LASALLE COUNTY NUCLEAR STATION

UNIT 1

REACTOR CONTAINMENT BUILDING

INTEGRATED LEAK RATE TEST

REACTOR CONTAINMENT BUILDING

INTEGRATED LEAK RATE TEST

LASALLE COUNTY NUCLEAR POWER STATION

COMMONWEALTH EDISON COMPANY

DOCKET NUMBER 50-373

UNIT ONE

JANUARY 14, 1993

ZCADTS/468

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TABLES AND FIGURES INDEX

INTRODUCTION

This report presents details of the Primary Containment Integrated Leak Rate Test (PCILRT) successfully performed on January 14, 1993 at LaSalle County Nuclear Power Station, Unit One. The test was performed in accordance with 10CFR50, Appendix J and the LaSalle County Unit One Technical Specifications. LaSalle County Station is a BWR 5, Mark II containment, located in Marseilles, Illinois. LaSalle Unit One received its operating license in April, 1982.

A short duration test (6.0 hours) was conducted using the general test method outlined in BN-TOP-1, Revision 1 (Bechtel Corporation Topical Report) dated November 1, 1972.

The total primary containment integrated leakage rate was found to be 0.2624 wt%/day at a test pressure of 40.9 psig, which is within the 0.476 wt%/day acceptance criterion. This value is the sum of the calculated leakage rate of 0.1879 wt%/day plus the leakage rate of all non-vented penetrations which is 0.0745 wt%/day. The total 95% upper confidence limit leakage rate was found to be 0.3498 wt%/day. This value is the sum of the measured 95% upper confidence limit of 0.2753 wt%/day plus the leakage rate of all non-vented penetrations which is 0.0745 wt%/day.

The total "as-found" containment leakage rate was found to be 0.3789 wt%/day which is also within the 0.476 wt%/day (0.75 La) acceptance criteria. This value is the sum of the "as-left" leak rate (0.2753 wt%/day), the non-vented penetrations (0.0745 wt%/day), and the back correction leak rate (0.0291 wt%/day) which takes into account the improvements made to type B and C pathways during the outage.

The Induced phase leakage test result was found to be 0.820 wt%/day. This value should compare with the sum of the measured leak rate phase of 0.1879 wt%/day and the induced leakage rate of 0.6342 wt%/day (385.0 SCFH), the sum of which being within the ± 0.159 wt%/day (0.25 La) tolerance band. The actual test data results show a difference of 0.0021 wt%/day which is within the acceptance criterion.

The next integrated primary containment leak rate test is to be performed during the sixth Unit 1 Refuel Outage which also happens to be the 10 year outage. The outage is currently scheduled to begin March 12, 1994.

SECTION A - TEST PREPARATIONS

A.1 Type A Test Procedure

The PCILRT was performed in accordance with Procedure LTS-300-4, Revision 17, dated December 23, 1992. This procedure was written to comply with 10CFR50 Appendix J, ANSI N45.4-1972, and LaSalle County Unit One Technical Specifications, and to reflect the Nuclear Regulatory Commission's, approval of a short duration test using the BN-TOP-1, Rev. 1 Topical Report as a test method.

A.2 Type A Test Instrumentation

Table One shows the specifications for the instrumentation used in the PCILRT. Table Two lists the physical locations of the temperature and humidity sensors within the primary containment.

a. Temperature

Sensors were suspended to prevent direct thermal influences from any metal surfaces. Sensors were also kept away from any direct air flows.

Each thermister was calibrated to yield an output of -99 mV to +99 mV over the range of 50°F to 140°F. Calibrations were done by Commonwealth Edison company, Operational Analysis Dept.

b. Pressure

Two precision PPM-1000 HR pressure transmitters were utilized. Each transmitter had a local digital readout in addition to a Binary Coded Decimal output to the process computer. Primary containment pressure was sensed by the pressure transmitters in parallel through a 3/8" tube connected to a primary Containment pressure sensing instrument line.

Each precision pressure transmitter was calibrated over the range 0 psia to 100 psia in approximately 5 psia increments using a Volumetrics Inc. VMC 836 calibration standard.

c. Vapor Pressure

Ten Lithium Chloride Dewpoint Temperature Units were installed throughout the Drywell and Suppression Pool. The dewpoint cells were placed in locations where the chance of the dewcell becoming damaged was slight.

A calibration was done on each dewcell network over the range of dewpoint temperatures of 34°C to 100°C. Calibrations were performed by Commonwealth Edison Company, Operational Analysis Dept.

d. **Flow**

A rotameter flowmeter, Fischer-Porter, calibrated to within ± 1.0% by Fischer-Porter, was used for flow measurement. One half inch polyflow tubing connected the rotameter to a test connection on one of the primary containment penetration lines.

A.3 **Type A Test Measurement**

The PCILRT was performed utilizing an interface with the Volumetrics Data Acquisition System (DAS) and Prime Computer. Information from the thermisters and dewcells is sent to a Dual Multiplexer Scanner in the Drywell. The Scanner takes the data and sends it through an electrical penetration (E-20) to a System Console. The System Console takes the raw data and converts it into data readable to a computer and the test engineer. This information is then sent to the Prime Computer where all needed calculations are performed and a hard copy of the information is produced.

A.4 **Type A Test Pressurization**

Two 1500 CFM, diesel driven air compressors were used to supply clean, oil free air for containment pressurization.

The compressors were physically located outside the reactor building. The compressed air was piped into the reactor building through an existing PCILRT Pressurizing Line. For ease of handling, a flexible 4 inch pipe was used outside of the reactor building.

The drywell was pressurized through the "A" containment spray header 16 inch flange with an inboard valve 1E12-F017A, open during the pressurization process.

TABLE 1
(Sheet 1 of 2)

INSTRUMENT SPECIFICATIONS

INSTRUMENT	MANUFACTURER	SERIAL NO.	RANGE	ACCURACY	REPEATABILITY
Pressure Transmitter	Volumetrics	10720-2	4-100psia	±0.005%F.S.	0.001%PSI
Pressure Transmitter	Volumetrics	10141-2	4-100psia	±0.005%F.S.	0.001%PSI
Thermister 1	Volumetrics	12576-23	50-140°F	±0.25°F	±0.01°F
Thermister 2	Volumetrics	11778-2	50-140°F	±0.25°F	±0.01°F
Thermister 3	Volumetrics	12576-27	50-140°F	±0.25°F	±0.01°F
Thermister 4	Volumetrics	12576-9	50-140°F	±0.25°F	±0.01°F
Thermister 5	Volumetrics	12576-16	50-140°F	±0.25°F	±0.01°F
Thermister 6	Volumetrics	11778-14	50-140°F	±0.25°F	±0.01°F
Thermister 7	Volumetrics	11778-8	50-140°F	±0.25°F	±0.01°F
Thermister 8	Volumetrics	11778-3	50-140°F	±0.25°F	±0.01°F
Thermister 9	Volumetrics	12576-10	50-140°F	±0.25°F	±0.01°F
Thermister 10	Volumetrics	12576-8	50-140°F	±0.25°F	±0.01°F
Thermister 11	Volumetrics	12576-6	50-140°F	±0.25°F	±0.01°F
Thermister 12	Volumetrics	11340-4	50-140°F	±0.25°F	±0.01°F
Thermister 13	Volumetrics	11340-12	50-140°F	±0.25°F	±0.01°F
Thermister 14	Volumetrics	12576-11	50-140°F	±0.25°F	±0.01°F
Thermister 15	Volumetrics	12576-22	50-140°F	±0.25°F	±0.01°F
Thermister 16	Volumetrics	11778-25	50-140°F	±0.25°F	±0.01°F
Thermister 17	Volumetrics	12576-30	50-140°F	±0.25°F	±0.01°F
Thermister 18	Volumetrics	12576-25	50-140°F	±0.25°F	±0.01°F
Thermister 19	Volumetrics	12576-29	50-140°F	±0.25°F	±0.01°F
Thermister 20	Volumetrics	12576-7	50-140°F	±0.25°F	±0.01°F
Thermister 21	Volumetrics	11778-16	50-140°F	±0.25°F	±0.01°F
Thermister 22	Volumetrics	12576-21	50-140°F	±0.25°F	±0.01°F
Thermister 23	Volumetrics	12576-17	50-140°F	±0.25°F	±0.01°F
Thermister 24	Volumetrics	12576-15	50-140°F	±0.25°F	±0.01°F
Thermister 25	Volumetrics	12576-18	50-140°F	±0.25°F	±0.01°F

TABLE 1
(Sheet 2 of 2)

INSTRUMENT SPECIFICATIONS

INSTRUMENT	MANUFACTURER	SERIAL NO.	RANGE	ACCURACY	REPEATABILITY
Thermister 26	Volumetrics	11778-18	50-140°F	±0.25°F	±0.01°F
Thermister 27	Volumetrics	11778-30	50-140°F	±0.25°F	±0.01°F
Thermister 28	Volumetrics	11778-12	50-140°F	±0.25°F	±0.01°F
Thermister 29	Volumetrics	12576-24	50-140°F	±0.25°F	±0.01°F
Thermister 30	Volumetrics	11340-11	50-140°F	±0.25°F	±0.01°F
Dewcell 1	Volumetrics	0940292	34-100°C	±0.25°F	±0.01°F
Dewcell 2	Volumetrics	0860292	34-100°C	±0.25°F	±0.01°F
Dewcell 3	Volumetrics	0900292	34-100°C	±0.25°F	±0.01°F
Dewcell 4	Volumetrics	0980292	34-100°C	±0.25°F	±0.01°F
Dewcell 5	Volumetrics	02000292	34-100°C	±0.25°F	±0.01°F
Dewcell 6	Volumetrics	1000292	34-100°C	±0.25°F	±0.01°F
Dewcell 7	Volumetrics	0920292	34-100°C	±0.25°F	±0.01°F
Dewcell 8	Volumetrics	0850292	34-100°C	±0.25°F	±0.01°F
Dewcell 9	Volumetrics	0950292	34-100°C	±0.25°F	±0.01°F
Dewcell 10	Volumetrics	1060292	34-100°C	±0.25°F	±0.01°F
Flowmeter	Fischer-Porter	8511A0113A7	60-870SCFH	±1.0%Max. Flow	N/A
Flowmeter	Fischer-Porter	8511A0113A8	60-870SCFH	±1.0%Max. Flow	N/A

TABLE 2A
(Sheet 1 of 2)

PCILRT INSTRUMENT PHYSICAL LOCATIONS

RTD NO.	EPN	SUBVOLUME	INSTRUMENT ELEVATION	INSTRUMENT AZIMUTH
1	1TE-CT001	9	708'	19°
2	1TE-CT002	9	724'	95°
3	1TE-CT003	9	708'	195°
4	1TE-CT004	9	724'	275°
5	1TE-CT005	6	746'	0°
6	1TE-CT006	6	750'	90°
7	1TE-CT007	6	754'	180°
8	1TE-CT008	6	758'	270°
9	1TE-CT009	5	762'	0°
10	1TE-CT010	5	767'	90°
11	1TE-CT011	5	772'	180°
12	1TE-CT012	5	777'	270°
13	1TE-CT013	4	785'	0°
14	1TE-CT014	4	791'	90°
15	1TE-CT015	3	797'	90°
16	1TE-CT016	3	808'	270°
17	1TE-CT017	3	811'	0°
18	1TE-CT018	3	815'	180°
19	1TE-CT019	2	804'	115°
20	1TE-CT020	2	804'	295°
21	1TE-CT021	1	822'	0°
22	1TE-CT022	1	826'	180°
23	1TE-CT023	8	743'	0°
24	1TE-CT024	8	743'	180°
25	1TE-CT025	7	730'	90°
26	1TE-CT026	7	730'	270°
27	1TE-CT027	4	791'	270°
28	1TE-CT028	9	724'	75°
29	1TE-CT029	4	785'	180°
30	1TE-CT030	9	708'	75°

TABLE 2A
(Sheet 2 of 2)

PCILRT INSTRUMENT PHYSICAL LOCATIONS

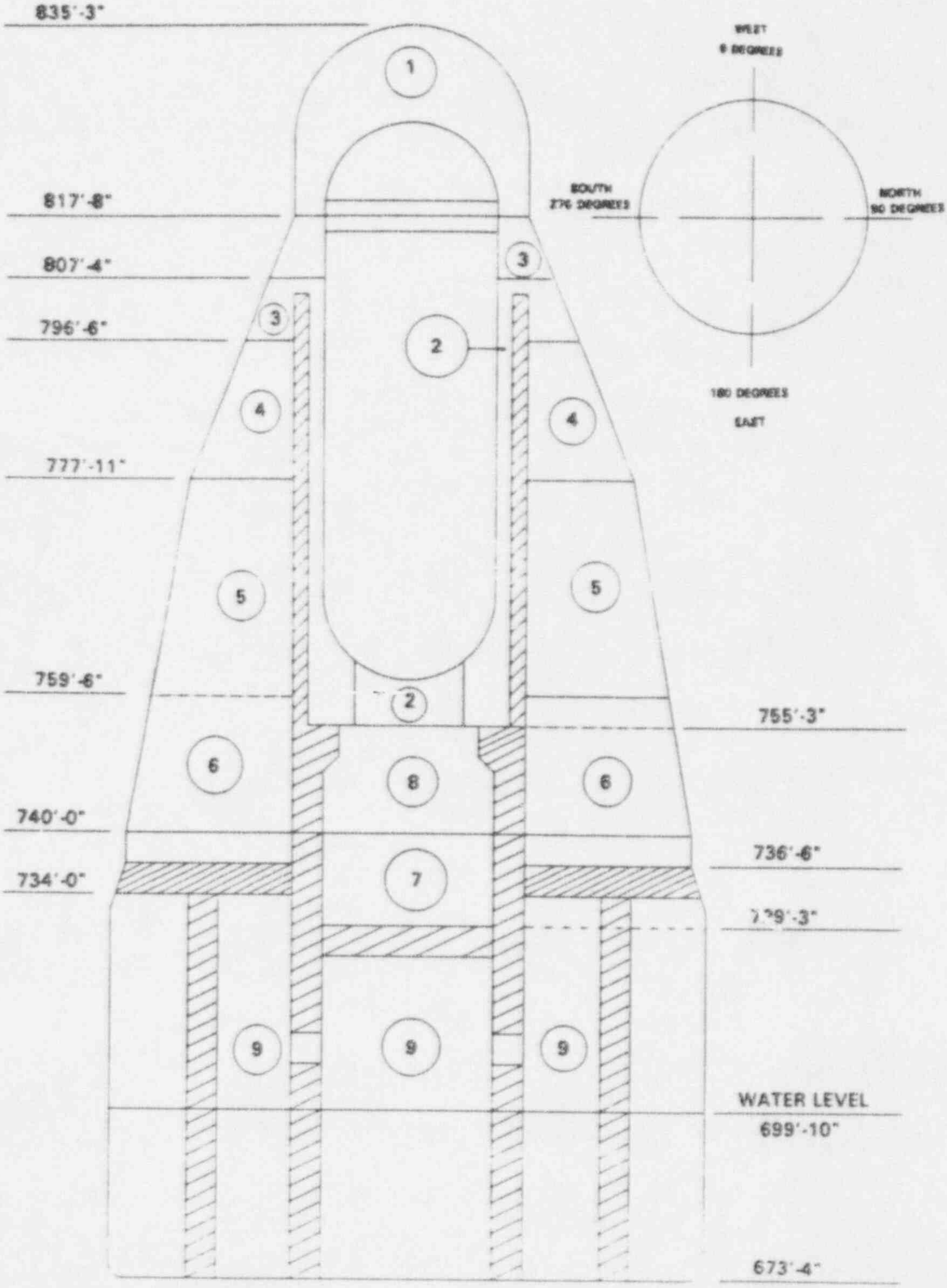
DEWCELL NO.	EPN	SUBVOLUME	INSTRUMENT ELEVATION	INSTRUMENT AZIMUTH
1	1ME-CT031	9	708'	195°
2	1ME-CT032	6	752'	0°
3	1ME-CT033	5	773'	180°
4	1ME-CT034	4	791'	0°
5	1ME-CT035	3	812'	180°
6	1ME-CT036	1	826'	0°
7	1ME-CT037	3	803'	180°
8	1ME-CT038	8	746'	270°
9	1ME-CT039	5	763'	0°
10	1ME-CT040	9	724'	75°

TABLE 2B

PCILRT SUBVOLUME SPECIFICATION

SUBVOLUME	LOCATION	VOLUME ft3	(wt. factor)
1	Drywell Head Area Above 818'-6"	7745	.01963
2	Annulus Between Rx Vessel and Shield	7126	.01806
3	Between Elev. 818'-6" and 796'-6"	18,357	.04652
4	Between Elev. 795'-6" and 777'-1"	36,786	.09321
5	Between Elev. 777'-11" and 759'-6"	55,595	.14088
6	Between Elev. 759'-6" and 734'-0"	95,910	.24303
7	Sump Area	3427	.00868
8	CRD Area	4592	.01164
9	Suppression Pool	165,100	.41836
	TOTAL	394,638	1.0000

FIGURE 1



ELEVATION VIEW OF CONTAINMENT AND SUBVOLUME LOCATIONS

SECTION B - TEST METHOD

B.1 Basic Technique

The absolute method of leak rate determination was used. The absolute method uses the ideal gas laws to calculate the measured leak rate, as defined in ANSI N45.4-1972. The inputs to the measured leak rate calculation include subvolume weighted containment temperature, subvolume weighted vapor pressure, and total absolute air pressure.

As required by the Nuclear Regulatory Commission, in order to perform a short duration test (measured leak rate phase of less than 24 hours), the measured leak rate was statistically analyzed using the principles outlined in BN-TOP-1, Rev. 1. A least squares regression line for the measured total time leak rate versus time since the start of the test is calculated after each new data set is scanned. The calculated leak rate at a point in time, t_i, is the leak rate on the regression line at the time t_i.

B.2 Supplemental Verification Test

The supplemental verification test superimposes a known leak of approximately the same magnitude as La (La = 385.7 SCFH or 0.6350 wt%/day as defined in the Technical Specifications). The degree of detectability of the combined leak rate (containment calculated leak rate plus the superimposed, induced leak rate) provides a basis for resolving any uncertainty associated with the measured leak rate phase of the test. The allowed error band is ± 0.25 La (0.159) wt%/day.

There are no references to the use of upper confidence limits to evaluate the acceptability of the induced leakage phase of the PCILRT in the ANS/ANSI standards or in BN-TOP-1, Rev. 1.

B.3 Instrumentation Error Analysis

An instrumentation error analysis was performed prior to the test in accordance with BN-TOP-1, Rev 1 Section 4.5. The instrument system error was calculated in two parts. The first part was to determine system accuracy uncertainty. The second and more important calculation (since the leak rate is impacted most by changes in the containment parameters) was performed to determine the system repeatability uncertainty. The maximum system error analysis performed prior to a 6 hour test yielded a total instrument uncertainty of ± 0.02 wt%/day.

The instrumentation uncertainty is used only to illustrate the system's ability to measure the required parameters to calculate the primary containment leak rate.

It is extremely important during a short duration test to quickly identify a failed sensor and in real time back the spurious data out of the calculated volume weighted containment temperature and vapor pressure. Failure to do so can cause the upper confidence limit value to place a short duration test in jeopardy. It has been station experience that sensor failures should be removed from all data collected, not just subsequent to the apparent failure, in order to minimize the discontinuity in computer values that are related to the sensor failure (not any real change in containment conditions).

SECTION C - SEQUENCE OF EVENTS

C.1 Test Preparation Chronology

The pretest preparation phase and containment inspection were completed on January 13, 1993 with no visible structural deterioration being found. Major preliminary steps included:

1. Completion of all Type B and C tests, component repairs, and retests.
2. Completion of PCILRT pretest valve checklist including draining and/or venting systems as described in the UFSAR.
3. Blocking of four drywell to suppression chamber vacuum breakers in the open position for pressure equalization between the drywell and suppression chamber volumes.
4. Venting of the reactor vessel to the primary containment via the manual head vent line and the drywell equipment drain sump.
5. Completion of pretest data gathering system, including computer program, instrument console, and associated wiring.
6. Temperature Sensor Channel 11 was locked out prior to containment pressurization due to sporadic response.

C.2 Test Pressurization Chronolocy

DATE	TIME	EVENT
01/13/93	0453	Primary Containment Pressurization Initiated. Atmospheric pressure is 14.17 psia.
01/13/93	0507	Received Reactor SCRAM and PCIS Groups 6 (partial), 7, and 9 isolations.
01/13/93	0825	General inspection/walkdown of containment completed. Found leakage at the Drywell Personnel Access Hatch inner bulkhead shaft seals. A packing leak also noted at the 1IN074 Containment Isolation Valve.
01/13/93	1058	Closed the 1E12-F017A valve which terminated containment pressurization. Drywell pressure at 55.87 psia (41.64 psig). Reactor Building atmospheric pressure is 14.23 psia. The pressurization line is vented per union connection at 0SA039.

C.3 Temperature Stabilization Chronology

DATE	TIME	EVENT
01/13/93	1205	Started containment stabilization phase. Containment pressure is 55.64 psia. Reactor Building pressure is 14.24 psia.
01/13/93	1345	Containment walkdown determined that drywell personnel airlock inner bulkhead shaft seals leaking greater than the initial inspection.
01/13/93	1445	Closed the outer door of the Drywell Personnel Access Hatch. Hatch pressure is equalizing with containment. Will open inner door after hatch is stabilized.
01/13/93	1640	Containment walkdown identified a leak on 1E21-F018, LPCS Injection Relief Valve to Suppression Pool. Nozzle ring plug on relief valve was leaking.
01/13/93	1715	It was determined that the 1E21-F018 relief valve was removed and tested during L1R05. The nozzle ring plug which was leaking, was removed and reinstalled during the maintenance activity. The leaking nozzle ring plug was tightened.
01/13/93	1730	Channel 39, Suppression Pool Temperature, Subvolume 9, was locked out due to sporadic response.
01/13/93	1900	Drywell Personnel Access Hatch inner door has been opened.
01/13/93	2030	Stabilization data fluctuations are believed to be caused by fluctuations in Reactor Water Temperature. The temperature will be set at 130° F and allowed to stabilize out.
01/13/93	2100	Stabilization criteria met for mass-plot and BN-TOP-1 test methods. Unit 2 is having problems with drywell pressure. Operations is considering nitrogen make-up to Unit 2. The Unit 1 ILRT Valve Lineup will have to be disturbed to make-up nitrogen to the Unit 2 containment.

DATE	TIME	EVENT
01/14/93	0020	A decision has been made to make-up nitrogen to Unit 2. The Unit 1 ILRT will be postponed until Unit 2 make-up is completed and Unit 1 ILRT valve lineup restored.
01/14/93	0930	Nitrogen make-up to Unit 2 containment is being terminated at this time. Operations is preparing to restore the Unit 1 ILRT valve lineup. Unit 1 containment ILRT pressure is 55.28 psia.
01/14/93	1045	The Unit 1 ILRT valve line-up has been restored and verified.

C.4 **Measured Leak Rate Phase**

DATE	TIME	EVENT
01/14/93	1051	Declare start of ILRT Measured leak rate phase at Data Set #1 [10:51:00].
01/14/93	1251	ILRT in progress and test results are satisfactory at this point. Containment pressure at 55.28 psia.
01/14/93	1701	ILRT Test Phase completed satisfactory at data set #38 with a duration of 6.0 hours. RESULTS: Calculated Leak Rate: 0.1879 wt%/day and 95% Upper Confidence Limit of 0.2753 wt%/day. Total 95% Upper Confidence Limit including non-vented penetrations: 0.3498 wt%/day. Test ended with slight upward trend. Extrapolated calculated leak rate over a 24 hour period and results were under 0.476 %/day (0.75 La). Extrapolated results yielded a calculated leak rate of 0.3366 wt%/day.

