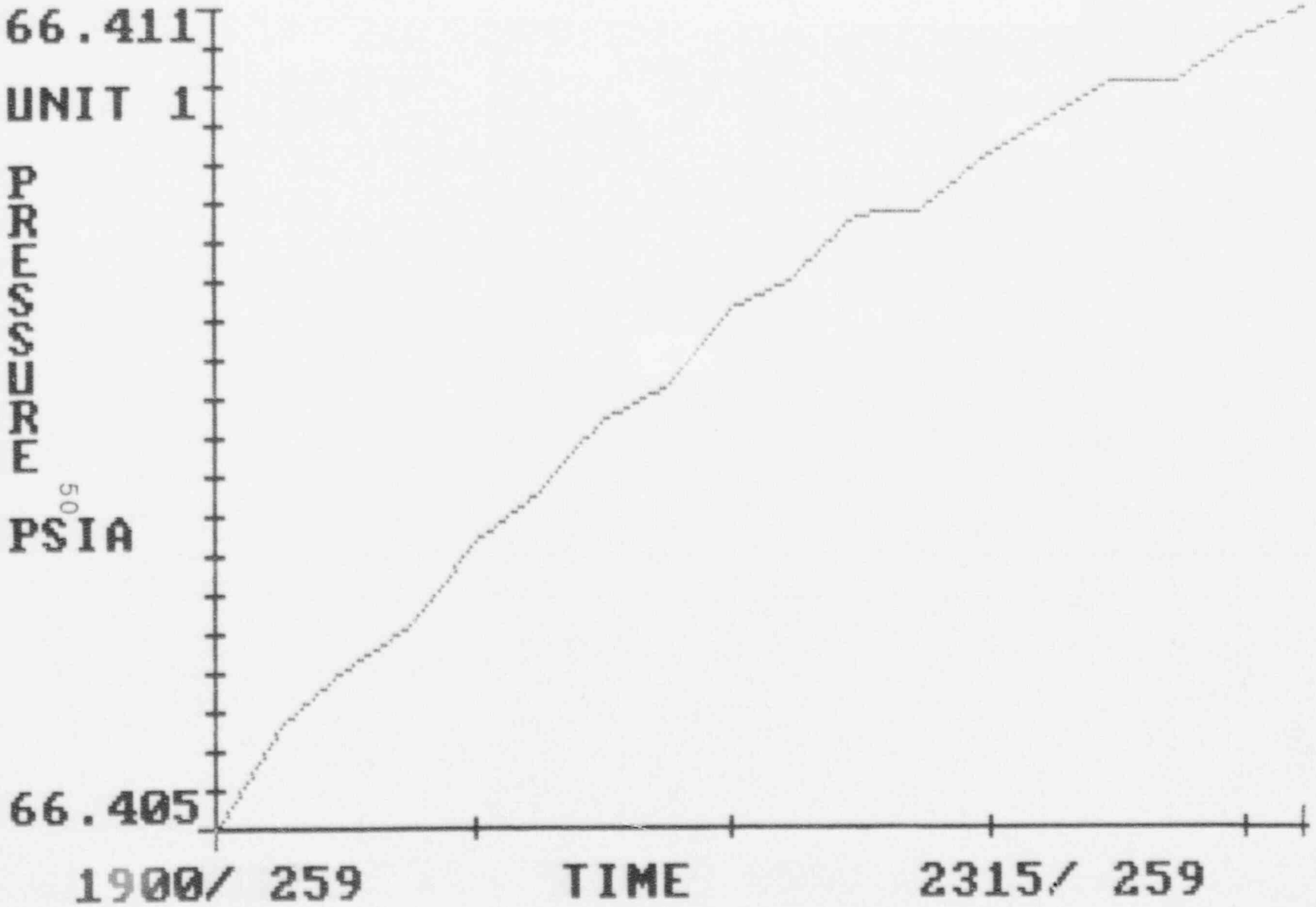
LEAKAGE RATE SUMMARY UNIT 1						
		TOTAL TIME			MASS/POINT	
DATE	TIME	TTLM	LMCALC	SL	LAM	L95
259	0.00	0.0000	0.0000	0.0000	0.0000	0.0000
259	0.25	0.1703	0.0000	0.0000	0.0000	0.0000
259	0.50	-0.2643	-0.2643	0.0000	-0.2640	1.8858
259	0.75	-0.0430	-0.1523	2.4420	-0.1076	0.3161
259	1.00	0.0101	-0.0706	1.0148	-0.0209	0.2076
259	1.25	0.0850	0.0123	0.7431	0.0615	0.2309
259	1.50	0.0639	0.0443	0.5964	0.0799	0.1951
259	1.75	0.0709	0.0653	0.5173	0.0904	0.1741
259	2.00	0.0465	0.0676	0.4567	0.0810	0.1451
259	2.25	0.1405	0.1041	0.4514	0.1200	0.1857
259	2.50	0.1218	0.1221	0.4356	0.1340	0.1889
259	2.75	0.0951	0.1260	0.4149	0.1304	0.1758
259	3.00	0.1175	0.1349	0.4031	0.1358	0.1742
259	3.25	0.1358	0.1462	0.3971	0.1456	0.1797
259	3.50	0.1207	0.1506	0.3880	0.1464	0.1758
259	3.75	0.1270	0.1552	0.3811	0.1484	0.1740
259	4.00	0.1266	0.1585	0.3746	0.1492	0.1717
259	4.25	0.1248	0.1604	0.3684	0.1487	0.1686

VERF MODE
Three Mile Island UNIT 1 Page 1

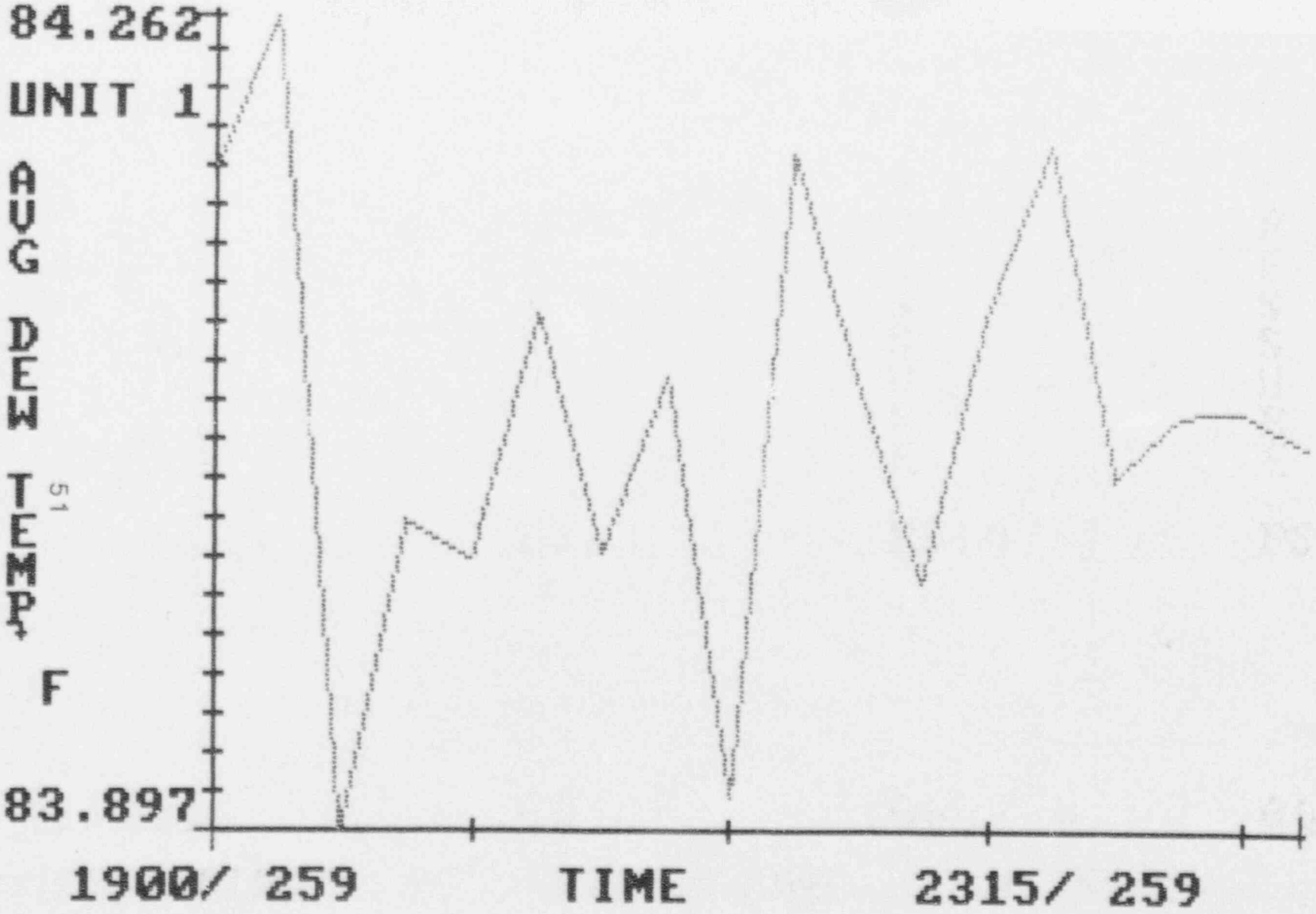
LEAKAGE RATE TREND SUMMARY UNIT 1						
		TOTAL TIME			MASS POINT	
DATE	TIME	TTLM	LMCALC	CHANGE	LAM	CHANGE
259	0.25	0.1703	0.0000	0.0000	0.0000	0.0000
259	0.50	-0.2643	-0.2643	-0.2643	-0.2640	-0.2640
259	0.75	-0.0430	-0.1523	0.1120	-0.1076	0.1564
259	1.00	0.0101	-0.0706	0.0817	-0.0209	0.0867
259	1.25	0.0850	0.0123	0.0830	0.0615	0.0824
259	1.50	0.0639	0.0443	0.0319	0.0799	0.0184
259	1.75	0.0709	0.0653	0.0211	0.0904	0.0105
259	2.00	0.0465	0.0676	0.0023	0.0810	-0.0093
259	2.25	0.1405	0.1041	0.0365	0.1200	0.0390
259	2.50	0.1218	0.1221	0.0181	0.1340	0.0140
259	2.75	0.0951	0.1260	0.0038	0.1304	-0.0036
259	3.00	0.1175	0.1349	0.0089	0.1358	0.0054
259	3.25	0.1358	0.1462	0.0113	0.1456	0.0098
259	3.50	0.1207	0.1506	0.0044	0.1464	0.0008
259	3.75	0.1270	0.1552	0.0046	0.1484	0.0020
259	4.00	0.1266	0.1585	0.0033	0.1492	0.0008
259	4.25	0.1248	0.1604	0.0020	0.1487	-0.0005

