HOUSTON LIGHTING & POWER COMPANY

South Texas Project Electric Generating Station

Unit 2

REACTOR CONTAINMENT BUILDING INTEGRATED LEAKAGE RATE TEST REPORT

November 19, 1991

GENERAL PHYSICS CORPORATION

GP-R-263117

HOUSTON LIGHTING & POWER COMPANY

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I. INTRODUCTION

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 do not exceed the allowable leakage rates specified in the Plant Technical Specifications.

The purpose of this report is to provide information pertinent to the activities related to the preparation, test performance, and reporting of the South Texas Project Electric Generating Station Unit 2 Integrated Leakage Rate Test (ILRT).

Highlights of activities and events which occured prior to and during the ILRT are presented in Section II, Test Synopsis.

Section III, Test Data Summary, contains data and results necessary to demonstrate containment atmosphere stabilization, acceptable leakage rate, and successful ve ification test. In addition, plots provided in Appendices B and C supply a visual history of containment atmospheric conditions beginning with the 24 hour ILRT test period and ending with the verification test.

Information in Section IV, Analysis and Interpretation, supplies the technical details associated with the ILRT computer program and its associated hardware as well as the instrumentation used during the ILRT.

Section V, References, lists the documents used for the conduct of the ILRT.

The successful periodic Type A and verification test were performed according to the requirements of the South Texas Project Unit 2 Technical Specifications and 10CFR50, Appendix J. The test method used was the Absolute Method, as described in ANSI/ANS 56.8-1987, "Containment System Leakage Testing Requirements".

Leakage rates were calculated using Mass point Analysis as described in ANSI/ANS 56.8-1987. The Total Time Analysis equations from ANSI N45.4-1972, "Leakage-Rate Testing of Containment Structures for Nuclear Reactors" were run concurrently for informational purposes. The test results are reported in accordance with the requirements of 10CFR50, Appendix J, Section V.B.3.

II. TEST SYNOPSIS

Prior to containment pressurization on September 22, 1991, site personnel were engaged in prerequisite activities for the conduct of the ILRT. The ILRT was conducted at the beginning of the refueling outage. The following discussion highlights some of the activities that were essential to the successful and timely completion of the ILRT. These items are presented in chronological order.

A. Pre-pressurization Activites

These activities included ILRT procedure review and finalization, ILRT computer program checkout and linkup to the Fluke 2280B Data Acquisition System, ILRT instrumentation installation and operability checks, and containment subvolume weighting factor and sensor failure analysis calculation.

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 to ensure that all instrumentation was operating correctly. Calibration records for the ILRT instrumentation system components are retained at the plant.

Per ANSI/ANS 56.8-1987, Section 5.5.1, a temperature survey was performed on all elevations of the reactor containment building, and at several locations in the dome region. The survey was conducted with the containment ventilation units in the proposed ILRT lineup.

B. Test Summary Time-Line

Phase	Time Frame	Duration
Pressurization	From: 0158 on 9/22/91 To: 1801 on 9/22/91	16.05 hours
Stabilization	From: 1810 on 9/22/91 To: 2218 on 9/22/91	4.13 hours
ILRT Test	From: 2235 on 9/22/91 To: 2248 on 9/23/91	24.22 hours
Verification Test	From: 2303 on 9/23/91 To: 0303 on 9/24/91	4.00 hours

C. Containment Pressurization

Containment pressurization started at 0158 on September 22, 1991 using five 1500 scfm, three 1200 scfm, and three 900 scfm diesel-driven 100% oil-free air compressors. The pressurization rate was maintained at approximately 3.6 psi per hour until containment pressure reached 40 psig. At this time, the pressurization rate was gradually reduced by reducing the number of operating compressors. All compressors were stopped when the containment pressure reached 44.6 psig at 1801 on September 22, 1991. This was within the procedural limits of 42.5 +3,-0 psig.

During pressurization a containment walkdown was performed to identify potential leakage. No measurable leakage was observed. Pressurization was conducted with the use of the Reactor Containment Fan Cooling Units. However, the fans were stopped at a pressure of 40 psig and were not used during the ILRT or verification test. No abnormal temperature stratification was observed.

D. Containment Atmosphere Stabilization

The stabilization phase was started at 1810 on September 22, 1991. By 2210 on September 22, 1991, the temperature stabilization criteria of ANSI/ANS 56.8-1987 had been met. Operations required a boron sample to be taken every 12 hours because rods were locked at the top for a rapid refueling. A sample was taken prior to the 24 hour ILRT test period. This activity was completed at 2218 and the temperature stabilization data was still within limits.

E. ILRT Test Period

The ILRT was officially started after the 2218 data point with the next data point at 2235 on September 22, 1991 and was successfully completed at 2248 on September 23, 1991. The maximum allowable leakage rate (L_a) for the containment is 0.3 % wt. per day with a test acceptance limit of 0.225 % wt. per day (0.75 L_a). The Total Time and Mass Point Analyses were run concurrently on the General Physics ILRT Computer Program. The leakage rate results are as follows:

	Total Time Analysis % wt./day	Mass Point Analysis % wt./day
Calculated Leakage Rate	0.0491 *	0.0628 *
95 % Upper Confidence Leakage rate	0.0569 *	0.0653 *

* Does not include penalties for nonstandard alignments and water level changes

F. Verification Test

A successful verification test was conducted following the ILRT. At 2252 on September 23, 1991, a leakage rate of 25.98 scfm was imposed on the primary containment. The 25.98 scfm leakage imposed (L_o) on the existing containment leakage was slightly less than L_a (0.3 % wt./day) at 0.2839 % wt. per day. The verification phase was completed at 0303 on the next day.

The verification test results are presented below:

	Total Time Analysis % wt./day	Mass Point Analysis % wt./day
Leakage Rate (L_{am})	0.0491	0.0628
Imposed Leak (L_o)	0.2839	0.2839
Lower Limit: $L_o + L_{am} + 0.25\ L_a$	0.2580	0.2716
Composite Leakage (L_c)	0.3153	0.2994
Upper Limit: $L_o + L_{am} + 0.25\ L_a$	0.4080	0.4216

G. Local Leakage Rate Testing

Subsequent to the completion of the ILRT, "as found" local leakage rate testing (LLRT) was performed as required by 10CFR50, Appendix J. Results from this testing were required for those penetrations not exposed to the ILRT pressure to complete the analysis of the "as found" ILRT results. The "as found" local leakage rate testing was completed on November 12, 1991.

III. TEST DATA SUMMARY

A. Plant Information

Owner	Houston Lighting & Power Company City Public Service Board of San Antonio Central Power and Light Company City of Austin
Plant	South Texas Project Electric Generating Station Unit 2
Location	Wadsworth, Texas
Containment Type	Post-tensioned concrete with a steel liner
NSSS Supplier, Type	Westinghouse, 4 loop PWR
Date Test Completed	November 19, 1991

B. Technical Data

Containment Net Free Volume	3,380,000 cubic feet
Design Pressure	56.5 psig
Design Temperature	286 ° F
Calculated Peak Accident Pressure	42.5 psig
Calculated Peak Accident Temperature	323 ° F

C. Test Results - Type A

Test Method	Absolute
Test Pressure	42.5 psig

Integrated Leakage Rate Mass Point Analysis Test Results:

Calculated Leakage Rate, L_{am}	0.0628 % wt./day
95 % Upper Confidence Limit Leakage Rate	0.0653 % wt./day

Integrated Leakage Rate Total Time Analysis Test Results (Presented for information only):

Calculated Leakage Rate, L_{am}	0.0491 % wt./day
95 % Upper Confidence Limit Leakage Rate	0.0569 % wt./day
Maximum Allowable Leakage Rate, L_a	0.3 % wt./day
ILRT Acceptance Criteria, 0.75 L_a	0.225 % wt./day
Verification Test Imposed Leakage Rate, L_o	25.98 scfm or 0.284 % wt./day

Verification Test Mass Point Analysis Results and Limits	
Upper Limit ($L_o + L_{am} + 0.25\ L_a$)	0.4216 % wt./day
Calculate Composite Leakage Rate, L_c	0.2994 % wt./day
Lower Limit ($L_o + L_{am} - 0.25\ L_a$)	0.2716 % wt./day
Verification Test Total Time Analysis Results and Limits (Presented for information only)	
Upper Limit ($L_o + L_{am} + 0.25\ L_a$)	0.4080 % wt./day
Calculated Composite Leakage Rate, L_c	0.3150 % wt./day
Lower Limit ($L_o + L_{am} - 0.25\ L_a$)	0.2580 % wt./day

Report Printouts

The report printouts of the ILRT and verification test calculations for the Total Time and Mass Point Analyses are provided in Appendices B and C. Stabilization data is provided in Appendix A.

D. Test Results - Type B and C Tests

A summary of local leakage rate test results since the ILRT in 1988 are included in Appendix F.

E. Integrated Leakage Rate Measurement System

1. Absolute Pressure

Quantity	2
Manufacturer	Ruska
Type	Quartz Manometer DDR 6000-151-100
Range	0 - 100 psia
Accuracy	± 0.02 % of reading
Sensitivity	± 0.001 psia
Repeatability	± 0.003 psia
Resolution	± 0.001 psia

2. Drybulb Temperature

Quantity	24
Manufacturer	Thermetrics Maveric
Type	FTA-T12, 100 ohm platinum resistance temperature detectors (RTD)
Range, calibrated	32 - 120 ° F
Accuracy	± 0.4 ° F
Sensitivity	± 0.01 ° F

3.	Dewpoint Temperature	
	Quantity	6
	Manufacturer	EG & G
	Type	Model 660, Chilled mirror hygrommeters
	Range, calibrated	40 - 100 ° F
	Accuracy	± 0.54 ° F
	Sensitivity	± 0.1 ° F
4.	Verification Flow	
	Quantity	2
	Manufacturer	Brooks
	Type	Model 1020AK4CC91A Rotometer
	Range	4 - 40 scfm @ 40.5 psig 90° F
	Accuracy	2% F.S.
5.	Readout Device	
	Quantity	1
	Manufacturer	Fluke
	Type	Model 2280B
	Repeatability	
	Drybulb Temp	± 0.072 ° F
	Dewpoint Temp	± 0.0081 ° F
	Resolution	± 0.01 ° F

The Instrumentation Selection Guide (ISG) value from ANSI/ANS 56.8-1987 based on a 24 hour test and the above ILRT instrumentation configuration is 0.009 % wt./day. (Refer to Appendix D for calculations). The sensor locations and volume fractions as installed for the ILRT are shown in Appendix G.

F. Information Retained at Plant

The following information is available for review at the South Texas Project Electric Generating Station site:

1. Access control procedure used to control access to the containment during testing.
2. A listing of all containment penetrations, including the total number, size, and function.
3. A listing of normal operating instrumentation used for the leakage test.
4. A system lineup (at time of test), showing required valve positions and status of piping systems.
5. A continuous, sequential log of events from the initial survey of containment to restoration of tested systems.
6. Documentation of instrumentation calibrations and standards, including a sensor failure analysis.
7. Data to verify temperature stabilization criteria as established by test procedure (Appendix A).
8. The working copy of the test procedure that includes signature sign-offs of procedural steps.
9. The procedure and data that verifies completion of penetration and valve testing, including as-found leak rates, corrective action, and final leak rates.
10. Computer printouts of ILRT data and automated data acquisition printouts along with summary description of the computer program.

11. The Quality Assurance audit plan or checklist that was used to monitor the ILRT with proper signoffs.
12. A listing of test exceptions including changes in the containment system boundaries.
13. Description of sensor malfunctions, repairs, and methods used to redistribute volume weighting fractions to operating instrumentation.
14. A review of confidence limits of test results with accompanying computer printouts.
15. Description of the method of leakage rate verification.
16. ILRT data plots obtained during the test.
17. The P&IDs of pertinent systems.

IV. ANALYSIS AND INTERPRETATION

The upper 95% confidence limit (UCL) Total Time and Mass Point leakage rates calculated during the ILRT were less than the test acceptance criteria of 0.75 L_a (0.225 % 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.

A. Type C Penalties

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

Pen No.	System	As Found Leakage Rate (sccm)
M-10	HHSI C Train	114
M-11	LHSI C Train	20
M-14	HHSI B Train	20
M-15	LHSI B Train	20
M-18	HHSI A Train	20
M-19	LHSI A Train	20
M-23	RCFC C Train Return	636
M-24	RCFC C Train Supply	51
M-25	RCFC A Train Supply	3543
M-26	RCFC A Train Return	76
M-27	RCFC B Train Supply	4838
M-28	RCFC B Train Return	403
M-32	ILRT Verification Test	20
M-33	CCW to RHR Pmp/Hx A	48
M-34	CCW to Ret.RHR Pmp/Hx A	3127
M-35	CCW to RHR Pmp/Hx B	6653

Pen No.	System	As Found Leakage Rate (sccm)
M-36	CCW Return RHR Pmp/Hx B	2072
M-37	CCW to RHR Pmp/Hx C	20
M-38	CCW Ret.to RHR Pmp/Hx C	636
M-39	CCW Supply to RCPs	2554
M-40	CCW Return from RCPs	3649
M-46	CVCS Letdown	61
M-48	CVCS Charging	298
M-53	CVCS Letdown to RHR	20
M-55	RHR Pmp B to RWST	20
M-71	ILRT Depressurization	20
M-76	RHR Pmp C to RWST	20
M-82(F)	ILRT Pressure Monitoring	20
M-86D	RHR Loop Sample	20
M-87	ILRT Depressurization	20

The total applicable local leakage rate Type C penalty addition of 29,039 sccm, which including the upper instrumentation error, is equivalent to 0.0112 % wt. per day.

B. Volume Change Corrections

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

Volume Monitored	Level Change	Volume Change
Pressurizer	-100 GAL	+13.37 cu. ft.
Normal Primary Sump	0	0
Normal Secondary Sump	+3.2 GAL	- 0.43 cu. ft.

Volume Monitored	Level Change	Volume Change
Pressurizer Relief Tank	0	0
Reactor Coolant Drain Tank	0	0
Safety Injection Accumulator A	0	0
Safety Injection Accumulator B	-10 GAL	+ 1.34 cu. ft.
Safety Injection Accumulator C	0	0

Based on the volumes monitored, there was an increase in the containment net free volume during the ILRT. This effect is already accounted for in the measured leakage rate.

C. As Found ILRT Results

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

	Total Time Analysis (% wt./day)	Mass Point Analysis (% wt./day)
95 % UCL Leakage Rate	0.0569	0.0653
Type C Penalties	0.0112	0.0112
Volume Change	0	0
As Found 95 % UCL Leakage Rate	0.0681	0.0765

The as found Total Time and Mass Point 95 % UCL leakage rates are less than the test acceptance criteria value of 0.75 L_a (0.225 % wt./day).

D. As Left ILRT Results

No repairs or adjustments were made on a minimum pathway basis which would require correction to the as found ILRT result.

V. REFERENCES

A. South Texas Project Electric Generating Station Department Procedure, OPSP11-IL-0007 Rev 1, Reactor Containment Building Integrated Leakage Rate Test.

B. South Texas Project Electric Generating Station Unit 2 Technical Specifications.

C. South Texas Project Electric Generating Station Unit 2 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.

VI APPENDICES

APPENDIX A

STABILIZATION PHASE DATA

STABILIZATION MODE TIME = 2218

OPTIONS MODE SUMMARY

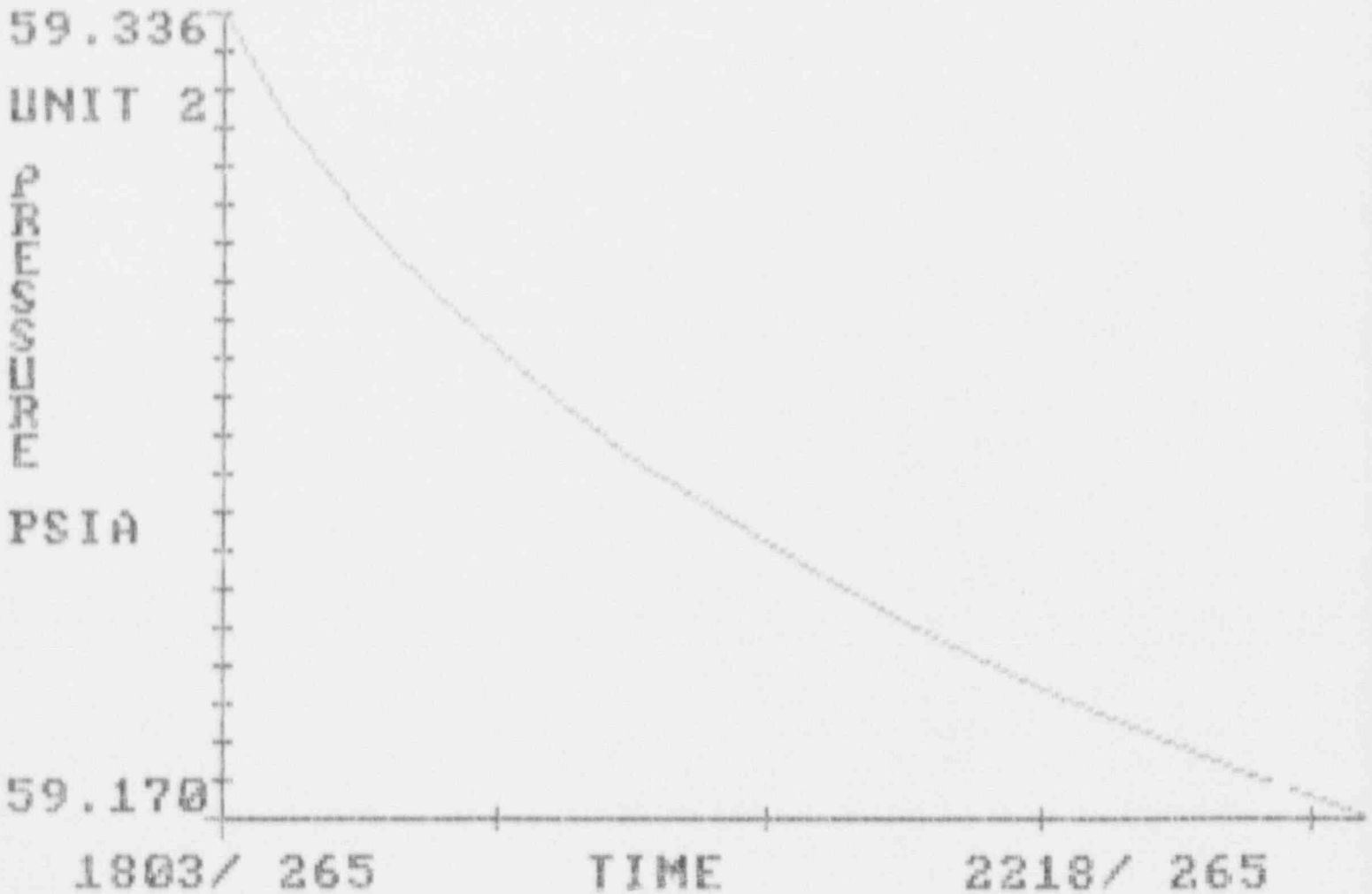
1 - MANUAL DATA ENTRY
2 - PARAMATER GRAPHS
3 - SENSOR PLOTS
4 - SENSOR DIFFERENTIALS
5 - ANSI STABILIZATION CRITERIA
6 - NN-TOP-1 STAB.CRITERIA
7 - ANSI CRITERIA PRINTOUT
8 - NN-TOP-1 CRITERIA PRINTOUT
9 - REPRINT CURRENT DATA POINT
P - PASS WORD MENU
0 - FLASH OFF