C.5 **Induced Leakage Rate Phase**

DATE	TIME	EVENT
01/14/93	1731	Imposed Induced leak rate of 385 SCFH or 0.6342 wt%/day. Started 1 hour stabilization period at Data Set #41 [17:31:00].
01/14/93	1831	Started Induced Leak Rate Test at Data Set #48, [18:41:00].

DATE	TIME	EVENT
01/14/93	2141	Induced Leak Rate Test Phase is completed satisfactorily at Data Set #66, with a duration of 3.0 hours. RESULTS: Induced Leakage 0.6342 wt%/day and Induced Calculated Leak Rate: 0.820 wt%/day. Isolated Induced Test rig.

C.6 <u>Depressurization Phase</u>

DATE	TIME	EVENT
01/14/93	2311	Commenced containment depressurization.
01/15/93	0450	Suspended containment depressurization at 17.02 psia (2.65 psig) in preparation for the Drywell Floor Bypass Test.
01/15/93	0455	Secured all vacuum breakers to closed position.
01/15/93	0505	Commenced depressurization of Suppression Chamber.
01/15/93	0525	Suppression Chamber depressurized to atmosphere.
01/15/93	0800	Drywell is depressurized to 16.07 psia (1.7 psig).
01/15/93	0921	Started ½ hour stabilization period for Drywell Floor Bypass Test, Data Set #146. Containment pressure is 16.08 psia. Reactor Building pressure is 14.37 psia.
01/15/93	0956	Started 1.5 psi Drywell Floor Bypass Test, Data Set #153.
01/15/93	1056	Completed 1.5 psi Drywell Floor Bypass Test, Data Set #165. Test satisfactory.
01/15/93	1126	Commenced Drywell depressurization.
01/15/93	1134	Drywell depressurized to atmosphere.
01/15/93	1300	Performed Containment Post Test Inspection.

SECTION D - TYPE A TEST DATA

D.1 Measured Leak Rate Phase Data

A summary of the computed data using the BN-TOP-1, Rev. 1 test method for a short duration test can be found in Table 3. Graphic results of the test are found in Figures 2-8.

D.2 Induced Leakage Phase Data

A summary of the computed data for the Induced Leakage Phase of the PCILRT is found in Table 4. Graphic results of the test are found in Figures 9-15.

MEASURED LEAKRATE

PHASE

DATA SETS 1 - 38

SOFTWARE PRODUCT ID NUMBER: GN01405-0.0

TABLE 3

***************************SUMMARY TABLE OF LEAKRATES***************************

LASALLE UNIT 1 09:43:16 WED, 03 MAR 1993

DATA SET 1 THROUGH 38

STATISTICAL LEAKRATE RESULTS CALCULATED USING THE BN-TOP-1 METHOD

DATA SET #	DATA SET TIME DAY HH MM SS	TEST TIME, (HR)	DRY AIR MASS, (LBM)	TOTAL TIME LEAKRATES , (%/D)	LSF OF LEAKRATES , (%/D)	BN-TOP UCL , (%/D)
1	014 10:51:00	0.000	0.10451984E+06			
2	014 11:01:00	0.167	0.10451776E+06	0.2863		
3	014 11:11:00	0.333	0.10451472E+06	0.3531		
4	014 11:21:00	0.500	0.10451405E+06	0.2662	0.2918	0.8994
5	014 11:31:00	0.667	0.10451469E+06	0.1776	0.2088	0.5100
6	014 11:41:00	0.833	0.10451016E+06	0.2669	0.2272	0.4634
7	014 11:51:00	1.000	0.10451595E+06	0.0893	0.1448	0.3682
8	014 12:01:00	1.167	0.10450814E+06	0.2303	0.1641	0.3855
9	014 12:11:00	1.333	0.10450926E+06	0.1822	0.1572	0.3510
10	014 12:21:00	1.500	0.10450620E+06	0.2088	0.1635	0.3450
11	014 12:31:00	1.667	0.10450742E+06	0.1711	0.1554	0.3203
12	014 12:41:00	1.833	0.10450116E+06	0.2341	0.1702	0.3353
13	014 12:51:00	2.000	0.10450267E+06	0.1972	0.1705	0.3256
14	014 13:01:00	2.167	0.10450144E+06	0.1951	0.1705	0.3171
15	014 13:11:00	2.333	0.10450219E+06	0.1738	0.1652	0.3034
16	014 13:21:00	2.500	0.10449878E+06	0.1935	0.1666	0.2986
17	014 13:31:00	2.667	0.10449892E+06	0.1802	0.1638	0.2905
18	014 13:41:00	2.833	0.10449359E+06	0.2127	0.1693	0.2939
19	014 13:51:00	3.000	0.10449495E+06	0.1905	0.1693	0.2896
20	014 14:01:00	3.167	0.10449481E+06	0.1815	0.1677	0.2836
21	014 14:11:00	3.333	0.10449594E+06	0.1647	0.1633	0.2751
22	014 14:21:00	3.500	0.10449037E+06	0.1933	0.1648	0.2740
23	014 14:31:00	3.667	0.10449094E+06	0.1810	0.1640	0.2703
24	014 14:41:00	3.833	0.10448856E+06	0.1874	0.1645	0.2683
25	014 14:51:00	4.000	0.10448678E+06	0.1898	0.1653	0.2670
26	014 15:01:00	4.167	0.10448601E+06	0.1864	0.1656	0.2651
27	014 15:11:00	4.333	0.10448391E+06	0.1904	0.1665	0.2641
28	014 15:21:00	4.500	0.10448356E+06	0.1851	0.1666	0.2622
29	014 15:31:00	4.667	0.10447894E+06	0.2013	0.1689	0.2635
30	014 15:41:00	4.833	0.10447912E+06	0.1934	0.1700	0.2630
31	014 15:51:00	5.000	0.10447434E+06	0.2090	0.1729	0.2653
32	014 16:01:00	5.167	0.10447648E+06	0.1927	0.1736	0.2645
33	014 16:11:00	5.333	0.10447347E+06	0.1997	0.1750	0.2647
34	014 16:21:00	5.500	0.10447478E+06	0.1881	0.1750	0.2631
35	014 16:31:00	5.667	0.10446278E+06	0.2312	0.1798	0.2688
36	014 16:41:00	5.833	0.10446167E+06	0.2290	0.1840	0.2732
37	014 16:51:00	6.000	0.10446309E+06	0.2172	0.1865	0.2750
38	014 17:01:00	6.167	0.10446384E+06	0.2085	0.1879	0.2753

****

NO PRESSURE CHANNELS ARE LOCKED OUT

DAS CHANNEL # 11 IS LOCKED OUT FROM DSN 1
DAS CHANNEL # 39 IS LOCKED OUT FROM DSN 1

FIGURE 8 (CONT.)

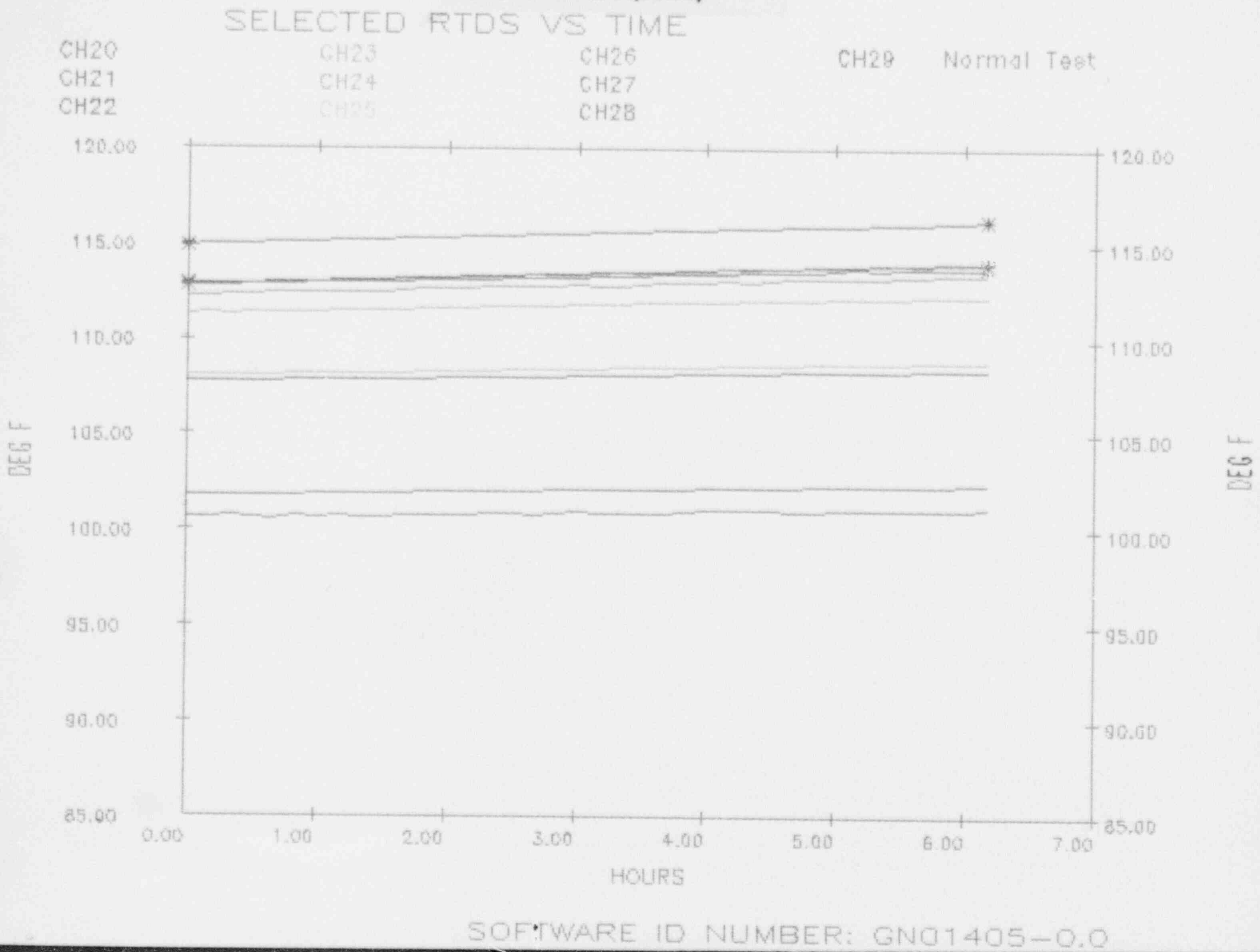
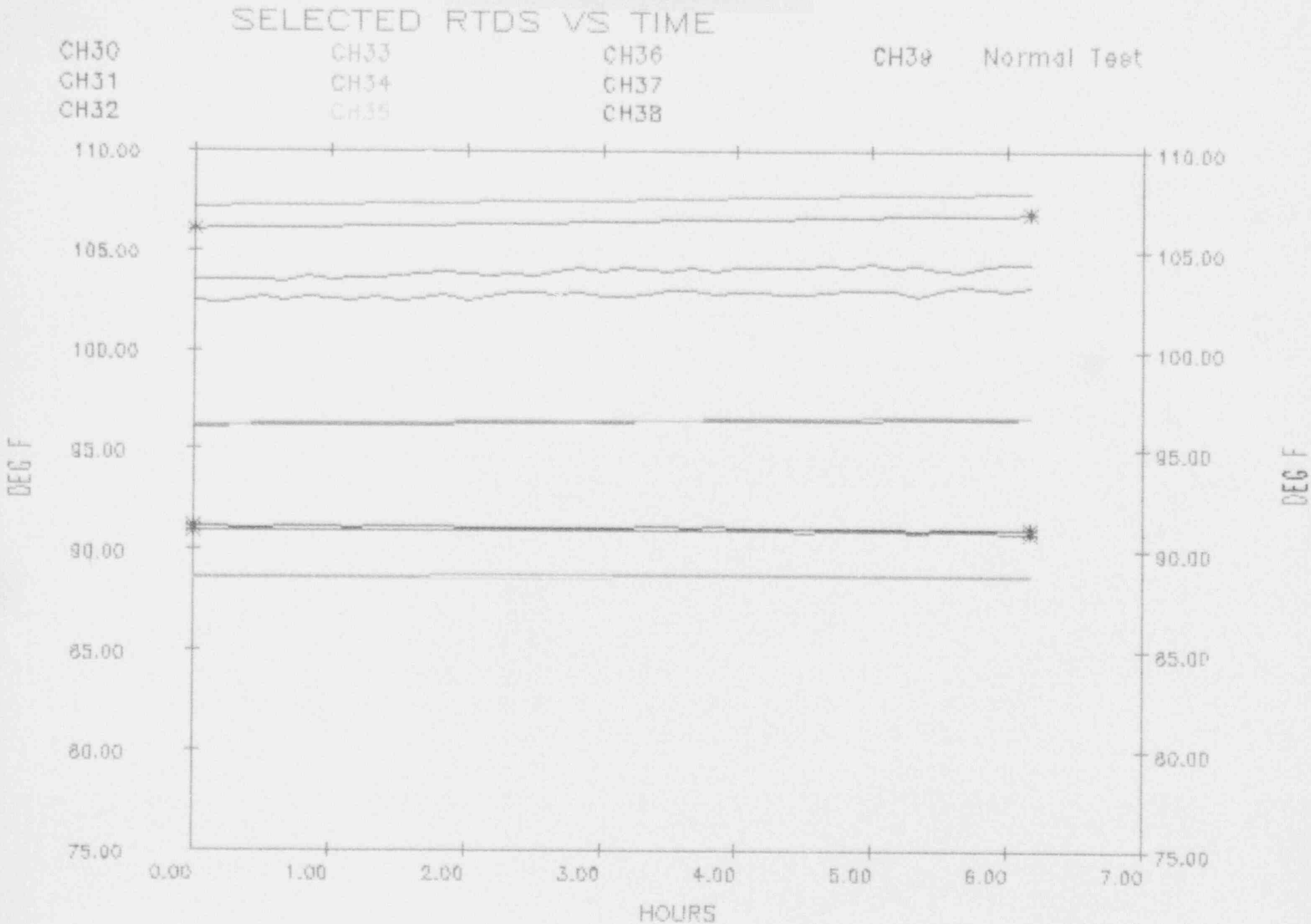
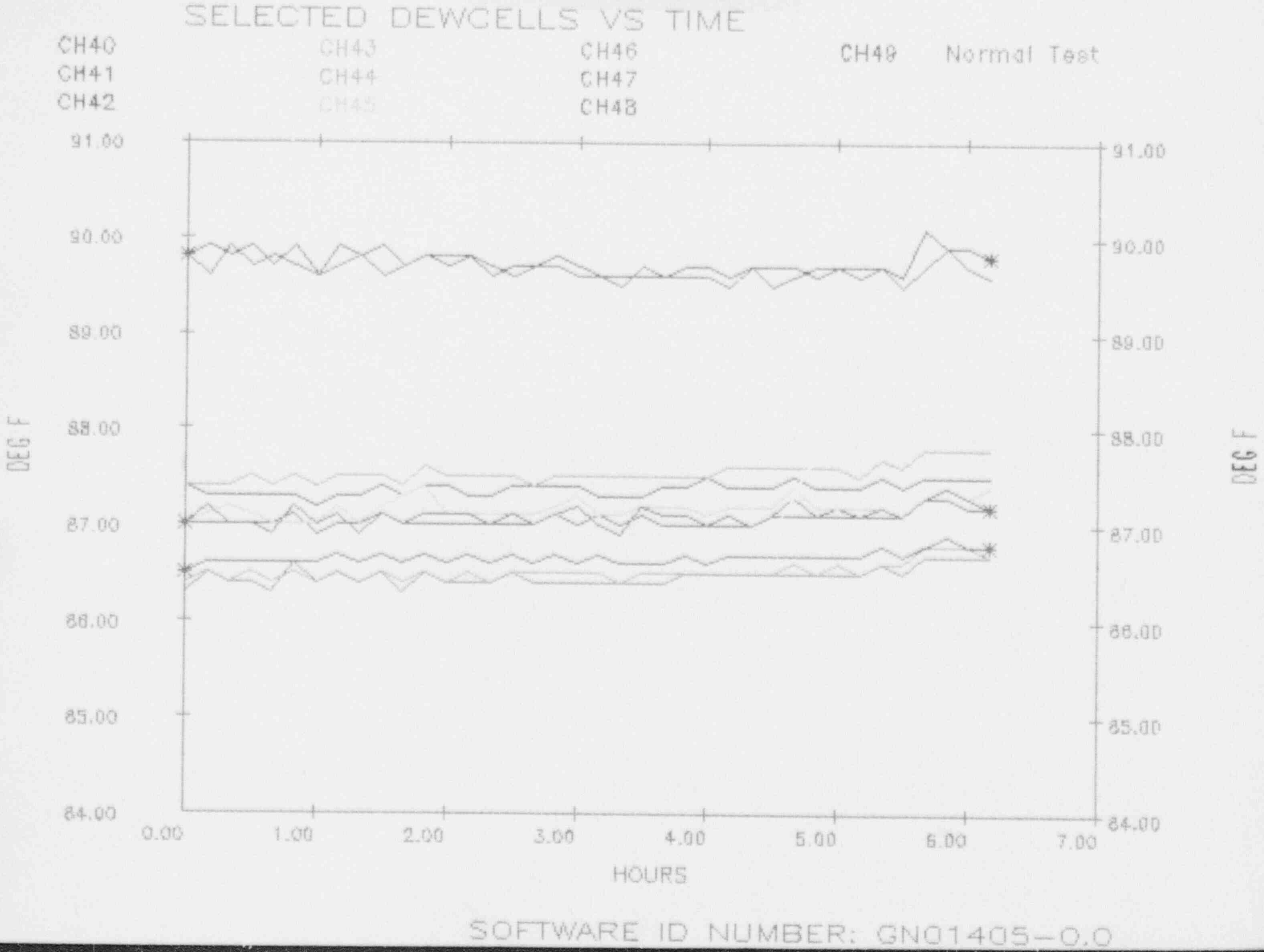


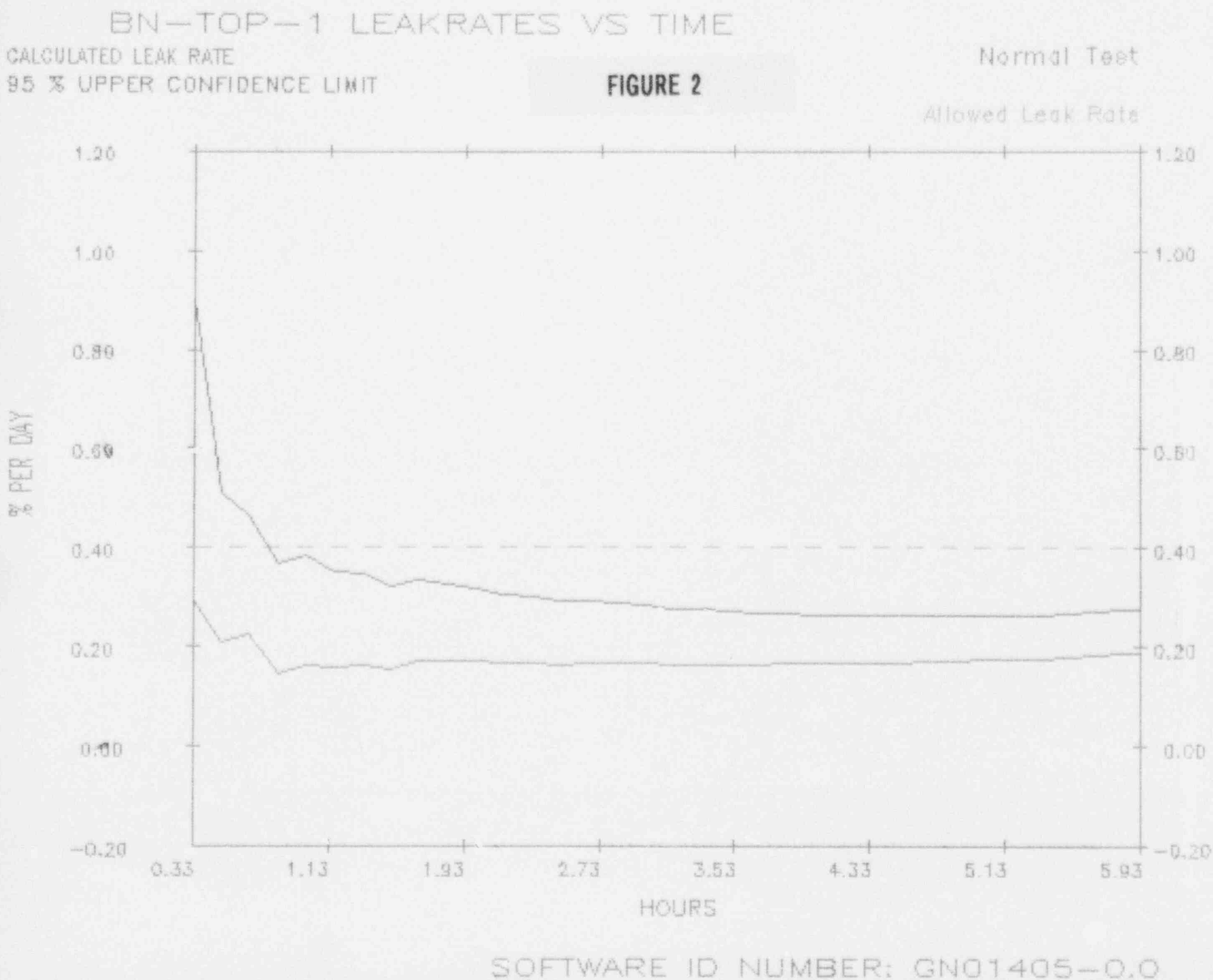
FIGURE 8 (CONT.)



SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 8 (CONT.)