20 POINT MEAN TOTAL TIME CALCULATED LEAKAGE = 0
20 POINT MEAN TOTAL TIME MEASURED LEAKAGE = 0
20 POINT MEAN MASS POINT LEAKAGE = 0
MASS POINT INTERCEPT = 642451.8
MASS POINT SLOPE =-39.80461

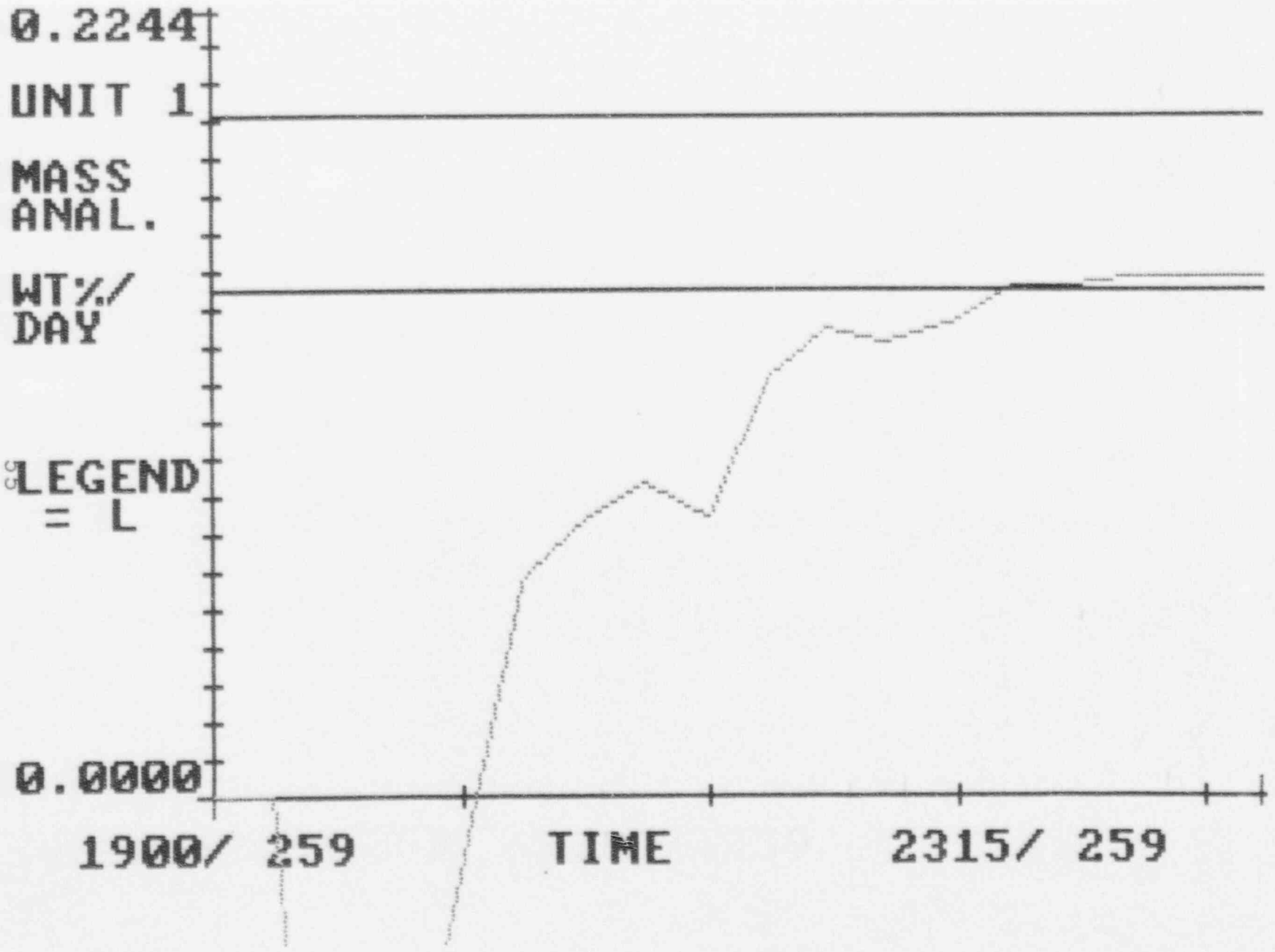
VERIFICATION TEST PRESSURE VS TIME

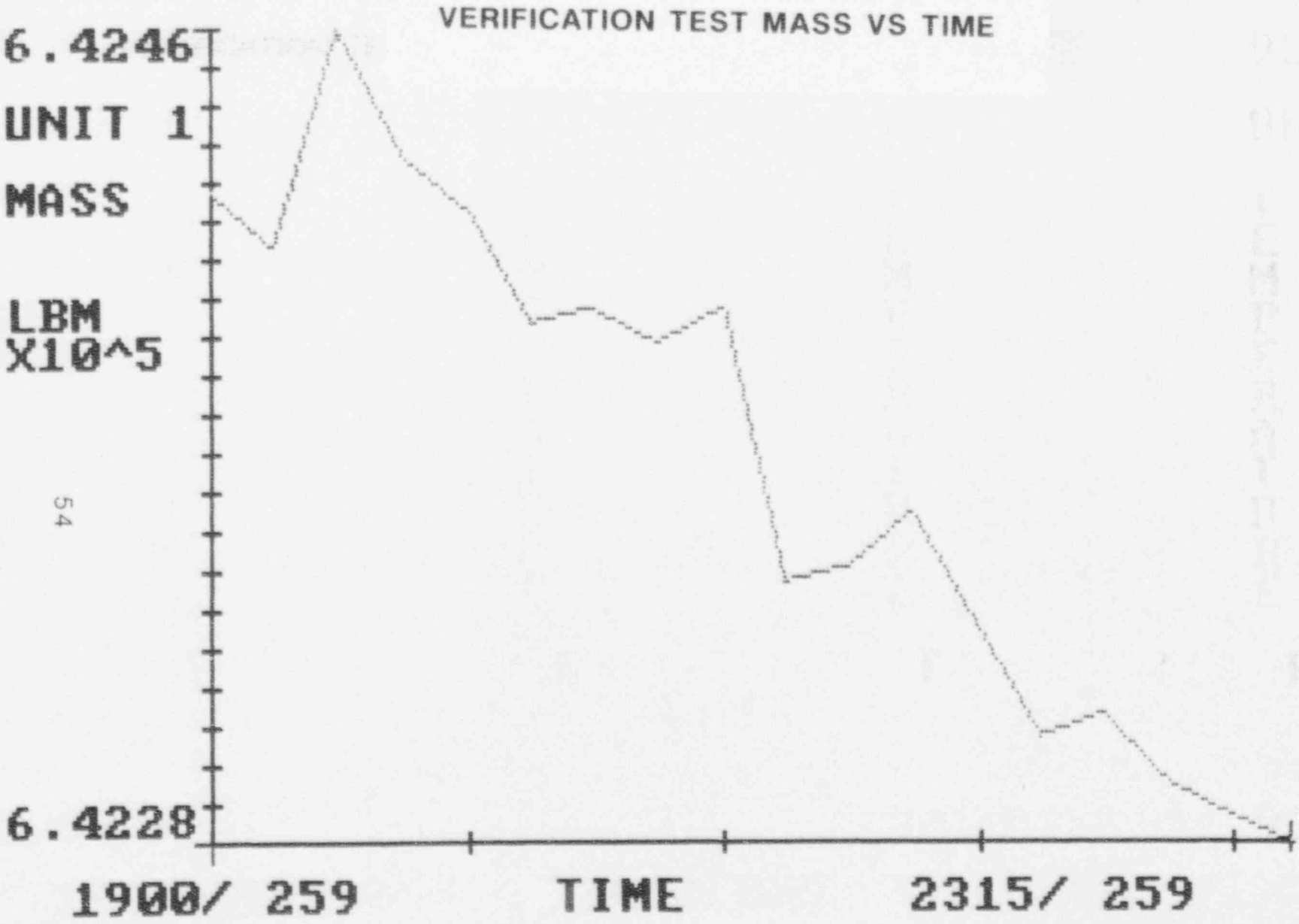


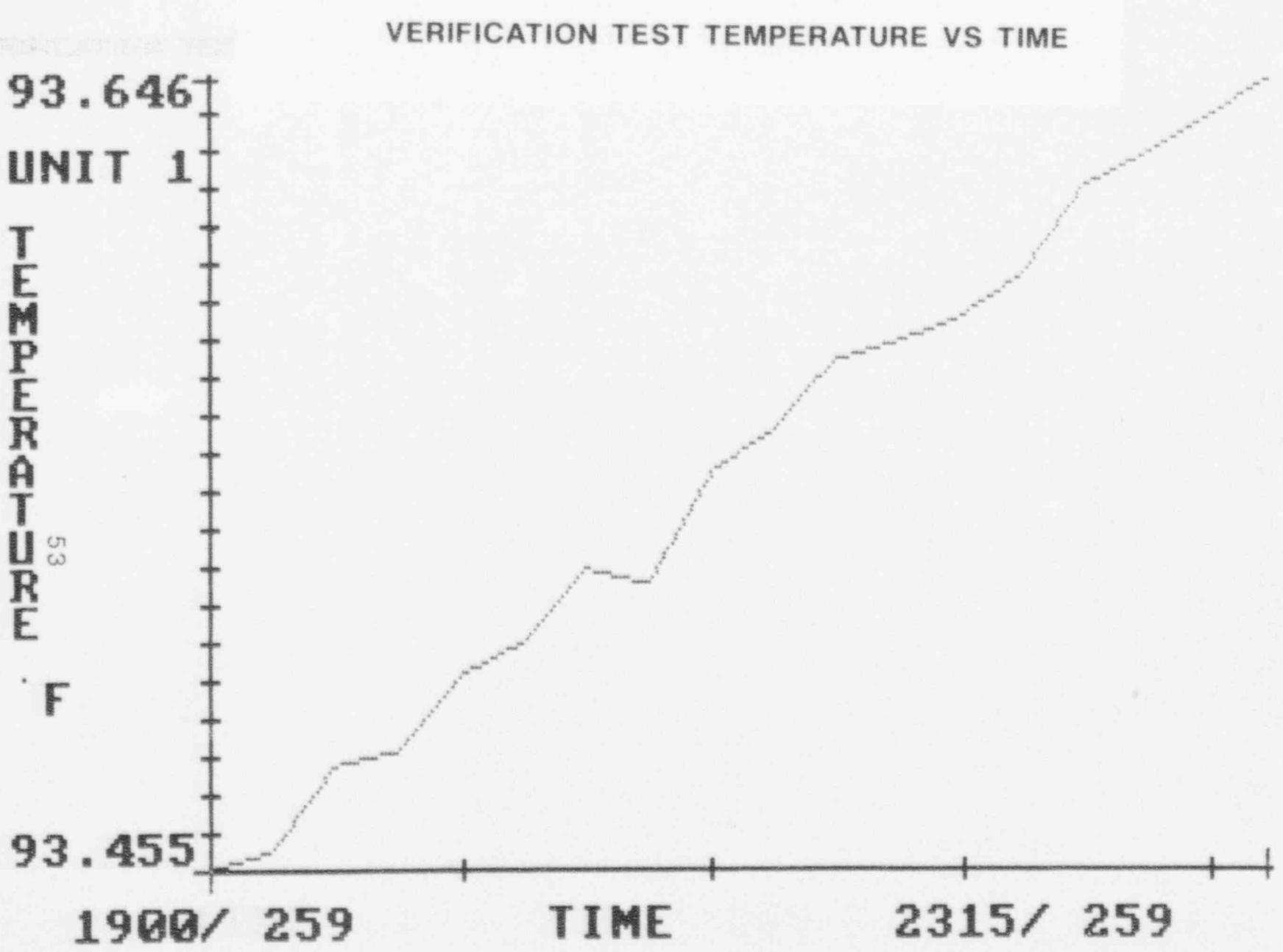
VERIFICATION TEST DEWPOINT TEMPERATURE VS TIME

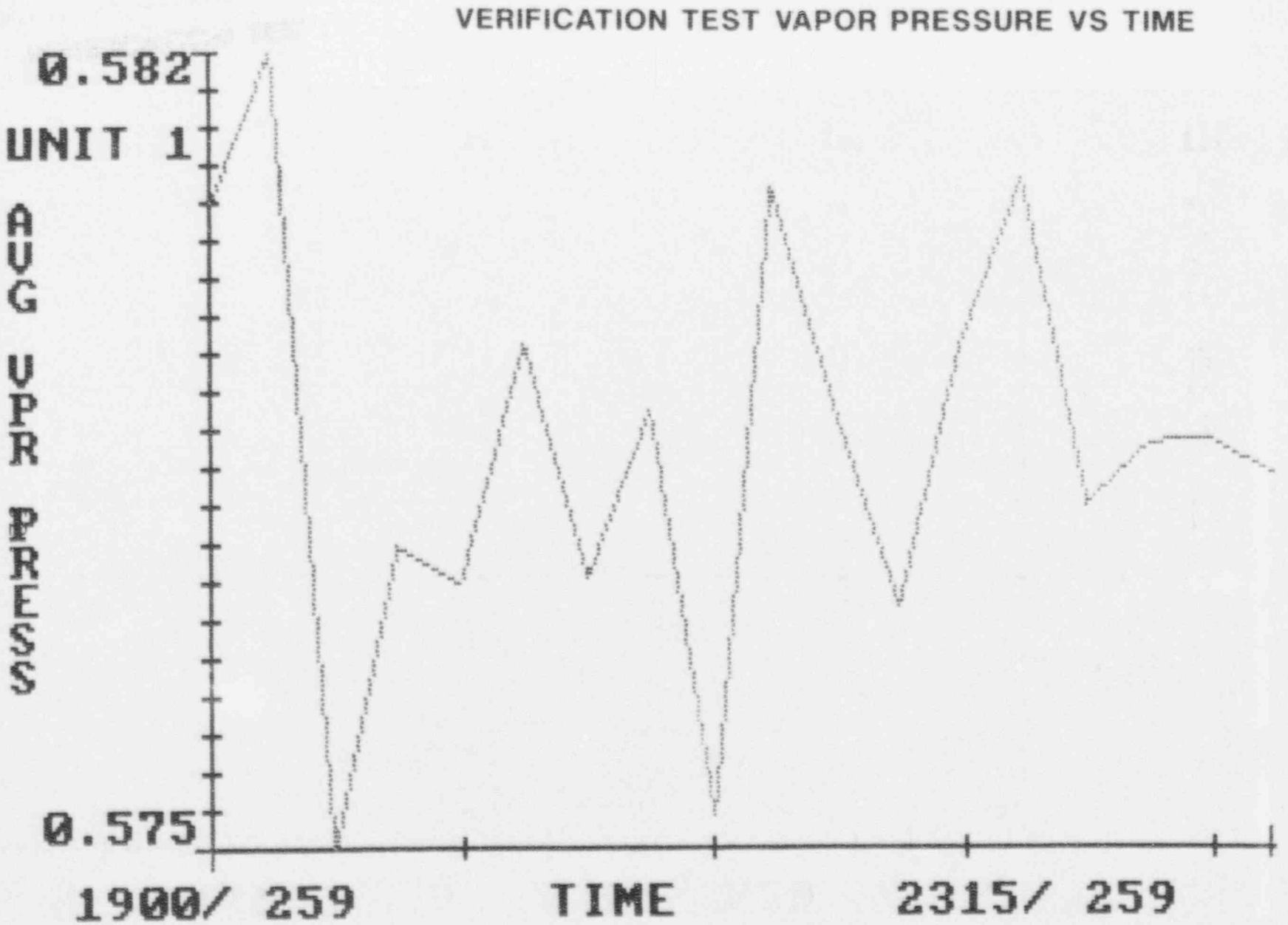


VERIFICATION TEST MASS POINT LEAK RATE VS TIME




VERIFICATION TEST MASS VS TIME
6.4246
UNIT 1
MASS
LBM
X10^5
6.4228
1900/ 259
TIME
2315/ 259


VERIFICATION TEST TEMPERATURE VS TIME
93.646
UNIT 1
TEMPERATURE
53
F
93.455
1900/ 259
TIME
2315/ 259


VERIFICATION TEST VAPOR PRESSURE VS TIME
0.582
UNIT 1
AVG VPR PRESS
0.575
1900/ 259
TIME
2315/ 259

APPENDIX D

ILRT COMPUTER PROGRAM DESCRIPTION

DESCRIPTION OF ILRT COMPUTER PROGRAM

The following paragraphs describe the various features and attributes of the General Physics ILRT Computer Program and the process used to certify it for each application.

REDUNDANCY

The General Physics ILRT team was equipped with two fully operational IBM compatible microcomputers during the ILRT and for on site data reduction and analysis. The computer software and hardware interfaced directly with the ILRT Measurement System Volumetrics A-100 Datalogger.

Two computers were brought on site for 100% redundancy, as each computer and its software is capable of independently performing the ILRT. The General Physics ILRT Computer Software is also capable of accepting manual input of raw sensor data and performing all required sensor data conversions if the data logger should cease to function. Each computer was equipped with back-up disks in the unlikely event of a disk "crash."

SECURITY

The General Physics ILRT Computer Program is written in IBM's BASICA. BASICA is a high level programming language which combines programming ease with user oriented command functions to create an easy to use and understand program. In order to increase speed of operation the program was then compiled into an executable command file. Compiling was accomplished using the IBM Basic Compiler. In addition to execution speed, this had the added benefit of making the program more secure as compiled programs cannot be edited or changed. The program requires a password to change modes of operation, start times, or enter the data editing routine to safeguard the integrity of the raw data files.

