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R. F. Burski
Director
Nuclear Safety
Waterford 3

W3F1-93-0098
A4.05
PR

November 16, 1993

Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
10CFR50 Appendix J, Exemption Type A Test Schedule Change

Gentlemen:

The purpose of this letter is to request a specific exemption to 10CFR50, Appendix J, Section III.D, in accordance with 10CFR50.12. The purpose of the exemption is to change the periodic test schedule for Type A tests from a set of three Type A tests performed at approximately equal intervals during each 10-year period, as specified in section III.D, to one Type A test performed at ten year intervals. The exemption request is provided as attachment one (1) to this letter.

The technical specification amendment request and the 10CFR50.92 evaluation have been submitted to the NRC via letter W3F1-93-0305. This letter provides the detailed justification for changing the test schedule, and therefore this letter also provides the basis for technical specification change request NPF-38-145.

On May 4 at the annual Regulatory Information Conference, Dr. Murley announced a pilot program, Cost Beneficial Licensing Action Initiative (CBLA), established by NRR to give special consideration to licensee requests for changes requiring staff review that involve high cost and low safety benefit. In response to Dr. Murley's initiative, Entergy Operations met with NRR staff on June 8, 1993, to present an initial list of CBLAs. As discussed on June 8, 1993, the proposed change to the Appendix J Type A test schedule is being submitted under the CBLA program.

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The exemption request is in compliance with sections (a)(2)(ii), (a)(2)(iv), and (a)(2)(vi) of 10CFR50.12. The exemption request demonstrates that: the underlying purpose of the regulation is achieved [(a)(2)(ii)], there is a benefit to the public health and safety [(a)(2)(iv)], and there are present material circumstances not considered when the regulation was adopted [(a)(2)(vi)].

The technical justification is predicated on the following technical bases:

1. Type A Testing History

   The Waterford 3 Type A test history provides substantial justification for the proposed test schedule. Three Type A tests have been performed over an eight (8) year period with successful results. The tests indicate that Waterford 3 has a low leakage containment and that the leakage has never exceeded 24.6% of L_a.

2. Structural Capability of Containment

   There are no mechanisms which would adversely affect the structural capability of the containment and that would be a factor in extending the Type A test schedule to ten years.

3. Risk Impact Assessment

   A risk impact assessment was performed, and a determination was made that there is no risk impact as a result of changing the Type A test schedule.

The request meets the eligibility criteria for the categorical exclusion of an environmental impact statement or environmental assessment as set forth in 10CFR51.22(c)(9).

In summary, we believe this exemption request is an excellent case of a requirement marginal to safety. The provisions of 10CFR50.12 are satisfied, the exemption is technically justified, and there is a benefit to the public health and safety.

Please contact me or Robert J. Murillo at (504) 739-6715 should there be any questions regarding this matter.

Very truly yours,

R.F. Burski
Director
Nuclear Safety

RFB/RJM/dc
Attachment

cc: J.L. Milhoan, NRC Region IV,
D.L. Wigginton, NRC-NRR,
R.B. McGehee,
N.S. Reynolds,
NRC Resident Inspectors Office,
Administrator Radiation Protection Division,
(State of Louisiana),
American Nuclear Insurers

Attachment One

10CFR50.12 Specific Exemption
to 10CFR50, Appendix J, Section III.D

1.0 Purpose

The purpose of this document is to request a specific exemption to 10CFR50, Appendix J, Section III.D, in accordance with 10CFR50.12. The purpose of the exemption is to change the periodic test schedule for Type A tests from a set of three Type A tests performed at approximately equal intervals during each 10-year period, as specified in section III.D, to one Type A test performed at ten year intervals.

2.0 Regulatory Basis For Specific Exemption

The exemption request is in compliance with sections (a)(2)(ii), (a)(2)(iv), and (a)(2)(vi) of 10CFR50.12. The exemption request demonstrates that: the underlying purpose of the regulation is achieved [(a)(2)(ii)], there is a benefit to the public health and safety [(a)(2)(iv)], and there are present material circumstances not considered when the regulation was adopted [(a)(2)(vi)].

3.0 Background Information

The applicable technical specification is T.S. 3.6.1.2 and the associated technical specification bases T.S. 3/4.6.1.2. Technical surveillance requirement 4.6.1.2.a requires that three Type A tests be conducted at 40± 10 month intervals during shutdown at either P_a 44 psig or at P_t 22 psig during each 10 year period. The tests are conducted in accordance with the provisions of ANSI N45.4-1972, March 16, 1972.

The limitations on containment leakage rates ensure that the total containment leakage volume will not exceed the value assumed in the safety analyses at the peak pressure, P_a. As an added conservatism the measured overall integrated leakage rate is further limited to less than or equal to 0.75 L_a or less than or equal to 0.75 L_t, as applicable during performance of the periodic tests.

The containment vessel completely encloses the reactor coolant system to ensure no leakage of radioactive materials to the environment in the unlikely event of a loss of coolant accident. The containment system incorporates a free-standing containment vessel surrounded by a low leakage reinforced concrete shield building. A four foot annular air space is provided between the outer wall of the containment vessel and the inner wall of the shield building to allow filtration of any containment vessel leakage during accident conditions to minimize off-site doses.

The free-standing containment vessel is a two inch thick circular cylinder, with a one inch thick hemispherical dome and a two inch thick ellipsoidal bottom. The overall vessel dimensions are: 140 foot diameter by 240.5 foot high. The vessel wall thickness is increased to a minimum of four inches adjacent to all penetrations and openings. The vessel is fabricated of ASME-SA 516 Grade 70 fully killed pressure vessel quality steel plate. The net free volume of the containment is approximately 2,680,000 cubic feet.

The containment vessel structure includes one personnel airlock, one emergency escape airlock, one fuel transfer tube, one equipment maintenance hatch, and one seal-welded construction hatch. All process piping and electrical penetrations are welded directly to the containment vessel nozzles, with the exception of the main steam, main feedwater, and fuel transfer tube penetrations. These penetrations are provided with testable expansion bellows to allow for thermal growth or building differential motion.

The containment vessel is designed and constructed in accordance with the requirements for class MC vessels contained in Section III, Subsection NE of the ASME Code, 1971 Edition including Summer 1971 Addenda and Code cases 1431, 1454-1, and 1517, as approved by the USNRC Regulatory Guides 1.84 and 1.85. The containment vessel is code stamped in accordance with Paragraph NE-8000 of Section III of the ASME Boiler and Pressure Vessel Code. The containment vessel and all penetrations are designed to limit total leakage to less than 0.5 percent by weight of the containment air mass per day at a design pressure of 44 psig. The calculated peak accident pressure for the design basis accident at Waterford SES Unit No. 3 is less than 44 psig.

4.0 Technical Justification

The Technical justification is predicated on the following technical bases:

Type A Testing History

The Waterford 3 Type A test history provides substantial justification for the proposed test schedule. Three Type A tests have been performed over an eight (8) year period with successful results. The tests indicate that Waterford 3 has a low leakage containment and that the leakage has never exceeded 24.6% of L_a.

Structural Capability of Containment

There are no mechanisms which would adversely affect the structural capability of the containment and that would be a factor in extending the Type A test schedule to ten years.

Risk Impact Assessment

A risk impact assessment was performed, and a determination was made that there is no risk impact as a result of changing the Type A test schedule.

Each of these technical bases is herein discussed:

a. Type A Testing History

Three (3) Type A full pressure, 44 psig, containment integrated leak rate tests have been conducted; preoperational Type A test (4/30/83), first periodic Type A test [Refuel 2, (5/23/88)], second periodic Type A test [Refuel 4, (5/12/91)]. Two different testing methods were employed in the performance of these tests. The first method, calculated Mass Point Leakage Rate, was the only method employed for the preoperational Type A test. The first and second periodic Type A tests employed both the calculated Mass Point Leakage Rate method and the BN-TOP-1 Total Time Leakage Rate method.

Passive containment failures

Passive (unloaded) failure of the containment structure (containment shell, penetration pipes, or welds) is not credible during normal operation. Under normal operating conditions, the containment is essentially at atmospheric pressure, so there is no significant stress that could cause a structural leak or failure. Passive failures resulting in significant containment structural leakage are therefore extremely unlikely to develop between Type A tests. No such failures have ever occurred at Waterford 3. Waterford 3 personnel performed a review of industry data and sources and did not find a single reported case wherein a Type A test failed to meet Appendix J acceptance criteria as a result of a containment structural leak not due to initial fabrication or a plant modification. Since passive failure of the containment structure is not a credible containment isolation failure mode, the impact of changing the Type A test frequency on the probability of containment failure is negligible.

Containment failure pressure

Pressures several times higher than the containment design pressure of 44 psig, reference eleven, are needed to cause containment structural failure. During normal operation there is no containment pressure-related stress on the containment shell or penetration pipes. The only pressure on the passive containment isolation boundary is pressure internal to pipes that are part of operating systems and penetrate containment. If such pipes were to rupture during operation, the failure would be immediately detected and would not be a latent failure as described previously. Changing the Type A test frequency would have no effect on the probability of containment isolation failure during an accident.

5.0 Compliance With 10CFR50.12

The following information demonstrates compliance with 10CFR50.12.

Section (a)(2)(ii): [The underlying purpose of the regulation is achieved]

The underlying purpose of 10CFR50, Appendix J, is achieved. 10CFR50, Appendix J, states that the leakage test requirements set forth in this appendix provide for periodic verification by tests of the leak tight integrity of the primary reactor containment. The appendix

The results of the three Type A tests are the following:

Preoperational Type A Test (4/30/83)

The preoperational Type A Containment Integrated Leak Rate Test was successfully performed on April 30, 1983 with a calculated Mass Point Leakage Rate of 0.066% wt per day and a 95% upper confidence limit of 0.068% wt per day. The Type A test report was provided to the NRC on July 19, 1983, via letter W3P83-2399, reference two, see attachment two.

First Periodic Type A Test [Refuel 2, (5/23/88)]

The first periodic Type A Containment Integrated Leakage Rate Test was successfully performed on 5/23/88 with the following results: 1. A calculated Mass Point Leakage Rate of 0.061% wt per day and a 95% UCL of 0.070% wt per day, 2. A 95% UCL Total Time Leakage Rate (including additions) of 0.116% wt per day, and 0.123% wt per day including minimum pathway improvements. Results from the Total Time Leakage Rate calculations were submitted as the final test results, but the calculated Mass Point Leakage Rates were also included in the report to the USNRC. The periodic Type A test report was provided to the NRC on August 23, 1988, via letter W3P88-1283, reference three, see attachment two.

Second Periodic Type A Test [Refuel 4, (5/12/91)]

The second periodic Type A Containment Integrated Leakage Rate Test was successfully performed on 5/12/91 with the following results: 1. A calculated Mass Point Leakage Rate of 0.0669% wt per day and a 95% UCL of 0.0679% wt per day, 2. A 95% UCL Total Time Leakage Rate (including additions) of 0.0731% wt per day, and 0.0858% wt per day including minimum pathway improvements. Results from the Total Time Leakage Rate calculations were submitted as the final test results, but the calculated Mass Point Leakage Rates were also included in the report to the USNRC. The periodic Type A test report was provided to the NRC on August 12, 1991, via letter W3F1-91-0447, reference four, see attachment two.

During the stabilization period for the second periodic CILRT, preliminary leakage rate calculations indicated excessive leakage of approximately 2.9% wt per day. The major portion of the leakage was observed at the refueling water storage pool access hatch. Air was leaking through the Safety Injection Sump Recirculation line valves SI-602A and B. These valves are not classified as containment

isolation valves and are not required to be vented for the CILRT per FSAR Table 6.2-32. Initial hand tightening of the valves reduced the leakage to approximately 0.60% wt per day. No other significant leakage paths were identified. Additional hand tightening of the valves reduced the leakage to approximately 0.06% wt per day. During the evolution of stopping the leakage, instead of a 4 hour stabilization period, the plant actually experienced a 22 hour 24 minute stabilization. This longer stabilization period resulted in the Mass Point Leakage Rate (0.068% wt per day) being close to the Total Time Leakage Rate (0.0858% wt per day) for Refuel 4 CILRT and the Total Time Leakage Rate (0.0858% wt per day) being less than the Refuel 2 CILRT Total Time Leakage Rate (0.123% wt per day).

Summary Type A Testing History

Figure 1, CILRT Test Results using the Calculated Mass Point Leakage Rate Method, shows graphically that Waterford 3 SES Unit No. 3 has a significantly low leakage containment and did not exceed 13.8% of L_a (0.5% wt per day) or 18.4% of the Acceptance Criteria 0.75 L_a (0.375% wt per day).

Figure 2, CILRT Test Results using the BN-TOP-1 Total Time Leakage Rate Method, shows graphically the results of Waterford SES Unit No. 3 first and second periodic CILRT's as reported to the USNRC. These results also strongly indicate that Waterford SES Unit No. 3 is a low leakage containment and did not exceed 24.6% of L_a (0.5% wt per day) or 32.8% of 0.75 L_a (0.375% wt per day).

The first periodic CILRT, which for the first time utilized BN-TOP-1, was performed in a shorter duration than the first preoperational test. The test results for the Total Time Leakage was higher than the Calculated Mass Point Leakage. This result can be attributed to the shorter stabilization and test duration. Initially, there is a wider band of data scatter and as the test progresses in time, the data scatter stabilizes. Therefore, the total time test results are very conservative compared to the Mass Point Leakage calculation.

The Type A tests over an approximate eight year period substantiate that the Waterford 3 containment is a low leakage containment, there is no increasing trend in leakage, and the leakage from containment is significantly below the maximum acceptable leakage rate of 0.75 L_a.

b. Containment Structural Capability

Two mechanisms are relevant in the consideration of the structural capability of containment. The first is deterioration of the structure due to pressure, temperature, radiation, chemical or other such effects. Secondly, modifications could be made to the structure which, if not carefully controlled, could leave the structure with a reduced capability.

Absent actual accident conditions, structural deterioration is a gradual phenomenon which requires periods of time well in excess of the proposed 10 year test interval. We are not aware of any information developed in the industry which identifies relatively quick-acting degradation mechanisms which could adversely affect containment integrity. Other than accident conditions, the only external mechanism inducing stress of the containment structure is the test itself. Longer test intervals would therefore lessen the frequency of stressing the containment.

10CFR50, Appendix J, Section V.A., requires a general inspection of the accessible interior and exterior surfaces of the containment structures and components to be performed prior to any Type A test to uncover any evidence of structural deterioration which may affect either the containment structural integrity or leak tightness. At Waterford 3 there has been no evidence of structural deterioration that would impact structural integrity or leak tightness. In accordance with section V.A, Waterford 3 technical specification surveillance requirements 4.6.1.6 and 4.6.6.3 require a visual inspection of the structural integrity of the containment vessel and shield building respectively during each Type A test. These visual inspections will therefore be performed at each 10 year interval Type A test.

Modifications made to the containment must continue to meet at least original construction requirements. In fact, modifications which may alter the passive containment structure are infrequent, at best. By their nature, such modifications receive extensive scrutiny to ensure containment capabilities are not diminished. The Waterford 3 design change program, 10CFR50.59, and similar programs have been demonstrated effective in providing a high quality oversight of such safety significant modifications. In addition, 10CFR50, Appendix J, Section IV.A, requires Type A testing to be performed following any major modification to the primary containment structure boundary. This requirement will be maintained.

c. Risk Impact Assessment

From a risk standpoint, the purpose of Appendix J containment leak testing is to detect any containment leakage resulting from failures in the containment isolation boundary before an accident occurs. Such leakage could be the result of leakage through containment penetrations, through airlocks, or through containment structural faults. The Appendix J Type B and C tests, which are unaffected by the proposed change, will detect leakage through containment valves and penetrations and through airlocks. Thus, the only potential affect of the proposed change to the Type A test frequency is to the probability that containment structural leakage would go undetected between tests. Since there is no credible failure mode for the containment structure under normal (unloaded) conditions, there is no possibility of a containment structural failure during normal operation. Therefore a change in the Type A test frequency would have no impact on the probability of containment failure during an accident. The following discusses these points in more detail.

Type B and C testing

The purpose of containment leak testing is to detect any containment leakage resulting from active or passive failures in the containment isolation boundaries before an accident occurs (termed latent failures). The existing Type B and C testing programs will continue to effectively detect containment leakage caused by the degradation of active containment isolation components (e.g., valves) as well as sealing material within containment penetrations. The only potential failures that would not be detected by Type B and C testing are mechanical failure of the containment shell, penetration guard pipes, or welds between pipes and the containment shell. Only these containment structural failures could possibly be affected by the proposed change to the Type A testing frequency.

Effect of leak test frequency

Changing a leak test frequency has no effect on the probability of a latent failure nor on the probability of containment failure caused by accident pressures. The test frequency only affects the length of time that the containment would be in an undetected failed state as a result of a latent failure, in the unlikely event that such a failure had occurred. Increasing the time during which containment is failed, the exposure time, increases the probability that if an accident were to occur, it would occur when the containment was already failed.

further states that the purpose of the tests are to assure that leakage through the primary reactor containment shall not exceed the allowable leakage rate values as specified in the technical specifications or associated bases.

Section III.D states that a set of three periodic Type A tests shall be performed at approximately equal intervals during each 10 year interval. This exemption would change the Type A test schedule to one Type A test each ten year interval. The methodology, acceptance criteria, and the technical specification leakage limits for the performance of the Type A test will not change, and the Type A tests will be performed in accordance with 10CFR50, Appendix J, and the Waterford 3 licensing bases.

The testing history, structural capability of the containment, and the risk assessment establish that Waterford 3 is a low leakage containment, the structural integrity of the containment is assured, and that there is a negligible risk impact in changing the Type A test schedule.

Thus collectively, there is significant assurance the Type A tests performed over a ten year schedule will continue to provide periodic verification of the leak tight integrity of the containment.

Section (a)(2)(iv): [There is a safety benefit to the public]

The implementation of the exemption would achieve a safety benefit for the public. Extending the Type A periodic test schedule will reduce radiation exposure attributed to valve line-ups and inspections. The containment must be depressurized after a Type A test. About 8.2 million standard cubic feet of air is released to the environment. The estimated radioactive releases for the second periodic Type A test at Waterford 3 were about 2.75 E04 gaseous, 2.85 E01 iodine, and 6.07 E03 particulate micro-curies. Therefore, performing the Type A tests at longer intervals will reduce radioactive releases to the environment. Also, in order to perform the Type A test, the containment is closed and all containment work activities and equipment operations are terminated. Generally, the outage personnel working on containment tasks cannot be quickly and fully utilized on other tasks during the time the test is being performed. The critical path days required for the performance of the Type A test is about 3.0 critical path days. Thus, there is a significant non-utilization of resources considering the large number of personnel working in containment and the number of equipment

operations held in abeyance as a result of the testing. The resources required for personnel actually doing the Type A test is about 1500 man-hours. Thus collectively, it is estimated there are about 16,000 man-hours of non-utilization resources that could be dedicated to safety significant outage activities.

Section (a)(2)(vi) [There are material circumstances not considered when the regulation was adopted]

The benefit of time has provided the experience and information which provide a better perspective about containment integrity. Two important material circumstances are testing history and containment structural integrity information.

Since the promulgation of 10CFR50, Appendix J, 1973, about 20 years of nuclear power plant operating history has been obtained. The Waterford 3 operating history establishes that the Waterford 3 containment is a low leakage containment, and it did not exceed 24.6% of L_a (0.5% wt per day) or 32.8% of the acceptance criteria 0.75 L_a (0.375% wt per day). Waterford 3 personnel performed a review of industry data and sources and did not find a single reported case wherein a Type A test failed to meet Appendix J acceptance criteria as a result of a containment structural leak not due to initial fabrication or a plant modification. Thus 20 years of operating history provide a significant indicator that containment structural integrity is not a safety concern.

Many technical studies have been performed and PRA tools have been developed which provide a better perspective about the structural integrity of containments and the likelihood of loss of containment integrity compared to other risks. As part of the IPEs that have been performed, structural analyses of containments have established that the containment failure pressures are high ranging from about 2.2 to 8.8 times design pressure. During normal operation the containment is at essentially atmosphere pressure so there is no significant stress that could cause a structural crack or failure. Secondly, IPEs have better defined the relative risks of plant operations. The likelihood of losing containment integrity as a result of extending the Type A test schedule is negligible compared to other risks like small break LOCA or station blackout. Thus Waterford 3 would be able to redirect significant resources to those activities having a higher risk profile.

6.0 Implementation

The third Type A test is required to be performed refuel 7, see references five through nine, attachment two. Waterford 3 proposes that the third Type A test be required to be performed within ten years from the second periodic Type A test or by May 12, 2001. The technical specification license amendment request, reference one, requires that the third periodic Type A test be performed within ten years from the second periodic Type A test.

7.0 References

1.0 Waterford 3 Letter to NRC, W3F1-93-0305, dated November 16, 1993

2.0 Waterford 3 Letter to NRC, W3P83-2399, dated July 19, 1983.

3.0 Waterford 3 Letter to NRC, W3P88-1283, dated August 23, 1988.

4.0 Waterford 3 Letter to NRC, W3F1-91-0447, dated August 12, 1991.

5.0 Waterford 3 Letter to NRC, W3F1-93-0034, dated May 7, 1993.

6.0 Waterford 3 Letter to NRC, W3F1-93-0041, dated May 7, 1993.

7.0 NRC Environmental Assessment Related to a Request for Exemption from the Requirements of Section III.D.(a) of Appendix J to 10CFR Part 50, dated June 22, 1993.

8.0 NRC Exemption to 10CFR Part 50, Appendix J, Section III.D.1.(a), dated August 12, 1993.

9.0 NRC Issuance of Amendment No. 85 to Facility Operating License NPF-38, dated August 12, 1993.

10.0 Waterford 3 FSAR, Table 6.2-3.

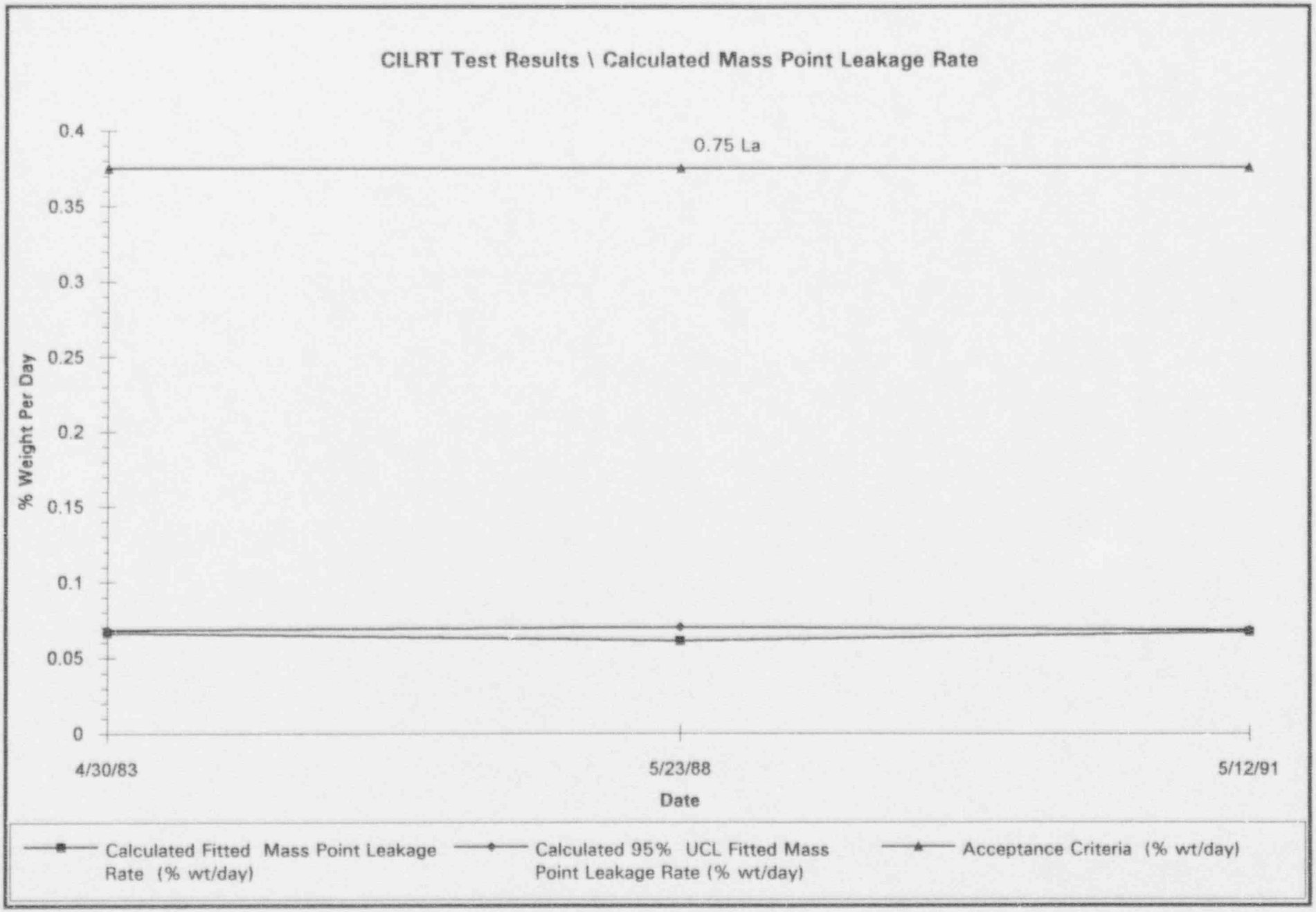

Figure 1. CILRT Test Results using the Calculated Mass Point Leakage Rate Method.

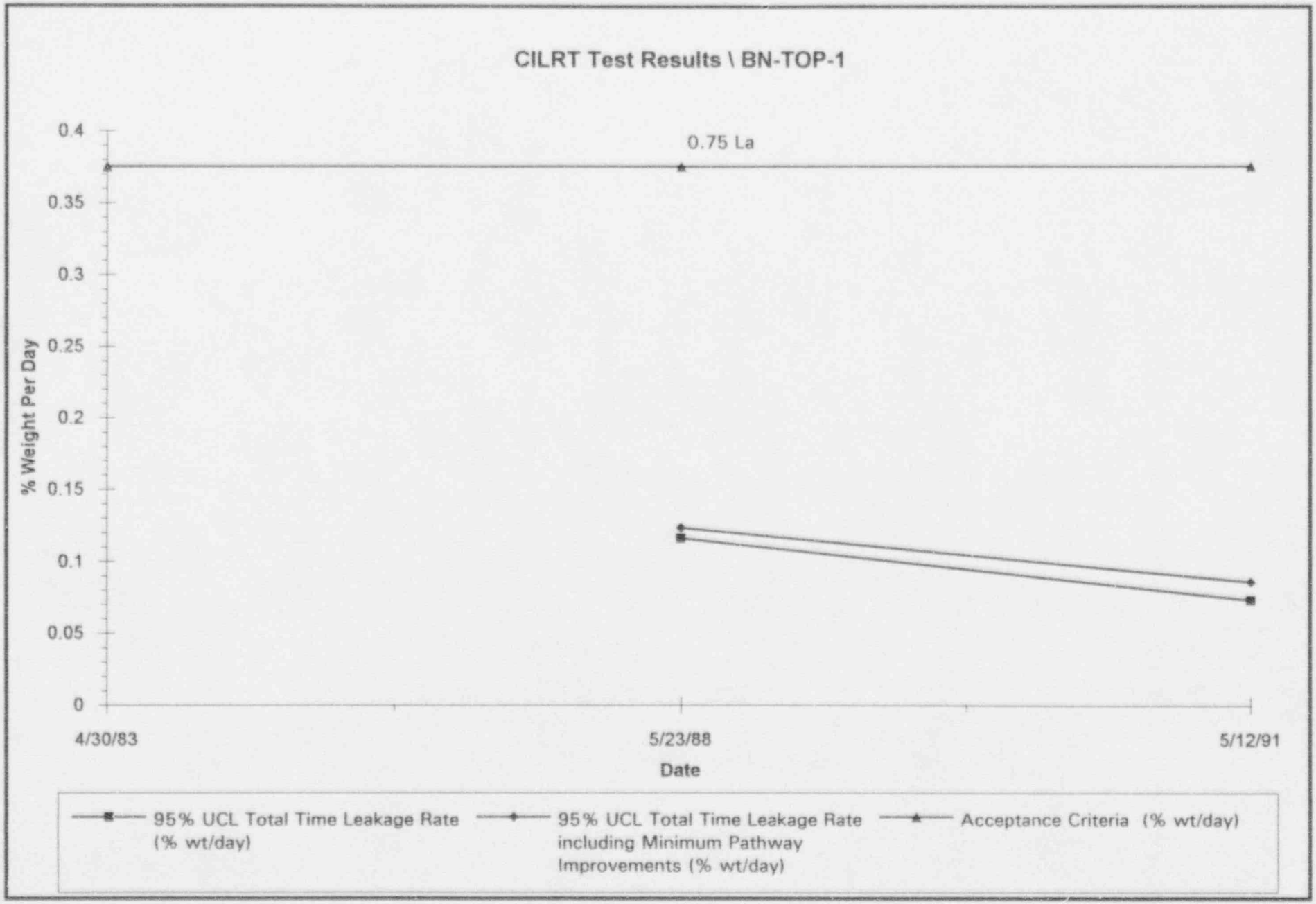

Figure 2. CILRT Test Results using the BN-TOP-1 Total Time Leakage Rate Method.

