TENNESSEE VALLEY AUTHORITY
DIVISION OF NUCLEAR POWER

REACTOR BUILDING CONTAINMENT INTEGRATED LEAK RATE TEST SEQUOYAH NUCLEAR PLANT UNIT 2 CONDUCTED FEBRUARY 14-15, 1981

DOCKET NUMBER 50-328

Submitted to
The United States Nuclear Regulatory Commission
Pursuant to
Facility Operating License

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DEFINITION OF SYMBOLS AND ABBREVIATIONS

CILRT	Containment integrated leak rate test
E	Repeatability error
e	Absolute error
ξ	Measurement system error
°F	Temperature, degrees Fahrenheit
FOM	Figure of merit
L_A	Full-pressure design basis leakage
L_{AM}	Containment leak rate during full-pressure CILRT
L_R	Imposed leak rate for verification
L_{RM}	Containment leak rate during verification
L_T	Reduced-pressure maximum allowable leak rate
L_{TM}	Containment leak rate during reduced-pressure CILRT
LLRT	Local leak rate test
P	Pressure
P_a	Design accident pressure
P_T	Reduced test pressure
P_{TA}	Corrected containment pressure during CILRT
P_{TR}	Corrected containment pressure during verification
psia	Absolute pressure
psig	Gauge pressure
°R	Temperature, degrees Rankine
SIT	Structural integrity test
T	Temperature
T_{dp}	Dew point temperature
t	Time
UCL	Upper confidence limit
V	Containment volume, cubic feet

1.0 SUMMARY

A reactor building containment integrated leak rate test (CILRT) was conducted on Sequoyah Nuclear Plant unit 2 February 14-15, 1981.

The measured leak rate for the CILRT was 0.14307 percentage of containment air mass per day, while the observed upper confidence limit was 0.14442 percentage of containment air mass per day. These values are less than the allowable 0.1875 percentage of containment air mass per day (0.75 L_A).

TVA has committed to conduct all CILRT's at Sequoyah Nuclear Plant at full-pressure, 12.0 psig. Therefore, a reduced-pressure test was not conducted.

2.0 INTRODUCTION

As prescribed in Sequoyah Nuclear Plant unit 2 technical specification 4.6.1.2, the leakage of air from the boundary forming the reactor building primary containment is limited to 0.25 percent by weight of the containment air mass per 24 hours at a pressure of P_a, 12.0 psig. In conformance with Title 10, Code of Federal Regulations, Part 50, Appendix J, Sequoyah technical specifications require that reactor building integrated leak rate tests be performed as a part of the startup and the surveillance programs to demonstrate the continuing leak-tight integrity of the reactor building primary containment.

A preoperational reactor building CILRT was successfully completed on Sequoyah unit 2 by personnel of the Tennessee Valley Authority on February 14-15, 1981. This test was conducted in accordance with a plant-approved preoperational test instruction, TVA-2A, which is on file at the plant site. This test instruction implements the requirements of Sequoyah unit 2 technical specifications and Appendix J to 10 CFR 50. The American National Standard for Containment Testing, ANSI N45.4-1972, and the proposed American Nuclear Society Standard for Containment Testing, N-274, provided guidance for the procedure implemented by the preoperational test instruction.

Sequoyah unit 2 is a 3,411 MW, pressurized-water reactor employing an ice condenser suppression containment. The Final Safety Analysis Report defines the calculated peak accident pressure, P_a, to be 12.0 psig. The reactor building containment is divided into four major compartments--the lower ice condenser compartment which houses the energy-absorbing ice beds, the upper ice condenser compartment which encloses the support equipment for the ice condenser system, the lower compartment which contains the reactor and the main piping systems, and the upper compartment which provides for a large work area within containment and also can accommodate the displaced air mass from the other compartments in the unlikely event of a loss-of-coolant accident (LOCA). These four compartments are connected by means of blowout panels located between the lower compartment and the lower ice condenser compartment and between the upper compartment and upper ice

condenser compartment. In the event of a LOCA, steam flows from the lower compartment through the ice condenser compartments and through to the upper compartment. The upper compartment is sealed from the lower compartment to ensure that any steam released in an accident will be forced through the energy-absorbing ice beds. For the performance of this CILRT, the lower and upper compartments were not sealed in order to allow the free flow of air in containment as would exist in a post-LOCA condition.

This report outlines the objectives, principal events, special equipment used, and analysis of the test results for the CILRT completed on February 15, 1981, on Sequoyah unit 2.

3.0 TEST PURPOSE AND RESULTS

3.1 Test Purpose

The objective of the preoperational CILRT performed on Sequoyah unit 2 was threefold. The principal objective was to demonstrate the leak-tight integrity of the reactor building containment for power operation. For Sequoyah unit 2, the leak-tight integrity is defined by technical specification 4.6.1.2 to be that leakage of air from containment not to exceed 0.0078 percentage per hour (0.1875 percentage per day) of containment air mass at a pressure of P_a.

A problem unique to preoperational CILRT's is that of possible incomplete construction. Therefore, the second objective was to verify that there were no unidentified openings in the containment vessel.

The third objective of this CILRT was to further evaluate a technique of modeling a multicompartment ice condenser pressure suppression containment. This was accomplished by using a computer-based data acquisition system that collected data from a number of sensors which sampled containment atmosphere in each of the four compartments.

3.2 Test Results

The leakage rate measured in the 24-hour CILRT was 0.00596 percentage of containment air mass per hour (0.14307 percentage per day) at a pressure of P_a (12.0 psig). The observed 95-percent upper confidence limit (UCL) for this measured leak rate was 0.00602 percentage of containment air mass per hour (0.14442 percentage per day). This measured leak rate is less than that allowed under technical specification 4.6.1.2. These values include the leakage measured from types B and C tests from testable lines that were in service during the CILRT. Table 1 lists the lines that were in service during the test.

After the completion of the 24-hour CILRT, a supplemental forced leakage verification test was conducted to check the results of the CILRT. A forced leakage rate of

0.0120 percentage of containment mass per hour (0.2884 percentage per day) was imposed on the containment. The leak rate measured for the 4.44-hour verification test was 0.0114 percentage of containment air mass per hour (0.27395 percentage per day). Agreement as prescribed by Appendix J between the CILRT and the verification test was -0.0997, which is well within the 0.250 required by technical specifications.

No leakage paths other than those identified as part of the types B and C test program were found in the performance of the CILRT or the supplemental verification test.

The technique of using a multicompartment model for the ice condenser suppression accurately measured the leak rate. The computer-based instrumentation provided reliable and immediate calculations of test results.

4.0 CONDUCT OF TEST

Prior to the pressurization of the reactor building containment for the structural integrity test (SIT), local leak rate tests (LLRT's) were performed in accordance with section 6.2 of the Sequoyah Nuclear Plant FSAR.

All tests were conducted using TVA-prepared and plant-approved preoperational test procedures--TVA-2B for testable penetrations, TVA-2C for testable containment isolation valves, and TVA-3 for the containment personnel air locks.

Figure 2 depicts the sequence of events for the test program. The following is a detailed accounting of principal events.

02/02/81		Started valve lineups.
02/04/81		Began installation of CILRT instrumentation.
02/09/81	1800	Established administrative control of reactor building.
02/10/81		Discovered that a high percentage of valves were misaligned.
	2000	Placed administrative control on the pipe gallery, elevation 690'.
		Operations agreed to recheck the entire valve lineup.
02/11/81	0730	All special test instrumentation installed, functionally checked, and calibrated in preparation for the CILRT.

	0930	RTD temperature sensor 14 discovered to be slightly damaged, replaced with RTD sensor 51.
	1300	High priority placed on finishing all corrections to the valve lineups.
02/11/81		Containment pressurization source checked for operability.
02/12/81		Shift engineer agreed to set defrost cycles for air handler units on six hour cycles.
		Finished CILRT valve lineups.
		Closed unit 2 containment in preparation for pressurization.
02/13/81	0555	Commenced pressurization of reactor building containment to a pressure of at least 13.5 psig for SIT. Containment pressure raised in steps with interim rest periods in conformance with the ASME Boiler and Pressure Vessel code requirements.
	0940	Containment pressurized to 6.186 psig, compressors shut down.
	1050	Compressors restarted with pressurization in 1.2 psig intervals.
	1554	SIT completed.
	1620	Depressurization of reactor building containment started.
	1935	Depressurization to 9.7893 psig completed.
		Start 24-hour hold ("soak") period.
02/14/81	1030	Noticed abnormal leakage rate resulting from misaligned transmitter from vacuum breakers--condition corrected.
	1200	Obtained permission from plant superintendent to enter reactor building containment to replace suspicious dewcell sensor 6.
	2043	Hold period at 9.7893 psig complete.
		Start pressurization for CILRT.

	2249	Completed pressurization for CILRT.
		Final containment pressure, 12.7233 psig.
		Containment pressurization source isolated and disconnected from reactor building containment.
02/15/81	0054	Began stabilizatoin for CILRT.
	0458	Temperature stabilized according to ANS N274 criteria.
		Started CILRT.
	1230	Found leak through vent valve 70-678A, no action taken.
02/16/81	0655	Completed CILRT.
	0745	Teledyne Hastings mass flowmeter found to be inoperable, decision made to use rotameter method to measure imposed leak.
	0854	Started verification test.
	1301	Completed verification test.
		Preliminary calculated agreement well within allowed $0.25L_A$.
	1345	Began blowdown of reactor building containment.
02/17/81	1500	Special test instrumentation functionally checked and removed from reactor building containment.
		Reactor building inspection revealed no apparent damage to containment.
		Plant operations notified to begin return of containment to normal condition.
02/23/81		All TVA-2A post tests completed.
		All acceptance criteria met.
04/11/81		Completed recalibration of all special test instrumentation.

5.0 MEASUREMENTS AND CALCULATIONS

5.1 Test Equipment

An ice condenser reactor containment is unique in the fact that containment design pressure is only 12 psig. This low pressure requires more accurate instrumentation to detect leakage to the same degree as for conventional containments with design pressures of 50 to 60 psig.

For the Sequoyah unit 2 CILRT, the instrumentation consisted of a large number of sensors used to measure containment parameters that were used to calculate the final leakage rate. Table 2 identifies the parameters measured and the sensor specification.

Pressurization for the Sequoyah unit 2 CILRT was accomplished by portable high-capacity air compressors. Rated at 3,500 SCFM of dry, oil-free air, these compressors brought the containment to test pressure in less than 6 hours.

Prior to the start of the CILRT, all special test equipment was calibrated by the Tennessee Valley Authority Central Laboratories, traceable to the National Bureau of Standards. After the installation of special test sensors in the containment, each sensor was checked for functional operation. Upon test completion and depressurization, each sensor was again checked to ensure adherence to the calibration.

5.2 Sensor Location

For the CILRT performed on Sequoyah unit 2, the temperature and dewpoint sensor locations were seleted so as to equalize the volume fraction of containment-free air represented by each measurement. No single sensor for temperature measurement represented more than 10 percent of the containment-free air volume. Appendix C lists the volumetric weighting factor for the vapor pressure, pressure, and temperature sensors. Figures 3-8 identify sensor locations.

5.3 Computer-Based Acquisition and Data Reduction System

Containment parameter measurements for the Sequoyah unit 2 CILRT were made and collected by a microprocessor-based data acquisition system. This raw data was automatically presented to a portable minicomputer system for correction to calibration curves and reduction to containment leakage rate. Statistical confidence levels of the calculated results were reported automatically to the test director as the data was acquired. Figure 9 depicts the functional relationship of the acquisition and data analysis system.

All calculations performed by the minicomputer system were in conformance with the procedures outlined in ANS N-274 (draft). Source listings for all computer programs are on file with the Division of Nuclear Power, Controls and Test Branch, in Chattanooga, Tennessee. Table 3 identifies the principal function of each computer program.

5.4 Reactor Building Containment Model

An ice condenser pressure suppression containment presents special problems not normally encountered in the leak testing of dry containment structures. The pressure suppression design feature requires the reactor building containment to be divided into distinct compartments, where vastly different temperatures and vapor pressures may exist. While each compartment is vented to the containment atmosphere during the performance of the CILRT, the direct circulation of air is very limited.

Since an ice condenser containment typically exhibits a 40°F temperature differential between compartments, it is necessary to compensate for compartmentalization so the leak rate is accurately measured. For Sequoyah unit 2 CILRT, a 4-compartment containment model was used to measure the leak rate. The free air mass is calculated individually for each compartment, and containment leak rate is calculated from the sum of the compartmental masses. Each sensor within a compartment is volume weighted for the calculation of compartment average temperature and vapor pressure. Figure 10 depicts the four compartments used in the Sequoyah unit 2 reactor building containment model.

6.0 ANALYSIS OF TEST DATA

The previous sections of this report have identified the principal test objectives and results, outlined significant events, and described the special test instrumentation. In this section, problems that influenced these results are discussed.

6.1 Instrument Check

Part III, Section 3.1, of the Sequoyah Nuclear Plant Operational Quality Assurance Manual, requires that all tests performed with an instrument be reviewed if that instrument is found out of calibration. After completion of the CILRT, all special test insrumentation was checked for adherence to the pretest calibration.

The post-test calibration revealed that three precision quartz manometers were out of tolerance. However, one of these quartz manometers (PT-4) was within tolerance over the range of pressures measured during the CILRT, and therefore its data was included in the test results. The second quartz manometer (PT-5) was out of tolerance over the range of pressures measured during the CILRT, but was registering higher than actual pressures. The actual test pressures were confirmed by

the other pressure gauges used during the test. The analysis of the post-test calibration data showed that the small amount of error found in this gauge had no effect on the measured leakage rate of the CILRT. Therefore, the data collected from this gauge (PT-5) was included in the test report. The third quartz manometer (PT-3) was inoperable for post-test calibration due to equipment malfunction resulting from a light source burning out. However, the pretest calibration and the nature of the malfunction support the conclusion that this gauge (PT-3) was within tolerance during the performance of the test, and therefore its data was also included in this test report.

6.2 Compartmental Analysis

6.2.1 12.0-Psig CILRT

Figure 11 is a graphical representation of the calculated containment leak rate for the 12.0-psig CILRT expressed as a percentage of containment mass. Tabulated data is shown in Table 4.

The graph axes are percentage of air mass leakage per hour versus time. The slope of the least squares fit line to these data is the measured containment leak rate.

Figure 12 is a graphical representation of the total mass loss from containment during the 12.0-psig CILRT. The graph axes are containment dry air mass versus time.

Figures 13 and 14 graphically depict two alternate methods of determining containment leakage--the point-to-point and the total time methods.

In reviewing the graphs for the CILRT, figures 15 through 18 show a mass loss in all compartments. The lower compartment, figure 16, exhibited the most prominent mass loss. Most containment penetrations and leakage paths are located in this lower compartment. The phenomena of mass flow from the lower ice condenser compartment through the upper ice condenser and upper compartments and finally to the lower compartment was not as evident for this test as in similar ice condenser containments due to the relatively small amount of ice loaded prior to the CILRT. Examination of figures 15 through 18 also reveals a "spike" in the mass plots at approximately 14-1/2 hours into the CILRT. This variation was determined to be caused by a defrost cycle of at least two air handling units in the upper ice condenser compartment being cycled at the same time.

An inspection of the compartmental vapor pressure plots, figures 19 through 22, reveals a relatively smooth decrease in the upper and lower compartment vapor pressures. However, the graphs of the upper and lower ice condenser compartments show a more irregular pattern, due to the air handling units located in the upper ice compartment being in operation during the test. These air handling units operated with 6-hour defrost cycles, with the corresponding peaks showing throughout figures 21 and 22. As expected, the "spike" at approximately 14-1/2 hours into the CILRT is most prevalent in the vapor pressure plot of the upper ice condenser, because of the air handling units cycling in that compartment.

Figures 23 through 26 represent the compartmental temperature plots, with smooth curves depicting the upper and lower compartment temperature changes and the more irregular plots representing the ice condenser compartments. Again, the cycling of the air handling units can be attributed to the irregular temperature patterns exhibited by the upper ice condenser compartment, with a less pronounced effect on the lower ice condenser compartment. These temperature peaks occurred as the result of the defrosting of the air handling units, with the most prominent spike appearing at approximately 14-1/2 hours on both the upper and lower ice condenser plots, figures 25 and 26.

6.3 Discussion of Agreement (Verification Test)

Appendix J to 10 CFR 50 and ANSI N45.4 specify different techniques for the calculation of agreement between the CILRT and its subsequent verification. Appendix J requires the absolute value of the difference between the measured containment leak rate with a superimposed leak and the sum of the imposed leak and the measured containment leak rate be less than 0.25 L_A or 0.25 L_T, as applicable. ANSI 45.4 requires this difference be less than 0.25 of the measured containment leak rate with the imposed leak. Common test practice is to set the imposed leak at between 75 and 125 percentage of the maximum allowable leak rate.

Appendix D details the methods of agreement calculations. By the procedure recommended in Appendix J to 10 CFR 50, agreement between the CILRT and the subsequent verification test was well within the 0.25 L_A allowable limit.

The imposed leak rate was measured by the rotameter method, utilizing a Fischer Porter rotameter. This method required that the imposed leak rate be manually calculated and directly read into the minicomputer, thereby causing an interruption in the verification leak rate sampling at approximately .7 hours into the verification test. This interruption can be seen graphically in figures 27 through 34.

Tabulated data for the verification test is shown in Table 5.

7.0 Conclusions

The results of the full-pressure CILRT clearly demonstrate the leak-tight integrity of Sequoyah unit 2. The total leak rate was less than the allowable leak rate under Sequoyah technical specifications.

The technique of modeling a multicompartment ice condenser pressure suppression containment using a computer-based data acquisition system yielded immediate results that accurately measured and displayed containment leak rate.

T A B L E S

TABLE 1
TESTABLE PENETRATIONS REQUIRED TO BE IN SERVICE DURING TEST PERFORMANCE

Penetration	Valve Number(s)	Description	Justification
X-27C	52-Inboard 52-Outboard	Integrated Leak Rate System Pressure	Isolation valves required to be open to monitor containment pressure.
X-68/69/74/75	67-580 A,B,C,D	Essential raw cooling water system	To correct inadvertent valve misalignment.
X-47A	61-191 61-192/533	Ice Condenser System	Glycol cooling supply to air-handling units in ice condenser required to ensure ice condition is maintained.
X-47B	61-193 61-194/680	Ice Condenser System	Same as X-47A.
X-54	No valves - Type B test	Thimble Renewal	Used as pressurization point for air compressors.
X-98	52-Inboard 52-Outboard	Integrated Leak Rate System Pressure	Same as X-27C.
X-107	74-2	Residual Heat Removal System	Residual heat removal system required inservice to remove decay heat from fuel.
X-114	61-110 61-122/745	Ice Condenser System	Glycol return from air-handling units required to ensure ice condition is maintained.
X-115	61-96 61-97/692	Ice Condenser System	Same as X-114.
X-118	Type B test	Hatch	Used a source for verification flow and post test depressurization.

TABLE 2
CONTAINMENT LEAKAGE MEASUREMENT SYSTEM
SPECIAL TEST EQUIPMENT

Measured Parameter	Manufacturer and Model Number	Number Used	Instrument Specification
Containment Temperature	Leeds and Northrup Model No. 178055	49	Range: 0-250°F Accuracy: 0.1°F Repeatability: 0.02°F
Containment Pressure	Mensor Corporation Model No. 10100-001	5	Range: 0-30 psia; 400,000 counts F.S. Accuracy: 0.015% reading Repeatability: 0.0005% reading
Containment Dewpoint	Foxboro Corporation Model No. 2701 RG	13	Accuracy: 1°F dewpoint Repeatability: 0.5°F dewpoint
Analog to Digital Converter	Acurex Corporation Autodata Nine	1	Accuracy: 0.001°F dewpoint 0.001°F temperature 1 count pressure
Atmospheric Pressure	Mensor Corporation Model No. 10100-001	1	Range: 0-30 psia; 400,000 counts F.S. Accuracy: 0.015% reading Repeatability: 0.0005% reading
Verification Flow	Fischer Porter Rotameter TVA Nos. 1032 & 1060	1	Accuracy: 1.0% F.S.

TABLE 3
CONTAINMENT LEAKAGE MEASUREMENT
MINICOMPUTER ROUTINE SUMMARY

Routine Name	Function
FORE	a. Does all calculations for the test. b. FORE controlled by the Autodata 9, FORE runs when the A-9 sends data.
BASE	a. Redefines test start.
STARTN	a. Used for reading in calibration curve data for pressure gauges and other local inputs.
S1	a. Creates all files. b. Tells system how many RTD's and DPE's are being used.
TALLY	a. Gives reportable test results.
TABLE	a. Tabulate test results versus time.
AM	a. Does calibrations.
CHECK	a. Reads data from Autodata 9. b. Enables a single RTD to be checked after calibration.
CHECK8	a. Reads raw data file. b. Looks at a particular RTD reading after calibration.
VERIFY	a. Tabulates verification results.
PLOT	a. Performs all graphics.

TENNESSE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT UNIT-2
CONTAINMENT LEAKAGE MEASUREMENT
TEST SUMMARY
ALL COMPARTMENTS
12.0 PSIG CILRT

SAMPLE	HOURS SINCE START	AVERAGE TEMPERATURE (DEG F.)	CORRECTED PRESSURE (PSIA)	TOTAL MASS OF AIR (LBM)	P-T-P LEAK RATE (% PER DAY)	TOTAL TIME LEAK RATE (% PER DAY)	MASS LEAK RATE (% PER DAY)
29	0.000	50.5792	27.1779	183146.73	0.0000000	0.0000000	0.0000000
30	0.167	50.5659	27.1759	183138.63	0.6374090	0.6374090	0.6372145
31	0.333	50.5475	27.1756	183143.50	-0.3834099	0.1271483	0.1271439
32	0.500	50.5380	27.1746	183140.33	0.2493185	0.1678777	0.1120235
33	0.667	50.5348	27.1754	183146.67	-0.4989196	0.0012295	-0.0132675
34	0.833	50.5205	27.1737	183140.64	0.4740655	0.0958166	0.0210585
35	1.000	50.5170	27.1728	183136.20	0.3439974	0.1379999	0.0684430
36	1.167	50.5110	27.1719	183132.17	0.3168005	0.1635577	0.1088033
37	1.333	50.4978	27.1718	183136.33	-0.3268930	0.1022714	0.0782767
38	1.500	50.4835	27.1719	183142.23	-0.4645216	0.0393127	0.0629002
39	1.667	50.4758	27.1695	183128.70	1.0636026	0.1417672	0.0884527
40	1.833	50.4623	27.1693	183132.31	-0.2838861	0.1030837	0.0886604
41	2.000	50.4578	27.1688	183131.12	0.0933466	0.1022714	0.0900734
42	2.167	50.4503	27.1681	183129.16	0.1548449	0.1063135	0.0922773
43	2.333	50.4453	27.1673	183125.06	0.3218057	0.1217078	0.0994043
44	2.500	50.4317	27.1665	183124.84	0.0172056	0.1147427	0.1023284
45	2.667	50.4188	27.1650	183119.62	0.4102506	0.1332137	0.1104209
46	2.833	50.4104	27.1642	183117.44	0.1720607	0.1354969	0.1173279
47	3.000	50.4037	27.1644	183121.53	-0.3220032	0.1100893	0.1154548
48	3.167	50.3869	27.1644	183127.48	-0.4679889	0.0796588	0.1057008
49	3.333	50.3945	27.1625	183111.92	1.2240366	0.1368571	0.1127306
50	3.500	50.3779	27.1612	183108.30	0.2849846	0.1439102	0.1204014
51	3.667	50.3623	27.1608	183110.77	-0.1941948	0.1285475	0.1223662
52	3.833	50.3590	27.1602	183107.23	0.2776161	0.1350282	0.1255261
53	4.000	50.3522	27.1592	183102.88	0.3429157	0.1436849	0.1302750
54	4.167	50.3364	27.1586	183103.78	-0.0712497	0.1350858	0.1322500
55	4.333	50.3292	27.1573	183097.73	0.4756661	0.1481774	0.1362242
56	4.500	50.3276	27.1570	183097.44	0.0233539	0.1435552	0.1389159
57	4.667	50.3154	27.1556	183093.63	0.2997489	0.1491323	0.1417558
58	4.833	50.3035	27.1544	183089.06	0.3589205	0.1563610	0.1458788
59	5.000	50.2944	27.1540	183090.05	-0.0773977	0.1485676	0.1478003
60	5.167	50.2781	27.1535	183092.94	-0.2274027	0.1364448	0.1473336
61	5.333	50.2797	27.1528	183088.39	0.3574962	0.1433514	0.1480504
62	5.500	50.2761	27.1514	183081.06	0.5765017	0.1564683	0.1504964
63	5.667	50.2572	27.1521	183071.86	-0.8489549	0.1268974	0.1479978
64	5.833	50.2501	27.1515	183090.84	0.0798975	0.1255542	0.1457123

TABLE 4

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT UNIT-2
CONTAINMENT LEAKAGE MEASUREMENT
TEST SUMMARY
ALL COMPARTMENTS
12.0 PSIG CILRT