OF DATA POINTS = 10
MODE DURATION (IN HRS) = 4.25
TOT TIME MEASURED LEAK = 0.2814
TOT TIME CALCULATED LEAK = 0.1993
TOT TIME 95% UCL = 0.4215
MASS PT LEAK = (.2154
MASS PT 95% UCL = (.2692

ANSI PRESSURE/TEMPERATURE STABLE CRITERIA MET
NN-TOP TEMPERATURE CRITERIA MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP: 81.341/ -0.044 AVG PRESS: 59.276/ -0.012
MASS: 91149.56/-110.375 AVG DEW PRESS: 0.3940/+0.0068



STABILIZATION MODE

TIME = 2218

OPTIONS

MODE SUMMARY

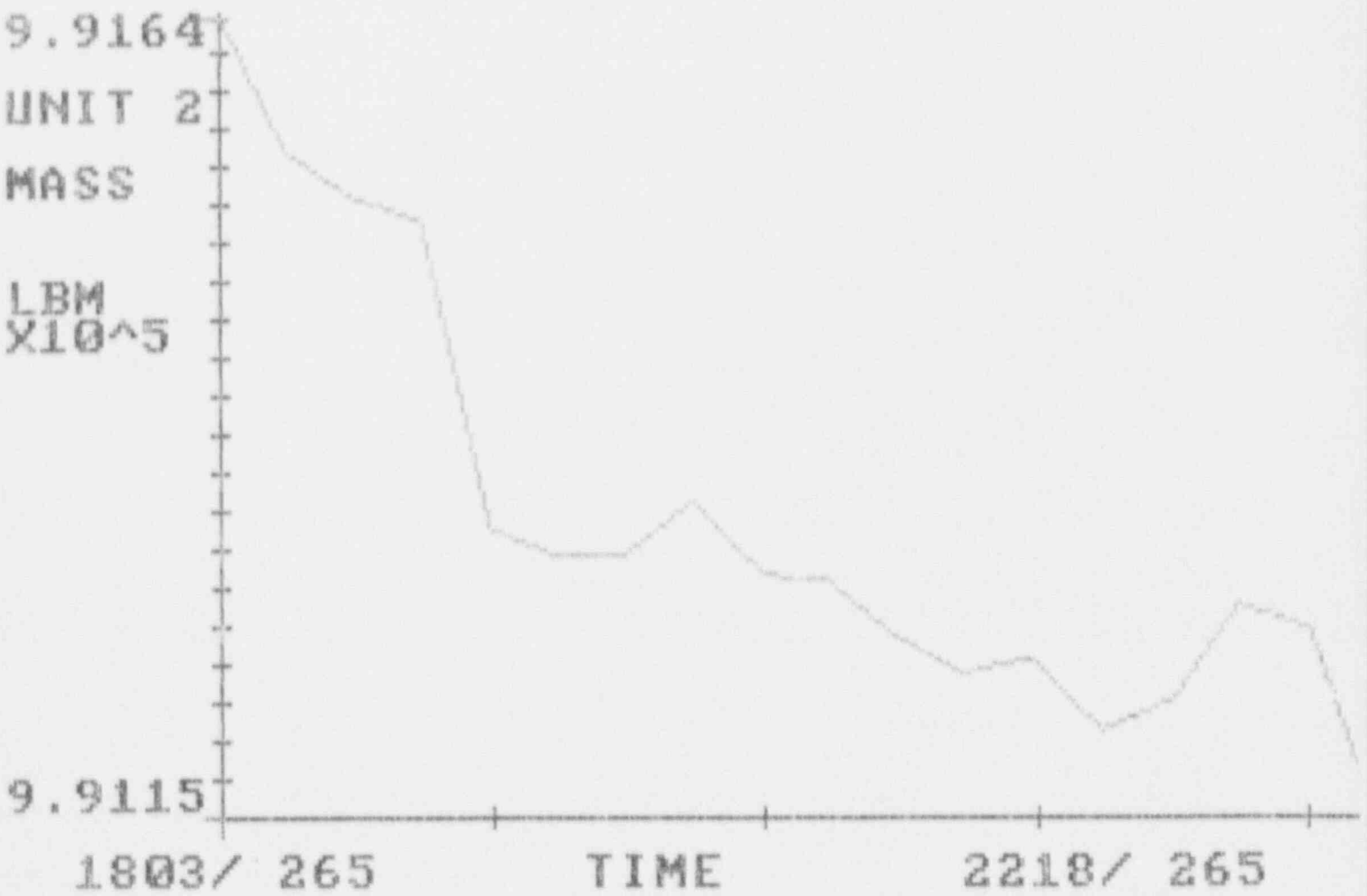
1 - MANUAL DATA ENTRY
2 - PARAMETER GRAPHS
3 - SENSOR PLOTS
4 - SENSOR DIFFERENTIALS
5 - ANSI STABILIZATION CRITERIA
6 - BN-TOP-1 STAB.CRITERIA
7 - ANSI CRITERIA PRINTOUT
8 - BN-TOP-1 CRITERIA PRINTOUT
9 - REPRINT CURRENT DATA POINT
P - PASS WORD MENU
0 - FLASH OFF

N OF DATA POINTS = 18
MODE DURATION (IN HRS) = 4.25
TOT TIME MEASURED LEAK = 0.2814
TOT TIME CALCULATED LEAK = 0.1993
TOT TIME 95% UCL = 0.4215
MASS PT LEAK = 0.2154
MASS PT 95% UCL = 0.2692

ANSI PRESSURE/TEMPERATURE STABLE CRITERIA MET
BN-TOP TEMPERATURE CRITERIA MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP: 81.341/ -0.044
MASS: 991149.56/-118.375
AVG PRESS: 50.776/ -0.012
AVG DEW PRESS: 0.3940/+0.0068



STABILIZATION ANSI56.8

TIME	TEMP	56.8 1 HR F/HR	56.8 4 HR F/HR	4-1 HR
4.25	81.341	0.175	0.303	-0.128
4.00	81.385	0.180	0.337	-0.157
3.75	81.423	0.196	0.000	0.196
3.50	81.465	0.217	0.000	0.217
3.25	81.515	0.224	0.000	0.224
3.00	81.565	0.242	0.000	0.242
2.75	81.619	0.256	0.000	0.256
2.50	81.681	0.278	0.000	0.278
2.25	81.739	0.311	0.000	0.311
2.00	81.807	0.342	0.000	0.342
1.75	81.876	0.392	0.000	0.392
1.50	81.959	0.438	0.000	0.438
1.25	82.050	0.501	0.000	0.501
1.00	82.149	0.585	0.000	0.585
0.75	82.268	0.000	0.000	0.000
0.50	82.397	0.000	0.000	0.000
0.25	82.551	0.000	0.000	0.000

EN-TOP-1 STABLIZATION CRITERIA

TIME	TEMP	EN dT	EN dT2
4.25	81.3408	-0.7204	-0.1994
4.00	81.3848	-0.2382	-0.2111
3.75	81.4234	-0.2519	-0.2262
3.50	81.4646	-0.2800	-0.2471
3.25	81.5154	-0.3094	-0.2673
3.00	81.5647	-0.3393	-0.2856
2.75	81.6195	-0.3868	-0.3241
2.50	81.6812	-0.4320	-0.3578
2.25	81.7395	-0.4976	-0.4060
2.00	81.8070	-0.5790	-0.4637
1.75	81.8759	0.0000	0.0000
1.50	81.9588	0.0000	0.0000
1.25	82.0501	0.0000	0.0000
1.00	82.1488	0.0000	0.0000
0.75	82.2677	0.0000	0.0000
0.50	82.3968	0.0000	0.0000
0.25	82.5515	0.0000	0.0000
0.00	82.7343	0.0000	0.0000

STABILIZATION MODE TIME : 2218

OPTIONS

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

MODE SUMMARY

OF DATA POINTS = 68
MODE DURATION (IN HRS) = 4.25
TOT TIME MEASURED LEAK = 0.2814
TOT TIME CALCULATED LEAK = 0.1993
TOT TIME 95% UCL = 0.4215
MASS PT LEAK = 0.2154
MASS PT 95% UCL = 0.2692

ANSI PRESSURE/TEMPERATURE STABLE CRITERIA MET
BN-TOP TEMPERATURE CRITERIA MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

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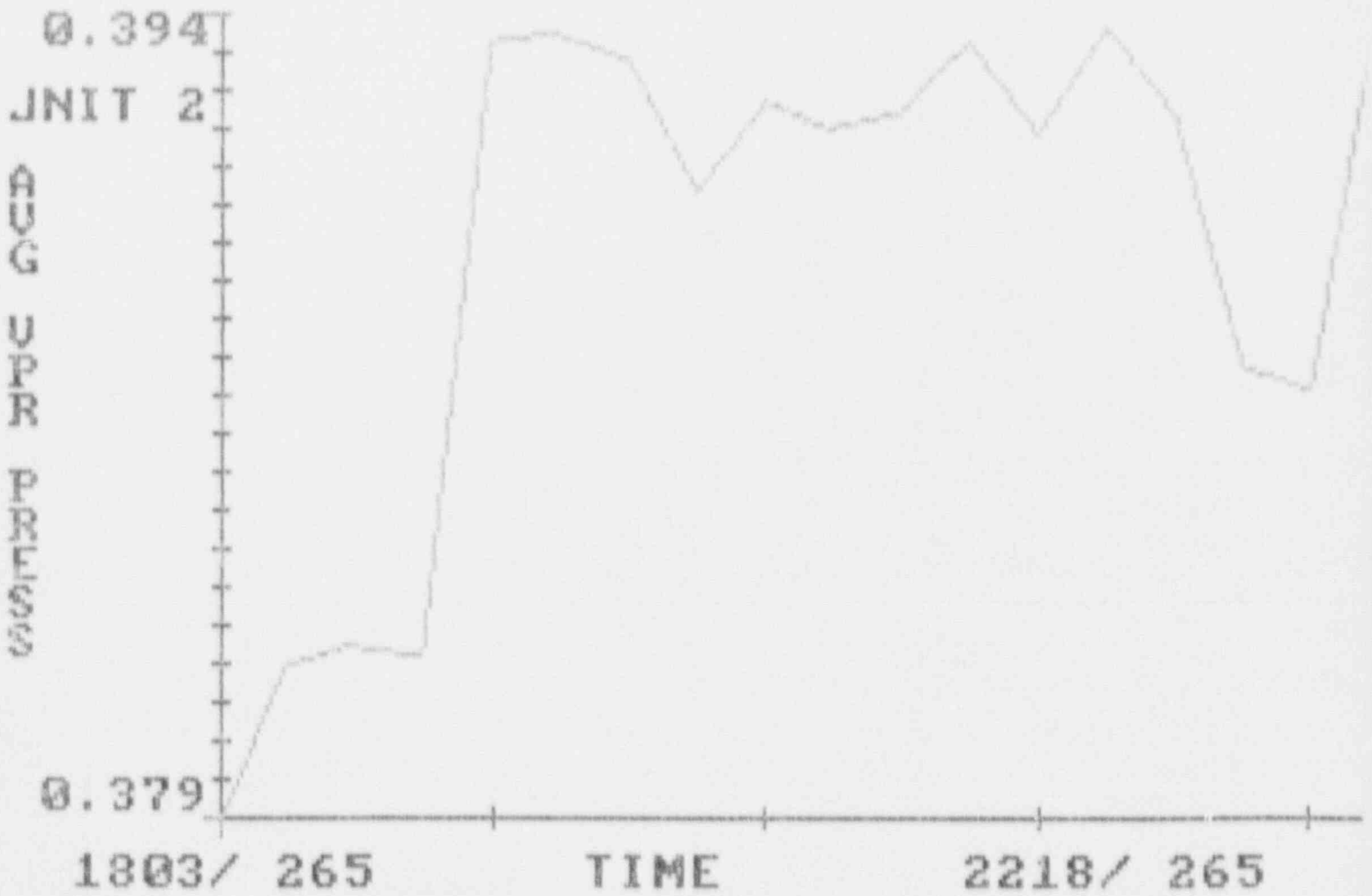
MASS: 991149.56/-110.375 AVG DEW PRESS: 0.3940/+0.0068



STABILIZATION MODE

OPTIONS

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

TIME: 2

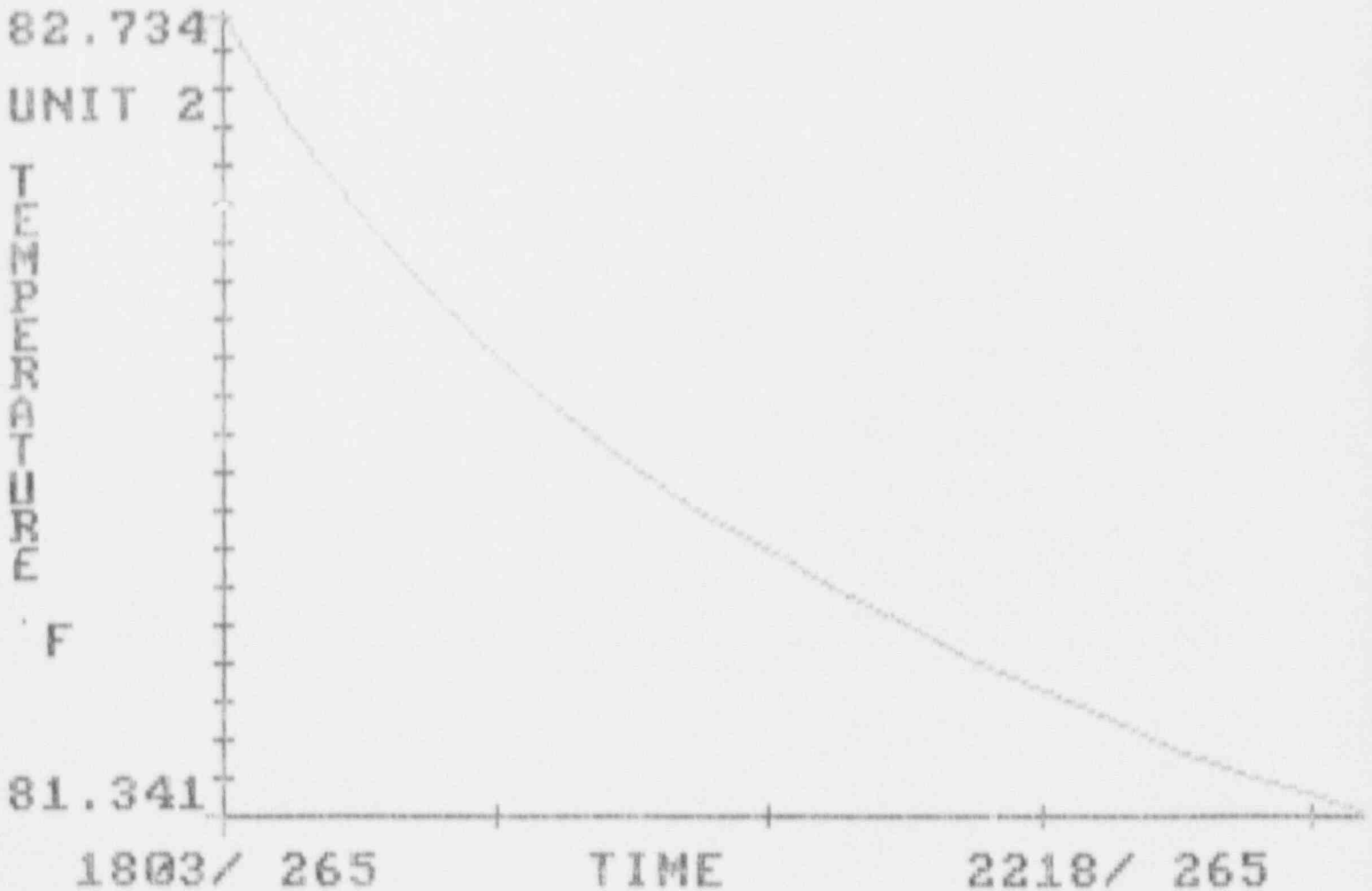
MODE SUMMARY

OF DATA POINTS = 18
MODE DURATION (IN HRS) = 4.25
TOT TIME MEASURED LEAK = 0.2814
TOT TIME CALCULATED LEAK = 0.1993
TOT TIME 95% UCL = 0.4215
MASS PT LEAK = 0.2134
MASS PT 95% UCL = 0.2692