Attachment Two to Letter
W3F1-93-0098 References

ENTERGY

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Tel 504 739 6661

Ross P. Barkhurst
Vice President, Operations
Waterford 3

W3F1-93-0305
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November 16, 1993

Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Technical Specification Change Request NPF-38-145

Gentlemen:

The attached description and safety analysis support a change to the Waterford 3 Technical Specifications. This submittal requests a change to technical specification surveillance requirement 4.6.1.2.a and technical specification bases 3/4.6.1.2. The purpose of this technical specification change request is to change the periodic test schedule for Type A test from a set of three Type A tests performed at approximately equal intervals during each 10-year period, as specified in 10CFR50, Appendix J, Section III.D, to one Type A test performed at ten year intervals.

This proposed change has been evaluated in accordance with 10CFR50.91(a)(1), using the criteria in 10CFR50.92(c) and it has been determined that this request involves no significant hazards consideration.

On May 4 at the annual Regulatory Information Conference, Dr. Murley announced a pilot program, Cost Beneficial Licensing Action Initiative (CBLA), established by NRR to give special consideration to licensee

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requests for changes requiring staff review that involve high cost and low safety benefit. In response to Dr. Murley's initiative, Entergy Operations met with NRR staff on June 8, 1993, to present an initial list of CBLAs. As discussed on June 8, 1993, the proposed change to the Appendix J Type A retest schedule is being submitted under the CBLA program.

Waterford 3 letter W3F1-93-0098 documents the exemption to 10CFR50, Appendix J, Section III.D, and this letter thus also provides the detailed justification for this technical specification amendment request.

The technical justification is predicated on the following technical bases:

1. Type A Testing History

   The Waterford 3 Type A test history provides substantial justification for the proposed test schedule. Three Type A tests have been performed over an eight (8) year period with successful results. The tests indicate that Waterford 3 has a low leakage containment and that the leakage has never exceeded 24.6% of L_a.

2. Structural Capability of Containment

   There are no mechanisms which would adversely affect the structural capability of the containment and that would be a factor in extending the Type A test schedule to ten years.

3. Risk Impact Assessment

   A risk impact assessment was performed, and a determination was made that there is essentially no risk impact as a result of changing the Type A test schedule.

In summary, we believe this exemption request is an excellent case of a requirement marginal to safety. The provisions of 10CFR50.12 are satisfied, the exemption is technically justified, and there is a benefit to the public health and safety.

Please contact me or Robert J. Murillo should there be any questions regarding this matter.

Very truly yours,

R.P. Barkhurst
Vice President, Operations
Waterford 3

RPB/RJM/tmm
Attachment: Affidavit
NPF-38-145

cc: J.L. Milhoan, NRC Region IV
D.L. Wigginton, NRC-NRR
R.B. McGehee
N.S. Reynolds
NRC Resident Inspectors Office
Administrator Radiation Protection Division
(State of Louisiana)
American Nuclear Insurers

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of	)	
	)	
Entergy Operations, Incorporated	)	Docket No. 50-382
Waterford 3 Steam Electric Station	)	

AFFIDAVIT

R.P. Barkhurst, being duly sworn, hereby deposes and says that he is Vice President Operations - Waterford 3 of Entergy Operations, Incorporated; that he is duly authorized to sign and file with the Nuclear Regulatory Commission the attached Technical Specification Change Request NPF-38-145; that he is familiar with the content thereof; and that the matters set forth therein are true and correct to the best of his knowledge, information and belief.

R.P. Barkhurst
Vice President Operations - Waterford 3

STATE OF LOUISIANA)
) ss
PARISH OF ST. CHARLES)

Subscribed and sworn to before me, a Notary Public in and for the Parish and State above named this 16TH day of NOVEMBER, 1993.

Notary Public

My Commission expires WITH LIFE.

DESCRIPTION AND SAFETY ANALYSIS
OF PROPOSED CHANGE NPF-38-145

The proposed change requests a change to technical specification surveillance requirement 4.6.1.2.a and technical specification bases 3/4.6.1.2. The purpose of the technical specification change amendment is to change the test schedule for Type A tests from a set of three Type A tests performed at approximately equal intervals during each 10-year period, as specified in 10CFR50, Appendix J, section III.D, to one Type A test performed at ten year intervals.

Existing Specification

See Attachment A

Proposed Specification

See Attachment B

Background Description

10CFR50, Appendix J, section III.D, technical specification surveillance requirement 4.6.1.2.a and technical specification bases 3/4.6.1.2 require that a set of three Type A tests be performed at approximately equal intervals during each 10-year period. This technical specification license amendment request changes the Type A schedule to one test performed at 10 year intervals. The technical justification for this request is predicated on the following technical bases:

1. Type A Testing History

   The Waterford 3 Type A test history provides substantial justification for the proposed test schedule. Three Type A tests have been performed over an eight (8) year period with successful results. The tests indicate that Waterford 3 has a low leakage containment and that the leakage has never exceeded 24.6% of L_a.

2. Structural Capability of Containment

   There are no mechanisms which would adversely affect the structural capability of the containment and that would be a factor in extending the type A schedule to ten years.

3. Risk Impact Assessment

A risk impact assessment was performed, and a determination was made that there is no risk impact as a results of changing the Type A test schedule.

Waterford 3 letter W3F1-93-0098 documents the exemption to 10CFR50, Appendix J, section III.D, and this letter provides the detailed justification for this technical specification amendment request.

Safety Analysis

The proposed change described above shall be deemed to involve a significant hazards consideration if there is a positive finding in any of the following areas:

1. Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The Waterford 3 Type A test history provides substantial jusficiation for the proposed test schedule. Three type A tests have been performed over an eight (8) year period with successful results. The tests indicate that Waterford 3 has a low leakage containment and that the leakage has never exceeded 24.6% of L_a. There are no structural mechanisms which would adversely affect the structural capability of the containment and that would be a factor in extending the Type A test schedule to ten years. A risk impact assessment was performed, and a determination was made that there is no risk impact as a result of changing the Type A test schedule. Therefore, the proposed change will not involve a significant increase in the probability or consequences of any accident previously evaluated.

2. Will operation of the facility in accordance with this proposed change create the possibility of a new or different type of accident from any accident previously evaluated?

   Response: No.

   There are no design changes being made that would create a new type of accident or malfunction. The proposed change will not alter the plant or the manner in which it is operated. The change proposes a change to the schedule for performing the periodic Type A test. The purpose of the

test is to provide periodic verification by test of the leaktight integrity of the primary reactor containment, and systems and components which penetrate containment. The tests assure that leakage through containment and systems and components penetrating containment will not exceeed the allowable leakage rate values associated with conditions resulting from an accident. The change in schedule for performing the Type A test will not adversely affect the containment integrity in the event of an accident. Therefore, the proposed change will not create the possibility of a new or different type of accident from any accident previously evaluated.

3. Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?

Response: No

The proposed change is a change to the schedule for performing the periodic Type A tests and does not reduce the margin of safety assumed in accident analysis for release of radioactive materials from the containment atmosphere into the environment or any margin of safety preserved by the Technical Specifications. The methodology, acceptance criteria, and the technical specification leakage limits for the performance of the Type A tests will not change, and the Type A tests will be performed in accordance with 10CFR 50, Appendix J, and the Waterford 3 licensing basis. Therefore, the proposed change will not involve a significant reduction in a margin of safety.

Safety and Significant Hazards Determination

Based on the above safety analysis, it is concluded that: (1) the proposed change does not constitute a significant hazards consideration as defined by 10 CFR 50.92; (2) there is a reasonable assurance that the health and safety of the public will not be endangered by the proposed change; and (3) this action will not result in a condition which significantly alters the impact of the station on the environment as described in the NRC final environmental statement.

NPF-38-145

ATTACHMENT A

Dupe

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SURVEILLANCE REQUIREMENTS (Continued)

a. Three Type A tests (Overall Integrated Containment Leakage Rate) shall be conducted at 40 ± 10 month intervals** during shutdown at either P_a, 44 psig, or at P_t, 22 psig, during each 10-year service period. The third test of each set shall be conducted during the shutdown for the 10-year plant inservice inspection.

b. If any periodic Type A test fails to meet either 0.75 L_a or 0.75 L_t, the test schedule for subsequent Type A tests shall be reviewed and approved by the Commission. If two consecutive Type A tests fail to meet either 0.75 L_a or 0.75 L_t, a Type A test shall be performed at least every 18 months until two consecutive Type A tests meet either 0.75 L_a or 0.75 L_t at which time the above test schedule may be resumed.

c. The accuracy of each Type A test shall be verified by a supplemental test which:

   1. Confirms the accuracy of the test by verifying that the supplemental test result, L_c, minus the sum of the Type A and the superimposed leak, L_o, are equal to or less than 0.25 L_a.

   2. Has a duration sufficient to establish accurately the change in leakage rate between the Type A test and the supplemental test.

   3. Requires the quantity of gas injected into the containment or bled from the containment during the supplemental test to be between 0.75 L_a and 1.25 L_a.

d. Type B and C tests shall be conducted with gas at P_a, 44 psig, at intervals no greater than 24 months* except for tests involving:

   1. Air locks,

   2. Purge supply and exhaust isolation valves with resilient material seals.

*Testing for the first cycle of operation shall be done during the first refueling outage.

**A one time extension of the test interval is allowed for the third Type A test of the first 10-year service period, provided that performance of the Type A test occurs prior to unit restart following Refuel 7.

BASES

3/4.6.1 PRIMARY CONTAINMENT

3/4.6.1.1 CONTAINMENT INTEGRITY

Primary CONTAINMENT INTEGRITY ensures that the release of radioactive materials from the containment atmosphere will be restricted to those leakage paths and associated leak rates assumed in the safety analyses. This restriction, in conjunction with the leakage rate limitation, will limit the SITE BOUNDARY radiation doses to within the limits of 10 CFR Part 100 during accident conditions.

3/4.6.1.2 CONTAINMENT LEAKAGE

The limitations on containment leakage rates ensure that the total containment leakage volume will not exceed the value assumed in the safety analyses at the peak accident pressure, P_a. As an added conservatism, the measured overall integrated leakage rate is further limited to less than or equal to 0.75 L_a or less than or equal to 0.75 L_t, as applicable during performance of the periodic tests to account for possible degradation of the containment leakage barriers between leakage tests.

The surveillance requirements for measuring leakage rates are consistent with the requirements of Appendix J of 10 CFR Part 50.*

Secondary containment bypass leakage paths previously, Table 3.6-1, have been incorporated into plant procedure UNT-005.026.

3/4.6.1.3 CONTAINMENT AIR LOCKS

The limitations on closure and leak rate for the containment air locks are required to meet the restrictions on CONTAINMENT INTEGRITY and containment leak rate. Surveillance testing of the air lock seals provides assurance that the overall air lock leakage will not become excessive due to seal damage during the intervals between air lock leakage tests.

*A one time extension of the test interval is allowed for the third Type A test of the first 10-year service period, as required by Surveillance Requirement 4.6.1.2.a and by Section III.D.(a) of Appendix J to 10 CFR Part 50, provided the performance of the Type A test occurs prior to unit restart following Refuel 7.

NPF-38-145

ATTACHMENT B

SURVEILLANCE Requirements (Continued)

a. A ~~Three~~ Type A test ~~s~~ (Overall Integrated Containment Leakage Rate) shall be conducted ~~at 40 ± 10 month intervals~~ during shutdown at either P_a, 44 psig, or at P_t, 22 psig, ~~during each 10-year service period. The third test of each set shall be conducted during the shutdown for the 10-year plant inservice inspection.~~ at intervals no greater than 10 years**.

b. If any periodic Type A test fails to meet either 0.75 L_a or 0.75 L_t, the test schedule for subsequent Type A tests shall be reviewed and approved by the Commission. If two consecutive Type A tests fail to meet either 0.75 L_a or 0.75 L_t, a Type A test shall be performed at least every 18 months until two consecutive Type A tests meet either 0.75 L_a or 0.75 L_t at which time the above test schedule may be resumed.

c. The accuracy of each Type A test shall be verified by a supplemental test which:

1. Confirms the accuracy of the test by verifying that the supplemental test result, L_c, minus the sum of the Type A and the superimposed leak, L_a are equal to or less than 0.25 L_a.

2. Has a duration sufficient to establish accurately the change in leakage rate between the Type A test and the supplemental test.

3. Requires the quantity of gas injected into the containment or bled from the containment during the supplemental test to be between 0.75 L_a and 1.25 L_a.

d. Type B and C tests shall be conducted with gas at P_a, 44 psig, at intervals no greater than 24 months* except for tests involving:

1. Air locks,

2. Purge supply and exhaust isolation valves with resilient material seals.

*Testing for the first cycle of operation shall be done during the first refueling outage.

** ~~A one-time extension of the test interval is allowed for the third Type A test of the first 10-year service period, provided that performance of the Type A test occurs prior to unit restart following Refue~~ 7. The third Type A test shall be performed within ten years of the second periodic Type A test or by May 12, 2001. This is an exemption from 10 CFR Part 50, Appendix J requirements.

3/4.6.1 PRIMARY CONTAINMENT

3/4.6.1.1 CONTAINMENT INTEGRITY

Primary CONTAINMENT INTEGRITY ensures that the release of radioactive materials from the containment atmosphere will be restricted to those leakage paths and associated leak rates assumed in the safety analyses. This restriction, in conjunction with the leakage rate limitation, will limit the SITE BOUNDARY radiation doses to within the limits of 10 CFR Part 100 during accident conditions.

3/4.6.1.2 CONTAINMENT LEAKAGE

The limitations on containment leakage rates ensure that the total containment leakage volume will not exceed the value assumed in the safety analyses at the peak accident pressure, P_a. As an added conservatism, the measured overall integrated leakage rate is further limited to less than or equal to 0.75 L_a or less than or equal to 0.75 L_t, as applicable during performance of the periodic tests to account for possible degradation of the containment leakage barriers between leakage tests.

The surveillance requirements for measuring leakage rates are consistent with the requirements of Appendix J of 10 CFR Part 50.*

Secondary containment bypass leakage paths previously, Table 3.6-1, have been incorporated into plant procedure UNT-005-026

3/4.6.1.3 CONTAINMENT AIR LOCKS

The limitations on closure and leak rate for the containment air locks are required to meet the restrictions on CONTAINMENT INTEGRITY and containment leak rate. Surveillance testing of the air lock seals provides assurance that the overall air lock leakage will not become excessive due to seal damage during the intervals between air lock leakage tests.

~~* A one time extension of the test interval is allowed for the third Type A test of the first 10 year service period, as required by Surveillance Requirement 4.6.1.2.a and by Section III.D.(a) of Appendix J to 10 CFR Part 50, provided the performance of the Type A test occures prior to unit restart folowing Refuel 7.~~ The third periodic Type A test shall be performed within ten years from the second periodic Type A test or by May 12, 2001. This is an exemption to 10 CFR Part 50, Appendix J Requirements

LOUISIANA POWER & LIGHT / 142 DELARONDE STREET • P.O. BOX 6008
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MIDDLE SOUTH UTILITIES SYSTEM

July 19, 1983

W3P83-2399
3-A 01.04
3-I

Director of Nuclear Reactor Regulation
Attention: Mr. G. W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

SUBJECT: Waterford SES Unit 3
Docket No. 50-382
Reactor Containment Building Integrated Leak Rate Test

Dear Sir:

In accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50, Appendix J - Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, enclosed please find five copies of the summary technical report detailing results of the preoperational Type A Integrated Leakage Rate Tests performed for Waterford 3.

Included in the report is a schematic arrangement of the leakage rate measurement system, and a description of the instrumentation, the supplemental test method and the test program employed. Also contained in the report is a presentation of the leakage rate test data along with an analysis demonstrating the acceptability of the containment leakage rate in meeting the prescribed acceptance criteria.

Should you have any questions or comments in this matter, please contact me or Mike Meisner at (504) 363-8938.

Yours very truly,

F.J. Drummond
Project Support Manager-Nuclear

FJD/MJM/ch
Enclosure

cc: W. M. Stevenson, E. L. Blake, J. Wilson (NRC), J. T. Collins (NRC-Region IV), G. L. Constable (NRC, Resident Inspector)

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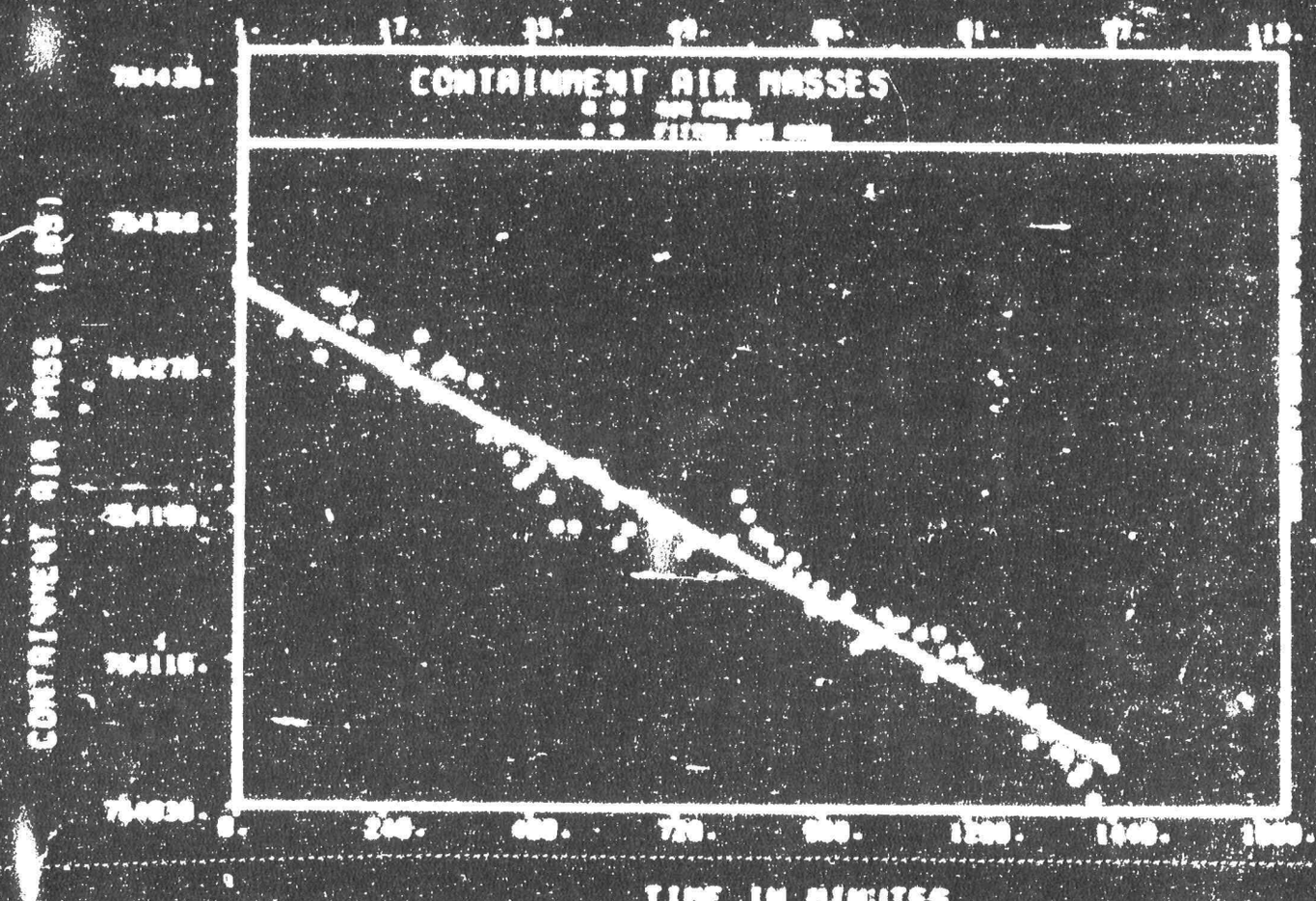
[redacted]

FINAL REPORT



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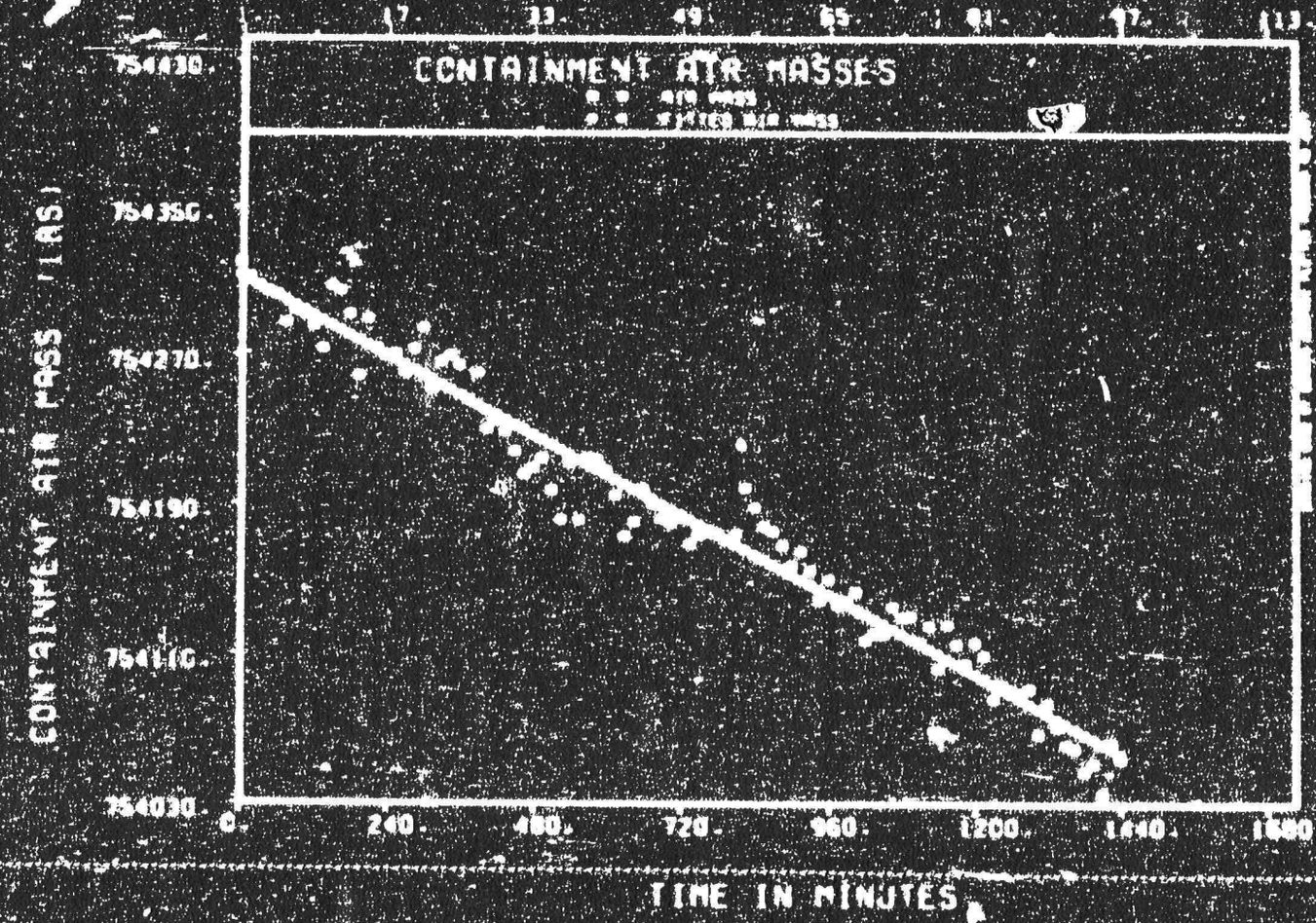
STARTUP SERVICES

Waterford Steam Electric Station - Unit No. 3
Taft, Louisiana
Docket Number 50-382

REACTOR CONTAINMENT BUILDING
INTEGRATED LEAKAGE RATE TEST

FINAL REPORT



EBASCO PLANT SERVICES INC.
A Subsidiary of Ebasco Services Incorporated
STARTUP SERVICES

EBASCO

WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3
TAFT, LOUISIANA

DOCKET NUMBER 50-382

REACTOR CONTAINMENT BUILDING INTEGRATED LEAKAGE RATE TEST

FINAL REPORT

Prepared for:

LOUISIANA POWER & LIGHT COMPANY

Prepared by:

M. Rubin

M Rubin
Ebasco Staff Engineer

J. Kane

Reviewed by:
Joint Test Group
Louisiana Power & Light Company
Waterford SES Unit No. 3

Approved by:

P B Dillon

P B Dillon
Ebasco Manager - Plant Test & Start-up

8305220419

Date of Test Completion:
May 1, 1983

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I. INTRODUCTION

A series of two preoperational Type "A" Integrated Leakage Rate Tests (ILRT) were performed on the primary containment structure of the Louisiana Power & Light Company, Waterford Steam Electric Station Unit No. 3, Pressurized Water Reactor.

The ILRT tests were performed using the "Absolute Method" of testing in accordance with the Code of Federal Regulations, Title 10, Part 50, Appendix J - Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors and in accordance with the American National Standard ANSI N45.4 - 1972, Leakage-Rate Testing of Containment Structures for Nuclear Reactors. The calculations of leakage rate were performed using the "Mass Point Method" as described in ANSI/ANS 56.8 - 1981, American National Standard - Containment System Leakage Testing Requirements. The first ILRT test was performed at a containment pressure slightly above one-half of peak accident internal pressure. The purpose of this test was to obtain a measured leakage rate to be used in determining the acceptance criteria, should a reduced pressure periodic leakage rate program be elected for future testing. The second ILRT test was performed at a pressure in excess of the calculated peak containment internal pressure related to the design basis accident as specified in the Final Safety Analysis Report (FSAR) and the Technical Specifications.

This report describes and presents the results of these preoperational type "A" leakage rate tests, including the supplemental test method utilized for verification.

II. SUMMARY

To prepare the containment and associated systems penetrating the containment for the preoperational Type "A" ILRTs, Type "B" local penetration leakage rate tests and Type "C" local containment isolation valve leakage rate tests were performed. These Type "B" and Type "C" tests, collectively known as Local Leakage Rate Tests (LLRT), are described in Section 6.2 of the FSAR.

Prior to pressurization of the containment vessel for the ILRT, all containment systems and isolation valves were lined up, vented and/or drained, to simulate accident conditions as described in Section 6.2 of the FSAR.

The containment was pressurized with air to a pressure slightly above one-half peak containment internal pressure to perform the reduced pressure ILRT test sequence. Following temperature stabilization, containment leakage rate data was accumulated for a twenty-four hour period during which an acceptable leakage was measured. The fitted mass point leakage rate for the period was calculated to be 0.002 percent of the contained mass per day. The one-sided ninety-five percent Upper Confidence Level (UCL) for this measurement was 0.008 percent per day. The acceptance criteria for the preoperational reduced pressure ILRT, as defined by Appendix J to 10 CFR 50, is that the measured leakage including uncertainties be less than 0.265 percent per day (0.75 times the reduced pressure design leakage). A supplementary Controlled Leakage Rate Test (CLRT) was performed to verify the reduced pressure ILRT leakage measurements with acceptable results determined.

The containment was then pressurized to slightly above the peak containment internal pressure to conduct the peak pressure ILRT test sequence. Following temperature stabilization, containment leakage rate data was accumulated for a twenty-four hour period during which an acceptable leakage was measured. **The fitted mass point leakage rate for the period was calculated to be 0.066 percent per day with a 0.068 percent per day UCL.** The acceptance criteria for the peak pressure ILRT, as defined by Appendix J to 10 CFR 50, is that the measured leakage including uncertainties be less than 0.375 percent per day (0.75 times the containment design leakage). The peak pressure CLRT results verified that the measured peak pressure ILRT leakage results are within the allowable acceptance band. It is worthwhile noting, that although Louisiana Power & Light Company has not committed to ANSI/ANS 56.8-1981, the peak pressure ILRT was performed in accordance with all recommendations of this standard, as applicable to the preoperational ILRT.

III. TEST DISCUSSION

A. Description of the Containment

The containment vessel completely encloses the entire reactor and reactor coolant system, to ensure no leakage of radioactive materials to the environment, in the unlikely event of a loss of coolant accident.

The containment system incorporates a freestanding containment vessel, surrounded by a low leakage reinforced concrete shield building. A four-foot annular air space is provided between the outer wall of the containment vessel and the inner wall of the shield building, to allow filtration of any containment vessel leakage during accident conditions to minimize off-site doses.

The freestanding containment vessel is a two-inch thick circular cylinder, with a one inch thick hemispherical dome and two inch thick ellipsoidal bottom. The overall vessel dimensions are: 140 foot diameter by 240.5 foot high. The vessel wall thickness is increased to a minimum of four inches adjacent to all penetrations and openings. The vessel is fabricated of ASME-SA 516 Grade 70 fully killed pressure vessel quality steel plate. The net free volume of the containment vessel is 2.677×10^6 cubic feet.

The containment vessel structure includes one personnel airlock, one emergency escape airlock, one fuel transfer tube, one equipment maintenance hatch and one seal-welded construction hatch. All process piping and electrical penetrations are welded directly to the containment vessel nozzles, with the exception of the main steam, main feedwater and fuel transfer tube penetrations. These penetrations are provided with testable expansion bellows, to allow for thermal growth or building differential motion.

The containment vessel is designed and constructed in accordance with the requirements for class MC vessels contained in section III, Subsection NE of the ASME Code, 1971 Edition including Summer 1971 Addenda and Code cases 1431, 1454-1 and 1517, as approved by USNRC Regulatory Guides 1.84 and 1.85. The containment vessel is code stamped in accordance with Paragraph NE-8000 of Section III of the ASME Boiler and Pressure Vessel Code. The containment vessel and all penetrations are designed to limit leakage to less than 0.5 percent by weight of the contained air mass per day, at the design pressure of 44 psig. The calculated peak accident pressure for the design basis accident at Waterford SES Unit No. 3 is 44 psig at 263°F.