SAMPLE	HOURS SINCE START	AVERAGE TEMPERATURE (DEG F.)	CORRECTED PRESSURE (PSIA)	TOTAL MASS OF AIR (LBM)	P-T-P LEAK RATE (% PER DAY)	TOTAL TIME LEAK RATE (% PER DAY)	MASS LEAK RATE (% PER DAY)
65	6.000	50.2413	27.1508	183080.83	0.1585666	0.1264696	0.1436039
66	6.167	50.2391	27.1496	183082.03	0.5344135	0.1374938	0.1452942
67	6.333	50.2308	27.1478	183071.69	0.8137684	0.1552786	0.1457363
68	6.500	50.2157	27.1472	183072.67	-0.0774051	0.1493114	0.1470992
69	6.667	50.2109	27.1458	183065.92	0.5310664	0.1588476	0.1495772
70	6.833	50.1980	27.1454	183067.41	-0.1167256	0.1521255	0.1507619
71	7.000	50.1894	27.1449	183067.39	0.0012294	0.1485337	0.1514534
72	7.167	50.1854	27.1446	183068.09	-0.0552906	0.1437927	0.1514626
73	7.333	50.1731	27.1432	183063.00	0.3380715	0.1482037	0.1517777
74	7.500	50.1768	27.1421	183055.33	0.6663240	0.1597080	0.1534942
75	7.667	50.1636	27.1407	183050.70	0.3637134	0.1641403	0.1557921
76	7.833	50.1513	27.1405	183054.14	-0.2704829	0.1548983	0.1564957
77	8.000	50.1463	27.1402	183054.44	-0.0233466	0.1511840	0.1565407
78	8.167	50.1416	27.1396	183053.30	0.0897493	0.1499296	0.1565747
79	8.333	50.1233	27.1390	183055.64	-0.1843163	0.1432446	0.1560798
80	8.500	50.1237	27.1308	183054.44	0.0946665	0.1422914	0.1553003
81	8.667	50.1142	27.1381	183053.94	0.0393206	0.1403102	0.1542830
82	8.833	50.0969	27.1374	183055.52	-0.1241741	0.1353223	0.1532014
83	9.000	50.0917	27.1366	183052.06	0.2717053	0.1378449	0.1520741
84	9.167	50.0920	27.1336	183045.55	0.5124027	0.1446522	0.1519379
85	9.333	50.0910	27.1355	183045.77	-0.0172130	0.1417626	0.1515400
86	9.500	50.0703	27.1346	183047.00	-0.0970772	0.1375722	0.1506939
87	9.667	50.0621	27.1328	183037.73	0.7290891	0.1477614	0.1508697
88	9.833	50.0697	27.1323	183031.91	0.4583721	0.1530229	0.1515239
89	10.000	50.0513	27.1320	183036.87	-0.3910110	0.1439620	0.1511773
90	10.167	50.0430	27.1317	183038.14	-0.0995397	0.1399700	0.1505359
91	10.333	50.046[illegible]	27.1308	183040.75	0.5815782	0.1470653	0.1507259
92	10.500	50.0316	27.1304	183033.80	-0.2397724	0.1409487	0.1502475
93	10.667	50.0341	27.1289	183023.69	0.7951024	0.1511652	0.1506775
94	10.833	50.0081	27.1277	183024.72	-0.0811569	0.1475927	0.1508634
95	11.000	50.0031	27.1279	183027.86	-0.2470224	0.1416144	0.1503074
96	11.167	49.9984	27.1279	183030.80	-0.2311688	0.1360549	0.1495349
97	11.333	49.9952	27.1270	183025.23	0.4374978	0.1404843	0.1490555
98	11.500	49.9841	27.1249	183013.73	0.9050143	0.1515531	0.1494924
99	11.667	49.9724	27.1247	183016.17	-0.1917304	0.1466495	0.1497178

TENNESSE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT UNIT-2
CONTAINMENT LEAKAGE MEASUREMENT
TEST SUMMARY
ALL COMPARTMENTS
12.0 PSIG CILRT

SAMPLE	HOURS SINCE START	AVERAGE TEMPERATURE (DEG F.)	CORRECTED PRESSURE (PSIA)	TOTAL MASS OF AIR (LBM)	P-T-P LEAK RATE (% PER DAY)	TOTAL TIME LEAK RATE (% PER DAY)	MASS LEAK RATE (% PER DAY)
100	11.833	49.9749	27.1245	183013.53	0.2078193	0.1475088	0.1498755
101	12.000	49.9622	27.1238	183013.17	0.0282835	0.1458530	0.1498543
102	12.167	49.9550	27.1225	183006.95	0.4891597	0.1505524	0.1502314
103	[illegible].333	49.9397	27.1218	183007.92	-0.0762452	0.1474891	0.15031[illegible]0
104	12.500	49.9465	27.1213	183003.17	0.3736403	0.1505015	0.1506484
105	[illegible].667	49.9264	27.1208	183007.67	-0.3541787	0.1438663	0.1503111
106	12.833	49.9154	27.1194	183002.20	0.4301786	0.1475815	0.1503299
107	13.000	49.9134	27.1173	182991.70	0.8264213	0.1562741	0.1581231
108	13.167	49.9116	27.1178	182992.41	-0.0553135	0.1535956	0.1515414
109	13.333	49.9045	27.1176	182994.13	-0.1352845	0.1499869	0.1517075
110	13.500	49.8925	27.1162	182990.52	0.2840949	0.1516392	0.1519745
111	13.667	49.8826	27.1169	182998.39	-0.6195152	0.1422385	0.1516167
112	13.833	49.8751	27.1161	182996.17	0.1746343	0.1426270	0.1513093
113	14.000	49.8732	27.1152	182990.70	0.4302056	0.1460474	0.1511200
114	14.167	49.8710	27.1145	182987.13	0.2816405	0.1476398	0.1511786
115	14.333	49.8556	27.1138	182987.03	0.0073753	0.1440078	0.1510459
116	14.500	49.8488	27.1131	182984.50	0.1992431	0.1466176	0.1511387
117	14.667	49.8545	27.1177	183013.45	-2.2777267	0.1170823	0.1491852
118	14.833	49.8443	27.1207	183035.67	-1.7486590	0.0981159	0.1460076
119	15.000	49.8332	27.1139	182990.72	3.5374694	0.1362978	0.1455141
120	15.167	49.8348	27.1141	182989.25	0.1155444	0.1360686	0.1450664
121	15.333	49.8213	27.1130	182984.89	0.3431368	0.1383156	0.1447726
122	15.500	49.8083	27.1114	182977.55	0.5777403	0.1480365	0.1447815
123	15.667	49.7998	27.1099	182969.38	0.6432688	0.1483505	0.1450643
124	15.833	49.7949	27.1096	182969.94	-0.0442562	0.1463229	0.1451851
125	16.000	49.8001	27.1093	182967.09	0.2238619	0.1471282	0.1455048
126	16.167	49.7896	27.1095	182972.80	-0.4487143	0.1409882	0.1453304
127	16.333	49.7805	27.1095	182975.91	-3.2447683	0.1370552	0.1448916
128	16.500	49.7794	27.1090	182972.80	0.2447641	0.1381406	0.1445738
129	16.667	49.7649	27.1072	182965.89	0.5433576	0.1421888	0.1445418
130	16.833	49.7680	27.1068	182963.03	0.2250969	0.1430073	0.1445999
131	17.000	49.7547	27.1060	182962.53	0.0393402	0.1419903	0.1444908
132	17.167	49.7418	27.1056	182965.13	-0.2041900	0.1386321	0.1442280
133	17.333	49.7453	27.1046	182957.78	0.5778027	0.1428507	0.1442932
134	17.500	49.7368	27.1036	182954.11	0.2890717	0.1442401	0.1443547

TABLE 4

2

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT UNIT-2
CONTAINMENT LEAKAGE MEASUREMENT
TEST SUMMARY
ALL COMPARTMENTS
12.0 PSIG CILRT

SAMPLE	HOURS SINCE START	AVERAGE TEMPERATURE (DEG F.)	CORRECTED PRESSURE (PSIA)	TOTAL MASS OF AIR (LBM)	P-T-P LEAK RATE (% PER DAY)	TOTAL TIME LEAK RATE (% PER DAY)	MASS LEAK RATE (% PER DAY)
135	17.667	49.7359	27.1027	182949.11	0.3934212	0.1465876	0.1445595
136	17.833	49.7313	27.1030	182953.16	-0.3186090	0.1422443	0.1445357
137	18.000	49.7261	27.1020	182949.64	0.2747777	0.1434869	0.1445808
138	18.167	49.7146	27.1013	182949.16	0.0381136	0.1425196	0.1445525
139	18.333	49.7137	27.1006	182944.78	0.3444421	0.1443514	0.1446546
140	18.500	49.7005	27.1001	182946.86	-0.1635240	0.1415785	0.1445539
141	18.667	49.6985	27.0998	182946.53	0.0258335	0.1405451	0.1443911
142	18.833	[illegible]	27.0986	182941.50	0.3958966	0.1428017	0.1443539
143	19.000	[illegible]	27.0982	182945.56	-0.3198525	0.1387475	0.1441942
144	19.167	49.6789	27.0984	182945.78	-0.0172130	0.1373910	0.1438049
145	19.333	49.6719	27.0982	182946.61	-0.0451992	0.1356456	0.1434859
146	19.500	49.6713	27.0976	182943.09	0.2767877	0.1368491	0.1431766
147	19.667	49.6706	27.0960	182931.27	0.9307432	0.1435703	0.1432524
148	19.833	49.6597	27.0955	182931.42	-0.0123027	0.1422608	0.1432652
149	20.000	49.6522	27.0951	182930.86	0.0442654	0.1414435	0.1432193
150	20.167	49.6497	27.0948	182929.30	0.1230273	0.1412902	0.1432680
151	20.333	49.6420	27.0939	182925.06	0.3332238	0.1428606	0.1432578
152	20.500	49.6394	27.0934	182922.31	0.2165350	0.1434573	0.1432878
153	20.667	49.6395	27.0922	182918.63	0.2901986	0.1446382	0.1433544
154	20.833	49.6271	27.0920	182919.05	-0.0332196	0.1432160	0.1433643
155	21.000	49.6223	27.0909	182913.94	0.4023254	0.1452680	0.1434534
156	21.167	49.6221	27.0900	182908.00	0.4672903	0.1477997	0.1437022
157	21.333	49.6124	27.0904	182914.80	-0.5352358	0.1424702	0.1436774
158	21.500	49.6019	27.0889	182908.45	0.4992605	0.1452320	0.1437679
159	21.667	49.5976	27.0886	182908.89	-0.0344519	0.1433505	0.1438045
160	21.833	49.5965	27.0881	182907.00	0.1487992	0.1438868	0.1438296
161	22.000	49.5875	27.0882	182911.11	-0.3236041	0.1403493	0.1437666
162	22.167	49.5852	27.0880	182910.13	0.0774730	0.1398750	0.1436588
163	22.333	49.5761	27.0869	182906.39	0.2940687	0.1410232	0.1435069
164	22.500	49.5647	27.0859	182903.13	0.2571615	0.1418808	0.1434632
165	22.667	49.5583	27.0855	182902.59	0.0418127	0.1411443	0.1433741
166	22.833	49.5598	27.0849	182898.06	0.3568344	0.1427149	0.1434506
167	23.000	49.5511	27.0841	182896.17	0.1488080	0.1437576	0.1434796
168	23.167	49.5468	27.0845	182900.91	-0.3728435	0.1390528	0.1432659
169	23.333	49.5404	27.0831	182894.72	0.4870004	0.1415342	0.1432120

TABLE 4

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT UNIT-2
CONTAINMENT LEAKAGE MEASUREMENT
TEST SUMMARY
ALL COMPARTMENTS
12.0 PSIG CILRT

SAMPLE	HOURS SINCE START	AVERAGE TEMPERATURE (DEG F.)	CORRECTED PRESSURE (PSIA)	TOTAL MASS OF AIR (LBM)	P-T-P LEAK RATE (% PER DAY)	TOTAL TIME LEAK RATE (% PER DAY)	MASS LEAK RATE (% PER DAY)
170	23.500	49.5348	27.0811	182882.75	0.9425756	0.1472048	0.1433710
171	23.667	49.5232	27.0809	182885.44	0.2115464	0.1446797	0.1434177
172	23.833	49.5237	27.0805	182883.94	0.1181356	0.1444930	0.1435466
173	24.000	49.5208	27.0801	182883.03	0.0713742	0.1439846	0.1436275
174	24.167	49.5210	27.0802	182884.28	-0.0983935	0.1423135	0.1435488
175	24.333	49.5110	27.0801	182888.34	-0.3199525	0.1391512	0.1434336
176	24.500	49.5000	27.0798	182890.27	-0.1512757	0.1371764	0.1432282
177	24.667	49.5021	27.0792	182885.34	0.3876221	0.1388645	0.1431070
178	24.833	49.4982	27.0786	182883.17	0.1709566	0.1390783	0.1429964
179	25.000	49.4940	27.0781	182882.19	0.0775274	0.1386673	0.1428051
180	25.167	49.4861	27.0772	182878.62	0.2804229	0.1396037	0.1426875
181	25.333	49.4851	27.0765	182874.97	0.2879662	0.1405768	0.1425888
182	25.500	49.4710	27.0762	182878.20	-0.2547444	0.1379961	0.1424034
183	25.667	49.4762	27.0759	182874.94	0.2570599	0.1387670	0.1422768

TENNESSE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT UNIT-2
CONTAINMENT LEAKAGE MEASUREMENT
TEST SUMMARY
ALL COMPARTMENTS
12.0 PSIG VERIFICATION

SAMPLE	HOURS SINCE START	AVERAGE TEMPERATURE (DEG F.)	CORRECTED PRESSURE (PSIA)	TOTAL MASS OF AIR (LBM)	P-T-P LEAK RATE (% PER DAY)	TOTAL TIME LEAK RATE (% PER DAY)	MASS LEAK RATE (% PER DAY)
14	0.000	49.4302	27.0694	182849.[illegible]7	0.0000000	0.0000000	0.0000000
15	0.083	49.4289	27.0690	182847.67	0.3618604	0.3618604	0.3656420
16	0.167	49.4306	27.0689	182846.44	0.1944716	0.2781648	0.2770018
17	0.250	49.4313	27.0686	182844.37	0.3224804	0.2929346	0.2836498
18	0.333	49.4237	27.0676	182839.86	0.7131124	0.3980601	0.3721257
19	0.417	49.4247	27.0667	182832.72	1.1250294	0.5434096	0.5045708
20	0.500	49.4178	27.0663	182832.19	0.0837035	0.4668046	0.5062743
21	0.583	49.4200	27.0661	182829.86	0.3668193	0.4525181	0.4950500
22	0.855	49.4143	27.0654	182828.72	0.0551026	0.3262148	0.3846044
23	0.938	49.4063	27.0641	182823.06	0.8912154	0.3763715	0.3771999
24	1.022	49.4010	27.0634	182820.23	0.4456216	0.3820134	0.3758360
25	1.105	49.3935	27.0627	182818.25	0.3126785	0.3767817	0.3735777
26	1.188	49.3924	27.0626	182818.09	0.0245936	0.3520631	0.3616215
27	1.272	49.3859	27.0624	182819.34	-0.1969651	0.3160959	0.3435298
28	1.355	49.3902	27.0627	182819.70	-0.0566271	0.2931791	0.3230551
29	1.438	49.3856	27.0625	182820.41	-0.1107919	0.2697802	0.3021841
30	1.522	49.3844	27.0620	182818.02	0.3764910	0.2756306	0.2879760
31	1.605	49.3815	27.0613	182814.47	0.5582753	0.2903132	0.2815915
32	1.688	49.3758	27.0606	182812.03	0.3840897	0.2949370	0.2778373
33	1.772	49.3793	27.0596	182804.17	1.2384595	0.3392950	0.2867019
34	1.855	49.3793	27.0596	182804.23	0.6098490	0.3236137	0.2893868
35	1.938	49.3739	27.0596	182805.38	-0.1795470	0.3019654	0.2876633
36	2.022	49.3705	27.0594	182805.34	0.0049245	0.2897242	0.2835461
37	2.105	49.3700	27.0586	182800.19	0.8125380	0.3104089	0.2841863
38	2.188	49.3571	27.0587	182805.05	-0.7657771	0.2694441	0.2774218
39	2.272	49.3598	27.0585	182803.64	0.2216016	0.2676874	0.2710985
40	2.355	49.3608	27.0573	182795.20	1.3281603	0.3052330	0.2731354
41	2.438	49.3617	27.0572	182794.25	0.1502047	0.2799344	0.2748503
42	2.522	49.3599	27.0568	182791.47	0.4383046	0.3045016	0.2762401
43	2.605	49.3452	27.0564	182793.98	-0.3964501	0.2820875	0.2741325
44	2.688	49.3406	27.0557	182790.27	0.5854053	0.2914922	0.2741995
45	2.772	49.3407	27.0554	182788.72	0.2437815	0.2900557	0.2735192
46	2.855	49.[illegible]	27.0550	182787.91	0.1280479	0.2853267	0.2725059
47	2.938	49.[illegible]0	27.0542	182781.86	0.9529763	0.3042482	0.2744640
48	3.022	49.33[illegible]5	27.0536	182778.47	0.5343738	0.3105879	0.2777623
49	3.105	49.3325	27.0539	182782.22	-0.5903747	0.2863931	0.2764855

TABLE 5

TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT UNIT 2
CONTAINMENT LEAKAGE MEASUREMENT
TEST SUMMARY
ALL COMPARTMENTS
12.0 PSIG VERIFICATION

SAMPLE	HOURS SINCE START	AVERAGE TEMPERATURE (DEG F.)	CORRECTED PRESSURE (PSIA)	TOTAL MASS OF AIR (LBM)	P-T-P LEAK RATE (% PER DAY)	TOTAL TIME LEAK RATE (% PER DAY)	MASS LEAK RATE (% PER DAY)
50	3.188	49.3303	27.0537	182781.95	0.0418633	0.2600029	0.2747467
51	3.272	49.3295	27.0535	182781.31	0.1009646	0.2754427	0.2726324
52	3.355	49.3231	27.0520	182773.25	1.2706809	0.3001455	0.2746546
53	3.438	49.3200	27.0514	182769.64	0.5682520	0.3066432	0.2767757
54	3.522	49.3129	27.0513	182772.06	-0.3817211	0.2903624	0.2768599
55	3.605	49.3178	27.0504	182764.70	1.1599244	0.3104469	0.2797052
56	3.688	49.3121	27.0503	182766.09	-0.2191877	0.2984856	0.2803495
57	3.772	49.3042	27.0495	182763.86	0.3521754	0.2996680	0.2813548
58	3.855	49.3020	27.0492	182762.95	0.1426053	0.2962702	0.2821746
59	3.938	49.3044	27.0491	182762.08	0.1379172	0.2929190	0.2821786
60	4.022	49.3089	27.0488	182758.39	0.5812253	0.2988858	0.2826993
61	4.105	49.2984	27.0487	182761.38	-0.5024253	0.2826277	0.2817364
62	4.188	49.2992	27.0486	182761.36	0.0344417	0.2776851	0.2798842
63	4.272	49.2978	27.0481	182758.23	0.4925657	0.2818714	0.2786368
64	4.355	49.2946	27.0485	182762.08	-0.6058662	0.2648943	0.2756635
65	4.438	49.2835	27.0476	182759.55	0.3989767	0.2674077	0.2739536

TABLE 5
Page 2

F I G U R E S

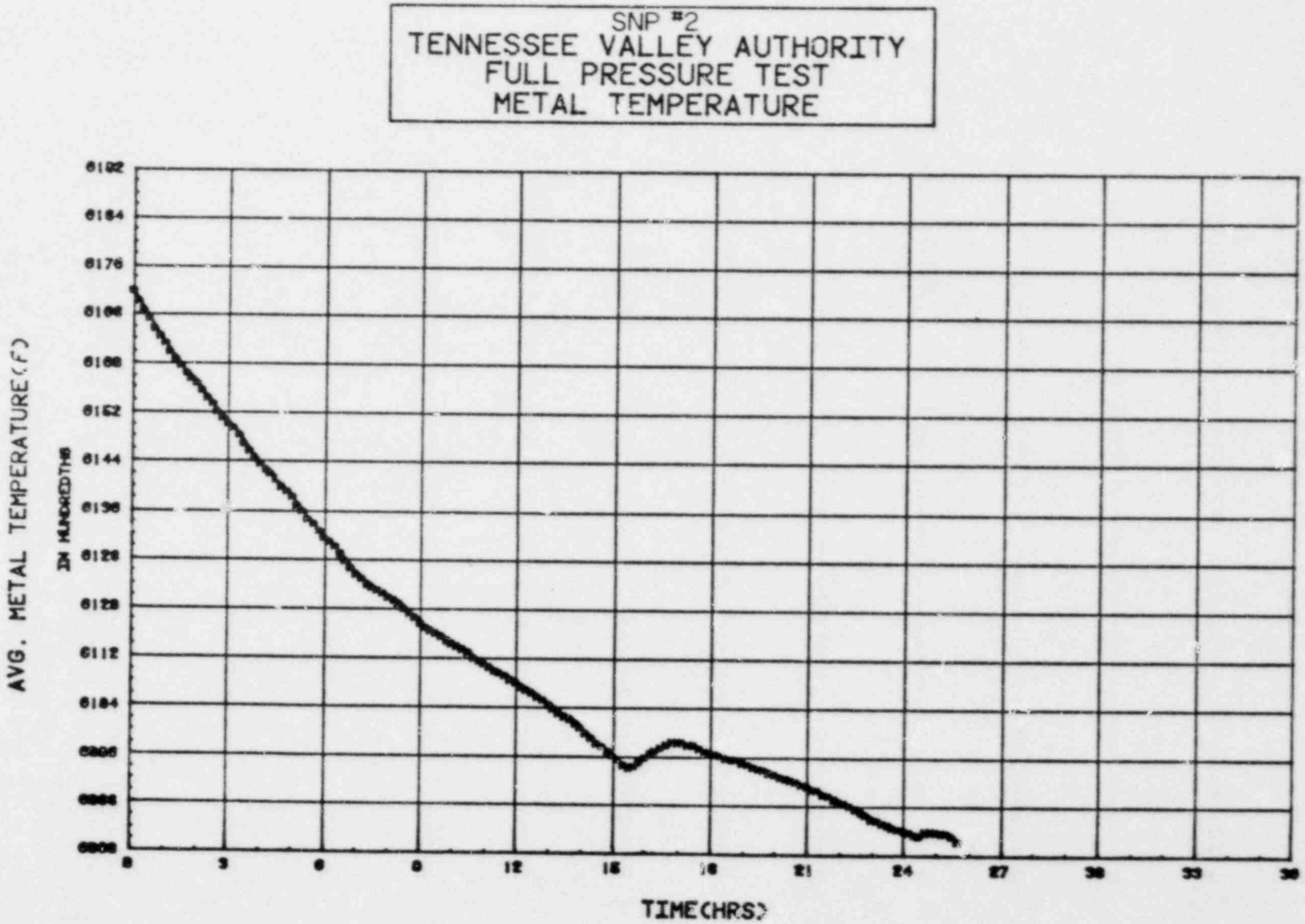

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
METAL TEMPERATURE
AVG. METAL TEMPERATURE (F)
IN HUNDREDTHS
6176
6144
6112
0
3
6
12
15
21
24
27
33
36
TIME(HRS)