ANSI PRESSURE/TEMPERATURE STABLE CRITERIA MET
BN-TOP TEMPERATURE CRITERIA MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP: 81.341/ -0.044 AVG PRESS: 59.726/ -0.012
MASS: 991149.56/-118.375 AVG DEW PRESS: 0.3940/-0.0068



APPENDIX B

ILRT TEST DATA AND PLOTS

ATTACHMENT 1
ST-HL-AE-3798
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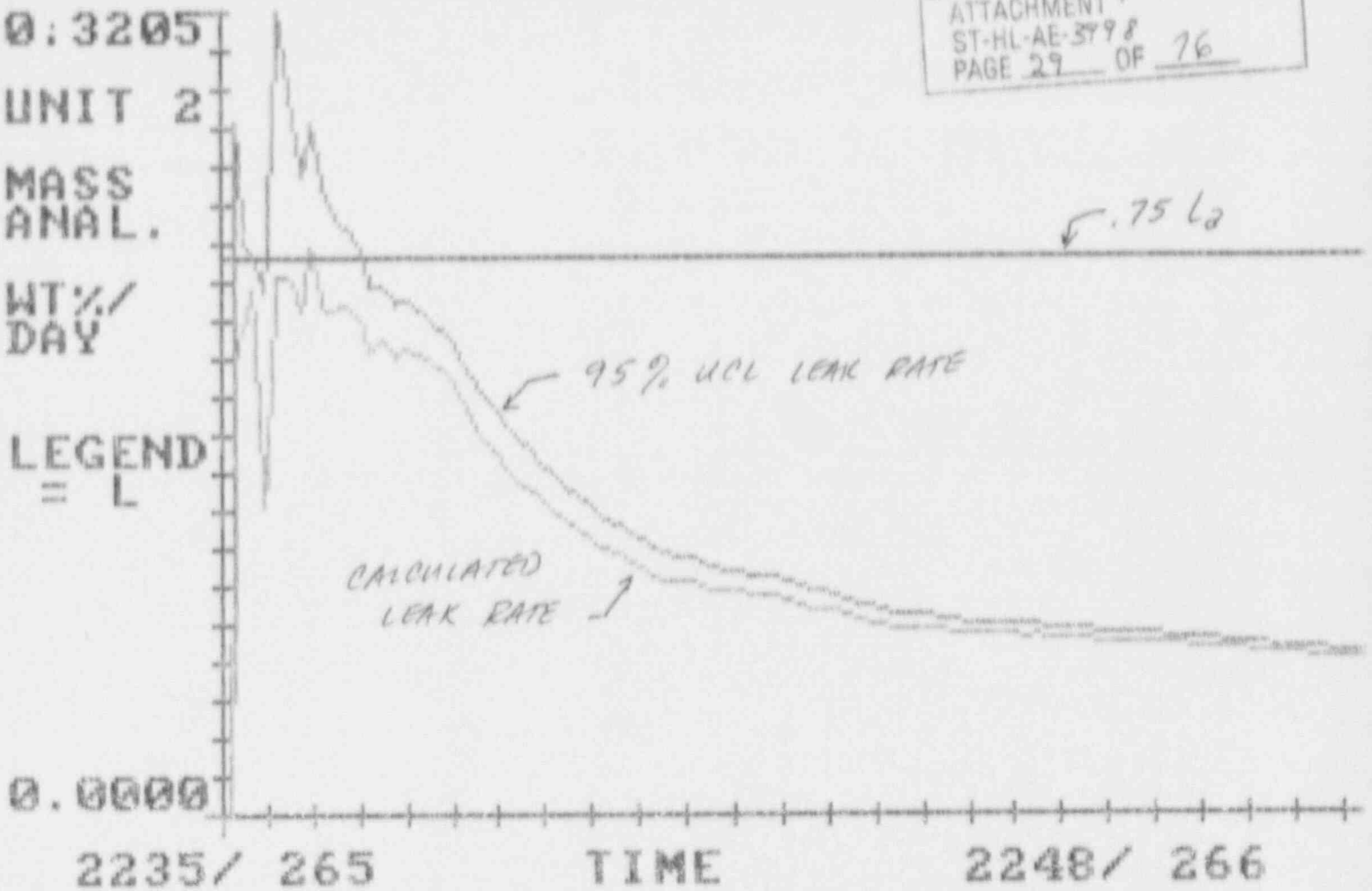

STPE05 2
23 SEP 91

TEST MODE

PLEASE SELECT THE OPTION
YOU WISH TO USE:

1 -- MANUAL DATA ENTRY
2 -- PARAMETER GRAPHS
3 -- SENSOR PLOTS
4 -- TREND ANALYSIS
5 -- REPRINT CURRENT DATA FT
6 -- SENSOR DIFFERENTIALS

P -- PASS WORD MENU

SELECTED OPTION=

TEST DATA 2248

OF DATA POINTS = 100
MODE DURATION (IN HOURS) = 24.21667
TOT TIME MEASURED LEAK = 0.0713
TOT TIME CALCULATED LEAK = 0.0491
TOT TIME 95% UCL = 0.0565
MASS POINT LEAK = 0.0628
MASS POINT 95% UCL = 0.0653
75% La = .225
MASS = 990577.06

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP: 80.214 / -0.002 AVG PRESS: 50.620 / +0.000
MASS: 990577.06 / +3.750 AVG DEW PRESS: 0.3638 /-0.0005

AVG. DATA VALUES UNIT # 2

ATTACHMENT 1
ST-HL-AE-3998
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DATE	TIME	T(I)	F(I)	D1(I)	V(	
265	0.00	81.287	58.779	71.761	0.388	991291
265	0.22	81.263	58.775	71.737	0.385	991275
265	0.28	81.252	58.774	71.739	0.385	991269
265	0.47	81.225	58.770	71.814	0.386	991252
265	0.72	81.193	58.765	71.821	0.386	991229
265	0.97	81.165	58.763	71.631	0.386	991250
265	1.22	81.132	58.754	72.028	0.389	991157
265	1.47	81.100	58.751	71.948	0.388	991160
265	1.72	81.076	58.748	71.909	0.387	991156
265	1.97	81.051	58.741	72.129	0.390	991087
266	2.22	81.021	58.740	71.894	0.387	991136
266	2.47	81.000	58.735	72.013	0.389	991090
266	2.72	80.968	58.730	72.197	0.391	991057
266	2.97	80.937	58.727	72.157	0.391	991063
266	3.22	80.918	58.726	72.048	0.389	991073
266	3.47	80.898	58.719	72.161	0.392	991001
266	3.72	80.882	58.716	72.043	0.389	991030
266	3.97	80.854	58.712	72.378	0.393	990963
266	4.22	80.833	58.710	72.252	0.392	990971
266	4.47	80.818	58.708	72.266	0.392	990953
266	4.72	80.799	58.706	72.226	0.391	990955
266	4.97	80.780	58.705	72.048	0.389	990979
266	5.22	80.763	58.704	71.934	0.388	991001
266	5.47	80.748	58.701	71.994	0.388	990974
266	5.72	80.733	58.699	71.962	0.388	990966
266	5.97	80.718	58.698	71.830	0.386	990979
266	6.22	80.708	58.697	71.812	0.386	990969
266	6.47	80.694	58.693	71.888	0.387	990936
266	6.72	80.679	58.691	71.829	0.386	990934
266	6.97	80.664	58.690	71.753	0.385	990945
266	7.22	80.650	58.689	71.718	0.385	990943
266	7.47	80.635	58.687	71.720	0.385	990936
266	7.72	80.624	58.686	71.632	0.384	990943
266	7.97	80.612	58.683	71.676	0.384	990913
266	8.22	80.601	58.682	71.594	0.383	990917
266	8.47	80.594	58.680	71.577	0.383	990901
266	8.72	80.579	58.679	71.579	0.383	990913
266	8.97	80.568	58.678	71.485	0.382	990909
266	9.22	80.555	58.676	71.478	0.382	990900
266	9.47	80.547	58.674	71.452	0.381	990886
266	9.72	80.538	58.671	71.511	0.382	990856
266	9.97	80.528	58.670	71.460	0.381	990852
266	10.22	80.519	58.670	71.350	0.380	990859
266	10.47	80.509	58.668	71.391	0.381	990842
266	10.72	80.498	58.665	71.390	0.381	990829
266	10.97	80.488	58.664	71.347	0.380	990824
266	11.22	80.480	58.662	71.333	0.380	990808
266	11.47	80.472	58.661	71.291	0.379	990798
266	11.72	80.462	58.660	71.300	0.379	990793
266	11.97	80.457	58.659	71.280	0.379	990803
266	12.22	80.448	58.662	70.978	0.376	990869

RAW DATA VALUES UNIT # 2

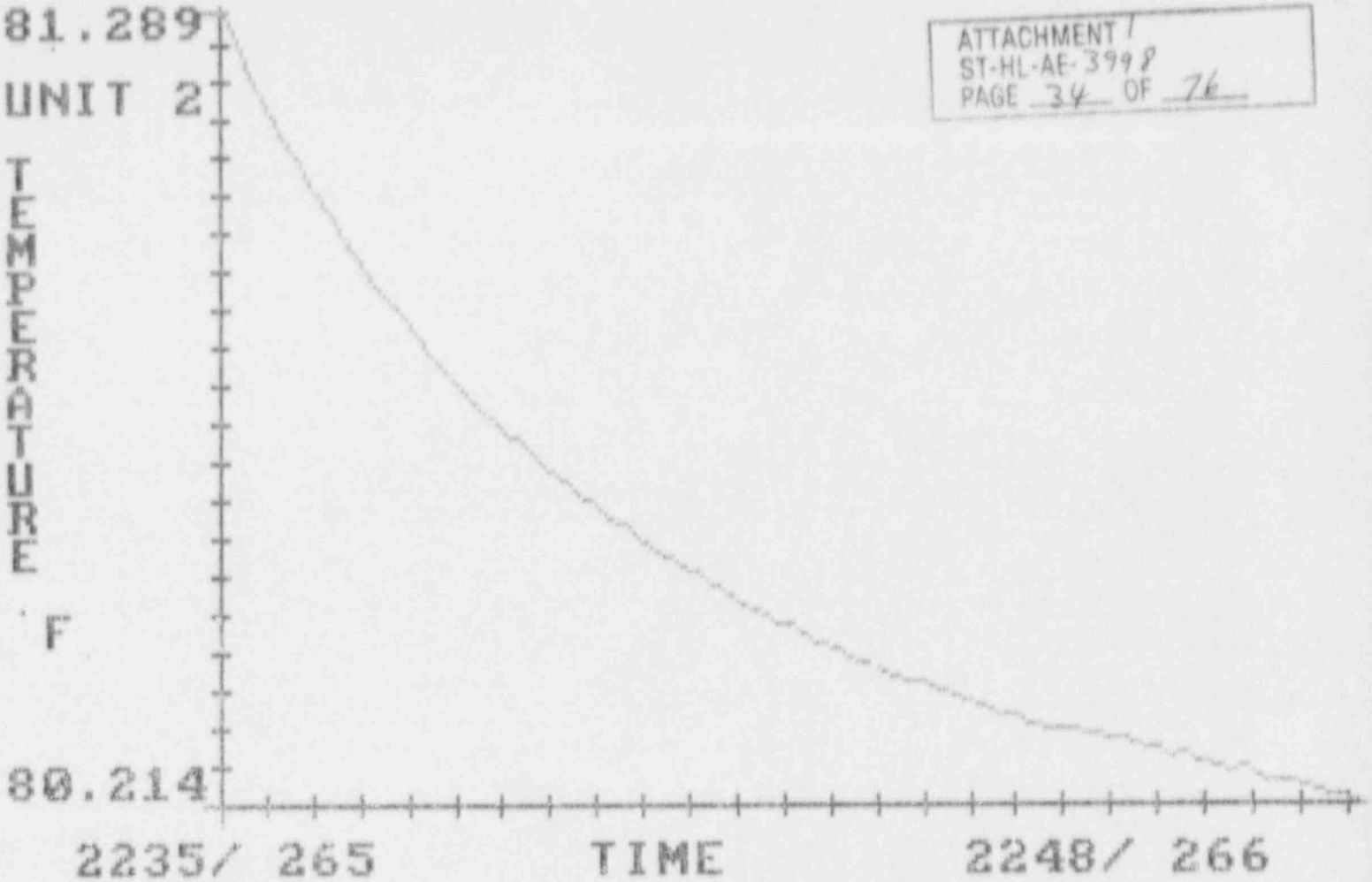
DATE	TIME	T(I)	P(I)	DT(I)	VP(I)	MASS(I)
266	12.47	80.433	58.658	71.230	0.378	990824
266	12.72	80.436	58.657	71.184	0.378	990802
266	12.97	80.427	58.656	71.168	0.378	990787
266	13.22	80.417	58.656	71.149	0.377	990812
266	13.47	80.407	58.655	71.078	0.376	990820
266	13.72	80.407	58.655	70.996	0.375	990816
266	13.97	80.399	58.656	70.990	0.375	990811
266	14.22	80.392	58.652	71.038	0.376	990789
266	14.47	80.386	58.648	71.061	0.376	990741
266	14.72	80.381	58.646	70.988	0.375	990751
266	14.97	80.376	58.648	70.932	0.375	990755
266	15.22	80.370	58.646	70.982	0.375	990739
266	15.47	80.363	58.648	70.720	0.372	990781
266	15.72	80.358	58.646	70.659	0.371	990763
266	15.97	80.350	58.642	70.693	0.374	990703
266	16.22	80.343	58.641	70.908	0.374	990695
266	16.47	80.340	58.639	70.895	0.374	990671
266	16.72	80.336	58.639	70.789	0.373	990682
266	16.97	80.326	58.638	70.732	0.372	990677
266	17.22	80.327	58.637	70.799	0.373	990663
266	17.47	80.322	58.636	70.716	0.372	990682
266	17.72	80.318	58.638	70.700	0.372	990693
266	17.97	80.319	58.638	70.660	0.371	990690
266	18.22	80.315	58.636	70.698	0.372	990668
266	18.47	80.313	58.637	70.643	0.371	990679
266	18.72	80.308	58.635	70.701	0.372	990659
266	18.97	80.306	58.633	70.665	0.371	990653
266	19.22	80.298	58.632	70.653	0.371	990634
266	19.47	80.293	58.633	70.427	0.368	990662
266	19.72	80.291	58.632	70.447	0.368	990636
266	19.97	80.284	58.630	70.467	0.369	990619
266	20.22	80.284	58.629	70.467	0.369	990609
266	20.47	80.273	58.628	70.508	0.369	990603
266	20.72	80.275	58.629	70.403	0.368	990615
266	20.97	80.270	58.630	70.189	0.365	990652
266	21.22	80.260	58.628	70.295	0.367	990639
266	21.47	80.265	58.629	70.153	0.365	990634
266	21.72	80.257	58.626	70.143	0.365	990644
266	21.97	80.252	58.625	70.325	0.367	990589
266	22.22	80.250	58.626	70.145	0.365	990619
266	22.47	80.246	58.625	70.112	0.364	990611
266	22.72	80.242	58.623	70.267	0.366	990577
266	22.97	80.236	58.622	70.227	0.366	990576
266	23.22	80.233	58.621	70.203	0.365	990566
266	23.47	80.227	58.622	70.123	0.364	990585
266	23.72	80.224	58.622	70.087	0.364	990590
266	23.97	80.217	58.619	70.131	0.365	990567
266	24.00	80.215	58.620	70.117	0.364	990573
266	24.22	80.214	58.620	70.073	0.364	990577

TERN REPORT UNIT 2 2

DATE	TIME	TTUT	LMCALC	BL	LOOP	LOOP
265	0.00	0.0000	0.0000	0.0000	0.0000	0.0000
265	0.25	0.1734	0.0000	0.0000	0.0000	0.0000
265	0.50	0.1961	0.0000	0.0000	0.1839	0.2777
265	0.75	0.1998	0.2005	0.2520	0.1987	0.2304
265	0.97	0.2070	0.2101	0.3401	0.3099	0.2366
265	1.22	0.1017	0.1407	0.3006	0.1257	0.2106
265	1.47	0.2667	0.2064	0.4070	0.3159	0.3205
266	1.72	0.2068	0.2104	0.3758	0.3157	0.2875
266	1.97	0.1867	0.2035	0.3458	0.3052	0.2571
266	2.22	0.2504	0.2246	0.3549	0.2286	0.2770
266	2.47	0.1685	0.2086	0.3354	0.2049	0.2499
266	2.72	0.1970	0.2069	0.3234	0.2033	0.2389
266	2.97	0.2084	0.2091	0.3169	0.2056	0.2340
266	3.22	0.1858	0.2042	0.3062	0.1997	0.2257
266	3.47	0.1637	0.1946	0.2959	0.1867	0.2123
266	3.72	0.2024	0.1967	0.2908	0.1910	0.2135
266	3.97	0.1701	0.1909	0.2816	0.1839	0.2047
266	4.22	0.1997	0.1927	0.2795	0.1828	0.2065
266	4.47	0.1833	0.1909	0.2742	0.1859	0.2026
266	4.72	0.1829	0.1891	0.2694	0.1846	0.1996
266	4.97	0.1723	0.1857	0.2638	0.1807	0.1947
266	5.22	0.1520	0.1793	0.2560	0.1727	0.1876
266	5.47	0.1343	0.1707	0.2477	0.1623	0.1792
266	5.72	0.1408	0.1645	0.2403	0.1555	0.1723
266	5.97	0.1377	0.1587	0.2332	0.1498	0.1662
266	6.22	0.1264	0.1520	0.2236	0.1427	0.1594
266	6.47	0.1252	0.1461	0.2185	0.1366	0.1531
266	6.72	0.1329	0.1420	0.2128	0.1333	0.1489
266	6.97	0.1287	0.1379	0.2071	0.1298	0.1447
266	7.22	0.1202	0.1332	0.2011	0.1254	0.1399
266	7.47	0.1166	0.1286	0.1953	0.1210	0.1352
266	7.72	0.1149	0.1243	0.1898	0.1171	0.1309
266	7.97	0.1090	0.1199	0.1842	0.1130	0.1265
266	8.22	0.1149	0.1166	0.1797	0.1101	0.1231
266	8.47	0.1101	0.1131	0.1751	0.1072	0.1197
266	8.72	0.1115	0.1102	0.1710	0.1051	0.1171
266	8.97	0.1053	0.1069	0.1667	0.1029	0.1140
266	9.22	0.1029	0.1037	0.1625	0.0999	0.1108
266	9.47	0.1025	0.1008	0.1587	0.0972	0.1082
266	9.72	0.1034	0.0983	0.1553	0.0954	0.1059
266	9.97	0.1082	0.0965	0.1528	0.0944	0.1044
266	10.22	0.1065	0.0947	0.1503	0.0935	0.1031
266	10.47	0.1023	0.0927	0.1476	0.0920	0.1013
266	10.72	0.1037	0.0910	0.1453	0.0912	0.1001
266	10.97	0.1043	0.0896	0.1434	0.0904	0.0989
266	11.22	0.1031	0.0881	0.1415	0.0897	0.0979
266	11.47	0.1041	0.0869	0.1399	0.0892	0.0970
266	11.72	0.1041	0.0858	0.1384	0.0890	0.0964
266	11.97	0.1019	0.0847	0.1369	0.0884	0.0956
266	12.22	0.0987	0.0834	0.1352	0.0877	0.0946
266	12.47	0.0836	0.0810	0.1322	0.0851	0.0922