Following field erection of the containment vessel, post weld heat treatment, pressurized vessel solution film testing and vessel overload testing were performed in accordance with Section III of the ASME Code. This sequence of testing is described in Sections 3.8.2.6 and 3.8.2.7 of the FSAR.

B. Description of ILRT Test Instrumentation

The containment system was equipped with instrumentation to permit leakage rate determination by the "absolute method." Utilizing this method, the actual mass of dry air within the containment is calculated. The leakage

rate becomes the time rate of change of this value. The air mass Q is calculated according to the Perfect Gas Law as follows:

$$Q = \frac{(P-Pv)\ V}{RT}$$

Where: P - Containment Total Absolute Pressure
Pv - Containment Water Vapor Pressure
V - Containment Net Free Volume
R - Gas Constant
T - Containment Absolute Temperature

The primary measurement variables required are: containment absolute pressure, containment relative humidity and containment temperature as a function of time. During the supplementary verification test, containment bleed-off flow was also recorded.

The Instrument Selection Guide (ISG) was used to determine the capability of the instrumentation to measure the leakage rate. The calculated ISG for this test met all acceptance criteria for the test instrumentation system.

1. Temperature Instrumentation

Forty precision Resistance Temperature Detectors (RTDs) were located throughout the containment to allow measurement of the volumetrically weighted average air temperature. The location of the temperature detectors in the containment is shown in Figure 1. The volumetric weighting factors for the RTDs are given in Appendix C. Each RTD was procured to an accuracy of $\pm 0.1^{\circ}F$. The sensitivity of the RTDs was measured as $\pm 0.05^{\circ}F$.

The signal conditioning circuit and readout for the RTD sensors was a Kaye datalogger with Wheatstone bridges used for RTD signal conditioning. The signal conditioning circuit and readout had a repeatability of $\pm 0.005^{\circ}F$ and a resolution of $\pm 0.005^{\circ}F$.

2. Humidity Instrumentation

Ten Resistance Humidity Detectors (RHDs) were located throughout the containment to allow measurement of the volumetrically weighted average containment vapor pressure. The location of the RHDs in the containment is shown in Figure 2. The volumetric weighting factors for the RHDs are given in Appendix C. The calibrated accuracy of the RHD, was ± 2.5 percent RH, the repeatability of the RHDs was ± 0.10 percent RH and the sensitivity of the RHDs was ± 0.1 percent RH.

The readout device used for the RHDs was a Kaye datalogger. The repeatability of this device was ± 0.01 percent RH while the resolution of the device was ± 0.01 percent RH.

3. Pressure Instrumentation

Two precision digital pressure gauges were used to determine containment absolute pressure. The arrangement of the piping connection between the pressure gauges and the containment is shown in Figure 3. Either pressure gauge could be used as the primary pressure sensor for the leakage rate calculations, with the remaining sensor being considered as a backup. The calibrated accuracy of the primary pressure sensor was ±0.02 percent of reading or ±0.012 psi for the high-pressure test. The sensitivity and repeatability of the pressure gauges was measured as ±0.001 psi.

The readout device for the pressure gauges was a Guildline digital multimeter, reading the current loop output of the pressure sensor. The readout device had a repeatability and resolution of ±0.00006 psi.

4. Flow Instrumentation

Two thermal mass flowmeters and one variable area Rotameter were used to superimpose leakage during the supplementary CLRT. The piping arrangement between the flowmeters and containment is shown in Figure 3. The two thermal mass flowmeters were arranged so that they could be used in series for greater repeatability or singly in case of a failure of the other sensor for increased reliability. The two thermal mass flowmeters were used for the reduced pressure CLRT. The variable area rotameter was used for the peak pressure CLRT and was calibrated at that pressure. The accuracy, repeatability, sensitivity and range of the three flowmeters in units of SCFM, and converted to equivalent leakage values, is given below:

	SCFM	Equivalent Leakage
Reduced Pressure Thermal Mass Flowmeter:		
Range	25.00	0.539%/day
Accuracy	±0.50	±0.011%/day
Repeatability	±0.25	±0.005%/day
Sensitivity	±0.25	±0.005%/day
Peak Pressure Rotameter:		
Range	60.00	0.808%/day
Accuracy	±0.60	±0.008%/day
Repeatability	±0.15	±0.002%/day
Sensitivity	±0.15	±0.002%/day

5. Instrument Selection Guide (ISG)

The Instrument Selection Guide is a method of compiling the instrumentation sensitivity and resolution for each process measurement variable used during the ILRT and evaluating the total instrumentation system's ability to detect leakage rates in the range required. Although the ISG is a very conservative measure of sensitivity, the general industry practice is to require sensitivity at least four times the containment design leakage or ISG $\leq$ 0.25La.

The pre-test ISG for the Waterford No. 3 ILRT instrumentation system was calculated as follows:

	Pre-Test ISG	Maximum Acceptable
Reduced Pressure Test	0.004%/day	0.088%/day
Peak Pressure Test	0.002%/day	0.125%/day

As noted in the above calculations, the pre-test ISG sensitivity of the ILRT instrumentation system was demonstrated as more than adequate.

C. Containment Pressurization Equipment

The equipment used to pressurize the containment and its piping arrangement are shown in Figure 4. The seven oil-free industrial electric driven air compressors had a total nominal capacity of 12,000 ACFM. The compressed air was then routed through chilled-water aftercoolers, moisture separators and a deliquescent desiscant air dryer. This equipment arrangement assured that only clean and dry air was used to pressurize the containment.

D. Description of the Computer Program

The Ebasco ILRT computer program is an interactive Fortran IV program written specifically for fast, easy utilization during all phases of the ILRT and CLRT. Data entry and modifications, if necessary, are readily accomplished by the data acquisition team. In addition to extensive data verification routines, the program calculates, on demand, total time and mass point leak rates as well as the 95 percent Upper Confidence Level for these leakage rate calculations.

Sample rejection based upon the Chauvenet criterion may be utilized in the analysis, if required, due to recording errors, power failures, etc.

Input data may be deleted for a given instrument in the case of a sensor malfunction. This deletion of a given instrument is performed on all samples in the data base. Volumetric weighting factors, if applicable, are then recalculated for the remaining instrument sensors of that type.

Data evaluations are enhanced by the flexible display of either sensor variables or various computed values in tabular or graphical form on the computer terminal. Data is recorded on tape to prevent loss during the

testing. All data is stored on the computer systems in use with retrieval capability to any desired data base throughout the testing.

Ancillary portions of the program assist the user in detection of temperature stabilization, perform ISG calculations, perform in-situ Instrument Loop Performance calculations and detect acceptable superimposed CLRT leakage verification.

Temperature, pressure and humidity data are entered interactively via the computer terminal at 15 minute intervals. Computer verification and checking routines supplement data verification by the data acquisition team. Modifications are promptly made when errors are detected. Prior to issuance of this report, further extensive data verification was performed.

E. Description of the Testing Sequence

On April 26, 1983, all type "B" and "C" local leakage rate tests, all ILRT instrumentation checks, all ILRT valve lineups and containment preparations for pressurization were complete. A final inspection of the interior and exterior of the containment vessel and internal components was made to prepare the containment for pressurization.

The containment was declared ready for pressurization and the air compressors started at 0420 hours on April 27, 1983. The sequence of pressure testing for the containment is graphically shown on Figure 5.

At 0725 hours on April 27, 1983, pressurization was secured at 10.2 psig, to perform external leak surveys of the containment vessel and its penetrations. The leak survey teams found and isolated a minor leak on a containment spray line level indicator, caused by improper positioning of valving. It was noted that this valving was inadvertently left out of the test valve lineup. Further procedural checks and leak surveys found no other discrepancies. The air compressors were restarted and pressurization to the next plateau begun at 1025 hours.

At 1120 hours, on the same day, pressurization was secured at 12.8 psig to investigate a fire alarm in the containment. Although external investigations implied that this was a false alarm, a containment personnel entry was made for confirmation. Once confirmation was received, containment pressurization was restarted at 1356 hours.

Pressurization of the containment was secured at 1720 hours on April 27, 1983, at a containment pressure of 23.2 psig, to conduct the reduced pressure ILRT test sequence. This pressure was 1.2 psi above the minimum test pressure of 22 psig to account for expected pressure decrease during temperature stabilization. At 2145 hours, after analyzing four and one-quarter hours of test data, containment temperature stabilization criteria were met, and ILRT leakage rate data taking was initiated.

Twenty four hours of ILRT leakage rate data were completed at 2200 hours on April 28, 1983. The data accumulated displayed low and stable leakage rates as follows:

Simple Mass Point Leakage Rate = 0.014%/day

Fitted Mass Point Leakage Rate = 0.002%/day

95 Percent Upper Confidence Level (UCL) = 0.008%/day

The acceptance criteria at this stage of testing was 0.265%/day and the reduced pressure CLRT was declared complete and acceptable.

The supplemental verification reduced pressure CLRT was initiated by using the thermal mass flow meters to superimpose a bleed-off flow of 17.21 SCFM, equivalent to a superimposed leakage of 0.363%/day. After allowing for a two hour stabilization period, CLRT data taking was initiated at 0015 hours on April 29, 1983. After four and one-quarter hours of data taking, the superimposed flow was secured. The fitted mass point leakage rate for the CLRT was 0.356%/day, well within the verification acceptance criteria for the low pressure CLRT.

Pressurization to peak pressure was initiated at 0515 hours on April 29, 1983, with the target pressure of 46.7 psig achieved at 1255 hours. This pressure was 2.7 psi above the required test pressure of 44 psig to account for the expected pressure decrease during temperature stabilization. A higher rate of containment pressure decay than could be accounted for due to temperature drop was initially exhibited, pointing to a leak in the containment. Leak survey teams found that the manual containment isolation valve on the ILRT pressurization line had not been fully closed. After full valve closure, temperature stabilization data taking was started at 1400 hours. Containment temperature stabilization criteria were met four hours later and peak pressure ILRT leakage rate data taking was initiated at 1800 hours on April 29, 1983.

Approximately nine hours into the peak pressure ILRT, one of the temperature sensors, RTD40, began to behave erratically and RTD40 was deleted from the leakage rate calculations. Volumetric weighting factors for the appropriate adjacent RTDs were adjusted and leakage rate data taking was continued. Approximately nineteen hours into the peak pressure ILRT, RTD18 and RTD20 were deleted from the leakage rate calculation for the same reason as noted for RTD40.

Twenty four hours of ILRT leakage rate data were completed at 1800 hours on April 30, 1983. The data accumulated displayed low and stable leakage rates as follows:

Simple mass point leakage rate = 0.057%/day

Fitted Mass point leakage rate = 0.066%/day

95 pecent Upper Confidence Level (UCL) = 0.068%/day

The acceptance criteria for this stage of testing was 0.375%/day and the peak pressure ILRT was declared complete and acceptable.

The peak pressure CLRT was initiated by using the variable area rotameter to superimpose a bleed-off flow of 38.46 SCFM, equivalent to a superimposed leakage of 0.499%/day. After allowing for a one and one-half hour stabilization period, CLRT data taking was initiated at 1945 hours on April 30, 1983. After five and one-half hours of data taking, the superimposed flow was secured. The fitted mass point leakage rate for the CLRT was 0.572%/day, well within the verification acceptance criteria for the peak pressure CLRT.

Between the time of 0127 and 0201 hours on May 1, 1983, depressurization of the containment vessel from 45.8 psig to 44.2 psig was performed as a prerequisite to the Containment Cooling System preoperational test. Upon successful completion of the Containment Cooling System preoperational test, depressurization of the containment to ambient pressure was initiated at 0315 hours.

At 1415 hours on May 1, 1983, the containment was at atmospheric pressure and a post-test internal inspection was made. The internal inspection showed no evidence of structural deformation.

Subsequent to the ILRT, the two process piping penetrations which were in use during the ILRT (pressure sensing, pressurization/depressurization) were subjected to LLRT tests. The result of the local tests was less than 0.0001 %/day leakage not accounted for during the ILRT and was to be added to the measured ILRT results. Due to the fact that this value was less than the minimum detectable leakage measured during the ILRT, it was therefore ignored.

IV. ANALYSIS AND INTERPRETATION

The initial reduced pressure and peak pressure Integrated Leak Rate Tests were successfully completed as a part of the Preoperational Test Program for the Waterford Steam Electric Station Unit No. 3 containment, between April 27, 1983 and May 1, 1983. The final mass point measured leakage rate at peak pressue was 0.066 percent per day with a 95 percent Upper Confidence Level of 0.068 percent per day. The acceptance criteria for this test is 0.375 percent per day or 75 percent of the containment design leakage rate.

The first section of the reduced pressure ILRT test plateau was containment atmospheric stabilzation. As shown in Appendix A.1, temperature stabilization criteria of 0.5°F/hr rate of change difference between the last hour and the last four hours was met in four and one-quarter hours.

The reduced pressure ILRT measurements were taken for a twenty four hour period at fifteen minute intervals and are presented in Appendix A.2. Instrumentation performance was evaluated using the Ebasco in-situ Instrument Loop Performance calculation and compared to the predicted ISG calculation presented in Section III.B.5. The actual Instrumentation Loop Performance was calculated as 0.016 percent per day compared with the predicted ISG of 0.004 percent per day. A breakdown of the variables influencing total instrumentation performance is given below:

Instrument loop	Predicted ISG	In-Situ Performance
Pressure (psia)	±0.001	±0.004
Temperature (°F)	±0.008	±0.007
Humidity (%RH)	±0.032	±0.029
Total (%/day)	±0.004	±0.016

It is noted that the pressure loop exhibited slightly lower performance than was predicted and was the contributor to the in-situ performance being lower than predicted. Although this instrument performance is four times the predicted value, it is still below the industry recommended limit of 0.068 percent per day as presented in Section III.B.5. This instrument performance does not directly impact containment leakages, measured during the ILRT, but is evidenced in the calculation of the 95 percent Upper Confidence Level (UCL).

As shown in Appendix A.2, the reduced pressure ILRT results yielded a 0.002 percent per day fitted mass point leakage rate with a 0.008 percent per day UCL. The UCL is nominally above the measured leakage due to the instrumentation performance noted above. Both the measured leakage and the UCL are well below the acceptance criteria for this test of 0.265 percent per day. No instrument sensors were deleted during this portion of the test. No data samples were rejected using the Chauvenet criterion during this portion of the test.

Following the reduced pressure ILRT, the measured leakage of 0.002 percent per day was verified by a Controlled Leakage Rate Test (CLRT), which superimposed a calibrated leakage of 0.363 percent per day on the containment. The measured results of the CLRT fell well within the acceptance band for this portion of the test, as shown in Appendix A.3, and verified the results of the reduced pressure ILRT. The formulation of the acceptance band for the CLRT is shown in Appendix A.3. No instrument sensors were deleted during this portion of the test. No data samples were rejected using the Chauvenet criterion during this portion of the test.

The peak pressure ILRT test plateau met the temperature stabilization criteria in four hours. A graphic and tabulated presentation of the temperature stabilization is shown in Appendix b.1.

The peak pressure ILRT measurements were taken for a twenty four hour period at fifteen minute intervals and are presented in Appendix b.2. The previously noted failure of three of the forty RTD temperature sensors during this portion of the test required recalculation of the instrument ISG presented in Section III.B.5 to assure that adequate instrumentation sensitivity was still present. The Ebasco in-situ Instrument Performance calculations were also performed at peak pressure. A summary of these calculation follows:

	Calculated Value	Maximum Acceptable
Pre-Test ISG	0.002%/day	0.125%/day
Post-Test ISG	0.003%/day	0.125%/day
In-Situ Performance	0.003%/day	0.125%/day

It should be noted that the in-situ Instrument Performance Calculation agrees with the post-test ISG and does not exhibit the degraded performance noted in the reduced pressure ILRT. This is due to the noise present in the pressure sensor becoming relatively less important as the absolute pressure increased and the noise remained constant. The pressure sensor noise was also made less important by the higher pressure drop over the test period, resulting from the higher leakage rate exhibited at peak pressure.

As shown in Appendix B.2, the peak pressure ILRT results yielded a 0.066 percent per day fitted mass point leakage rate with a 0.068 percent per day UCL. Both the measured leakage and UCL are well below the acceptance criteria for this test of 0.375 percent per day. No data samples were rejected using the Chauvenet criterion during this portion of the test. Only the above noted three RTDs were deleted during this portion of the test.

Following the peak pressure ILRT, the measured leakage of 0.066 percent per day was verified during the peak pressure CLRT by superimposing a calibrated leakage of 0.499 percent per day on the containment. The measured

results of the CLRT fell well within the acceptance band for this portion of the test, as shown in Appendix B.3, and verify the results of the peak pressure ILRT. The formulation of the acceptance band for the CLRT is shown in Appendix B.3. The same three RTD temperature sensors, deleted during the peak pressure ILRT, were deleted from this test. No data samples were rejected using the Chauvenet criterion during this portion of the test.

The post-ILRT Local Leakage Rate Test results are discussed in Section III.E of this report. These results have no influence on the measured leakages of the ILRT.

To allow the option of performing a reduced pressure ILRT in future postoperational periodic tests, 10CFR50 Appendix J directs that the leakage acceptance criteria for a reduced pressure test be established by using the results of the preoperational reduced pressure and peak pressure ILRTs. The formulation of this acceptance criteria follows:

$$Lt = La\ (Ltm/Lam)$$

$$Lt = 0.5\ (0.002/0.066)$$

$$Lt = 0.015 \text{ percent per day}$$

$$Pt \geq 22 \text{ psig}$$

FIGURES

LOUISIANA POWER & LIGHT COMPANY
WATERFORD S. E. S. UNIT NO. 3
RTD LOCATION/VOLUME

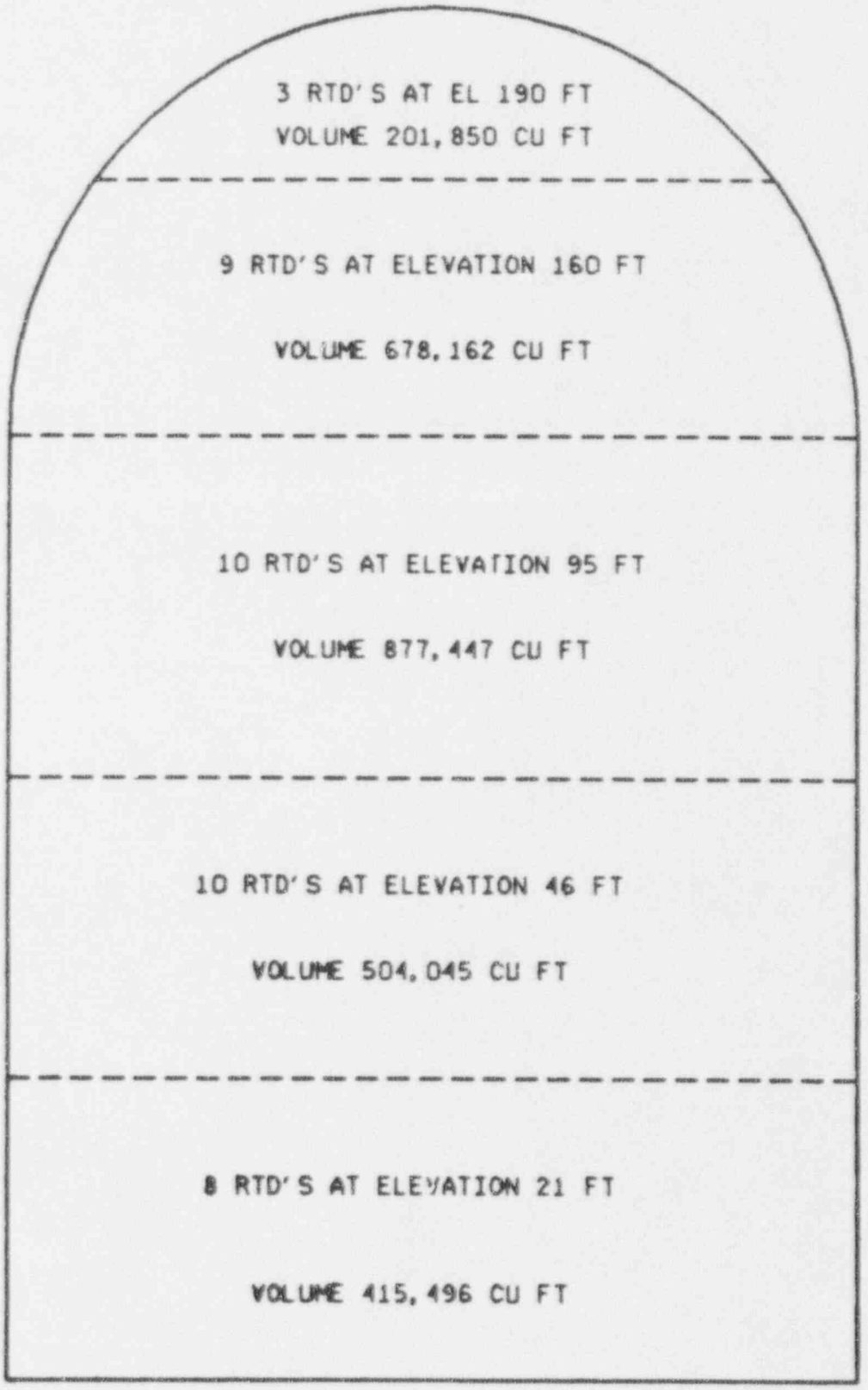


FIGURE 1

LOUISIANA POWER & LIGHT COMPANY
WATERFORD S. E. S. UNIT NO. 3
RHD LOCATION/VOLUME

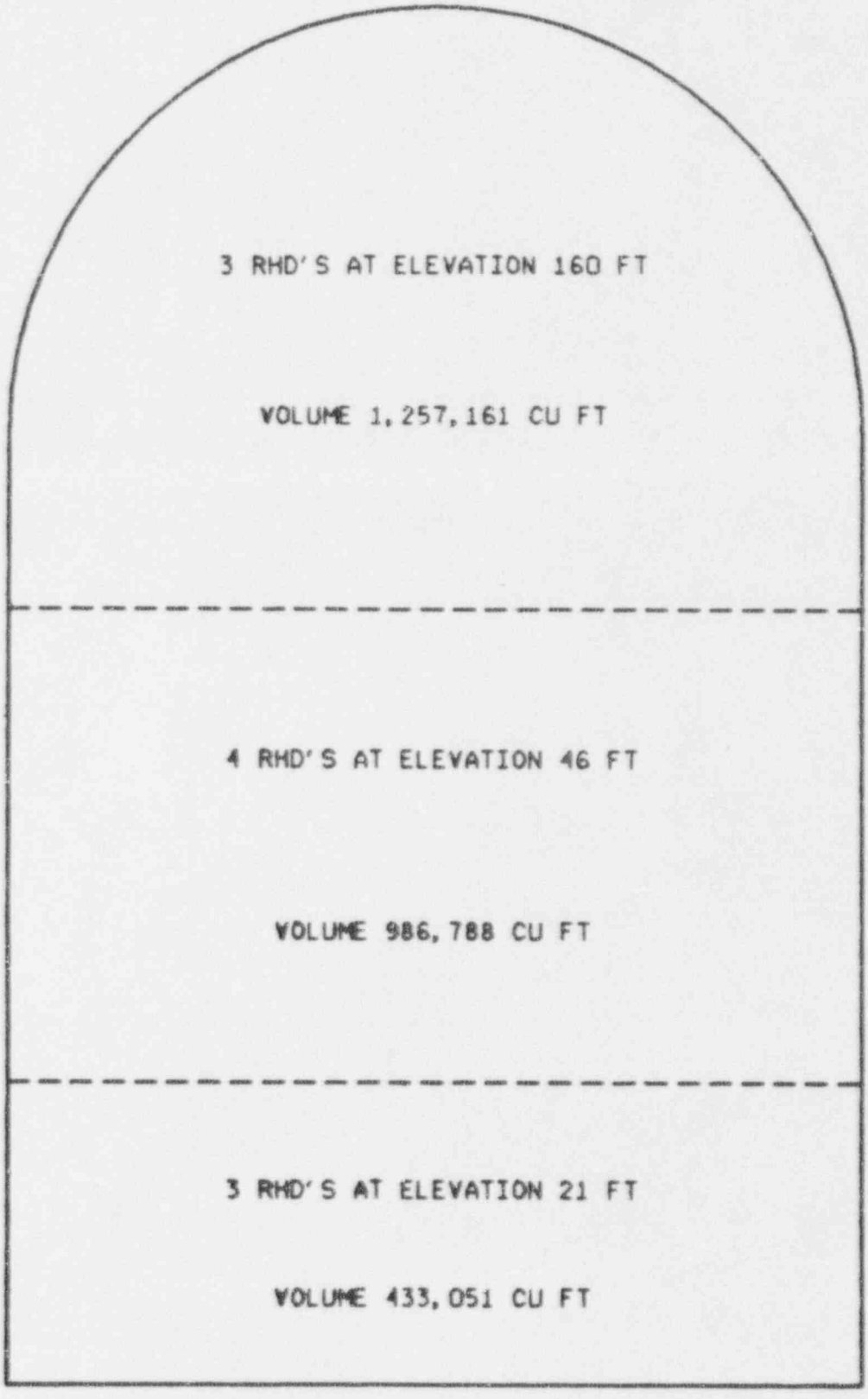


FIGURE 2

LOUISIANA POWER & LIGHT COMPANY
WATERFORD S. E. S. UNIT NO. 3
FLOW DIAGRAM
ILRT PRESSURE SENSING AND CONTROLLED LEAKAGE INST