FIGURE 1

CILRT SEQUENCE OF EVENTS

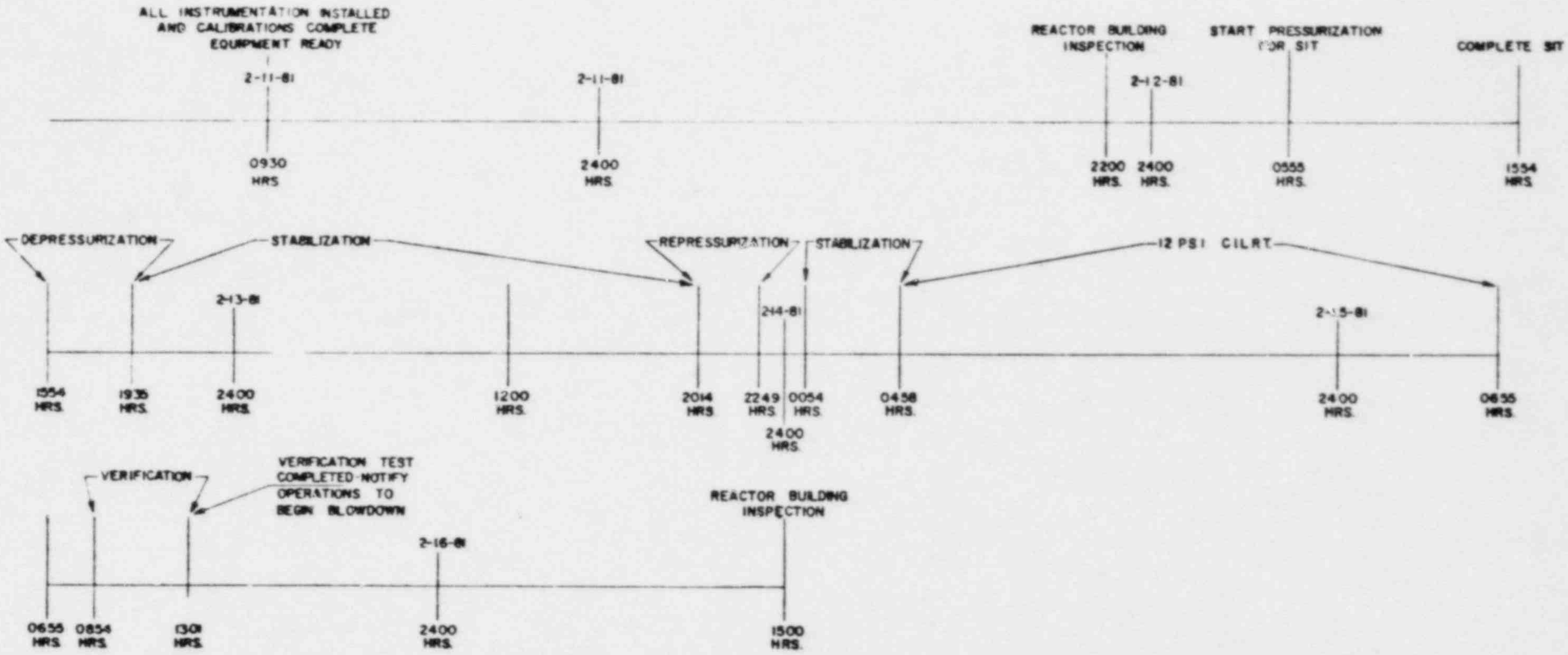
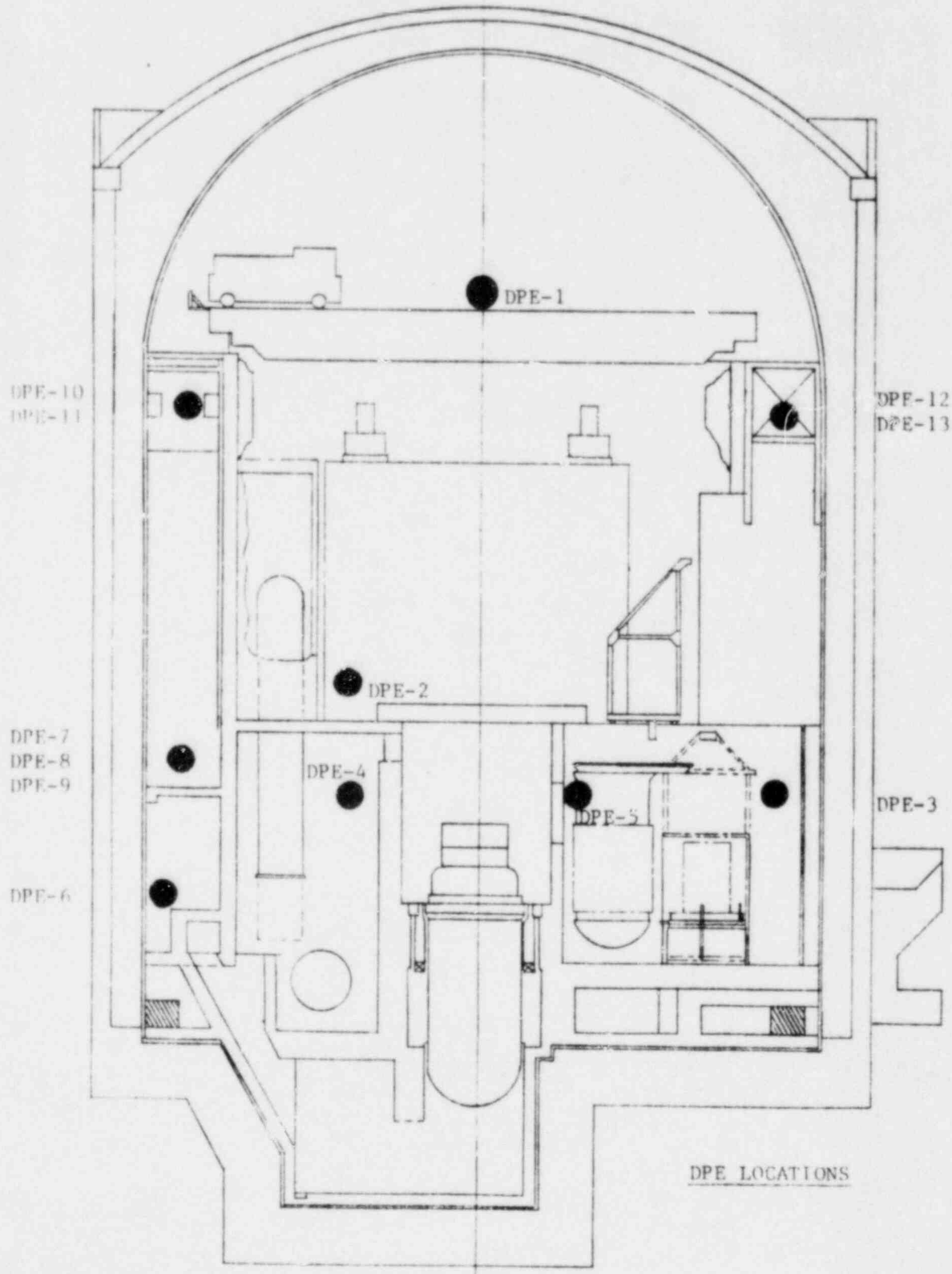


FIGURE 2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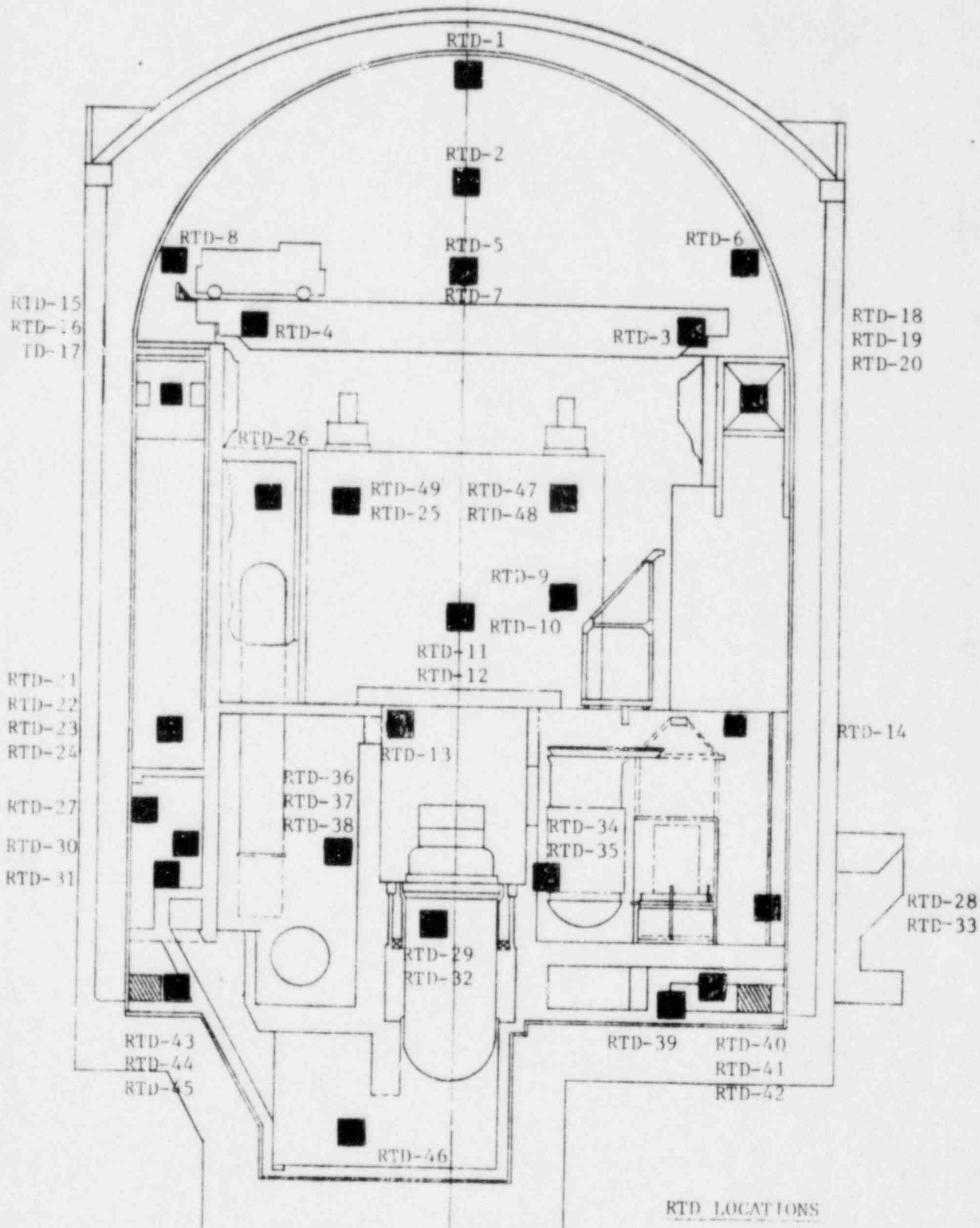
DPE-11
DPE-12
DPE-13
DPE-2
DPE-7
DPE-8
DPE-9
DPE-4
DPE-5
DPE-3
DPE-6
DPE LOCATIONS

FIGURE 3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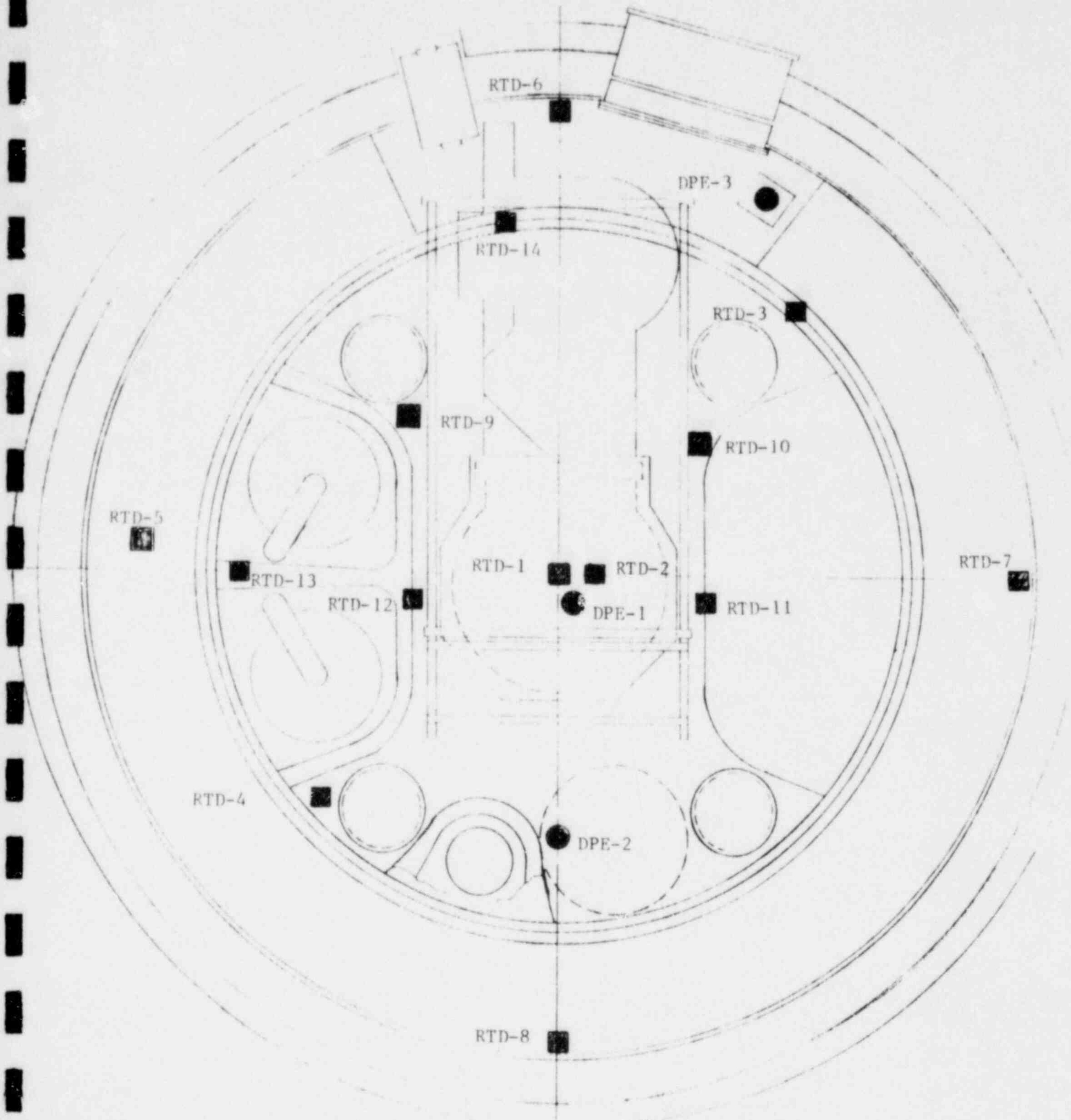
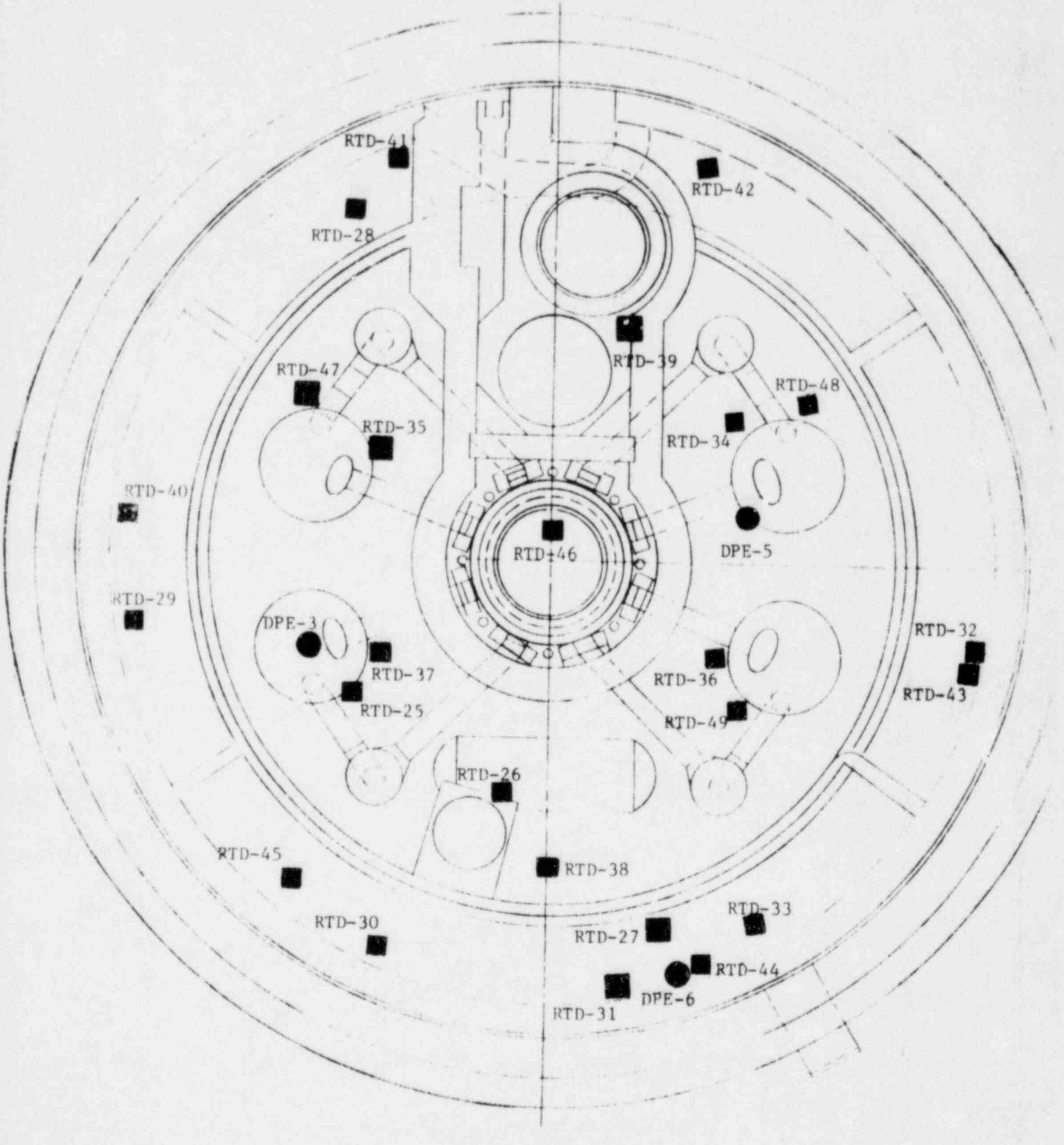
RTD-2
RTD-8
RTD-5
RTD-6
RTD-7
RTD-15
RTD-16
TD-17
RTD-4
RTD-3
RTD-18
RTD-19
RTD-20
RTD-26
RTD-49
RTD-25
RTD-47
RTD-48
RTD-9
RTD-10
RTD-11
RTD-12
RTD-21
RTD-22
RTD-23
RTD-24
RTD-13
RTD-14
RTD-36
RTD-37
RTD-38
RTD-27
RTD-30
RTD-31
RTD-34
RTD-35
RTD-28
RTD-33
RTD-29
RTD-32
RTD-43
RTD-44
RTD-45
RTD-39
RTD-40
RTD-41
RTD-42
RTD-46
RTD LOCATIONS