FEATURES

The program itself is designed to be a menu driven program consisting of five separate, menu driven operating modes. These are the:

1. Pressurization Mode
2. Stabilization Mode
3. Test Mode
4. Verification Mode
5. Depressurization Mode

These modes also correspond to the phases of the ILRT. Menu driven means that the user is presented with a list of options that the program can perform and from which the user can choose. It allows for interactive information exchange between the user and the computer and prevents invalid information or user mistakes from crashing the program. Program organization consists of a master menu which controls access to the seven operating modes chained to the individual menus which control these modes. The data processing, information display capabilities and function of each mode is as follows:

1. Pressurization Mode: All data reduction, graphic displays of average temperature, dewpoint, and corrected pressure.

2. Stabilization Mode: All data reduction, automatic comparison of data against ANSI 56.8 and BN-TOP-1 temperature stabilization criteria, notification when criteria is met, graphic displays of average temperature, dewpoint, and corrected pressure.

3. Test Mode: All data reduction, calculation of leakage rates using mass point, total time and point-to-point analysis techniques, display of trend report information required by BN-TOP-1, graphic display of average temperature, dewpoint, pressure and mass, as well as graphic display of mass point measured leakage, 95% UCL; total time measured and calculated leakage and the total time leakage rate at the 95% UCL (as calculated by BN-TOP-1), including a superimposed acceptance criteria line).

4. Verification Test Mode: With input of imposed leakage in SCFM automatically calculates and displays on graph and trend report the acceptance criteria band, plus all graphics displays available in test mode.

5. Depressurization Mode: All data and graphics capabilities of Pressurization Mode. In programs for BWR units, this mode also includes a Drywell to Suppression Chamber Bypass Test routine.