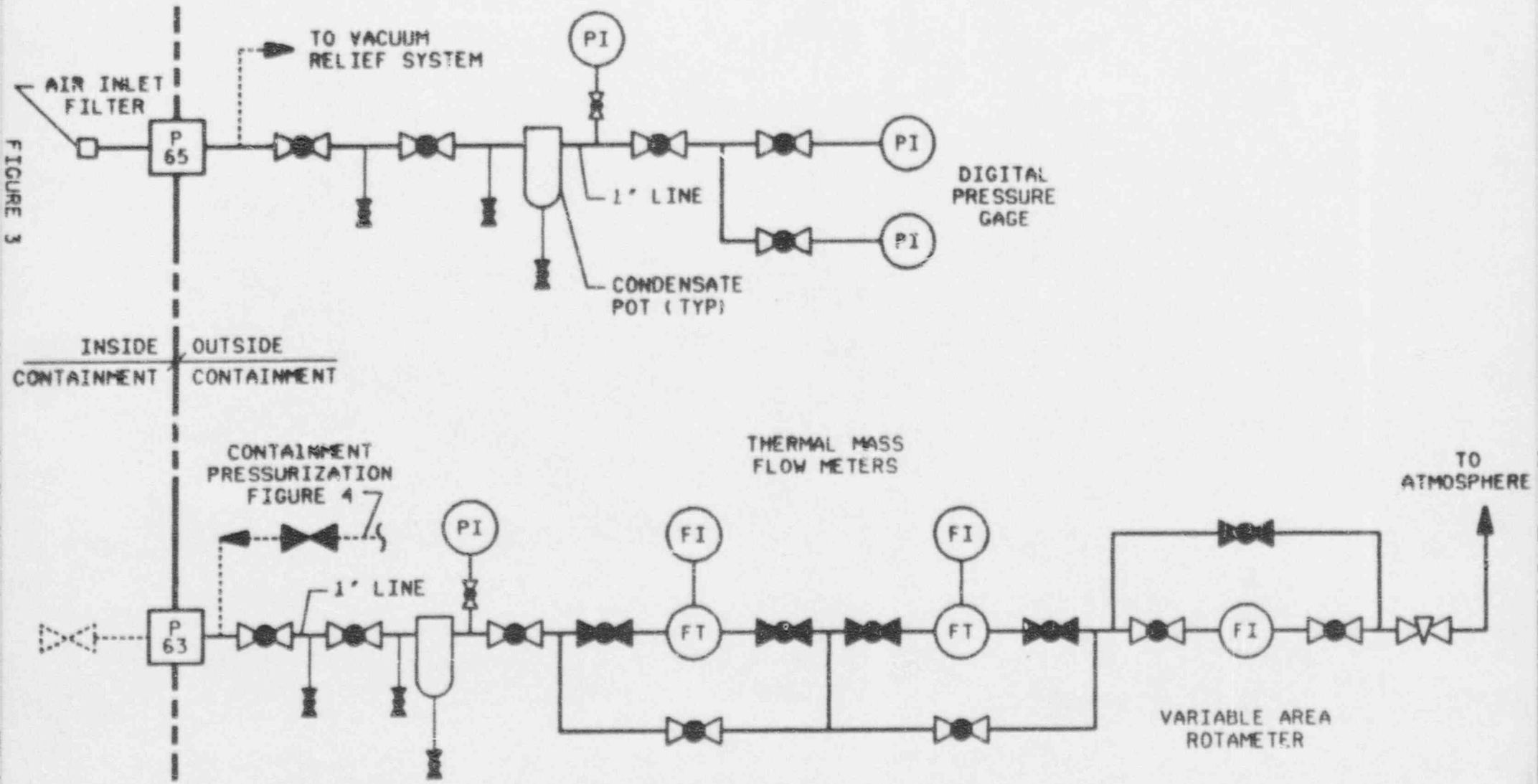


FIGURE 3

LOUISIANA POWER & LIGHT COMPANY
WATERFORD S. E. S. UNIT NO. 3
FLOW DIAGRAM
ILRT PRESSURIZING AND DEPRESSURIZING SYSTEM

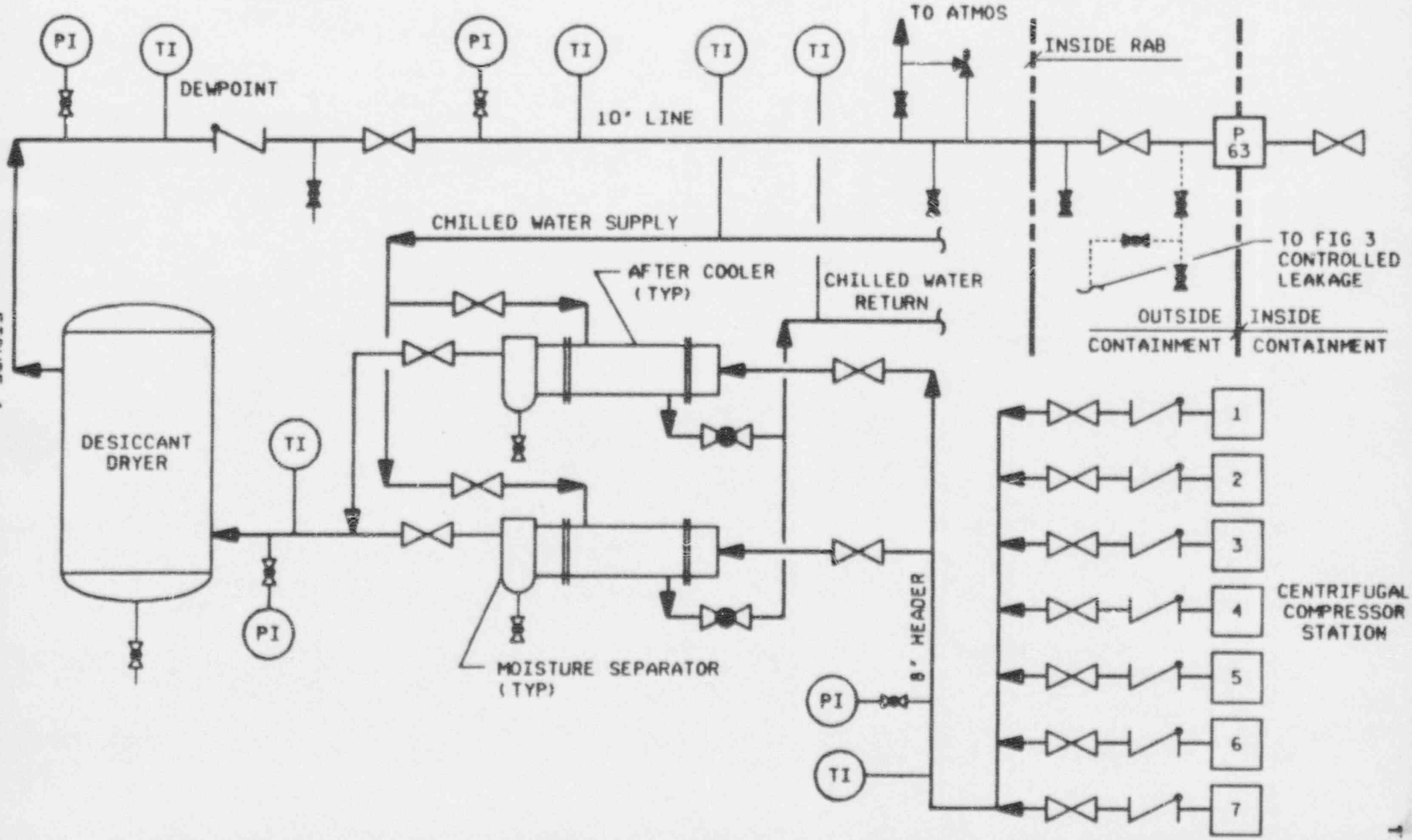


FIGURE 4

LOUISIANA POWER & LIGHT COMPANY
WATERFORD S.E.S. UNIT NO. 3
ILRT TEST SEQUENCE

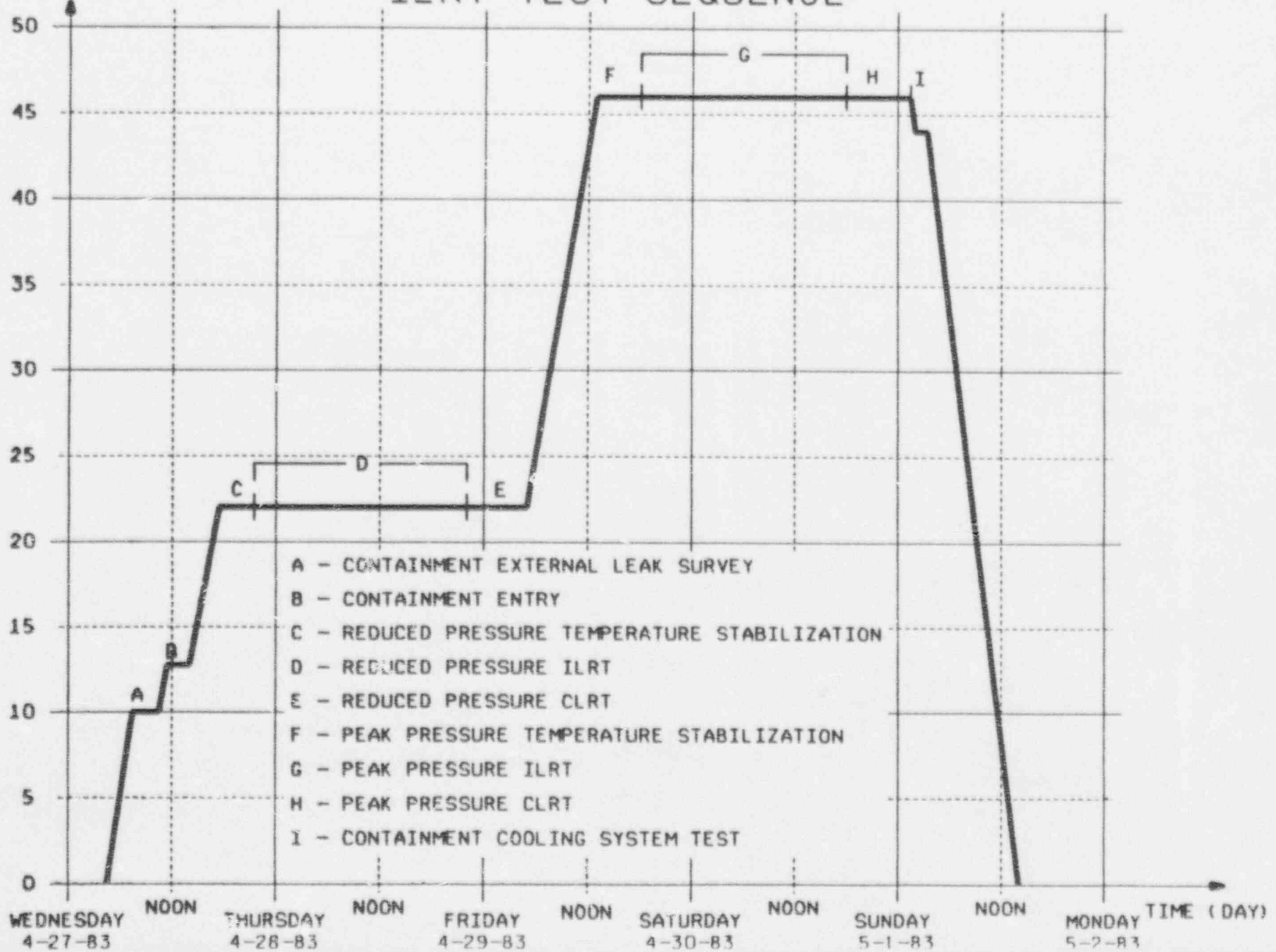


FIGURE 5

APPENDIX A.1

REDUCED PRESSURE ILRT
COMPUTER GENERATED REPORT
TEMPERATURE STABILIZATION

TEMPERATURE STABILIZATION
STARTED AT 1730 HOURS ON APRIL 27, 1983
CONDUCTED FOR 4.25 HOURS

A	B	C	D	E
1730	94.717			
1745	93.533			
1800	92.807			
1815	92.318			
1830	92.012			
1845	91.798			
1900	91.616			
1915	91.458			
1930	91.330			
1945	91.203			
2000	91.091			
2015	90.995			
2030	90.898			
2045	90.821			
2100	90.741			
2115	90.672			
2130	90.599	1.030	0.299	0.731
2145	90.532	0.750	0.289	0.461

A = TIME OF DAY IN MILITARY STANDARD

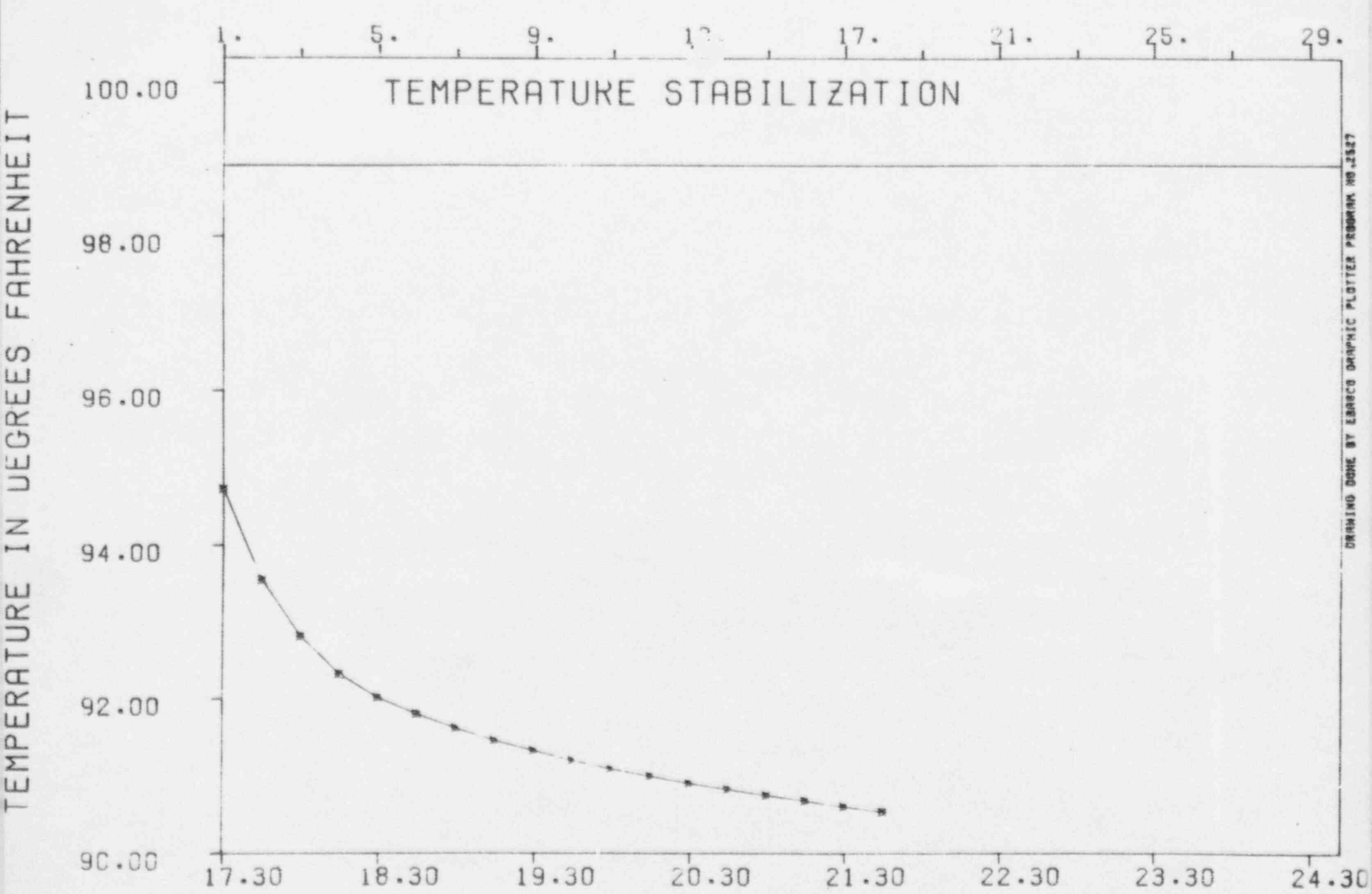
B = AVERAGE CONTAINMENT TEMPERATURE F

C = AVERAGE DIFFERENCE IN TEMP. OVER LAST 4 HOURS

D = AVERAGE DIFFERENCE IN TEMP. OVER LAST 1 HOUR

E = C - D

EBASCO SERVICES INCORPORATED



APPENDIX A.2.

REDUCED PRESSURE ILRT

COMPUTER GENERATED REPORT

INTEGRATED LEAKAGE RATE TEST

(ILRT)

APPENDIX A-24

REDUCED PRESSURE TEST
COMPUTER GENERATED REPORT
INTEGRATED LEAKAGE RATE
TEST

LOUISIANA POWER & LIGHT COMPANY
WATERFORD SES UNIT NO. 3

CONTAINMENT INTEGRATED LEAKAGE RATE TEST
LEAKAGE RATE MEASURED USING THE ABSOLUTE METHOD
LEAKAGE RATE COMPUTED USING THE MASS POINT METHOD

TEST PERIOD STARTED AT 2200 HOURS ON APRIL 27, 1983
TEST CONDUCTED FOR 24.00 HOURS

FREE SPACE VOLUME OF CONTAINMENT IS 2677000 CU FT
CONTAINMENT WAS PRESSURIZED TO 37.65 PSIA

INITIAL CONTAINMENT AIR WEIGHT 492709.2 LBS
FINAL CONTAINMENT AIR WEIGHT 492641.4 LBS
FITTED MASS POINT LEAKAGE RATE IS 0.0022 % PER DAY
UPPER LIMIT OF 95% CONFIDENCE LEVEL IS 0.008 % PER DAY
NRC MAXIMUM ALLOWABLE LEAKAGE RATE IS 0.265 % PER DAY

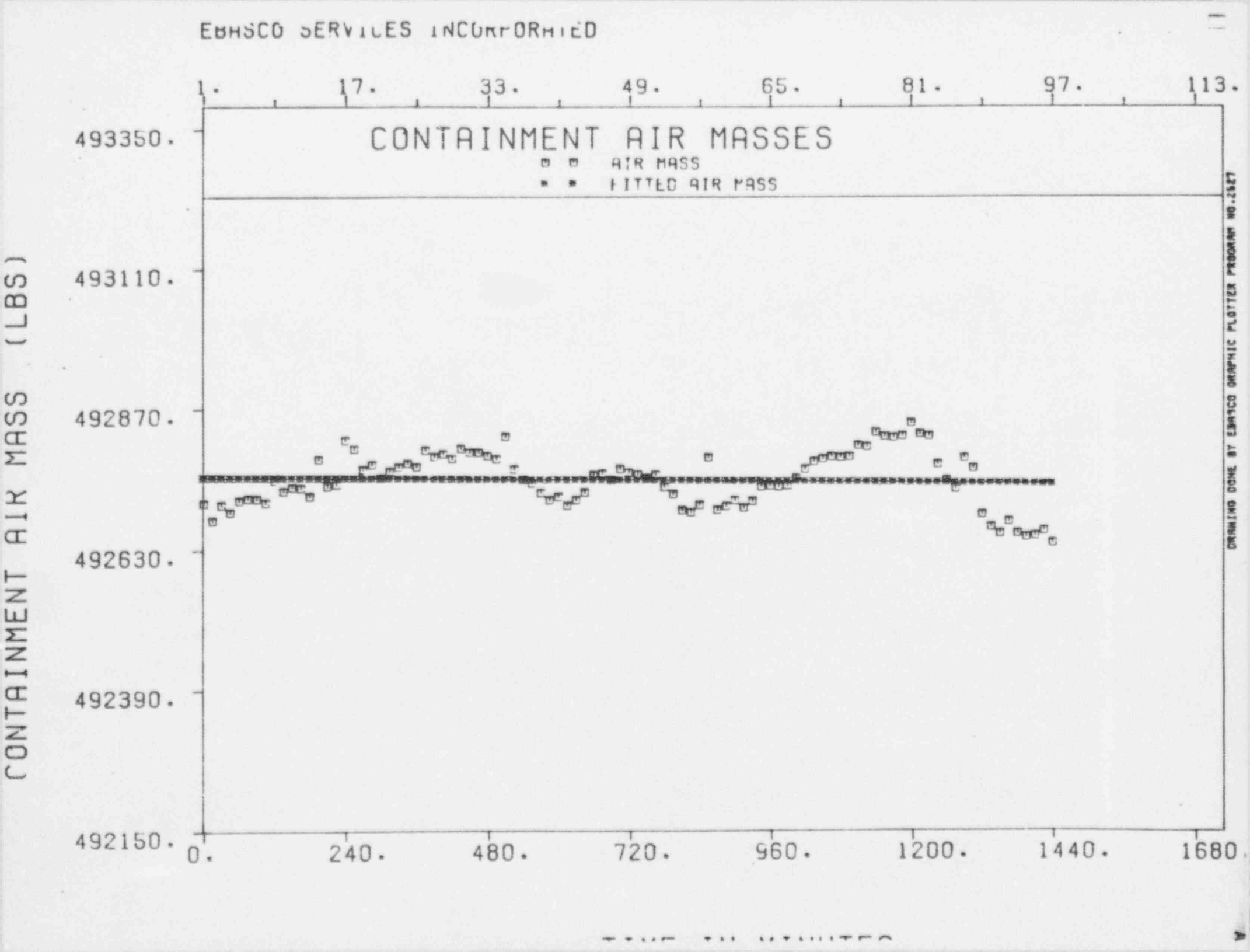
DESCRIPTION OF VARIABLES

AVG. TEM - CONTAINMENT MEAN TEMPERATURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RTD SENSOR INDICATIONS.
AVE. PRE - PRIMARY CONTAINMENT PRESSURE INDICATION.
VAP. PRE - CONTAINMENT VAPOR PRESSURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RHD SENSOR INDICATIONS.
LEAK SIM - SIMPLE TOTAL TIME LEAKAGE RATE.
LEAK MAS - LEAKAGE RATE COMPUTED FROM FIRST ORDER
REGRESSION OF AIR MASS DATA.
AIR MASS - CONTAINMENT AIR MASS.

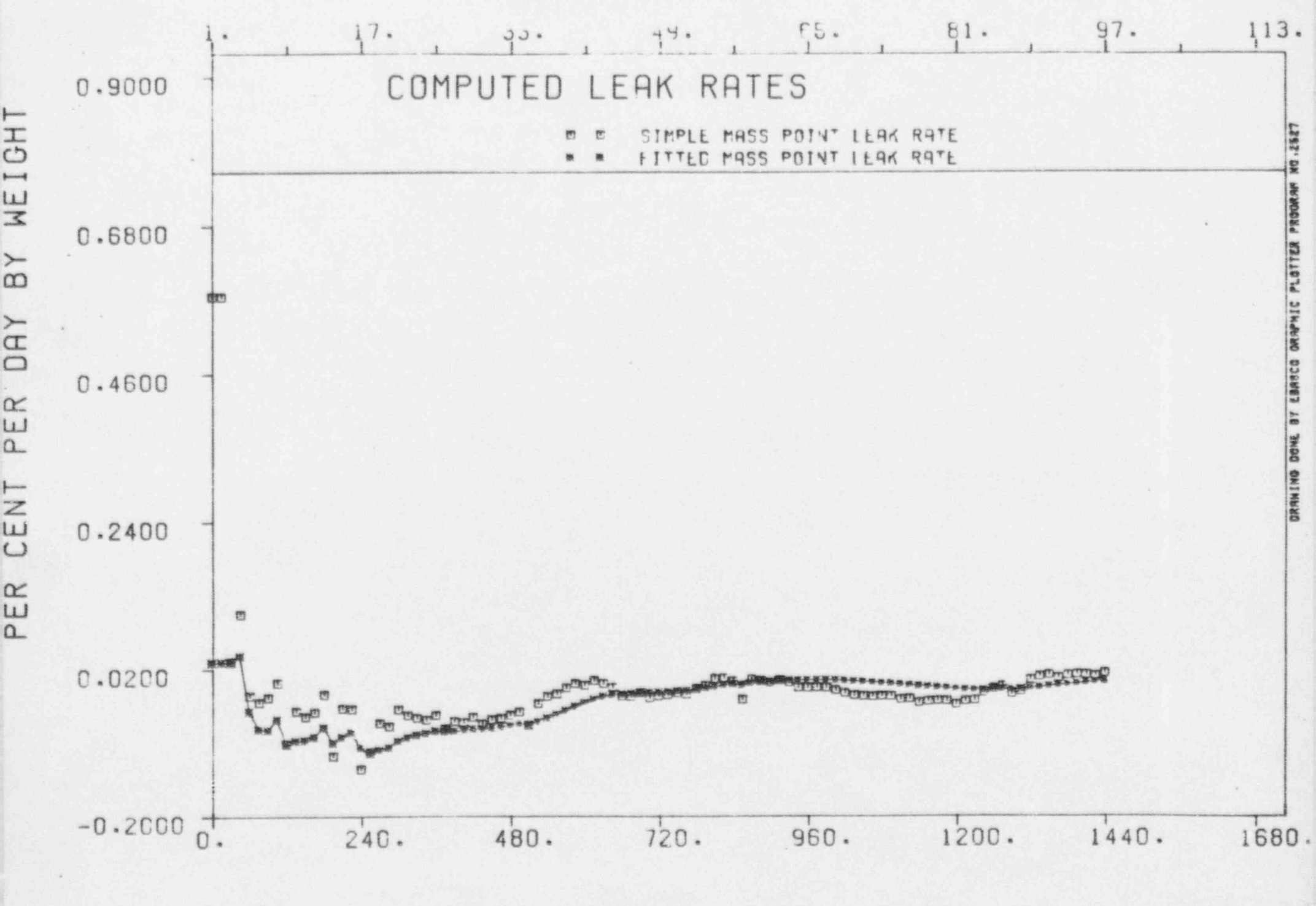
NOTE FOR TABULAR DATA -
TABLE VALUES OF ZERO SIGNIFY DATA IS
NOT APPLICABLE TO THE CALCULATION.

NOTE FOR CURVES -

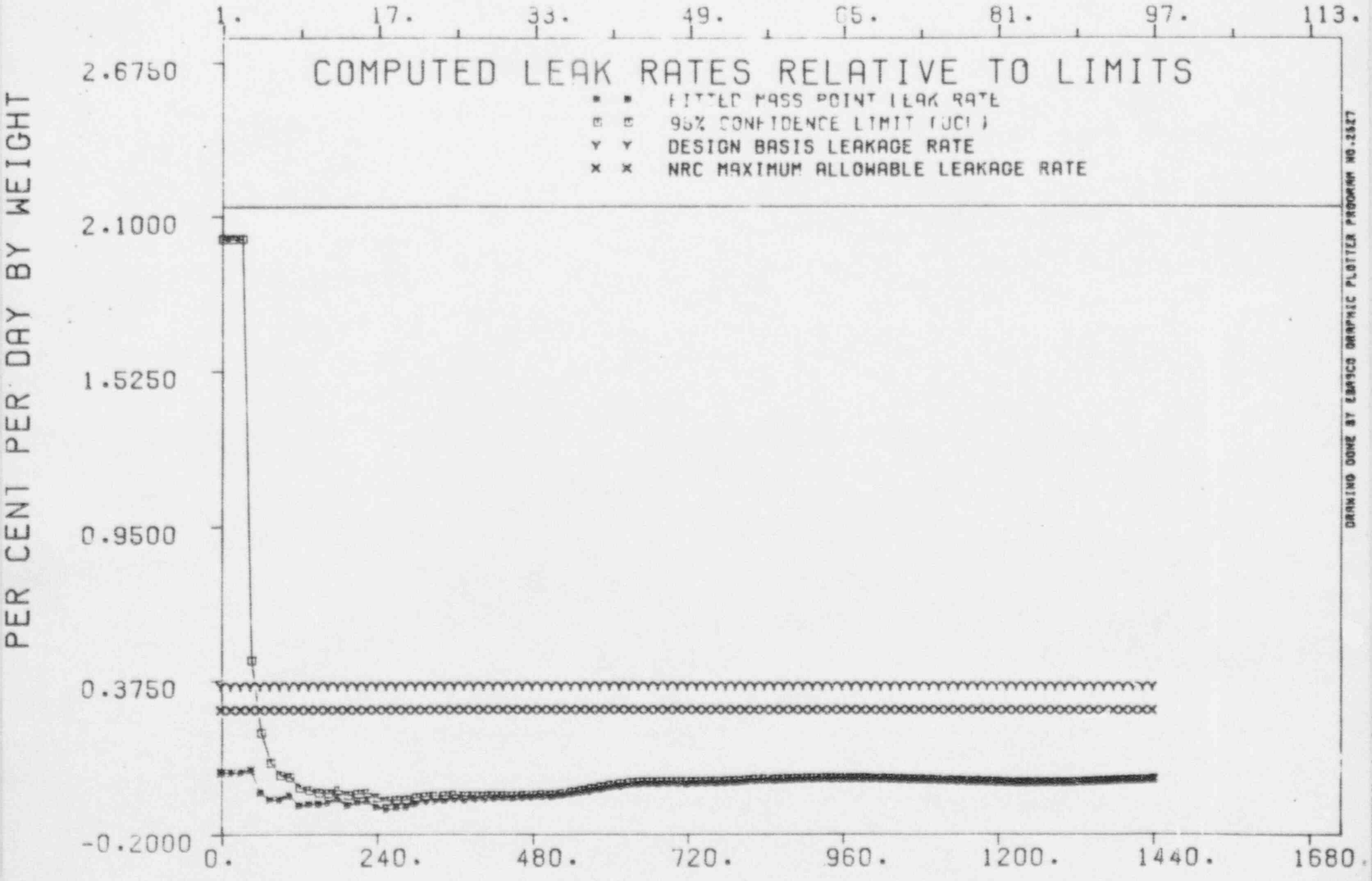
1. TOP ABSCISSA SCALE REPRESENTS SAMPLE NUMBERS.
2. AIR MASS IS THE CALCULATED CONTAINMENT AIR MASS AND FITTED AIR MASS IS THE LINEAR LEAST SQUARE FIT OF THE AIR MASSES.
3. SIMPLE MASS POINT IS THE TOTAL TIME LEAKAGE RATE AND FITTED MASS POINT IS THE LEAKAGE RATE COMPUTED FROM FIRST ORDER REGRESSION OF AIR MASS DATA.
4. UCL IS THE UPPER LIMIT OF THE 95% CONFIDENCE LEVEL OF AIR MASS DATA.