FIGURE 4



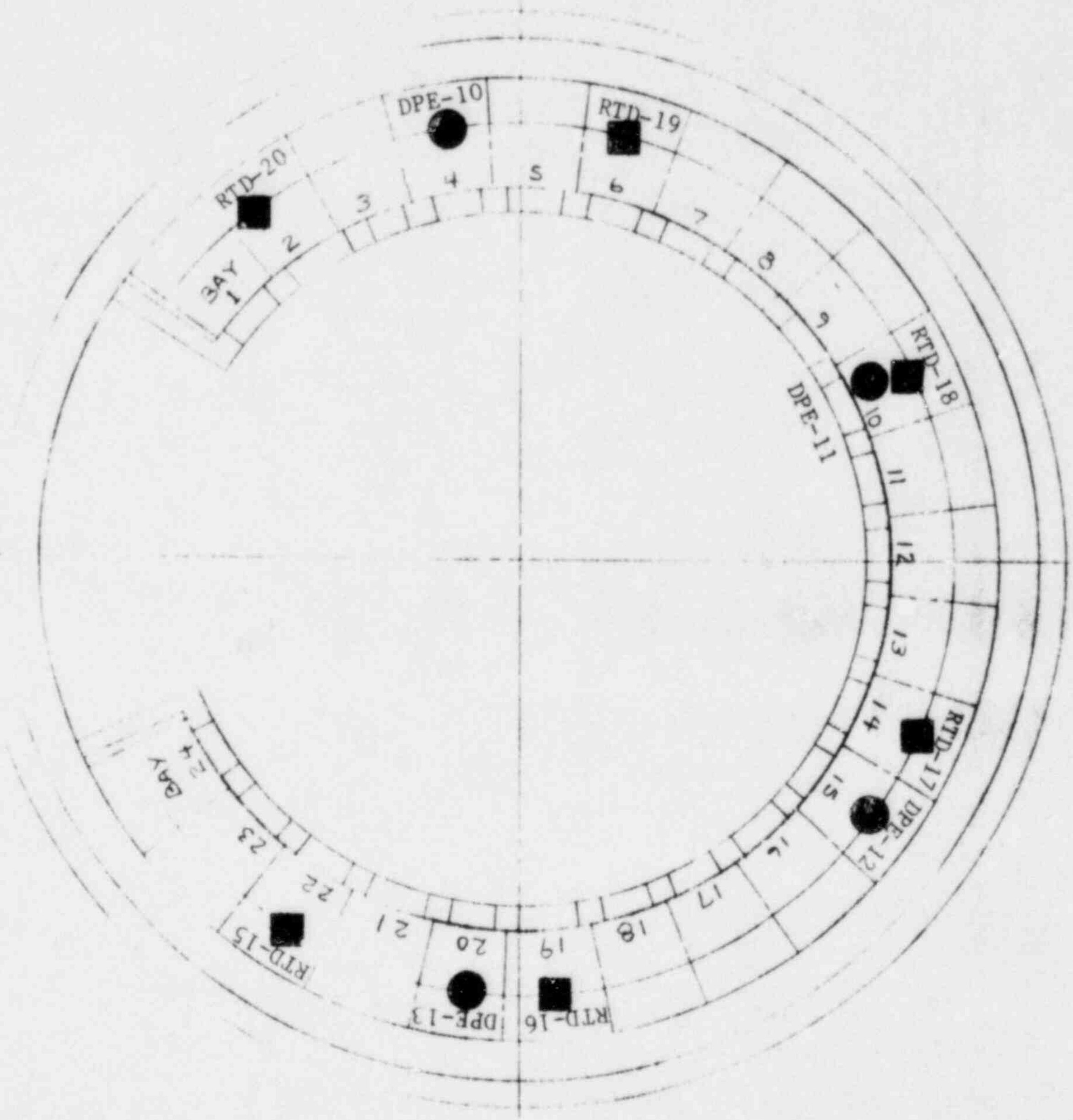
PLAN-UPPER COMPARTMENT
SENSOR LOCATIONS

FIGURE 5



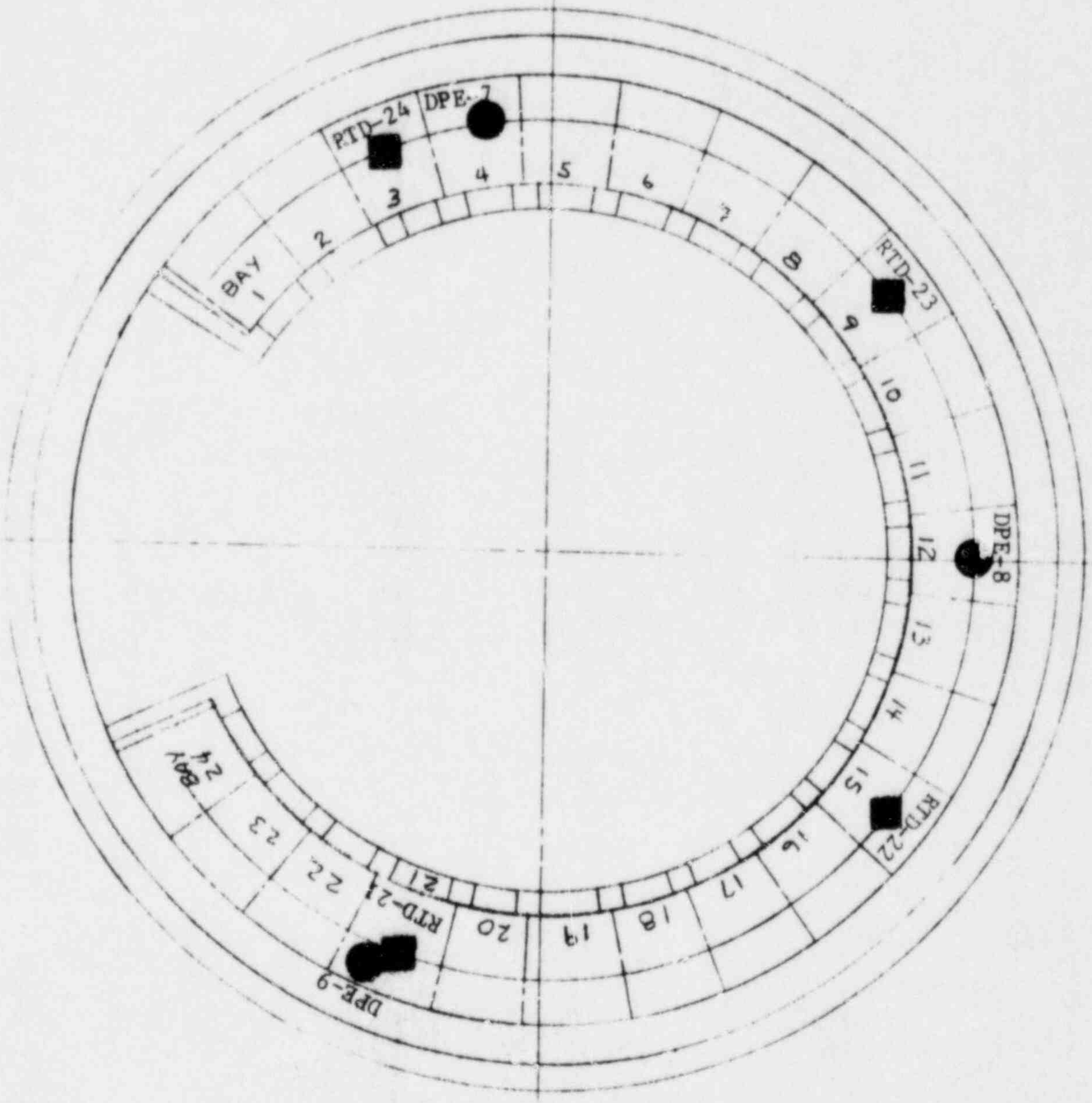
PLAN-LOWER COMPARTMENT
SENSOR LOCATIONS

FIGURE 6



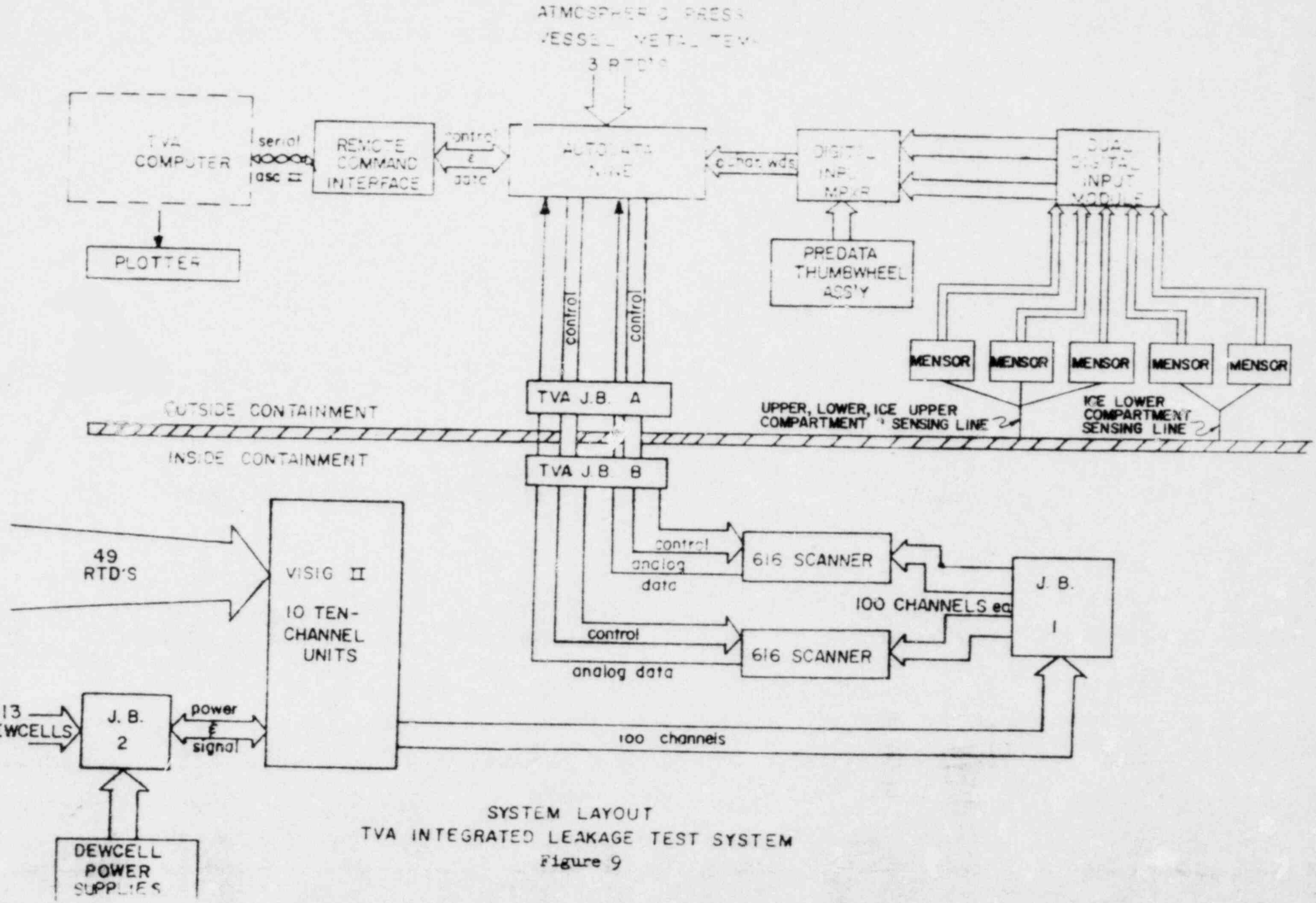
UPPER ICE COMPARTMENT

FIGURE 7



LOWER ICE COMPARTMENT

FIGURE 8



SYSTEM LAYOUT
TVA INTEGRATED LEAKAGE TEST SYSTEM
Figure 9

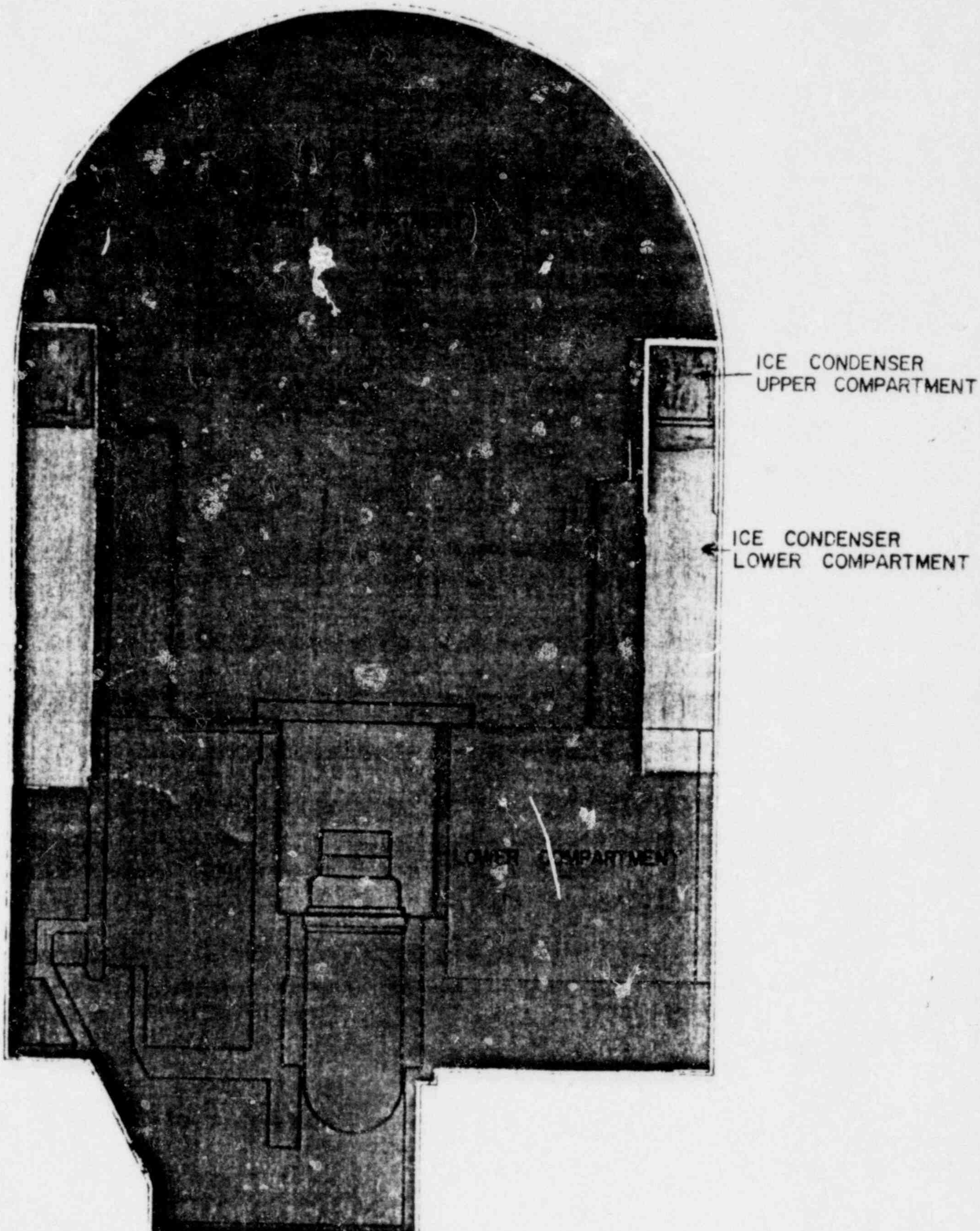

ICE CONDENSER
UPPER COMPARTMENT
ICE CONDENSER
LOWER COMPARTMENT
LOWER COMPARTMENT

Figure 10

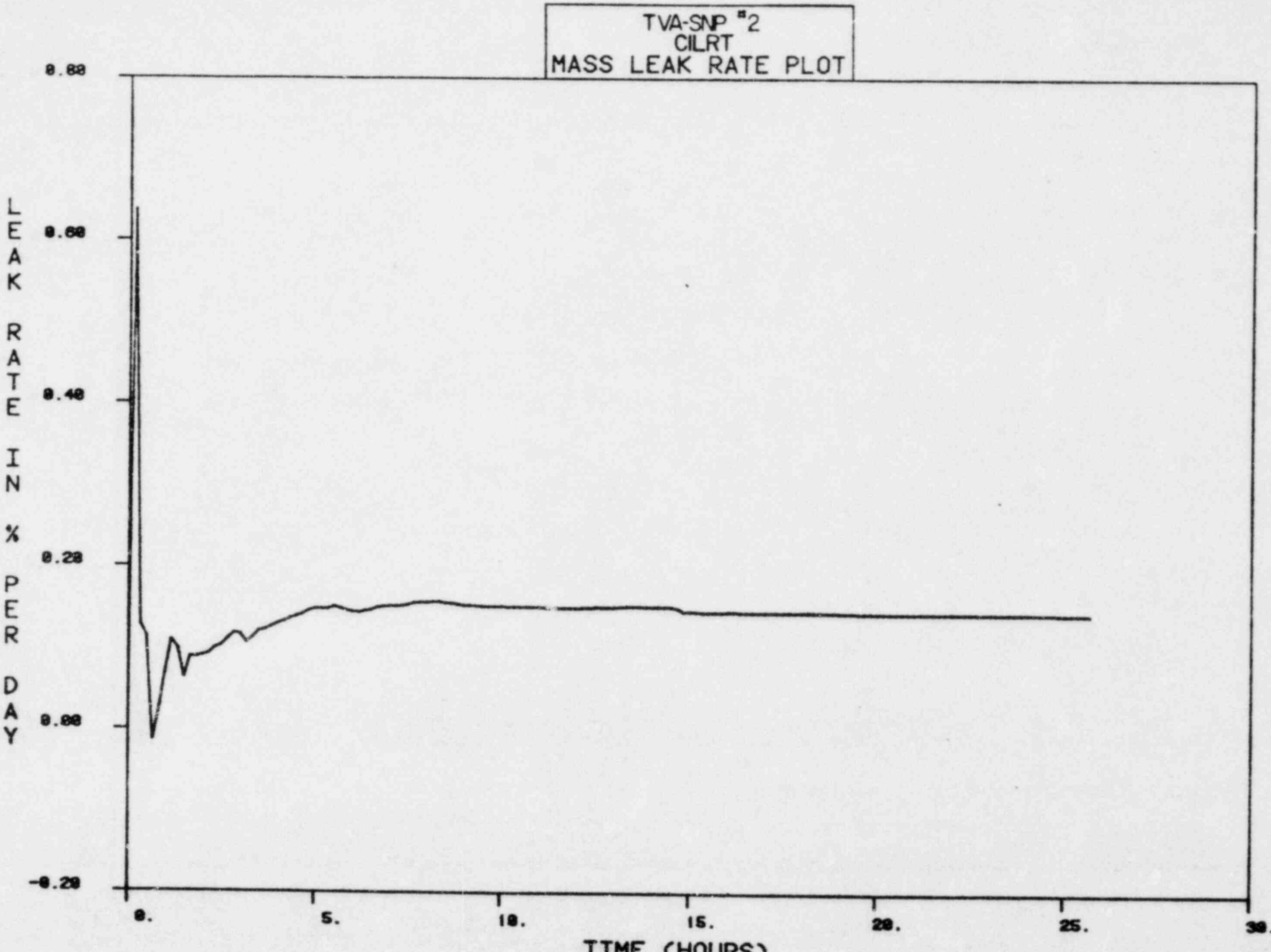

TVA-SNP #2
CILRT
MASS LEAK RATE PLOT
LEAK RATE IN % PER DAY
0.80
0.60
0.40
0.20
0.00
-0.20
0.
5.
10.
15.
20.
25.
30.
TIME (HOURS)

FIGURE 11

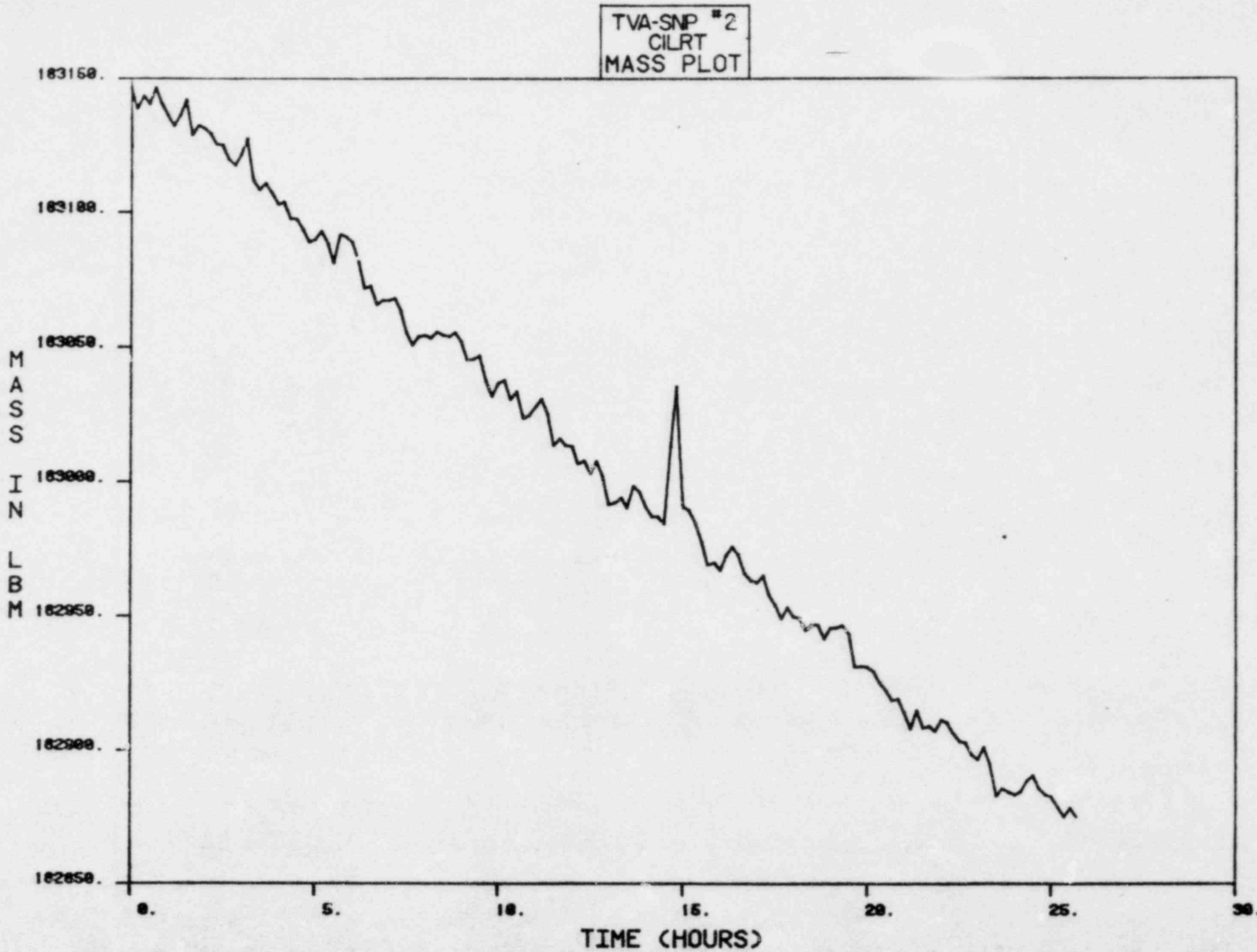

TVA-SNP #2
CILRT
MASS PLOT
183150.
183100.
183050.
183000.
182950.
182900.
182850.
MASS IN LBM
0.
5.
10.
15.
20.
25.
30.
TIME (HOURS)

FIGURE 12

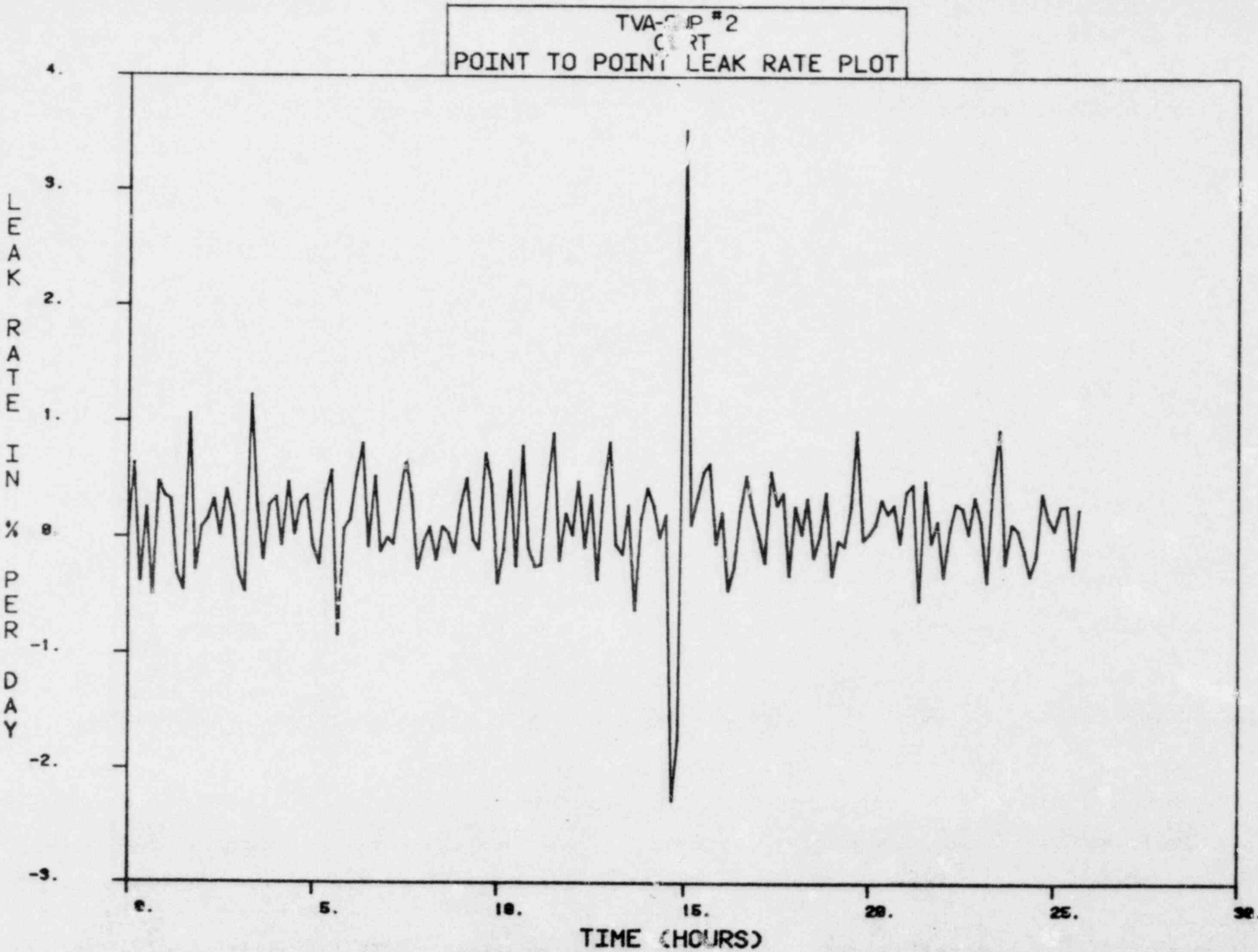

POINT TO POINT LEAK RATE PLOT
LEAK RATE IN % PER DAY
TIME (HOURS)
4.
3.
2.
1.
0.
-1.
-2.
-3.
0.
5.
10.
15.
20.
25.
30.

FIGURE 13

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
TOTAL TIME LEAK RATE
% PER DAY

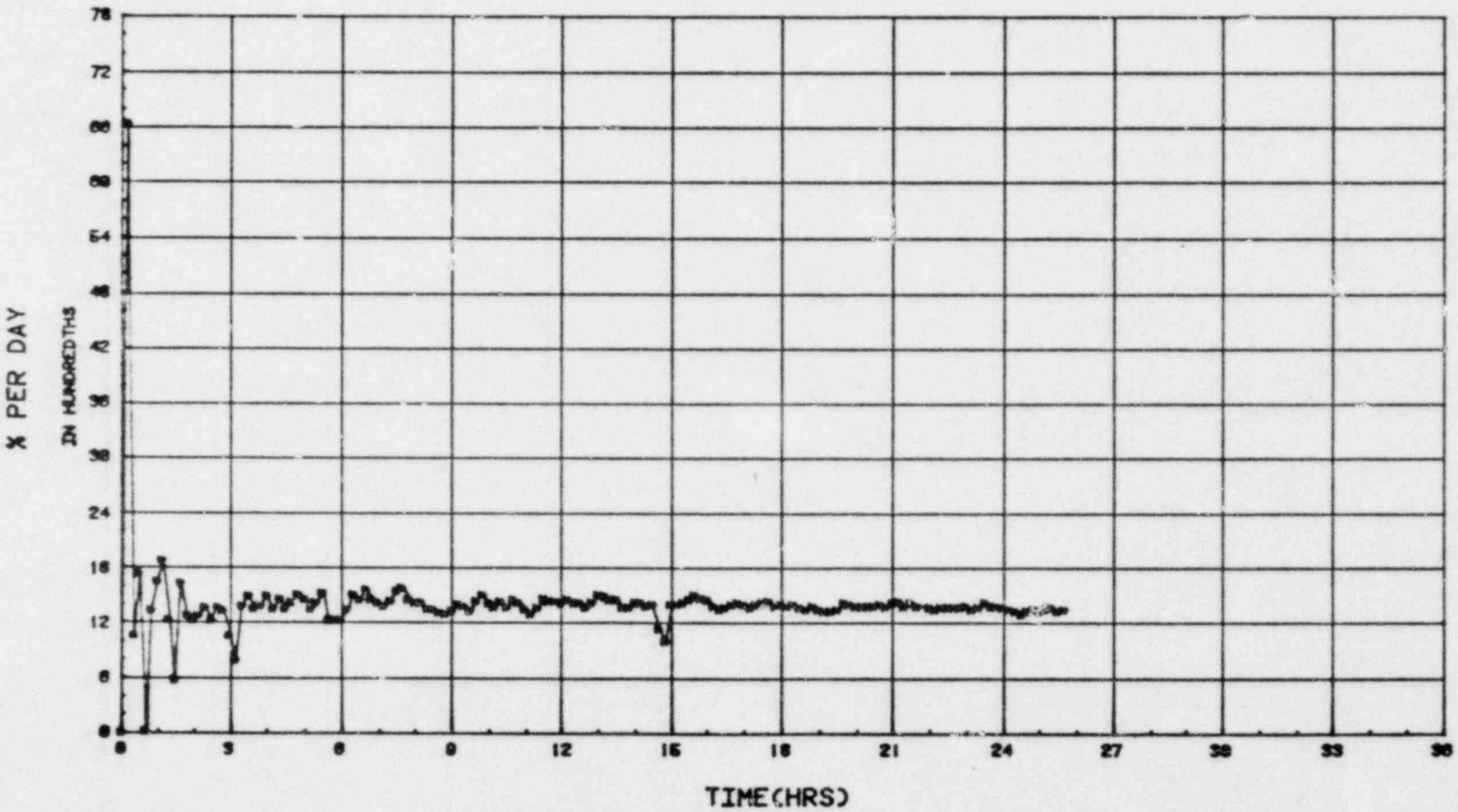


FIGURE 14

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
MASS PLOT
UPPER COMPARTMENT

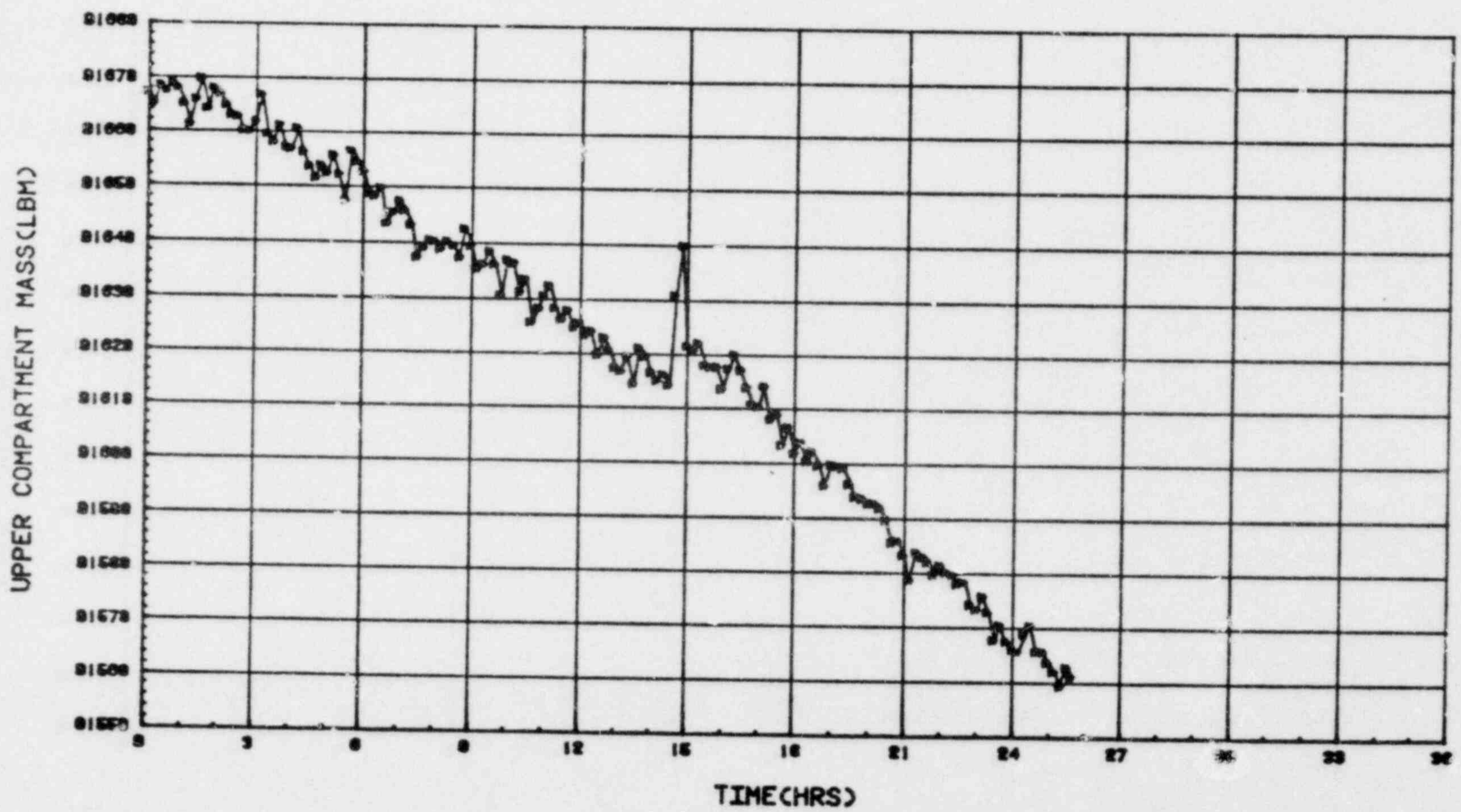


FIGURE 15

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
MASS PLOT
LOWER COMPARTMENT