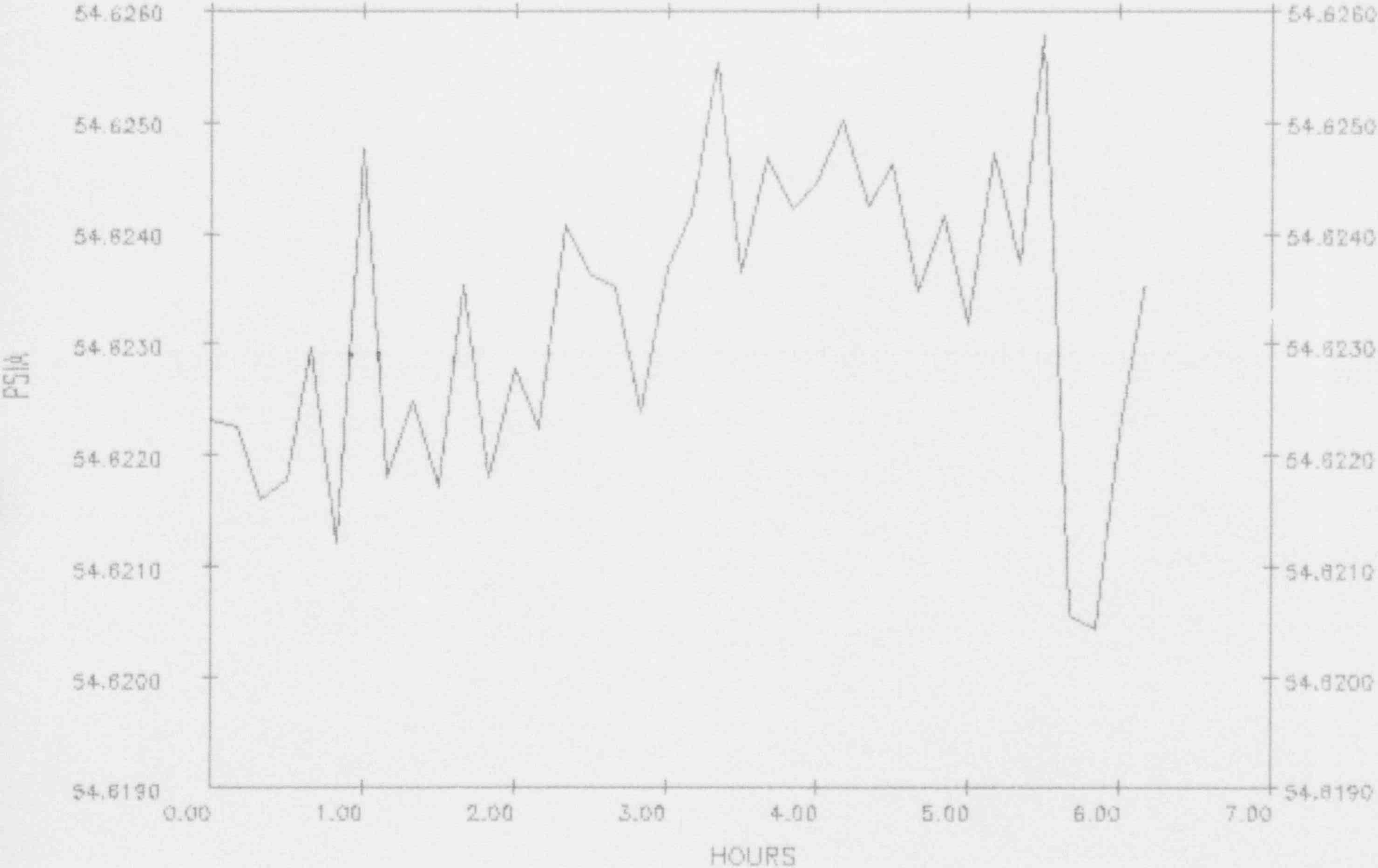


BN-TOP-1 LEAKRATES VS TIME
CALCULATED LEAK RATE
95 % UPPER CONFIDENCE LIMIT
FIGURE 2
Normal Test
Allowed Leak Rate
1.20
1.00
0.80
0.60
0.40
0.20
0.00
-0.20
% PER DAY
0.33
1.13
1.93
2.73
3.53
4.33
5.13
5.93
HOURS
SOFTWARE ID NUMBER: GN01405-0.0

CONTAINMENT DRY AIR PRESSURE VS TIME

Normal Test

FIGURE 3

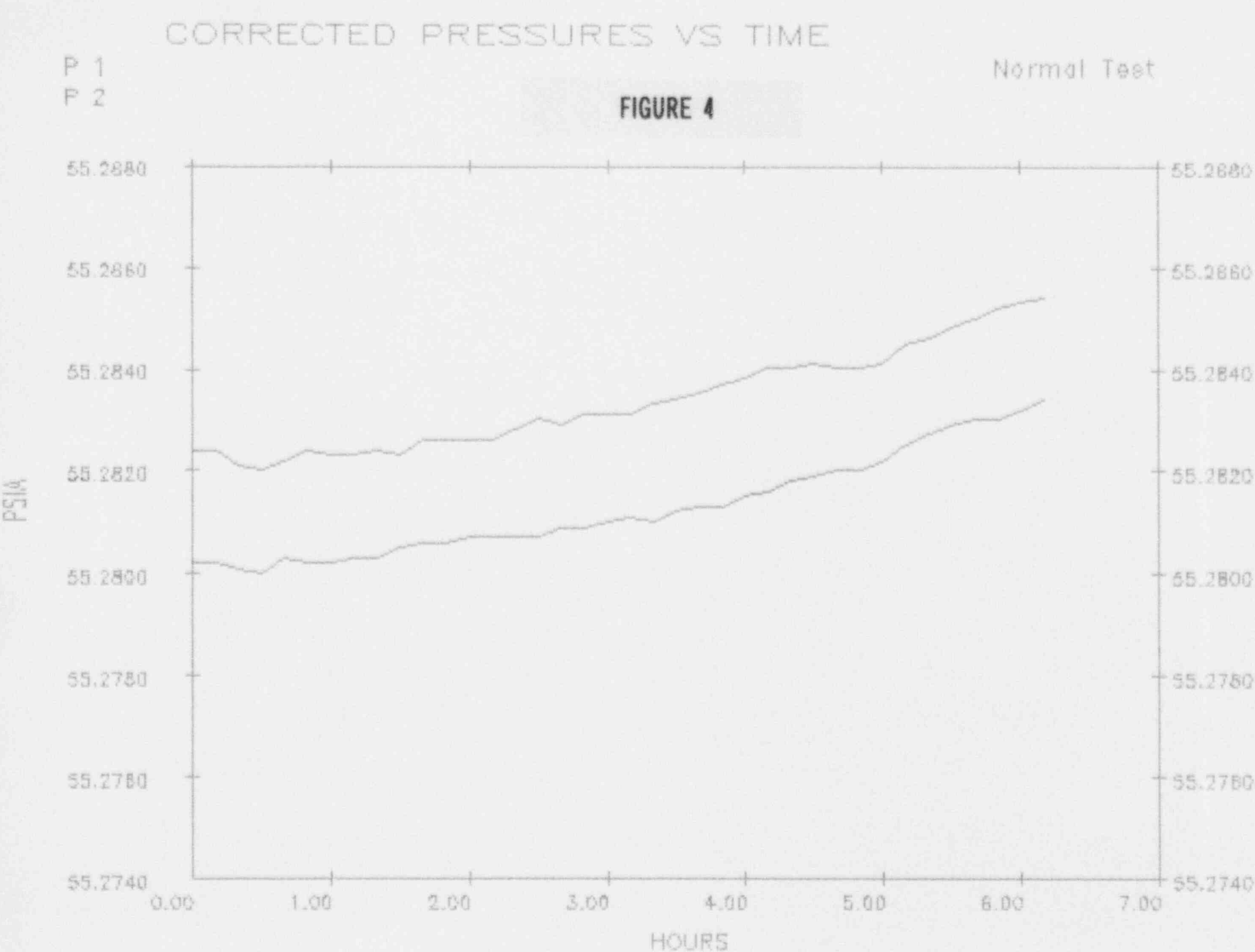


SOFTWARE ID NUMBER: GN01405-0.0

CORRECTED PRESSURES VS TIME

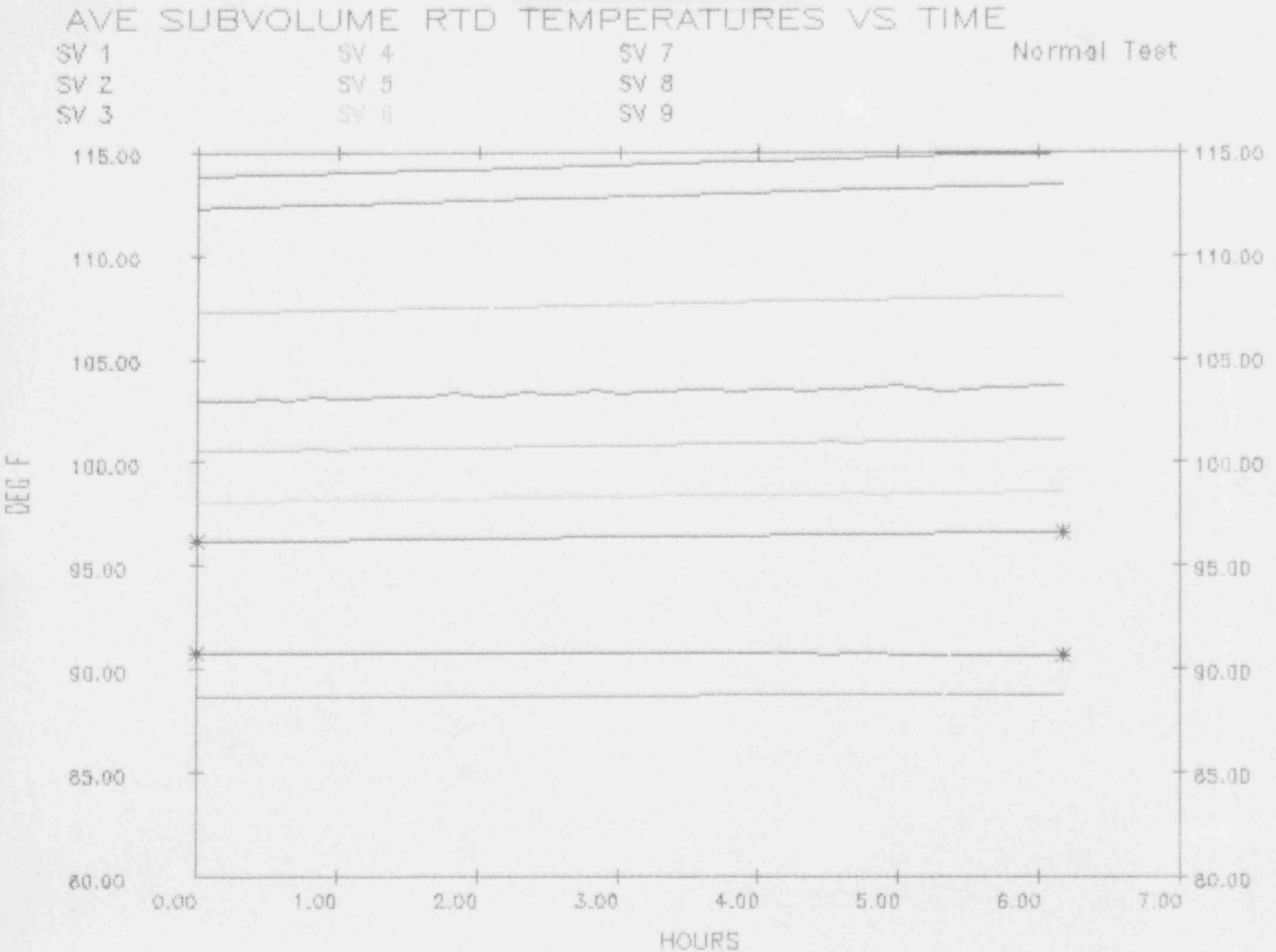
Normal Test

FIGURE 4



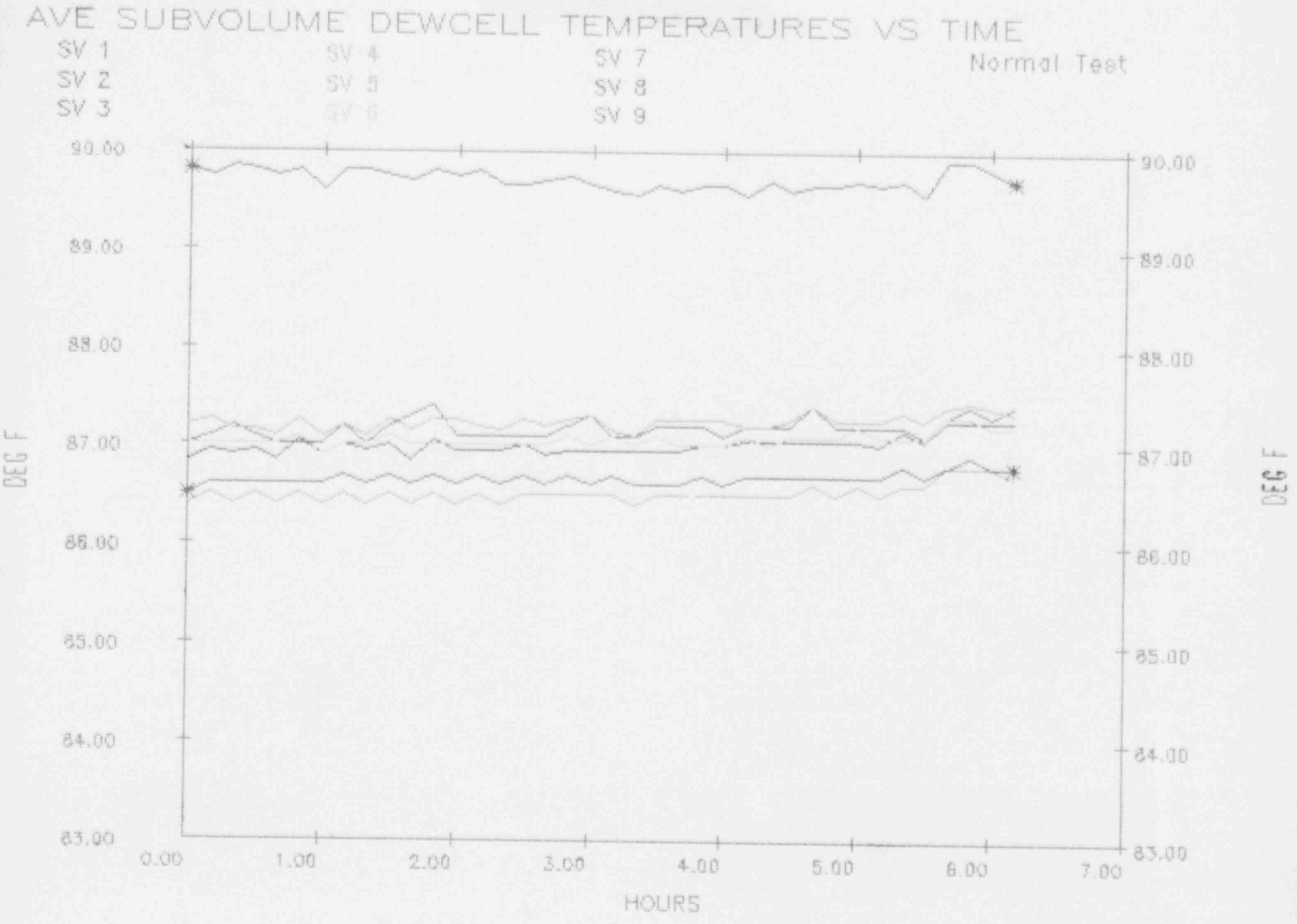
SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 5



SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 6

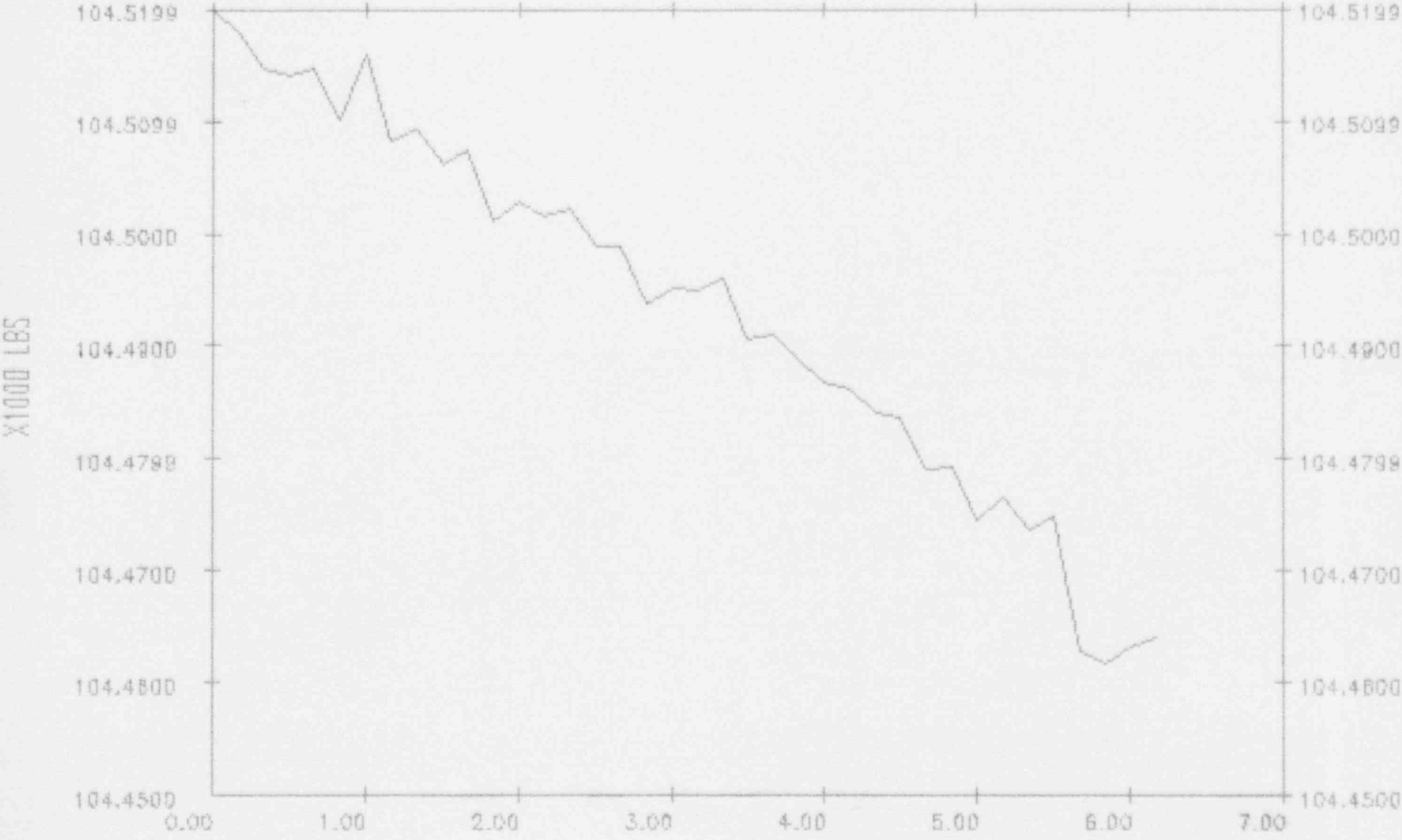


SOFTWARE ID NUMBER: GN01405-0.0

CONTAINMENT DRY AIR MASS VS TIME

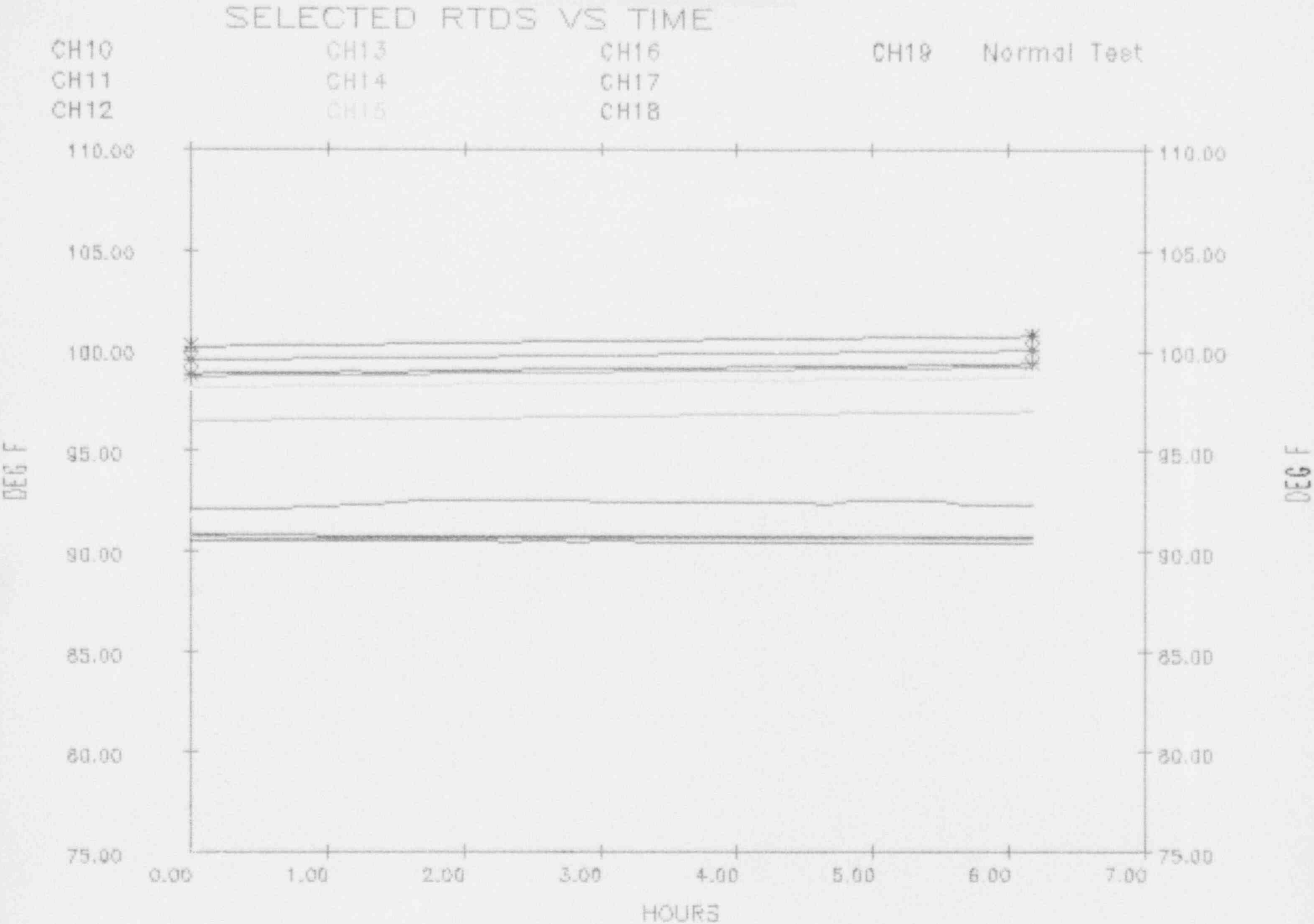
Normal Test

FIGURE 7



SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 8



SOFTWARE ID NUMBER: GN01405-0.0

INDUCED LEAKRATE

PHASE

DATA SETS 48 - 66

SOFTWARE PRODUCT ID NUMBER: GN01405-0.0

TABLE 4

**************************SUMMARY TABLE OF LEAKRATES**************************

LASALLE UNIT 1 10:39:47 WED, 03 MAR 1993

DATA SET 48 THROUGH 66

VERIFICATION TEST RESULTS CALCULATED USING THE BN-TOP-1 METHOD

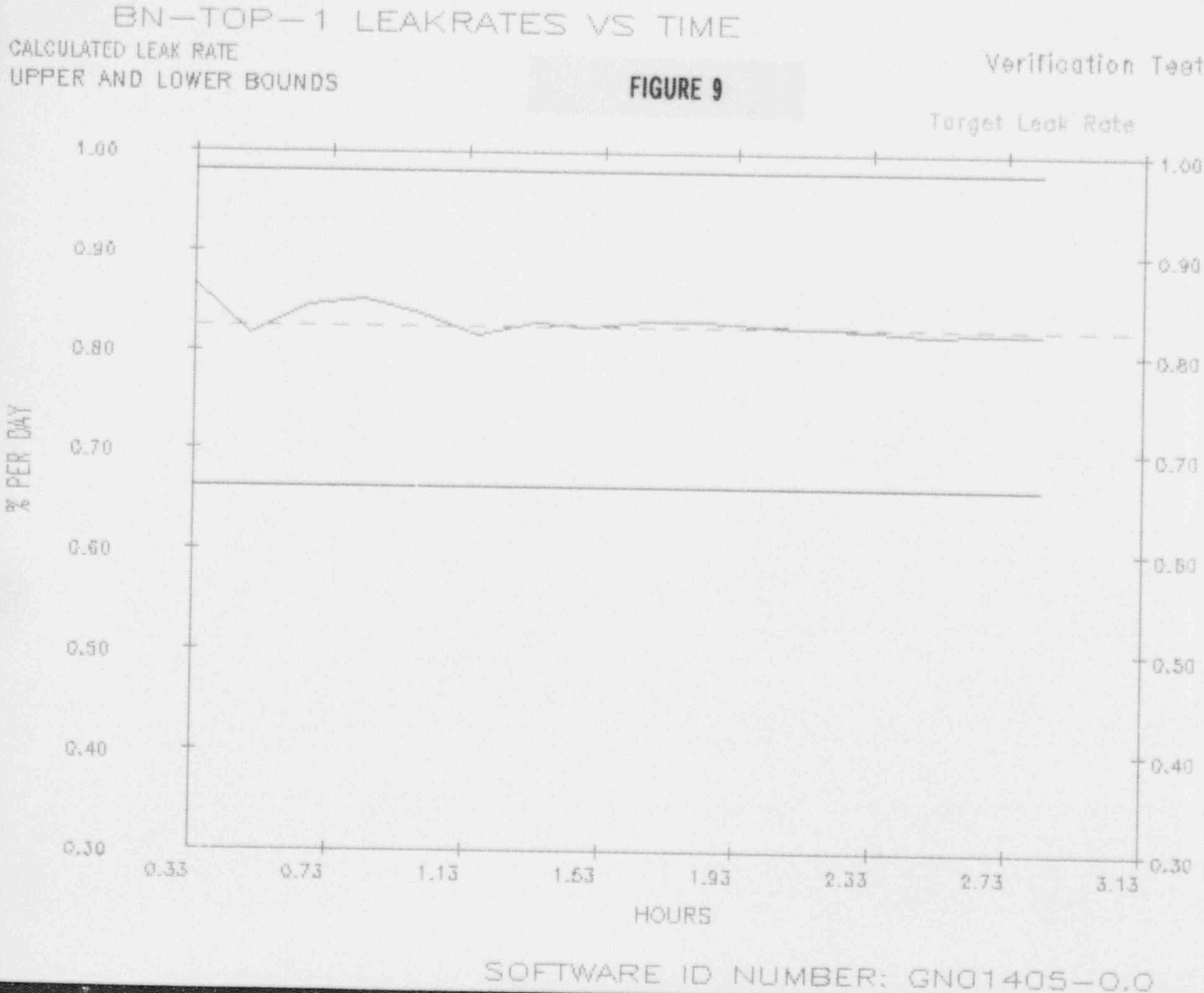
DATA SET #	DATA SET TIME DAY HH MM SS	TEST TIME, (HR)	DRY AIR MASS, (LBM)	TOTAL TIME LEAKRATES , (%/D)	LSF OF LEAKRATES , (%/D)	BN-TOP UCL , (%/D)
48	014 18:41:00	0.000	0.10442056E+06			
49	014 18:51:00	0.167	0.10441369E+06	0.9480		
50	014 19:01:00	0.333	0.10440741E+06	0.9070		
51	014 19:11:00	0.500	0.10440175E+06	0.8648	0.8650	0.8703
52	014 19:21:00	0.667	0.10439698E+06	0.8129	0.8160	0.8366
53	014 19:31:00	0.833	0.10438820E+06	0.8925	0.8440	1.0160
54	014 19:41:00	1.000	0.10438239E+06	0.8773	0.8517	0.9955
55	014 19:51:00	1.167	0.10437820E+06	0.8345	0.8368	0.9546
56	014 20:01:00	1.333	0.10437397E+06	0.8032	0.8150	0.9178
57	014 20:11:00	1.500	0.10436331E+06	0.8772	0.8292	0.9401
58	014 20:21:00	1.667	0.10436016E+06	0.8330	0.8241	0.9247
59	014 20:31:00	1.833	0.10435164E+06	0.8640	0.8306	0.9292
60	014 20:41:00	2.000	0.10434667E+06	0.8492	0.8312	0.9242
61	014 20:51:00	2.167	0.10434247E+06	0.8284	0.8262	0.9131
62	014 21:01:00	2.333	0.10433619E+06	0.8311	0.8231	0.9052
63	014 21:11:00	2.500	0.10432994E+06	0.8332	0.8214	0.8996
64	014 21:21:00	2.667	0.10432539E+06	0.8203	0.8172	0.8917
65	014 21:31:00	2.833	0.10431642E+06	0.8448	0.8192	0.8925
66	014 21:41:00	3.000	0.10431095E+06	0.8398	0.8200	0.8914

****

NO PRESSURE CHANNELS ARE LOCKED OUT

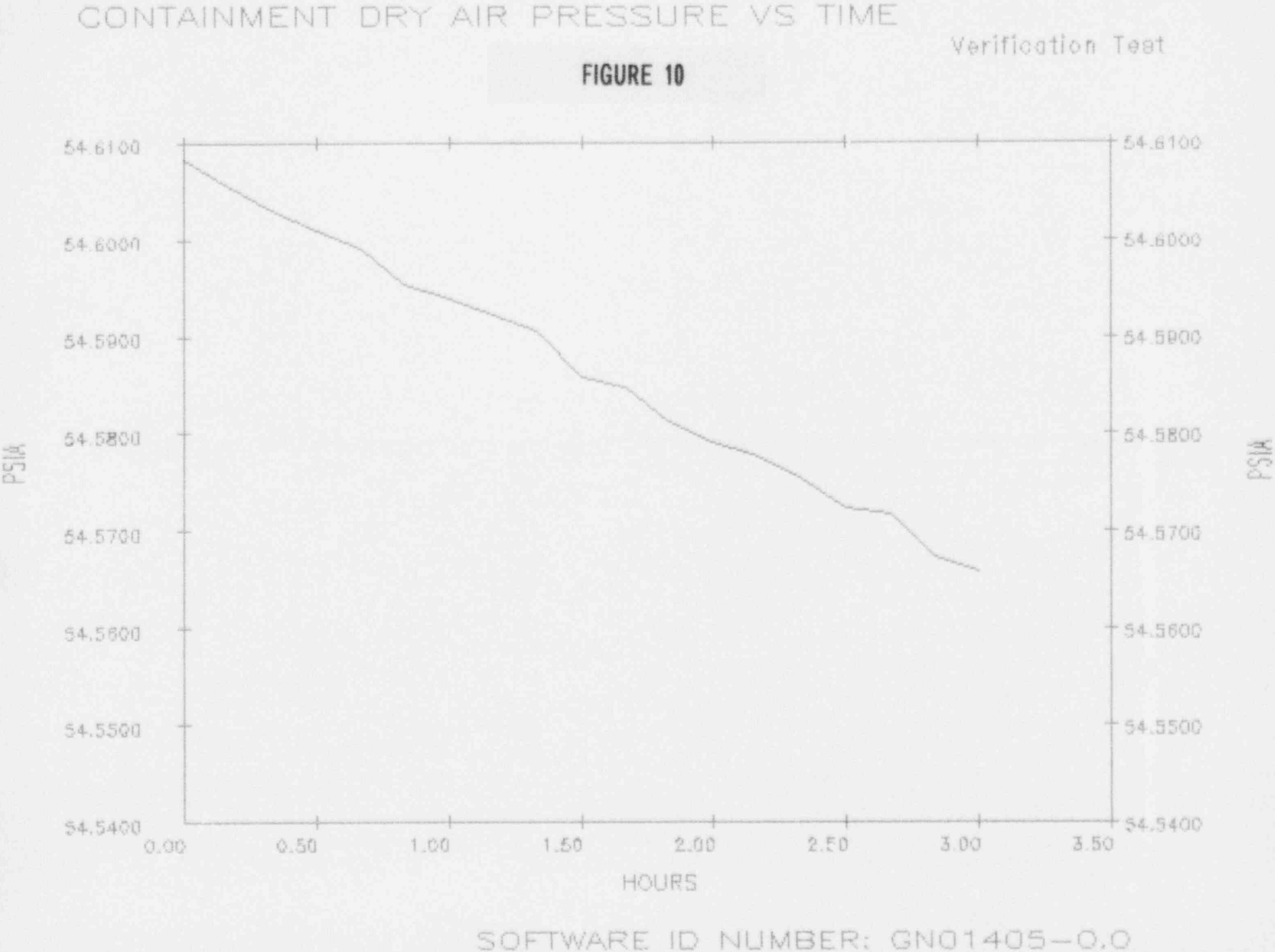
DAS CHANNEL # 11 IS LOCKED OUT FROM DSN 1
DAS CHANNEL # 39 IS LOCKED OUT FROM DSN 1

FIGURE 9



BN—TOP—1 LEAKRATES VS TIME
CALCULATED LEAK RATE
UPPER AND LOWER BOUNDS
Verification Test
Target Leak Rate
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
% PER DAY
0.33
0.73
1.13
1.53
1.93
2.33
2.73
3.13
HOURS
SOFTWARE ID NUMBER: GN01405—0.0

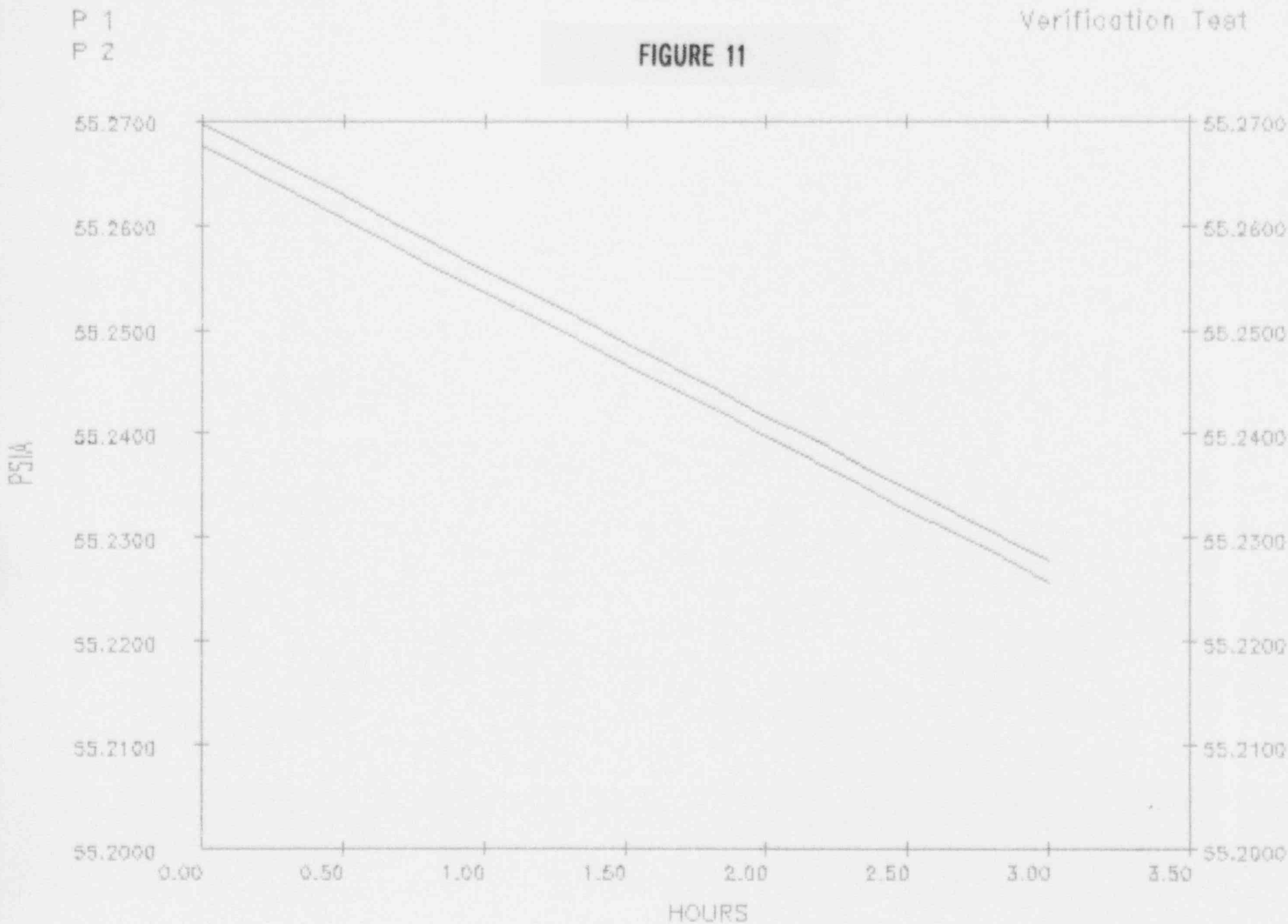
FIGURE 10


CONTAINMENT DRY AIR PRESSURE VS TIME
Verification Test
54.6100
54.6000
54.5900
54.5800
54.5700
54.5600
54.5500
54.5400
PSIA
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
HOURS
SOFTWARE ID NUMBER: GN01405-0.0

CORRECTED PRESSURES VS TIME

Verification Test

FIGURE 11



SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 12

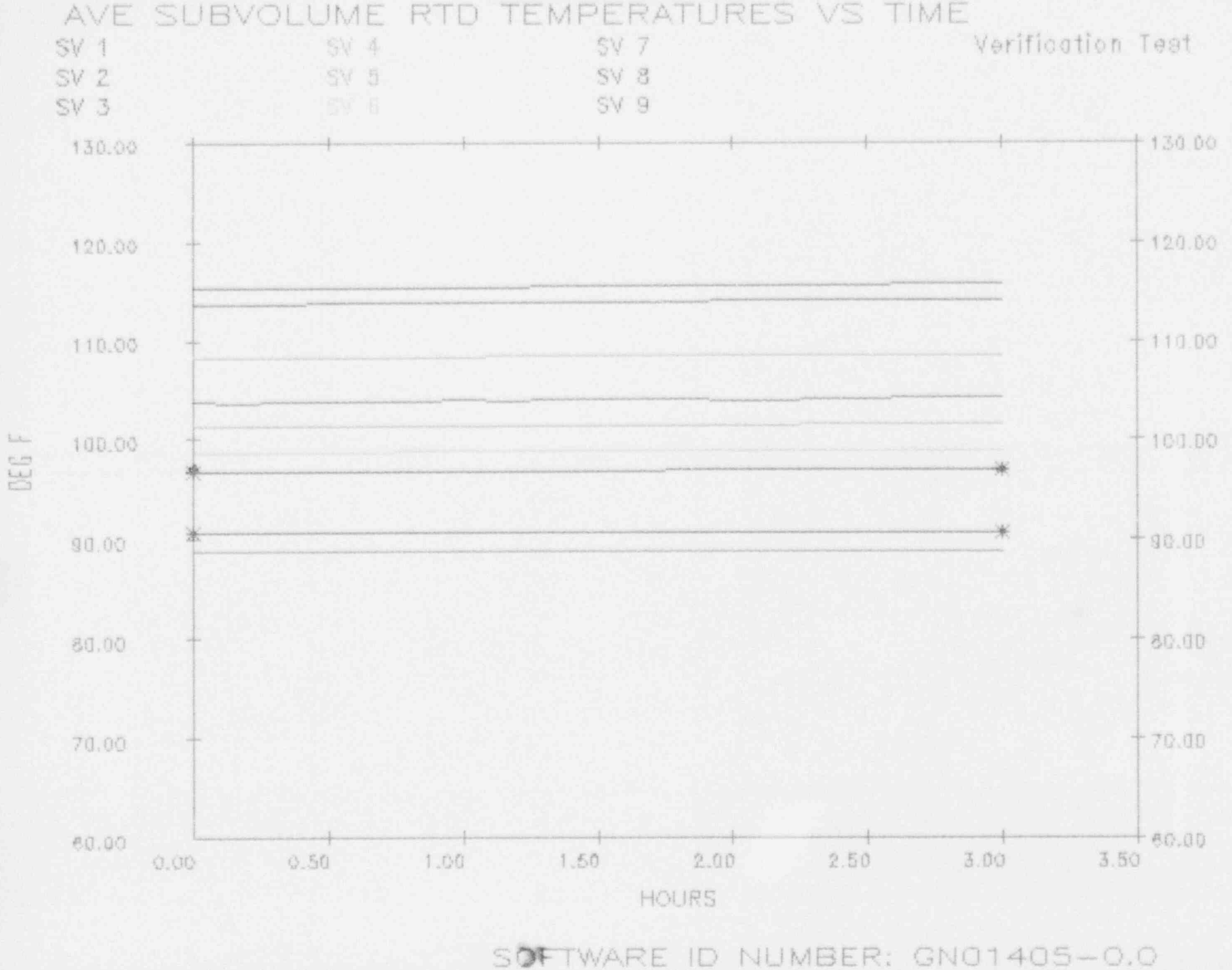
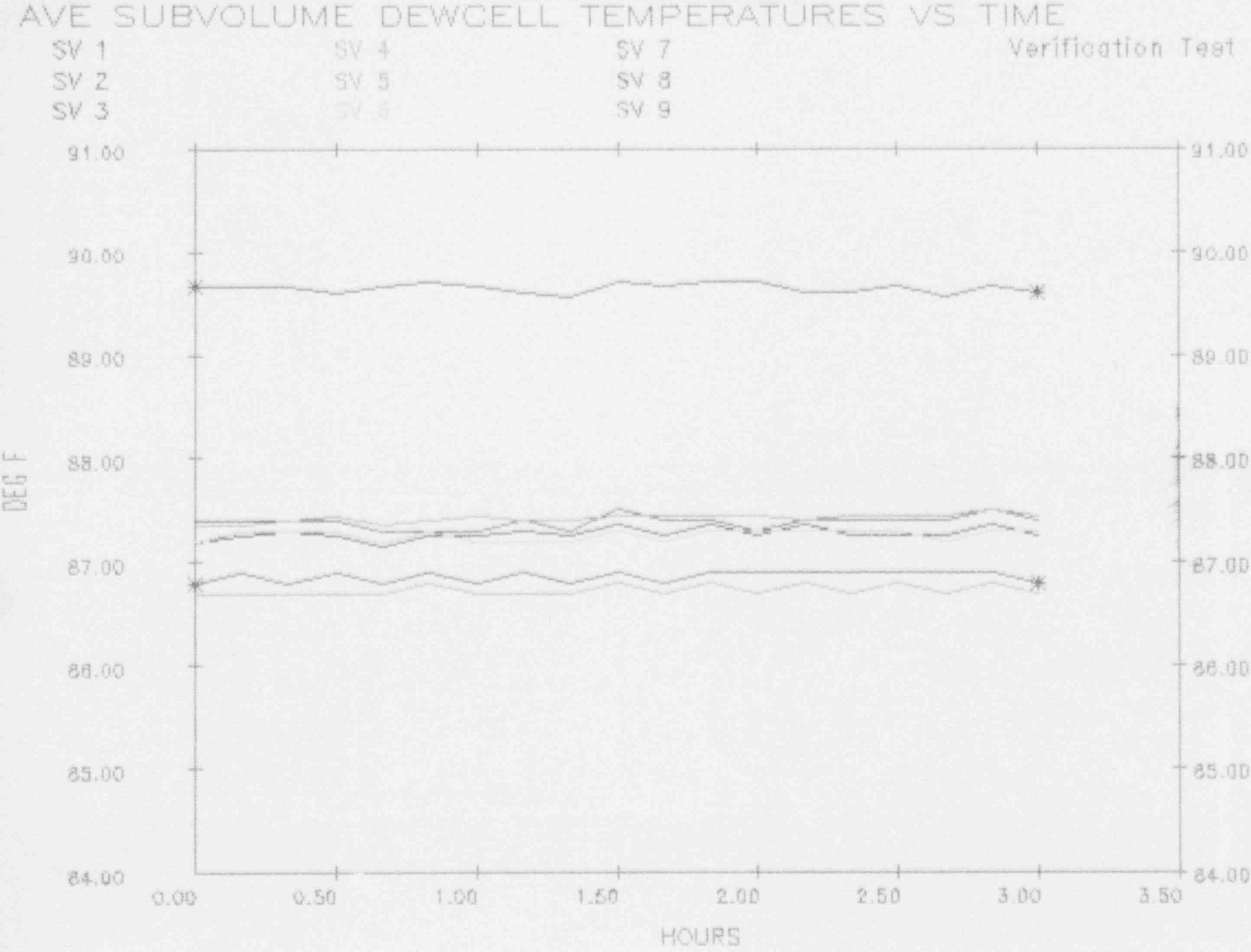

AVE SUBVOLUME RTD TEMPERATURES VS TIME
SV 1
SV 2
SV 3
SV 4
SV 5
SV 6
SV 7
SV 8
SV 9
Verification Test
DEG F
130.00
120.00
110.00
100.00
90.00
80.00
70.00
60.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
HOURS
SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 13