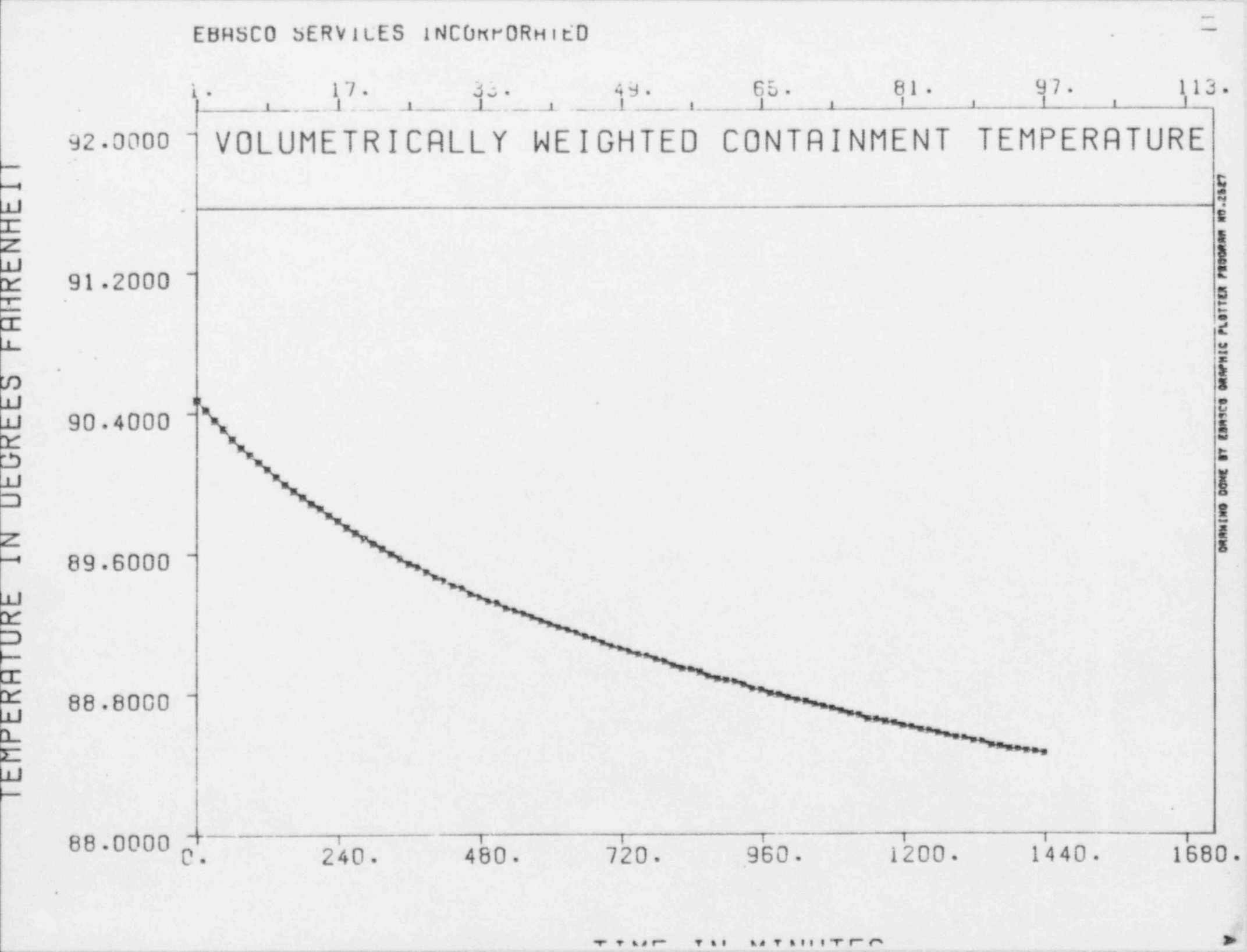

EBASCO SERVICES INCORPORATED
CONTAINMENT AIR MASSES
AIR MASS
FITTED AIR MASS
CONTAINMENT AIR MASS (LBS)
493350.
493110.
492870.
492630.
492390.
492150.
1.
17.
33.
49.
65.
81.
97.
113.
0.
240.
480.
720.
960.
1200.
1440.
1680.
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.2427

EBASCO SERVICES INCORPORATED

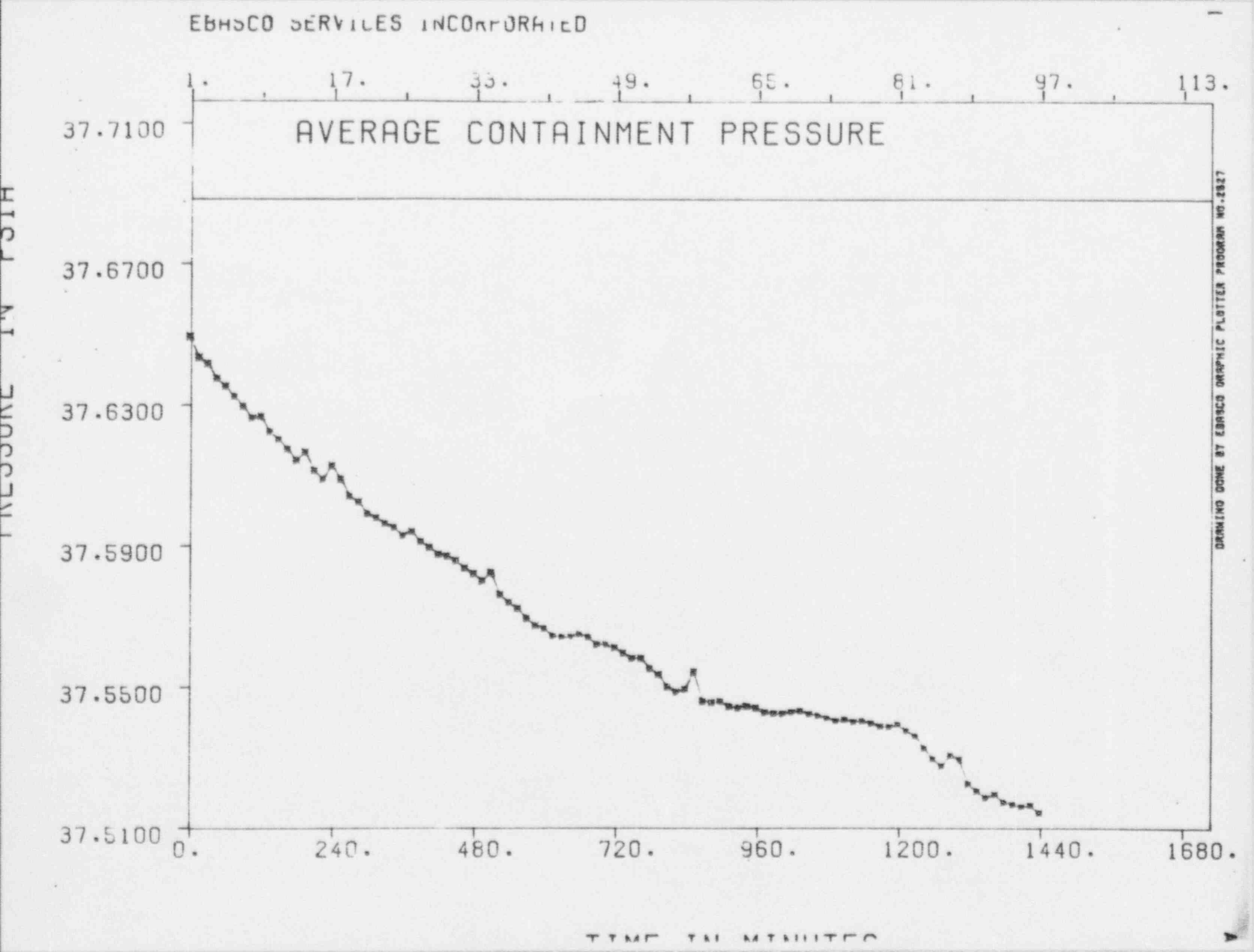


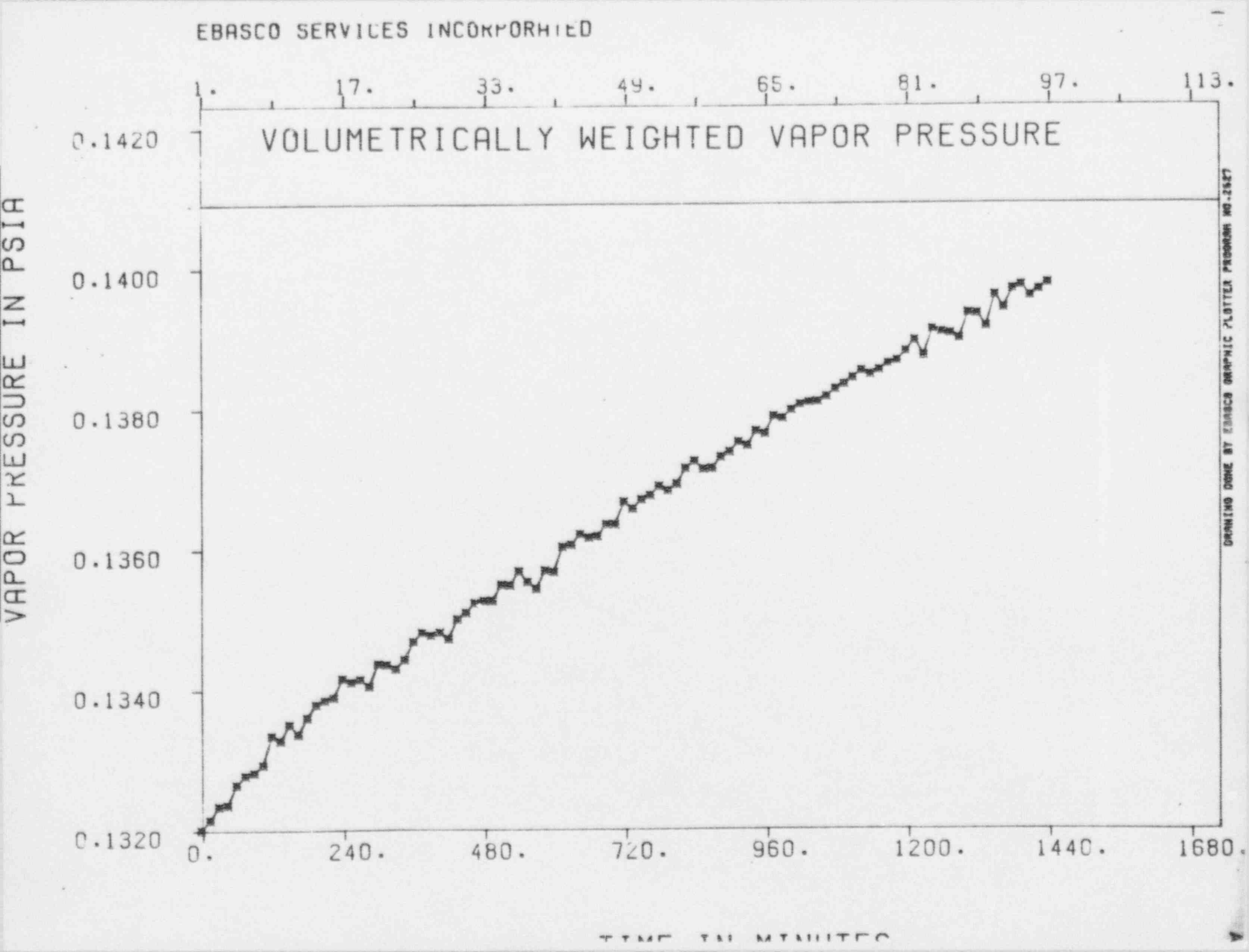
EBASCO SERVICES INCORPORATED




EBASCO SERVICES INCORPORATED
1.
17.
33.
49.
65.
81.
97.
113.
VOLUMETRICALLY WEIGHTED CONTAINMENT TEMPERATURE
92.0000
91.2000
90.4000
89.6000
88.8000
88.0000
TEMPERATURE IN DEGREES FAHRENHEIT
0.
240.
480.
720.
960.
1200.
1440.
1680.
TIME IN MINUTES
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.2527

EBASCO SERVICES INCORPORATED




EBASCO SERVICES INCORPORATED
1.
17.
33.
49.
65.
81.
97.
113.
VOLUMETRICALLY WEIGHTED VAPOR PRESSURE
0.1420
0.1400
0.1380
0.1360
0.1340
0.1320
VAPOR PRESSURE IN PSIA
0.
240.
480.
720.
960.
1200.
1440.
1680.
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.2527

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	AVG. TEM DEG. F	AVG. PRE PSIA	VAP. PRE PSIA	LEAK SIM PER CENT	LEAK MAS PER CENT	AIR MASS POUNDS
1	0	90.473	37.6494	0.1320	0.000	0.000	492709
2	15	90.417	37.6434	0.1321	0.575	0.000	492680
3	30	90.360	37.6418	0.1323	0.031	0.031	492706
4	45	90.311	37.6375	0.1324	0.102	0.040	492694
5	60	90.253	37.6353	0.1326	-0.020	-0.043	492713
6	75	90.204	37.6324	0.1328	-0.030	-0.070	492717
7	90	90.163	37.6296	0.1328	-0.023	-0.071	492716
8	105	90.120	37.6263	0.1329	-0.001	-0.055	492710
9	120	90.079	37.6268	0.1333	-0.093	-0.093	492747
10	135	90.035	37.6223	0.1333	-0.043	-0.088	492729
11	150	89.991	37.6201	0.1335	-0.052	-0.087	492736
12	165	89.955	37.6173	0.1334	-0.045	-0.082	492735
13	180	89.918	37.6140	0.1336	-0.018	-0.067	492720
14	195	89.881	37.6164	0.1338	-0.111	-0.091	492783
15	210	89.853	37.6111	0.1339	-0.039	-0.082	492737
16	225	89.814	37.6087	0.1339	-0.040	-0.075	492740
17	240	89.782	37.6126	0.1342	-0.130	-0.098	492816
18	255	89.745	37.6088	0.1341	-0.105	-0.107	492801
19	270	89.714	37.6041	0.1342	-0.061	-0.102	492766
20	285	89.681	37.6024	0.1341	-0.067	-0.098	492774
21	300	89.654	37.5991	0.1344	-0.041	-0.088	492751
22	315	89.625	37.5979	0.1344	-0.050	-0.083	492763
23	330	89.594	37.5963	0.1343	-0.053	-0.079	492770
24	345	89.568	37.5951	0.1344	-0.056	-0.077	492776
25	360	89.537	37.5929	0.1347	-0.049	-0.073	492770
26	375	89.520	37.5940	0.1348	-0.070	-0.074	492799
27	390	89.492	37.5912	0.1348	-0.059	-0.073	492787
28	405	89.462	37.5896	0.1348	-0.060	-0.072	492792
29	420	89.443	37.5876	0.1347	-0.052	-0.070	492784
30	435	89.413	37.5871	0.1350	-0.062	-0.069	492801
31	450	89.401	37.5859	0.1351	-0.056	-0.068	492795
32	465	89.368	37.5838	0.1352	-0.054	-0.067	492795
33	480	89.351	37.5822	0.1353	-0.049	-0.065	492789
34	495	89.326	37.5801	0.1353	-0.044	-0.062	492784
35	510	89.315	37.5825	0.1355	-0.065	-0.063	492822
36	525	89.286	37.5763	0.1355	-0.032	-0.059	492766
37	540	89.272	37.5741	0.1357	-0.021	-0.059	492748
38	555	89.256	37.5724	0.1355	-0.017	-0.048	492742
39	570	89.236	37.5697	0.1354	-0.009	-0.042	492726
40	585	89.215	37.5676	0.1357	-0.002	-0.036	492713
41	600	89.196	37.5668	0.1357	-0.005	-0.031	492719
42	615	89.178	37.5647	0.1360	0.002	-0.025	492704
43	630	89.162	37.5643	0.1361	-0.002	-0.021	492713
44	645	89.146	37.5644	0.1362	-0.008	-0.018	492726
45	660	89.125	37.5651	0.1362	-0.021	-0.017	492756
46	675	89.110	37.5643	0.1362	-0.021	-0.017	492758
47	690	89.087	37.5621	0.1364	-0.016	-0.015	492747
48	705	89.067	37.5622	0.1364	-0.024	-0.015	492766
49	720	89.056	37.5613	0.1367	-0.021	-0.015	492760
50	735	89.039	37.5598	0.1366	-0.019	-0.014	492757

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	AVG. TEM DEG. F	AVG. PRE PSIA	VAP. PRE PSIA	LEAK SIM PER CENT	LEAK MAS PER CENT	AIR MASS POUNDS
51	750	89.022	37.5583	0.1367	-0.016	-0.013	492751
52	765	89.015	37.5583	0.1368	-0.018	-0.012	492756
53	780	88.994	37.5554	0.1369	-0.010	-0.011	492735
54	795	88.983	37.5536	0.1368	-0.005	-0.009	492723
55	810	88.959	37.5501	0.1369	0.005	-0.007	492696
56	825	88.941	37.5488	0.1371	0.006	-0.004	492692
57	840	88.935	37.5494	0.1372	0.002	-0.002	492705
58	855	88.920	37.5544	0.1371	-0.026	-0.004	492785
59	870	88.896	37.5460	0.1371	0.004	-0.002	492696
60	885	88.881	37.5456	0.1373	0.002	-0.000	492703
61	900	88.873	37.5459	0.1374	-0.001	0.001	492713
62	915	88.865	37.5446	0.1375	0.003	0.002	492700
63	930	88.847	37.5441	0.1375	-0.001	0.003	492711
64	945	88.824	37.5446	0.1377	-0.008	0.003	492736
65	960	88.817	37.5442	0.1376	-0.009	0.003	492737
66	975	88.797	37.5429	0.1379	-0.008	0.004	492736
67	990	88.790	37.5426	0.1378	-0.008	0.004	492738
68	1005	88.772	37.5425	0.1380	-0.012	0.003	492750
69	1020	88.760	37.5429	0.1380	-0.016	0.003	492766
70	1035	88.751	37.5433	0.1381	-0.020	0.002	492779
71	1050	88.734	37.5425	0.1381	-0.021	0.001	492783
72	1065	88.722	37.5421	0.1382	-0.021	-0.000	492787
73	1080	88.711	37.5413	0.1383	-0.021	-0.001	492786
74	1095	88.697	37.5405	0.1383	-0.021	-0.002	492787
75	1110	88.680	37.5409	0.1384	-0.025	-0.003	492806
76	1125	88.672	37.5403	0.1385	-0.025	-0.004	492804
77	1140	88.649	37.5405	0.1385	-0.031	-0.005	492828
78	1155	88.646	37.5398	0.1385	-0.028	-0.006	492821
79	1170	88.633	37.5389	0.1386	-0.028	-0.007	492820
80	1185	88.627	37.5388	0.1387	-0.028	-0.008	492823
81	1200	88.611	37.5395	0.1388	-0.033	-0.010	492845
82	1215	88.603	37.5377	0.1390	-0.028	-0.011	492826
83	1230	88.588	37.5362	0.1387	-0.027	-0.011	492823
84	1245	88.585	37.5327	0.1391	-0.015	-0.011	492775
85	1260	88.569	37.5296	0.1391	-0.009	-0.011	492748
86	1275	88.557	37.5276	0.1391	-0.005	-0.010	492733
87	1290	88.544	37.5306	0.1390	-0.017	-0.010	492785
88	1305	88.542	37.5295	0.1393	-0.013	-0.010	492768
89	1320	88.526	37.5224	0.1393	0.004	-0.009	492690
90	1335	88.523	37.5204	0.1392	0.009	-0.007	492668
91	1350	88.500	37.5185	0.1396	0.011	-0.005	492657
92	1365	88.494	37.5194	0.1394	0.007	-0.004	492678
93	1380	88.480	37.5173	0.1397	0.011	-0.003	492658
94	1395	88.478	37.5167	0.1397	0.012	-0.001	492651
95	1410	88.468	37.5160	0.1396	0.012	-0.000	492653
96	1425	88.462	37.5164	0.1397	0.010	0.001	492662
97	1440	88.453	37.5143	0.1398	0.014	0.002	492641

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 1 DEG. F	TEMP 2 DEG. F	TEMP 3 DEG. F	TEMP 4 DEG. F	TEMP 5 DEG. F	TEMP 6 DEG. F
1	0	90.403	90.396	90.445	90.538	90.533	90.923
2	15	90.342	90.314	90.379	90.461	90.472	90.868
3	30	90.281	90.259	90.313	90.396	90.418	90.802
4	45	90.243	90.193	90.264	90.335	90.379	90.802
5	60	90.160	90.127	90.198	90.269	90.308	90.681
6	75	90.105	90.066	90.137	90.220	90.264	90.731
7	90	90.050	90.022	90.088	90.165	90.187	90.681
8	105	89.984	89.978	90.027	90.099	90.137	90.604
9	120	89.940	89.946	89.995	90.049	90.099	90.527
10	135	89.918	89.869	89.934	90.027	90.060	90.461
11	150	89.852	89.820	89.896	89.984	90.011	90.428
12	165	89.819	89.788	89.841	89.934	89.951	90.418
13	180	89.775	89.771	89.803	89.885	89.907	90.363
14	195	89.764	89.733	89.765	89.868	89.885	90.412
15	210	89.698	89.695	89.716	89.819	89.835	90.231
16	225	89.671	89.641	89.677	89.775	89.808	90.297
17	240	89.632	89.586	89.639	89.737	89.786	90.258
18	255	89.600	89.565	89.623	89.709	89.742	90.214
19	270	89.561	89.548	89.601	89.682	89.704	90.066
20	285	89.517	89.494	89.540	89.643	89.665	90.082
21	300	89.506	89.488	89.530	89.616	89.649	89.995
22	315	89.451	89.428	89.486	89.572	89.605	90.066
23	330	89.446	89.407	89.453	89.561	89.589	89.901
24	345	89.408	89.407	89.420	89.528	89.550	90.000
25	360	89.397	89.385	89.387	89.468	89.512	89.819
26	375	89.347	89.330	89.365	89.473	89.495	89.835
27	390	89.320	89.320	89.354	89.446	89.446	89.901
28	405	89.298	89.232	89.316	89.391	89.440	89.863
29	420	89.265	89.260	89.294	89.397	89.413	89.885
30	435	89.248	89.232	89.240	89.358	89.364	89.747
31	450	89.216	89.211	89.240	89.336	89.369	89.819
32	465	89.194	89.183	89.196	89.298	89.336	89.769
33	480	89.177	89.162	89.190	89.292	89.325	89.775
34	495	89.155	89.129	89.136	89.270	89.303	89.687
35	510	89.122	89.173	89.125	89.243	89.270	89.544
36	525	89.106	89.107	89.136	89.227	89.243	89.615
37	540	89.078	89.075	89.081	89.188	89.238	89.670
38	555	89.046	89.053	89.070	89.177	89.177	89.637
39	570	89.040	89.015	89.037	89.150	89.183	89.593
40	585	89.018	89.015	89.026	89.133	89.172	89.500
41	600	88.985	88.982	88.999	89.106	89.122	89.599
42	615	88.969	88.977	88.993	89.084	89.095	89.505
43	630	88.952	88.955	88.983	89.078	89.095	89.451
44	645	88.919	88.917	88.933	89.051	89.057	89.500
45	660	88.903	88.922	88.922	89.035	89.035	89.412
46	675	88.875	88.873	88.906	89.007	89.051	89.423
47	690	88.854	88.846	88.873	88.985	89.024	89.374
48	705	88.837	88.813	88.862	88.947	88.969	89.429
49	720	88.832	88.813	88.873	88.952	88.958	89.385
50	735	88.821	88.813	88.851	88.925	88.963	89.363

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 1 DEG. F	TEMP 2 DEG. F	TEMP 3 DEG. F	TEMP 4 DEG. F	TEMP 5 DEG. F	TEMP 6 DEG. F
51	750	88.810	88.770	88.829	88.919	88.925	89.346
52	765	88.782	88.764	88.786	88.903	88.919	89.269
53	780	88.760	88.726	88.775	88.886	88.919	89.192
54	795	88.744	88.721	88.747	88.859	88.892	89.286
55	810	88.711	88.704	88.747	88.832	88.848	89.220
56	825	88.683	88.677	88.747	88.815	88.832	89.181
57	840	88.683	88.672	88.709	88.810	88.821	89.214
58	855	88.673	88.672	88.704	88.815	88.826	89.137
59	870	88.667	88.661	88.649	88.799	88.810	89.088
60	885	88.634	88.606	88.649	88.749	88.760	89.159
61	900	88.634	88.628	88.621	88.749	88.744	89.140
62	915	88.629	88.596	88.632	88.727	88.727	89.203
63	930	88.585	88.579	88.621	88.722	88.733	89.143
64	945	88.574	88.552	88.589	88.705	88.705	89.126
65	960	88.557	88.541	88.600	88.683	88.689	89.060
66	975	88.541	88.530	88.556	88.673	88.678	89.093
67	990	88.530	88.536	88.534	88.656	88.656	88.984
68	1005	88.486	88.530	88.550	88.634	88.634	89.000
69	1020	88.486	88.508	88.501	88.612	88.634	89.000
70	1035	88.475	88.470	88.523	88.601	88.618	88.989
71	1050	88.470	88.454	88.485	88.590	88.607	89.055
72	1065	88.453	88.454	88.468	88.579	88.590	89.033
73	1080	88.420	88.443	88.474	88.557	88.557	88.984
74	1095	88.409	88.410	88.452	88.530	88.552	88.951
75	1110	88.393	88.367	88.425	88.535	88.513	89.071
76	1125	88.387	88.405	88.430	88.535	88.524	88.874
77	1140	88.371	88.383	88.419	88.497	88.497	88.835
78	1155	88.365	88.329	88.414	88.491	88.497	88.890
79	1170	88.343	88.361	88.359	88.464	88.491	88.885
80	1185	88.332	88.356	88.342	88.464	88.464	88.841
81	1200	88.332	88.318	88.337	88.448	88.475	88.824
82	1215	88.316	88.291	88.321	88.431	88.437	88.945
83	1230	88.300	88.280	88.321	88.426	88.426	88.890
84	1245	88.283	88.291	88.304	88.404	88.420	88.918
85	1260	88.272	88.258	88.288	88.393	88.393	88.857
86	1275	88.256	88.236	88.277	88.376	88.365	88.846
87	1290	88.250	88.263	88.266	88.376	88.393	88.791
88	1305	88.256	88.231	88.260	88.365	88.376	88.857
89	1320	88.228	88.220	88.266	88.365	88.371	88.764
90	1335	88.223	88.274	88.255	88.349	88.354	88.709
91	1350	88.212	88.204	88.239	88.332	88.305	88.676
92	1365	88.201	88.209	88.222	88.310	88.343	88.692
93	1380	88.179	88.214	88.222	88.300	88.338	88.643
94	1395	88.184	88.209	88.244	88.283	88.294	88.676
95	1410	88.168	88.149	88.189	88.294	88.278	88.797
96	1425	88.151	88.144	88.195	88.283	88.289	88.731
97	1440	88.146	88.133	88.178	88.272	88.283	88.709

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 7 DEG. F	TEMP 8 DEG. F	TEMP 9 DEG. F	TEMP 10 DEG. F	TEMP 11 DEG. F	TEMP 12 DEG. F
1	0	90.220	90.434	90.346	90.802	90.570	90.527
2	15	90.143	90.352	90.291	90.769	90.521	90.385
3	30	90.099	90.291	90.236	90.648	90.395	90.253
4	45	90.039	90.231	90.137	90.609	90.373	90.236
5	60	89.956	90.165	90.093	90.527	90.307	90.220
6	75	89.913	90.126	90.027	90.483	90.241	90.099
7	90	89.864	90.077	89.978	90.423	90.181	90.082
8	105	89.804	90.017	89.929	90.390	90.164	90.066
9	120	89.777	89.978	89.885	90.373	90.110	90.038
10	135	89.733	89.929	89.819	90.231	90.088	90.006
11	150	89.668	89.913	89.808	90.209	89.967	89.880
12	165	89.657	89.848	89.765	90.115	89.967	89.886
13	180	89.603	89.820	89.726	90.187	89.940	89.842
14	195	89.543	89.788	89.688	90.099	89.902	89.777
15	210	89.532	89.744	89.660	90.060	89.875	89.771
16	225	89.472	89.679	89.600	90.000	89.826	89.641
17	240	89.445	89.646	89.551	89.973	89.777	89.619
18	255	89.412	89.619	89.535	89.984	89.745	89.641
19	270	89.374	89.575	89.458	89.946	89.718	89.597
20	285	89.336	89.559	89.463	89.896	89.642	89.477
21	300	89.309	89.537	89.403	89.837	89.636	89.553
22	315	89.287	89.494	89.398	89.744	89.636	89.423
23	330	89.255	89.472	89.381	89.809	89.501	89.444
24	345	89.222	89.472	89.310	89.700	89.528	89.423
25	360	89.206	89.401	89.294	89.689	89.506	89.428
26	375	89.140	89.385	89.299	89.711	89.501	89.417
27	390	89.129	89.358	89.244	89.662	89.430	89.450
28	405	89.102	89.325	89.228	89.613	89.446	89.341
29	420	89.070	89.325	89.233	89.657	89.327	89.270
30	435	89.070	89.265	89.184	89.499	89.397	89.199
31	450	89.032	89.260	89.140	89.651	89.370	89.297
32	465	89.021	89.227	89.113	89.608	89.316	89.243
33	480	88.983	89.227	89.102	89.548	89.273	89.178
34	495	88.972	89.211	89.080	89.450	89.278	89.183
35	510	88.966	89.162	89.064	89.450	89.197	89.118
36	525	88.923	89.140	89.047	89.439	89.186	89.112
37	540	88.885	89.118	89.009	89.460	89.153	89.041
38	555	88.885	89.102	88.981	89.417	89.202	89.101
39	570	88.847	89.091	88.959	89.395	89.159	89.058
40	585	88.814	89.036	88.927	89.390	89.137	89.080
41	600	88.803	89.042	88.899	89.308	89.104	89.058
42	615	88.787	88.998	88.916	89.373	89.099	89.009
43	630	88.760	88.998	88.877	89.352	89.055	88.981
44	645	88.770	88.982	88.855	89.302	89.066	88.987
45	660	88.716	88.949	88.834	89.204	89.072	88.900
46	675	88.689	88.922	88.817	89.199	89.061	88.981
47	690	88.678	88.911	88.828	89.281	88.925	88.889
48	705	88.667	88.884	88.795	89.215	88.979	88.845
49	720	88.651	88.884	88.784	89.215	88.931	88.834
50	735	88.656	88.851	88.757	89.183	88.941	88.785

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 7 DEG. F	TEMP 8 DEG. F	TEMP 9 DEG. F	TEMP 10 DEG. F	TEMP 11 DEG. F	TEMP 12 DEG. F
51	750	88.629	88.824	88.740	89.177	88.898	88.753
52	765	88.618	88.835	88.713	89.128	88.963	88.834
53	780	88.558	88.819	88.697	89.079	88.882	88.780
54	795	88.591	88.770	88.658	89.123	88.893	88.775
55	810	88.558	88.753	88.658	89.101	88.887	88.764
56	825	88.564	88.743	88.642	89.014	88.882	88.775
57	840	88.520	88.743	88.631	89.025	88.838	88.775
58	855	88.515	88.726	88.631	89.095	88.838	88.715
59	870	88.487	88.726	88.593	89.025	88.751	88.589
60	885	88.482	88.677	88.587	88.959	88.779	88.633
61	900	88.471	88.661	88.582	89.090	88.762	88.638
62	915	88.455	88.666	88.576	89.041	88.757	88.617
63	930	88.411	88.666	88.527	88.992	88.697	88.562
64	945	88.422	88.634	88.505	88.932	88.665	88.535
65	960	88.395	88.617	88.516	88.888	88.724	88.573
66	975	88.357	88.585	88.478	88.932	88.670	88.540
67	990	88.368	88.552	88.478	88.910	88.670	88.513
68	1005	88.351	88.547	88.445	88.856	88.621	88.529
69	1020	88.330	88.557	88.456	88.823	88.578	88.524
70	1035	88.324	88.541	88.434	88.916	88.675	88.519
71	1050	88.330	88.508	88.412	88.768	88.637	88.535
72	1065	88.286	88.519	88.395	88.790	88.588	88.420
73	1080	88.292	88.498	88.363	88.817	88.529	88.513
74	1095	88.281	88.470	88.390	88.741	88.616	88.410
75	1110	88.254	88.465	88.341	88.774	88.567	88.431
76	1125	88.303	88.427	88.319	88.719	88.534	88.404
77	1140	88.210	88.421	88.341	88.687	88.491	88.426
78	1155	88.221	88.405	88.280	88.790	88.507	88.382
79	1170	88.194	88.421	88.291	88.676	88.491	88.388
80	1185	88.221	88.389	88.280	88.687	88.512	88.355
81	1200	88.177	88.372	88.275	88.670	88.431	88.361
82	1215	88.161	88.356	88.269	88.714	88.507	88.366
83	1230	88.134	88.329	88.248	88.687	88.426	88.312
84	1245	88.150	88.340	88.242	88.605	88.480	88.317
85	1260	88.139	88.323	88.237	88.649	88.426	88.263
86	1275	88.079	88.302	88.220	88.687	88.442	88.263
87	1290	88.085	88.302	88.215	88.594	88.409	88.208
88	1305	88.123	88.296	88.209	88.670	88.420	88.241
89	1320	88.101	88.285	88.160	88.567	88.382	88.241
90	1335	88.090	88.263	88.171	88.599	88.404	88.241
91	1350	88.058	88.258	88.154	88.572	88.393	88.219
92	1365	88.041	88.247	88.160	88.556	88.312	88.268
93	1380	88.063	88.236	88.138	88.540	88.306	88.115
94	1395	88.063	88.231	88.133	88.561	88.355	88.235
95	1410	88.025	88.220	88.111	88.556	88.317	88.121
96	1425	88.030	88.214	88.100	88.534	88.344	88.132
97	1440	88.003	88.209	88.100	88.540	88.322	88.170