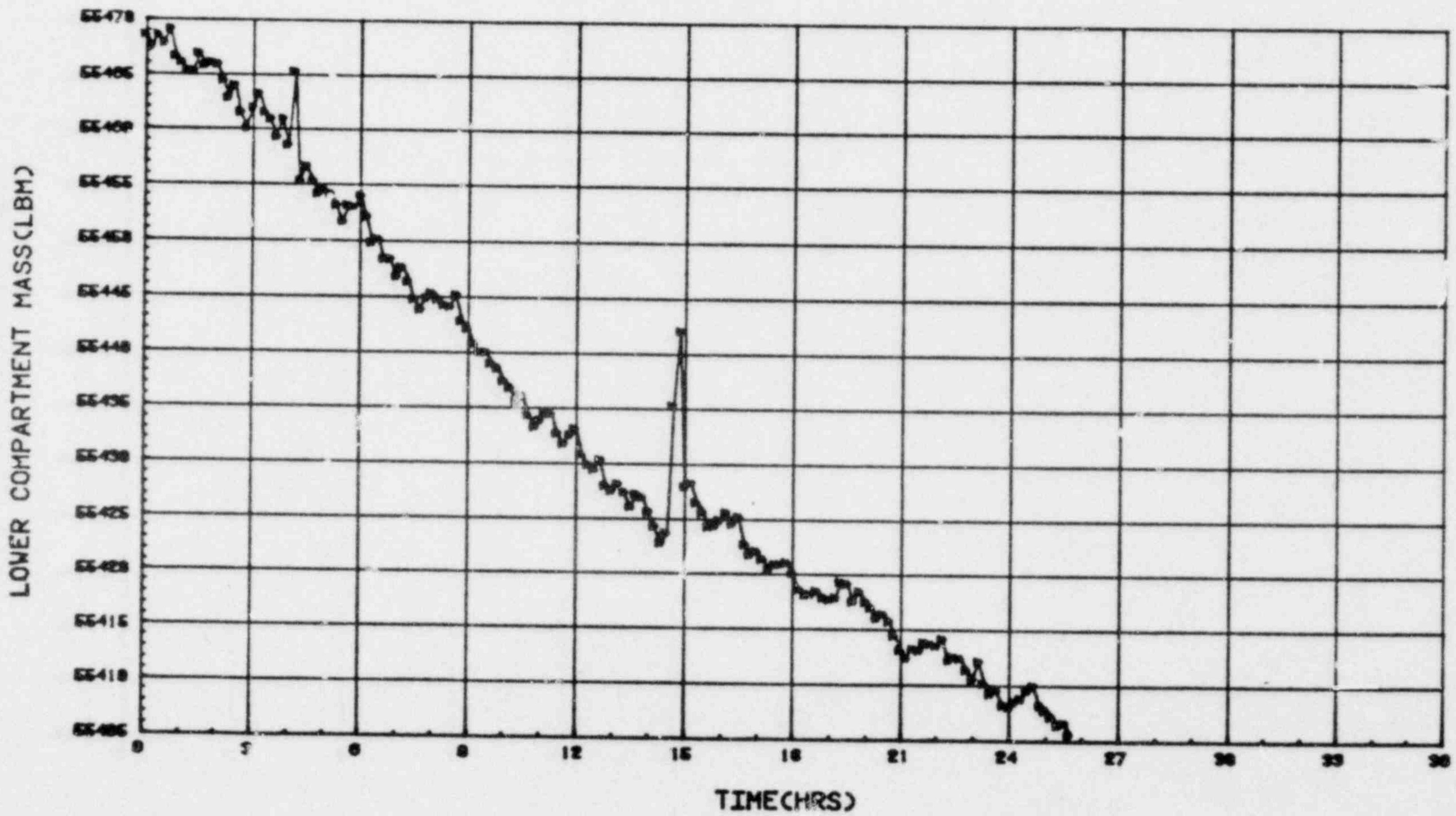


FIGURE 16

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
MASS PLOT
UPPER ICE COMPARTMENT

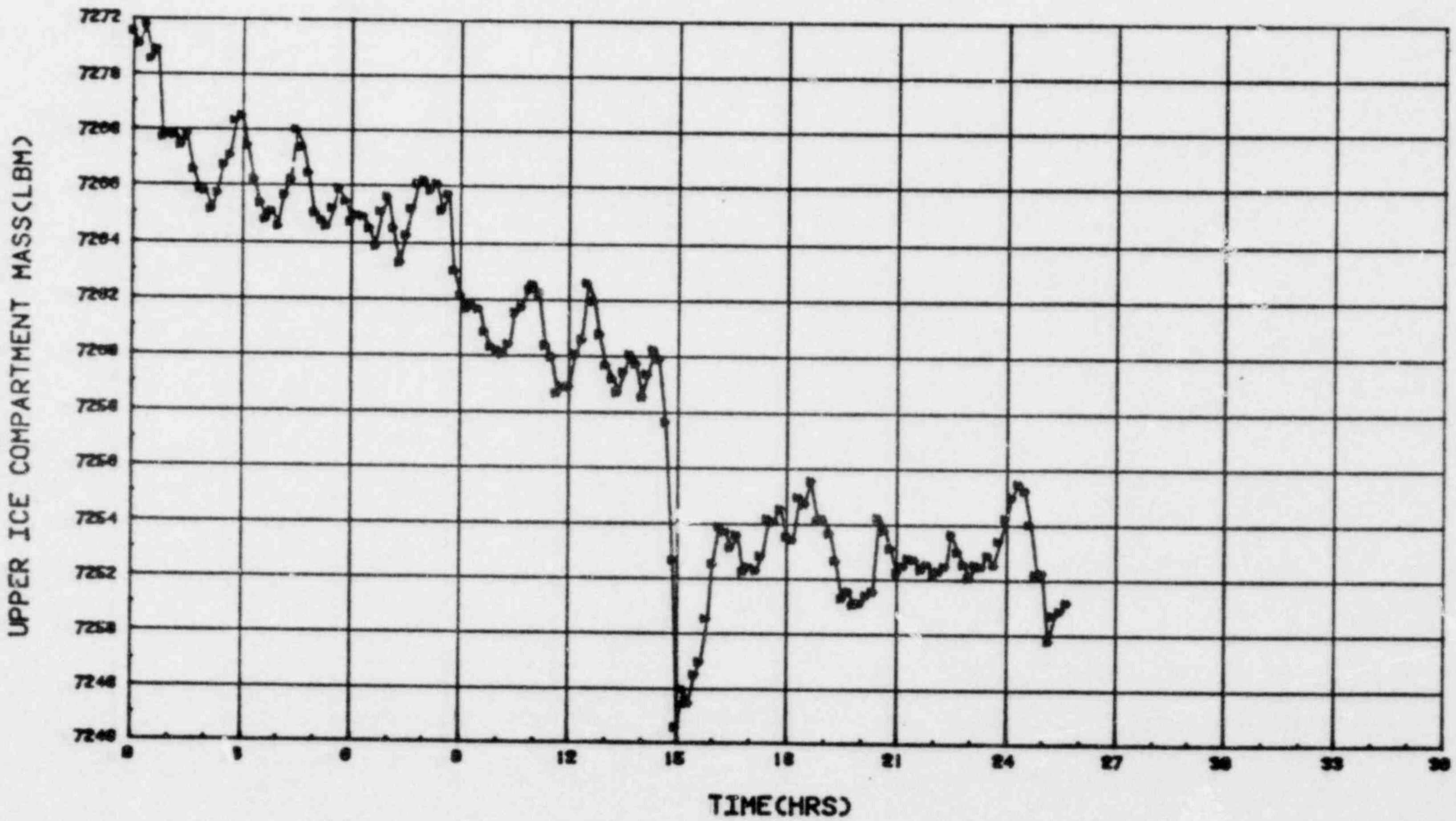
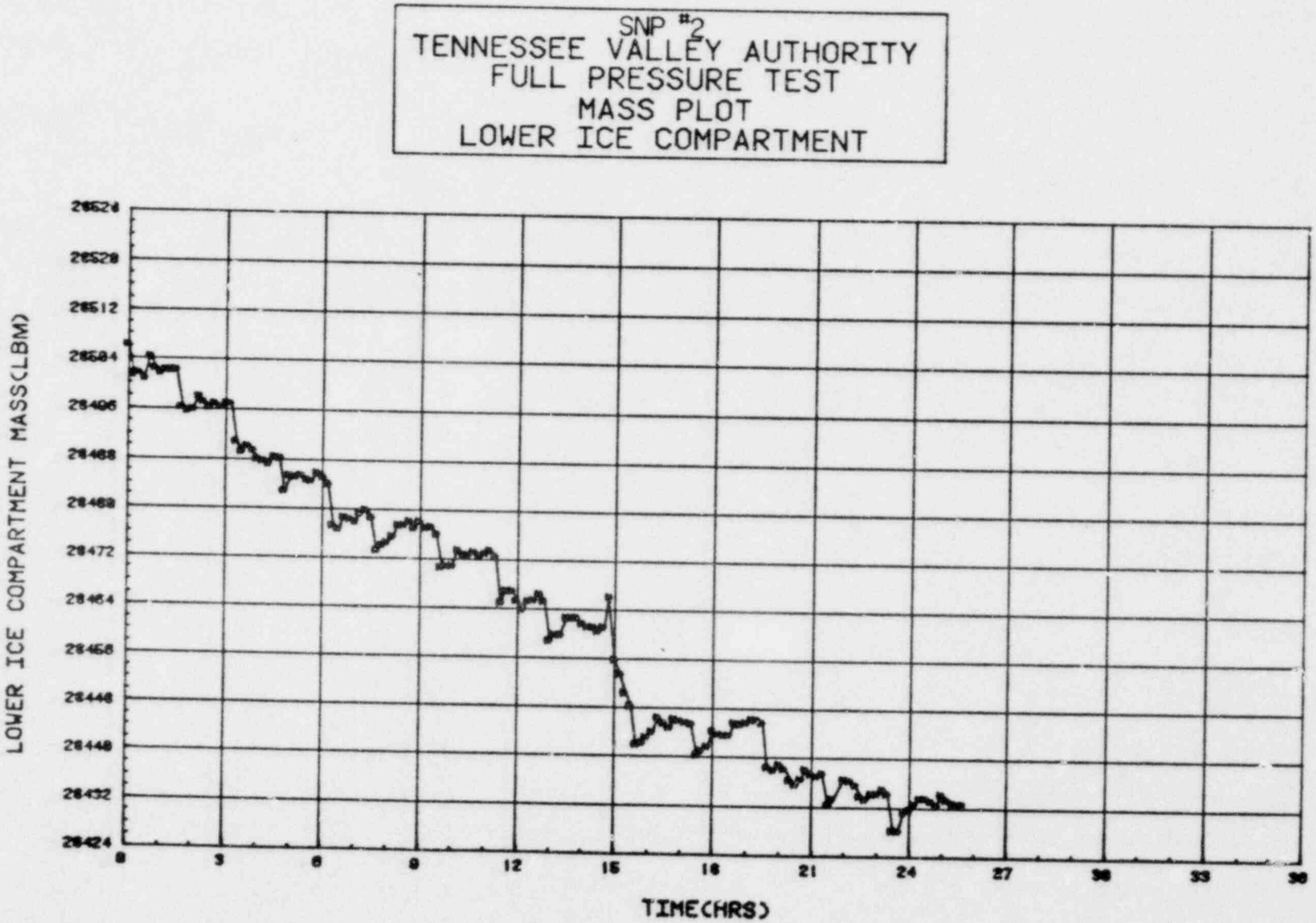


FIGURE 17



SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
MASS PLOT
LOWER ICE COMPARTMENT
LOWER ICE COMPARTMENT MASS(LBM)
28528
28520
28512
28504
28496
28488
28480
28472
28464
28456
28448
28440
28432
28424
0
3
6
9
12
15
18
21
24
27
30
33
36
TIME(HRS)

FIGURE 18

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
VAPOR PRESSURE PLOT
UPPER COMPARTMENT

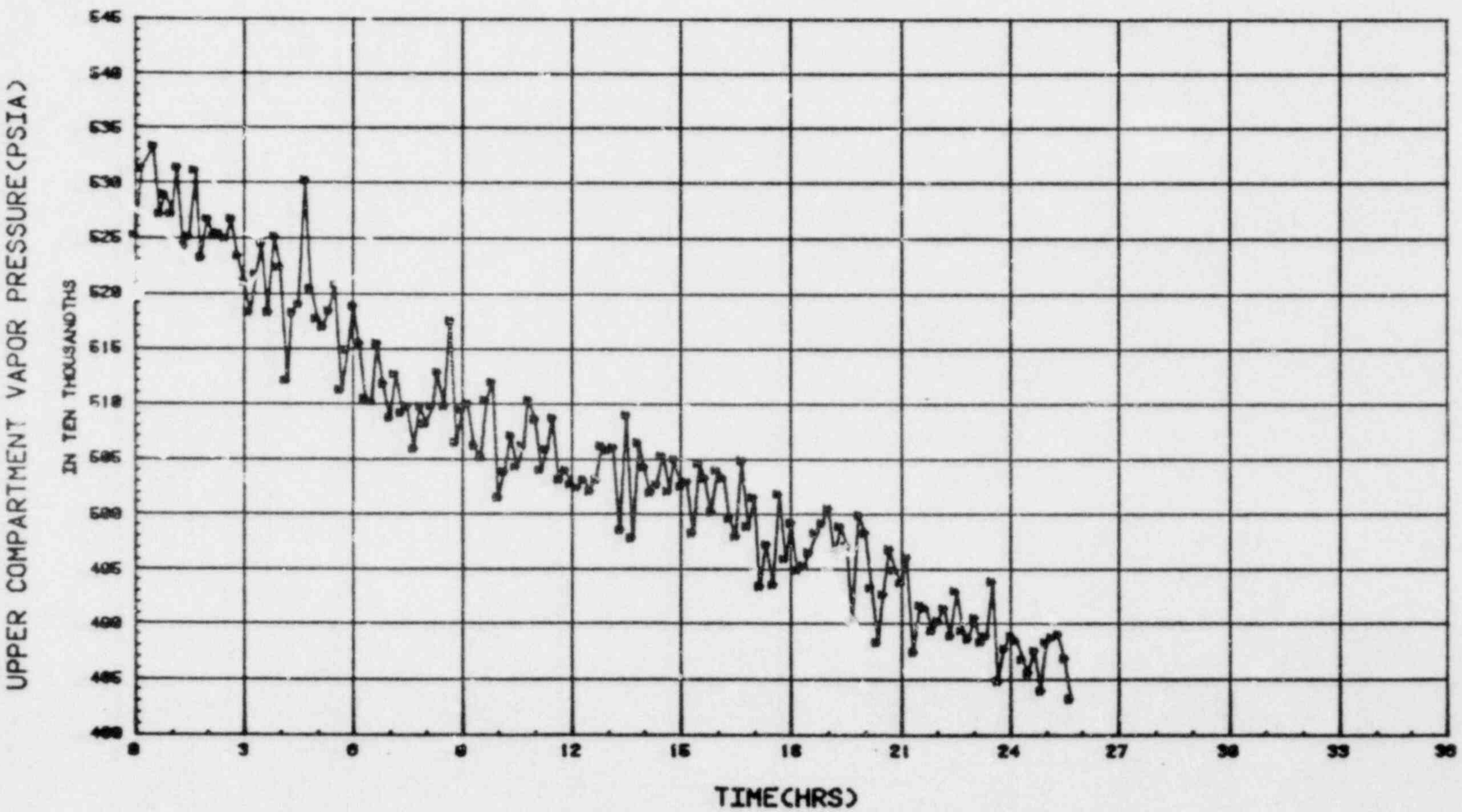


FIGURE 19

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
VAPOR PRESSURE PLOT
LOWER COMPARTMENT

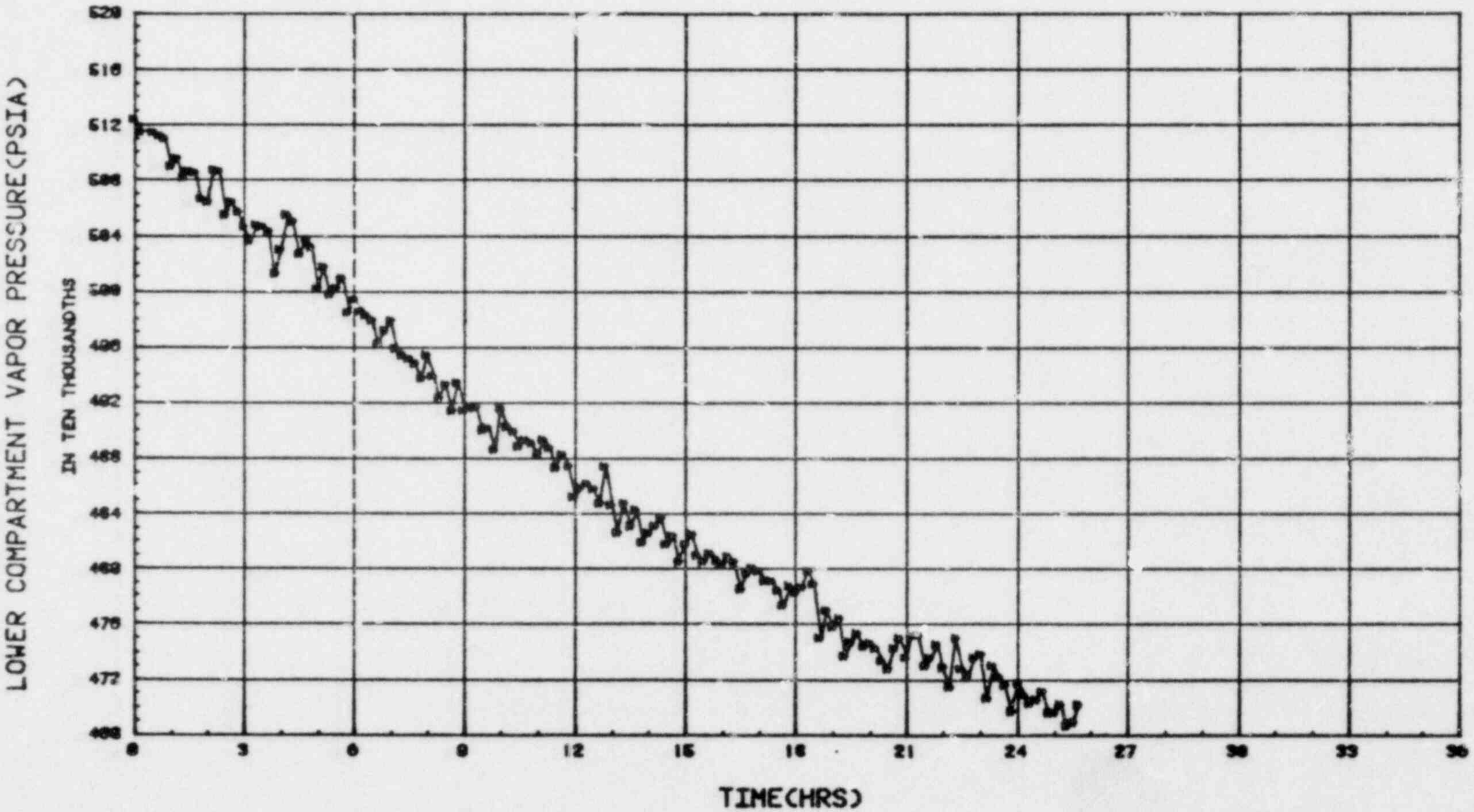


FIGURE 20

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
VAPOR PRESSURE PLOT
UPPER ICE COMPARTMENT

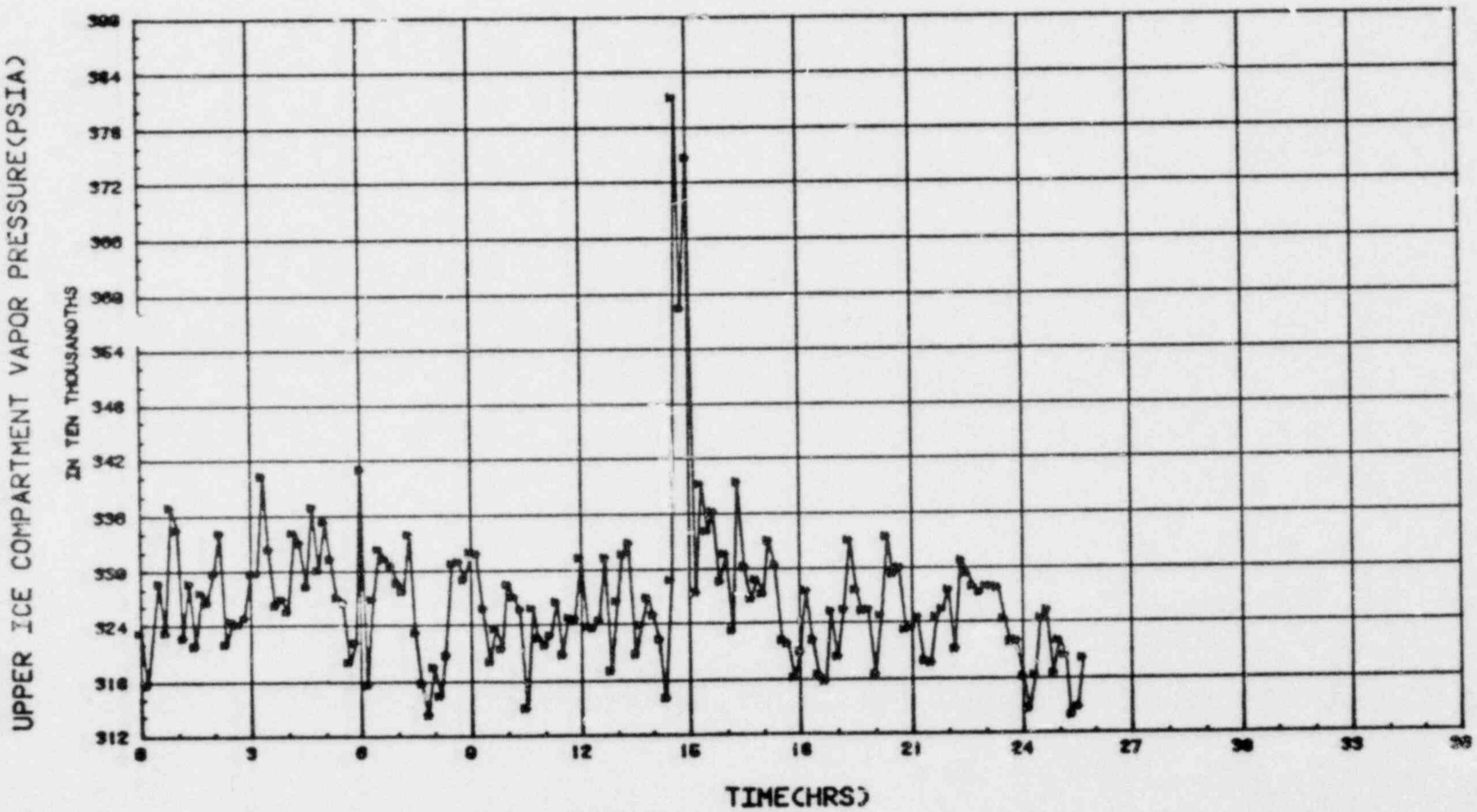


FIGURE 21

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
VAPOR PRESSURE PLOT
LOWER ICE COMPARTMENT

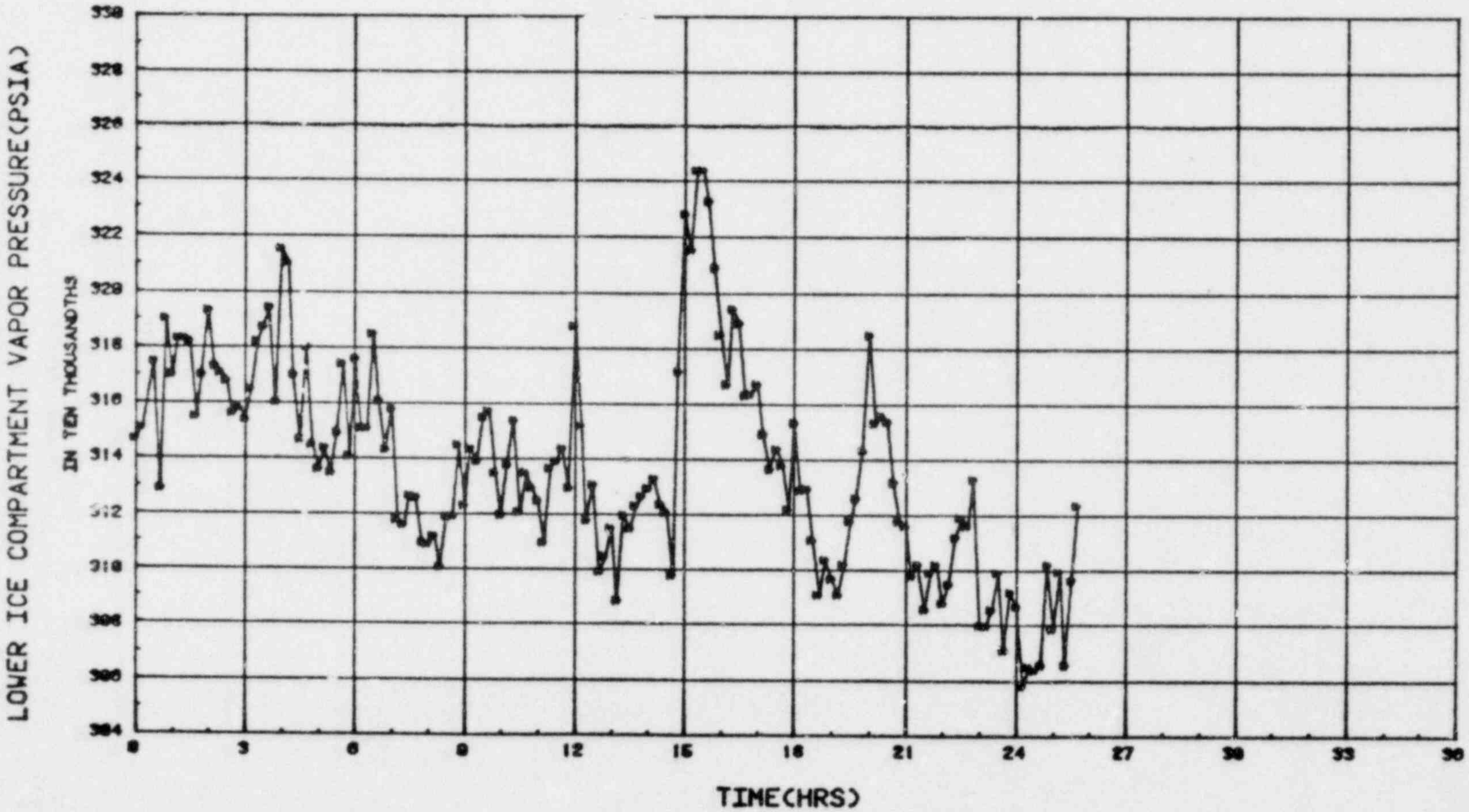


FIGURE 22

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
TEMPERATURE PLOT
UPPER COMPARTMENT