[illegible] UNIT # 2

DATE	TIME	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
266	12.47	0.0906	0.0773	0.1301	0.0839	0.0908
266	12.72	0.0930	0.0780	0.1288	0.0830	0.0877
266	12.97	0.0922	0.0767	0.1268	0.0821	0.0886
266	13.22	0.0878	0.0752	0.1249	0.0809	0.0872
266	13.47	0.0846	0.0735	0.1228	0.0794	0.0857
266	13.72	0.0842	0.0720	0.1209	0.0782	0.0844
266	13.97	0.0832	0.0705	0.1191	0.0769	0.0830
266	14.22	0.0859	0.0693	0.1176	0.0760	0.0820
266	14.47	0.0917	0.0686	0.1169	0.0758	0.0814
266	14.72	0.0888	0.0677	0.1159	0.0755	0.0811
266	14.97	0.0856	0.0668	0.1140	0.0749	0.0803
266	15.22	0.0877	0.0660	0.1140	0.0745	0.0798
266	15.47	0.0796	0.0648	0.1125	0.0735	0.0787
266	15.72	0.0812	0.0637	0.1113	0.0727	0.0778
266	15.97	0.0891	0.0632	0.1108	0.0726	0.0776
266	16.22	0.0889	0.0627	0.1105	0.0726	0.0774
266	16.47	0.0911	0.0624	0.1103	0.0728	0.0774
266	16.72	0.0861	0.0620	0.1100	0.0726	0.0771
266	16.97	0.0873	0.0615	0.1096	0.0724	0.0768
266	17.22	0.0882	0.0612	0.1093	0.0725	0.0769
266	17.47	0.0843	0.0606	0.1088	0.0721	0.0763
266	17.72	0.0817	0.0599	0.1081	0.0717	0.0757
266	17.97	0.0809	0.0593	0.1073	0.0712	0.0752
266	18.22	0.0832	0.0588	0.1069	0.0709	0.0748
266	18.47	0.0801	0.0582	0.1062	0.0704	0.0743
266	18.72	0.0817	0.0577	0.1057	0.0701	0.0738
266	18.97	0.0840	0.0573	0.1054	0.0700	0.0737
266	19.22	0.0827	0.0569	0.1051	0.0699	0.0734
266	19.47	0.0782	0.0566	0.1045	0.0694	0.0729
266	19.72	0.0804	0.0559	0.1041	0.0691	0.0725
266	19.97	0.0814	0.0556	0.1037	0.0689	0.0722
266	20.22	0.0816	0.0552	0.1035	0.0687	0.0720
266	20.47	0.0812	0.0549	0.1032	0.0686	0.0718
266	20.72	0.0799	0.0545	0.1028	0.0684	0.0715
266	20.97	0.0787	0.0539	0.1021	0.0678	0.0709
266	21.22	0.0744	0.0533	0.1015	0.0673	0.0704
266	21.47	0.0740	0.0528	0.1009	0.0668	0.0698
266	21.72	0.0721	0.0522	0.1002	0.0662	0.0692
266	21.97	0.0773	0.0518	0.0999	0.0660	0.0690
266	22.22	0.0732	0.0513	0.0993	0.0655	0.0685
266	22.47	0.0732	0.0508	0.0988	0.0651	0.0680
266	22.72	0.0760	0.0505	0.0985	0.0649	0.0677
266	22.97	0.0753	0.0502	0.0982	0.0647	0.0674
266	23.22	0.0756	0.0499	0.0980	0.0645	0.0672
266	23.47	0.0720	0.0494	0.0975	0.0641	0.0667
266	23.72	0.0716	0.0490	0.0970	0.0637	0.0663
266	23.97	0.0731	0.0487	0.0967	0.0634	0.0661
266	24.00	0.0724	0.0494	0.0972	0.0631	0.0657
266	24.22	0.0713	0.0491	0.0969	0.0629	0.0653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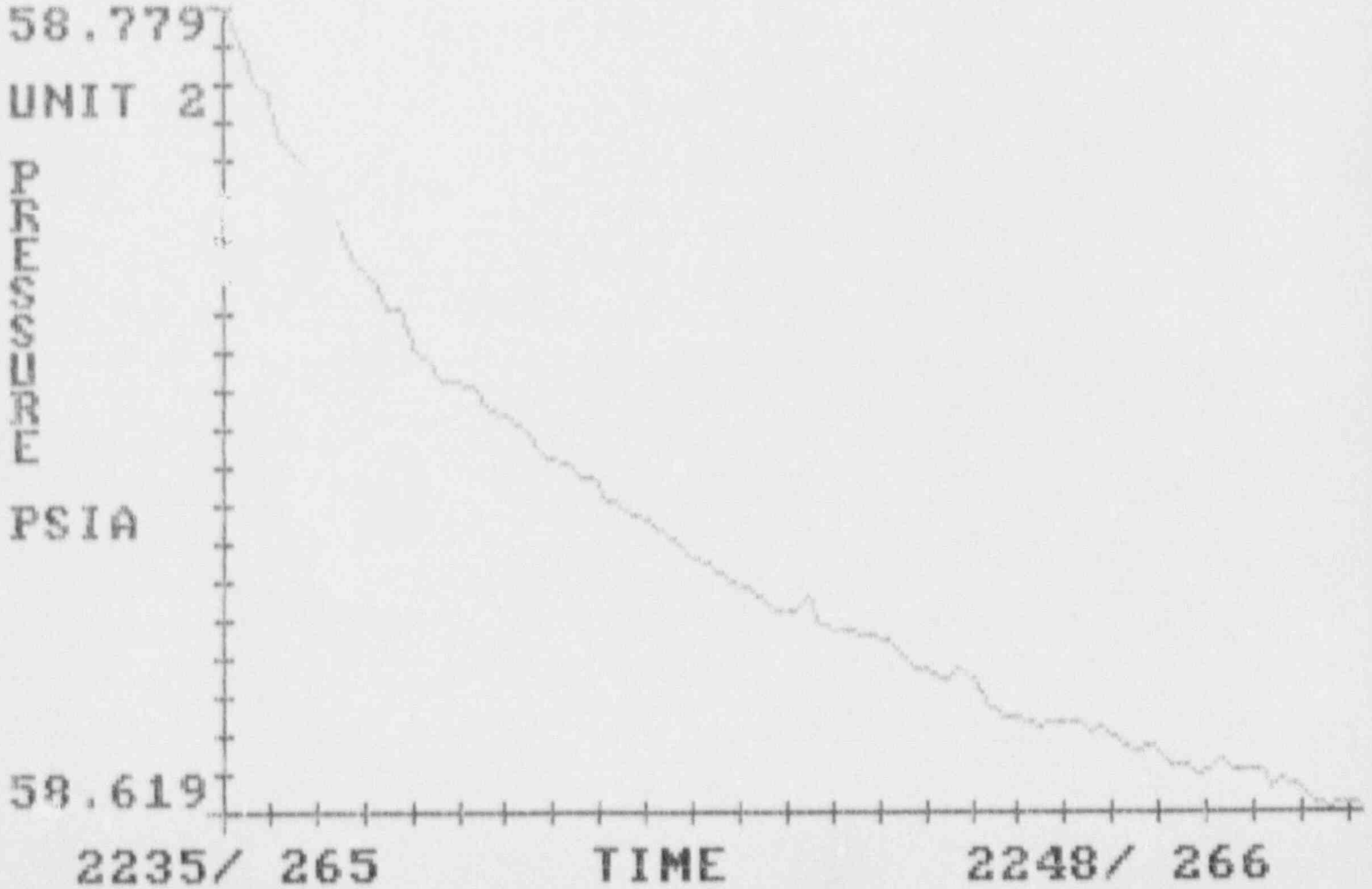
F
80.214
2235/ 265
TIME
2248/ 266


58.779
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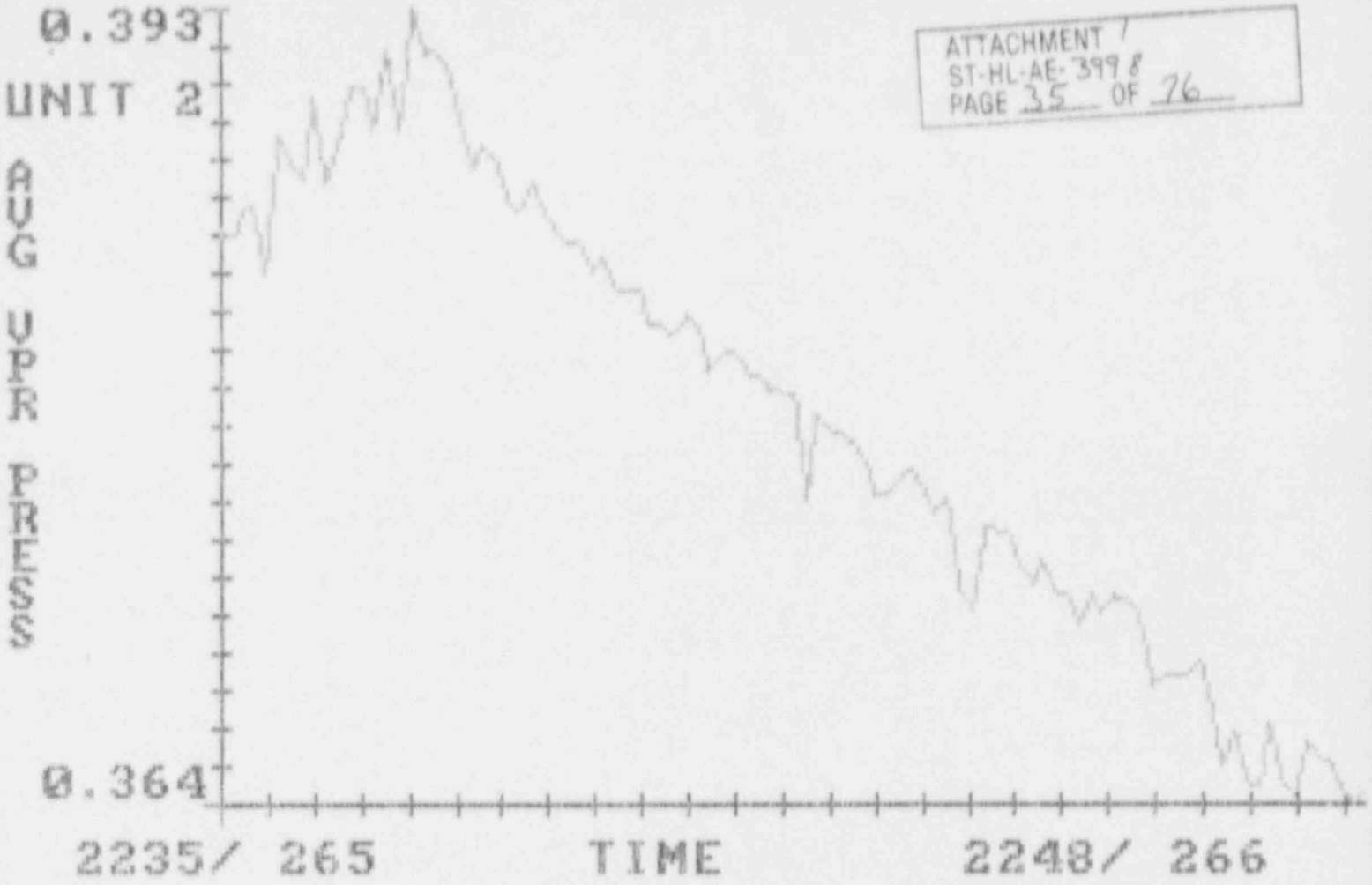
PRESSURE
PSIA
58.619
2235/ 265
TIME
2248/ 266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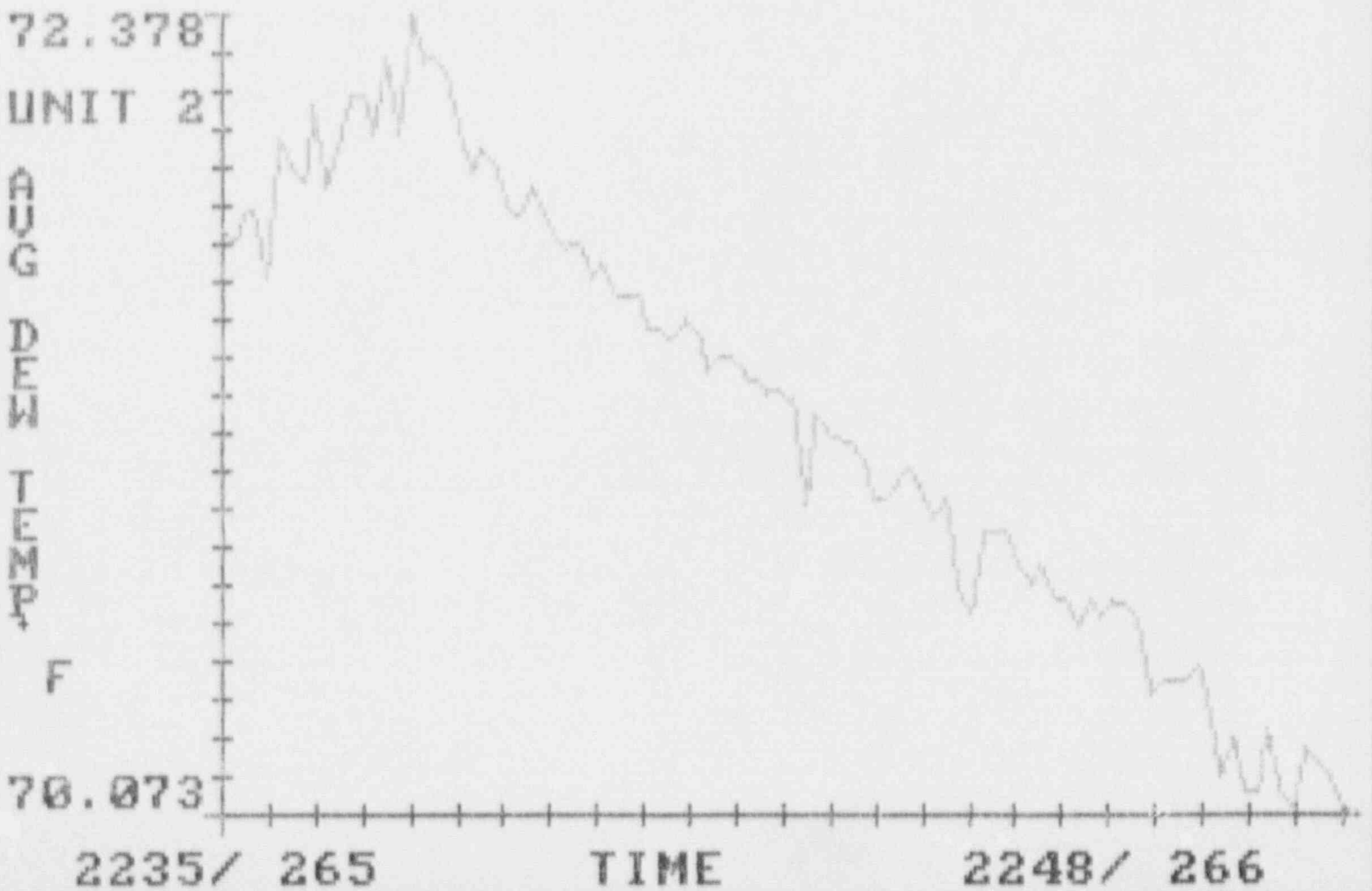
AUG UPR PRESS
0.364
2235/ 265
TIME
2248/ 266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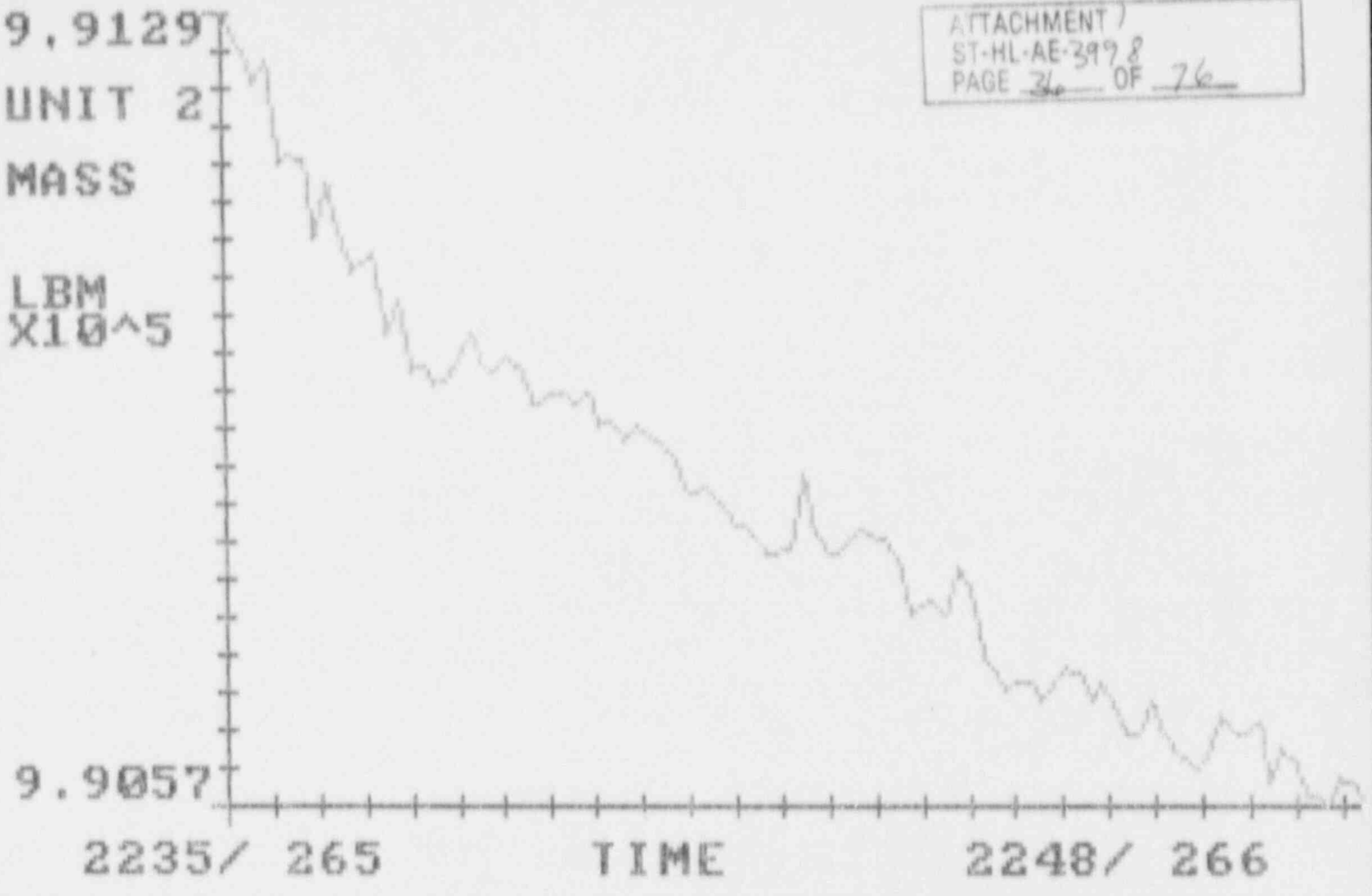
AUG DEW TEMP
F
70.073
2235/ 265
TIME
2248/ 266