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 13 DEG. F	TEMP 14 DEG. F	TEMP 15 DEG. F	TEMP 16 DEG. F	TEMP 17 DEG. F	TEMP 18 DEG. F
1	0	90.297	90.011	90.264	90.385	89.392	90.160
2	15	90.259	89.951	90.231	90.297	89.354	90.105
3	30	90.187	89.875	90.154	90.242	89.332	90.077
4	45	90.138	89.832	90.121	90.269	89.288	90.055
5	60	90.099	89.783	90.072	90.176	89.261	90.011
6	75	90.050	89.767	90.044	90.099	89.233	89.983
7	90	90.006	89.712	89.989	90.104	89.206	89.994
8	105	89.956	89.658	89.956	90.022	89.162	89.945
9	120	89.918	89.598	89.923	89.989	89.140	89.967
10	135	89.880	89.571	89.874	89.912	89.118	89.928
11	150	89.841	89.528	89.841	89.879	89.107	89.928
12	165	89.798	89.490	89.797	89.923	89.080	89.884
13	180	89.765	89.457	89.758	89.770	89.042	89.857
14	195	89.721	89.430	89.731	89.764	89.020	89.791
15	210	89.699	89.403	89.714	89.770	89.003	89.818
16	225	89.650	89.349	89.665	89.726	88.992	89.785
17	240	89.628	89.354	89.621	89.688	88.949	89.752
18	255	89.584	89.295	89.588	89.731	88.932	89.774
19	270	89.562	89.262	89.560	89.666	88.927	89.730
20	285	89.546	89.257	89.538	89.583	88.894	89.692
21	300	89.508	89.224	89.511	89.550	88.877	89.692
22	315	89.480	89.186	89.473	89.468	88.844	89.670
23	330	89.458	89.154	89.456	89.523	88.823	89.626
24	345	89.415	89.143	89.429	89.457	88.784	89.620
25	360	89.393	89.094	89.401	89.468	88.795	89.631
26	375	89.376	89.088	89.379	89.474	88.779	89.604
27	390	89.344	89.067	89.352	89.479	88.735	89.604
28	405	89.322	89.018	89.341	89.380	88.735	89.582
29	420	89.305	89.012	89.291	89.326	88.719	89.565
30	435	89.272	89.002	89.291	89.276	88.702	89.548
31	450	89.256	88.953	89.253	89.238	88.675	89.532
32	465	89.223	88.947	89.242	89.287	88.669	89.515
33	480	89.207	88.931	89.225	89.282	88.631	89.499
34	495	89.185	88.893	89.209	89.200	88.636	89.477
35	510	89.163	88.899	89.181	89.216	88.614	89.868
36	525	89.141	88.866	89.148	89.189	88.604	89.939
37	540	89.119	88.866	89.159	89.128	88.598	89.950
38	555	89.108	88.855	89.110	89.216	88.571	89.950
39	570	89.081	88.828	89.104	89.167	88.532	89.945
40	585	89.059	88.779	89.077	89.112	88.521	89.917
41	600	89.048	88.779	89.049	89.106	88.527	89.923
42	615	89.021	88.757	89.027	89.024	88.483	89.906
43	630	89.010	88.736	89.022	88.975	88.483	89.906
44	645	88.993	88.741	89.000	89.046	88.472	90.270
45	660	88.977	88.719	88.978	89.035	88.467	90.237
46	675	88.950	88.698	88.978	88.997	88.439	90.242
47	690	88.944	88.671	88.956	88.925	88.428	90.231
48	705	88.928	88.649	88.940	88.909	88.417	90.237
49	720	88.900	88.622	88.918	88.898	88.401	90.220
50	735	88.889	88.606	88.923	88.920	88.390	90.215

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	TEMP 13 DEG.	F	TEMP 14 DEG.	F	TEMP 15 DEG.	F	TEMP 16 DEG.	F	TEMP 17 DEG.	F	TEMP 18 DEG.	F
51	750	88.873		88.627		88.890		88.893		88.379		90.209	
52	765	88.857		88.600		88.857		88.942		88.352		90.198	
53	780	88.851		88.589		88.835		88.898		88.346		90.198	
54	795	88.818		88.573		88.846		88.882		88.324		90.204	
55	810	88.824		88.546		88.824		88.843		88.324		90.187	
56	825	88.780		88.530		88.802		88.854		88.319		90.171	
57	840	88.791		88.530		88.786		88.843		88.302		90.171	
58	855	88.764		88.519		88.775		88.816		88.269		90.132	
59	870	88.758		88.475		88.736		88.772		88.269		90.121	
60	885	88.736		88.464		88.764		88.717		88.258		90.132	
61	900	88.720		88.464		88.709		88.788		88.253		90.116	
62	915	88.709		88.470		88.725		88.673		88.226		90.099	
63	930	88.698		88.448		88.692		88.723		88.220		90.094	
64	945	88.682		88.421		88.692		88.734		88.215		90.099	
65	960	88.682		88.421		88.670		88.712		88.209		90.110	
66	975	88.660		88.389		88.654		88.679		88.182		90.088	
67	990	88.649		88.410		88.659		88.673		88.171		90.072	
68	1005	88.632		88.378		88.626		88.750		88.182		90.072	
69	1020	88.605		88.345		88.610		88.673		88.165		90.061	
70	1035	88.616		88.351		88.593		88.684		88.127		90.055	
71	1050	88.600		88.313		88.615		88.596		88.138		90.039	
72	1065	88.578		88.323		88.566		88.646		88.154		90.044	
73	1080	88.578		88.307		88.571		88.602		88.094		90.055	
74	1095	88.572		88.318		88.560		88.536		88.133		90.017	
75	1110	88.545		88.280		88.538		88.542		88.105		90.011	
76	1125	88.550		88.264		88.527		88.514		88.094		90.017	
77	1140	88.512		88.269		88.506		88.531		88.061		90.011	
78	1155	88.539		88.275		88.506		88.503		88.072		90.017	
79	1170	88.501		88.231		88.489		88.547		88.050		90.011	
80	1185	88.474		88.226		88.495		88.553		88.045		90.215	
81	1200	88.485		88.215		88.456		88.536		88.023		90.204	
82	1215	88.468		88.204		88.473		88.498		88.045		90.209	
83	1230	88.457		88.209		88.456		88.487		88.034		90.204	
84	1245	88.457		88.161		88.440		88.542		88.028		90.209	
85	1260	88.446		88.182		88.434		88.487		88.007		90.193	
86	1275	88.430		88.177		88.418		88.427		87.996		90.204	
87	1290	88.425		88.171		88.379		88.432		87.990		90.209	
88	1305	88.397		88.128		88.390		88.438		87.996		90.187	
89	1320	88.397		88.128		88.379		88.459		87.979		90.165	
90	1335	88.392		88.112		88.379		88.438		87.974		90.165	
91	1350	88.381		88.117		88.357		88.427		87.963		90.165	
92	1365	88.348		88.112		88.357		88.388		87.952		90.165	
93	1380	88.342		88.101		88.346		88.344		87.930		90.149	
94	1395	88.364		88.133		88.335		88.311		87.979		90.154	
95	1410	88.348		88.074		88.335		88.344		87.963		90.149	
96	1425	88.337		88.068		88.330		88.383		87.946		90.132	
97	1440	88.337		88.068		88.286		88.339		87.963		90.143	

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 19 DEG. F	TEMP 20 DEG. F	TEMP 21 DEG. F	TEMP 22 DEG. F	TEMP 23 DEG. F	TEMP 24 DEG. F
1	0	89.157	93.807	90.654	90.758	90.847	92.134
2	15	89.157	93.780	90.588	90.698	90.792	92.046
3	30	89.157	93.741	90.544	90.632	90.682	92.024
4	45	89.135	93.736	90.462	90.560	90.676	91.925
5	60	89.097	93.725	90.390	90.505	90.599	91.881
6	75	89.125	93.692	90.335	90.456	90.506	91.777
7	90	89.086	93.681	90.297	90.401	90.440	91.744
8	105	89.097	93.670	90.231	90.357	90.484	91.700
9	120	89.048	93.653	90.192	90.313	90.445	91.661
10	135	89.032	93.631	90.143	90.247	90.335	91.551
11	150	89.027	93.626	90.099	90.220	90.258	91.463
12	165	89.005	93.615	90.055	90.170	90.286	91.430
13	180	88.999	93.598	90.011	90.132	90.231	91.441
14	195	88.983	93.576	89.962	90.055	90.115	91.337
15	210	88.978	93.565	89.934	90.022	90.088	91.337
16	225	88.961	93.554	89.901	89.989	90.099	91.304
17	240	88.929	93.543	89.830	89.962	90.093	91.210
18	255	88.912	93.532	89.802	89.912	89.956	91.199
19	270	88.885	93.510	89.769	89.874	89.962	91.161
20	285	88.880	93.493	89.742	89.857	89.934	91.111
21	300	88.880	93.482	89.698	89.819	89.890	91.045
22	315	88.858	93.471	89.693	89.781	89.841	91.089
23	330	88.825	93.444	89.638	89.742	89.824	90.979
24	345	88.804	93.444	89.605	89.720	89.753	90.957
25	360	88.787	93.427	89.572	89.688	89.742	90.930
26	375	88.782	93.405	89.544	89.666	89.748	90.919
27	390	88.771	93.389	89.539	89.638	89.671	90.880
28	405	88.738	93.372	89.468	89.594	89.660	90.858
29	420	88.711	93.361	89.462	89.567	89.621	90.825
30	435	88.700	93.361	89.440	89.534	89.610	90.803
31	450	88.684	93.350	89.424	89.534	89.583	90.759
32	465	88.684	93.339	89.374	89.512	89.539	90.748
33	480	88.668	93.328	89.363	89.463	89.550	90.693
34	495	88.630	93.306	89.352	89.452	89.473	90.671
35	510	88.635	93.301	89.325	89.441	89.479	90.677
36	525	88.613	93.290	89.292	89.391	89.429	90.633
37	540	88.608	93.273	89.259	89.364	89.435	90.583
38	555	88.581	93.262	89.248	89.348	89.396	90.550
39	570	88.554	93.251	89.221	89.342	89.385	90.534
40	585	88.554	93.235	89.199	89.309	89.358	90.512
41	600	88.543	93.235	89.177	89.304	89.363	90.501
42	615	88.543	93.218	89.171	89.271	89.363	90.473
43	630	88.521	93.218	89.133	89.254	89.297	90.479
44	645	88.499	93.196	89.116	89.221	89.270	90.418
45	660	88.505	93.196	89.111	89.227	89.341	90.402
46	675	88.472	93.180	89.072	89.167	89.254	90.391
47	690	88.477	93.174	89.051	89.156	89.232	90.380
48	705	88.472	93.169	89.040	89.139	89.193	90.341
49	720	88.456	93.163	89.034	89.139	89.204	90.330
50	735	88.434	93.147	89.001	89.106	89.149	90.308

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 19 DEG. F	TEMP 20 DEG. F	TEMP 21 DEG. F	TEMP 22 DEG. F	TEMP 23 DEG. F	TEMP 24 DEG. F
51	750	88.418	93.125	88.968	89.084	89.177	90.286
52	765	88.401	93.130	88.990	89.084	89.133	90.281
53	780	88.401	93.125	88.919	89.052	89.166	90.253
54	795	88.385	93.119	88.935	89.057	89.094	90.231
55	810	88.396	93.114	88.891	89.002	89.050	90.226
56	825	88.374	93.108	88.897	89.002	89.023	90.209
57	840	88.352	93.086	88.875	89.002	89.072	90.165
58	855	88.347	93.086	88.847	88.964	89.001	90.165
59	870	88.341	93.070	88.847	88.958	89.029	90.121
60	885	88.341	93.064	88.825	88.942	89.012	90.138
61	900	88.341	93.059	88.798	88.925	88.996	90.099
62	915	88.303	93.064	88.787	88.914	88.952	90.121
63	930	88.314	93.053	88.782	88.904	88.985	90.083
64	945	88.293	93.037	88.738	88.849	88.919	90.072
65	960	88.309	93.037	88.754	88.876	88.946	90.050
66	975	88.282	93.026	88.732	88.838	88.908	90.011
67	990	88.287	93.031	88.732	88.849	88.968	90.000
68	1005	88.271	93.026	88.699	88.821	88.880	90.017
69	1020	88.265	93.009	88.683	88.799	88.875	89.978
70	1035	88.238	92.998	88.666	88.766	88.836	89.989
71	1050	88.238	92.998	88.650	88.772	88.831	89.951
72	1065	88.227	92.982	88.639	88.777	88.814	89.956
73	1080	88.244	92.987	88.628	88.739	88.831	89.962
74	1095	88.227	92.982	88.600	88.739	88.858	89.896
75	1110	88.195	92.971	88.606	88.723	88.765	89.896
76	1125	88.216	92.971	88.595	88.723	88.732	89.907
77	1140	88.195	92.949	88.578	88.695	88.727	89.869
78	1155	88.184	92.943	88.584	88.684	88.727	89.853
79	1170	88.195	92.949	88.540	88.657	88.749	89.858
80	1185	88.178	92.943	88.546	88.657	88.699	89.863
81	1200	88.173	92.921	88.546	88.646	88.694	89.803
82	1215	88.135	92.932	88.496	88.624	88.694	89.809
83	1230	88.140	92.910	88.485	88.602	88.705	89.782
84	1245	88.119	92.921	88.491	88.591	88.683	89.765
85	1260	88.124	92.910	88.474	88.591	88.655	89.771
86	1275	88.113	92.910	88.480	88.580	88.661	89.754
87	1290	88.119	92.894	88.452	88.575	88.639	89.716
88	1305	88.119	92.899	88.430	88.542	88.628	89.754
89	1320	88.113	92.899	88.414	88.542	88.595	89.727
90	1335	88.108	92.877	88.425	88.525	88.595	89.727
91	1350	88.064	92.883	88.419	88.542	88.551	89.694
92	1365	88.086	92.872	88.381	88.514	88.589	89.683
93	1380	88.053	92.877	88.392	88.514	88.535	89.683
94	1395	88.053	92.861	88.375	88.514	88.518	89.689
95	1410	88.097	92.861	88.364	88.509	88.551	89.667
96	1425	88.032	92.861	88.359	88.476	88.535	89.661
97	1440	88.015	92.850	88.348	88.470	88.535	89.623

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 25 DEG. F	TEMP 26 DEG. F	TEMP 27 DEG. F	TEMP 28 DEG. F	TEMP 29 DEG. F	TEMP 30 DEG. F
1	0	90.679	90.363	90.434	90.579	90.369	90.438
2	15	90.597	90.302	90.450	90.502	90.341	90.378
3	30	90.569	90.258	90.406	90.424	90.275	90.345
4	45	90.482	90.198	90.291	90.375	90.171	90.285
5	60	90.422	90.115	90.236	90.309	90.132	90.203
6	75	90.367	90.099	90.192	90.259	90.094	90.142
7	90	90.318	90.049	90.159	90.221	90.055	90.115
8	105	90.296	90.006	90.077	90.176	89.984	90.044
9	120	90.208	89.913	90.055	90.094	89.951	89.989
10	135	90.197	89.951	90.027	90.039	89.885	89.967
11	150	90.110	89.919	89.989	89.995	89.847	89.929
12	165	90.110	89.843	89.956	89.956	89.803	89.852
13	180	90.033	89.778	89.867	89.929	89.754	89.836
14	195	90.011	89.745	89.900	89.912	89.748	89.743
15	210	90.011	89.740	89.806	89.857	89.743	89.727
16	225	89.961	89.659	89.812	89.830	89.699	89.721
17	240	89.912	89.664	89.790	89.775	89.623	89.656
18	255	89.857	89.583	89.734	89.720	89.546	89.639
19	270	89.840	89.594	89.701	89.703	89.546	89.617
20	285	89.780	89.561	89.640	89.665	89.579	89.568
21	300	89.752	89.512	89.657	89.643	89.497	89.563
22	315	89.736	89.507	89.601	89.610	89.497	89.513
23	330	89.708	89.501	89.574	89.572	89.437	89.497
24	345	89.681	89.420	89.563	89.550	89.448	89.448
25	360	89.637	89.425	89.524	89.489	89.366	89.431
26	375	89.626	89.377	89.474	89.478	89.333	89.410
27	390	89.587	89.322	89.441	89.451	89.311	89.393
28	405	89.604	89.290	89.452	89.429	89.267	89.322
29	420	89.554	89.290	89.430	89.396	89.284	89.300
30	435	89.505	89.274	89.396	89.390	89.278	89.306
31	450	89.494	89.252	89.385	89.341	89.235	89.240
32	465	89.444	89.160	89.297	89.303	89.218	89.229
33	480	89.433	89.192	89.308	89.264	89.207	89.207
34	495	89.428	89.214	89.302	89.281	89.191	89.180
35	510	89.395	89.220	89.286	89.259	89.136	89.169
36	525	89.384	89.089	89.214	89.226	89.103	89.131
37	540	89.356	89.095	89.230	89.198	89.120	89.125
38	555	89.307	89.122	89.192	89.187	89.065	89.142
39	570	89.351	89.084	89.181	89.138	89.081	89.060
40	585	89.318	89.079	89.147	89.143	89.071	89.049
41	600	89.290	89.073	89.136	89.110	88.999	89.043
42	615	89.241	89.019	89.081	89.099	89.038	89.021
43	630	89.246	89.035	89.131	89.077	88.994	88.994
44	645	89.174	88.997	89.048	89.028	88.978	88.989
45	660	89.191	88.949	89.042	89.023	88.928	88.956
46	675	89.191	88.916	89.014	89.001	88.939	88.972
47	690	89.158	88.905	88.998	89.006	88.934	88.907
48	705	89.119	88.905	88.992	88.968	88.885	88.901
49	720	89.119	88.883	88.987	88.957	88.846	88.885
50	735	89.086	88.878	88.987	88.951	88.846	88.863

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 25 DEG. F	TEMP 26 DEG. F	TEMP 27 DEG. F	TEMP 28 DEG. F	TEMP 29 DEG. F	TEMP 30 DEG. F
51	750	89.086	88.835	88.920	88.907	88.824	88.824
52	765	89.081	88.835	88.926	88.891	88.814	88.835
53	780	89.042	88.829	88.959	88.891	88.786	88.797
54	795	89.031	88.829	88.893	88.891	88.786	88.808
55	810	89.009	88.780	88.848	88.852	88.759	88.775
56	825	89.004	88.743	88.826	88.830	88.732	88.748
57	840	88.993	88.743	88.826	88.825	88.726	88.753
58	855	88.993	88.726	88.815	88.808	88.742	88.710
59	870	88.949	88.721	88.815	88.775	88.704	88.699
60	885	88.949	88.699	88.793	88.781	88.655	88.721
61	900	88.910	88.678	88.749	88.731	88.671	88.693
62	915	88.905	88.694	88.798	88.737	88.671	88.682
63	930	88.899	88.699	88.782	88.704	88.595	88.650
64	945	88.872	88.612	88.760	88.710	88.611	88.606
65	960	88.861	88.607	88.710	88.688	88.600	88.611
66	975	88.833	88.596	88.732	88.677	88.568	88.584
67	990	88.822	88.640	88.693	88.666	88.595	88.595
68	1005	88.822	88.591	88.632	88.633	88.535	88.589
69	1020	88.811	88.569	88.682	88.655	88.551	88.551
70	1035	88.800	88.553	88.666	88.611	88.535	88.535
71	1050	88.745	88.537	88.682	88.611	88.496	88.551
72	1065	88.756	88.515	88.682	88.589	88.491	88.513
73	1080	88.756	88.526	88.594	88.578	88.458	88.546
74	1095	88.729	88.482	88.621	88.583	88.486	88.469
75	1110	88.696	88.466	88.577	88.572	88.475	88.469
76	1125	88.712	88.472	88.555	88.556	88.475	88.475
77	1140	88.679	88.417	88.527	88.523	88.469	88.458
78	1155	88.674	88.423	88.483	88.501	88.431	88.469
79	1170	88.630	88.417	88.566	88.495	88.393	88.431
80	1185	88.646	88.396	88.555	88.451	88.360	88.431
81	1200	88.624	88.444	88.483	88.446	88.360	88.420
82	1215	88.619	88.390	88.488	88.446	88.371	88.343
83	1230	88.608	88.379	88.488	88.435	88.343	88.360
84	1245	88.591	88.369	88.461	88.413	88.393	88.371
85	1260	88.586	88.374	88.433	88.429	88.360	88.332
86	1275	88.553	88.347	88.433	88.402	88.321	88.349
87	1290	88.575	88.331	88.455	88.364	88.311	88.338
88	1305	88.542	88.325	88.427	88.391	88.300	88.311
89	1320	88.553	88.341	88.389	88.369	88.289	88.289
90	1335	88.520	88.304	88.367	88.386	88.305	88.283
91	1350	88.520	88.282	88.361	88.336	88.234	88.283
92	1365	88.492	88.260	88.378	88.325	88.261	88.267
93	1380	88.498	88.271	88.306	88.331	88.223	88.283
94	1395	88.476	88.233	88.317	88.298	88.234	88.245
95	1410	88.481	88.201	88.311	88.303	88.256	88.229
96	1425	88.459	88.238	88.311	88.325	88.239	88.245
97	1440	88.459	88.222	88.344	88.287	88.174	88.245

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 31 DEG. F	TEMP 32 DEG. F	TEMP 33 DEG. F	TEMP 34 DEG. F	TEMP 35 DEG. F	TEMP 36 DEG. F
1	0	90.451	90.313	90.319	90.137	90.483	90.248
2	15	90.402	90.275	90.275	90.110	90.417	90.226
3	30	90.314	90.198	90.214	90.038	90.456	90.165
4	45	90.347	90.137	90.148	90.016	90.461	90.099
5	60	90.330	90.082	90.104	89.989	90.302	90.061
6	75	90.226	90.071	90.066	89.940	90.264	89.989
7	90	90.187	90.060	90.038	89.912	90.264	89.934
8	105	90.116	90.000	89.951	89.869	90.253	89.918
9	120	90.099	89.951	89.934	89.836	90.198	89.879
10	135	90.028	89.973	89.880	89.792	90.225	89.936
11	150	90.105	89.880	89.852	89.743	90.165	89.803
12	165	89.946	89.853	89.792	89.721	90.132	89.753
13	180	89.929	89.815	89.781	89.710	90.099	89.709
14	195	89.875	89.744	89.759	89.650	90.132	89.660
15	210	89.924	89.755	89.699	89.633	90.060	89.644
16	225	89.799	89.701	89.672	89.601	90.011	89.600
17	240	89.902	89.690	89.623	89.568	90.038	89.567
18	255	89.777	89.668	89.617	89.546	89.935	89.534
19	270	89.728	89.614	89.579	89.502	89.935	89.512
20	285	89.695	89.575	89.557	89.480	89.951	89.485
21	300	89.761	89.559	89.502	89.453	89.820	89.452
22	315	89.652	89.532	89.480	89.431	89.875	89.435
23	330	89.619	89.505	89.447	89.415	89.831	89.391
24	345	89.603	89.488	89.420	89.382	89.804	89.364
25	360	89.587	89.488	89.404	89.344	89.799	89.342
26	375	89.538	89.418	89.371	89.333	89.859	89.320
27	390	89.532	89.385	89.338	89.305	89.712	89.298
28	405	89.527	89.385	89.327	89.278	89.712	89.271
29	420	89.483	89.336	89.300	89.256	89.793	89.254
30	435	89.450	89.352	89.272	89.251	89.663	89.211
31	450	89.418	89.309	89.245	89.201	89.717	89.194
32	465	89.418	89.287	89.240	89.179	89.570	89.200
33	480	89.347	89.265	89.207	89.179	89.690	89.167
34	495	89.358	89.249	89.196	89.158	89.576	89.139
35	510	89.342	89.238	89.158	89.130	89.668	89.112
36	525	89.353	89.200	89.141	89.125	89.472	89.090
37	540	89.331	89.205	89.119	89.092	89.554	89.095
38	555	89.266	89.162	89.097	89.070	89.581	89.041
39	570	89.293	89.145	89.097	89.037	89.516	89.041
40	585	89.309	89.102	89.070	89.043	89.521	89.002
41	600	89.178	89.096	89.048	89.010	89.510	88.997
42	615	89.200	89.085	89.026	88.977	89.516	88.975
43	630	89.168	89.091	89.021	88.977	89.489	88.964
44	645	89.157	89.069	88.988	88.972	89.456	88.936
45	660	89.113	89.036	88.955	88.955	89.423	88.947
46	675	89.124	89.031	88.944	88.955	89.407	88.914
47	690	89.086	88.977	88.928	88.917	89.412	88.909
48	705	89.059	88.977	88.922	88.884	89.369	88.871
49	720	89.075	88.966	88.900	88.868	89.325	88.854
50	735	89.026	88.949	88.879	88.868	89.309	88.849

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	TEMP 31 DEG. F	TEMP 32 DEG. F	TEMP 33 DEG. F	TEMP 34 DEG. F	TEMP 35 DEG. F	TEMP 36 DEG. F
51	750	89.064	88.944	88.868	88.818	89.282	88.827
52	765	89.037	88.928	88.846	88.840	89.309	88.827
53	780	89.010	88.911	88.824	88.797	89.358	88.816
54	795	88.988	88.889	88.813	88.775	89.314	88.794
55	810	88.966	88.889	88.807	88.791	89.260	88.783
56	825	88.939	88.841	88.797	88.769	89.233	88.777
57	840	88.961	88.862	88.775	88.764	89.206	88.761
58	855	88.945	88.835	88.764	88.709	89.260	88.739
59	870	88.950	88.813	88.747	88.720	89.222	88.723
60	885	88.863	88.792	88.731	88.693	89.151	88.701
61	900	88.868	88.786	88.714	88.704	89.184	88.695
62	915	88.857	88.770	88.698	88.676	89.162	88.673
63	930	88.814	88.759	88.682	88.682	89.200	88.662
64	945	88.857	88.781	88.676	88.654	89.140	88.646
65	960	88.825	88.743	88.654	88.632	89.124	88.651
66	975	88.776	88.737	88.643	88.627	89.086	88.629
67	990	88.749	88.704	88.621	88.611	89.091	88.618
68	1005	88.803	88.694	88.627	88.611	89.064	88.602
69	1020	88.770	88.721	88.589	88.589	89.081	88.586
70	1035	88.776	88.694	88.589	88.561	89.004	88.580
71	1050	88.683	88.661	88.567	88.539	89.037	88.564
72	1065	88.705	88.655	88.550	88.539	89.026	88.569
73	1080	88.678	88.645	88.556	88.539	89.004	88.547
74	1095	88.683	88.650	88.534	88.501	88.983	88.553
75	1110	88.640	88.596	88.528	88.485	88.934	88.520
76	1125	88.738	88.601	88.518	88.485	89.004	88.503
77	1140	88.683	88.579	88.507	88.485	88.879	88.498
78	1155	88.667	88.617	88.490	88.446	88.950	88.498
79	1170	88.640	88.617	88.474	88.457	88.945	88.476
80	1185	88.596	88.557	88.468	88.468	88.939	88.470
81	1200	88.602	88.568	88.446	88.419	88.917	88.443
82	1215	88.591	88.525	88.430	88.408	88.857	88.465
83	1230	88.514	88.514	88.430	88.392	88.896	88.438
84	1245	88.526	88.519	88.425	88.397	88.906	88.427
85	1260	88.553	88.481	88.392	88.386	88.879	88.410
86	1275	88.575	88.487	88.381	88.353	88.819	88.399
87	1290	88.504	88.465	88.370	88.364	88.863	88.383
88	1305	88.515	88.476	88.364	88.348	88.798	88.388
89	1320	88.498	88.438	88.364	88.315	88.857	88.372
90	1335	88.558	88.465	88.364	88.359	88.819	88.355
91	1350	88.515	88.449	88.332	88.310	88.743	88.350
92	1365	88.520	88.432	88.326	88.293	88.727	88.339
93	1380	88.471	88.427	88.321	88.321	88.770	88.333
94	1395	88.482	88.389	88.304	88.304	88.743	88.328
95	1410	88.444	88.383	88.304	88.288	88.721	88.328
96	1425	88.466	88.400	88.288	88.244	88.711	88.322
97	1440	88.417	88.410	88.293	88.255	88.732	88.295