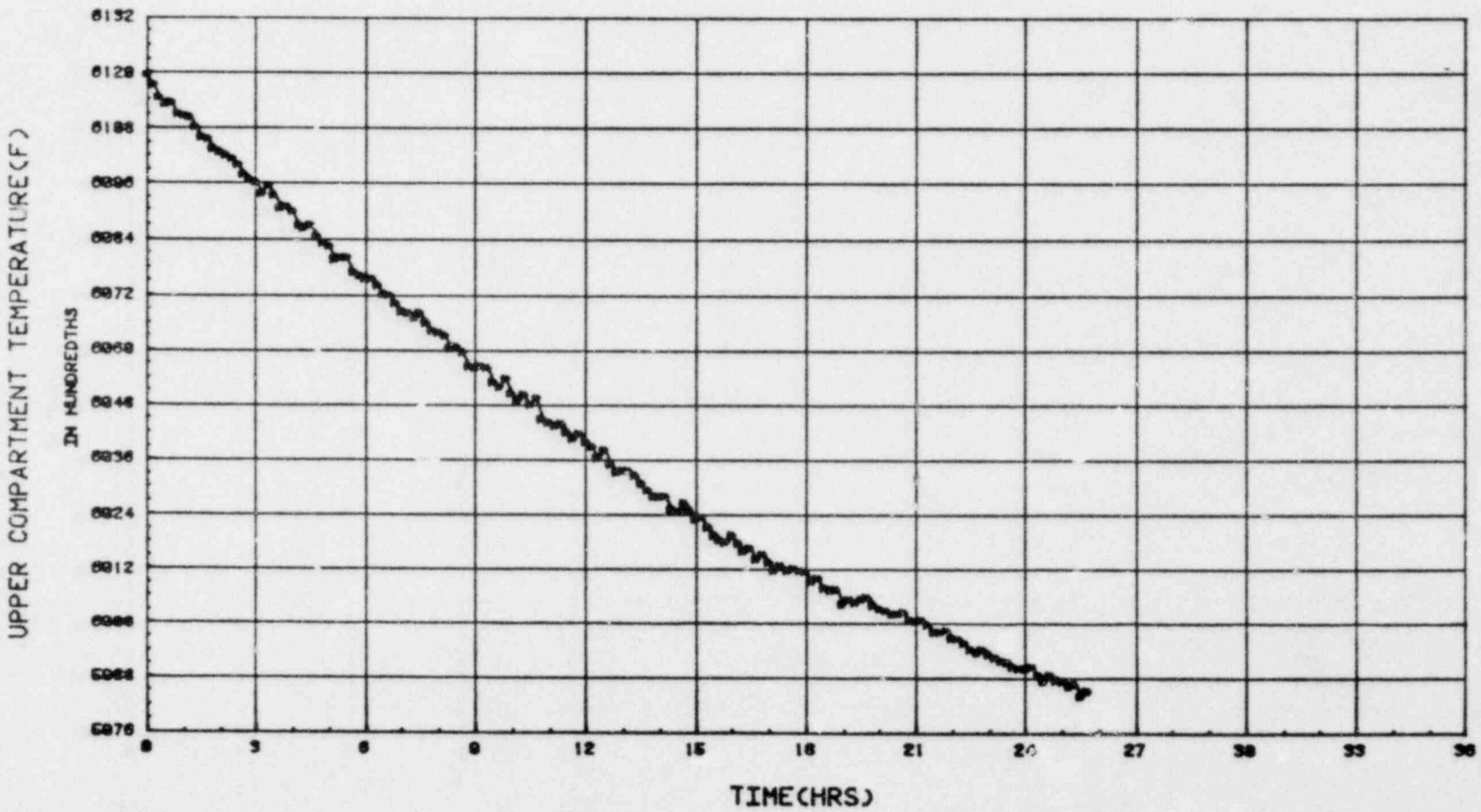


FIGURE 23

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
TEMPERATURE PLOT
LOWER COMPARTMENT

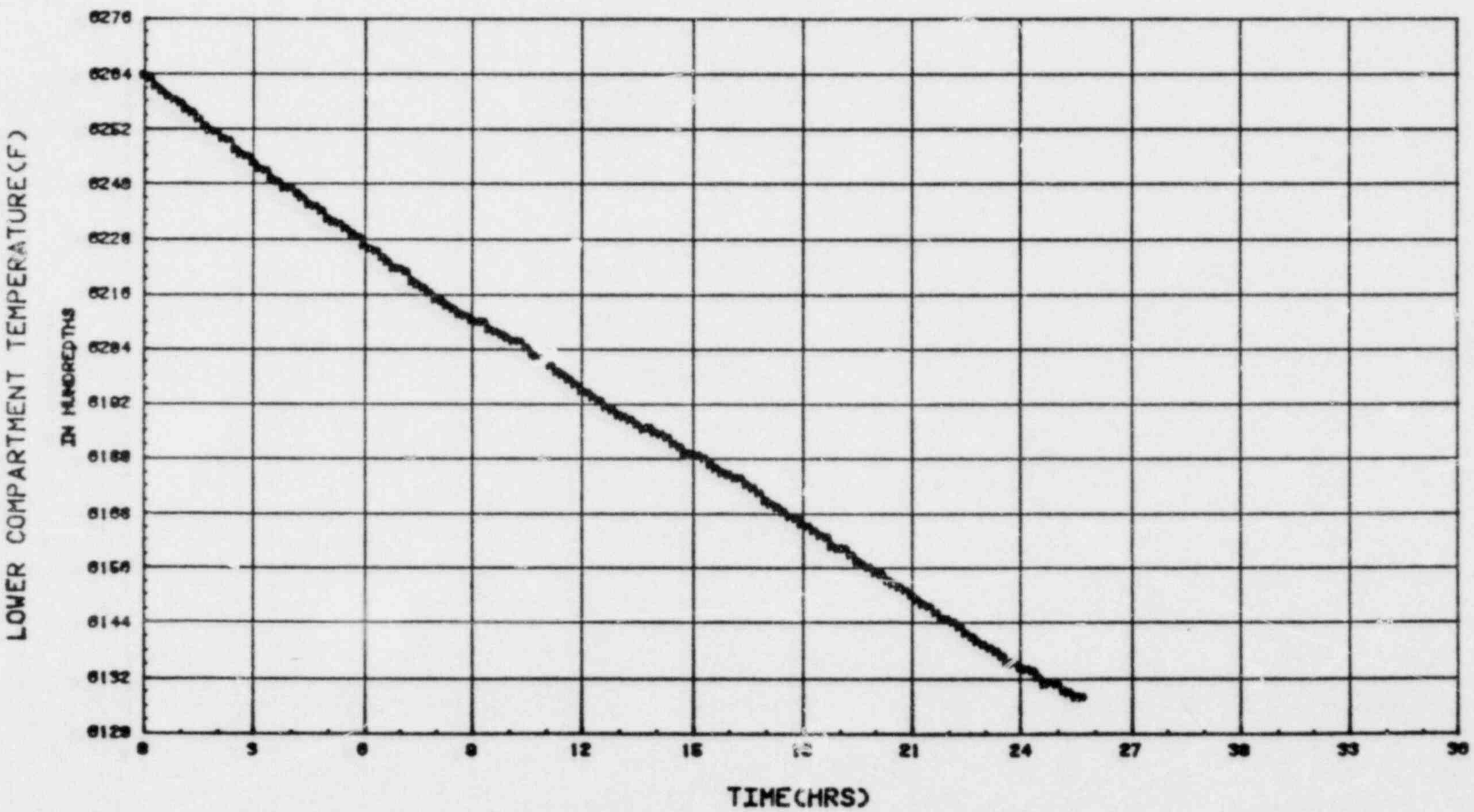
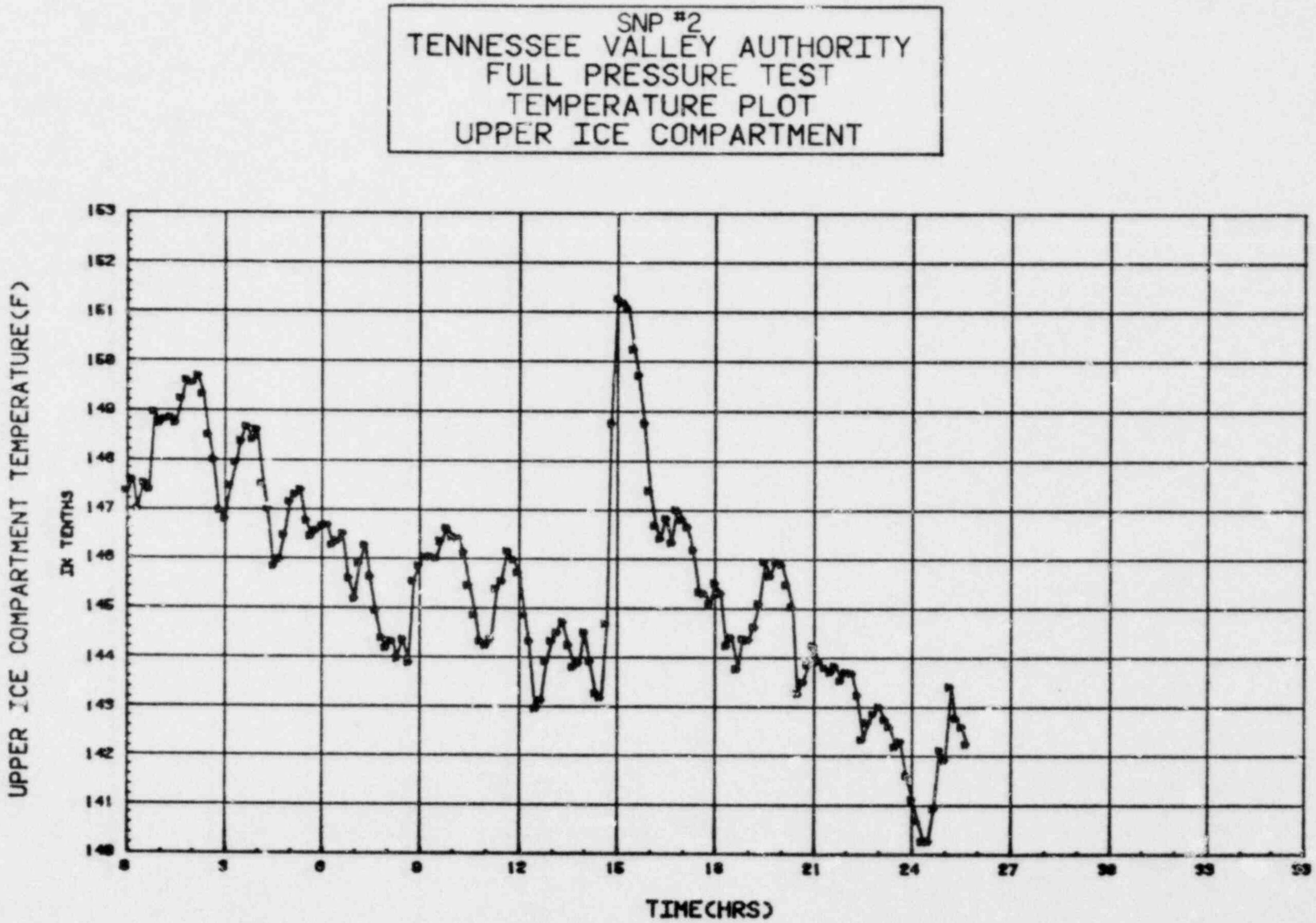


FIGURE 24



SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
TEMPERATURE PLOT
UPPER ICE COMPARTMENT
UPPER ICE COMPARTMENT TEMPERATURE(F)
IN TENTHS
153
152
151
150
149
148
147
146
145
144
143
142
141
140
0
3
6
9
12
15
18
21
24
27
30
TIME(HRS)

FIGURE 25

SNP #2
TENNESSEE VALLEY AUTHORITY
FULL PRESSURE TEST
TEMPERATURE PLOT
LOWER ICE COMPARTMENT

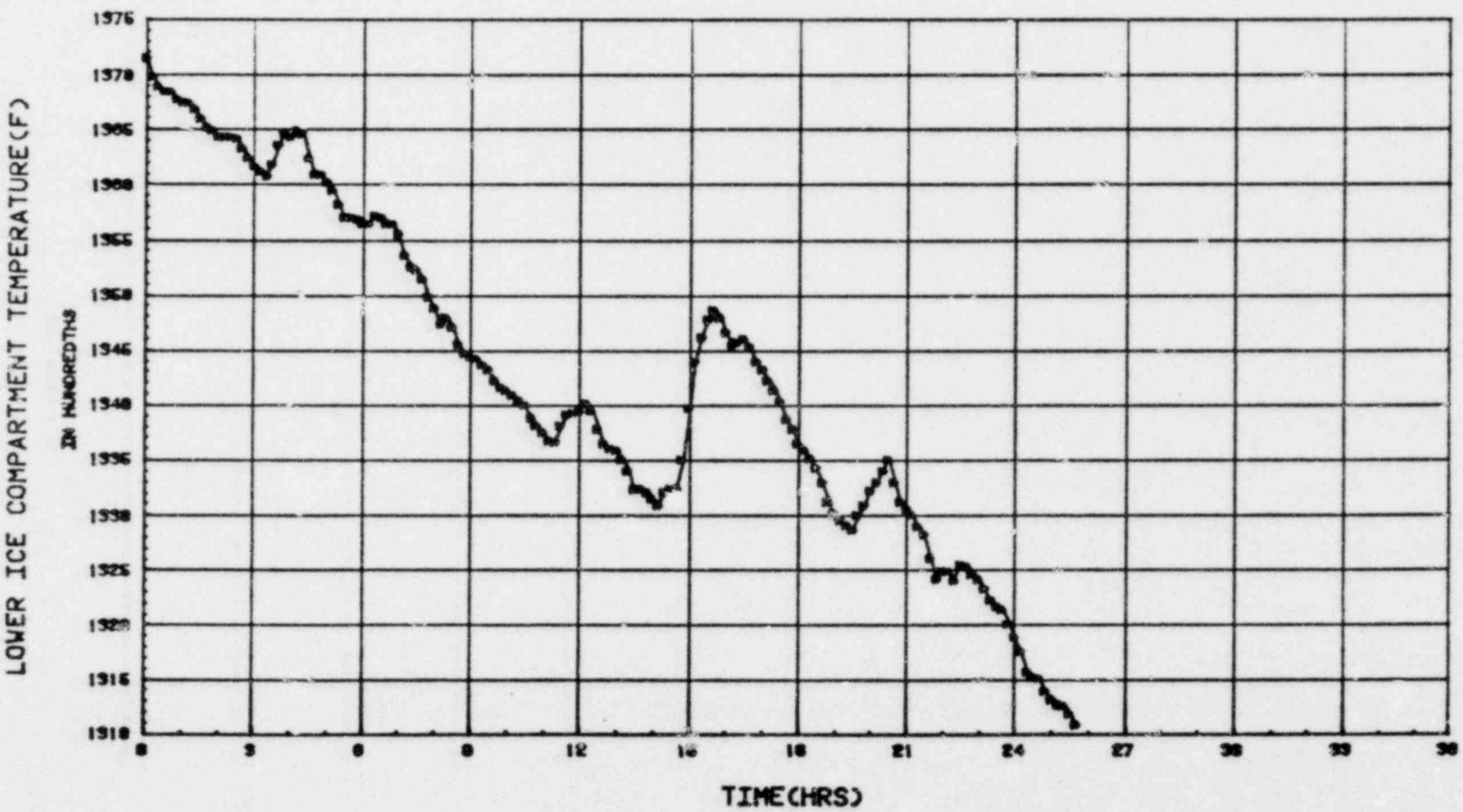


FIGURE 26

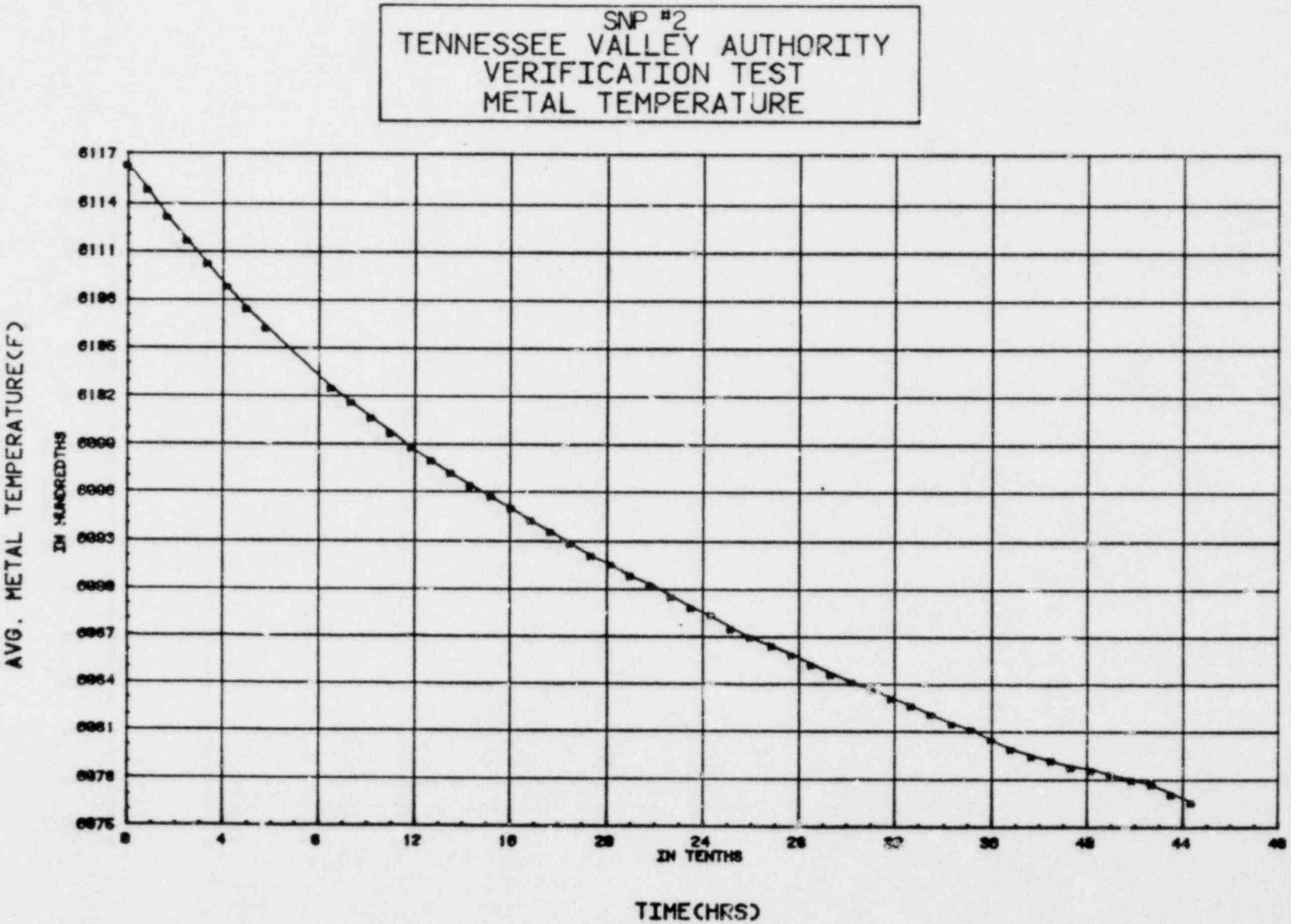

SNP #2
TENNESSEE VALLEY AUTHORITY
VERIFICATION TEST
METAL TEMPERATURE
AVG. METAL TEMPERATURE(F)
IN HUNDREDTHS
IN TENTHS
TIME(HRS)