TEST MODE

PLEASE SELECT THE OPTION
YOU WISH TO USE:

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

P - PASS WORD MENU

SELECTED OPTION:

TEST DATA 2248

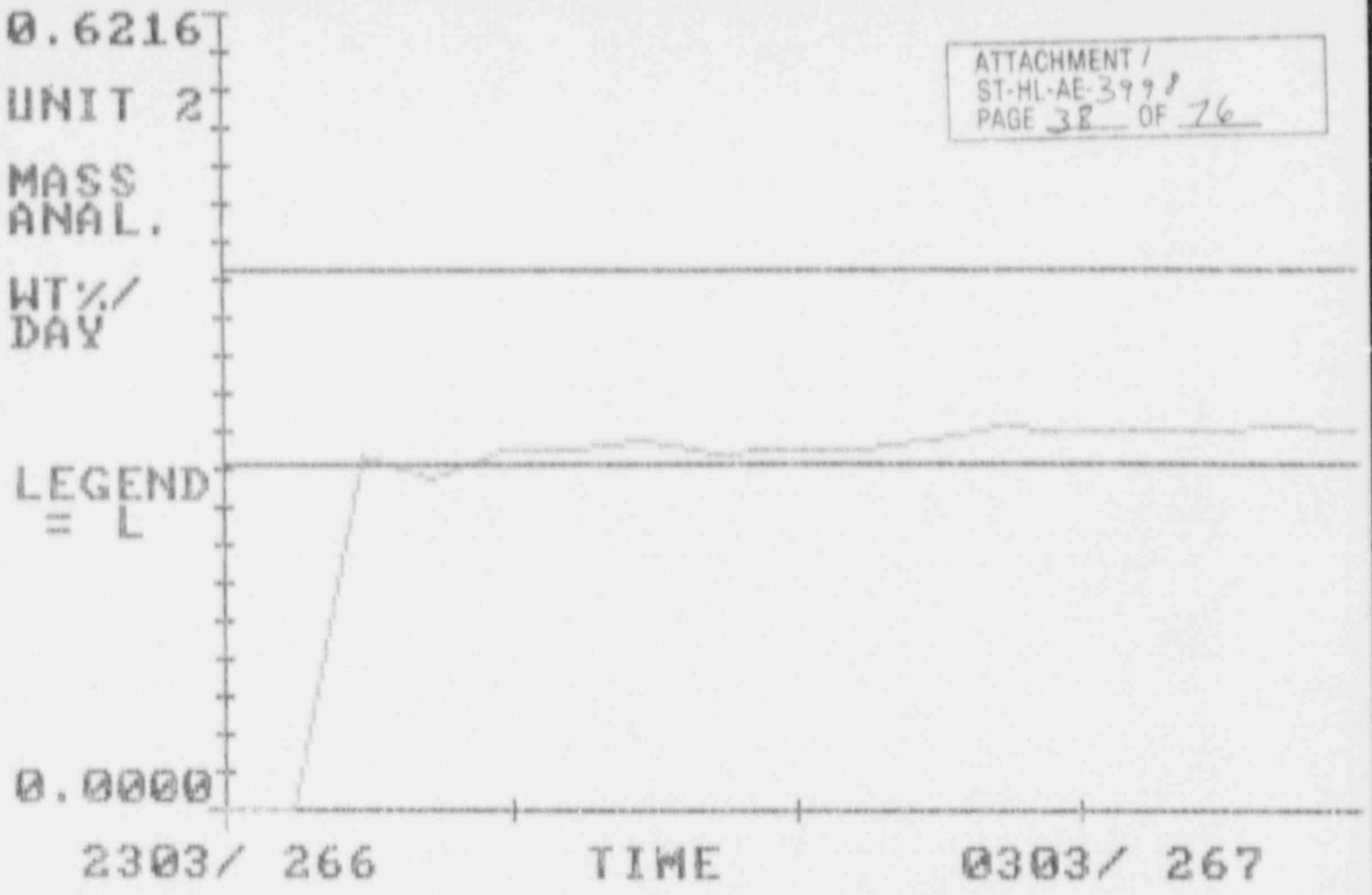
# OF DATA POINTS	= 100
MODE DURATION (IN HOURS)	= 24.21667
TOT TIME MEASURED LEAK	= 0.0713
TOT TIME CALCULATED LEAK	= 0.0491
TOT TIME 95% UCL	= 0.0569
MASS POINT LEAK	= 0.0628
MASS POINT 95% UCL	= 0.0652
75% LA	= .225
MASS	= 990577.06

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	80.218 / -0.002	AVG PRESS:	58.620 / +0.000
MASS:	990577.06 / +3.750	AVG DEW PRESS:	0.3638 /-0.0003

APPENDIX C

VERIFICATION TEST DATA AND PLOTS



VERIFICATION MODE

TIME= 0303

OPTIONS:

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

P - PASS WORD MENU

SELECTED OPTION =

TEST SUMMARY

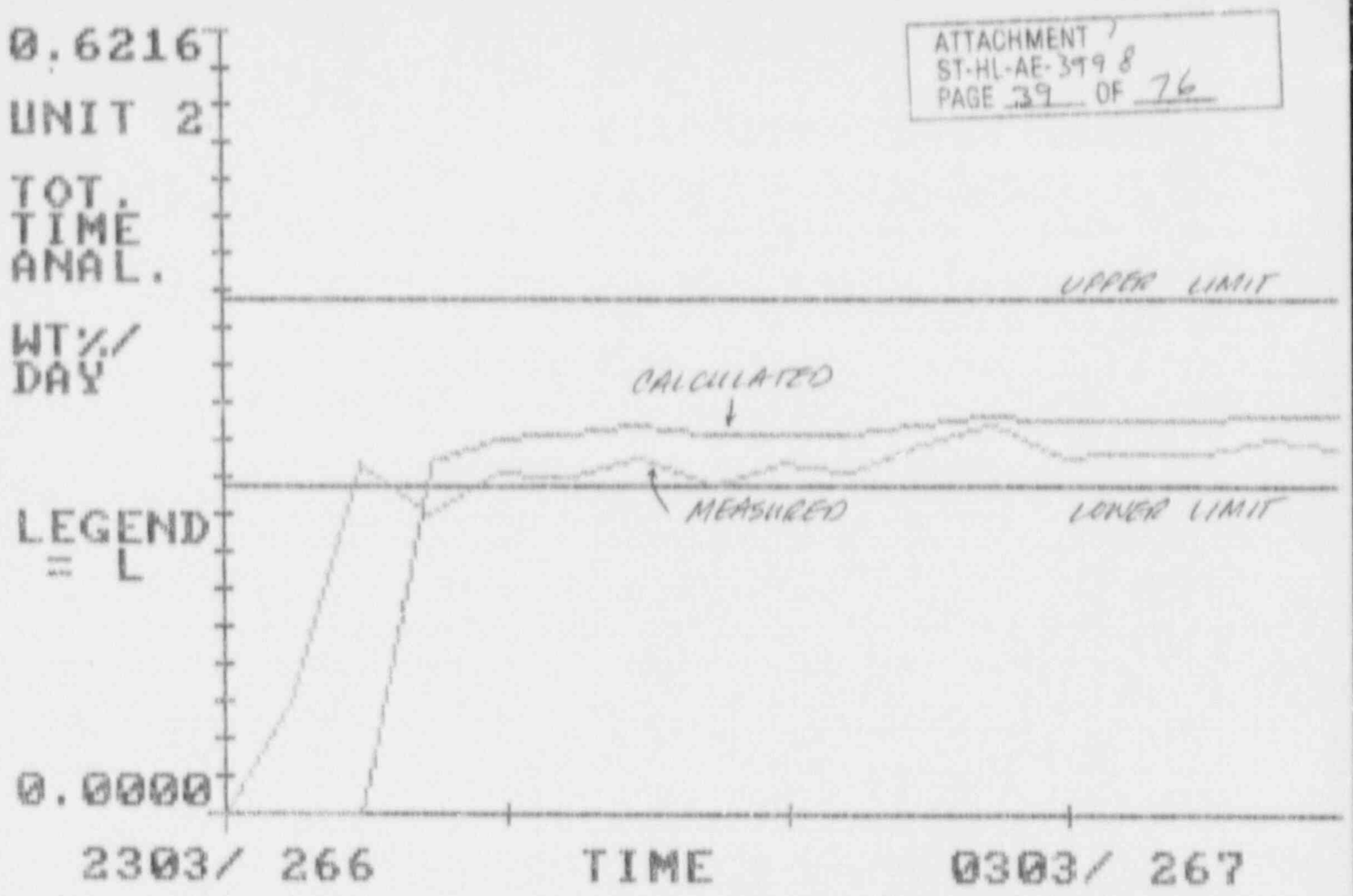
# OF DATA POINTS	= 17
MODE DURATION (IN HOURS)	= 4
TOT TIME MEASURED LEAK	= 0.2907
TOT TIME CALCULATED LEAK	= 0.3150
MASS PT LEAK	= 0.2994
IMPOSED LEAK	= 0.2839
TOT TIME UPPER LIMIT	= 0.4080
TOT TIME LOWER LIMIT	= 0.2580
MASS PT UPPER LIMIT	= 0.4216
MASS PT LOWER LIMIT	= 0.2716

TOT TIME VERIFICATION CRITERIA HAS BEEN MET

MASS PT VERIFICATION CRITERIA HAS BEEN MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	80.132/ -0.008	AVG PRESS:	58.580/ -0.002
MASS:	990055.19/ -16.625	AVG DEW PRESS:	0.3586/-0.0001



VERIFICATION MODE

TIME= 0303

OPTIONS:

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

P - PASS WORD MENU

SELECTED OPTION =

TEST SUMMARY

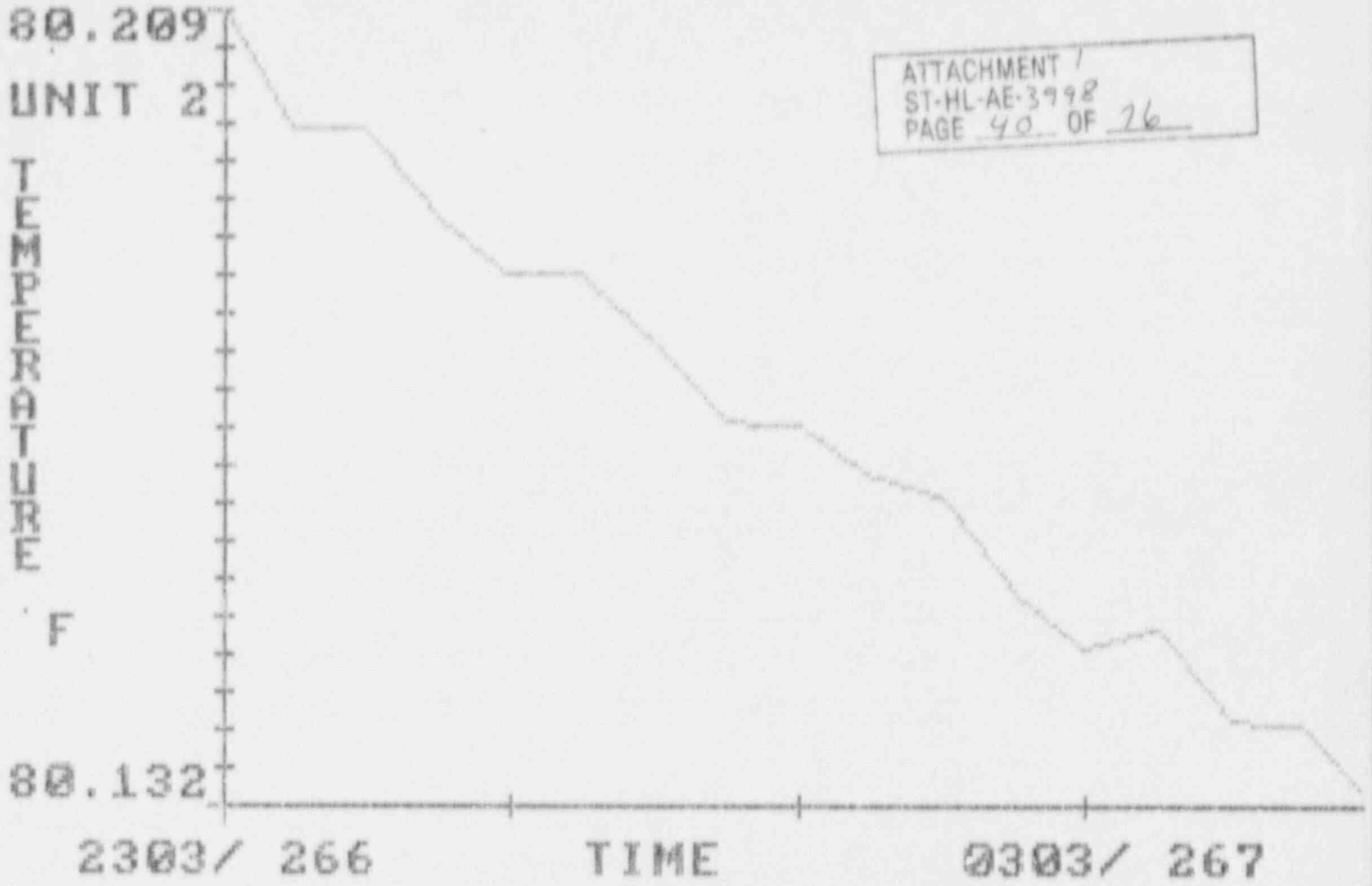
# OF DATA POINTS	= 17
MODE DURATION (IN HOURS)	= 4
TOT TIME MEASURED LEAK	= 0.2907
TOT TIME CALCULATED LEAK	= 0.3150
MASS PT LEAK	= 0.2994
IMPOSED LEAK	= 0.2839
TOT TIME UPPER LIMIT	= 0.4080
TOT TIME LOWER LIMIT	= 0.2580
MASS PT UPPER LIMIT	= 0.4216
MASS PT LOWER LIMIT	= 0.2716