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 37 DEG. F	TEMP 38 DEG. F	TEMP 39 DEG. F	TEMP 40 DEG. F	PRES 1 PSIA	HUM 1 FRACTION
1	0	89.557	89.513	90.088	88.717	37.649	0.182
2	15	89.497	89.475	90.044	88.678	37.643	0.183
3	30	89.486	89.447	90.011	88.667	37.642	0.184
4	45	89.442	89.403	89.995	88.640	37.637	0.184
5	60	89.415	89.376	89.978	88.613	37.635	0.184
6	75	89.371	89.321	89.918	88.575	37.632	0.185
7	90	89.371	89.272	89.874	88.553	37.630	0.186
8	105	89.327	89.267	89.880	88.525	37.626	0.186
9	120	89.305	89.239	89.858	88.509	37.627	0.187
10	135	89.300	89.201	89.820	88.482	37.622	0.187
11	150	89.261	89.152	89.798	88.471	37.620	0.188
12	165	89.207	89.130	89.770	88.438	37.617	0.188
13	180	89.174	89.108	89.738	88.411	37.614	0.189
14	195	89.174	89.070	89.705	88.400	37.616	0.189
15	210	89.163	89.059	89.705	88.389	37.611	0.190
16	225	89.119	89.020	89.677	88.367	37.609	0.190
17	240	89.125	89.009	89.650	88.362	37.613	0.190
18	255	89.070	88.955	89.601	88.323	37.609	0.191
19	270	89.048	88.933	89.595	88.318	37.604	0.191
20	285	89.026	88.922	89.595	88.307	37.602	0.191
21	300	88.999	88.900	89.557	88.280	37.599	0.191
22	315	88.993	88.867	89.541	88.258	37.598	0.192
23	330	88.972	88.867	89.513	88.252	37.596	0.192
24	345	88.955	88.823	89.492	88.241	37.595	0.192
25	360	88.911	88.807	89.453	88.225	37.593	0.193
26	375	88.911	88.785	89.470	88.220	37.594	0.193
27	390	88.873	88.774	89.420	88.187	37.591	0.194
28	405	88.862	88.736	89.399	88.181	37.590	0.193
29	420	88.846	88.703	89.382	88.176	37.588	0.194
30	435	88.829	88.719	89.366	88.170	37.587	0.195
31	450	88.802	88.719	89.371	88.165	37.586	0.195
32	465	88.791	88.664	89.338	88.110	37.584	0.195
33	480	88.775	88.648	89.311	88.088	37.582	0.195
34	495	88.758	88.610	89.295	88.083	37.580	0.196
35	510	88.758	88.632	89.289	88.061	37.582	0.196
36	525	88.725	88.582	89.267	88.034	37.576	0.196
37	540	88.709	88.571	89.240	88.039	37.574	0.196
38	555	88.704	88.566	89.218	88.034	37.572	0.197
39	570	88.693	88.550	89.229	88.028	37.570	0.197
40	585	88.687	88.528	89.224	88.023	37.568	0.197
41	600	88.665	88.522	89.180	88.017	37.567	0.197
42	615	88.638	88.528	89.185	88.017	37.565	0.198
43	630	88.643	88.484	89.185	88.007	37.564	0.198
44	645	88.621	88.473	89.153	87.990	37.564	0.199
45	660	88.600	88.446	89.109	87.979	37.565	0.198
46	675	88.600	88.462	89.114	87.957	37.564	0.199
47	690	88.583	88.424	89.109	87.957	37.562	0.199
48	705	88.572	88.413	89.071	87.941	37.562	0.199
49	720	88.561	88.407	89.081	87.936	37.561	0.200
50	735	88.545	88.385	89.049	87.930	37.560	0.200

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 37 DEG. F	TEMP 38 DEG. F	TEMP 39 DEG. F	TEMP 40 DEG. F	PRES 1 PSIA	HUM 1 FRACTION
51	750	88.539	88.374	89.043	88.094	37.558	0.200
52	765	88.523	88.352	89.043	88.088	37.558	0.200
53	780	88.523	88.358	89.060	88.088	37.555	0.201
54	795	88.507	88.352	88.994	88.067	37.554	0.201
55	810	88.479	88.325	88.999	88.072	37.550	0.201
56	825	88.457	88.303	88.978	88.072	37.549	0.201
57	840	88.474	88.309	88.961	88.067	37.549	0.202
58	855	88.457	88.292	88.967	88.061	37.554	0.202
59	870	88.446	88.276	88.956	88.061	37.546	0.202
60	885	88.446	88.259	88.917	88.061	37.546	0.202
61	900	88.430	88.248	88.923	88.056	37.546	0.202
62	915	88.430	88.265	88.923	88.039	37.545	0.203
63	930	88.408	88.259	88.939	88.050	37.544	0.203
64	945	88.397	88.221	88.896	88.039	37.545	0.203
65	960	88.392	88.221	88.874	88.045	37.544	0.203
66	975	88.375	88.205	88.868	88.034	37.543	0.203
67	990	88.359	88.199	88.874	88.039	37.543	0.204
68	1005	88.364	88.188	88.852	88.028	37.542	0.204
69	1020	88.348	88.172	88.846	88.017	37.543	0.204
70	1035	88.342	88.183	88.824	88.017	37.543	0.204
71	1050	88.326	88.155	88.814	88.012	37.542	0.204
72	1065	88.310	88.139	88.808	88.012	37.542	0.205
73	1080	88.310	88.128	88.781	88.012	37.541	0.205
74	1095	88.299	88.123	88.803	88.001	37.541	0.205
75	1110	88.288	88.123	88.764	88.001	37.541	0.205
76	1125	88.282	88.128	88.770	87.985	37.540	0.206
77	1140	88.277	88.112	88.748	87.979	37.541	0.206
78	1155	88.260	88.090	88.770	87.985	37.540	0.206
79	1170	88.249	88.084	88.742	87.974	37.539	0.206
80	1185	88.249	88.079	88.742	87.974	37.539	0.207
81	1200	88.233	88.062	88.742	87.979	37.539	0.206
82	1215	88.222	88.046	88.704	87.968	37.538	0.207
83	1230	88.200	88.051	88.688	87.968	37.536	0.207
84	1245	88.211	88.046	88.693	87.957	37.533	0.207
85	1260	88.200	88.035	88.699	87.946	37.530	0.208
86	1275	88.195	88.019	88.688	87.946	37.528	0.208
87	1290	88.184	88.035	88.660	87.941	37.531	0.208
88	1305	88.178	88.008	88.650	87.930	37.529	0.208
89	1320	88.167	88.019	88.639	87.925	37.522	0.208
90	1335	88.167	87.997	88.655	87.930	37.520	0.208
91	1350	88.151	87.986	88.633	87.914	37.519	0.209
92	1365	88.151	88.002	88.633	87.914	37.519	0.209
93	1380	88.146	87.997	88.644	87.914	37.517	0.209
94	1395	88.146	87.969	88.595	87.908	37.517	0.209
95	1410	88.129	87.953	88.589	87.897	37.516	0.209
96	1425	88.113	87.953	88.589	87.903	37.516	0.209
97	1440	88.113	87.947	88.589	87.886	37.514	0.209

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	HUM 2 FRACTION	HUM 3 FRACTION	HUM 4 FRACTION	HUM 5 FRACTION	HUM 6 FRACTION	HUM 7 FRACTION
1	0	0.181	0.174	0.191	0.187	0.188	0.183
2	15	0.182	0.174	0.192	0.188	0.189	0.183
3	30	0.183	0.175	0.192	0.188	0.190	0.184
4	45	0.183	0.175	0.193	0.189	0.190	0.184
5	60	0.184	0.177	0.193	0.189	0.190	0.185
6	75	0.184	0.178	0.194	0.190	0.191	0.184
7	90	0.186	0.177	0.194	0.190	0.191	0.185
8	105	0.186	0.178	0.195	0.190	0.192	0.185
9	120	0.186	0.181	0.195	0.191	0.192	0.186
10	135	0.187	0.180	0.195	0.191	0.193	0.187
11	150	0.187	0.182	0.196	0.192	0.193	0.187
12	165	0.188	0.180	0.196	0.192	0.193	0.187
13	180	0.188	0.181	0.196	0.192	0.194	0.188
14	195	0.189	0.182	0.197	0.192	0.194	0.188
15	210	0.189	0.182	0.197	0.193	0.194	0.188
16	225	0.189	0.183	0.197	0.193	0.195	0.188
17	240	0.190	0.184	0.198	0.193	0.195	0.189
18	255	0.190	0.183	0.199	0.194	0.195	0.189
19	270	0.191	0.184	0.198	0.194	0.196	0.189
20	285	0.191	0.183	0.199	0.194	0.196	0.190
21	300	0.191	0.185	0.199	0.194	0.196	0.190
22	315	0.191	0.184	0.199	0.195	0.197	0.191
23	330	0.192	0.184	0.199	0.195	0.197	0.190
24	345	0.192	0.184	0.200	0.195	0.197	0.191
25	360	0.193	0.186	0.200	0.195	0.197	0.192
26	375	0.193	0.187	0.200	0.195	0.197	0.191
27	390	0.193	0.186	0.200	0.196	0.198	0.191
28	405	0.193	0.186	0.201	0.196	0.198	0.192
29	420	0.194	0.185	0.201	0.196	0.199	0.192
30	435	0.194	0.186	0.201	0.197	0.199	0.192
31	450	0.195	0.186	0.201	0.197	0.199	0.193
32	465	0.194	0.188	0.202	0.197	0.199	0.193
33	480	0.195	0.188	0.202	0.197	0.199	0.193
34	495	0.195	0.188	0.202	0.198	0.200	0.194
35	510	0.196	0.189	0.202	0.198	0.200	0.194
36	525	0.196	0.188	0.203	0.198	0.200	0.194
37	540	0.196	0.189	0.203	0.198	0.200	0.195
38	555	0.196	0.188	0.203	0.198	0.201	0.194
39	570	0.196	0.188	0.203	0.199	0.201	0.194
40	585	0.197	0.188	0.204	0.199	0.201	0.195
41	600	0.197	0.188	0.204	0.199	0.201	0.195
42	615	0.197	0.190	0.204	0.199	0.202	0.196
43	630	0.197	0.190	0.204	0.199	0.202	0.196
44	645	0.198	0.190	0.205	0.200	0.202	0.196
45	660	0.198	0.190	0.205	0.200	0.202	0.196
46	675	0.198	0.190	0.205	0.200	0.202	0.196
47	690	0.199	0.191	0.205	0.200	0.203	0.197
48	705	0.199	0.191	0.206	0.201	0.203	0.197
49	720	0.199	0.192	0.206	0.201	0.203	0.198
50	735	0.199	0.191	0.206	0.201	0.204	0.197

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	HUM 2 FRACTION	HUM 3 FRACTION	HUM 4 FRACTION	HUM 5 FRACTION	HUM 6 FRACTION	HUM 7 FRACTION
51	750	0.200	0.191	0.206	0.201	0.204	0.198
52	765	0.199	0.192	0.206	0.201	0.204	0.198
53	780	0.200	0.193	0.207	0.201	0.204	0.198
54	795	0.200	0.192	0.206	0.202	0.204	0.199
55	810	0.200	0.192	0.207	0.202	0.204	0.199
56	825	0.201	0.193	0.207	0.202	0.205	0.198
57	840	0.201	0.193	0.207	0.202	0.205	0.199
58	855	0.201	0.192	0.208	0.202	0.205	0.199
59	870	0.201	0.193	0.208	0.203	0.205	0.200
60	885	0.201	0.193	0.208	0.203	0.205	0.200
61	900	0.202	0.194	0.208	0.203	0.206	0.199
62	915	0.202	0.194	0.208	0.203	0.206	0.200
63	930	0.202	0.193	0.208	0.204	0.206	0.200
64	945	0.202	0.195	0.209	0.204	0.206	0.200
65	960	0.203	0.194	0.209	0.204	0.206	0.200
66	975	0.203	0.195	0.209	0.204	0.207	0.201
67	990	0.203	0.195	0.209	0.204	0.207	0.201
68	1005	0.204	0.195	0.209	0.205	0.207	0.201
69	1020	0.204	0.196	0.210	0.205	0.207	0.201
70	1035	0.204	0.196	0.210	0.205	0.207	0.201
71	1050	0.204	0.196	0.210	0.205	0.208	0.201
72	1065	0.204	0.196	0.210	0.205	0.208	0.202
73	1080	0.205	0.196	0.210	0.205	0.208	0.202
74	1095	0.205	0.196	0.210	0.206	0.208	0.203
75	1110	0.204	0.198	0.210	0.206	0.208	0.203
76	1125	0.205	0.197	0.211	0.206	0.208	0.202
77	1140	0.205	0.197	0.211	0.206	0.209	0.203
78	1155	0.205	0.197	0.211	0.206	0.209	0.202
79	1170	0.205	0.197	0.212	0.207	0.209	0.203
80	1185	0.206	0.197	0.211	0.207	0.209	0.203
81	1200	0.205	0.199	0.212	0.207	0.209	0.203
82	1215	0.206	0.198	0.212	0.207	0.209	0.204
83	1230	0.206	0.197	0.212	0.207	0.210	0.203
84	1245	0.206	0.199	0.212	0.207	0.210	0.204
85	1260	0.206	0.199	0.212	0.208	0.210	0.204
86	1275	0.207	0.198	0.213	0.208	0.210	0.205
87	1290	0.207	0.198	0.213	0.208	0.210	0.204
88	1305	0.207	0.199	0.213	0.208	0.211	0.205
89	1320	0.207	0.200	0.213	0.208	0.211	0.204
90	1335	0.207	0.198	0.213	0.208	0.211	0.205
91	1350	0.208	0.201	0.213	0.209	0.211	0.205
92	1365	0.208	0.199	0.213	0.209	0.211	0.205
93	1380	0.208	0.201	0.214	0.209	0.211	0.206
94	1395	0.208	0.201	0.214	0.209	0.211	0.205
95	1410	0.208	0.199	0.214	0.209	0.212	0.206
96	1425	0.209	0.200	0.214	0.209	0.212	0.205
97	1440	0.208	0.200	0.214	0.210	0.212	0.206

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE "UMBER	DELTA MINS	HUM 8 FRACTION	HUM 9 FRACTION	HUM 10 FRACTION
1	0	0.207	0.201	0.206
2	15	0.208	0.201	0.206
3	30	0.208	0.201	0.206
4	45	0.208	0.202	0.207
5	60	0.208	0.202	0.207
6	75	0.209	0.202	0.207
7	90	0.209	0.202	0.207
8	105	0.209	0.203	0.208
9	120	0.209	0.203	0.208
10	135	0.210	0.203	0.208
11	150	0.210	0.203	0.208
12	165	0.211	0.204	0.208
13	180	0.211	0.204	0.208
14	195	0.211	0.204	0.209
15	210	0.211	0.204	0.209
16	225	0.211	0.205	0.209
17	240	0.212	0.205	0.209
18	255	0.212	0.205	0.210
19	270	0.213	0.205	0.209
20	285	0.212	0.206	0.210
21	300	0.213	0.206	0.210
22	315	0.213	0.206	0.210
23	330	0.213	0.206	0.210
24	345	0.213	0.206	0.211
25	360	0.214	0.207	0.211
26	375	0.214	0.207	0.211
27	390	0.214	0.207	0.211
28	405	0.214	0.207	0.211
29	420	0.214	0.207	0.211
30	435	0.215	0.208	0.211
31	450	0.215	0.208	0.212
32	465	0.215	0.208	0.212
33	480	0.215	0.208	0.212
34	495	0.215	0.208	0.212
35	510	0.216	0.209	0.213
36	525	0.216	0.209	0.213
37	540	0.216	0.209	0.213
38	555	0.216	0.209	0.214
39	570	0.217	0.209	0.213
40	585	0.217	0.210	0.214
41	600	0.217	0.209	0.214
42	615	0.217	0.210	0.214
43	630	0.217	0.210	0.214
44	645	0.218	0.210	0.214
45	660	0.218	0.211	0.214
46	675	0.218	0.211	0.215
47	690	0.218	0.211	0.215
48	705	0.218	0.211	0.215
49	720	0.218	0.211	0.215
50	735	0.218	0.211	0.215

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	HUM 8 FRACTION	HUM 9 FRACTION	HUM 10 FRACTION
51	750	0.218	0.212	0.215
52	765	0.219	0.212	0.215
53	780	0.219	0.212	0.216
54	795	0.219	0.212	0.216
55	810	0.219	0.212	0.216
56	825	0.219	0.213	0.216
57	840	0.219	0.213	0.216
58	855	0.220	0.213	0.216
59	870	0.220	0.213	0.216
60	885	0.220	0.213	0.217
61	900	0.220	0.213	0.217
62	915	0.220	0.213	0.217
63	930	0.221	0.213	0.217
64	945	0.221	0.214	0.217
65	960	0.221	0.214	0.217
66	975	0.221	0.214	0.217
67	990	0.221	0.214	0.217
68	1005	0.221	0.214	0.218
69	1020	0.222	0.215	0.218
70	1035	0.222	0.215	0.218
71	1050	0.222	0.215	0.218
72	1065	0.222	0.215	0.218
73	1080	0.222	0.215	0.218
74	1095	0.222	0.215	0.218
75	1110	0.223	0.215	0.218
76	1125	0.223	0.216	0.219
77	1140	0.223	0.216	0.219
78	1155	0.223	0.216	0.219
79	1170	0.223	0.216	0.219
80	1185	0.223	0.216	0.219
81	1200	0.224	0.216	0.219
82	1215	0.223	0.217	0.219
83	1230	0.224	0.217	0.219
84	1245	0.224	0.217	0.220
85	1260	0.224	0.217	0.220
86	1275	0.224	0.217	0.220
87	1290	0.224	0.217	0.220
88	1305	0.225	0.217	0.220
89	1320	0.225	0.218	0.220
90	1335	0.225	0.218	0.220
91	1350	0.225	0.218	0.221
92	1365	0.225	0.218	0.221
93	1380	0.225	0.218	0.221
94	1395	0.225	0.218	0.221
95	1410	0.226	0.218	0.221
96	1425	0.226	0.218	0.221
97	1440	0.226	0.219	0.222

END OF TABLE

APPENDIX A.3.

REDUCED PRESSURE ILRT
COMPUTER GENERATED REPORT
CONTROLLED LEAKAGE RATE TEST
(CLRT)

LOUISIANA POWER & LIGHT COMPANY
WATERFORD SES UNIT NO. 3

CONTAINMENT INTEGRATED LEAKAGE RATE TEST
SUPPLEMENTAL VERIFICATION TEST
LEAKAGE RATE MEASURED USING THE ABSOLUTE METHOD
LEAKAGE RATE COMPUTED USING THE MASS POINT METHOD

TEST PERIOD STARTED AT 15 HOURS ON APRIL 29, 1983
TEST CONDUCTED FOR 4.25 HOURS

FREE SPACE VOLUME OF CONTAINMENT IS 2677000 CU FT
CONTAINMENT WAS PRESSURIZED TO 37.51 PSIA

INITIAL VERIFICATION AIR WEIGHT 492700.8 LBS
FINAL VERIFICATION AIR WEIGHT 492362.2 LBS
FITTED MASS POINT LEAKAGE RATE IS 0.356 % PER DAY

LC = 0.356 LTM = 0.0022 L0 = 0.3626

$$L0 + LTM - .25LT < LC < L0 + LTM + .25LT$$

$$0.3626 + 0.0022 - 0.0885 < 0.356 < 0.3626 + 0.0022 + 0.0885$$

$$0.2763 < 0.356 < 0.4533$$

LC =REDUCED PRESSURE FITTED CLRT MASS POINT LEAKAGE RATE
LTM =REDUCED PRESSURE FITTED ILRT MASS POINT LEAKAGE RATE
L0 =SUPERIMPOSED LEAKAGE DURING VERIFICATION TEST
LT =CONTAINMENT DESIGN LEAKAGE RATE FOR REDUCED PRESSURE

DESCRIPTION OF VARIABLES

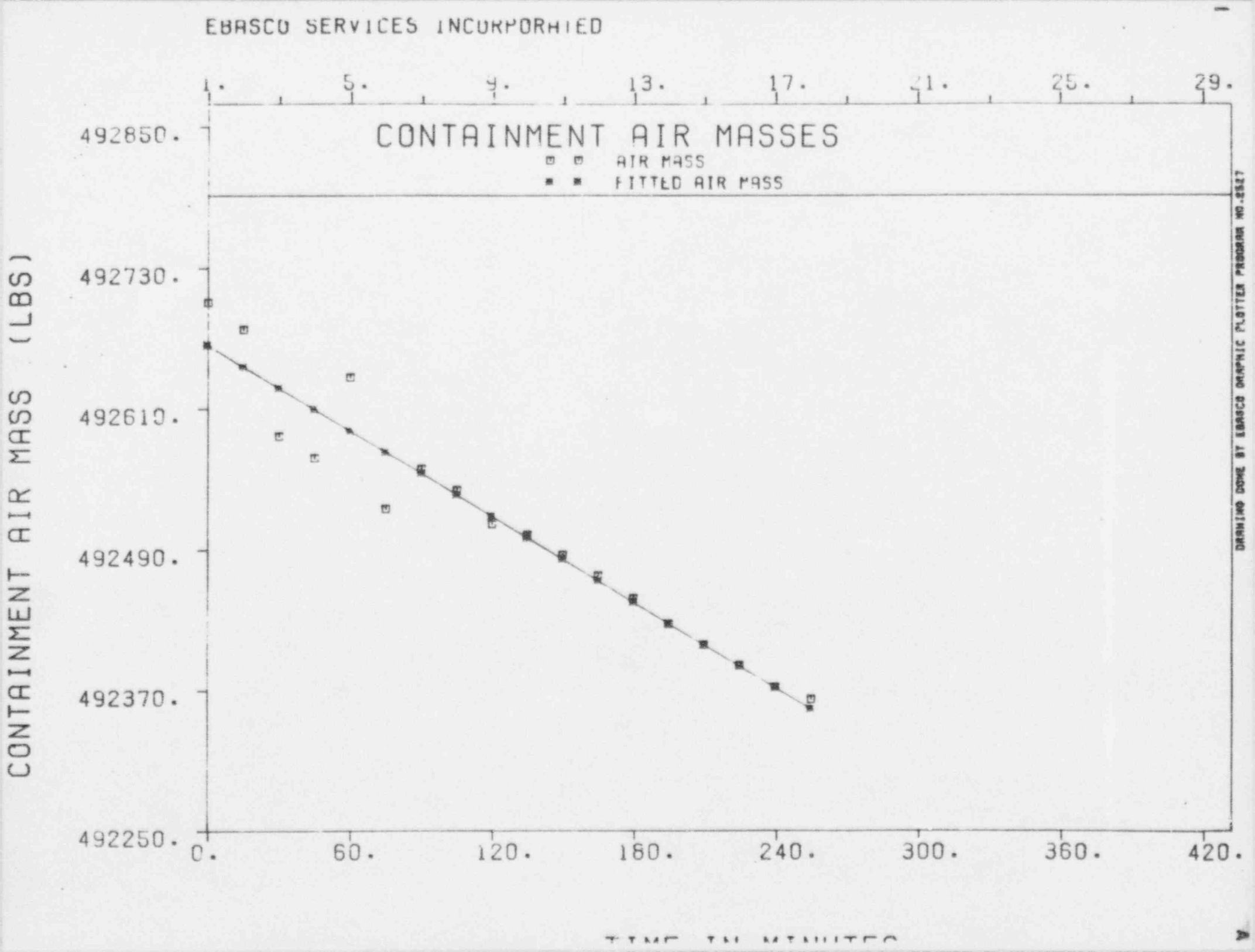
AVG. TEM - CONTAINMENT MEAN TEMPERATURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RTD SENSOR INDICATIONS.
AVE. PRE - PRIMARY CONTAINMENT PRESSURE INDICATION.
VAP. PRE - CONTAINMENT VAPOR PRESSURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RHD SENSOR INDICATIONS.
LEAK SIM - SIMPLE TOTAL TIME LEAKAGE RATE.
LEAK MAS - LEAKAGE RATE COMPUTED FROM FIRST ORDER
REGRESSION OF AIR MASS DATA.
AIR MASS - CONTAINMENT AIR MASS.

NOTE FOR TABULAR DATA -
TABLE VALUES OF ZERO SIGNIFY DATA IS
NOT APPLICABLE TO THE CALCULATION.

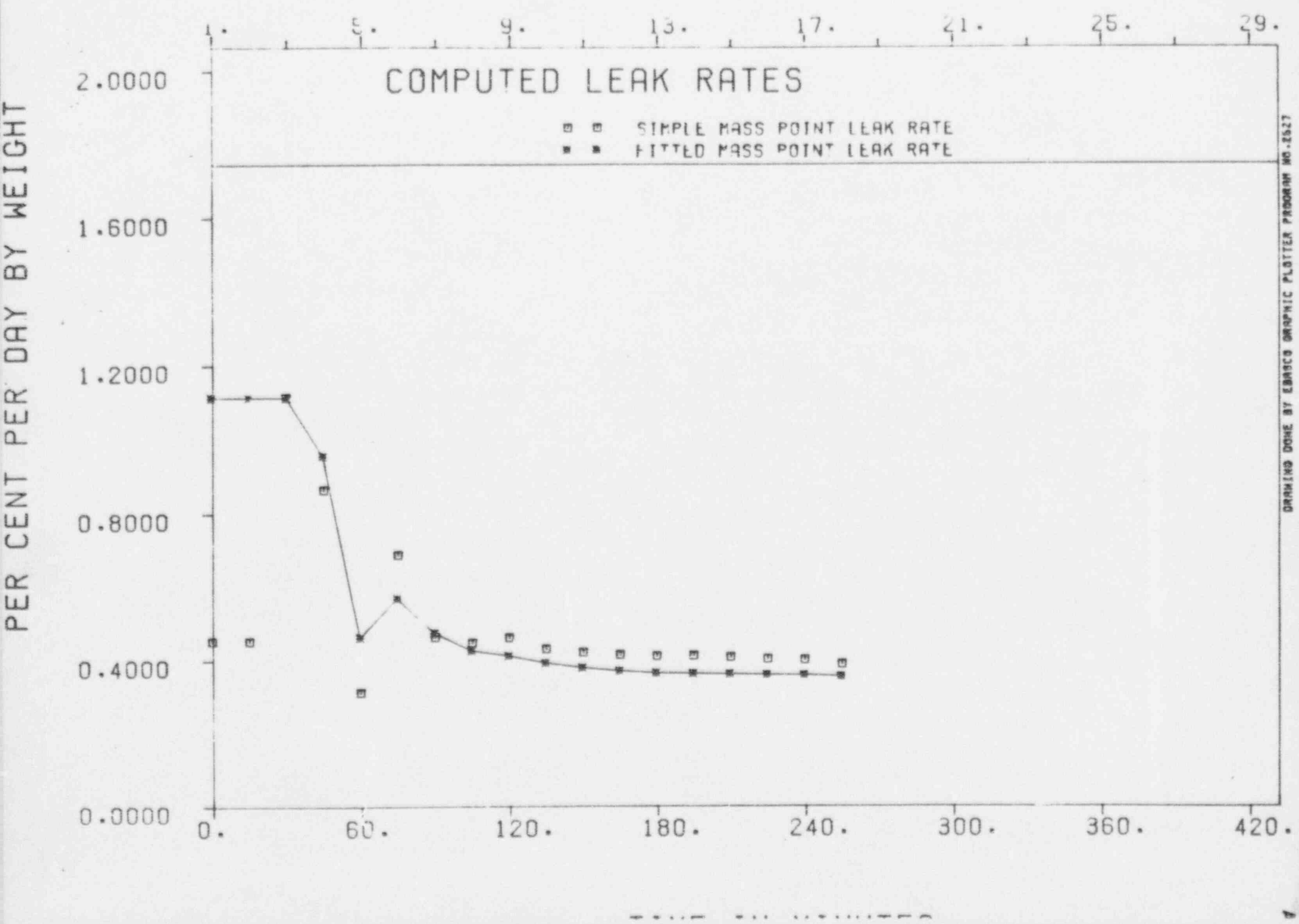
NOTE FOR CURVES -

1. TOP ABSCISSA SCALE REPRESENTS SAMPLE NUMBERS.
2. AIR MASS IS THE CALCULATED CONTAINMENT AIR MASS AND FITTED AIR MASS IS THE LINEAR LEAST SQUARE FIT OF THE AIR MASSES.
3. SIMPLE MASS POINT IS THE TOTAL TIME LEAKAGE RATE AND FITTED MASS POINT IS THE LEAKAGE RATE COMPUTED FROM FIRST ORDER REGRESSION OF AIR MASS DATA.
4. UCL IS THE UPPER LIMIT OF THE 95% CONFIDENCE LEVEL OF AIR MASS DATA.