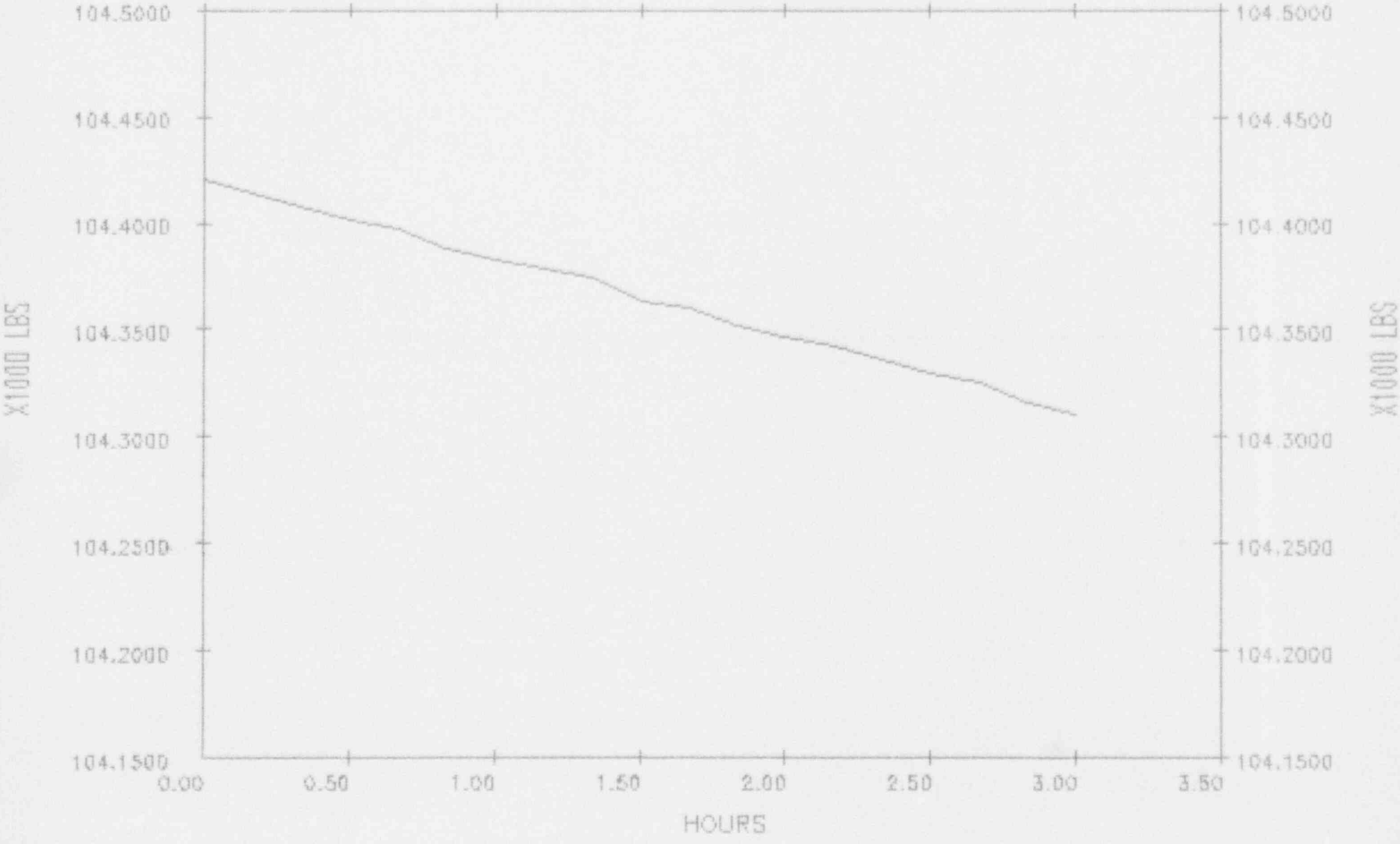


SOFTWARE ID NUMBER: GN01405-0.0

CONTAINMENT DRY AIR MASS VS TIME

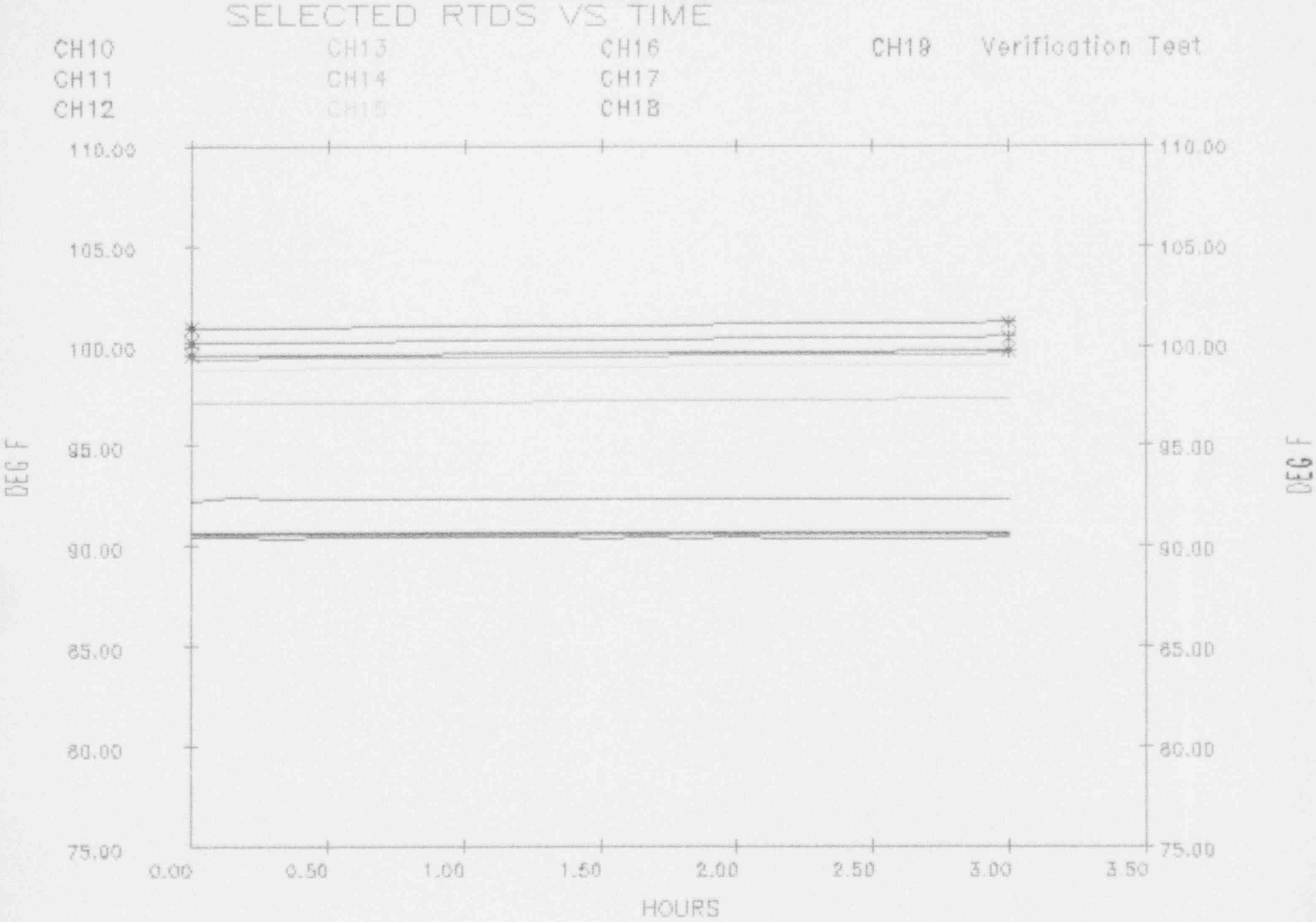
Verification Test

FIGURE 14



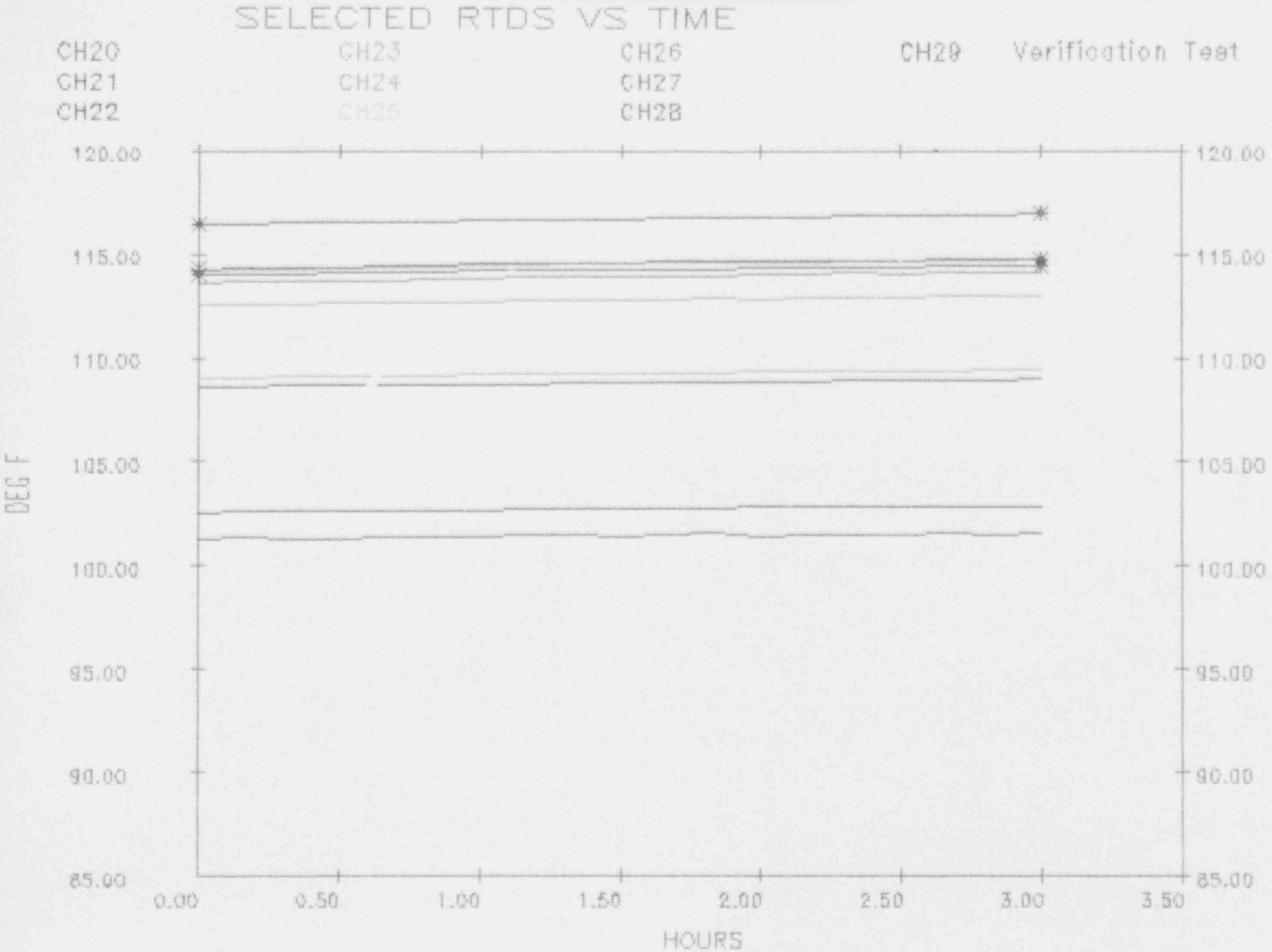
SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 15



SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 15 (CONT.)



SOFTWARE ID NUMBER: GN01405-0.0

FIGURE 15 (CONT.)

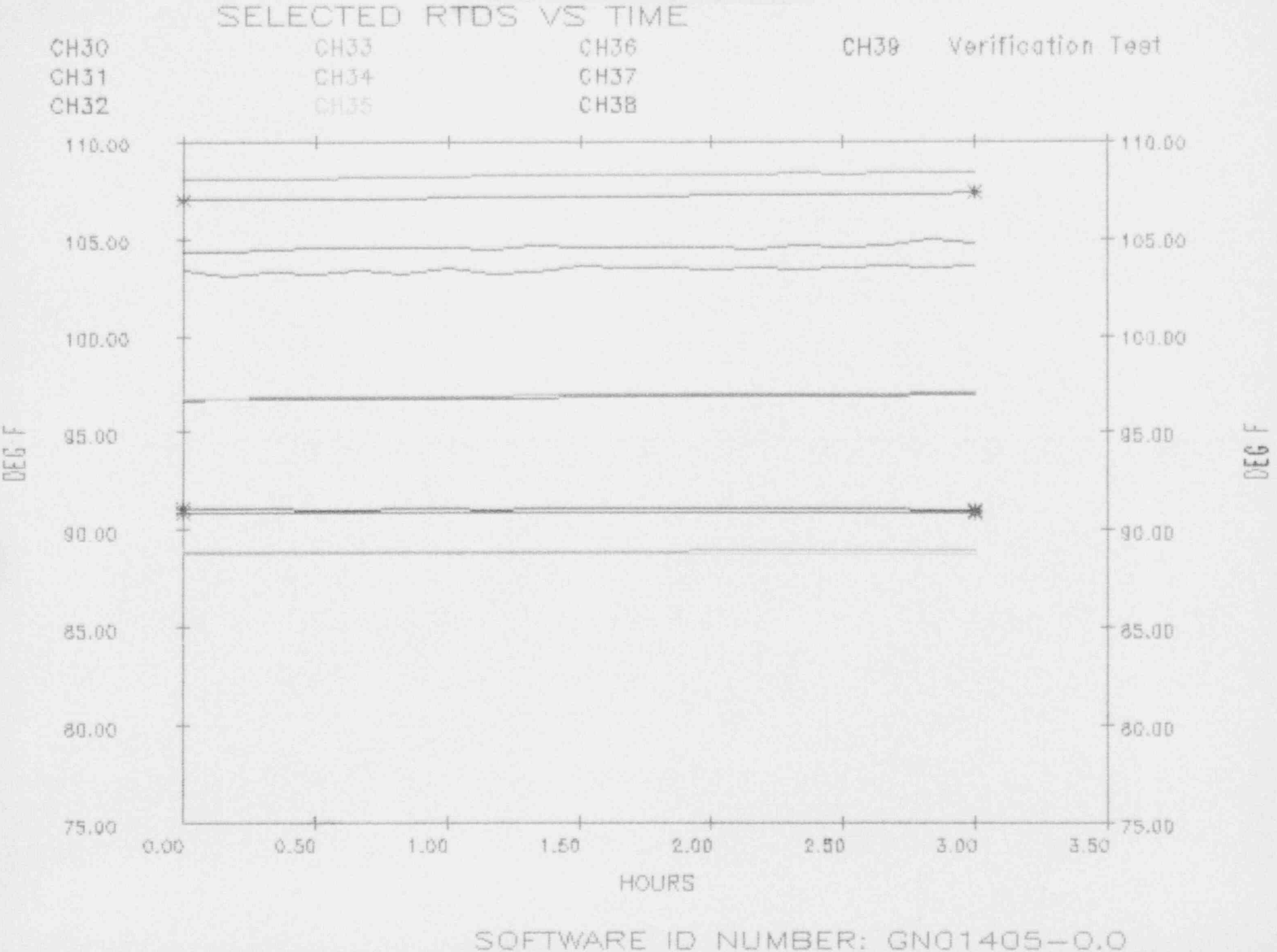
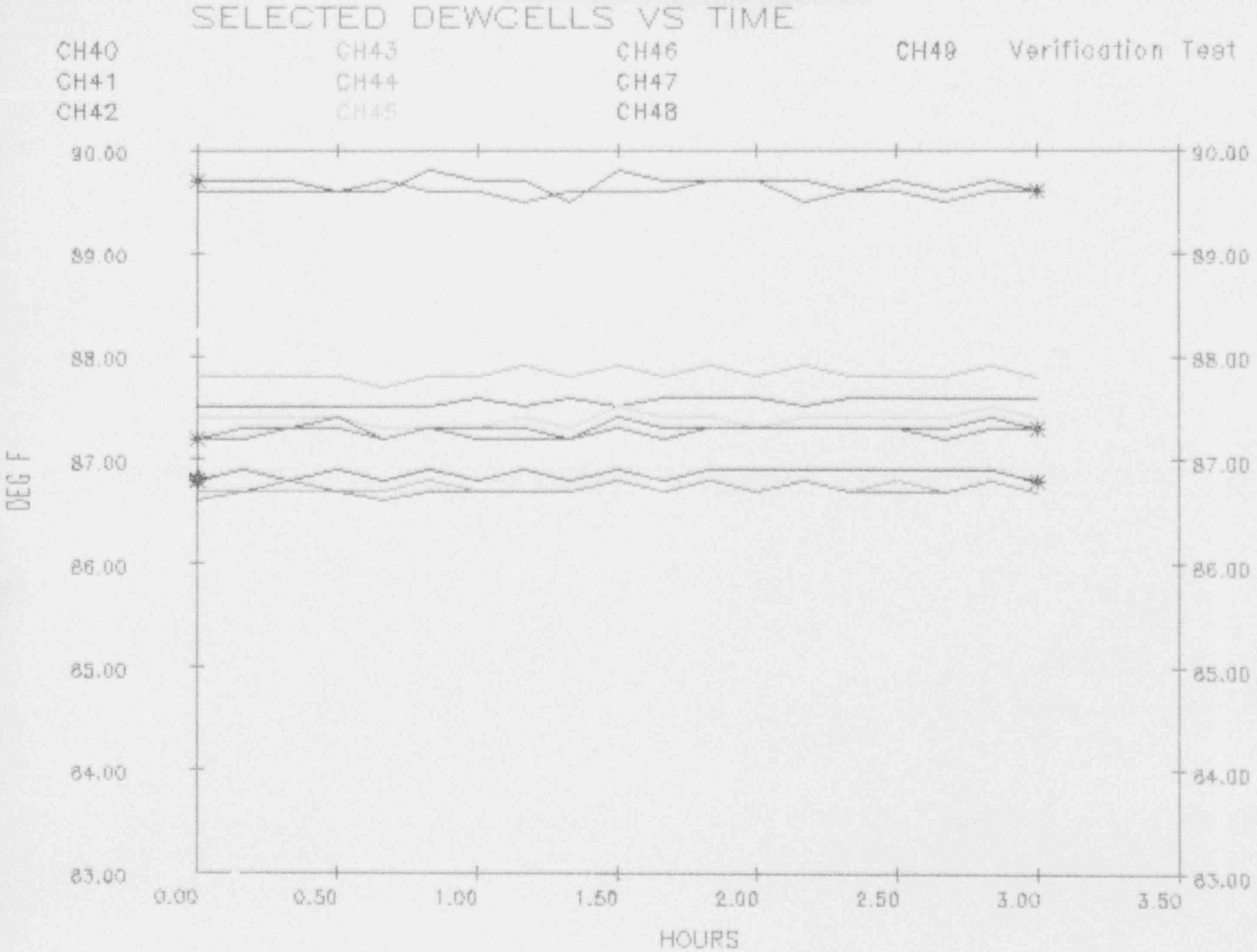


FIGURE 15 (CONT.)



SOFTWARE ID NUMBER: GN01405-0.0

SECTION E - TEST CALCULATIONS

Calculations for the test were based on LaSalle County Procedure LTS-300-4. A reproduction of this computational procedure is found in Appendix C. The instrument error analyses are also found in Appendix C. In preparing for the LaSalle Station short duration test using BN-TOP-1, Rev. 1 a number of editorial error and ambiguous statements in the topical report were identified. These errors are presented in Appendix D and are editorial in nature only. The Station has made no attempt to improve or deviate from the methodology outlined in the topical report.

SECTION F - TYPE A TEST RESULTS AND INTERPRETATION

F.1 Measured Leak Rate Test Results

Based upon data collected during the Short Duration Test, the following results were determined:

	Actual Leak Rate (wt%/day)	Acceptance Criterion (wt%/day)
Total time measured leak rate	0.2085	0.476
Calculated leak rate	0.1879	0.476
Upper 95% confidence limit leak rate	0.2753	0.476

F.2 Induced Phase Test Results

A leak of 385.0 SCFH (0.6342 wt%/day) was induced on the Primary Containment for this phase of the test. The following results were determined:

	Actual Leak Rate (wt%/day)
Superimposed Flowmeter Leakrate (L_o)	0.6342
Calculated Leakrate prior to verification test (L_i)	0.1879
Induced Calculated Leakrate during verification test (L_c)	0.820

Acceptance Criterion: $|L_c - (L_i + L_o)| \leq 0.159$ wt%/day

$$|L_c - (L_i + L_o)| = 0.0021 \text{ wt\%/day}$$

F.3 Leak Rate Compensation for Non-Vented Penetrations

The Integrated Primary Containment Leak Rate Test was performed with the following penetrations not drained and vented as required by 10CFR50, Appendix J. The minimum pathway As Left Leak Rate of each of these penetrations, as determined by Type C testing is listed:

Penetration	Function	SCFH
M-16	RBCCW Supply	0.065
M-17	RBCCW Return	0.0
M-25	PCCW "A" Supply	0.23
M-26	PCCW "B" Supply	0.345
M-27	PCCW "A" Return	0.56
M-28	PCCW "B" Return	0.74
M-30	RWCU Suction	0.0
M-36	Recirc Loop Sample	0.0
M-96	Drywell Equipment Drain Sump	6.72
M-98	Drywell Floor Drain Sump	2.045
M-97	Drywell Equipment Sump Cooling	0.5
M-22	Inboard MSIV Drain	0.0
M-7	RHR Shutdown Cooling Suction	0.0
M-15	RCIC Steam Supply	0.51
ECCS/RCIC	Worst Division	10.4
M-HG	Unit 2 Hydrogen Recombiner	7.19
M-34	Standby Liquid Control	0.0
M-5	"A" Feedwater Line	15.36
	TOTAL	45.25

This yields the following Non-Vented Penetration Penalty:

Total (SCFH) x 1.6473×10^{-3}

Non-vented Penetration Penalty : 0.0745 wt%/day

F.4 Change in Drywell Sump Level

Changes in drywell sump levels were not used in calculating the final leakage rate. The sump level during the test did not change as verified by pre and post ILRT sump level measurement.

F.5 Evaluation of Instrument Failures

There were no instruments or sensor rejected during the PCILRT Leakage and Verification Tests. Channel 11, a temperature sensor located in the Suppression Chamber Subvolume 9, was locked out of the Data Acquisition System prior to containment pressurization, due to sporadic response. Channel 39, a temperature sensor, also located in the Suppression Chamber Subvolume 9, was locked out during the stabilization phase due to erratic instrument response, as compared to other sensors in that Subvolume. No further instrument problems occurred during the PCILRT or verification test. These changes did not affect ISG calculations prior and post test for instrument errors.

F.6 As-Found (Calculated Adjusted) Local Leak Rate

The 95% Upper Confidence Limit, Type A test leak rate, plus the total leak rate penalty for non-vented penetrations, plus the sum of the Calculated Adjusted local leak rates must be less than 0.75 La. The Calculated Adjusted local leak rates are summarized in Table 5.

As Found Test Results

95% Upper Confidence Limit	0.2753 wt%/day
A Penalty for Non-Vented Penetrations	0.0745 wt%/day
Calculated Adjusted Leakage	0.0291 wt%/day
TOTAL	0.3789 wt%/day

The total "As Found" Containment leakage rate was below the Maximum allowable leakage rate of 0.75 La (0.476 wt%/day). Thus, the "AS-FOUND" Containment Integrated Leakage is satisfactory.

TABLE 5
(Sheet 1 of 5)

CALCULATED ADJUSTED LEAKAGE

VALVE(S) OR PENETRATION	TEST VOLUME	MINIMUM PATHWAY AS FOUND/AS LEFT (SCFH)	ADJUSTED LOCAL LEAK RATE (SCFH)
1B21-F016/F019	Inboard MSIV Drain	0.0 / 0.0	* 0.0
1VQ029/30/42	Drywell Vent	0.0 / 0.0	* 0.0
1VQ034/35/36/68	Drywell Purge	3.0 / 3.46	# 0.0
1B21-F010A/F032A	"A" FW to Reactor	10.71/15.36	@ 0.0
1B21-F010B/F032B	"B" FW to Reactor	2.34/ 7.45	@ 0.0
1PC001D OUTBD Flange	Drywell Vacuum Bkr	0.73/ 0.0	$ 0.73
DW Personnel Airlock M-111	DW Personnel Airlock	3.03/ 4.26	$ 0.0
1RF012/1RF013	Drywell Floor Drain Sump	0.24/ 0.0	* 0.24
1RE026/1RE029	DW Equipment Drain Sump Cooling	1.0 / 0.0	* 1.0
E-2	Electrical Penetration	0.0 / 0.38	$ 0.0

TABLE 5
(Sheet 2 of 5)

CALCULATED ADJUSTED LEAKAGE

VALVE(S) OR PENETRATION	TEST VOLUME	MINIMUM PATHWAY AS FOUND/AS LEFT (SCFH)	ADJUSTED LOCAL LEAK RATE (SCFH)
1RE024/1RE025	Drywell Equip Drain Sump	0.245/ 0.0	* 0.245
1G33-F001/F004	RWCU Suction	0.0 / 0.0	@ 0.0
1E51-F080/F086	RCIC Turbine Exhaust Vacuum Breaker	0.185/ 0.6	# 0.0
1VP063A/113A	PCCW A Supply	0.46 / 0.0	* 0.46
1VP053B/114B	PCCW B Return	0.74 / 0.0	$ 0.74
1HG001A/2A	Combustible Gas Control A Suction	0.0 / 0.0	* 0.0
1HG001B/2B	Combustible Gas Control B Suction	0.23 / 0.0	* 0.23
1HG005A/6A	Combustible Gas Control A Return	1.45 / 0.0	* 1.45
1HG005B/6B	Combustible Gas Control B Return	3.52 / 0.0	* 3.52

TABLE 5
(Sheet 3 of 5)

CALCULATED ADJUSTED LEAKAGE

VALVE(S) OR PENETRATION	TEST VOLUME	MINIMUM PATHWAY AS FOUND/AS LEFT (SCFH)	ADJUSTED LOCAL LEAK RATE (SCFH)
1E51-F063/76/64/08	RCIC Steam Supply	7.5 /0.515	+ 6.99
1E51-F013/1E12-F023	RHR/RCIC Head Spray	0.0/0.65	$ 0.0
1WR029/179	RBCCW Supply	0.0/0.65	@ 0.0
1WR040/180	RBCCW Return	0.0/0.0	@ 0.0
1E22-F004	HPCS Injection	0.0 /0.0	$ 0.0
1E12-F008/F009	RHR SDC Suction	0.47/0.0	@ 0.47
1C41-F004A/4B/F007	SBLC Injection	0.0/0.0	+ 0.0
1E51-F028/F069	RCIC Vacuum Pump Disch.	2.3/3.065	* 0.0
1E51-F040/F068	RCIC Turbine Exhaust	0.5/0.0	* 0.5
1VQ047/48	Drywell Inerting Makeup	0.0/0.0	# 0.0

TABLE 5
(Sheet 4 of 5)

CALCULATED ADJUSTED LEAKAGE

VALVE(S) OR PENETRATION	TEST VOLUME	MINIMUM PATHWAY AS FOUND/AS LEFT (SCFH)	ADJUSTED LOCAL LEAK RATE (SCFH)
1E12-F016A/F017A	RHR A Drywell Spray	0.92/0.0	* 0.92
1E12-F016B/F017B	RHR B Drywell Spray	0.0 /0.0	* 0.0
1E12-F042B	RHR B LPCI Injection	3.68/3.53	$ 0.15
1E12-F053B	RHR B SCD Return	0.0 /0.37	$ 0.0
1E12-F042C	RHR C LPCI Injection	2.53/6.5	$ 0.0
1CM022A/24A/25A	Post Loca Containment Monitoring	0.46/8.3	+ 0.0

TOTAL 17.645 SCFH

Total (SCFH) X 1.6473 x 10^{-3}

Calculated Adjusted Leakage = 0.02907 wt%/day

TABLE 5
(Sheet 5 of 5)

CALCULATED ADJUSTED LEAKAGE

@ In the case where individual leak rates are assigned to two valves in series (both before and after the R&A), the penetration through-leakage would simply be the smaller or best of the two valves' leak rates.