TOT TIME VERIFICATION CRITERIA HAS BEEN MET

MASS PT VERIFICATION CRITERIA HAS BEEN MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	80.132/ -0.008	AVG PRESS:	58.580/ -0.002
MASS:	990055.19/ -16.625	AVG DEW PRESS:	0.3586/-0.0001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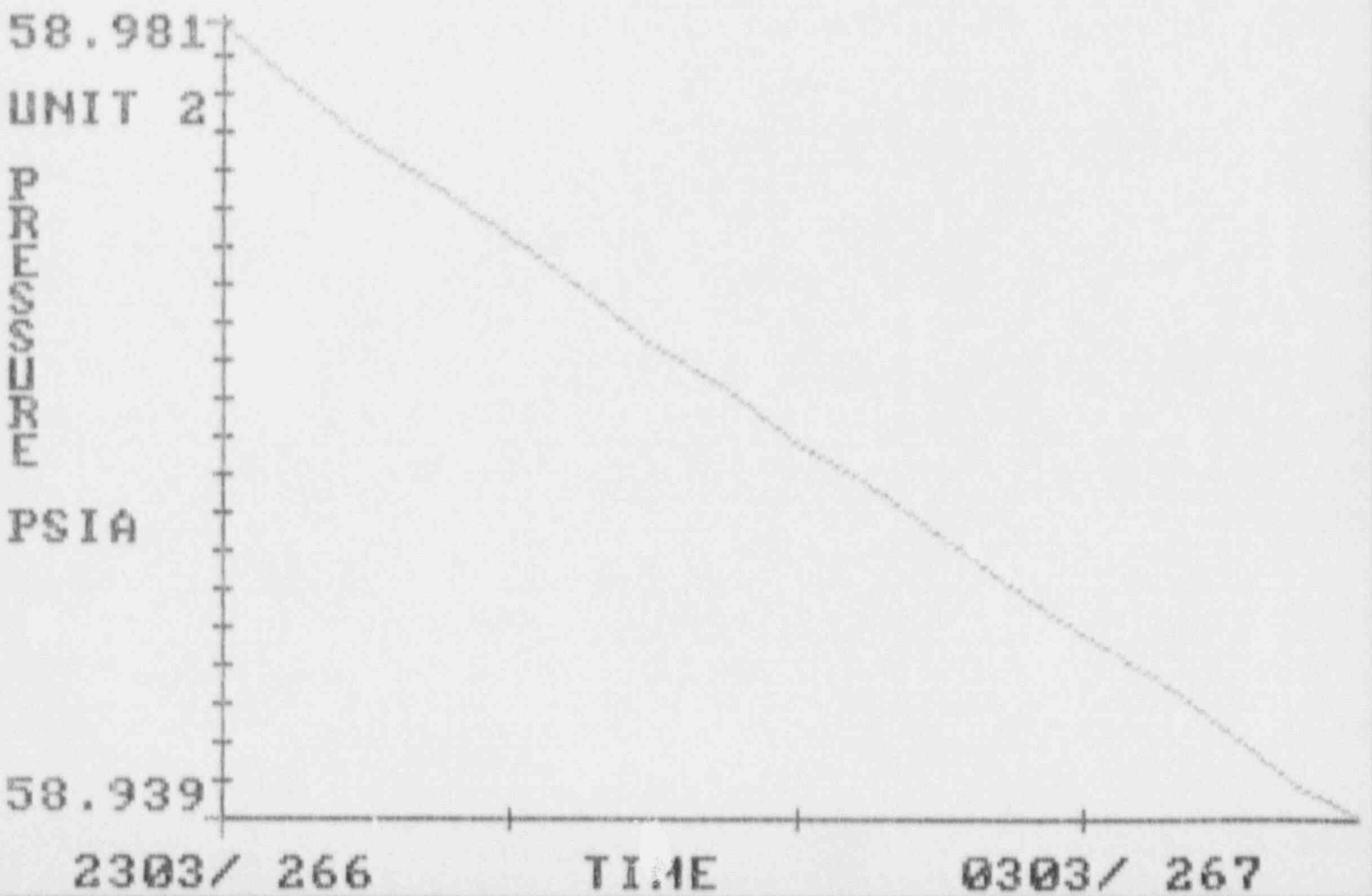
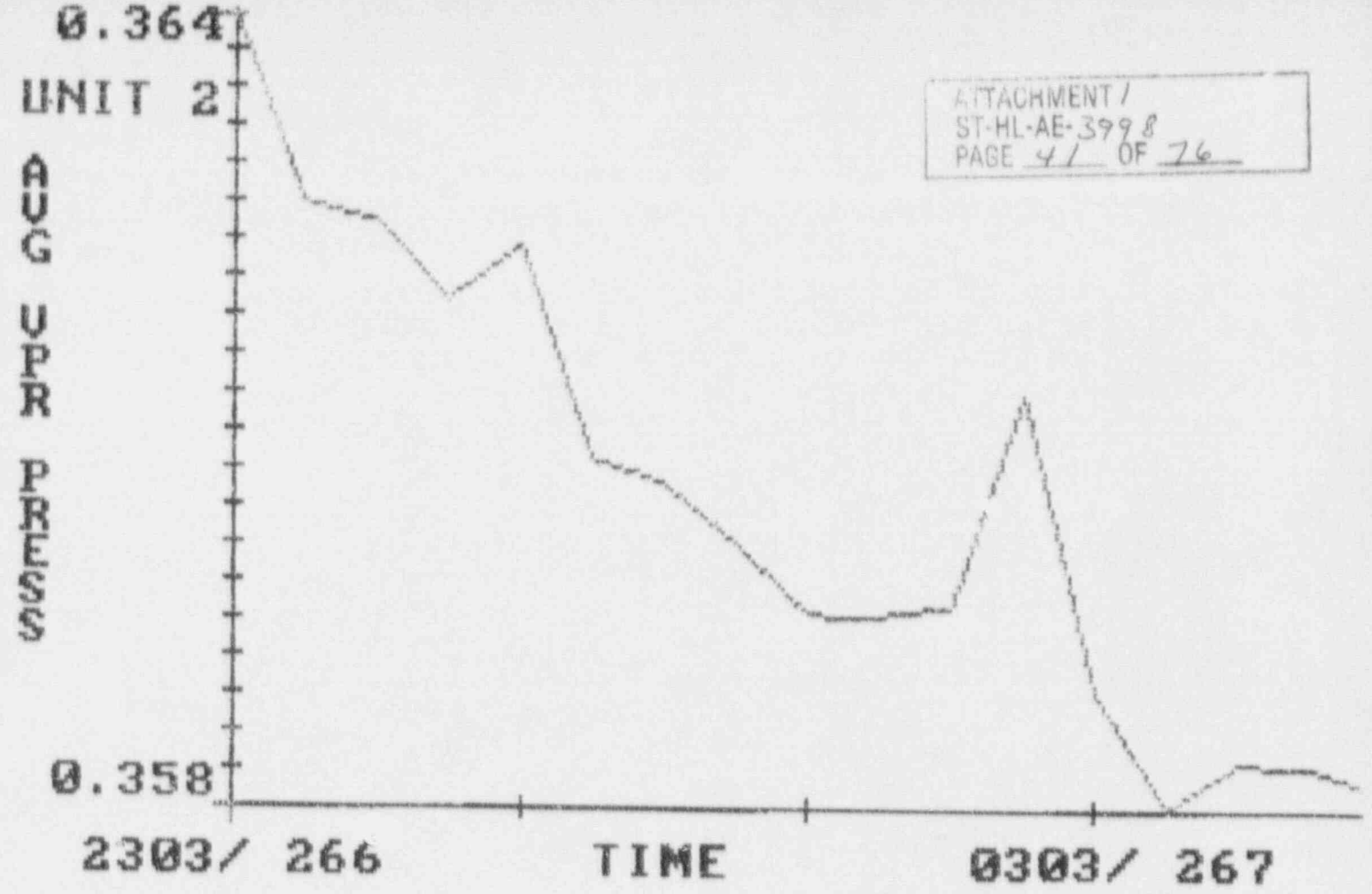
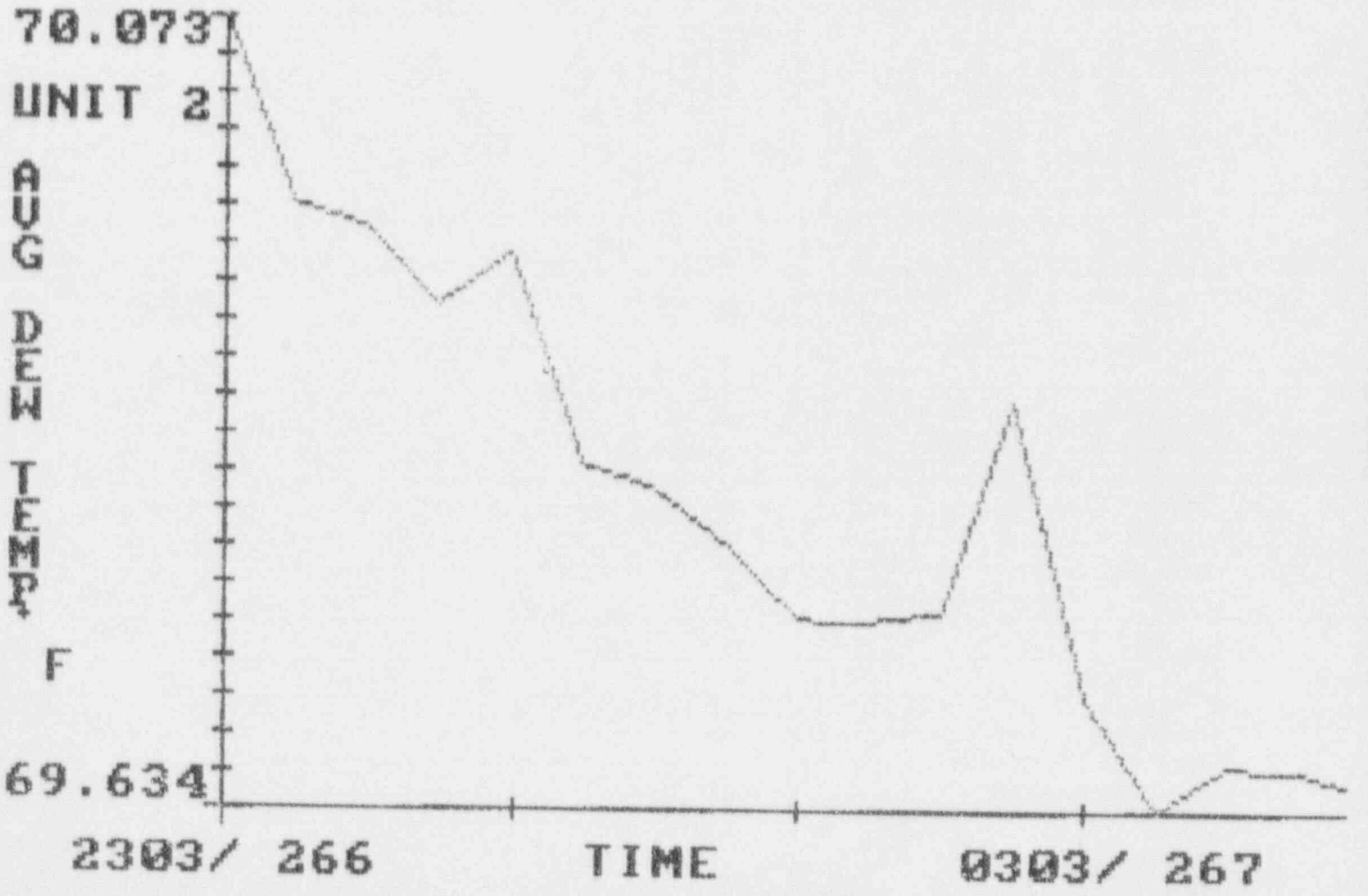
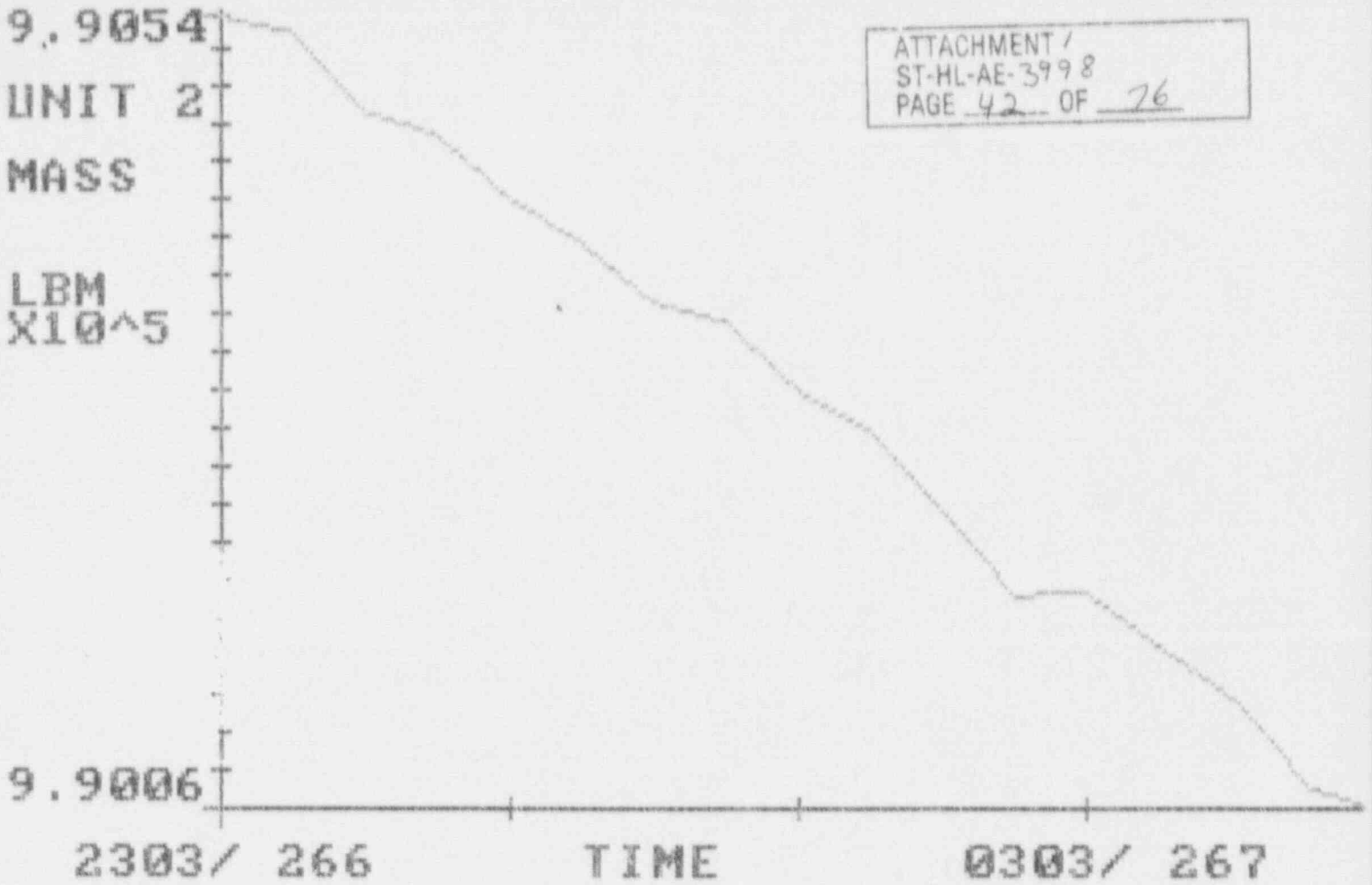
UNIT 2
TEMPERATURE
F
80.132
2303/ 266
TIME
0303/ 267


58.981
UNIT 2
PRESSURE
PSIA
58.939
2303/ 266
TIME
0303/ 267


0.364
UNIT 2
AUG UPR PRESS
0.358
2303/ 266
TIME
0303/ 267


70.073
UNIT 2
AUG DEW TEMP
F
69.634
2303/ 266
TIME
0303/ 267



VERIFICATION MODE

TIME= 0303

OPTIONS:

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

P - PASS WORD MENU

SELECTED OPTION =

TEST SUMMARY

# OF DATA POINTS =	17
MODE DURATION (IN HOURS) =	4
TOT TIME MEASURED LEAK =	0.2907
TOT TIME CALCULATED LEAK =	0.3150
MASS PT LEAK =	0.2994
IMPOSED LEAK =	0.2839
TOT TIME UPPER LIMIT =	0.4080
TOT TIME LOWER LIMIT =	0.2580
MASS PT UPPER LIMIT =	0.4216
MASS PT LOWER LIMIT =	0.2716

TOT TIME VERIFICATION CRITERIA HAS BEEN MET

MASS PT VERIFICATION CRITERIA HAS BEEN MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	80.132/ -0.008	AVG PRESS:	58.580/ -0.002
MASS:	990055.19/ -13.625	AVG DEW PRESS:	0.3586/-0.0001

APPENDIX D

INSTRUMENT SELECTION GUIDE CALCULATION

INSTRUMENT SELECTION GUIDE CALCULATION

I. PRE-TEST ISG

A. TEST PARAMETERS

La = 0.3%/day P = 59.7 psia

T = 534.67° R T_{dp} = 68° F

t = 24 hours

B. INSTRUMENT PARAMETERS

1. Total Absolute Pressure

No. of Sensors = 2

Range: 0 - 100 psia

Sensor sensitivity error (E_p): ± 0.001 psia

Measurement system error (ϵ_p):

Resolution: 0.001 psia

Repeatability of Ruska 6000 pressure instrument: ± .003 psia

Repeatability of Fluke 8810A: ± .003 psia

Repeatability of Fluke 2280B: ± .0018 psia

$$\epsilon_p = [(.003)^2 + (.003)^2 + (.0018)^2]^{1/2}$$

$$\epsilon_p = \pm 0.00471593$$

$$e_p = \pm [(E_p)^2 + (\epsilon_p)^2]^{1/2} / (\text{No. of instruments})^{1/2}$$

$$e_p = \pm 0.0034088 \text{ psia}$$

2. Water Vapor Pressure

No. of Sensors = 6

Sensor sensitivity error (E_{pv}): 0.1° F

Measurement system error (ϵ_{pv}):

Resolution: 0.01° F

Repeatability of EG&G 660 ± 0.02° F

Repeatability of Fluke 2280B ± 0.0081° F

$$\epsilon_{pv} = \pm [(0.01)^2 + (0.02)^2 + (0.0018)^2]^{1/2}$$

$$\epsilon_{pv} = \pm 0.02378^\circ F$$

At a dewpoint of 68° F, the equivalent water vapor pressure change (as determined from steam tables) is 0.012015 psia/° F.