Other reduction and analysis capabilities of the General Physics ILRT computer program include:

1. Containment total pressure conversion from counts to psia (if required), and averaging.

2. Containment drybulb temperature weighted averaging and conversion to absolute units.

3. Containment dewpoint temperature weighted averaging (conversion from Foxboro dewcell element temperature to dewpoint temperature if required) and conversion to partial pressure of water vapor (psia).

4. Data storage of ILRT measurement system inputs for each data point.

5. Weight (mass) point calculations using the ideal gas law.

6. Automated Data Acquisition and/or Manual Data Entry.

7. Sensor performance and deviation information for sensor failure criteria, graphic display of individual sensor performance for selected operating mode.

8. Calculation of ISG formula at beginning of test; acceptance criteria based on number of sensors remaining and actual test duration.

9. Computer System Error Functions automatically checks for error in incoming data, printer or disk drive faults.

The computer program used by General Physics has been previously certified for six tests at the San Onofre Nuclear Generating Station and over a dozen other ILRTs. The initial certification required verification of the program through hand calculations and an independent review by Bechtel Power Corporation. After certification was completed, a calibration set of raw data was used to verify software of the program prior to usage. Additionally, once the computer was linked to the data acquisition system and a complete data stream was available, the input function of each mode of the program was verified by comparing the data acquisition system output to the computer printout data point summary.

APPENDIX E

SENSOR LOCATIONS

APPENDIX E

SENSOR LOCATIONS

SENSOR NUMBER	ELEV. (FEET)	LEVEL	SENSOR TYPE	QUADRANT
TE-655R	287	1	RTD	I
TE-655S	287	1	RTD	III
TE-655T	287	1	RTD	IV
TE-655U	287	1	RTD	II
TE-655V	287	1	RTD	IV
TE-654I	287	1	DEWCELL	III
TE-654J	287	1	DEWCELL	I
TE-655M	314 to 321	2	RTD	I
TE-655N	314 to 321	2	RTD	III
TE-655O	314 to 321	2	RTD	IV
TE-655P	314 to 321	2	RTD	II
TE-655Q	314 to 321	2	RTD	II
TE-654G	314 to 321	2	DEWCELL	I
TE-654H	314 to 321	2	DEWCELL	III
TE-655A	352 to 365	3	RTD	

APPENDIX E

SENSOR LOCATIONS

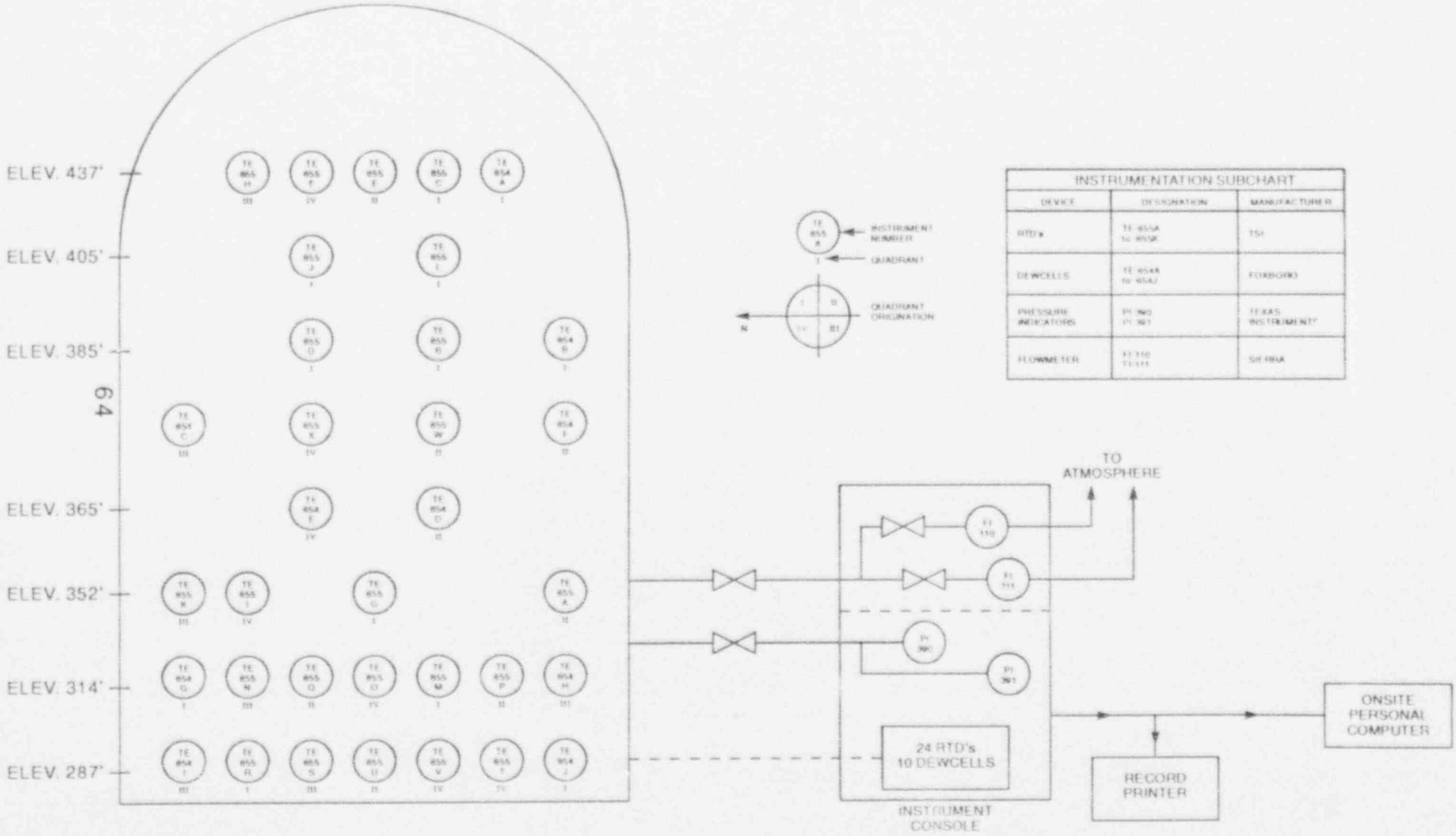
SENSOR NUMBER	ELEV. (FEET)	LEVEL	SENSOR TYPE	QUADRANT
TE-655K	352 to 365	3	RTD	III
TE-654D	352 to 365	3	DEWCELL	II
TE-655E	352 to 365	3	DEWCELL	IV
TE-655D	365 to 405	4	RTD	I
TE-655J	365 to 405	4	RTD	I
TE-655L	365 to 405	4	RTD	I
TE-655W	365 to 405	4	RTD	II
TE-655X	365 to 405	4	RTD	IV
TE-655B	365 to 405	4	RTD	I
TE-654B	365 to 405	4	DEWCELL	I
TE-654C	365 to 405	4	DEWCELL	III
TE-654F	365 to 405	4	DEWCELL	II
TE-655C	437	5	RTD	I
TE-655E	437	5	RTD	II
TE-655H	437	5	RTD	III

APPENDIX E

SENSOR LOCATIONS

SENSOR NUMBER	ELEV. (FEET)	LEVEL	SENSOR TYPE	QUADRANT
TE-655F	437	5	RTD	IV
TE-654A	437	5	DEWCELL	I

The trend of dewcell temperature sensors TE-654A and TE-654J during the ILRT did not reflect the trend of the other dewcell temperature sensors. All ILRT calculations were redone with the input from dewcell temperature sensors TE-654A and TE-654J removed.



INSTRUMENTATION SUBCHART		
DEVICE	DESIGNATION	MANUFACTURER
RTD's	TE 855A to 855K	TSI
DEWCELLS	TE 854A to 854J	FOXBORO
PRESSURE INDICATORS	PI 110 PI 111	TEXAS INSTRUMENTS
FLOWMETER	FI 110 FI 111	SIERRA

APPENDIX F

INSTRUMENTATION SELECTION GUIDE VALUE

INSTRUMENTATION SELECTION GUIDE CALCULATION

PRE-TEST ISG

A. TEST PARAMETERS

1. Test Pressure: 50.6 psig = 65.3 psia

2. Containment Avg. Drybulb Temperature (T): 70 ^{o}F = 529.67 ^{o}R

3. Containment Avg. Dewpoint Temperature (Tdp): 65 ^{o}F

B. Instrument and Measurement System Errors

1. Definitions

a. e = the error associated with the measurement of change in a given parameter.

b. E = the error associated with the sensitivity of the sensor.

c. ϵ = the error associated with the measurement system readout and signal conditioning (excludes sensor), including resolution and repeatability.

1) Instrumentation errors (e.g., repeatability and resolution) are combined using a root-sum-square formula (per ANSI/ANS-56.8-1987, Appendix G).

2) In cases where repeatability is tested and specified for both the sensor and the readout device, the largest source of error is used to calculate ϵ.