$ The Minimum Pathway Leak Rate of a single valve pathway is equal to the measured leak rate past that single valve.

In the case where a leak rate is obtained by pressurizing between two isolation valves and the individual valve's leak rate is not quantified, the AS-FOUND and AS-LEFT penetration through-leakage for each valve would be one half the measured leak rate if both valves are repaired.

* In the case where a leak rate is obtained by pressurizing between two isolation valves and only one valve is repaired, the AS-FOUND penetration leak rate would conservatively be the final measured leak rate or one half of the measured value prior to repairs or adjustments, whichever is smaller. The AS-LEFT penetration through leak rate, in either case is zero. This assumes the repaired valve leaks zero.

+ The Minimum Pathway Leak Rate of a parallel multi-valve pathway is equal to the sum of the leakages of all the inboard valves or the sum of the leakages of all the outboard valves whichever is smaller. If individual valve leakage rates are not known and the system is tested by pressurizing between all the valves, the Minimum Pathway Leak Rate is equal to half the measured leakage rate.

The correction (Calculated Adjustment) for each pathway is that pathway's Minimum Path Leakage Rate before the R&A minus its Minimum Path Leakage after the R&A but before the Type A Test. Any negative corrections will be set equal to zero.

APPENDICES

APPENDIX A

TYPE B AND C TESTS

Presented herein are the results of local leak rate tests conducted on all penetrations, double-gasketed seals, and isolation valves during the last two Unit One Refuel Outages, L1R04 (fourth) and L1R05 (fifth). Total leakage for double-gasketed seals and total leakage for all other penetrations and isolation valves following repairs satisfied all Technical Specification limits. These results are listed in Table 6.

L1R05

LLRT RESULTS

TABLE 6
(L1R05 Sheet 1 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH)				AS-LEFT (SCFH)			
			DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-22	Inboard MSIV Drain	1B21-F016/1B21-F019	10/06/92	1.56	0.78	1.56	12/05/92	0.0	0.0	0.0
M-66	Suppression Chamber Vent	1VQ026/1VQ027/1VQ043	10/10/92	0.46	0.23	0.46	10/10/92	0.46	0.23	0.46
M-20	Drywell Vent	1VQ029/1VQ030/1VQ042	10/10/92	0.0	0.0	0.0	12/15/92	0.6	0.3	0.6
M-67	Suppression Chamber Purge	1VQ031/1VQ032/1VQ040	10/10/92	0.55	0.275	0.55	10/10/92	0.55	0.275	0.55
M-21	Drywell Purge	1VQ034/1VQ035/1VQ036 1VQ068	10/12/92	6.0	3.0	6.0	12/15/92	6.92	3.46	6.92
I-36	Suppression Chamber C.A.M.	1CM027/1CM028	10/08/92	0.0	0.0	0.0	10/08/92	0.0	0.0	0.0
I-11	Drywell C.A.M.	1CM029/1CM030	10/08/92	0.0	0.0	0.0	10/08/92	0.0	0.0	0.0
I-11	P.C. Air Sample	1CM031/1CM032	10/08/92	0.0	0.0	0.0	10/08/92	0.0	0.0	0.0
I-45	Sample Return to Suppression Chamber	1CM033/1CM034	10/08/92	0.0	0.0	0.0	10/08/92	0.0	0.0	0.0
M-5	A Feedwater	1B21-F010A	10/06/92	Infinite			12/20/92	29.45		
		1B21-F032A	10/06/92	10.71			12/23/92	15.36		
		1B21-F065A	10/06/92	0.0	10.71	Infinite	10/06/92	0.0	15.36	29.45
M-6	B Feedwater and RWCU Return	1B21-F010B	10/12/92	7.45			10/12/92	7.45		
		1B21-F032B	10/12/92	2.34			12/03/92	8.84		
		1B21-F065B	10/12/92	0.0			12/03/92	0.37		
		1G33-F040	10/24/92	0.0	2.34	7.45	10/24/92	0.0	7.45	8.84
M-62	Drywell Pneumatic Suction	1IN001A/1IN001B	10/14/92	1.015	0.51	1.015	10/14/92	1.015	0.51	1.015
M-36	Recirc Loop Sample	1B33-F019	10/17/92	0.0			10/17/92	0.0		
		1B33-F020	10/17/92	0.0	0.0	0.0	10/17/92	0.0	0.0	0.0
			PAGE TOTAL		17.845	Infinite			27.585	47.835

TABLE 6
(L1R05 Sheet 2 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-98	Drywell Floor Drain Sump	1RF012/1RF013	10/09/92	0.48	0.24	0.48	12/29/92	4.09	2.045	4.09
M-111	Drywell Personnel Access Hatch	Drywell Personnel Access Hatch	10/02/92	3.03	3.03	3.03	01/08/93	4.26	4.26	4.26
M-112	Drywell Equipment Hatch	Drywell Equipment Hatch	10/04/92	0.0	0.0	0.0	01/10/93	0.0	0.0	0.0
M-113	NW Suppression Pool Access Hatch	NW Suppression Pool Access Hatch	10/02/92	0.0	0.0	0.0	01/04/93	0.0	0.0	0.0
M-114	SE Suppression Pool Access Hatch	SE Suppression Pool Access Hatch	10/02/92	0.0	0.0	0.0	12/15/92	0.0	0.0	0.0
M-115	CRD Removal Hatch	CRD Removal Hatch	10/02/92	0.0	0.0	0.0	12/17/92	0.0	0.0	0.0
N/A	Drywell Head	Drywell Head	10/04/92	0.0	0.0	0.0	01/06/93	0.0	0.0	0.0
M-42	E T.I.P. Penetration Flange	E T.I.P. Penetration Flange	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-43	D T.I.P. Penetration Flange	D T.I.P. Penetration Flange	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-44	C T.I.P. Penetration Flange	C T.I.P. Penetration Flange	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-45	B T.I.P. Penetration Flange	B T.I.P. Penetration Flange	10/03/92	0.0	0.0	0.0	01/04/92	0.0	0.0	0.0
M-46	A T.I.P. Penetration Flange	A T.I.P. Penetration Flange	10/03/92	0.0	0.0	0.0	10/03/92	0.C	0.0	0.0
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Outboard Flange O-Ring Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
		PAGE TOTAL			3.27	3.51			6.305	8.35

TABLE 6
(L1R05 Sheet 3 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Inboard Flange O-Ring Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Actuator O-Ring	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Actuator Seal	10/03/92	0.55	0.55	0.55	10/03/92	0.55	0.55	0.55
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Outboard Flange O-Ring Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Inboard Flange O-Ring Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Actuator O-Ring	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Actuator Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Outboard Flange O-Ring Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Inboard Flange O-Ring Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Actuator O-Ring	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Actuator Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Outboard Flange O-Ring Seal	10/03/92	0.73	0.73	0.73	01/02/93	0.0	0.0	0.0
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Inboard Flange O-Ring Seal	10/03/92	0.0	0.0	0.0	01/02/93	0.0	0.0	0.0
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Actuator O-Ring	10/03/92	0.0	0.0	0.0	01/02/93	0.0	0.0	0.0
		PAGE TOTAL			1.28	1.28			0.55	0.55

TABLE 6
(L1R05 Sheet 4 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Actuator Seal	10/03/92	0.0	0.0	0.0	01/02/93	0.0	0.0	0.0
M-20	Drywell Vent	1VQ030 Inner Flange Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-82	HPCS Spare Penetration	HPCS Spare Flange	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-66	Suppression Pool Vent	1VQ027 Inner Flange Seal	10/02/92	0.82	0.82	0.82	10/02/92	0.82	0.82	0.82
M-67	Suppression Chamber Purge	1VQ031 Inner Flange Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-21	Drywell Purge	1VQ034 Inner Flange Seal	10/03/92	0.46	0.46	0.46	10/03/92	0.46	0.46	0.46
M-20	Drywell Vent	1VQ030 Valve Stem Packing	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-66	Suppression Chamber Vent	1VQ027 Valve Stem Packing	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-38	SA to Drywell	Service Air Blind Flange Seal	10/02/92	0.0	0.0	0.0	01/12/93	0.0	0.0	0.0
M-37	MC to Drywell	MC Blind Flange Seal	10/02/92	0.0	0.0	0.0	01/09/93	0.0	0.0	0.0
M-67	Suppression Chamber Purge	1VQ031 Valve Stem Packing	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-21	Drywell Purge	1VQ034 Valve Stem Packing	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-103	C Vacuum Breaker Line	1PC003C Inner Flange Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-104	A Vacuum Breaker Line	1PC003A Inner Flange Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
		PAGE TOTAL			1.28	1.28			1.28	1.28

TABLE 6
(L1R05 Sheet 5 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-105	D Vacuum Breaker Line	1PC003D Inner Flange Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-106	B Vacuum Breaker Line	1PC003B Inner Flange Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-107	C Vacuum Breaker Line	1PC002C Inner Flange Seal	10/02/92	0.0	0.0	0.0	10/02/92	0.0	0.0	0.0
M-108	A Vacuum Breaker Line	1PC002A Inner Flange Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-109	D Vacuum Breaker Line	1PC002D Inner Flange Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-110	B Vacuum Breaker Line	1PC002B Inner Flange Seal	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-97	DW Equipment Drain Sump Cooling	1RE026/1RE029	10/09/92	6.88	3.44	6.88	12/30/92	1.0	0.5	1.0
E-2	Electrical Penetration	Electrical Penetration E-2	10/03/92	0.0	0.0	0.0	12/22/92	0.38	0.38	0.38
E-3	Electrical Penetration	Electrical Penetration E-3	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-4	Electrical Penetration	Electrical Penetration E-4	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-5	Electrical Penetration	Electrical Penetration E-5	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-6	Electrical Penetration	Electrical Penetration E-6	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-7	Electrical Penetration	Electrical Penetration E-7	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-8	Electrical Penetration	Electrical Penetration E-8	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
			PAGE TOTAL		3.44	6.88			0.88	1.38

TABLE 6
(L1R05 Sheet 6 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
E-9	Electrical Penetration	Electrical Penetration E-9	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-10	Electrical Penetration	Electrical Penetration E-10	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-11	Electrical Penetration	Electrical Penetration E-11	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-12	Electrical Penetration	Electrical Penetration E-12	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-13	Electrical Penetration	Electrical Penetration E-13	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-14	Electrical Penetration	Electrical Penetration E-14	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-15	Electrical Penetration	Electrical Penetration E-15	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-16	Electrical Penetration	Electrical Penetration E-16	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-17	Electrical Penetration	Electrical Penetration E-17	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-18	Electrical Penetration	Electrical Penetration E-18	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-19	Electrical Penetration	Electrical Penetration E-19	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-20	Electrical Penetration	Electrical Penetration E-20	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-21	Electrical Penetration	Electrical Penetration E-21	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-23	Electrical Penetration	Electrical Penetration E-23	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
			PAGE TOTAL		0.0	0.0			0.0	0.0

TABLE 6
(L1R05 Sheet 7 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	AS-FOUND TOTAL	AS-FOUND MINIMUM PATHWAY	AS-FOUND MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	AS-LEFT TOTAL	AS-LEFT MINIMUM PATHWAY	AS-LEFT MAXIMUM PATHWAY
E-24	Electrical Penetration	Electrical Penetration E-24	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
E-26	Electrical Penetration	Electrical Penetration E-26	10/03/92	0.0	0.0	0.0	10/03/92	0.0	0.0	0.0
M-96	DW Equipment Drain Sump	1RE024/1RE025	10/09/92	0.49	0.245	0.49	01/11/93	13.44	6.72	13.44
M-30	RWCU Suction	1G33-F001	10/27/92	25.6			12/06/92	0.0		
		1G33-F004	10/27/92	0.0	0.0	25.6	12/06/92	0.0	0.0	0.0
M-101	RCIC Turbine Exhaust Vacuum Breaker	1E51-F080/1E51-F086	10/14/92	0.37	0.185	0.37	01/04/93	1.2	0.6	1.2
M-25	PCCW A Supply	1VP063A/1VP113A	10/10/92	0.94	0.47	0.94	11/13/92	0.46	0.23	0.46
M-26	PCCW B Supply	1VP063B/1VP113B	10/07/92	0.69	0.345	0.69	10/07/92	0.69	0.345	0.69
M-27	PCCW A Return	1VP053A/1VP114A	10/10/92	1.11	0.56	1.11	10/10/92	1.11	0.56	1.11
M-28	PCCW B Return	1VP053B/1VP114B	10/07/92	1.66	0.83	1.66	01/05/93	1.48	0.74	1.48
M-47	T.I.P. Index Purge Air Supply	1IN031	10/14/92	0.0	0.0	0.0	10/14/92	0.0	0.0	0.0
M-60	DW Pneumatic Discharge to DW	1IN017	10/14/92	0.0			10/14/92	0.0		
		1IN018	10/14/92	0.0	0.0	0.0	10/14/92	0.0	0.0	0.0
M-53	Combustible Gas Control A Suction	1HG001A/1HG002A	10/23/92	0.0	0.0	0.0	12/08/92	0.0	0.0	0.0
M-104	Combustible Gas Control A Return	1HG005A/1HG006A	10/23/92	2.9	1.45	2.9	12/08/92	2.32	1.16	2.32
M-33	Combustible Gas Control B Suction	1HG001B/1HG002B	10/23/92	0.46	0.23	0.46	12/12/92	0.46	0.23	0.46
		PAGE TOTAL			4.315	34.22			10.585	21.16

TABLE 6
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PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	AS-FOUND (SCFH) TOTAL	AS-FOUND (SCFH) MINIMUM PATHWAY	AS-FOUND (SCFH) MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	AS-LEFT (SCFH) TOTAL	AS-LEFT (SCFH) MINIMUM PATHWAY	AS-LEFT (SCFH) MAXIMUM PATHWAY
M-106	Combustible Gas Control B Return	1HG005B/1HG006B	10/24/92	13.33	6.67	13.33	12/12/92	3.52	1.76	3.52
M-15	Steam to RCIC	1E51-F063/1E51-F076 1E51-F064/1E51-F008	10/13/92	15.0	7.5	15.0	12/18/92	1.02	0.51	1.02
M-38	SA to Drywell	1SA042 & 1SA046 Packing	01/12/93	0.0	0.0	0.0	01/12/93	0.0	0.0	0.0
M-37	MC to Drywell	1MC027 & 1MC033 Packing	01/08/93	0.0	0.0	0.0	01/08/93	0.0	0.0	0.0
M-29	RHR/RCIC Head Spray	1E12-F023/1E51-F013	10/23/92	0.0	0.0	0.0	12/31/92	0.65	0.65	0.65
M-59	CY to Refueling Bellows	1FC113 1FC114	10/08/92 10/08/92	0.0 0.0	0.0	0.0	10/08/92 10/08/92	0.0 0.0	0.0	0.0
M-65	Reactor Well Drain	1FC086 1FC115	10/07/92 10/07/92	0.0 0.0	0.0	0.0	10/07/92 10/07/92	0.0 0.0	0.0	0.0
M-16	RBCCW Supply	1WR029 1WR179	10/15/92 10/15/92	0.0 6.678	0.0	6.678	12/29/92 12/24/92	6.79 0.65	0.65	6.79
M-17	RBCCW Return	1WR040 1WR180	10/24/92 10/24/92	0.0 Infinite	0.0	Infinite	12/30/92 12/24/92	0.0 0.0	0.0	0.0
I-4F	DW Humidity Monitor A Suction	1CM017A/1CM018A	10/08/92	0.0	0.0	0.0	10/08/92	0.0	0.0	0.0
I-5F	DW Humidity Monitor B Suction	1CM017B/1CM018B	10/08/92	0.0	0.0	0.0	10/08/92	0.0	0.0	0.0
I-45	DW Humidity Monitor A Return	1CM019A/1CM020A	10/09/92	0.55	0.275	0.55	10/09/92	0.55	0.275	0.55
I-45	DW Humidity Monitor B Return	1CM019B/1CM020B	10/09/92	0.0	0.0	0.0	10/09/92	0.0	0.0	0.0
M-60	DW Pneumatic Dryer Purge	1IN074/1IN075	10/14/92	0.47	0.235	0.47	10/14/92	0.47	0.235	0.47
		PAGE TOTAL			14.68	Infinite			4.08	13.0

TABLE 6
(L1R05 Sheet 9 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-11	HPCS Injection	1E22-F004	10/08/92	0.0	0.0	0.0	12/21/92	0.0	0.0	0.0
M-7	RHR Shutdown	1E12-F008	10/22/92	1.11			10/22/92	1.11		
	Cooling Suction	1E12-F009	10/22/92	0.47	0.47	1.11	11/29/92	0.0	0.0	1.11
M-34	SBLC Injection	1C41-F004A/1C41-F004B	04/02/91	0.0			12/01/92	0.0		
	Line	1C41-F007	12/01/92	0.0	0.0	0.0	12/01/92	0.0	0.0	0.0
M-81	RCIC Vacuum Pump Discharge	1E51-F028/1E51-F069	10/14/92	Infinite	2.18	Infinite	01/02/93	6.13	3.07	6.13
M-76	RCIC Turbine Exhaust	1E51-F040/1E51-F068	10/13/92	7.37	3.685	7.37	01/02/93	0.5	0.25	0.5
M-20	Drywell Inerting Makeup	1VQ047/1VQ048	10/15/92	0.0	0.0	0.0	12/15/92	0.0	0.0	0.0
M-66	Suppression Pool Inerting Makeup	1VQ050/1VQ051	10/15/92	0.0	0.0	0.0	10/15/92	0.0	0.0	0.0
M-46	A T.I.P. Penetration	T.I.P. Ball Valve A	10/14/92	0.37	0.37	0.37	10/14/92	0.37	0.37	0.37
M-45	B T.I.P. Penetration	T.I.P. Ball Valve B	10/14/92	1.11	1.11	1.11	10/14/92	1.11	1.11	1.11
M-44	C T.I.P. Penetration	T.I.P. Ball Valve C	10/14/92	0.37	0.37	0.37	10/14/92	0.37	0.37	0.37
M-43	D T.I.P. Penetration	T.I.P. Ball Valve D	10/14/92	1.86	1.86	1.86	10/14/92	1.86	1.86	1.86
M-42	E T.I.P. Penetration	T.I.P. Ball Valve E	10/14/92	0.37	0.37	0.37	10/14/92	0.37	0.37	0.37
M-18	A RHR Drywell Spray	1E12-F016A/1E12-F017A	10/23/92	0.92	0.46	0.92	11/30/92	1.94	0.97	1.94
M-19	B RHR Drywell Spray	1E12-F016B/1E12-F017B	10/13/92	0.0	0.0	0.0	11/20/92	0.0	0.0	0.0
			PAGE TOTAL		10.875	Infinite			8.37	13.76

TABLE 6
(L1R05 Sheet 10 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-13	A RHR LPCI Injection	1E12-F042A	10/23/92	0.0	0.0	0.0	10/23/92	0.0	0.0	0.0
M-14	B RHR LPCI Injection	1E12-F042B	10/12/92	3.68	3.68	3.68	11/24/92	3.53	3.53	3.53
M-8	A RHR Shutdown Cooling Return	1E12-F053A	10/23/92	0.37	0.37	0.37	10/23/92	0.37	0.37	0.37
M-9	B RHR Shutdown Cooling Return	1E12-F053B	10/13/92	0.0	0.0	0.0	11/24/92	0.37	0.37	0.37
M-10	LPCS Injection	1E21-F005	11/17/92	2.51	2.51	2.51	11/17/92	2.51	2.51	2.51
M-12	C RHR LPCI Injection	1E12-F042C	10/10/92	2.53	2.53	2.53	11/21/92	6.5	6.5	6.5
M-77	RCIC Test Return to Suppression Pool	1E51-F362/1E51-F363	N/A	N/A	N/A	N/A	01/04/93	0.0	0.0	0.0
I-11/I-36/ I-45	A POST LOCA Containment Monitoring	1CM022A/1CM024A/1CM025A	10/09/92	0.46	0.46	0.46	12/30/92	8.3	8.3	8.3
I-50/I-35/ I-47	B POST LOCA Containment Monitoring	1CM021B/1CM023B/1CM026B	10/09/92	11.44	11.44	11.44	12/30/92	3.93	3.93	3.93
				PAGE TOTAL	20.99	20.99			25.51	25.51
				TOTAL ALL PAGES	77.975	Infinite			85.145	132.825

L1R04

LLRT RESULTS

TABLE 6
(L1R04 Sheet 1 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-22	Inboard MSIV Drain	1B21-F016/1B21-F019	02/18/91	7.8	3.9	7.8	04/08/91	0.85	0.425	0.85
M-66	Suppression Chamber Vent	1VQ026/1VQ027/1VQ043	02/21/91	1.57	0.785	1.57	04/10/91	0.371	0.186	0.371
M-20	Drywell Vent	1VQ029/1VQ030/1VQ042	02/21/91	0.65	0.325	0.65	02/21/91	0.65	0.325	0.65
M-67	Suppression Chamber Purge	1VQ031/1VQ032/1VQ040	02/22/91	1.66	0.83	1.66	04/10/91	0.512	0.256	0.512
M-21	Drywell Purge	1VQ034/1VQ035/1VQ036 1VQ068	02/21/91	13.0	6.5	13.0	02/21/91	4.22	2.11	4.22
I-36	Suppression Chamber C.A.M.	1CM027/1CM028	02/24/91	0.0	0.0	0.0	02/24/91	0.0	0.0	0.0
I-11	Drywell C.A.M.	1CM029/1CM030	02/24/91	0.0	0.0	0.0	02/24/91	0.0	0.0	0.0
I-11	P.C. Air Sample	1CM031/1CM032	02/24/91	0.0	0.0	0.0	02/24/91	0.0	0.0	0.0
I-45	Sample Return to Suppression Chamber	1CM033/1CM034	02/24/91	0.0	0.0	0.0	02/24/91	0.0	0.0	0.0
M-5	A Feedwater	1B21-F010A	02/18/91	Infinite			03/06/91	8.87		
		1B21-F032A	02/18/91	7.4			03/04/91	9.26		
		1B21-F065A	02/18/91	0.0	7.4	Infinite	03/04/91	1.31	8.87	9.26
M-6	B Feedwater and RWCU Return	1B21-F010B	02/19/91	0.94			02/19/91	0.94		
		1B21-F032B	02/20/91	1.11			04/04/91	6.01		
		1B21-F065B	02/20/91	0.47			03/24/91	3.42		
		1G33-F040	02/20/91	0.0	0.94	1.11	03/24/91	0.0	0.94	6.01
M-62	Drywell Pneumatic Suction	1IN001A/1IN001B	02/21/91	1.29	0.645	1.29	02/21/91	1.29	0.645	1.29
M-36	Reactor Recirc Sample	1B33-F019	02/25/91	1.97			02/25/91	1.97		
		1B33-F020	02/25/91	1.42	1.42	1.97	02/25/91	1.42	1.42	1.97
			PAGE TOTAL		22.745	Infinite			15.177	25.133