FIGURE 27

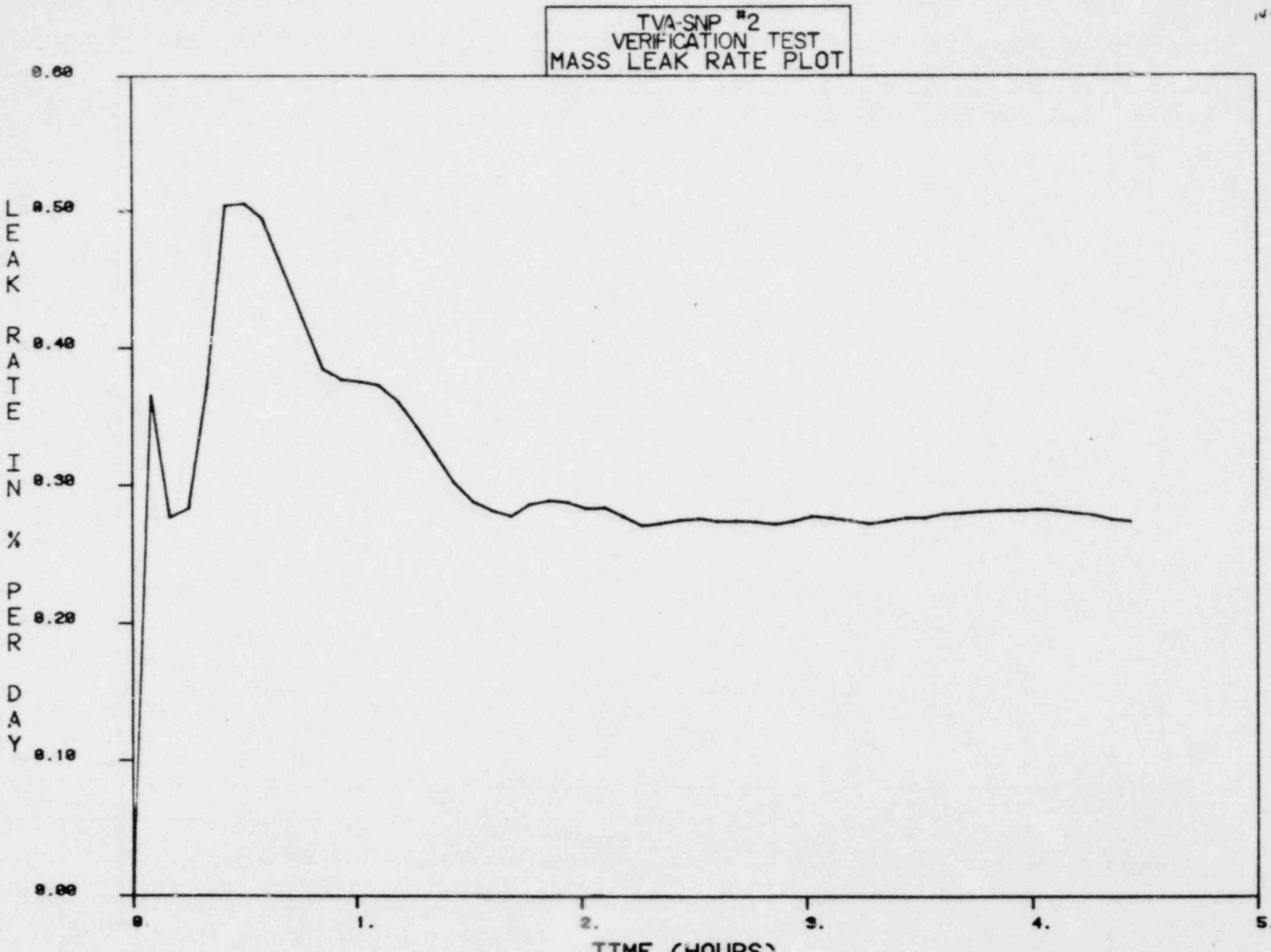
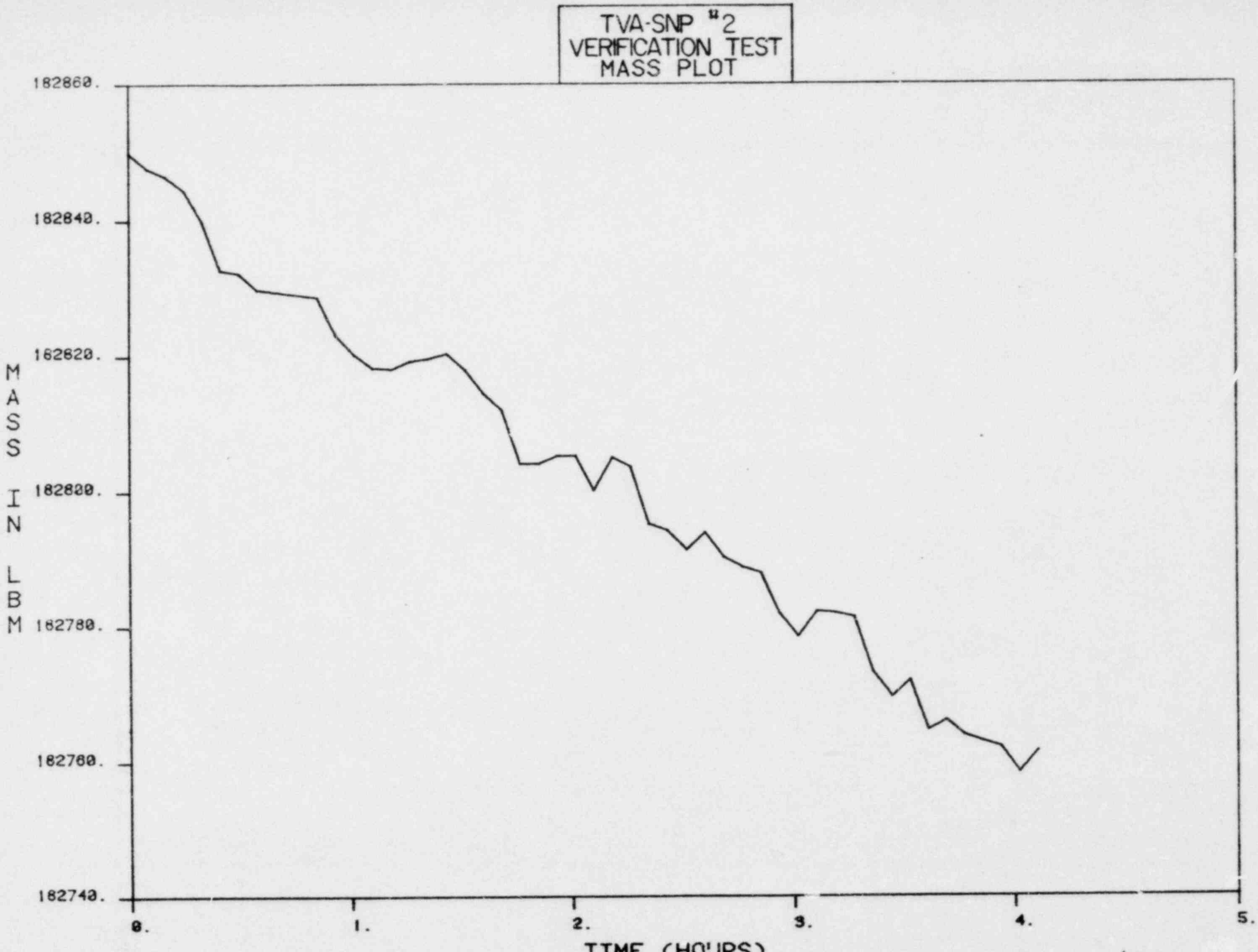

TVA-SNP #2
VERIFICATION TEST
MASS LEAK RATE PLOT
LEAK RATE IN % PER DAY
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.
1.
2.
3.
4.
5.
TIME (HOURS)

FIGURE 28


TVA-SNP #2
VERIFICATION TEST
MASS PLOT
182860.
182840.
182820.
182800.
182780.
182760.
182740.
MASS IN LBM
0.
1.
2.
3.
4.
5.
TIME (HOURS)
FIGURE 29

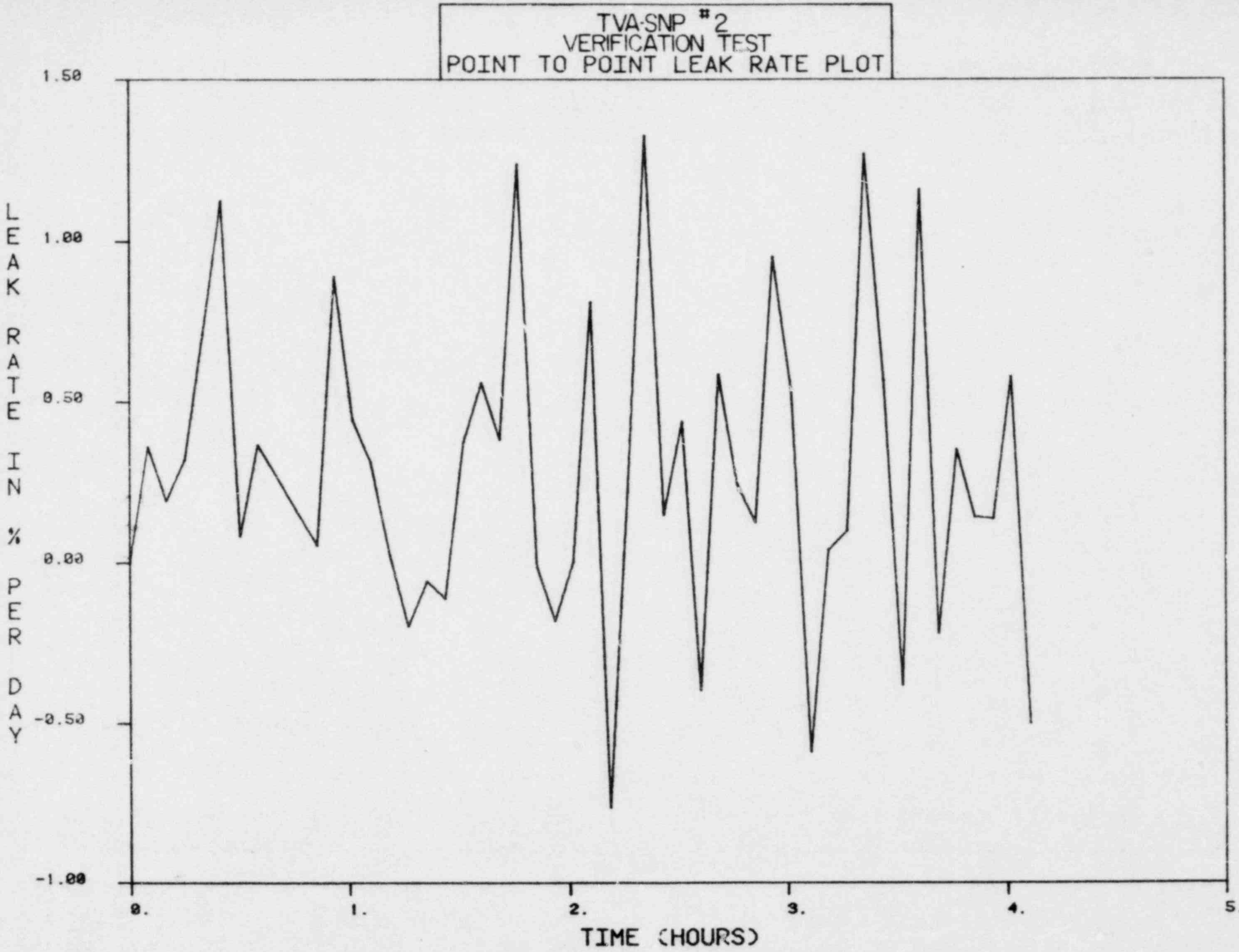

TVA-SNP #2
VERIFICATION TEST
POINT TO POINT LEAK RATE PLOT
LEAK RATE IN % PER DAY
1.50
1.00
0.50
0.00
-0.50
-1.00
0.
1.
2.
3.
4.
5.
TIME (HOURS)

FIGURE 30

SNP #2
TENNESSEE VALLEY AUTHORITY
VERIFICATION TEST
MASS PLOT
UPPER COMPARTMENT

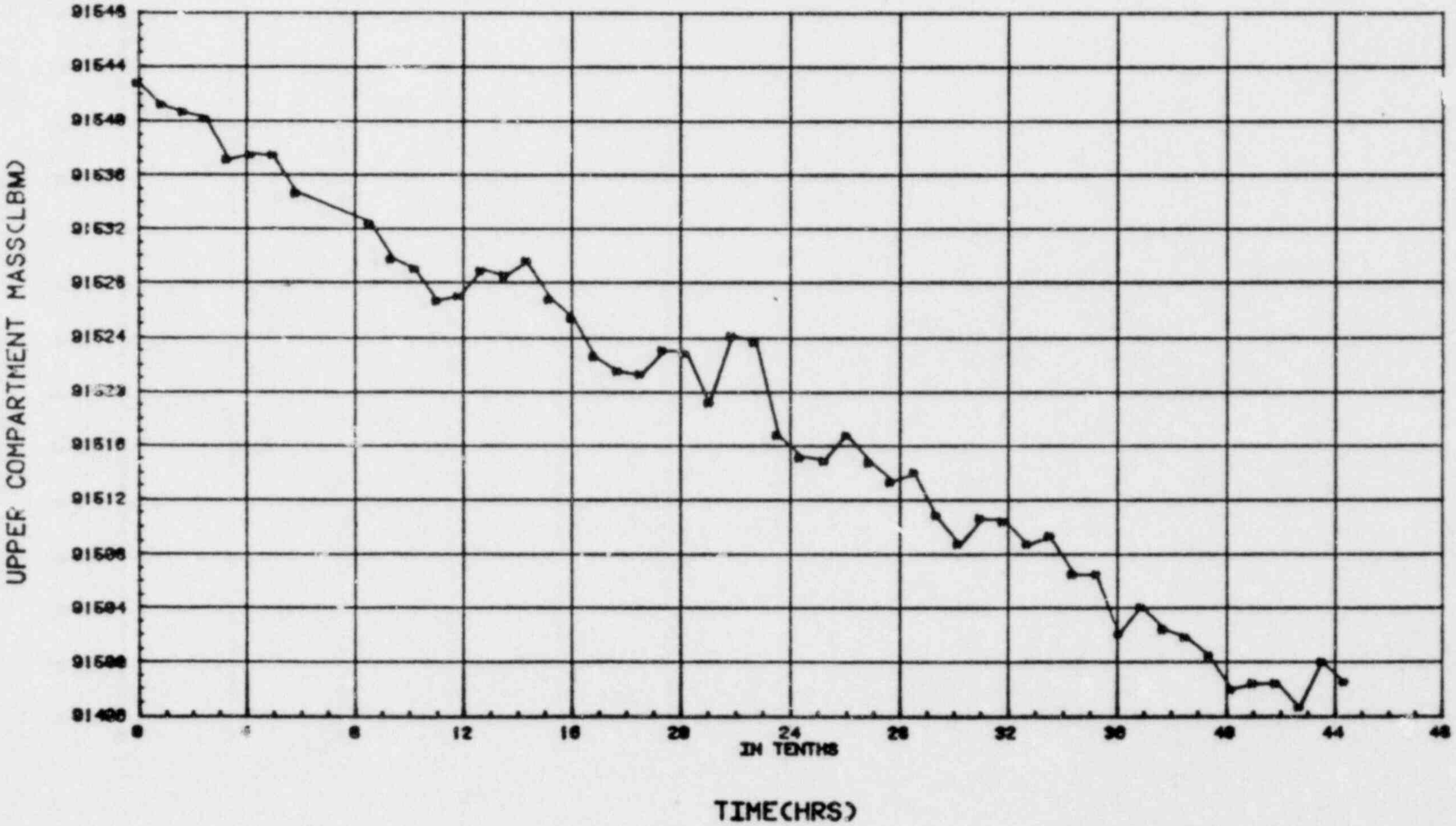


FIGURE 31

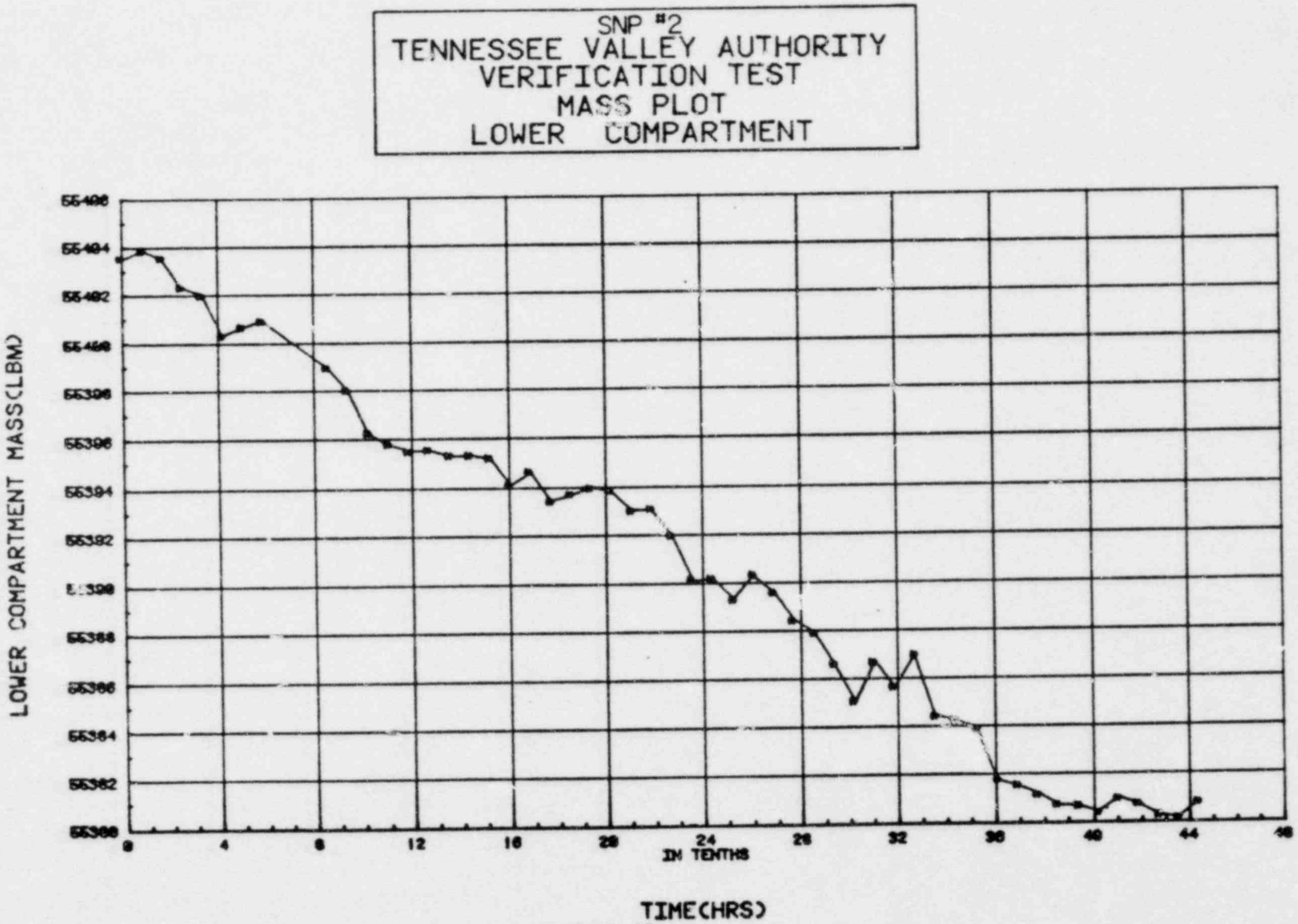

SNP #2
TENNESSEE VALLEY AUTHORITY
VERIFICATION TEST
MASS PLOT
LOWER COMPARTMENT
LOWER COMPARTMENT MASS(LBM)
55406
55404
55402
55400
55398
55396
55394
55392
55390
55388
55386
55384
55382
55380
0
4
8
12
16
20
24
IN TENTHS
28
32
36
40
44
48
TIME(HRS)

FIGURE 32

SNP #2
TENNESSEE VALLEY AUTHORITY
VERIFICATION TEST
MASS PLOT
UPPER ICE COMPARTMENT

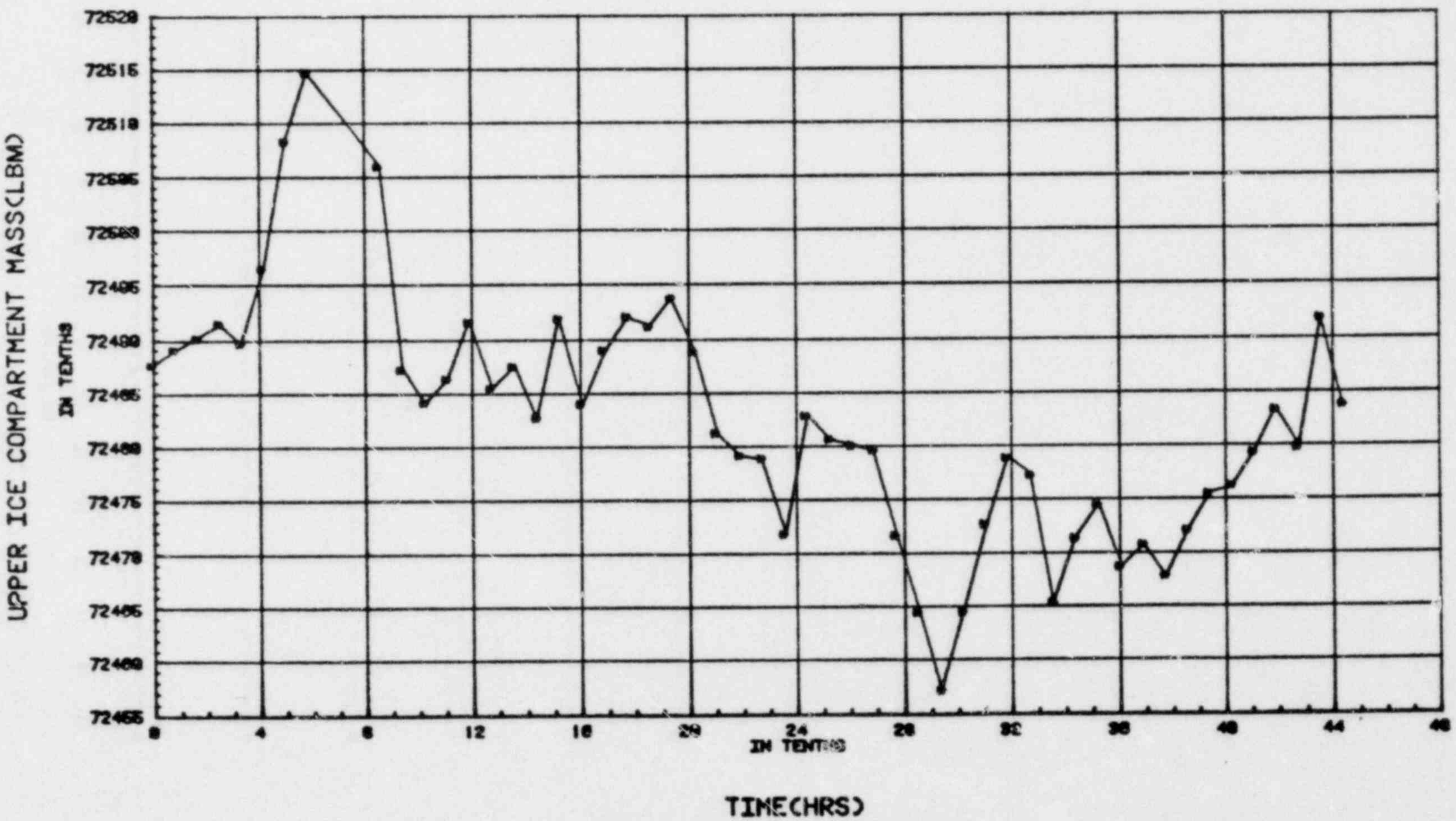


FIGURE 33

SNP #2
TENNESSEE VALLEY AUTHORITY
VERIFICATION TEST
MASS PLOT
LOWER ICE COMPARTMENT

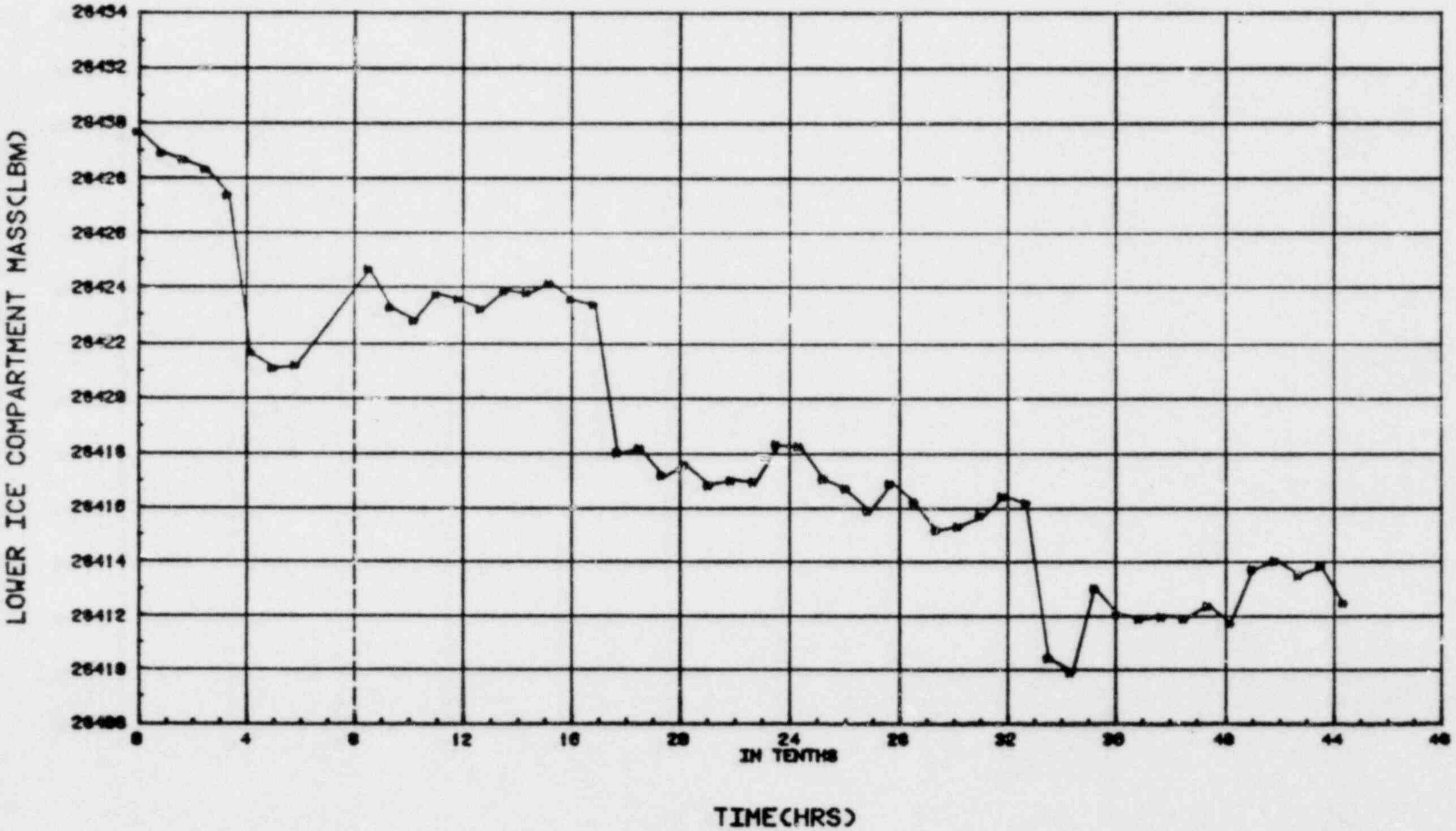


FIGURE 34

APPENDICES

APPENDIX A
ERROR ANALYSIS

Equations and derivations for these equations can be found in Appendix G of Proposed ANSI N-247/ANS-56.8, Draft 1, Revision 3, June 25, 1976.