C. Instrument Errors

1. Total, Absolute Pressure

a. $E_p = \pm 0.001$ psia (per manufacturer spec.)

b. $\epsilon_p = \pm[(0.001 \text{ psia})^2 + (0.008 \text{ psia})^2]^{1/2}$

$\epsilon_p = \pm[1.0 \times 10^{-6} + 6.4 \times 10^{-5}]^{1/2}$

$\epsilon_p = \pm[6.5 \times 10^{-5}]^{1/2}$

$\epsilon_p = \pm 8.062 \times 10^{-3}$ psia

c. $e_p = \pm[(Ep)^2 + (\epsilon p)^2]^{1/2}/[\text{no. of sensors}]^{1/2}$

$e_p = \pm[(0.001)^2 + (8.062 \times 10^{-3})^2]^{1/2}/(2)^{1/2}$

$e_p = \pm[1 \times 10^{-6} + 6.5 \times 10^{5}]^{1/2}/1.414$

$e_p = \pm[6.6 \times 10^{-5}]^{1/2}/1.414$

$e_p = \pm 5.7454 \times 10^{-3}$ psia

2. Drybulb Temperature

a. $E_T = \pm 0.01^{o}F$

b. $\epsilon_T = \pm[(0.01)^2 + (0.001)^2]^{1/2}$

$\epsilon_T = \pm[1.0 \times 10^{-4} + 1 \times 10^{-6}]^{1/2}$

$\epsilon_T = \pm[1.01 \times 10^{-4}]^{1/2}$

$\epsilon_T = \pm 1.005 \times 10^{-2}\ ^{o}F$

c. $e_T = \pm[(E_T)^2 + (\epsilon_T)^2]^{1/2}/(24)^{1/2}$

$e_T = \pm[(0.01)^2 + (1.005 \times 10^{-2})^2]^{1/2}/(24)^{1/2}$

$e_T = \pm[1.0 \times 10^{-4} + 1.010025 \times 10^{-4}]^{1/2}/4.899$

$e_T = \pm[2.010025 \times 10^{-4}]^{1/2}/4.899$

$e_T = \pm 1.4177 \times 10^{-2}/4.899$

$e_T = \pm 2.89396 \times 10^{-3}\ ^{o}F$

3. Water Vapor Pressure

a. $E_{pv} = \pm 0.1^{o}F$

b. $\epsilon_{pv} = \pm[(0.01)^2 + (0.001)^2]^{1/2}$

$\epsilon_{pv} = \pm[1 \times 10^{-4} + 1 \times 10^{-6}]^{1/2}$

$\epsilon_{pv} = \pm[1.01 \times 10^{-4}]^{1/2}$

$\epsilon_{pv} = \pm 1.005 \times 10^{-2}\ ^{o}F$

c. At a 65°F dewpoint, water vapor pressure change/°F is 0.0106450 psia/°F (from the General Physics ILRT Data Management Computer Program)

d. $e_{pv} = \pm[(E_{pv})^2 + (\varepsilon_{pv})^2]^{1/2}/(\text{no. of sensors})^{1/2}$

$e_{pv} = \pm[(0.1)^2 + (1.005 \times 10^{-2})^2]^{1/2}/(10)^{1/2}$

$e_{pv} = \pm[1.0101 \times 10^{-2}]^{1/2}/3.1623$

$e_{pv} = \pm 0.1005/3.1623$

$e_{pv} = \pm 0.03178^{\circ}F \times 0.0106450$ psia/°F

$e_{pv} = \pm 3.383 \times 10^{-4}$ psia

D. Instrumentation Selection Guide Formula (24 hr. Test)

$$ISG = \pm \frac{2400}{t} \sqrt{2\left(\frac{e_P}{P}\right)^2 + 2\left(\frac{e_{Pv}}{P}\right)^2 + 2\left(\frac{e_T}{T}\right)^2}$$

$$= \pm \frac{2400}{24} \sqrt{2\left(\frac{5.7454 \times 10^{-3}}{65.3}\right)^2 + 2\left(\frac{3.383 \times 10^{-4}}{65.3}\right)^2 + 2\left(\frac{2.89396 \times 10^{-3}}{529.67}\right)^2}$$

$$= \pm 100 \sqrt{(1.5483 \times 10^{-8}) + (5.3680 \times 10^{-11}) + (8.9336 \times 10^{-11})}$$

$$ISG = \pm 100 \sqrt{1.562637 \times 10^{-8}}$$

$$ISG = \pm 100 (1.25 \times 10^{-4})$$

$$ISG = \pm 0.0125 \frac{wt.\%}{24 \text{ hours}}$$

F. ISG Acceptance Criteria

1. ISG must be $\leq 25\% L_a$
2. 25% (0.1 wt.%/day) = 0.025 wt.%/day
3. ISG = 0.0125 $\leq$ 0.125 wt.%/24 hours

POST-TEST ISG

A. TEST PARAMETERS

1. Test Pressure: 51.52 psig = 66.1 psia

2. Containment Avg. Drybulb Temperature (T): 90.62 ^{o}F = 550.29 ^{o}R

3. Containment Avg. Dewpoint Temperature (Tdp): 82.86 ^{o}F

B. Instrument and Measurement System Errors

1. Definitions

a. e = the error associated with the measurement of change in a given parameter.

b. E = the error associated with the sensitivity of the sensor.

c. ε = the error associated with the measurement system readout and signal conditioning (excludes sensor), including resolution and repeatability.

1) Instrumentation errors (e.g., repeatability and resolution) are combined using a root-sum-square formula (per ANSI/ANS-56.8-1987, Appendix G).

2) In cases where repeatability is tested and specified for both the sensor and the readout device, the largest source of error is used to calculate ε.

C. Instrument Errors

1. Total, Absolute Pressure

a. $E_p = \pm 0.001$ psia (per manufacturer spec.)

b. $\varepsilon_p = \pm[(0.001 \text{ psia})^2 + (0.008 \text{ psia})^2]^{1/2}$

$\varepsilon_p = \pm[1.0 \times 10^{-6} + 6.4 \times 10^{-5}]^{1/2}$

$\varepsilon_p = \pm[6.5 \times 10^{-5}]^{1/2}$

$\varepsilon_p = \pm 8.062 \times 10^{-3}$ psia

c. $e_p = \pm[(Ep)^2 + (\varepsilon p)^2]^{1/2}/[\text{no. of sensors}]^{1/2}$

$e_p = \pm[(0.001)^2 + (8.062 \times 10^{-3})^2]^{1/2}/(2)^{1/2}$

$e_p = \pm[1 \times 10^{-6} + 6.5 \times 10^{-5}]^{1/2}/1.414$

$e_p = \pm[6.6 \times 10^{-5}]^{1/2}/1.414$

$e_p = \pm 5.7454 \times 10^{-3}$ psia

2. Drybulb Temperature

a. $E_T = \pm 0.01^{\circ}F$

b. $\varepsilon_T = \pm[(0.01)^2 + (0.001)^2]^{1/2}$

$\varepsilon_T = \pm[1.0 \times 10^{-4} + 1 \times 10^{-6}]^{1/2}$

$\varepsilon_T = \pm[1.01 \times 10^{-4}]^{1/2}$

$\varepsilon_T = \pm 1.005 \times 10^{-2}\ ^{\circ}F$

c. $e_T = \pm[(E_T)^2 + (\varepsilon_T)^2]^{1/2}/(24)^{1/2}$

$e_T = \pm[(0.01)^2 + (1.005 \times 10^{-2})^2]^{1/2}/(24)^{1/2}$

$e_T = \pm[1.0 \times 10^{-4} + 1.010025 \times 10^{-4}]^{1/2}/4.899$

$e_T = \pm[2.010025 \times 10^{-4}]^{1/2}/4.899$

$e_T = \pm 1.4177 \times 10^{-2}/4.899$

$e_T = \pm 2.89396 \times 10^{-3}\ ^{\circ}F$

3. Water Vapor Pressure

a. $E_{pv} = \pm 0.1^{\circ}F$

b. $\varepsilon_{pv} = \pm[(0.01)^2 + (0.001)^2]^{1/2}$

$\varepsilon_{pv} = \pm[1 \times 10^{-4} + 1 \times 10^{-6}]^{1/2}$

$\varepsilon_{pv} = \pm[1.01 \times 10^{-4}]^{1/2}$

$\varepsilon_{pv} = \pm 1.005 \times 10^{-2}\ ^{\circ}F$

c. At a 82.86°F dewpoint, water vapor pressure change/°F is 0.01797 psia/°F (from the General Physics ILRT Data Management Computer Program)

d. $e_{pv} = \pm[(E_{pv})^2 + (\varepsilon_{pv})^2]^{1/2}/(\text{no. of sensors})^{1/2}$

$e_{pv} = \pm[(0.1)^2 + (1.005 \times 10^{-2})^2]^{1/2}/(8)^{1/2}$

$e_{pv} = \pm[1.0101 \times 10^{-2}]^{1/2}/2.8284$

$e_{pv} = \pm 0.1005/2.8284$

$e_{pv} = \pm 0.03553^{\circ}F \times 0.01797$ psia/°F

$e_{pv} = \pm 6.3847 \times 10^{-4}$ psia

D. Instrumentation Selection Guide Formula (24 hr. Test)

$$ISG = \pm \frac{2400}{t} \sqrt{2\left(\frac{e_P}{P}\right)^2 + 2\left(\frac{e_{Pv}}{P}\right)^2 + 2\left(\frac{e_T}{T}\right)^2}$$

$$= \pm \frac{2400}{24} \sqrt{2\left(\frac{5.7454 \times 10^{-3}}{66.1}\right)^2 + 2\left(\frac{6.3847 \times 10^{-4}}{66.1}\right)^2 + 2\left(\frac{2.89396 \times 10^{-3}}{550.29}\right)^2}$$

$$= \pm 100 \sqrt{(1.511 \times 10^{-8}) + (1.866 \times 10^{-10}) + (8.2766 \times 10^{-11})}$$

$$ISG = \pm 100 \sqrt{1.5379 \times 10^{-8}}$$

$$ISG = \pm 100 (1.24 \times 10^{-4})$$

$$ISG = \pm 0.0124 \frac{wt.\%}{24 \text{ hours}}$$

F. ISG Acceptance Criteria

1. ISG must be $\leq 25\%$ L_a
2. 25% (0.1 wt.%/day) = 0.025 wt.%/day

3. ISG = 0.0124 $\leq$ 0.125 wt.%/24 hours

APPENDIX G

LOCAL LEAKAGE RATE TEST SUMMARIES

APPENDIX G

THREE MILE ISLAND UNIT 1

1991 REACTOR BUILDING LOCAL LEAK RATE TESTING REPORT
(Includes 9R Refueling Outage Test Data
and 8R Operating Cycle 1990 Test Data)

SP 1303-11.18

APPENDG

INDEX - 1991 REACTOR BUILDING LOCAL LEAK RATE TESTING REPORT

REACTOR BUILDING LOCAL LEAK RATE TESTING REPORT

1991 REFUELING FREQUENCY

1. PURPOSE

1.1 To provide analysis to the Nuclear Regulatory Commission on the Twelfth Periodic Type B and Type C leakage tests performed on the Three Mile Island, Unit 1, Reactor Building.

This report is in accordance with Title 10, Code of Federal Regulations, Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors". This regulation required the contents of this summary report to become part of the Type A test report along with the details of any other Type B and Type C testing performed since the previous Type A test (also required per Technical Specification 4.4.1.1.8).