TABLE 6
(L1R04 Sheet 2 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-98	Drywell Floor Drain Sump	1RF012/1RF013	03/18/91	2.49	1.245	2.49	04/26/91	0.99	0.495	0.99
M-111	Drywell Personnel Access Hatch	Drywell Personnel Access Hatch	02/15/91	2.3	2.3	2.3	05/02/91	1.12	1.12	1.12
M-112	Drywell Equipment Hatch	Drywell Equipment Hatch	02/16/91	0.0	0.0	0.0	04/30/91	0.0	0.0	0.0
M-113	NW Suppression Pool Access Hatch	NW Suppression Pool Access Hatch	02/16/91	0.0	0.0	0.0	04/22/91	0.0	0.0	0.0
M-114	SE Suppression Pool Access Hatch	SE Suppression Pool Access Hatch	02/16/91	0.0	0.0	0.0	04/22/91	0.0	0.0	0.0
M-115	CRD Removal Hatch	CRD Removal Hatch	02/16/91	0.0	0.0	0.0	04/19/91	0.0	0.0	0.0
N/A	Drywell Head	Drywell Head	02/16/91	0.0	0.0	0.0	04/29/91	0.0	0.0	0.0
M-42	E T.I.P. Penetration Flange	E T.I.P. Penetration Flange	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-43	D T.I.P. Penetration Flange	D T.I.P. Penetration Flange	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-44	C T.I.P. Penetration Flange	C T.I.P. Penetration Flange	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-45	B T.I.P. Penetration Flange	B T.I.P. Penetration Flange	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-46	A T.I.P. Penetration Flange	A T.I.P. Penetration Flange	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Outboard Flange Seal	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
		PAGE TOTAL			3.545	4.79			1.615	2.11

TABLE 6
(L1R04 Sheet 3 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Inboard Flange O-Ring Seal	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Actuator O-Ring	02/17/91	0.65	0.65	0.65	02/17/91	0.65	0.65	0.65
M-108/M-104	DW to S.P. A Vacuum Breaker	1PC001A Actuator Seal	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Outboard Flange O-Ring Seal	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Inboard Flange O-Ring Seal	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Actuator O-Ring	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-106/M-110	DW to S.P. B Vacuum Breaker	1PC001B Actuator Seal	02/17/91	0.37	0.37	0.37	02/17/91	0.37	0.37	0.37
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Outboard Flange O-Ring Seal	02/16/91	2.17	2.17	2.17	04/17/91	0.0	0.0	0.0
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Inboard Flange O-Ring Seal	02/16/91	0.0	0.0	0.0	04/17/91	0.0	0.0	0.0
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Actuator O-Ring	02/16/91	0.0	0.0	0.0	04/17/91	0.0	0.0	0.0
M-103/M-107	DW to S.P. C Vacuum Breaker	1PC001C Actuator Seal	02/16/91	0.0	0.0	0.0	04/17/91	0.0	0.0	0.0
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Outboard Flange O-Ring Seal	02/18/91	1.2	1.2	1.2	02/18/91	1.2	1.2	1.2
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Inboard Flange O-Ring Seal	02/18/91	0.0	0.0	0.0	02/18/91	0.0	0.0	0.0
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Actuator O-Ring	02/18/91	0.0	0.0	0.0	02/18/91	0.0	0.0	0.0
		PAGE TOTAL			4.39	4.39			2.22	2.22

TABLE 6
(L1R04 Sheet 4 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-105/M-109	DW to S.P. D Vacuum Breaker	1PC001D Actuator Seal	02/18/91	0.0	0.0	0.0	02/18/91	0.0	0.0	0.0
M-20	Drywell Vent	1VQ030 Inner Flange Seal	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-82	HPCS Spare Penetration	HPCS Spare Flange	02/19/91	0.0	0.0	0.0	02/19/91	0.0	0.0	0.0
M-66	Suppression Pool Vent	1VQ027 Inner Flange Seal	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-67	Suppression Chamber Purge	1VQ031 Inner Flange Seal	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-21	Drywell Purge	1VQ034 Inner Flange Seal	02/17/91	0.599	0.599	0.599	02/17/91	0.599	0.599	0.599
M-20	Drywell Vent	1VQ030 Valve Stem Packing	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-66	Suppression Chamber Vent	1VQ027 Valve Stem Packing	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-38	SA to Drywell	Service Air Blind Flange Seal	02/16/91	0.0	0.0	0.0	05/03/91	0.0	0.0	0.0
M-37	MC to Drywell	MC Blind Flange Seal	02/16/91	0.0	0.0	0.0	05/03/91	0.47	0.47	0.47
M-67	Suppression Chamber Purge	1VQ031 Valve Stem Packing	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-21	Drywell Purge	1VQ034 Valve Stem Packing	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-103	C Vacuum Breaker Line	1PC003C Inner Flange Seal	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-104	A Vacuum Breaker Line	1PC003A Inner Flange Seal	02/19/91	0.0	0.0	0.0	02/19/91	0.0	0.0	0.0
		PAGE TOTAL			0.599	0.599			1.069	1.069

ZCADTS/468

TABLE 6
(L1R04 Sheet 5 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-105	D Vacuum Breaker Line	1PC003D Inner Flange Seal	02/19/91	0.0	0.0	0.0	02/19/91	0.0	0.0	0.0
M-106	B Vacuum Breaker Line	1PC003B Inner Flange Seal	02/19/91	0.0	0.0	0.0	02/19/91	0.0	0.0	0.0
M-107	C Vacuum Breaker Line	1PC002C Inner Flange Seal	02/16/91	0.0	0.0	0.0	02/16/91	0.0	0.0	0.0
M-108	A Vacuum Breaker Line	1PC002A Inner Flange Seal	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-109	D Vacuum Breaker Line	1PC002D Inner Flange Seal	02/18/91	0.0	0.0	0.0	02/18/91	0.0	0.0	0.0
M-110	B Vacuum Breaker Line	1PC002B Inner Flange Seal	02/17/91	0.0	0.0	0.0	02/17/91	0.0	0.0	0.0
M-97	DW Equipment Drain Sump Cooling	1RE026/1RE029	02/25/91	3.35	1.675	3.35	03/16/91	0.74	0.37	0.74
E-2	Electrical Penetration	Electrical Penetration E-2	02/25/91	0.0	0.0	0.0	02/25/91	0.0	0.0	0.0
E-3	Electrical Penetration	Electrical Penetration E-3	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-4	Electrical Penetration	Electrical Penetration E-4	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-5	Electrical Penetration	Electrical Penetration E-5	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-6	Electrical Penetration	Electrical Penetration E-6	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-7	Electrical Penetration	Electrical Penetration E-7	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-8	Electrical Penetration	Electrical Penetration E-8	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
		PAGE TOTAL			1.675	3.35			0.37	0.74

TABLE 6
(L1R04 Sheet 6 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	AS-FOUND TOTAL	AS-FOUND MINIMUM PATHWAY	AS-FOUND MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	AS-LEFT TOTAL	AS-LEFT MINIMUM PATHWAY	AS-LEFT MAXIMUM PATHWAY
E-9	Electrical Penetration	Electrical Penetration E-9	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-10	Electrical Penetration	Electrical Penetration E-10	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-11	Electrical Penetration	Electrical Penetration E-11	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-12	Electrical Penetration	Electrical Penetration E-12	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-13	Electrical Penetration	Electrical Penetration E-13	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-14	Electrical Penetration	Electrical Penetration E-14	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-15	Electrical Penetration	Electrical Penetration E-15	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-16	Electrical Penetration	Electrical Penetration E-16	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-17	Electrical Penetration	Electrical Penetration E-17	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-18	Electrical Penetration	Electrical Penetration E-18	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-19	Electrical Penetration	Electrical Penetration E-19	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-20	Electrical Penetration	Electrical Penetration E-20	02/25/91	0.0	0.0	0.0	02/25/91	0.0	0.0	0.0
E-21	Electrical Penetration	Electrical Penetration E-21	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
E-23	Electrical Penetration	Electrical Penetration E-23	02/25/91	0.0	0.0	0.0	02/25/91	0.0	0.0	0.0
		PAGE TOTAL			0.0	0.0			0.0	0.0

TABLE 6
(L1R04 Sheet 7 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
E-24	Electrical Penetration	Electrical Penetration E-24	02/25/91	0.0	0.0	0.0	02/25/91	0.0	0.0	0.0
E-26	Electrical Penetration	Electrical Penetration E-26	02/25/91	0.0	0.0	0.0	02/25/91	0.0	0.0	0.0
M-96	DW Equipment Drain Sump	1RE024/1RE025	03/12/91	32.92	16.46	32.92	04/04/91	0.0	0.0	0.0
M-30	RWCU Suction	1G33-F001	02/19/91	23.38			03/24/91	0.0		
		1G33-F004	02/19/91	28.06	23.38	28.06	03/24/91	0.0	0.0	0.0
M-101	RCIC Turbine Exhaust Vacuum Breaker	1E51-F080/1E51-F086	02/22/91	0.0	0.0	0.0	02/22/91	0.0	0.0	0.0
M-25	PCCW A Supply	1VP063A/1VP113A	02/20/91	0.0	0.0	0.0	02/20/91	0.0	0.0	0.0
M-26	PCCW B Supply	1VP063B/1VP113B	02/22/91	1.35	0.675	1.35	03/17/91	1.3	0.65	1.3
M-27	PCCW A Return	1VP053A/1VP114A	02/20/91	0.0	0.0	0.0	04/14/91	0.37	0.185	0.37
M-28	PCCW B Return	1VP053B/1VP114B	02/22/91	1.71	0.855	1.71	02/22/91	1.71	0.855	1.71
M-47	T.I.P. Index Purge Air Supply	1IN031	02/21/91	0.0	0.0	0.0	02/21/91	0.0	0.0	0.0
M-60	DW Pneumatic Discharge to DW	1IN017	02/21/91	0.37			02/21/91	0.37		
		1IN018	02/21/91	0.37	0.37	0.37	02/21/91	0.37	0.37	0.37
M-53	Combustible Gas Control A Suction	1HG001A/1HG002A	03/03/91	3.8	1.9	3.8	04/12/91	0.38	0.19	0.38
M-104	Combustible Gas Control A Return	1HG005A/1HG006A	03/03/91	1.58	0.79	1.58	04/12/91	1.12	0.56	1.12
M-33	Combustible Gas Control B Suction	1HG001B/1HG002B	03/02/91	0.56	0.28	0.56	04/11/91	0.0	0.0	0.0
		PAGE TOTAL			44.71	70.35			2.81	5.25

TABLE 6
(L1R04 Sheet 8 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH)				AS-LEFT (SCFH)			
			DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-106	Combustible Gas Control B Return	1HG005B/1HG006B	03/02/91	0.28	0.14	0.28	04/11/91	0.65	0.325	0.65
M-15	Steam to RCIC	1E51-F063/1E51-F064 1E51-F008/1E51-F076	02/23/91	1.57	0.785	1.57	04/19/91	1.5	0.75	1.5
M-38	SA to Drywell	1SA042 & 1SA046 Packing	05/03/91	0.0	0.0	0.0	05/03/91	0.0	0.0	0.0
M-37	MC to Drywell	1MC027 & 1MC033 Packing	05/03/91	0.0	0.0	0.0	05/03/91	0.0	0.0	0.0
M-29	RHR/RCIC Head Spray	1E12-F023/1E51-F013	02/27/91	0.0	0.0	0.0	03/22/91	0.47	0.47	0.47
M-59	CY to Refueling Bellows	1FC113 1FC114	02/17/91 02/17/91	0.0 0.092	0.0	0.092	02/17/91 02/17/91	0.0 0.092	0.0	0.092
M-65	Reactor Well Drain	1FC086 1FC115	02/17/91 02/17/91	0.481 0.463	0.463	0.481	02/17/91 02/17/91	0.481 0.463	0.463	0.481
M-16	RBCCW Supply	1WR029 1WR179	03/08/91 02/21/91	0.0 0.0	0.0	0.0	04/19/91 04/22/91	0.0 1.57	0.0	1.57
M-17	RBCCW Return	1WR040 1WR180	02/21/91 02/21/91	0.0 0.0	0.0	0.0	02/21/91 02/21/91	0.0 0.0	0.0	0.0
I-4F	DW Humidity Monitor A Suction	1CM017A/1CM018A	02/22/91	0.48	0.24	0.48	02/22/91	0.48	0.24	0.48
I-5F	DW Humidity Monitor B Suction	1CM017B/1CM018B	02/22/91	0.0	0.0	0.0	02/22/91	0.0	0.0	0.0
I-45	DW Humidity Monitor A Return	1CM019A/1CM020A	02/22/91	0.0	0.0	0.0	02/22/91	0.0	0.0	0.0
I-45	DW Humidity Monitor B Return	1CM019B/1CM020B	02/24/91	0.09	0.045	0.09	03/24/91	0.09	0.045	0.09
M-60	DW Pneumatic Dryer Purge	1IN074/1IN075	02/21/91	0.69	0.345	0.69	02/21/91	0.69	0.345	0.69
			PAGE TOTAL		2.018	3.683			2.638	6.023

TABLE 6
(L1R04 Sheet 9 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH)				AS-LEFT (SCFH)			
			DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-11	HPCS Injection	1E22-F004	02/21/91	0.0	0.0	0.0	02/21/91	0.0	0.0	0.0
M-7	RHR Shutdown	1E12-F008	03/04/91	0.0			03/20/91	2.57		
	Cooling Suction	1E12-F009	03/05/91	0.0	0.0	0.0	03/20/91	0.48	0.48	2.57
M-34	SBLC Injection	1C41-F004A/1C41-F004B	04/02/91	0.0			04/02/91	0.0		
	Line	1C41-F007	04/02/91	0.0	0.0	0.0	04/02/91	0.0	0.0	0.0
M-81	RCIC Vacuum Pump Discharge	1E51-F028/1E51-F069	02/22/91	104.0	0.0	104.0	04/26/91	1.04	0.52	1.04
M-76	RCIC Turbine Exhaust	1E51-F040/1E51-F068	02/22/91	1.05	0.525	1.05	02/22/91	1.05	0.525	1.05
M-20	Drywell Inerting Makeup	1VQ047/1VQ048	02/21/91	0.0	0.0	0.0	02/21/91	0.0	0.0	0.0
M-66	Suppression Pool Inerting Makeup	1VQ050/1VQ051	02/21/91	0.0	0.0	0.0	04/10/91	0.0	0.0	0.0
M-46	A T.I.P. Penetration	T.I.P. Ball Valve A	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
M-45	B T.I.P. Penetration	T.I.P. Ball Valve B	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
M-44	C T.I.P. Penetration	T.I.P. Ball Valve C	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
M-43	D T.I.P. Penetration	T.I.P. Ball Valve D	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
M-42	E T.I.P. Penetration	T.I.P. Ball Valve E	02/26/91	0.0	0.0	0.0	02/26/91	0.0	0.0	0.0
M-18	A RHR Drywell Spray	1E12-F016A/1E12-F017A	02/24/91	1.39	0.695	1.39	03/23/91	3.14	1.57	3.14
M-19	B RHR Drywell Spray	1E12-F016B/1E12-F017B	03/07/91	0.171	0.086	0.171	04/11/91	0.37	0.185	0.37
			PAGE TOTAL		1.306	106.611			3.28	8.17

TABLE 6
(L1R04 Sheet 10 of 10)

PENETRATION	DESCRIPTION	VALVES(s)/COMPONENT	AS-FOUND (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY	AS-LEFT (SCFH) DATE	TOTAL	MINIMUM PATHWAY	MAXIMUM PATHWAY
M-13	A RHR LPCI Injection	1E12-F042A	02/24/91	0.0	0.0	0.0	02/24/91	0.0	0.0	0.0
M-14	B RHR LPCI Injection	1E12-F042B	03/07/91	0.0	0.0	0.0	03/07/91	0.0	0.0	0.0
M-8	A RHR Shutdown Cooling Return	1E12-F053A	02/24/91	0.0	0.0	0.0	03/22/91	0.46	0.46	0.46
M-9	B RHR Shutdown Cooling Return	1E12-F053B	03/07/91	0.0	0.0	0.0	03/07/91	0.0	0.0	0.0
M-10	LPCS Injection	1E21-F005	02/23/91	3.81	3.81	3.81	03/15/91	1.67	1.67	1.67
M-12	C RHR LPCI Injection	1E12-F042C	03/03/91	0.0	0.0	0.0	03/03/91	0.0	0.0	0.0
		PAGE TOTAL			3.81	3.81			2.13	2.13
		TOTAL ALL PAGES			84.8	Infinite			31.31	52.85

APPENDIX B

L1R05 TYPE B AND C TEST SUMMARY

The As-Found leak rate for the Primary Containment Isolation Valves/Components, excluding the Main Steam Isolation Valves was below the Tech Spec Limit of 231.4 SCFH using the Minimum Path Methodology. The Tech Spec limit was exceeded using the Maximum Path Methodology due to a large leakage contribution from the A Feedwater Inboard Check Valve, 1B21-F010A and RCIC Vacuum Pump Discharge Check Valve, 1E51-F028. Both components resulted in infinite leakage. Failed components were repaired/adjusted to bring the total B and C leakage well below the Tech Spec Limit.

	As-Found Min Path (SCFH)	As-Found Max Path (SCFH)	As-Left Max Path (SCFH)	Tech Spec Limit (SCFH)
Type B	5.59	5.59	6.47	-----
Type C	72.385	Infinite	126.355	-----
Total	77.975	Infinite	132.825	231.4

MAIN STEAM ISOLATION VALVES (TESTED AT 25 psig)

The As-Found leak rate for the Main Steam Isolation Valves exceeded Tech Spec limit due to the failure of the Leakage Control System Containment Isolation Valve, 1E32-F001E on the B Main Steam Line. Repairs/adjustments of the Main Steam Line Components resulted in a leakage rate below the Tech Spec Limit.

STEAM LINE	AS FOUND LEAK RATE (SCFH)	AS LEFT LEAK RATE (SCFH)	TECH SPEC LIMIT (SCFH)
A	19.26	19.26	-----
B	353.38	23.4	-----
C	7.76	12.61	-----
D	16.24	16.24	-----
TOTAL	396.64	71.51	100

APPENDIX B

L1R04 TYPE B AND C TEST SUMMARY

The As-Found leak rate for the Primary Containment Isolation Valves/Components, excluding the Main Steam Isolation Valves was below the Tech Spec Limit of 231.4 SCFH using the Minimum Path Methodology. The Tech Spec limit was exceeded using the Maximum Path Methodology due to a large leakage contribution from the A Feedwater Inboard Check Valve which resulted in infinite leakage. Failed components were repaired/adjusted to bring the total B and C leakage well below the Tech Spec Limit.

	As-Found Min Path (SCFH)	As-Found Max Path (SCFH)	As-Left Max Path (SCFH)	Tech Spec Limit (SCFH)
Type B	7.289	7.289	4.409	-----
Type C	77.511	Infinite	48.441	-----
Total	84.8	Infinite	52.85	231.4

MAIN STEAM ISOLATION VALVES (TESTED AT 25 psig)

The As-Found leak rate for the Main Steam Isolation Valves exceeded the Tech Spec Limit due to the failure of the Outboard MSIV Drain Valves on the A and B Main Steam Lines. Repairs/adjustments of the Main Steam Line components resulted in a leakage rate below the Tech Spec Limit.

STEAM LINE	AS FOUND LEAK RATE (SCFH)	AS LEFT LEAK RATE (SCFH)	TECH SPEC LIMIT (SCFH)
A	375.1	11.4	-----
B	153.0	20.47	-----
C	4.7	4.7	-----
D	9.4	9.72	-----
TOTAL	542.2	46.29	100

APPENDIX C
(Sheet 1 of 16)

CALCULATION OF CONTAINMENT DRY AIR MASS

A. Average Temperature of Subvolume #i (T_i)

The average temperature of subvolume #i (T_i) equals the average of all RTD/Thermister temps in subvolume #i

$$T_i = \frac{1}{N} \sum_{j=1} T_{i,j}$$

Where:

N = The number of RTDs/Thermi ters in subvolume #i

B. Average Dew Temperature of Subvolume #i (D_i)

The average dew temperature of subvolume #i (D_i) equals the average of all dew cell dew temps in subvolume #i

$$D_i = \frac{1}{N} \sum_{j=1} D_{i,j}$$

Where:

N = the number of Dew Cells in subvolume #i

If the subvolume in question is the suppression pool, the above assumption may be used if it can be shown from previous test data that there is a very close correlation between suppression pool chamber and water temperature.

C. Total Corrected Pressure for Pressure Transmitter #i (P_i)

The total corrected pressure #i, (P_i) is

$$P_i = C_i + M_i \, Pr_i$$

Where:

C_i = Zero shift correction factor for raw pressure #i
M_i = Slope correction factor for raw pressure #i
Pr_i = Raw pressure #i, in decimal form

D. Whole Containment Volume Weighted Average Temperature, (T_c)

Calculate T_c using the below equation or one that yields equivalent values to two decimal places.

APPENDIX C
(Sheet 2 of 16)

CALCULATION OF CONTAINMENT DRY AIR MASS

$$T_c = \frac{1}{\sum_{i=1}^{N} \frac{f_i}{T_i}}$$

Where:

f_i = The volume fraction of the i^{th} subvolume
N = The total number of subvolumes in containment

E. **Calculation of the Average Vapor Pressure of Subvolume i, (Pv_i)**

Average Subvolume Vapor Pressure as functions of Average Dew Temperatures (D_i) are most accurately found from ASME Steam Tables. A similar correlation that is extremely accurate is given below. *

For $32 \leq D_i \leq 80°F$

$$Pv_i = 0.2105538 \times 10^{-1} + 0.1140313 \times 10^{-2} D_i + 0.1680644 \times 10^{-4} \times D_i^2 + 0.3826294 \times 10^{-6} D_i^3 + 0.5787831 \times 10^{-9} D_i^4 + 0.2056074 \times 10^{-10} D_i^5$$

For $80 \leq D_i \leq 115°F$

$$Pv_i = 0.18782 - 0.7740034 \times 10^{-2} D_i + 0.204009 \times 10^{-3} \times D_i^2 - 0.1569692 \times 10^{-5} D_i^3 + 0.1065012 \times 10^{-7} D_i^4$$

For $115 \leq D_i \leq 155°F$

$$Pv_i = 0.9897124 - 0.3502587 \times 10^{-1} D_i + 0.5537028 \times 10^{-3} \times D_i^2 - 0.3570467 \times 10^{-5} D_i^3 + 0.1496218 \times 10^{-7} D_i^4$$

For $155 \leq D_i \leq 215°F$

$$Pv_i = 0.3338872 \times 10^{1} - 0.9456801 \times 10^{-1} D_i + 0.1121381 \times 10^{-2} D_i^2 - 0.598361 \times 10^{-5} D_i^3 + 0.1882153 \times 10^{-7} D_i^4$$

***NOTE: Numbers from ASME Standard Steam Tables, Fifth Edition.**

APPENDIX C
(Sheet 3 of 16)

CALCULATION OF CONTAINMENT DRY AIR MASS

F. Whole Containment Average Vapor Pressure, (Pv_c)

Calculate Pv_c using the below equation or one that yields equivalent values to two decimal places.

$$Pv_c = T_c \sum_{i=1}^{N} \frac{f_i \, Pv_i}{T_i}$$

Where:

N = The total of subvolumes in containment

f_i = Volume fraction of the i^{th} subvolume

G. Calculation of the Whole Containment Average Dew Temperature, (D_c)

Whole Containment Average Dew Temperature as functions of Whole Containment Average Vapor Pressures are most accurately found from ASME Steam Tables. A simpler correlation that is extremely accurate is given below. *

D_c is in units of °F.