$$e_{pv} = \pm [(E_{pv})^2 + (\epsilon_{pv})^2]^{1/2} / (\text{No. of instruments})^{1/2} (0.012015 \text{ psia}/^\circ F)$$

$$e_{pv} = \pm [(0.1)^2 + (0.02378)^2]^{1/2} / (6)^{1/2} (0.012015 \text{ psia}/^\circ F)$$

$$e_{pv} = \pm 0.000504 \text{ psia}$$

3. Temperature

No. of Sensors = 24

Sensor sensitivity error (E_T): ± 0.01° F

Measurement system error (ϵ_T):

Resolution: 0.01° F

Repeatability: ± 0.072° F

$$\epsilon_T = \pm [(0.01)^2 + (0.072)^2]^{1/2}$$

$$\epsilon_T = \pm 0.07269^\circ F$$

$e_T = \pm [(0.01)^2 + (0.07269)^2]^{1/2} / (24)^{1/2}$

$e_T = \pm 0.0149775°$ F

4. Instrumentation Selection Guide Formula

$ISG = +/- (2400/t) [2(e_p/P)^2 + 2(e_{pv}/P)^2 + 2(e_T/T)^2]^{1/2}$

$ISG = +/- (2400/24) [(6.52055 \times 10^{-9}) + (1.56941 \times 10^{-9}) + (0.14254 \times 10^{-9})]^{1/2}$

$ISG = \pm 100 [8.2325 \times 10^{-9}]^{1/2}$

$ISG = \pm 100 (9.0733 \times 10^{-5})$

$ISG = \pm 0.00907$ wt-%/day

II. POST TEST ISG

A. TEST PARAMETERS

La = 0.3%/day P = 58.984 psia

T = 539.884° R T_{dp} = 70.073° F

t = 24 hours

B. INSTRUMENT PARAMETERS

1. Total Absolute Pressure

No. of Sensors = 2

Range: 0 - 100 psia

Sensor sensitivity error (E_p): ± 0.001 psia

Measurement system error (ϵ_p):

Resolution: 0.001 psia

Repeatability of Ruska 6000 pressure instrument: ± .003 psia

Repeatability of Fluke 8810A: ± .003 psia

Repeatability of Fluke 2280B: ± .0018 psia

$$\epsilon_p = [(.003)^2 + (.003)^2 + (.0018)^2]^{1/2}$$

$$\epsilon_p = \pm 0.00471593$$

$$e_p = \pm [(E_p)^2 + (\epsilon_p)^2]^{1/2} / (\text{No. of instruments})^{1/2}$$

$$e_p = \pm 0.0034088 \text{ psia}$$

2. Water Vapor Pressure

No. of Sensors = 6

Sensor sensitivity error (E_{pv}): 0.1° F

Measurement system error (ϵ_{pv}):

Resolution: 0.01° F

Repeatability of EG&G 660 ± 0.02° I

Repeatability of Fluke 2280B ± 0.0081° F

$$\epsilon_{pv} = \pm [(0.01)^2 + (0.02)^2 + (0.0018)^2]^{1/2}$$

$$\epsilon_{pv} = \pm 0.02378° \text{ F}$$

At a dewpoint of 70.073° F, the equivalent water vapor pressure change (as determined from steam tables) is 0.01257 psia/° F.

$$e_{pv} = \pm [(E_{pv})^2 + (\epsilon_{pv})^2]^{1/2} / (\text{No. of instruments})^{1/2} (0.01257 \text{ psia/°F})$$

$$e_{pv} = \pm [(0.1)^2 + (0.02378)^2]^{1/2} / (6)^{1/2} (0.01257 \text{ psia/°F})$$

$$e_{pv} = \pm 0.000527 \text{ psia}$$

3. Temperature

No. of Sensors = 24

Sensor sensitivity error (E_T): ± 0.01° F

Measurement system error (ϵ_T):

Resolution: 0.01° F

Repeatability: ± 0.072° F

$$\epsilon_T = \pm [(0.01)^2 + (0.072)^2]^{1/2}$$

$$\epsilon_T = \pm 0.07269° \text{ F}$$

$$e_T = \pm [(0.01)^2 + (0.07269)^2]^{1/2} / (24)^{1/2}$$

$$e_T = \pm 0.0149775° \text{ F}$$

4. Instrumentation Selection Guide Formula

$$ISG = +/- (2400/t) [2(e_p/P)^2 + 2(e_{pv}/P)^2 + 2(e_T/T)^2]^{1/2}$$

$$ISG = (2400/24)[(6.67982 \times 10^{-9}) + (1.53924 \times 10^{-9}) + (0.15996 \times 10^{-9})]^{1/2}$$

$$ISG = \pm 100 [8.2351 \times 10^{-9}]^{1/2}$$

$$ISG = \pm 100 (9.0747 \times 10^{-5})$$

$$ISG = \pm 0.00975 \text{ wt-\%/day}$$

APPENDIX E

GENERAL PHYSICS ILRT COMPUTER PROGRAM DESCRIPTION

DESCRIPTION OF GENERAL PHYSICS 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 Data Acquisition System (Fluke 2280B).

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 stram 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 F

LOCAL LEAKAGE RATE TEST SUMMARIES

APPENDIX F

LOCAL LEAKAGE RATE TEST SUMMARIES

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-9	Containment Spray C Train	CS0006	11/28/88	207
			11/15/90	190
			10/11/91	18
		CS0001C	11/28/88	20
			11/15/90	732
			10/11/91	11
M-10	High Head Safety Injection C Train	SI000C	11/28/88	10,900
			11/15/90	3,936
			9/27/91	1,238
			10/10/91	3,489
		SI0004C	11/28/88	136
			11/15/90	201
			9/27/91	114
			10/10/91	36
M-11	Low Head Safety Injection C Train	SI0030C	11/28/88	37.4
			11/15/90	96.37
			9/27/91	18
			10/10/91	18
		SI0018C	11/28/88	33.1
			11/15/90	83
			9/27/91	241
			10/10/91	10
M-12	Chemical Cleaning Return Line	SL0927	11/7/88	987
			11/16/90	14.06
			10/29/91	25
		SL0029	11/7/88	3,410
			11/16/90	72.87
			8/19/91	36
			10/29/91	12
M-13	Containment Spray B Train	CS0004	11/23/88	20
			10/18/90	29
			11/15/91	13,740
		CS0005	11/23/88	20
			10/18/90	31
			11/15/91	20
		CS0001B	11/23/88	1,280
			10/18/90	45.36
			11/15/91	91

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-14	High Head Safety Injection B Train	SI0005B	11/23/88	1615
			10/18/90	732
			10/19/91	817
		SI0004B	11/23/88	25.1
			10/18/90	20
			10/19/91	19
			11/15/91	91
M-15	Low Head Safety Injection B Train	SI0030B	11/23/88	103.5
			10/18/90	30
			10/19/91	10
		SI0018B	11/23/88	1,202
			10/18/90	20
			10/19/91	22
			11/15/91	48
M-16	Sludge Lancing High Pressure Line	SL0004	11/7/88	786
			11/30/90	20
			10/29/91	20
		SL0002	11/7/88	435
			11/30/90	20
			10/29/91	20
M-17	Containment Spray Train A	CS0002	12/1/88	114
			10/23/90	20
			10/25/91	96
		CS0001A	12/1/88	28.8
			10/23/90	54
			10/25/91	90
M-18	High Head Safety Injection A Train	SI0005A	12/1/88	2,970
			10/23/90	732
			10/9/91	1,238
		SI0004A	12/1/88	131.4
			10/23/90	46.67
			10/9/91	16
			10/25/91	70
M-19	Low Head Safety Injection A Train	SI0030A	12/1/88	20
			10/23/90	20
			10/9/91	10
		SI0018A	12/1/88	39
			10/24/90	23.35
			10/9/91	35
			10/25/91	114

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-20	Emergency Sump Train C	SI0016C	11/29/88 11/15/90 10/11/91	20 747 91
M-21	Emergency Sump Train B	SI0016B	11/23/88 10/18/90 11/15/91	20 20 90
M-22	Emergency Sump Train A	SI0016A	12/1/88 10/23/90 10/25/91	791 344 1,569
M-23	RCFC Component Cooling Water Return Train C	CC0208	11/11/88 11/17/90 9/28/91	5,390 3,993 1,268
		CC0209/ CC0210	11/11/88 12/9/88 1/17/89 11/17/90 9/28/91	20 2,110 2,370 4,420 636
		CC0210/ CC0864	11/11/88 1/17/89 11/17/90 9/28/91 10/7/91	82.1 2,050 4,420 409 200
M-24	RCFC Component Cooling Water Supply Train C	CC0198	11/10/88 1/3/89 11/9/90 11/15/90 9/28/91	Failed 60.1 Failed 16,769 51
		CC0197/ CC0199	11/10/88 11/15/90 9/28/91	3,170 1,799 138
M-25	RCFC Component Cooling Water Supply Train A	CC0058	11/14/88 2/11/89 10/22/90 10/11/91	Failed 1,363 3,568 3,870
		CC0057/ CC0059	11/14/88 11/4/90 10/11/91	7,490 1,284 3,543

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-26	RCFC Component Cooling Water Return Train A	CC0068	11/13/88 11/4/90 10/11/91	3,340 190 841
		CC0069/ CC0070	11/14/88 11/4/90 10/11/91	17,710 103 76
		CC0069 CC0862	11/14/88 11/4/90 10/11/91	16,460 240 46
M-27	RCFC Component Cooling Water Supply Train B	CC0138	11/18/88 10/10/90 11/2/91	921 643 5,165
		CC0136/ CC0137	11/18/88 10/10/90 11/7/91 11/12/91	1,840 1,555 4,838 4,349
M-28	RCFC Component Cooling Water Return Train B	CC0147	11/18/88 10/19/90 11/2/91	960 2,544 2,499
		CC0148/ CC0149	11/18/88 1/11/89 10/19/90 10/19/90 11/7/91 11/12/91 11/14/91	Failed 11,060 Failed 1,013 269 Failed 376
		CC0148/ CC0863	11/18/88 1/11/89 10/19/90 11/7/91 11/14/91	Failed 11,150 1,013 403 3,128
M-29	SI Accumulator Sample	PS4824	11/11/88 11/3/90 10/17/91	64.3 20 51
		PS4466	11/11/88 11/3/90 10/17/91	62.4 20 20

ATTACHMENT 1
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Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-30	Reactor Coolant Drain Tank Vent & Nitrogen Supply	WL4920	11/7/89 10/3/90 10/17/91	39 20 20
		WL4919	11/7/89 12/5/89 10/3/90 11/21/90 10/17/91	Failed 35 Failed 20 20
M-32	ILRT Verification	2 Blank Flanges	11/7/88 10/1/90 9/3/91 10/1/91	20 20 20 20
M-33	Component Cooling Water Supply to RHR Pmp/Hx A	CC0013	11/14/88 2/3/89 10/31/90 10/12/91	Failed 10,490 3,034 241
		CC0012	11/14/88 10/31/90 10/12/91	37.6 139 48
M-34	Component Cooling Water Return from RHR Pmp/Hx A	CC0049	11/14/88 11/1/90 10/12/91	2,190 7,299 3,127
		CC0050	11/14/88 11/3/90 10/12/91	10,740 1,013 3,306
M-35	Component Cooling Water Supply to RHR Pmp/Hx B	CC0123	11/16/88 10/15/90 11/29/90 11/7/91 11/17/91	8,780 Failed 30,243 Failed 7,782
		CC0122	11/16/88 1/7/89 11/28/90 11/7/91	Failed 10,150 3,289 6,653
M-36	Component Cooling Water Return from RHR Pmp/Hx B	CC0129	11/16/88 10/17/90 11/8/91 11/14/91	14,220 2,774 2,072 634
		CC0130	11/16/88 10/17/90 10/19/90 11/8/91	17,650 Failed 2,056 3,543

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-37	Component Cooling Water Supply to RHR Pmp/Hx C	CC0183	11/10/88 11/9/90 9/28/91	238 312 40
		CC0182	11/10/88 11/9/90 9/28/91	901 269 0
M-38	Component Cooling Water Return from RHR Pmp/Hx C	CC0189	11/11/88 11/17/90 9/28/91	7,940 142 841
		CC0190	11/11/88 11/17/90 9/28/91	20 415 636
M-39	Component Cooling Water Supply to RCPs	CC0319	11/9/89 11/5/90 10/2/91	2,700 4,479 3,858
		CC0318/ CC0291	11/9/89 11/5/90 10/2/91	15,030 312 2,554
M-40	Component CoolingjWater Return From RCPs	CC0403/ CC0446/ CC0542	11/10/89 11/16/90 10/2/91	980 3,166 3,649
		CC0404/ CC4493	11/10/89 11/16/90 10/2/91 11/19/91	21,200 7,299 13,355 11,195
M-41	Normal Purge Exhaust	HC0009/ HC0010	11/29/88 3/30/89 11/21/89 5/14/90 11/4/90 3/26/91 9/21/91	7,220 6,640 2,530 2,310 3,291 3,143 1,665
M-42	Normal Purge Supply	HC0008/ HC0007	11/29/88 12/10/88 7/11/89 11/21/89 1/9/90 7/3/90 11/15/90 6/27/91 9/21/91	Failed 12,580 11,700 12,600 1,395 1,054 484 298 636

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-43	Supplementary Purge Supply	HC0003/ FV9776	11/29/88	Failed
			12/13/88	1,870
			3/14/89	1,504
			7/3/89	1,257
			10/3/89	1,685
			1/2/90	3,680
			3/19/90	2,500
			6/28/90	847
			10/8/90	1,013
			12/20/90	2,800
			3/20/91	1,727
			7/11/91	841
			9/21/91	1,449
M-44	Supplementary Purge Exhaust	HC0005/ FV9777	11/29/88	Failed
			12/13/88	1,681
			12/19/88	1,056
			3/16/89	1,135
			7/5/89	1,260
			9/28/89	1,771
			12/26/89	1,713
			3/20/90	2,030
			6/19/90	1,089
			10/25/90	1,089
			2/15/91	2,800
			6/6/91	1,490
			9/21/91	2,085
M-45	Rx Makeup to Pzr Relief Tank	RC0046	12/16/89	702
			11/27/90	47
			11/21/91	52
		RC3651/ AP2458	12/16/89	745
			11/27/90	1,727
			11/21/91	1,929
M-46	CVCS Letdown	CV0022/ CV0023	11/15/88	5,370
			5/18/90	63
			10/30/90	50
			10/11/91	61
			10/17/91	297
		CV0024	11/15/88	64
			10/30/90	19
			10/11/91	76
			10/17/91	78

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-47	RCP Seal Water Return	CV0077/ CV0078	11/17/89	26
			10/28/90	39
			11/2/91	1,665
			11/7/91	264
		CV0079	11/17/89	27
			10/28/90	11
			11/7/91	298
M-48	CVCS Charging	CV0026	11/15/88	2,900
			12/9/88	15,920
			1/16/89	5,000
			10/29/90	5,484
			10/11/91	1,911
			10/20/91	5,165
		CV0025	11/15/88	320
			10/29/90	3,291
			10/11/91	298
			10/20/91	817
M-51(A)	RCP A CVCS Seal Supply	CV0034A	11/10/88	20
			10/24/90	20
			10/15/91	12
		CV0033A	11/10/88	126.5
			10/24/90	20
			10/15/91	12
M-51(B)	RCP B CVCS Seal Supply	CV0034B	11/10/88	670
			10/24/90	312
			10/5/91	12
		CV0033B	11/10/88	20
			10/24/90	20
			10/5/91	0
M-52(C)	RCP C CVCS Seal Supply	CV0034C	11/10/88	89
			10/24/90	20
			10/30/91	20
		CV0033C	11/10/88	23
			10/24/90	20
			10/30/91	20
M-52(D)	RCP D CVCS Seal Supply	CV0034D	11/10/88	414
			10/24/90	20
			10/15/91	117
		CV0033D	11/10/88	20
			10/24/90	46
			11/23/90	60
			10/15/91	12

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-53	CVCS Letdown to RHR	CV0158	11/8/88	Failed
			1/12/89	407
			10/23/90	20
			10/21/91	20
		CV0157	11/8/88	20
			11/26/90	20
			10/21/91	143
M-55	RHR B to RWST	RH0036B	11/10/88	579
			10/16/90	640
			11/12/91	20
		RH0064B	11/10/88	744
			10/16/90	640
			11/12/91	20
M-56	Liquid Waste to Holdup Tank	WL0312	11/10/89	45
			11/25/90	20
			11/9/91	7,813
		WL4913	11/10/89	79
			11/25/90	20
			11/9/91	115
M-57	Service Air to RCB	SA0505	11/21/88	307
			11/24/90	122
			11/8/91	70
		SA0504	11/21/88	39
			11/24/90	73
			11/8/91	31
M-58	Instrument Air to RCB	IA0541	11/13/89	1,090
			10/25/90	115
			10/19/91	143
		IA8565	11/13/89	20
			10/25/90	20
			10/14/91	20
M-61	Demin Water to RCB	DW0502	11/12/88	82
			10/23/90	20
			11/5/91	20
		DW0501	11/12/88	20
			10/23/90	20
			11/5/91	20

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-68(A)	Nitrogen Supply to SI Accumulators	SI0058	12/6/88	1,042
			1/16/89	335
			10/11/90	24
			10/2/91	30
		SI3983	12/6/88	80
			10/11/90	27
			10/2/91	20
M-68(C)	Pzr Relief Tank Vent	FV3653	11/6/89	175
			10/24/90	20
			10/2/91	51
		FV3652	11/6/89	20
			10/24/90	20
			10/2/91	50
M-68(E)	Safety Injection Test Line	FV3970	12/6/88	20
			10/10/90	142
			10/16/91	20
		FV3971	12/6/88	20
			10/10/90	142
			10/16/91	20
M-69	Spent Fuel Pool Cooling & Cleanup	FC0013F	11/9/88	34
			11/15/90	36
			11/21/91	37
		FC0050	11/9/88	20
			11/15/90	20
			11/21/91	20
		FC0013E	11/9/88	20
			11/15/90	643
			11/21/91	380
M-70	Spent Fuel Pool Cooling & Cleanup	FC0006C	11/9/88	32
			11/15/90	20
			11/21/91	28
		FC0007C	11/9/88	35
			11/15/90	227
			11/21/91	102
M-71	ILRT Depressurization	2 Blanks	11/7/88	37
			10/1/90	20
			9/3/91	20
			10/1/91	32