Assumed conditions at the time of test:

P = 27 psia
T = 514°R
T_{dp} = 30°F
t = 24 hours

Using the Absolute Method:

1. Total absolute pressure:

No. of sensors: 5
Range: 0-30 psia

Measurement system repeatability error (E_p) = ± 0.0005% reading = ± 0.000135 psia

$\xi_p = (1/400{,}000) \times 30$ psia = 0.000075 psia

$e_p = \pm \left\{(E_p)^2 + (\ _p)^2\right\}^{1/2} / \left\{\text{No. of sensors}\right\}^{1/2}$

$e_p = \pm$ 0.0000691 psia

2. Water vapor pressure:

No. of sensors: 13
Sensor repeatability error (E): ± 0.5°F
Measurement system error (ξ), excluding sensor: ± 0.001°F

At a dewpoint temperature of 30°F, the equivalent water vapor change (as determined by the ASME calculation for vapor pressure) is:

$e_{pv} = \pm \left\{(E_{pv})^2 + (\xi_{pv})^2\right\}^{1/2} / \left\{\text{No. of sensors}\right\}^{1/2}$

$E_{pv} = \pm$ 0.5°F(0.00167 psia/°F) = 0.000835 psia

$\xi_{pv} = \pm$ 0.001°F(0.00167 psia/°F) = 0.0000017 psia

$e_{pv} = \pm$ 0.000232 psia

3. Temperature

No. of sensors: 49
Sensor repeatability error = ± 0.02°F
Measurement system error (ξ), exluding sensor = ± 0.001°F

$$e_T = \pm \left\{ (E_T)^2 + (\xi_T)^2 \right\}^{1/2} / \left\{ \text{No. of sensors} \right\}^{1/2}$$

$$e_T = \pm 0.00286^\circ R$$

4. FOM

$$FOM = \pm \frac{2400}{t} \left\{ 2\left(\frac{e_p}{p}\right)^2 + 2\left(\frac{e_{pv}}{p}\right)^2 + 2\left(\frac{e_T}{T}\right)^2 \right\}^{1/2}$$

$$FOM = \pm \frac{2400}{24} \left\{ 2\left(\frac{0.0000691}{27}\right)^2 + 2\left(\frac{0.000232}{27}\right)^2 + 2\left(\frac{0.00286}{514}\right)^2 \right\}^{1/2}$$

FOM = ± 0.00149 %/day

or ± 0.00006211 %/hour

APPENDIX B
LOCAL LEAK RATE TEST SUMMARY

A. Type B Tests

Two methods were used to perform the type B tests - the absolute method (pressure decay) and the volumetrics mass flowmeter method. Both methods use air or nitrogen as the test medium, with the testable volume pressurized to a designated test pressure. The absolute method determines the leakage rate by a measured pressure drop during a set time specified in the applicable preoperational procedures, TVA-2B, Containment Vessel Pressure and Leak Test - Testable Penetrations, and TVA-3, Containment Vessel Pressure and Leak Test - Personnel Air Lock. The Volumetrics mass flowmeter makes a direct mass flow measurement with readings given in standard cubic centimeters per minute (SCCM).

All testable penetrations, with the exception of those listed in this appendix, were tested prior to the performance of the CILRT. These penetrations were tested following the completion of the CILRT, and the leakage rates were added to the total leak rate.

Any penetrations or hatch covers opened after the completion of the CILRT will be tested prior to unit startup under the applicable plant-approved surveillance instructions.

A summary of all type B test data is included in this appendix.

B. Type C Tests

Three methods were used to perform the type C tests--an airflow method, a water displacement method, and the volumetrics mass flowmeter method. The airflow method consists of a rotameter flow facility in line with the testable valve through a test connection. An air supply is connected to the rotameter facility, which measures the flow of air necessary to replace the air leakage past the valve being tested. From this, a leakage rate is determined.

The water displacement method consists of a calibrated water test tank equipped with a sight glass. A timed water level drop is measured to calculate the leakage past the valve(s) being tested. A separate air source is used to maintain the water pressure at the prescribed test pressure. A special "water inventory test" is conducted on containment spray, applicable only to valves FCV-72-2 and FCV-72-39.

The Volumetrics mass flowmeter is also used to conduct type C tests. The results of these tests are noted in the summary of type C data in this appendix.

All testable containment isolation valves were tested prior to the performance of the CILRT.

Any maintenance action or repairs on containment isolation valves subject to type C tests which would affect leakage from primary containment will be retested under the applicable plant-approved surveillance instruction before unit startup.

A summary of the data for all type C tests is included in this appendix. Penetrations in water-sealed systems subject to inventory restrictions and penetrations whose leakage might bypass the shield building emergency gas treatment system are identified in Appendices B.2, B.3.1, and B.3.2.

APPENDIX B.1
SUMMARY OF LOCAL LEAKAGE RATES

Type B Leakage:

A.	Bellows	0.3159 SCFH
B.	Electrical	0.1798 SCFH
C.	Resilient Seals	0.1631 SCFH
D.	Air Lock Doors	13.3584 SCFH
	Total Type B	14.0172 SCFH

Type C Leakage: 1.5892 SCFH

	Actual	Maximum Allowable
Total (Types B and C):	15.6064 SCFH	141.9 SCFH
Penetrations defined as potential bypass leakage paths:	1.0401 SCFH	59.1250 SCFH
Penetrations water sealed to at least 1.1 P_a subject to inventory restrictions:		
A. ERCW discharge	0.0040 SCFH	0.24 CFH
B. Containment spray	0.0000 SCFH	0.08 CFH

APPENDIX B.2
TYPE C TEST DATA

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-4	Ventilation	30-56/57	1-16-81	0.0000	0.0000
X-5	Ventilation	30-58/59	1-16-81	0.0000	0.0000
X-6	Ventilation	30-50/51	1-18-81	0.0000	0.0000
X-7	Ventilation	30-52/53	11-13-80	0.0000	0.0000
X-9A	Ventilation	30-7/8	1-16-81	0.0000	0.0000
X-9B	Ventilation	30-9/10	11-13-80	0.0000	0.0000
X-10A	Ventilation	30-14/15	1-16-81	0.0000	0.0000
X-10B	Ventilation	30-16/17	11-07-80	0.0000	0.0000
X-11	Ventilation	30-19/20	1-13-81	0.0000	0.0000
X-15(2)	CVCS	62-72/73/74	12-29-80	0.0000	0.0000
		62-77/662	12-29-80	0.0000	
X-25A(2)	Sampling	43-2	11-25-80	0.0000	0.0000
		43-3	11-25-80	0.0000	
X-25D(2)	Sampling	43-11	11-25-80	0.0000	0.0000
		43-12	11-25-80	0.0000	
X-26B(2)	Control Air	32-103/341	2-08-81	0.6811	0.6811
		32-348	1-26-81	0.0000	

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-27C(2)(1)	ILRT	52-Inboard	11-18-80	0.0000	0.0000
		52-Outboard	2-18-81	0.0000	
X-29(2)(1)	Component Cooling	70-89/698	12-06-80	0.0000	0.0000
		70-92	8-16-80	0.0000	
X-30(2)	SIS	63-71	1-15-81	0.0000	0.0000
		63-84/23	12-30-80	0.0000	
X-34(2)	Control Air	32-111/385	1-25-81	0.0000	0.0000
		32-387	1-13-81	0.0000	
X-35(2)	Component Cooling	70-85/143/703	8-16-80	0.0999	0.0999
X-39A(2)	SIS	63-64	12-16-80	0.0000	0.0000
		77-868	11-13-80	0.0000	
X-39B(2)	Main Coolant	68-305	11-21-80	0.0000	0.0000
		77-849	11-06-80	0.0000	
X-41(2)	Waste Disposal	77-127	12-02-80	0.0000	0.0000
		77-128	12-02-80	0.0000	

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-42(2)	Primary Water	81-12	8-12-80	0.0000	0.1141
		81-502	11-21-80	0.1141	
X-44	CVCS	62-61/639	12-22-80	0.4307	0.4307
		62-63	8-20-80	0.0000	
X-45(2)	Waste Disposal	77-18	11-05-80	0.0000	0.0000
		77-19/20	11-05-80	0.0000	
X-46(2)	Waste Disposal	77-9	11-14-80	0.0000	0.0000
		77-10/84-512	11-14-80	0.0000	
X-47A(1)(2)	Ice Condenser	61-191	12-12-80	0.0000	0.0000
		61-192/533	12-12-80	0.0000	
X-47B(1)(2)	Ice Condenser	61-193	12-12-80	0.0000	0.0000
		61-194/680	12-12-80	0.0000	
X-50A(2)	Component Cooling	70-87/687	10-25-80	0.0000	0.0000
		70-90	11-26-80	0.0000	
X-50B(2)	Component Cooling	70-134	1-20-81	0.0868	0.0868
		70-679	1-14-81	0.0000	

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-51(2)	Fire Protection	26-240	10-23-80	0.0000	0.0000
		26-1260	11-06-80	0.0000	
X-52	Component Cooling	70-140	12-03-80	0.0000	0.0000
		70-692	12-03-80	0.0000	
X-56	ERCW	67-107	11-16-80	0.0000	0.0000
		67-562D	12-20-80	0.0000	
X-58	ERCW	67-83	11-16-80	0.0000	0.0000
		67-562A	12-20-80	0.0000	
X-60	ERCW	67-99	11-16-80	0.0000	0.0000
		67-562B	12-20-80	0.0000	
X-62	ERCW	67-91	11-16-80	0.0000	0.0000
		67-562C	12-22-80	0.0000	
X-64(2)	Chilled Water	31C-222	1-07-81	0.0000	0.0000
		31C-223/752	12-20-80	0.0000	
X-65(2)	Chilled Water	31C-224	11-16-80	0.0000	0.0000
		31C-225/734	1-07-81	0.0000	

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-66(2)	Chilled Water	31C-229	11-16-80	0.0000	0.0000
		31C-230/715	11-26-80	0.0000	
X-67(2)	Chilled Water	31C-231	11-16-80	0.0000	0.0000
		31C-232/697	12-06-80	0.0000	
X-68	ERCW	67-141	12-30-80	0.0000	0.1184
		67-580D	1-12-81	0.1184	
X-69	ERCW	67-130	12-30-80	0.0000	0.0000
		67-580A	12-30-80	0.0000	
X-74	ERCW	67-138	1-16-81	0.0000	0.0000
		67-580B	1-13-81	0.0000	
X-75	ERCW	67-133	12-30-80	0.0000	0.0000
		67-580C	1-13-81	0.0000	
X-76(2)	Service Air	33-722	12-24-80	0.0000	0.0000
		33-739	12-24-80	0.0000	
X-77(2)	Demineralized Water	59-522/529	10-31-80	0.0000	0.0000
		59-633	10-21-80	0.0000	
X-78(2)	Fire Protection	26-243	1-31-81	0.0000	0.0000
		26-1296	11-13-80	0.0000	

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-80	Ventilation	30-37/40	12-05-80	0.0000	0.0000
X-81(2)	Waste Disposal	77-16	11-05-80	0.0000	0.0000
		77-17	11-05-80	0.0000	
X-82(2)	Fuel Pool Cooling	78-560	12-18-80	0.0000	0.0582
		78-561	12-18-80	0.0582	
X-83(2)	Fuel Pool Cooling	78-557	12-18-80	0.0000	0.0000
		78-558	12-18-80	0.0000	
X-84A(2)	Main Coolant	68-307	11-21-80	0.0000	0.0000
		68-308	11-28-80	0.0000	
X-85A(2)	Sampling System	43-75	1-07-81	0.0000	0.0000
		43-77	1-07-81	0.0000	
X-90(2)	Control Air	32-358	1-30-81	0.0000	0.0000
		32-81/353	1-27 81	0.0000	
X-92A	Sampling System	43-207	1-30-81	0.0000	0.0000
X-92B	Sampling System	43-208	1-30-81	0.0000	0.0000
X-93(2)	Sampling System	43-34	11-25-80	0.0000	0.0000
		43-35	11-25-80	0.0000	

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-94 A/B/C(2)	Radiation Monitoring	90-113	1-15-81	0.0000	
		90-114	2-01-81	0.0000	
		90-115	1-15-81	0.0000	
		90-116	1-15-81	0.0000	0.0000
		90-117	1-15-81	0.0000	
X-95 A/B/C(2)	Radiation Monitoring	90-107	1-15-81	0.0000	
		90-108	1-15-81	0.0000	
		90-109	1-18-81	0.0000	0.0000
		90-110	1-15-81	0.0000	
		90-111	2-03-81	0.0000	
X-96C(2)	Sampling System	43-22	11-25-80	0.0000	0.0000
		43-23	11-25-80	0.0000	
X-97	Ventilation	30-134	1-20-81	0.0000	0.0000
		30-135	1-30-81	0.0000	
X-98(1)(2)	ILRT	52-Inboard	11-18-80	0.0000	0.0000
		52-Outboard	11-18-80	0.0000	
X-99	Sampling System	43-202	1-30-81	0.0000	0.0000

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-100	Sampling System	43-201	1-30-81	0.0000	0.0000
X-107(2)	RHR	74-2	1-27-81	0.0000	0.0000
X-110(2)	Upper Head Injection	87-7/8/9	12-16-80	0.0000	0.0000
X-111	Ventilation	30-46/571	2-07-81	0.0000	0.0000
X-112	Ventilation	30-47/572	2-07-81	0.0000	0.0000
X-113	Ventilation	30-48/573	2-08-81	0.0000	
X-114(1)(2)	Ice Condenser	61-110	12-10-80	0.0000	0.0000
		61-122/745	12-10-80	0.0000	
X-115(1)(2)	Ice Condenser	61-96	12-10-80	0.0000	0.0000
		61-97/692	12-10-80	0.0000	
		* Penetrations Subject to Inventory Requirements			
X-59	ERCW	67-87/575A	11-15-80	0.0006	0.0006
		67-88	11-15-80	0.0000	
X-63	ERCW	67-95/575C	11-15-80	0.0000	0.0000
		67-96	11-15-80	0.0000	
X-61	ERCW	67-103/575B	11-15-80	0.0004	0.0004
		67-104	11-15-80	0.0000	

Penetration Number	System Name	Valve Number(s)	Test Date	Individual Leakage (SCFH)	Penetration Leakage (SCFH)
X-57	ERCW	67-111/575D	11-15-80	0.0000	0.0000
		67-112	11-15-80	0.0000	
X-73	ERCW	67-131	11-19-80	0.0000	0.0001
		67-295/585A	11-19-80	0.0001	
X-71	ERCW	67-134	11-19-80	0.0000	0.0009
		67-296/585C	11-19-80	0.0009	
X-70	ERCW	67-139	11-19-80	0.0000	0.0009
		67-297/585B	1-30-81	0.0009	
X-72	ERCW	67-142	11-19-80	0.0011	0.0011
		67-298/585D	11-19-80	0.0000	
X-48B	Containment Spray	72-2	11-13-80	0.0000	0.0000
X-48A	Containment Spray	72-39	7-23-80	0.0000	0.0000

*Leakage from these penetrations is not added to the total type C leakage.

Notes:

(1) Performed after CILRT and added to total leak rate.

(2) Isolation valves subject to bypass leakage requirements.

APPENDIX B.3.1
AIR LOCK DOOR TESTS

Leakage Path	Leakage (SCFH)	Date Tested
X-2A Resilient Seal		
Inner Door	0.0169	2-13-81
Outer Door	0.0275	1-26-81
X-2B Reslient Seal		
Inner Door	0.5106	2-11-81
Outer Door	0.0127	1-24-81
*X-2A Overall	2.5267	1-31-81
*X-2B Overall	10.8317	1-26-81

*Penetrations subject to bypass leakage requirements.

APPENDIX B.3.2
TYPE B TEST SUMMARY

Resilient Seals

Leakage Path	Leakage (SCFH) As Left	As Left Date
X-1	0.0000	2-08-81
*X-3	0.0000	1-30-81
X-54	0.0000	2-19-81
X-79A	0.0000	1-26-81
X-79B	0.0000	2-11-81
X-118	0.0000	2-11-81
X-111	0.0953	1-26-81
X-112	0.0551	1-31-81
X-113	0.0127	1-31-71
*X-40D	0.0000	1-26-81
Total	0.1631	

*Penetrations subject to bypass leakage requirements.

APPENDIX B.3.3
TYPE B TEST SUMMARY

Electrical

Leakage Path	Leakage (SCFH) As Left	As Left Date
X-120E	0.0021	12-30-80
X-121E	0.0275	1-03-81
X-122E	0.0042	12-29-80
X-123E	0.0042	12-29-80
X-124E	0.0297	1-02-81
X-126E	0.0042	1-03-81
X-127E	0.0381	1-05-81
X-128E	0.0000	12-29-80
X-129E	0.0000	1-02-81
X-131E	0.0000	12-29-80
X-132E	0.0127	12-29-80
X-133E	0.0064	12-29-80
X-134E	0.0000	12-29-80
X-135E	0.0000	12-29-80
X-136E	0.0000	12-29-80
X-137E	0.0063	12-29-80
X-138E	0.0000	12-29-80
X-139E	0.0106	1-03-81
X-140E	0.0000	12-29-80
X-141E	0.0021	12-29-80
X-142E	0.0042	1-05-81
X-143E	0.0064	12-29-80
X-144E	0.0000	12-29-80
X-145E	0.0021	12-29-80
X-146E	0.0000	12-29-80
X-147E	0.0000	1-03-81
X-148E	0.0000	1-03-81
X-149E	0.0000	1-03-81
X-150E	0.0000	1-03-81
X-151E	0.0000	1-03-81
X-152E	0.0000	1-03-81
X-153E	0.0000	1-05-81
X-154E	0.0000	1-05-81
X-156E	0.0021	1-05-81
X-157E	0.0000	1-05-81
X-158E	0.0000	1-05-81
X-159E	0.0042	12-29-80

Electrical (Continued)

Leakage Path		Leakage (SCFH) As Left	As Left Date
X-160E		0.0064	12-29-80
X-161E		0.0000	12-29-80
X-163E		0.0000	12-29-80
X-164E		0.0000	12-29-80
X-165E		0.0021	12-29-80
X-166E		0.0042	1-05-81
X-167E		0.0000	1-02-81
X-168E		0.0000	1-02-81
X-169E		0.0000	1-02-81
X-170E		0.0000	1-02-81
	Total	0.1798	

APPENDIX B.3.4
TYPE B TEST SUMMARY

Bellows

Leakage Path	Leakage (SCFH) As Left	As Left Date
X-12A Inboard	0.0085	1-02-81
Outboard	0.0000	1-02-81
X-12B Inboard	0.0000	12-16-80
Outboard	0.0000	12-16-80
X-12C Inboard	0.0000	12-17-80
Outboard	0.0000	12-17-80
X-12D Inboard	0.0000	1-02-81
Outboard	0.0000	1-02-81
X-13A Inboard	0.0233	1-03-81
Outboard	0.0000	1-09-81
X-13B Inboard	0.0000	12-17-80
Outboard	0.0001	12-17-80
X-13C Inboard	0.0021	1-17-81
Outboard	0.0000	12-20-80
X-13D Inboard	0.0212	1-03-81
Outboard	0.0000	1-09-81
X-14A	0.0042	1-02-81
X-14B	0.0000	1-02-81
X-14C	0.0000	1-02-81
X-14D	0.0000	1-02-81
X-15	0.0000	12-30-80
X-17	0.0000	12-30-80
X-20A	0.0000	12-30-80
X-20B	0.0000	12-30-80
X-21	0.0000	12-30-80
X-22	0.0000	12-30-80
X-24	0.0170	12-31-80
X-30	0.0191	2-09-81
X-32	0.0000	12-31-80
X-33	0.0000	12-31-80
X-45	0.0042	12-31-80
X-46	0.0106	12-31-80
X-47A Inboard	0.0318	1-03-81
Outboard	0.0254	1-03-81
X-47B Inboard	0.0275	1-03-81
Outboard	0.0318	1-03-81
X-81	0.0318	12-31-80
X-107	0.0170	12-31-80
X-108	0.0170	1-03-81
X-109	0.0233	1-03-81
K-14	0.0000	12-24-80
K-15	0.0000	12-24-80
Total	0.3159	

APPENDIX C
SPECIAL TEST INSTRUMENTATION

I. Pressure Measurement: (5 Total)

Two quartz manometers for ice lower compartment condenser pressure.

Three quartz manometers for upper and lower compartment pressure, and ice upper compartment condenser pressure.

II. Temperature Measurement: (49 Total)

Upper compartment (14 Total)	V = 651,000 cubic feet
RTD-1	RTD-8
RTD-2	RTD-9
RTD-3	RTD-10
RTD-4	RTD-11
RTD-5	RTD-12
RTD-6	RTD-13
RTD-7	RTD-14

Lower compartment (25 Total)	V = 395,000 cubic feet
RTD-25	RTD-38
RTD-26	RTD-39
RTD-27	RTD-40
RTD-28	RTD-41
RTD-29	RTD-42
RTD-30	RTD-43
RTD-31	RTD-44
RTD-32	RTD-45
RTD-33	RTD-46
RTD-34	RTD-47
RTD-35	RTD-48
RTD-36	RTD-49
RTD-37	

Ice Condenser (10 Total)

Upper Volume V = 47,000 cubic feet	Lower Volume V=183,787 cubic feet
RTD-15	RTD-21
RTD-16	RTD-22
RTD-17	RTD-23
RTD-18	RTD-24
RTD-19	
RTD-20	

III. Vapor Pressure Measurement (13 Total):

<u>Upper Compartment</u> (3 Total)

DPE-1
DPE-2
DPE-3

<u>Lower Compartment</u> (3 Total)

DPE-4
DPE-5
DPE-6

Ice Condenser (7 Total)

Upper Volume	Lower Volume
DPE-10	DPE-7
DPE-11	DPE-8
DPE-12	DPE-9
DPE-13	

IV. <u>Test Station Environment</u>

Temperature: 1 RTD

V. <u>Atmospheric Pressure Measurement</u> (1 Total)

Total pressure: 1 quartz manometer

VI. <u>Containment Vessel Metal Temperature Measurements</u> (3 Total)

Temperature: 3 RTD

APPENDIX D
CALCULATION OF AGREEMENT

Appendix J Method

A. Full-Pressure Test:

$$\text{Agreement} = \frac{L_{RM} - L_R - L_{AM}}{L_A}$$

Where:

$$L_{RM} = \left(\frac{\%\ L_{RM}^*}{100}\right) \times V \times \left(\frac{28,316.85}{60}\right) \times \left(\frac{P_{TR}}{14.696}\right) =$$

$$\left(\frac{0.0114}{100}\right) \times (1.276787 \times 10^6) \times \left(\frac{28,316.85}{60}\right) \times \left(\frac{27.0585}{14.696}\right) =$$

126,479.9158

$$L_R = \frac{L_R(\text{SCFH})}{60} \times 28,316.85 = \frac{153.4251}{60} \times 28,316.85 =$$

72,408.5938

$$L_{AM} = \left(\frac{\%\ L_{AM}^*}{100}\right) \times (V) \times \left(\frac{28,316.85}{60}\right) \times \left(\frac{P_{TA}}{14.696}\right) =$$

$$\left(\frac{0.0059}{100}\right) \times (1.276787 \times 10^6) \times \left(\frac{28,316.85}{60}\right) \times \left(\frac{27.1269}{14.696}\right) =$$

65,624.3745

$$L_A = \left(\frac{1}{100}\right) \times \left(\frac{0.25}{24}\right) \times (V) \times \left(\frac{28,316.85}{60}\right) \times \left(\frac{P_{TA}}{14.696}\right) =$$

$$\left(\frac{1}{100}\right) \times \left(\frac{0.25}{24}\right) \times (1.276787 \times 10^6) \times \left(\frac{28,316.85}{60}\right) \times$$

$$\left(\frac{27.1269}{14.696}\right) = 115,862.2430$$

$$\text{Agreement} = \frac{(126,479.9158) - (72,408.5938) - (65,624.3745)}{(115,862.2430)} =$$

-0.0997 which is less than the 0.25 allowable.

*Percent per hour of containment mass

ANSI N45.4, 1972 Method

If L_A is replaced with L_{RM}:

$$\text{Agreement} = \frac{(126,479.9158) - (72,408.5938) - (65,624.3745)}{(126,479.9158)} =$$

-0.0913 which is less than the 0.25 allowable.

APPENDIX E

References

1. 10 CFR 50, Appendix J, "Reactor Containment Leakage Testing for Water-Cooled Power Reactors"
2. ANSI N45.4-1972, American National Standard, "Leakage Rate Testing of Containment Structures of Nuclear Service"
3. ANS N274, American Nuclear Society, "Containment System Leakage Testing Requirements"
4. Sequoyah Nuclear Plant FSAR chapters 6.2 and 6.3.
5. Sequoyah Nuclear Plant technical specification 4.6.1.2.