2. SUMMARY OF WORK ACCOMPLISHED

2.1 Valve Testing/Repairs/Modifications

Appendix J, Type B and C leak tests were performed on the components as listed in TMI, Unit 1, FSAR, Update Number 9, Table 5.7-2 and 5.7-3, respectively. In addition the following components were leak tested though not yet listed in the FSAR (will be added during Update Number 10).

1. NI-V26

Repairs or modifications were initiated on the 9R following components due to higher than desirable leakage during 10R or during previous outages.

1. CA-V13 motor operator gear ratio was increased by BA # 123265.

2. CM-V4 repaired due to leakage by actuator solenoid valve. Actuator solenoid valve was repaired. The CIV was not disassembled or refurbished.

3. West side fuel transfer tube PP line had leaking pipe fitting repaired.

4. IC-V2 adjusted packing.

5. MU-V2B yoke bushing replaced.

6. NI-V26 adjusted packing.

7. Spare penetration 221 and 222 modified. "Blind" flanges were installed to make the penetrations usable for temporary routing of wires and hoses.

8. WDL-V304 flushed line and lapped seats. Did not significantly improve leak rate.

2.2 Access Hatch Testing/Repairs

2.2.1 Access Hatch Door Seals, SP 1303-11.25 (Reference 8.5)

Access Hatch Door seal leak tests were performed as required by Technical Specification 4.4.1.2.5.

2.2.2 Overall Hatch Test SP 1303-11.18 (Reference 8.2)

Semi-annual integrated type leak tests were performed as required by Technical Specification 4.4.1.2.5.

3. METHODS OF TESTING

3.1 Valve Test Methods

Testing was performed in accordance with SP 1303-11.18 Reactor Building Local Leak Rate Testing. This procedure gives detailed guidance on the test equipment and methods to be used for each penetration/valve. The following general philosophy is contained in the surveillance procedure.

3.1.1 Use air or nitrogen to establish a pressure differential across the valve greater than P_a (50.6 psig - calculated accident pressure).

3.1.2 Assure that the pressure is exerted in the accident test direction unless it can be demonstrated that pressurizing in the non-accident direction provides equal or conservative leak rate data. Butterfly valves AH-V1B/1C, and globe valves WDG-V4, DH-V64, SA-V3, IA-V20, and WDL-V534 (gate valve) were tested in the reverse direction.

3.1.3 Assure that the test volume is drained of liquid so that air or nitrogen test pressure is against valve seats.

3.1.4 Assure that the test verifies valve packing integrity in those cases where the packing would be a Reactor Building leakage boundary.

3.1.5 Assure adequate time period for stabilization of test conditions.

3.1.6 Assure test equipment is calibrated and used in a manner consistent with the data accuracy desired (weekly meter standardization was performed during the test program to verify meters accurate within $\pm$ 4% full scale (Reference 8.1).

3.1.7 Assure valves to be tested are closed by the normal method prior to testing.

3.1.8 Document As-Found conditions (prior to adjustments/repairs) and As-Left conditions.

3.1.9 Record test instrument scale readings prior to doing any data corrections.

3.1.10 Assure that system drains and vents which could serve as containment isolation valves, are closed and capped and tagged after completion of the test program.

A training program prior to the refueling outage was performed to assure that the above philosophy was understood by the personnel involved in the testing.

3.2 Access Hatch Test Methods

3.2.1 Access Hatch Seal Leak Tests-Method

Access Hatch Door seal leak tests were performed in accordance with SP 1303-11.25 (Reference 8.5). This procedure provides detailed guidance on the test equipment and methods to be used.

The Access Hatch Door seal tests are performed by pressurizing the interspace between the double seals on each Access Hatch with metered air at the manufacturers recommended test pressure of 10 psig. After stabilization, the air rotameter indicates the rate of air input required to maintain the test pressure.

3.2.2 Overall Access Hatch Leak Test - Semi-annual overall hatch leak testing was performed in accordance with SP 1303-11.18, Reactor Building Local Leak Rate Testing. This procedure provides detailed guidance on the test equipment and methods to be used. The overall integrated leak test verified the integrity of all of the following barriers:

1. Hatch shell/welds
2. Rubber door seals
3. Teflon operating shaft packing
4. Bulkhead electrical penetrations
5. Penetration pressurization check valves
6. Emergency air flange and associated "O" rings on outer bulkhead
7. Bulkhead equalizing ball valves and associated mounting flanges/"O" rings

The overall leak test was performed by pressurizing the hatch to greater than calculated accident pressure and observing the rate of pressure drop on a high accuracy (Heise) pressure gage.

Pressure corrections were made by reference to a barometer. Minimum test duration was 4 hours after a 1 hour stabilization period.

4. TEST EQUIPMENT USED

4.1 Valve Test Equipment

a. Rotameters - Sets of 3

Mfgr. - Brooks Inst. Co.
Model - 1114 Full View

Ranges:

Float Mat'l.	Tube No.	Range
Pyrex	R-2-15D	8-1,120 SCCM
Sapphire	R-2-15C	100-12,200 SCCM
Carboloy	R-6-15B	1,000-142,000 SCCM

Accuracy ± 2% full scale industrial accuracy

b. Temperature Indicators (as follows or similar)

Mfgr. - Ashcroft
Model - EH or AH / 3" or 5" Dial
Range - 30^{O} to $130^{O}F$
Accuracy - ± $2^{O}F$

c. Pressure Indicators (as follows or similar)

Mfgr. - Ashcroft
Model - 1279 - 4-1/2" Dial
Range - 0 to 60 or 0 to 100 psig
Accuracy - ± 2 psig

d. Pressure Regulator (as follows or similar)

Mfgr. - Union Carbide Corp.
Model - UPG 3-75-580
Range - 0 to 100 psi output / 0 to 3000 psi input

e. Calibration Rotameters (Set of 2)

Mfgr. - Brooks Inst. Co.
Models - 1110-05K2B1Z49, 1110-08K2B1Z06
Ranges - 20 to 16,000 SCCM, 3,600 to 234,000 SCCM
Repeatability - ± 1/4% of instantaneous
Accuracy - ± 1% instantaneous

f. Flow rate Calibrator
Mfgr. - Brooks Inst. Co.
Model - 1056A
Range 0 to 2,400 SCCM
Accuracy - ± 0.2% of indicated volume

4.2 Access Hatch Test Equipment

a. Precision Pressure Gage (as follows or similar)

Mfgr. - Heise
Model - CM
Range - 0 to 60 psig
Resolution - 0.25 psig
Accuracy - 0.1% of instrument span

b. Barometer (as follows or similar)

Mfgr. - Pennwalt
Model - FA185260A
Range - 10.8 to 15.5 psia
Resolution - 0.005 psia
Accuracy - 0.1% of instrument span

5. SUMMARY AND INTERPRETATION OF DATA

5.1 Valve Test Results

As-Found/As-Left Leakage to this date:

	Total Leakage	Tech. Spec. Limit	% Tech. Spec. Limit
As-Found MAXPATH(MINPATH)	17,737(8767) SCCM	104,846 SCCM	<16.9%(8.4%)
As-Left MAXPATH(MINPATH)	17,377(8839) SCCM	104,846 SCCM	<16.6%(8.4%)

1991 Reactor Building Purge Valve Data		
FREQUENCY	AH-V1A/1B LEAKAGE RESULTS (SCCM)	AH-V1C/1D LEAKAGE RESULTS (SCCM)
FIRST QUARTER	AS FOUND 24844 AS LEFT 2184	2379
SECOND QUARTER	1365	819
THIRD QUARTER	683	410
FOURTH QUARTER	546	1599

* Adjust AH-V1B seat.

1990 Reactor Building Purge Valve Data		
FREQUENCY	AH-V1A/1B LEAKAGE RESULTS (SCCM)	AH-V1C/1D LEAKAGE RESULTS (SCCM)
FIRST QUARTER	5885	1599
SECOND QUARTER	351	1053
THIRD QUARTER	624	2379
FOURTH QUARTER	468	1560

5.2 Access Hatch Test Results

5.2.1 Overall semi-annual access hatch leakage test results in accordance with SP 1303-11.18 (Reference 8.2):

1991 Reactor Building Access Hatch Data		
COMPONENT	FIRST HALF TEST LEAKAGE RESULTS (SCCM)	SECOND HALF TEST LEAKAGE RESULTS (SCCM)
PERSONNEL ACCESS HATCH	1057	1638
EQUIPMENT ACCESS HATCH	1931	1337

1990 Reactor Building Access Hatch Data		
COMPONENT	FIRST HALF TEST LEAKAGE RESULTS (SCCM)	SECOND HALF TEST LEAKAGE RESULTS (SCCM)
PERSONNEL ACCESS HATCH	1420	925
EQUIPMENT ACCESS HATCH	2154	2302

5.2.2 Door Seal Leakage Test in accordance with SP 1303-11.25 (Reference 8.5).

The Personnel and Equipment Hatch Door seals had been satisfactory leak tested throughout 1992 and 1993 resulting in leakage from each door seal to be less than 3 SCFH.

6. ERROR ANALYSIS

6.1 Valve Testing Errors (For purge valves see Section 6.2)

The flow meters used in the field have normal industrial accuracies of ± 2% full scale in the 10-100% (15-150 mm) scale range. Prior to use, mm versus sccm graphs were developed for the meters by 10 point calibrations using high accuracy (± 1% instantaneous) lab rotameters. During the leak test program, weekly 3 point standardizations were performed on the field rotameters to verify continued accuracy. The acceptance criteria for these standardizations was a variance of no more than 4% from the calibration graphs. If meters were repaired or the 3 point standardization exceeded the inaccuracy limit, a new 10 point calibration was performed. Scale readings on the leak rate procedure (SP 1303-11.18) data sheets were evaluated and corrected for temperature. Conservative bias was introduced into the results by assuming 15 mm (10% of scale) as the minimum scale.