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-72	Containment Normal Sump	ED0064	11/15/89 11/27/90 11/14/91	20 20 20
		ED7800/ AP2453	11/15/89 11/27/90 11/14/91	26 28,081 20
M-75	RCP Oil Return Line	PO0217	11/8/88 10/2/90 11/6/91	40 20 20
		PO0218	11/8/88 10/2/90 11/6/91	38 23 20
M-76	RHR C to RWST	RH0063C	11/8/88 11/13/90 9/28/91	338 83 0
		RH0064C	11/8/88 11/13/90 9/28/91	348 148 20
M-77	RCB Fire Protection	FP0943	11/16/89 11/1/90 10/30/91	1,240 3,580 2,902
		FP0756	11/16/89 11/1/90 10/30/91	690 3,177 2,085
M-79	Sludge Lancing Low Pressure Line	SL004	11/7/88 11/24/90 10/29/91	669 24 76
		SL0012	11/7/88 11/24/90 10/29/91	1,887 643 143
M-80(A)	Radiation Monitoring Supply	RA0001/ RA0004	11/13/89 10/30/90 10/15/91	68 46 19
M-80(D)	RCB Hydrogen Monitoring Return	CM4128/ CM4127	11/8/89 10/4/90 10/21/91	37 20 20

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Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-80(E)	RCB Hydrogen Monitoring Supply	CM4135	11/8/89	88
			10/5/90	29
			10/5/91	0
		CM4101	11/8/89	59
			10/5/90	20
			10/5/91	0
M-80(F)	Radiation Monitoring Exhaust	RA0003/ RA0006	11/13/89	20
			10/30/90	20
			10/15/91	20
			11/23/91	20
M-81	RCP Oil Changing Line	PO0204	11/8/88	323
			10/2/90	20
			11/6/91	20
		PO0203	11/8/88	447
			10/2/90	24
			11/6/91	20
M-82(A)	Breathing Air to RCB	BA0006	11/9/88	71
			10/5/90	20
			10/23/91	20
		BA0004	11/9/88	185
			10/5/90	20
			10/23/91	20
M-82(D)	RCB Hydrogen Monitoring Sample Supply	CM4136	11/7/89	263
			11/24/90	377
			11/19/91	65
		CM4104/ AP2456	11/8/89	360
			11/24/90	24,035
			11/19/91	Failed
			12/1/91	20
M-82(E)	RCB Hydrogen Monitoring Return	CM4134/ CM4133/ AP2457	11/8/89	360
			10/4/90	24
			10/12/91	51
M-82(F)	ILRT Pressure Monitoring	No Valves, 2 Blank Flanges	11/7/88	20
			10/1/90	20
			9/3/91	20
			10/1/91	20
M-85(A)	Pzr Vapor Sample	PS4450	11/9/89	875
			11/19/90	73
			12/1/91	7,907
		PS4452	11/9/89	175
			11/19/90	122
			12/1/91	20

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-85(B)	Pzr Liquid Sample	PS4451	11/9/89	20
			11/7/90	20
			10/15/91	96
		PS4451B	11/9/89	23
			11/7/90	20
			10/15/91	9
M-85(E)	RCS Hot Leg Sample	PS4454	11/7/89	700
			11/23/90	20
			11/28/91	103
		PS4455	11/7/89	82
			11/23/90	190
			11/28/91	20
		PS4456/ AP2455	3/23/89	20
			11/7/89	21
			1/10/90	20
			11/23/90	20
			11/28/91	21
M-86(D)	RHR Sample	PS4823	11/16/89	200
			11/8/90	20
			10/23/91	46
		PS4461/ AP2454	11/16/89	200
			11/8/90	20
			10/23/91	20
M-87	ILRT Depressurization	2 Blank Flanges	11/7/88	34
			10/1/90	20
			9/3/91	20
			10/1/91	20
M-88	RCS Vacuum Degas	RD0008	11/9/88	847
			10/23/90	83
			10/31/91	20
		RD0010	11/9/88	808
			10/23/90	83
			10/31/91	20
M-89	Fuel Transfer Canal (Type B)		1/11/89	102
			11/24/90	333
			11/21/91	1,338

Pen No.	System	Valve No.	Test Date	Leakage SCCM
M-90	Personnel Airlock Barrel		1/21/89 6/29/90 12/21/89 5/3/90 9/13/90 3/8/91 8/22/91 11/28/91	771 4,230 8,470 4,690 5,877 4,780 2,933 6,653
M-90(A)	Personnel Airlock Rx Door Seal Supply	FV1025	1/21/89 11/29/90 11/28/91	20 20 20
M-90(B)	Personnel Airlock Outer Door Seal Supply	FV1026	1/21/89 11/29/90 11/28/91	53 20 20
M-90(C)	Personnel Airlock Outer Door Between Seals Test Line	FV1027	1/21/89 11/29/90 11/28/91	130 29 25
M-90(D)	Personnel Airlock Rx Door Between Seals Test Line	FV1028	1/21/89 1/29/90 11/28/81	112 27 20
M-91	Auxiliary Airlock Barrel Test		1/4/89 6/22/89 12/1/89 4/5/90 9/6/90 3/1/91 8/15/91 11/5/91	1,289 1.000 88 648 150 1,557 759 0
M-92	Equipment Hatch		12/6/88 11/28/90 11/27/91	20 20 20
EP-1	Electrical Penetration		6/18/88 3/21/90	0 6.3
EP-2	Electrical Penetration		3/21/90 11/27/90 4/22/91 11/17/91	.19 .31 .15 .14
EP-3	Electrical Penetration		3/21/90 11/27/90 4/22/91 11/18/91	.2 .46 .5 .14

Pen No.	System	Valve No.	Test Date	Leakage SCCM
EP-4	Electrical Penetration		3/21/90 11/27/90 4/22/91 11/17/91	5.8 .44 .08 .12
EP-5	Electrical Penetration		6/25/88 3/30/90	.03 .06
EP-6	Electrical Penetration		7/5/88 3/20/90	0 8.6
EP-7	Electrical Penetration		6/21/88 3/20/90	.08 .41
EP-8	Electrical Penetration		6/22/88 3/20/90	.04 .1
EP-9	Electrical Penetration		6/22/88 3/20/90	.08 .13
EP-10	Electrical Penetration		6/20/88 3/21/90	.04 .42
EP-11	Electrical Penetration		6/22/88 3/20/90	0 .13
EP-13	Electrical Penetration		6/21/88 3/21/90	0 .29
EP-14	Electrical Penetration		6/22/88 3/20/90	0 .03
EP-15	Electrical Penetration		6/23/88 3/20/90	.12 .04
EP-16	Electrical Penetration		6/22/88 3/21/90	.09 .1
EP-17	Electrical Penetration		6/23/88 3/21/90	0 .35
EP-18	Electrical Penetration		6/25/88 3/23/90	.1 0
EP-19	Electrical Penetration		6/20/88 3/21/90	.22 .12
EP-20	Electrical Penetration		6/28/88 3/23/90	.09 .36
EP-22	Electrical Penetration		6/21/88 3/23/90	.23 .22
EP-24	Electrical Penetration		6/25/88 3/21/90	.01 .12

Pen No.	System	Valve No.	Test Date	Leakage SCCM
EP-25	Electrical Penetration		6/20/88 3/21/90	.01 .02
EP-26	Electrical Penetration		6/23/88 3/20/90	.17 1.38
EP-27	Electrical Penetration		6/23/88 3/23/90	.17 0
EP-28	Electrical Penetration		6/15/88 4/3/90	.03 .05
EP-29	Electrical Penetration		6/15/88 4/3/90	.15 .34
EP-30	Electrical Penetration		6/18/88 4/3/90	0 .01
EP-31	Electrical Penetration		6/18/88 4/3/90	.01 7.3
EP-32	Electrical Penetration		6/17/88 4/3/90	0 8.24
EP-33	Electrical Penetration		6/15/88 4/3/90	0 .08
EP-34	Electrical Penetration		6/17/88 4/3/90	.03 0
EP-35	Electrical Penetration		6/17/88 4/3/90	0 0
EP-36	Electrical Penetration		6/15/88 4/3/90	.1 8.62
EP-37	Electrical Penetration		6/17/88 4/3/90	.07 .32
EP-38	Electrical Penetration		11/9/88 10/17/90	.84 .04
EP-40	Electrical Penetration		6/2/88 4/3/90	.09 .35
EP-42	Electrical Penetration		6/15/88 4/3/90	.03 .14
EP-43	Electrical Penetration		6/16/88 4/3/90	.35 1.1
EP-44	Electrical Penetration		6/18/88 4/3/90	0 .14

Pen No.	System	Valve No.	Test Date	Leakage SCCM
EP-45	Electrical Penetration		6/18/88 4/3/90	.02 .04
EP-46	Electrical Penetration		6/10/88 4/10/90	.1 .2
EP-47	Electrical Penetration		6/11/88 4/10/90	.14 1.36
EP-48	Electrical Penetration		7/6/88 4/10/90	0 .84
EP-49	Electrical Penetration		6/14/88 4/10/90	.19 .45
EP-50	Electrical Penetration		6/11/88 4/9/90	.01 2.92
EP-51	Electrical Penetration		7/5/88 4/9/90	0 5.34
EP-52	Electrical Penetration		7/7/88 4/9/90	.03 .21
EP-53	Electrical Penetration		6/11/88 4/9/90	.09 .65
EP-54	Electrical Penetration		6/11/88 4/10/90	0 .38
EP-55	Electrical Penetration		6/10/88 4/10/90	0 .84
EP-56	Electrical Penetration		9/7/88 8/20/90	.34 .07
EP-57	Electrical Penetration		6/10/88 4/10/90	.07 1.85
EP-58	Electrical Penetration		6/13/88 4/10/90	0 2.47
EP-59	Electrical Penetration		6/11/88 4/10/90	.06 .37
EP-60	Electrical Penetration		6/13/88 4/10/90	.07 .73
EP-61	Electrical Penetration		6/11/88 4/10/90	.38 .31

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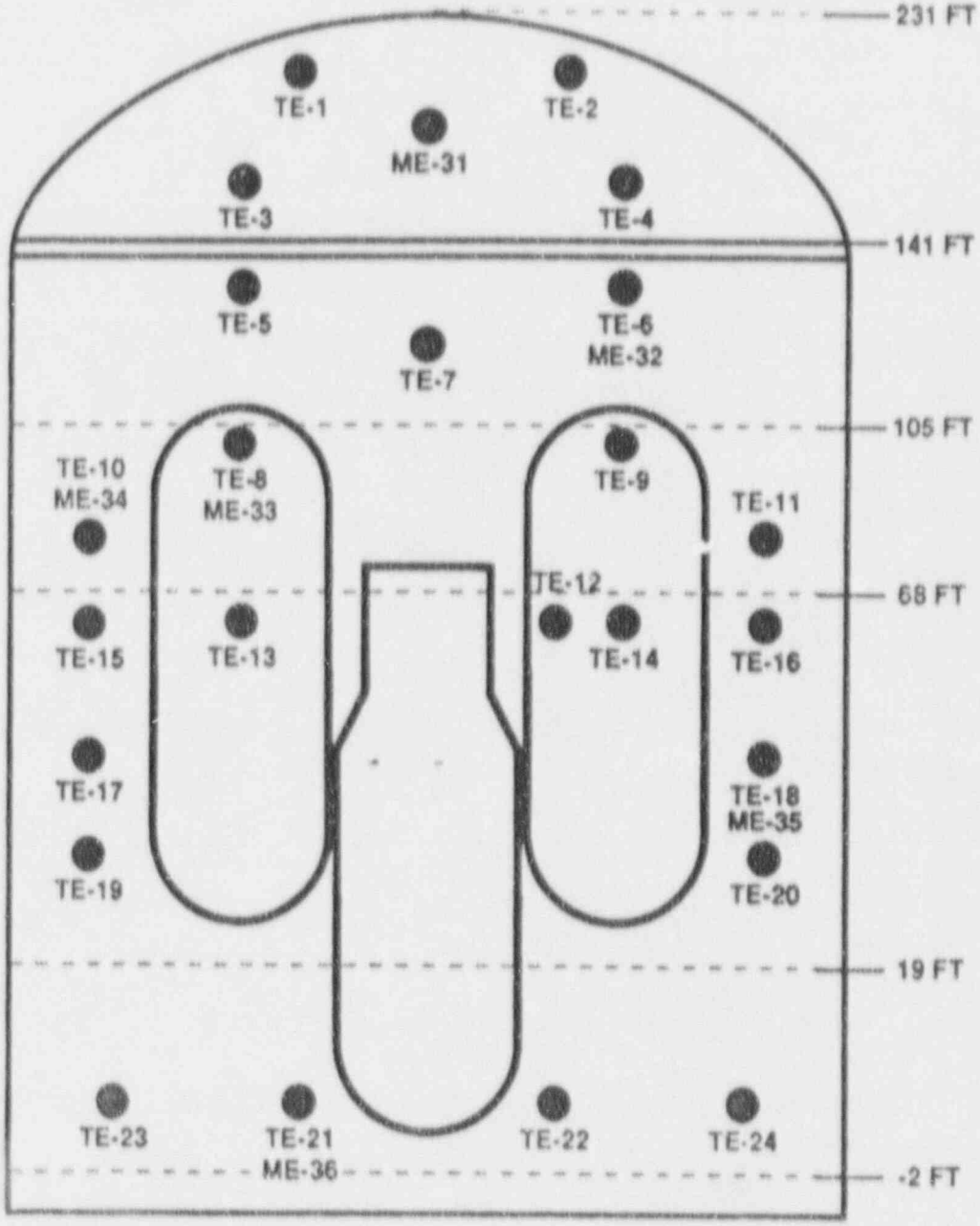
Pen. No.	System	Valve No.	Test Date	Leakage (SCCM)
EP-62	Electrical Penetration		6/14/88 4/11/90	.42 .04
EP-63	Electrical Penetration		6/11/88 4/11/90	0 .49
EP-64	Electrical Penetration		6/11/88 4/10/90	.14 .01
EP-66	Electrical Penetration		6/13/88 4/10/90	.12 .92
EP-67	Electrical Penetration		6/13/88 4/10/90	.16 .11
EP-68	Electrical Penetration		6/14/88 4/10/90	.11 2.32
EP-69	Electrical Penetration		6/14/88 4/10/90	.08 .36

APPENDIX G

SENSOR LOCATIONS AND VOLUME FRACTIONS


231 FT
TE-1
TE-2
ME-31
TE-3
TE-4
141 FT
TE-5
TE-6
ME-32
TE-7
105 FT
TE-10
ME-34
TE-8
ME-33
TE-9
TE-11
TE-12
68 FT
TE-15
TE-13
TE-14
TE-16
TE-17
TE-18
ME-35
TE-19
TE-20
19 FT
TE-23
TE-21
TE-22
TE-24
ME-36
-2 FT

South Texas Project 2

INSTALLED CONSTANTS

RTD WEIGHT FACTORS

RTD 1 WEIGHT FACTOR	= 0.061900
RTD 2 WEIGHT FACTOR	= 0.061900
RTD 3 WEIGHT FACTOR	= 0.061900
RTD 4 WEIGHT FACTOR	= 0.061900
RTD 5 WEIGHT FACTOR	= 0.067800
RTD 6 WEIGHT FACTOR	= 0.067800
RTD 7 WEIGHT FACTOR	= 0.067800
RTD 8 WEIGHT FACTOR	= 0.067800
RTD 9 WEIGHT FACTOR	= 0.067800
RTD 10 WEIGHT FACTOR	= 0.021200
RTD 11 WEIGHT FACTOR	= 0.021200
RTD 12 WEIGHT FACTOR	= 0.026800
RTD 13 WEIGHT FACTOR	= 0.030300
RTD 14 WEIGHT FACTOR	= 0.030300
RTD 15 WEIGHT FACTOR	= 0.018000
RTD 16 WEIGHT FACTOR	= 0.018000
RTD 17 WEIGHT FACTOR	= 0.019500
RTD 18 WEIGHT FACTOR	= 0.019500
RTD 19 WEIGHT FACTOR	= 0.025800
RTD 20 WEIGHT FACTOR	= 0.025800
RTD 21 WEIGHT FACTOR	= 0.039500
RTD 22 WEIGHT FACTOR	= 0.039500
RTD 23 WEIGHT FACTOR	= 0.039000
RTD 24 WEIGHT FACTOR	= 0.039000
RTD WEIGHTING FACTOR SUM	= 1.000000

PRESSURE GAUGE WEIGHT FACTORS

PRESS. GAUGE # 1 WEIGHT FACTOR	= 0.5000
PRESS. GAUGE # 2 WEIGHT FACTOR	= 0.5000
PRESS. GAUGE WEIGHTING FACTOR SUM	= 1.0000

DEW CELL WEIGHT FACTORS

DEW CELL 1 WEIGHT FACTOR	= 0.247600
DEW CELL 2 WEIGHT FACTOR	= 0.169500
DEW CELL 3 WEIGHT FACTOR	= 0.169500
DEW CELL 4 WEIGHT FACTOR	= 0.129800
DEW CELL 5 WEIGHT FACTOR	= 0.126600
DEW CELL 6 WEIGHT FACTOR	= 0.157000
DEW CELL WEIGHTING FACTOR SUM	= 1.000000

CONTAINMENT VOLUME	= 3380000
LA	= 0.30