For $0.08859 \leq Pv_c \leq 0.50683$ psia

Note: P_c (0.08859) = 32°F, P_c (0.50683) = 80°F

$$\begin{aligned} D_c = & - 0.5593968 \times 10^1 + 0.6348248 \times 10^3 \, Pv_c \\ & - 0.320306 \times 10^4 \, Pv_c^2 + 0.1130089 \times 10^5 \, Pv_c^3 \\ & - 0.2411539 \times 10^5 \, Pv_c^4 + 0.2796469 \times 10^5 \, Pv_c^5 \\ & - 0.1348916 \times 10^5 \, Pv_c^6 \end{aligned}$$

For $0.50683 \leq Pv_c \leq 1.4711$ psia

Note: P_c (0.50683) = 80°F, P_c (1.4711) = 115°F

$$\begin{aligned} D_c = & + 0.2334173 \times 10^2 + 0.2004024 \times 10^3 \, Pv_c \\ & - 0.2785328 \times 10^3 \, Pv_c^2 + 0.2765841 \times 10^3 \, Pv_c^3 \\ & - 0.168669 \times 10^3 \, Pv_c^4 + 0.5658985 \times 10^2 \, Pv_c^5 \\ & - 0.7977715 \times 10^1 \, Pv_c^6 \end{aligned}$$

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(Sheet 4 of 16)

CALCULATION OF CONTAINMENT DRY AIR MASS

For $1.4711 \leq Pv_c \leq 4.2036$ psia

Note: P_c (1.4711) = 115°F, P_c (4.2036) = 155°F

$$D_c = +\,0.5221757 \times 10^2 + 0.7391149 \times 10^2\,Pv_c - 0.3306993 \times 10^2\,Pv_c^2 + 0.1074842 \times 10^2\,Pv_c^3 - 0.2169825 \times 10^1\,Pv_c^4 + 0.2432796\,Pv_c^5 - 0.1155358 \times 10^{-1}\,Pv_c^6$$

For $4.2036 \leq Pv_c \leq 15.592$ psia

Note: P_c (4.2036) = 155°F, P_c (15.592) = 215°F

$$D_c = 0.8512278 \times 10^2 + 0.274613 \times 10^2\,Pv_c - 0.3847812 \times 10^1\,Pv_c^2 + 0.3909064\,Pv_c^3 - 0.2451226 \times 10^{-1}\,Pv_c^4 + 0.8484505 \times 10^{-3}\,Pv_c^5 - 0.1237098 \times 10^{-4}\,Pv_c^6$$

***NOTE: Numbers from ASME Standard Steam Tables, Fifth Edition.**

H. **Average Total Containment Pressure, (P)**

$$P = \frac{1}{N} \sum_{i=1}^{N} P_{ri}$$

Where:

N is the number of pressure transmitters used

I. **Average Total Containment Dry Air Pressure, (P_d)**

$$P_d = P - Pv_c$$

APPENDIX C
(Sheet 5 of 16)

CALCULATION OF CONTAINMENT DRY AIR MASS

J. **Total Containment Dry Air Mass, (M)**

Type 1:

$$M = \frac{P_d V_c}{R T_c}$$

Where:

R = Perfect gas constant of air, 53.35 lb_f - ft/lb_m - °R

V_c = Total containment free volume.

APPENDIX C
(Sheet 6 of 16)

BN-TOP-1 METHOD TEST CALCULATIONS

A. Measured Leak Rate (Total time calculations)

From BN-TOP-1 Revision 1, Section 6.0 the following equation is given for the measured leak rate using the total time procedure:

$$M_i = \frac{2400}{t_i} \left| 1 - \frac{T_o \bar{P}_{ith}}{T_{ith} \bar{P}_o} \right|$$

Where:

M_i = Measured leak rate in weight % per day for the ith data point

t_i = Time since the beginning of the test period to the ith data point in hours

T_o, T_{ith} = mean volume weighted containment temperature at the beginning of the test and at the ith data point (R)

P_1, P_2 = mean total absolute pressure, PSIA of the containment atmosphere at the beginning and end of test interval (t_i) respectively.

P_{v1}, P_{v2} = mean total water vapor pressure, PSIA, of the containment atmosphere at the beginning and end of test interval (t_i) respectively

$\bar{P}_o = P_1 - P_{v1}$

$\bar{P}_{ith} = P_2 - P_{v2}$

B. Calculated Leak Rate

The method of Least Squares is a statistical procedure for finding the "best fit" straight line, commonly called the regression line, for a set of measured data such that the sum of the squares of the deviations of each measured data point from the straight line is minimized.

To determine the calculated leak rate (L_i) at time t_i, the regression line is determined using the measured leak rate data from the start of the test to time t_i. The calculated leak rate is the point on this line at time t_i.

$$L_i = A_i + B_i(t_i) \qquad [4]$$

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(Sheet 7 of 16)

BN-TOP-1 METHOD TEST CALCULATIONS

Using differential calculus, the numerical values of A_i and B_i that will minimize the sum of the squares of the deviations can be shown to be:

$$A_i = \frac{(\Sigma Mi)\ (\Sigma ti^2)\ -\ (\Sigma ti)\ (\Sigma tiMi)}{n(\Sigma ti^2)\ -\ (\Sigma ti)^2} \quad [5]$$

$$B_i = \frac{n\Sigma tiMi\ -\ (\Sigma ti)\ (\Sigma Mi)}{n(\Sigma ti^2)\ -\ (\Sigma ti)^2} \quad [6]$$

Where:

n = number of data sets to time ti

Equations [5] and [6] are referred to as the Least Square equations and are used by the computer program to compute the calculated leak rate for the Total Time and Point to Point calculations.

C. Confidence Limits

Even though the regression line is statistically determined to minimize the sum of the squares of the error, the values of the calculated leak rate cannot be considered to be exactly correct. If the containment integrated leak rate test were run a number of times, under the same conditions, the calculated leak rates would be close in value but not exactly the same each time.

However, based on statistics we can establish confidence limits associated with the regression line such that the limits of the calculated leak rate computed would successfully enclose the true value of the desired parameter a large fraction of the time. This fraction is called the confidence coefficient and the interval within the confidence limits is the confidence interval.

Confidence limits for the integrated leak test computer program are determined based on a confidence coefficient of 95%. This means that the probability that the value of the calculated leak rate will fall within the upper and lower confidence limits, or confidence interval, is 95%.

APPENDIX C
(Sheet 8 of 16)

BN-TOP-1 METHOD TEST CALCULATIONS

To determine the value of the confidence limits the following statistical information is required: the variance, standard deviation, and the Student's T-distribution.

The variance, as the name implies, is a measure of the variability of individually measured data points from the mean, or in this case, from the regression line. The variance of the measured leak rate (Mi) from the calculated leak rate (Li) is given by:

$$s^2 = \frac{SSQ}{n-2} \qquad [7]$$

Where s is the variance and s is the standard deviation based on (n-2) degrees of freedom. SSQ is the sum of the squares of the deviations from the regression line and is mathematically expressed below:

$$SSQ = \Sigma\ (Mi - Ni)^2 \qquad [8]$$

Where: N_i = deviation from regression line

The standard deviation has more practical significance since computing the standard deviation returns the measure of variability to the original units of measurement. Additionally, it can be shown that given a normal distribution of measurements, approximately 95% of the measurements will fall within two standard deviations of the mean.

The number of standard deviations either side of the regression line which establish a upper confidence interval are more accurately determined using a statistical table called a "Table of Percentage Points of the T-distribution" and provide increased confidence in outcomes for small and large sample sizes.

Since we are interested in reporting a single value of calculated leak rate based on measurements taken over a specific time period, an additional factor is applied to the formula for computing the variance and hence, the standard deviation.

APPENDIX C
(Sheet 9 of 16)

BN-TOP-1 METHOD TEST CALCULATIONS

The Table of T-distributions has been formulated for use by the computer program as follows:

$$T = 1.95996 + \left|\frac{2.37226}{(n-2)}\right| + \left|\frac{2.8225}{(n-2)^2}\right| \qquad [9]$$

Where: the value of T is based on 95% confidence limits and (n-2) degrees of freedom.

The application of the additional factor to the variance formula yields:

$$\sigma^2 = s^2 \left| 1 + \frac{1}{n} + \frac{(tp - \bar{t})^2}{\Sigma\,(ti - \bar{t})^2} \right| \qquad [10]$$

Where:

tp = time from the start of the test of the last data set for which the standard deviation of the measured leak rates (Mi) from the regression line is being computed.

ti = time from the start of the test of the ith data set

n = number of data sets to time tp

$$\Sigma = \sum_{i=1}^{n} \quad ; \quad \text{and} \qquad [11]$$

$$\bar{t} = \frac{1}{n}\,\Sigma\, ti$$

Taking the square root of equation [10] yields the standard deviation:

$$\sigma = s \left| 1 + \frac{1}{n} + \frac{(tp - \bar{t})^2}{\Sigma\,(ti - \bar{t})^2} \right|^{1/2}$$

The upper confidence limit can now be determined, the confidence limit being equal to T standard deviations above and below the regression line. Combining equations [10] and [11] yields:

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(Sheet 10 of 16)

BN-TOP-1 METHOD TEST CALCULATIONS

Confidence limits = $L \pm T\sigma$ [12]

or

$UCL = Li + T\sigma$ [13]

Where: UCL is the upper confidence limit respectfully.

Where: Li = Calculated Leak Rate at Time ti

T = T-Distribution value based on n, the number of data sets received up until time ti.

σ = Standard deviation of Measure Leak Rate (Mi) values about the regression line based on data from the start of the test until time ti.

APPENDIX C
(Sheet 11 of 16)

Data Rejection Criteria

1. If a sensor, in the opinion of the Tech Staff Engineer, is out of range, it will be ignored (i.e., set=0) and the number of operable RTD's/Thermisters or Dewcells in the subvolume will be reduced by one. The sensor should be considered out of range if it is evident that the sensor has malfunctioned. All rejected data should be maintained if possible and the reason for rejection documented on Attachment Z data sheet and in the Events log, (Attachment C).

   Should the number of RTD's/Thermisters or the number of Dew cells in a subvolume become equal to zero (accept for Subvolume, 2 and 7: Zero dewcells already) then with approval of the Technical Staff Supervisor, substitute the average temperature of the appropriate subvolume which is chosen based upon the temperature survey and/or temperature distribution prior to instrument failure. Document on Attachment Z data sheet and in Events Log, (Attachment C).

NOTES

[1] If all RTD's/Thermisters in Subvolume 9 are lost, then stop the test and repair the RTD's/Thermisters, or it the AIR in Subvolume 9 can be shown to be near saturation, use Subvolume 9 Average Dewcell Temperature.

[2] If all Dewcells in Subvolume 9 are lost, and the AIR in Subvolume 9 can be shown to be near saturation, use Subvolume 9 Average RTD/Thermister Temperature. Also, if the Average RTD/Thermister Temperature over the last 6 data sets is within 0.5° F of a specific RTD/Thermister, the specific RTD/Thermister may be chosen as the Dewcell.

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2. If one pressure transmitter is out of the range of $14 < P$ (psia) < 60 the pressure transmitter will be ignored (set=0).

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NOTE

All data should be recalculated with bad element(s) deleted.

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3. Raw temperature, pressure, and dew point data should not be rejected statistically, but may be rejected and not used in the final calculations provided there is a good physical reason for the rejection. Data rejected, including the cause or probable cause for the bad data, are to be documented. If the validity of certain data is suspect, but no physical reason is found, then a statistical rejection technique may be applied. (See ANSI/ANS 56.8-1987, for Data Rejection Criterion). A data point may be rejected if it is expected to occur statistically less than 5% of the time. The statistical rejection of more than 5% of a set of data should not be allowed.

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10CFR50, Appendix J specifies that all Type A tests be conducted in accordance with the provisions of the American National Standard, N45.4-1972. Section 6.4 of that standard requires that the combined precision of all instruments used to perform a Type A test be such that the accuracy of the collected data is consistent with the magnitude of the specified leakage rate.

The Instrument Selection Guide (ISG) formulation defined in Appendix G of the 1987 Standard, ANSI/ANS-56.8, is an acceptable means of determining the ability of the Type A Test Instrumentation System to measure the integrated leakage rate of a Primary Reactor Containment System. This rather long formulation is labor intensive to calculate, either by hand or by computer.

Section 5.4 of Commonwealth Edison NO Directive, NOD-TS.13, specifies that all Commonwealth Edison plants shall use a standardized instrumentation system for Type A testing. The following is a list of the resolutions, repeatabilities, and sensitivities which may be expected when the standardized system is used. Also listed are the recommended minimum numbers of each type of sensor:

ILRT INSTRUMENTATION SYSTEM SPECIFICATIONS

Pressure Transmitters:	Resolution	0.0001 psi
	Repeatability	0.001 psi
	Sensitivity	0.0001 psi
	Minimum Number	1
Temperature Channels:	Resolution	0.01 °F
	Repeatability	0.02 °F
	Sensitivity	0.01 °F
	Minimum Number	15
Dew Temperature Channels:	Resolution	0.01 °F
	Repeatability	0.1 °F
	Sensitivity	0.1 °F
	Minimum Number	5

Instrument Parameter Definitions From ANSI/ANS 56.8 - 1987

Repeatability: The capability of the measurement system to reproduce a given reading from a constant source.

Resolution: The least unit discernible on the display mechanism.

Sensitivity: The capability of a measurement system to respond to change in the measured parameter.

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CALCULATION OF INSTRUMENT SELECTION GUIDE, (ISG)

$$ISG = \frac{2400}{t} \left[\frac{2}{N_p}(e_p/p)^2 + \frac{2}{N_r}(e_r/T)^2 + \frac{2}{N_d}(e_d/P)^2 \right]^{½}$$

Where: t is the test time, in hours
p is test pressure, psia
T is the volume weighed average containment temperature, (°R)
N_p is the number of pressure transmitters
N_r is the number of RTDs/Thermisters
N_d is the number of dew cells
e_p is the combined pressure transmitters' error, (psia)
e_r is the combined RTDs'/thermisters error, (°R)
e_d is the combined dew cells' error, (°R)

$$ep = \left[(S_p)^2 + (RP_p + RS_p)^2 \right]^{½}$$

Where: S_p is the sensitivity of a pressure transmitter
RP_p is the repeatability of a pressure transmitter
RS_p is the resolution of pressure transmitter

$$e_r = \left[(S_r)^2 + (RP_r + RS_r)^2 \right]^{½}$$

Where: S_r is the sensitivity of an RTD/thermister
RP_r is the repeatability of an RTD/thermister
RS_p is the resolution of an RTD/thermister

$$e_d = \left.\frac{\Delta P_v}{\Delta T_d}\right|_{T_d} \left[(S_d)^2 + (RP_d + RS_d)^2 \right]^{½}$$

Where: S_d is the sensitivity of a dew cell
RP_d is the repeatability of a dew cell
PS_d is the resolution of a dew cell

$$\left.\frac{\Delta P_v}{\Delta T_d}\right|_{T_d} = \frac{\text{change in vapor pressure}}{\text{change in saturation temperature}}$$

The above ratio is from ASME steam tables and evaluated at the containment's saturation temperature at that time.

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It can be concluded that if the Standard Type A Test Instrumentation Specifications and the minimum sensor numbers are met, then the ANS 56.8 ISG acceptance criteria is always satisfied. This eliminates the need to demonstrate by calculation, in station procedures that the ISG acceptance criteria is met.

The Instrumentation Error Analysis and total instrument uncertainty resulted in ± 0.02 wt%/day based on the loss of 50% of each type of sensor for the LaSalle Station ILRT.

APPENDIX C
(Sheet 16 of 16)

DEFINITIONS

A. Maximum Allowable Leak Rate (L_A) at pressure Pa (39.6 psig)

$$L_a = 0.635\% \text{ of containment volume per day}$$
$$= 0.00635 \times 394{,}638 \text{ ft}^3/24 \text{ hr}$$
$$= 2506 \text{ ft}^3/24 \text{ hr}$$
$$= 104.4 \text{ ft}^3/\text{hr}$$
$$= 104.4 \frac{(39.6 + 14.7)}{14.7} = 385.7 \text{ SCFH}$$

B. Maximum Allowable Operational Leak Rate (L_T) at pressure P_A (39.6 psig)

$$L_T = 0.75\ L_A$$
$$= 0.75\ (.635\%/\text{day})$$
$$= 0.476\%/\text{day}$$
$$= 289.3 \text{ SCFH}$$

C. Maximum Allowable Total Type "B" and "C" tests (L_1)

$$L_1 = 0.60\ L_A$$
$$= 0.60\ (.635\%/\text{day})$$
$$= 0.381\%/\text{day}$$
$$= 231.4 \text{ SCFH}$$

D. Induced Leak Rate Acceptance Criteria

L_o = superimposed flowmeter leak rate (%/day)
L_c = Induced Statistically Averaged/Calculated leak rate during verification test (%/day)
L_i = Statistically Averaged/Calculated leak rate prior to verification test (%/day)

$$\left| L_c - (L_o + L_i) \right| \le 0.25\ L_a$$
$$\le 0.25 L_a\ (.635\%/\text{day})$$
$$\le 0.159\%/\text{day}$$

E. Rotometer: Induced Flowmeter Flowrate [L_o (scfh)] pressure-temperature correction

$$L_o = L_m \left| \frac{(Pm)(Tc)}{(Pc)(Tm)} \right|^{1/2}$$

Lm = Measured Flow (SCFH)
Pm = Rotometer Outlet Pressure (PSIA)
Pc = Calibrated Pressure (PSIA)
Tm = Rotometer Outlet Temperature (°R)[°F + 459.69]
Tc = Calibrated Temperature (°R)[°F + 459.69]

APPENDIX D
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BN-TOP-1, REV. 1 ERRATA

The Commission has approved short duration testing for the IPCLRT provided the Station uses the general test method outlined in the BN-TOP-1, Rev. 1 topical report. The primary difference between that method and the ones previously used is in the statistical analysis of the measured leak rate data.

Without making any judgements concerning the validity of this test method, certain errors in the editing of the mathematical expressions were discovered. The intent here is not to change the test method, but rather to clarify the method in a mathematically precise manner that allows its implementation. The errors are listed below.

EQUATION 3A, SECTION 6.2

Reads: $L_i = A + B\ t_i$

Should Read: $L_i = A_i + B_i\ t_i$

Reason: The calculated leak rate (L_i) at time t_i is computed using the regression line constants A_i, B_i (computed using equations 6 and 7). The summation signs in equation 6 are defined as $\Sigma = \sum_{i=1}^{n}$, where n is the number of data sets up until time t_i. The regression line constants change each time a new data set is received. The calculated leak rate is not a linear function of time.

PARAGRAPH FOLLOWING EQ. 3A, SECTION 6.2

Reads: The deviation of the measured leak rate (M) from the calculated leak rate (L) is shown graphically on Figure A.1 in Appendix A and is expressed as:

$$\text{Deviation} = M_i - L_i$$

Should Read: The deviation of the measured leak rate (M_i) from the regression line (N_i) is shown graphically on Figure A.1 in Appendix A and is expressed as:

$$\text{Deviation} = M_i - N_i$$

Where: $N_i = A_p + B_p * t_i$,

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A_p, B_p = Regression line constants computed from all data sets available from the start of the test to the last data set at time t_p,

t_i = time from the start of the test to the ith data set.

Reason: The calculated leak rate as a function of time during the test is based on a regression line. The regression line constants, A_i and B_i are changing as each additional data set is received. Equation 3A is used later in the test to compute the upper confidence limit as a function of time. For the purpose of this calculation, it is the deviation from the last computed regression line at time t_p that is important.

EQUATION 4, SECTION 6.2

Reads: $SSQ = \Sigma\ (M_i - L_i)^2$

Should Read: $SSQ = \Sigma\ (M_i - N_i)^2$

Reason: Same As Above

EQUATION 5, SECTION 6.2

Reads: $SSQ = \Sigma\ [M_i - (A + Bt_i)]^2$

Should Read: $SSQ = \Sigma\ [M_i - (A_p + B_p * t_i)]^2$

Reason: Same As Above

EQUATION ABOVE EQUATION 6, SECTION 6.2

Reads:

$$B = \frac{(t_i - \bar{t})(M_i - \bar{M})}{\Sigma(t_i - t)^2}$$

Should Read:

$$B_i = \frac{\Sigma[(t_i - \bar{t})(M_i - \bar{M})]}{(t_i - \bar{t})^2}$$

Reason: Regression line constant B_i changes over time (as a function of t_p) as each additional data set is received. Bar of "t" left out of denominator. Summation signs omitted.

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EQUATION 6, SECTION 6.2

Reads: $$B = \frac{n \Sigma t_i M_i - (\Sigma t_i)(\Sigma M_i)}{n \Sigma t_i^2 - (\Sigma t_i)^2}$$

Should Read: $$B_i = \frac{n \Sigma t_i M_i - (\Sigma t_i)(\Sigma M_i)}{n \Sigma t_i^2 - (\Sigma t_i)^2}$$

Reason: Same as above.

EQUATION 7, SECTION 6.2

Reads: $$A = \bar{M} - B \bar{t}$$

Should Read: $$A_i = \bar{M} - B_i \bar{t}$$

Reason: Same as above.

EQUATION 10, SECTION 6.2

Reads: $$A = \frac{(\Sigma M_i)(\Sigma t_i^2) - (\Sigma t_i)(\Sigma t_i M_i)}{n \Sigma t_i^2 - (\Sigma t_i)^2}$$

Should Read: $$A_i = \frac{(\Sigma M_i)(\Sigma t_i^2) - (\Sigma t_i)(\Sigma t_i M_i)}{n \Sigma t_i^2 - (\Sigma t_i)^2}$$

Reason: Same as above.

EQUATION 13, SECTION 6.3

Reads: $$\sigma^2 = s^2 \left[1 + \frac{1}{n} + \frac{(t_p - t)^2}{(t_i - t)^2}\right]$$

Should Read: $$\sigma^2 = s^2 \left[1 + \frac{1}{n} + \frac{(t_p - \bar{t})^2}{\Sigma(t_i - \bar{t})^2}\right]$$

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where t_p = time from the start of the test of the last data set for which the standard deviation of the measured leak rates (M_i) from the regression line (N_i) is being computed;

t_i = time from the start of the test of the i^{th} data set;

n = number of data sets to time t_p

$\Sigma = \sum_{i=1}^{n}$; and

$t = \frac{1}{n} \Sigma t_i$

Reason: Appears to be error in editing of the report. Report does a poor job of defining variables.

EQUATION 14, SECTION 6.3

Reads:

$$\sigma = s \left[1 + \frac{1}{n} + \frac{(t_p - t)^2}{(t_i - t)^2} \right.$$

Should read:

$$\sigma = s \left[1 + \frac{1}{n} + \frac{(t_p - \bar{t})^2}{\Sigma (t_i - \bar{t})^2} \right.$$

Reason: Same As Above.

EQUATION 15, SECTION 6.3

Reads: Confidence Limit = L $\pm$ T

Should Read: Confidence Limits = L $\pm$ T x σ

Where: L = calculated lead rate at time t_p,

T = T distribution value based on n, the number of data sets received up until time t_p;

σ = standard deviation of measured leak rate values (M_i) about the regression line based on data from the start of the test until time t_p.

Reason: Same As Above.

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EQUATION 16, SECTION 6.3

Reads: UCL = L + T

Should Read: UCL = L + T * σ

Reason: Same As Above.

EQUATION 17, SECTION 6.3

Reads: LCL = L - T

Should Read: LCL = L - T * σ

Reason: Same As Above.