6.2 Access Hatch and Purge Valve Testing Errors

The measured pressure drops were corrected by adding the minimum scale increment of the gage used for both the Heise gage and the barometer. This conservatively corrected for the resolution and repeatability errors. Gages used were recently calibrated. A minimum one hour temperature/pressure stabilization period was used prior to each pressure drop test. The access hatches and purge valves are not instrumented to allow temperature corrections.

7. LESSONS LEARNED/IMPROVEMENTS/DEGRADATION

7.1 The As-Found MAXPATH leakage was 16.9% of the Technical Specification limit of 104,846 SCCM.

The material condition of the containment isolation valves were considered excellent.

APPENDG

8. REFERENCES

8.1 1430-Y-22, Standardization of Flow Rotameters

8.2 SP 1303-11.18, Reactor Building Local Leak Rate Testing

8.3 Three Mile Island, Unit 1, Technical Specification 4.4.1

8.4 TMI Surveillance File (Records stored in CARIRS, Data Base AA60 REC.TYPE 018-12)

8.5 SP 1303-11.25, Reactor Building Local Leakage Access Hatch Door Seals

1991 9R OUTAGE LOCAL LEAK RATE TEST RESULTS

COMPONENT	AS-FOUND	AS-LEFT
EMERGENCY ACCESS HATCH	1931	1931
PERSONNEL ACCESS HATCH	1057	1057
EQUIPMENT FLANGE	109	109
AH-V1A/1B	546	546
AH-V1C/1D	1599	1599
CA-V1	117	117
CA-V3	46	161
CA-V13	46	46
CA-V2	150	150
CA-V4A	44	44
CA-V5A	44	44
CA-V4B	33	33
CA-V5B	1762	1762
CA-V192	98	98
CA-V189	1558	1558
CF-V2A	28	28
CF-V20A	1086	1086
CF-V2B	28	28
CF-V20B	585	585
CF-V12A	62	62
CF-V19A	28	28
CF-V12B	62	62
CF-V19B	28	28
CM-V1	62	62
CM-V2	61	61
CM-V3	61	61
CM-V4	816	61
DH-V69	56	56
DH-V64	56	56
FTT EAST	105	105
FTT WEST	105	105
HM-V1A	64	64

HM-V1B	43	43
HM-V2A	64	64
HM-V2B	43	43
HM-V3A	64	64
HM-V3B	43	43
HM-V4A	46	46
HM-V4B	43	43
HP-V1	198	198
HP-V6	47	47
HR-V22A/22B	61	61
HR-V2A/2B	62	62
HR-V23A	61	61
HR-V23B	61	61
HR-V4A/4B	75	62
IA-V20/6	103	103
IC-V2	62	62
IC-V3	62	62
IC-V18	61	61
IC-V4	332	332
IC-V16	62	62
IC-V6	28	28
MU-V2A	48	48
MU-V2B	18	144
MU-V3	48	48
MU-V18	171	171
MU-V116	143	143
MU-V20	61	61
MU-V25	155	155
MU-V26	65	65
NI-V26	65	65
NI-V27	89	89
NS-V11	156	156
NS-V15	28	28
NS-V35	38	38
NS-V4	694	694

PENET 104	55	55
PENET 105	127	127
PENET 106	56	56
PENET 210	56	56
PENET 211	55	55
PENET 241	104	104
PENET 414	54	54
PENET 417	60	55
PENET 221	62	62
PENET 222	56	62
PP-V210	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
PP-V211	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
PP-V212	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
PP-V213	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
RB-V2A	60	60
RB-V7	60	61
SA-V3/2	56	56
SF-V23	165	165
WDG-V3/4	99	99
WDL-V303	154	154
WDL-V304	2014	2208
WDL-V534/535	162	162
MAX PATH TOTAL	17737	17377
MIN PATH TOTAL	8767	8839

APPENDIX G

THREE MILE ISLAND UNIT 1

1993 REACTOR BUILDING LOCAL LEAK RATE TESTING REPORT

(Includes 10R Refueling Outage Test Data
and 9R Operating Cycle 1992 Test Data)

SP 1303-11.18

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REACTOR BUILDING LOCAL LEAK RATE TESTING REPORT

1993 REFUELING FREQUENCY

1. PURPOSE

1.1 To provide analysis to the Nuclear Regulatory Commission on the Twelfth Periodic Type B and Type C leakage tests performed on the Three Mile Island, Unit 1, Reactor Building.

This report is in accordance with Title 10, Code of Federal Regulations, Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors". This regulation required the contents of this summary report to become part of the Type A test report along with the details of any other Type B and Type C testing performed since the previous Type A test (also required per Technical Specification 4.4.1.1.8).

A majority of the local leak rate testing was performed during the ILRT when the plant was shutdown for the 10R Refueling Outage. Testing began on September 11, 1993 and was completed October 16, 1993. The LLRT during a refueling normally requires approximately 1800 manhours. By combining the ILRT and LLRT, the LLRT was reduced to approximately 600 manhours.

2. SUMMARY OF WORK ACCOMPLISHED

2.1 Valve Testing/Repairs/Modifications

Appendix J, Type B and C leak tests were performed on the components as listed in TMI, Unit 1, FSAR, Update Number 9, Table 5.7-2 and 5.7-3, respectively. In addition the following components were leak tested though not yet listed in the FSAR (will be added during Update Number 10).

1. NI-V26

2. Industrial Cooling System Closed Loop Pipe

Repairs or modifications were initiated on the following components due to higher than desirable leakage during 10R or during previous outages. Also listed are valves which were retested due to MOVATS testing of motor operators.

1. CA-V1, CA-V3, and CA-V13 were reconfigured by Engineering Modification T1-MM-412616-229 due to motor operator concerns. The valves have always performed well for seat leakage tests. CA-V13 is now the only inner containment isolation valve.

2. During 9R Operating Cycle a bonnet to body leak was repaired on CA-V2. CA-V2 had high but acceptable leakrate during 10R and will be replaced with a globe valve by end of 1993.

3. The Industrial Cooling Closed Loop piping in the Reactor Building had high but acceptable leakage during 10R and repairs will be scheduled for associated valve packing and bonnet gaskets.

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4. Equipment Hatch Equalizing Ball Valve Seats were repaired, replaced inner Reactor Building door seal, and tightened handwheel packing.

5. Retested after MOVATS:

CF-V2A Torque setting increased 135.3%
CF-V2B Torque setting increased 65%
WDL-V-303 Torque setting increased 59.4%

Indicated leakage rate slightly increased after MOVATS, but it's due to the fact that pressure rotameter vs. vent rotameter method was used. Actual leakage rate remained essentially identical.

2.2 Access Hatch Testing/Repairs

2.2.1 Access Hatch Door Seals, SP 1303-11.25 (Reference 8.5)

Access Hatch Door seal leak tests were performed as required by Technical Specification 4.4.1.2.5.

2.2.2 Overall Hatch Test SP 1303-11.18 (Reference 8.2)

Semi-annual integrated type leak tests were performed as required by Technical Specification 4.4.1.2.5.

3. METHODS OF TESTING

3.1 Valve Test Methods

Testing was performed in accordance with SP 1303-11.18 Reactor Building Local Leak Rate Testing. This procedure gives detailed guidance on the test equipment and methods to be used for each penetration/valve. The following general philosophy is contained in the surveillance procedure.

3.1.1 Use air or nitrogen to establish a pressure differential across the valve greater than P_a (50.6 psig - calculated accident pressure).

3.1.2 Assure that the pressure is exerted in the accident test direction unless it can be demonstrated that pressurizing in the non-accident direction provides equal or conservative leak rate data. Butterfly valves AH-V1B/1C, and globe valves WDG-V4, DH-V64, SA-V3, IA-V20, PP-V211, PP-V212, and WDL-V534 (gate valve) were tested in the reverse direction.

3.1.3 Assure that the test volume is drained of liquid so that air or nitrogen test pressure is against valve seats.

3.1.4 Assure that the test verifies valve packing integrity in those cases where the packing would be a Reactor Building leakage boundary.

3.1.5 Assure adequate time period for stabilization of test conditions.

3.1.6 Assure test equipment is calibrated and used in a manner consistent with the data accuracy desired (weekly meter standardization was performed during the test program to verify meters accurate within $\pm$ 4% full scale (Reference 8.1).

3.1.7 Assure valves to be tested are closed by the normal method prior to testing.

3.1.8 Document As-Found conditions (prior to adjustments/repairs) and As-Left conditions.

3.1.9 Record test instrument scale readings prior to doing any data corrections.

3.1.10 Assure that system drains and vents which could serve as containment isolation valves, are closed and capped and tagged after completion of the test program.

A training program prior to the refueling outage was performed to assure that the above philosophy was understood by the personnel involved in the testing.

3.1.11 As much LLRT as possible was done using the ILRT pressure in the Reactor Building and utilizing the valve lineups and drains accomplished for ILRT.

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3.2 Access Hatch Test Methods

3.2.1 Access Hatch Seal Leak Tests-Method

Access Hatch Door seal leak tests were performed in accordance with SP 1303-11.25 (Reference 8.5). This procedure provides detailed guidance on the test equipment and methods to be used.

The Access Hatch Door seal tests are performed by pressurizing the interspace between the double seals on each Access Hatch with metered air at the manufacturers recommended test pressure of 10 psig. After stabilization, the air rotameter indicates the rate of air input required to maintain the test pressure.

3.2.2 Overall Access Hatch Leak Test - Semi-annual overall hatch leak testing was performed in accordance with SP 1303-11.18, Reactor Building Local Leak Rate Testing. This procedure provides detailed guidance on the test equipment and methods to be used. The overall integrated leak test verified the integrity of all of the following barriers:

1. Hatch shell/welds
2. Rubber door seals
3. Teflon operating shaft packing
4. Bulkhead electrical penetrations
5. Penetration pressurization check valves
6. Emergency air flange and associated "O" rings on outer bulkhead
7. Bulkhead equalizing ball valves and associated mounting flanges/"O" rings

The overall leak test was performed by pressurizing the hatch to greater than calculated accident pressure and observing the rate of pressure drop on a high accuracy (Heise) pressure gage.

Pressure corrections were made by reference to a barometer. Minimum test duration was 4 hours after a 1 hour stabilization period.

4. TEST EQUIPMENT USED

4.1 Valve Test Equipment

a. Rotameters - Sets of 3

Mfgr. - Brooks Inst. Co.
Model - 1114 Full View

Ranges:

Float Mat'l.	Tube No.	Range
Pyrex	R-2-15D	8-1,120 SCCM
Sapphire	R-2-15C	100-12,200 SCCM
Carboloy	R-6-15B	1,000-142,000 SCCM

Accuracy ± 2% full scale industrial accuracy

b. Temperature Indicators (as follows or similar)

Mfgr. - Ashcroft
Model - EH or AH / 3" or 5" Dial
Range - 30° to 130°F
Accuracy - ± 2°F

c. Pressure Indicators (as follows or similar)

Mfgr. - Ashcroft
Model - 1279 - 4-1/2" Dial
Range - 0 to 60 or 0 to 100 psig
Accuracy - ± 2 psig

d. Pressure Regulator (as follows or similar)

Mfgr. - Union Carbide Corp.
Model - UPG 3-75-580
Range - 0 to 100 psi output / 0 to 3000 psi input

e. Calibration Rotameters (Set of 2)

Mfgr. - Brooks Inst. Co.
Models - 1110-05K2B1Z49, 1110-08K2B1Z06
Ranges - 20 to 16,000 SCCM, 3,600 to 234,000 SCCM
Repeatability - ± 1/4% of instantaneous
Accuracy - ± 1% instantaneous

f. Flow rate Calibrator
Mfgr. - Brooks Inst. Co.
Model - 1056A
Range 0 to 2,400 SCCM
Accuracy - ± 0.2% of indicated volume

4.2 Access Hatch Test Equipment

a. Precision Pressure Gage (as follows or similar)

Mfgr. - Heise
Model - CM
Range - 0 to 60 psig
Resolution - 0.25 psig
Accuracy - 0.1% of instrument span

b. Barometer (as follows or similar)

Mfgr. - Pennwalt
Model - FA185260A
Range - 10.8 to 15.5 psia
Resolution - 0.005 psia
Accuracy - 0.1% of instrument span

5.2 Access Hatch Test Results

5.2.1 Overall semi-annual access hatch leakage test results in accordance with SP 1303-11.18 (Reference 8.2):

1993 Reactor Building Access Hatch Data		
COMPONENT	FIRST HALF TEST LEAKAGE RESULTS (SCCM)	SECOND HALF TEST LEAKAGE RESULTS (SCCM)
PERSONNEL ACCESS HATCH	463	859
EQUIPMENT ACCESS HATCH	1634	1782

1992 Reactor Building Access Hatch Data		
COMPONENT	FIRST HALF TEST LEAKAGE RESULTS (SCCM)	SECOND HALF TEST LEAKAGE RESULTS (SCCM)
PERSONNEL ACCESS HATCH	1057	2444
EQUIPMENT ACCESS HATCH	4040	AS FOUND 8986 *AS LEFT 6832

* Repaired equalizing ball valve seats, replaced inner RB door seal, tightened inner door handwheel packing.

5.2.2 Door Seal Leakage Test in accordance with SP 1303-11.25 (Reference 8.5).

The Personnel and Equipment Hatch Door Seals had been satisfactory leak tested throughout 1992 and 1993 resulting in leakage from each door seal to be less than 3 SCFH.

5. SUMMARY AND INTERPRETATION OF DATA

5.1 Valve Test Results

As-Found/As-Left Leakage to this date:

	Total Leakage	Tech. Spec. Limit	% Tech. Spec. Limit
As-Found MAXPATH(MINPATH)	61,379(9650) SCCM	104,846 SCCM	<58.5%(9.2%)
As-Left MAXPATH(MINPATH)	61,379(9844) SCCM	104,846 SCCM	<58.5%(9.4%)

1993 Reactor Building Purge Valve Data		
FREQUENCY	AH-V1A/1B LEAKAGE RESULTS (SCCM)	AH-V1C/1D LEAKAGE RESULTS (SCCM)
FIRST QUARTER	254	2379
SECOND QUARTER	1638	624
THIRD QUARTER	761	1794
FOURTH QUARTER		

1992 Reactor Building Purge Valve Data		
FREQUENCY	AH-V1A/1B LEAKAGE RESULTS (SCCM)	AH-V1C/1D LEAKAGE RESULTS (SCCM)
FIRST QUARTER	819	1989
SECOND QUARTER	819	4017
THIRD QUARTER	1521	1443
FOURTH QUARTER	975	3939

6. ERROR ANALYSIS

6.1 Valve Testing Errors (For purge valves see Section 6.2)

The flow meters used in the field have normal industrial accuracies of ± 2% full scale in the 10-100% (15-150 mm) scale range. Prior to use, mm versus sccm graphs were developed for the meters by 10 point calibrations using high accuracy (± 1% instantaneous) lab rotameters. During the leak test program, weekly 3 point standardizations were performed on the field rotameters to verify continued accuracy. The acceptance criteria for these standardizations was a variance of no more than 4% from the calibration graphs. If meters were repaired or the 3 point standardization exceeded the inaccuracy limit, a new 10 point calibration was performed. Scale readings on the leak rate procedure (SP 1303-11.18) data sheets were evaluated and corrected for temperature. Conservative bias was introduced into the results by assuming 15 mm (10% of scale) as the minimum scale.

6.2 Access Hatch and Purge Valve Testing Errors

The measured pressure drops were corrected by adding the minimum scale increment of the gage used for both the Heise gage and the barometer. This conservatively corrected for the resolution and repeatability errors. Gages used were recently calibrated. A minimum one hour temperature/pressure stabilization period was used prior to each pressure drop test. The access hatches and purge valves are not instrumented to allow temperature corrections.

7. LESSONS LEARNED/IMPROVEMENTS/DEGRADATION

7.1 The As-Found MAXPATH leakage was 58.5% of the Technical Specification limit of 104,846 SCCM. Of this total 38,527 SCCM was attributed to CA-V2 seat leakage and industrial cooling R.B. closed loop piping system joint/packing leakage.

CA-V2 was scheduled to be replaced during the 10R Refueling Outage. However, due to manufacturing scheduling, the valve was unavailable during the 10R Refueling Outage. The valve is scheduled to be replaced by the end of 1993. Repairs to minimize leakage of the R.B. closed cooling loop piping will be performed during 11R Outage.

7.2 Leakage noted on the outlet side of the Industrial Cooling Closed Loop will be minimized by scheduling maintenance on packing and bonnet gaskets for the valves inside the Reactor Building on that loop.

7.3 TMI-1 performed a combination ILRT/LLRT at the beginning of the refueling outage. About two-thirds of the LLRT was performed just prior to the ILRT test. The inner valves were tested using ILRT building pressure while the outer valves were tested by pressurizing the interspace using LLRT pressure rigs. Considerable man hours and radiation exposure were reduced since the ILRT line up also supported the LLRT.

8. REFERENCES

8.1 1430-Y-22, Standardization of Flow Rotameters

8.2 SP 1303-11.18, Reactor Building Local Leak Rate Testing

8.3 Three Mile Island, Unit 1, Technical Specification 4.4.1

8.4 TMI Surveillance File (Records stored in CARIRS, Data Base AA60 REC.TYPE 018-12)

8.5 SP 1303-11.25, Reactor Building Local Leakage Access Hatch Door Seals

1993 10R OUTAGE LOCAL LEAK RATE TEST RESULTS

COMPONENT	AS-FOUND	AS-LEFT
EMERGENCY ACCESS HATCH	1634	1634
PERSONNEL ACCESS HATCH	463	463
EQUIPMENT FLANGE	90	90
AH-V1A/1B	1248	1248
AH-V1C/1D	1794	1794
CA-V1/3/13	16	(SEE CA-V13)
CA-V13	(SEE CA-V1/3/13)	67
CA-V2	18634	18634
CA-V4A	17	17
CA-V5A	86	86
CA-V4B	11	11
CA-V5B	1916	1916
CA-V192	23	23
CA-V189	1264	1264
CF-V2A	15	67
CF-V20A	68	68
CF-V2B	44	67
CF-V20B	2232	2232
CF-V12A	55	55
CF-V19A	1246	1246
CF-V12B	262	262
CF-V19B	1139	1139
CM-V1	17	17
CM-V2	85	85
CM-V3	85	85
CM-V4	31	31
DH-V69	15	15
DH-V64	281	281
FTT EAST	67	67
FTT WEST	67	67
HM-V1A	79	79
HM-V1B	85	85

HM-V2A	79	79
HM-V2B	85	85
HM-V3A	16	16
HM-V3B	16	16
HM-V4A	16	16
HM-V4B	16	16
HP-V1	17	17
HP-V6	113	113
HR-V22A/22B	59	59
HR-V2A/2B	70	70
HR-V23A	59	59
HR-V23B	59	59
HR-V4A/4B	70	70
IA-V20/6	85	85
IC-V2	16	16
IC-V3	67	67
IC-V18	49	49
IC-V4	68	68
IC-V16	360	360
IC-V6	319	319
MU-V2A	16	16
MU-V2B	16	16
MU-V3	67	67
MU-V18	276	276
MU-V116	1476	1476
MU-V20	79	79
MU-V25	13	13
MU-V26	90	90
NI-V26	16	16
NI-V27	16	16
NS-V11	16	16
NS-V15	290	290
NS-V35	16	16
NS-V4	303	303
PENET 104	56	56

PENET 105	69	69
PENET 106	67	67
PENET 210	56	56
PENET 211	56	56
PENET 241	67	67
PENET 414	55	55
PENET 417	67	67
PENET 221	67	67
PENET 222	67	67
PP-V210	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
PP-V211	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
PP-V212	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
PP-V213	INCLUDED IN AH LEAKAGE	INCLUDED IN AH LEAKAGE
RB-V2A	85	85
RB-V7	376	376
RB CLOSED LOOP	19893	19893
SA-V3/2	86	86
SF-V23	63	63
WDG-V3/4	67	67
WDL-V303	16	84
WDL-V304	3470	3470
WDL-V534/535	67	67
MAX PATH TOTAL	61379	61379
MIN PATH TOTAL	9650	9844