EBASCO SERVICES INCORPORATED



EBASCO SERVICES INCORPORATED



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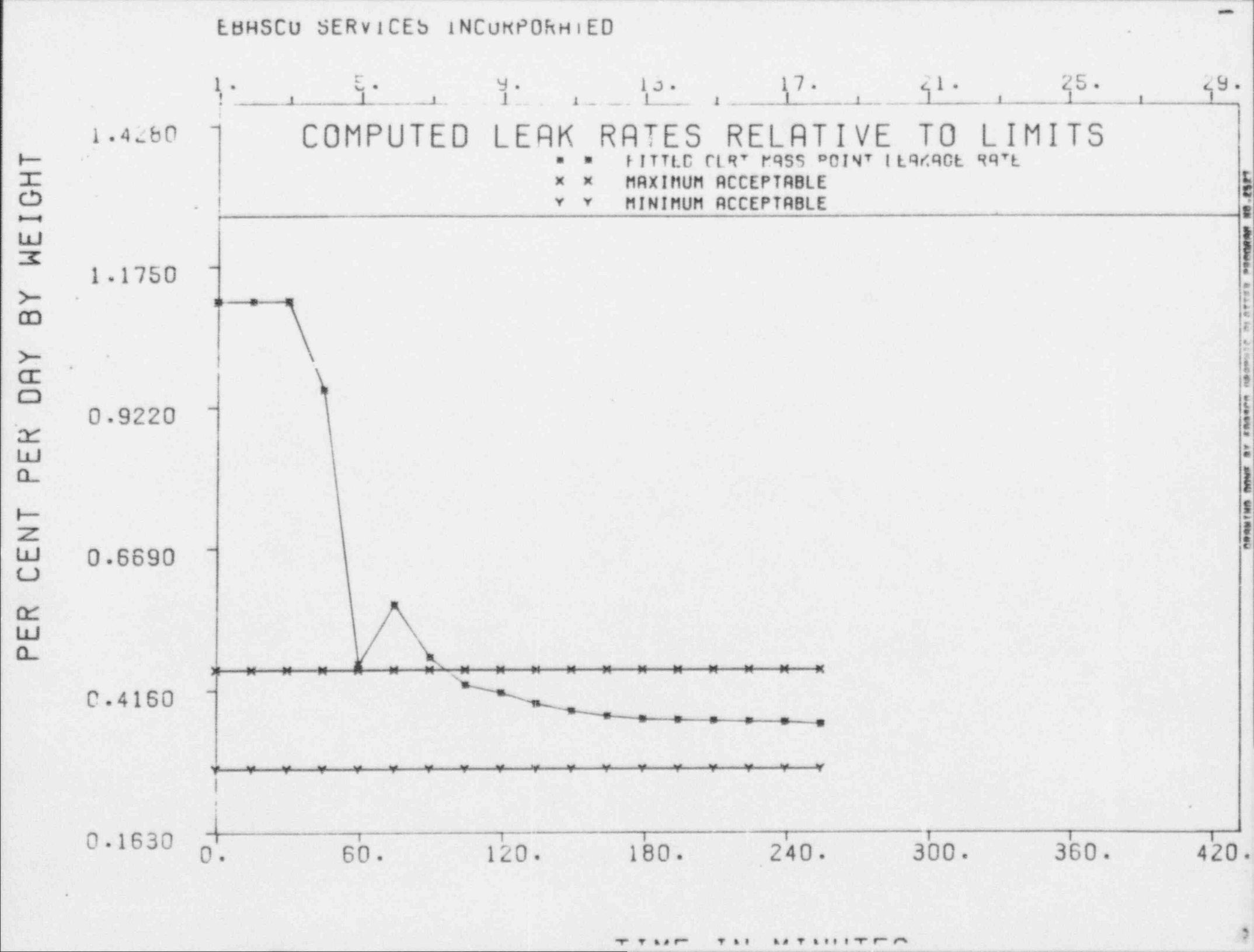
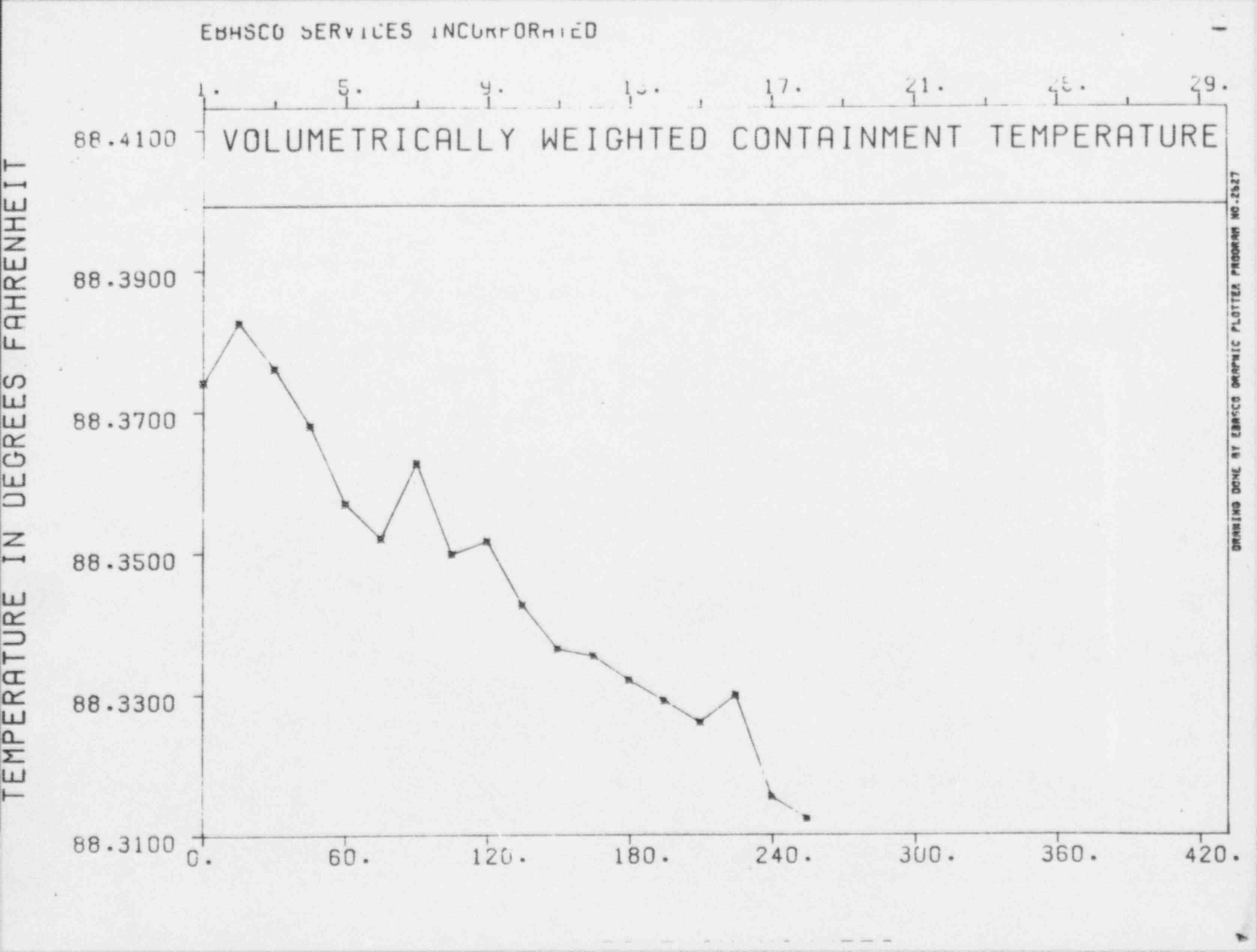
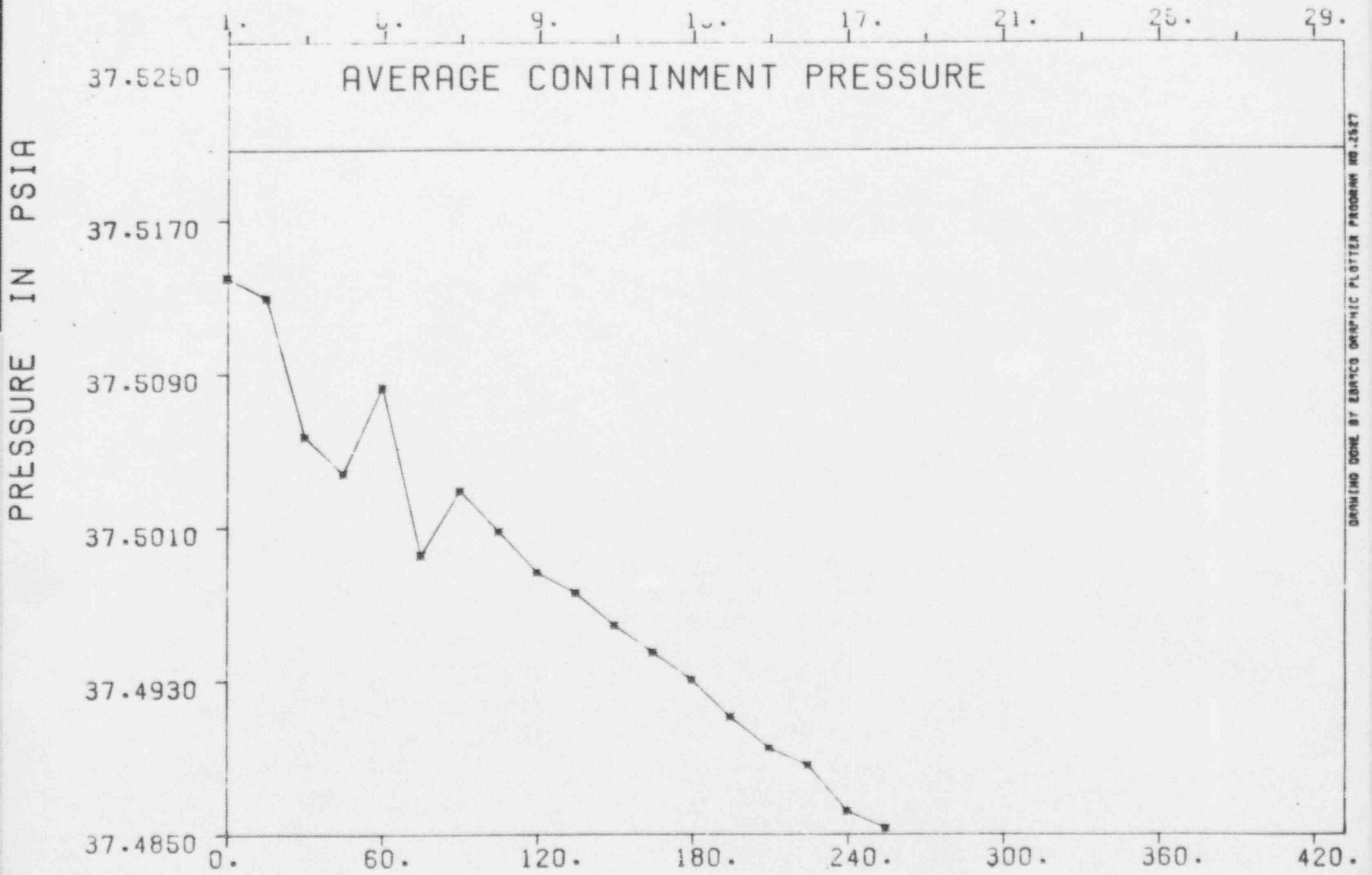



EBASCO SERVICES INCORPORATED
1.
5.
9.
13.
17.
21.
25.
29.
VOLUMETRICALLY WEIGHTED CONTAINMENT TEMPERATURE
TEMPERATURE IN DEGREES FAHRENHEIT
88.4100
88.3900
88.3700
88.3500
88.3300
88.3100
0.
60.
120.
180.
240.
300.
360.
420.
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.2527

EBASCO SERVICES INCORPORATED



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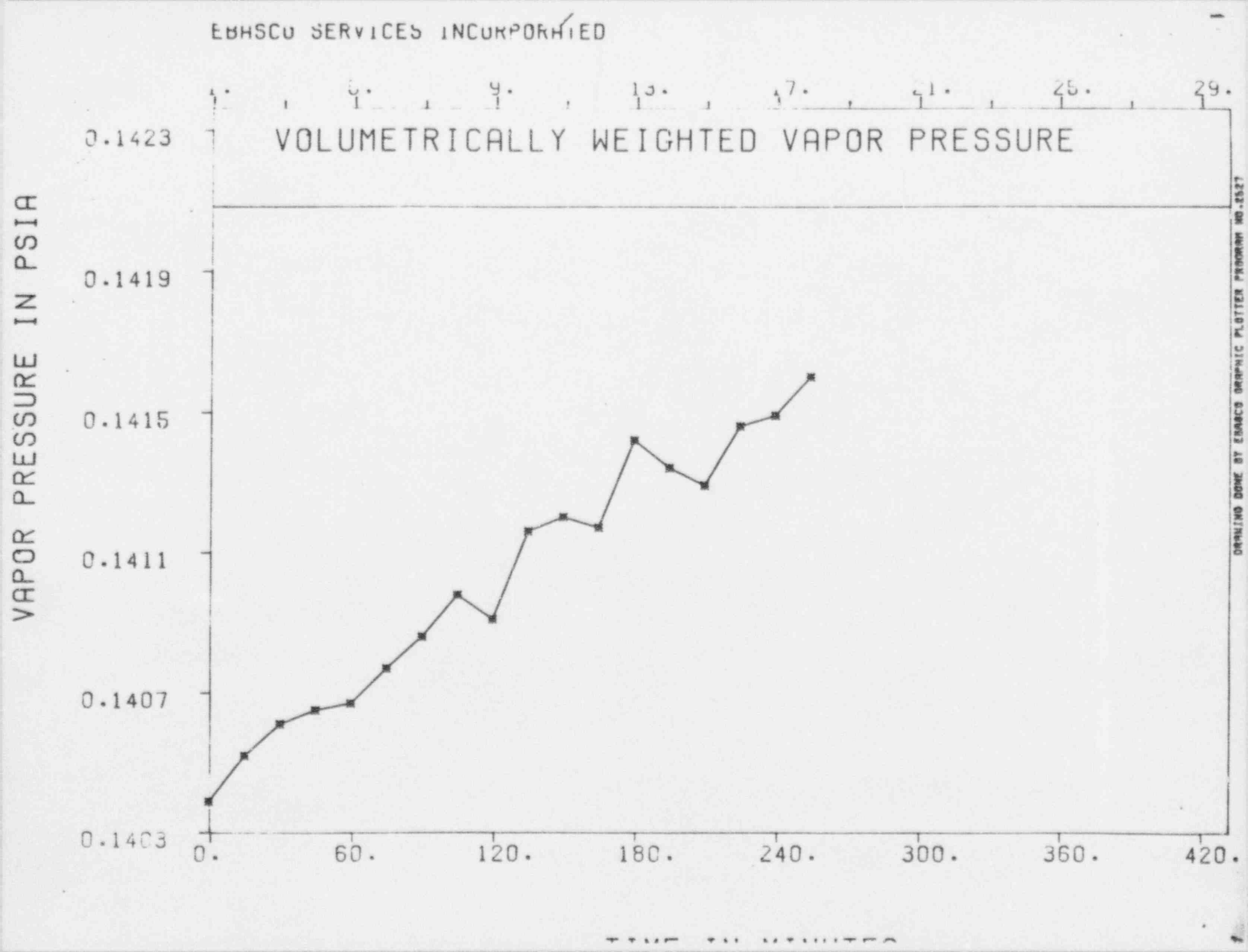


VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	AVG. TEM DEG. F	AVG. PRE PSIA	VAP. PRE PSIA	LEAK SIM PER CENT	LEAK MAS PER CENT	AIR MASS POUNDS
1	0	88.374	37.5140	0.1404	0.000	0.000	492701
2	15	88.382	37.5129	0.1405	0.453	0.000	492678
3	30	88.376	37.5057	0.1406	1.113	1.113	492587
4	45	88.368	37.5038	0.1406	0.864	0.955	492568
5	60	88.357	37.5083	0.1407	0.312	0.463	492637
6	75	88.352	37.4995	0.1408	0.687	0.569	492525
7	90	88.362	37.5029	0.1409	0.463	0.475	492558
8	105	88.350	37.5008	0.1410	0.447	0.426	492540
9	120	88.352	37.4986	0.1409	0.461	0.412	492512
10	135	88.343	37.4976	0.1412	0.430	0.392	492502
11	150	88.336	37.4959	0.1412	0.420	0.379	492485
12	165	88.335	37.4944	0.1412	0.413	0.370	492467
13	180	88.332	37.4930	0.1414	0.410	0.364	492448
14	195	88.329	37.4911	0.1413	0.411	0.363	492426
15	210	88.326	37.4894	0.1413	0.407	0.361	492408
16	225	88.330	37.4886	0.1415	0.402	0.360	492391
17	240	88.315	37.4862	0.1415	0.400	0.359	492372
18	255	88.312	37.4853	0.1416	0.388	0.356	492362

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 1 DEG. F	TEMP 2 DEG. F	TEMP 3 DEG. F	TEMP 4 DEG. F	TEMP 5 DEG. F	TEMP 6 DEG. F
1	0	88.069	88.073	88.102	88.184	88.168	88.604
2	15	88.058	88.046	88.096	88.190	88.195	88.599
3	30	88.075	88.078	88.091	88.184	88.195	88.566
4	45	88.064	88.062	88.091	88.184	88.184	88.560
5	60	88.047	88.057	88.074	88.184	88.151	88.632
6	75	88.036	88.046	88.080	88.173	88.184	88.473
7	90	88.053	88.106	88.102	88.173	88.190	88.440
8	105	88.036	88.051	88.063	88.162	88.146	88.533
9	120	88.025	88.040	88.058	88.162	88.151	88.495
10	135	88.036	88.057	88.069	88.157	88.157	88.506
11	150	88.020	88.046	88.036	88.140	88.162	88.429
12	165	88.014	88.008	88.053	88.157	88.124	88.495
13	180	88.031	87.997	88.025	88.140	88.151	88.555
14	195	88.020	88.051	88.047	88.146	88.146	88.484
15	210	88.020	88.008	88.058	88.135	88.135	88.560
16	225	88.020	88.046	88.042	88.140	88.140	88.555
17	240	87.998	87.986	88.020	88.118	88.118	88.538
18	255	87.992	88.008	88.009	88.118	88.135	88.522

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 7 DEG. F	TEMP 8 DEG. F	TEMP 9 DEG. F	TEMP 10 DEG. F	TEMP 11 DEG. F	TEMP 12 DEG. F
1	0	87.933	88.111	88.012	88.360	88.203	88.072
2	15	87.954	88.133	88.034	88.436	88.252	88.105
3	30	87.922	88.106	87.990	88.392	88.214	88.121
4	45	87.922	88.127	88.001	88.414	88.246	88.088
5	60	87.911	88.127	87.968	88.403	88.154	88.001
6	75	87.905	88.095	88.001	88.409	88.214	88.077
7	90	87.933	88.111	87.990	88.403	88.192	88.088
8	105	87.889	88.084	87.968	88.403	88.203	88.007
9	120	87.894	88.089	87.990	88.414	88.181	88.045
10	135	87.894	88.095	87.968	88.343	88.203	88.007
11	150	87.905	88.073	87.979	88.381	88.154	88.061
12	165	87.911	88.068	87.957	88.392	88.176	88.023
13	180	87.889	88.062	87.963	88.431	88.176	88.039
14	195	87.900	88.073	87.957	88.403	88.181	88.034
15	210	87.873	88.068	87.957	88.398	88.160	87.985
16	225	87.905	88.084	87.957	88.409	88.127	88.056
17	240	87.878	88.051	87.924	88.343	88.111	88.061
18	255	87.845	88.062	87.952	88.332	88.132	87.979

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 13 DEG. F	TEMP 14 DEG. F	TEMP 15 DEG. F	TEMP 16 DEG. F	TEMP 17 DEG. F	TEMP 18 DEG. F
1	0	88.249	88.014	88.242	88.240	87.892	90.088
2	15	88.266	87.998	88.236	88.268	87.897	90.094
3	30	88.266	88.003	88.231	88.235	87.870	90.099
4	45	88.249	87.987	88.203	88.240	87.875	90.083
5	60	88.239	87.971	88.198	88.257	87.864	90.077
6	75	88.228	87.992	88.209	88.229	87.870	90.077
7	90	88.239	87.960	88.209	88.246	87.859	90.072
8	105	88.217	87.987	88.209	88.213	87.870	90.072
9	120	88.222	87.954	88.181	88.235	87.848	90.077
10	135	88.206	87.965	88.192	88.262	87.859	90.055
11	150	88.233	87.971	88.165	88.240	87.864	90.061
12	165	88.217	87.965	88.176	88.251	87.859	90.066
13	180	88.217	87.965	88.159	88.207	87.853	90.077
14	195	88.195	87.954	88.176	88.246	87.837	90.072
15	210	88.200	87.938	88.137	88.191	87.820	90.061
16	225	88.184	87.927	88.170	88.268	87.820	90.061
17	240	88.184	87.927	88.154	88.196	87.842	90.055
18	255	88.184	87.916	88.143	88.185	87.837	90.044

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 19 DEG. F	TEMP 20 DEG. F	TEMP 21 DEG. F	TEMP 22 DEG. F	TEMP 23 DEG. F	TEMP 24 DEG. F
1	0	87.983	92.817	88.260	88.377	88.458	89.569
2	15	87.988	92.822	88.266	88.399	88.425	89.563
3	30	88.010	92.806	88.260	88.372	88.447	89.536
4	45	87.955	92.806	88.244	88.377	88.430	89.541
5	60	87.966	92.811	88.244	88.372	88.436	89.525
6	75	87.961	92.806	88.222	88.355	88.381	89.547
7	90	87.961	92.800	88.255	88.361	88.370	89.574
8	105	87.961	92.806	88.249	88.366	88.436	89.519
9	120	87.939	92.806	88.238	88.350	88.386	89.547
10	135	87.955	92.795	88.233	88.366	88.370	89.530
11	150	87.950	92.800	88.211	88.339	88.364	89.514
12	165	87.934	92.800	88.238	88.339	88.364	89.503
13	180	87.950	92.795	88.211	88.339	88.397	89.470
14	195	87.934	92.795	88.205	88.317	88.364	89.541
15	210	87.912	92.789	88.244	88.333	88.425	89.492
16	225	87.945	92.784	88.216	88.322	88.397	89.481
17	240	87.917	92.784	88.189	88.322	88.375	89.470
18	255	87.923	92.784	88.178	88.295	88.353	89.492

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 25 DEG. F	TEMP 26 DEG. F	TEMP 27 DEG. F	TEMP 28 DEG. F	TEMP 29 DEG. F	TEMP 30 DEG. F
1	0	88.371	88.136	88.234	88.226	88.141	88.130
2	15	88.398	88.184	88.289	88.199	88.136	88.152
3	30	88.382	88.195	88.272	88.182	88.190	88.130
4	45	88.387	88.157	88.267	88.182	88.103	88.168
5	60	88.382	88.163	88.261	88.193	88.097	88.141
6	75	88.354	88.108	88.234	88.177	88.097	88.119
7	90	88.365	88.168	88.239	88.193	88.081	88.136
8	105	88.343	88.119	88.200	88.138	88.092	88.097
9	120	88.354	88.136	88.195	88.182	88.086	88.157
10	135	88.343	88.098	88.206	88.193	88.081	88.130
11	150	88.327	88.125	88.151	88.144	88.097	88.136
12	165	88.349	88.103	88.178	88.160	88.081	88.141
13	180	88.316	88.119	88.162	88.177	88.070	88.097
14	195	88.316	88.119	88.156	88.155	88.054	88.092
15	210	88.294	88.108	88.156	88.127	88.097	88.125
16	225	88.332	88.103	88.145	88.149	88.065	88.103
17	240	88.305	88.076	88.167	88.133	88.075	88.114
18	255	88.316	88.125	88.184	88.127	88.092	88.092

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 31 DEG. F	TEMP 32 DEG. F	TEMP 33 DEG. F	TEMP 34 DEG. F	TEMP 35 DEG. F	TEMP 36 DEG. F
1	0	88.379	88.291	88.217	88.200	88.662	88.229
2	15	88.346	88.334	88.217	88.200	88.596	88.235
3	30	88.384	88.302	88.189	88.173	88.678	88.207
4	45	88.324	88.307	88.184	88.189	88.634	88.191
5	60	88.303	88.269	88.178	88.151	88.623	88.191
6	75	88.362	88.318	88.189	88.173	88.645	88.207
7	90	88.319	88.285	88.189	88.195	88.580	88.191
8	105	88.362	88.274	88.173	88.167	88.613	88.196
9	120	88.368	88.329	88.189	88.178	88.623	88.191
10	135	88.319	88.263	88.178	88.135	88.553	88.169
11	150	88.313	88.263	88.167	88.173	88.607	88.185
12	165	88.292	88.285	88.162	88.140	88.602	88.152
13	180	88.303	88.231	88.156	88.102	88.596	88.180
14	195	88.264	88.231	88.140	88.151	88.634	88.152
15	210	88.281	88.258	88.151	88.135	88.542	88.158
16	225	88.313	88.242	88.140	88.129	88.585	88.158
17	240	88.286	88.280	88.156	88.129	88.591	88.141
18	255	88.308	88.269	88.140	88.135	88.591	88.163

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 37 DEG. F	TEMP 38 DEG. F	TEMP 39 DEG. F	TEMP 40 DEG. F	PRES 1 PSIA	HUM 1 FRACTION
1	0	88.063	87.909	88.535	87.875	37.514	0.211
2	15	88.042	87.909	88.513	87.865	37.513	0.211
3	30	88.058	87.898	88.529	87.875	37.506	0.211
4	45	88.047	87.893	88.513	87.870	37.504	0.211
5	60	88.036	87.882	88.507	87.859	37.508	0.212
6	75	88.031	87.871	88.496	87.865	37.499	0.211
7	90	88.025	87.882	88.502	88.198	37.503	0.212
8	105	88.020	87.882	88.491	88.165	37.501	0.212
9	120	88.020	87.871	88.464	88.154	37.499	0.212
10	135	88.020	87.876	88.469	88.132	37.498	0.212
11	150	88.020	87.843	88.491	88.121	37.496	0.212
12	165	88.020	87.849	88.464	88.110	37.494	0.213
13	180	88.003	87.849	88.464	88.099	37.493	0.213
14	195	87.992	87.854	88.507	88.094	37.491	0.212
15	210	87.998	87.849	88.458	88.099	37.489	0.213
16	225	87.998	87.849	88.486	88.088	37.489	0.213
17	240	87.992	87.838	88.458	88.083	37.486	0.213
18	255	87.981	87.833	88.486	88.078	37.485	0.213

END OF TABLE

VARIABLE TABLE SUMMARY

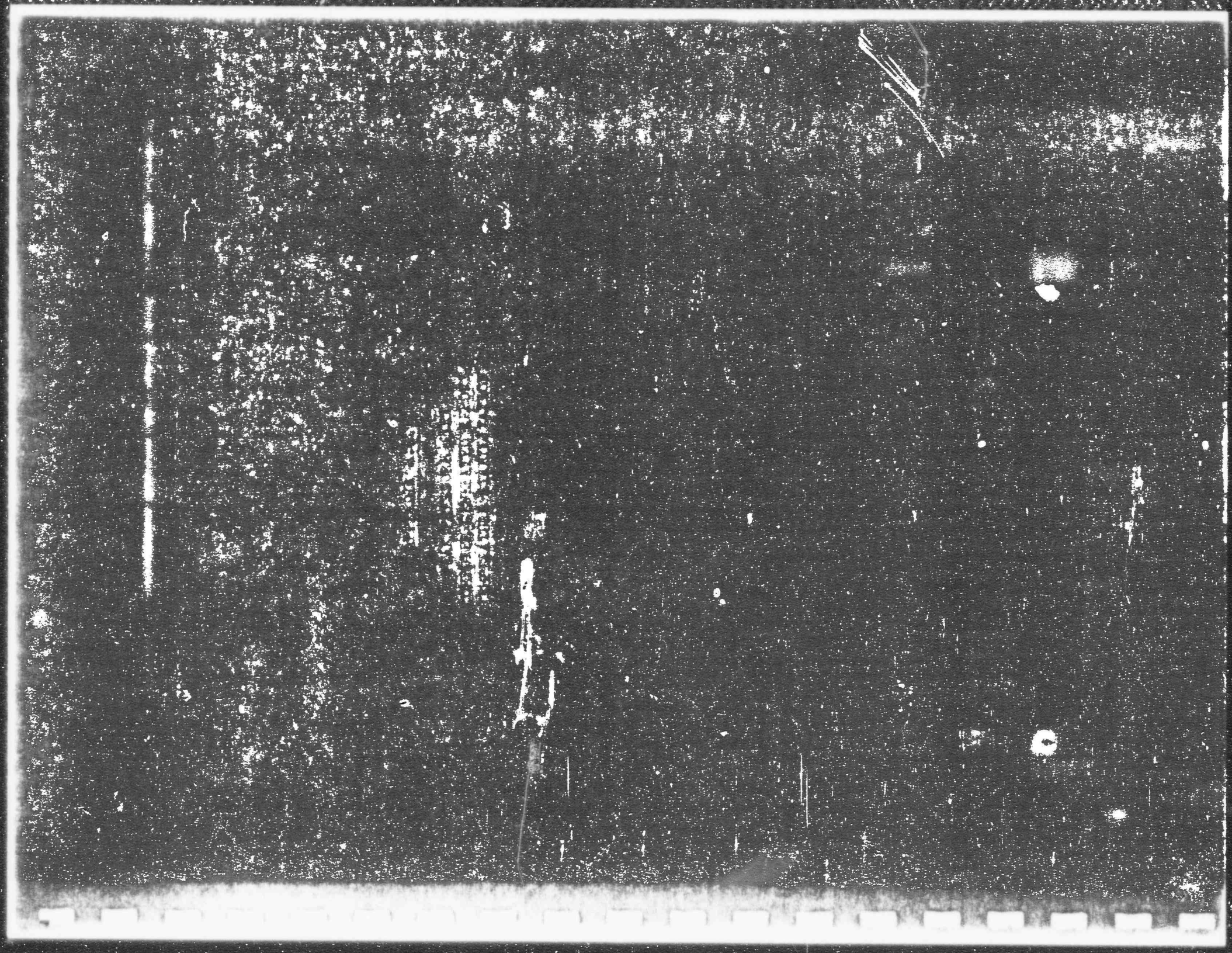
SAMPLE UMBER	DELTA MINS	HUM 2 FRACTION	HUM 3 FRACTION	HUM 4 FRACTION	HUM 5 FRACTION	HUM 6 FRACTION	HUM 7 FRACTION
1	0	0.210	0.202	0.216	0.211	0.213	0.208
2	15	0.210	0.202	0.216	0.211	0.213	0.207
3	30	0.211	0.202	0.216	0.211	0.214	0.208
4	45	0.211	0.203	0.216	0.211	0.214	0.207
5	60	0.211	0.202	0.216	0.211	0.214	0.207
6	75	0.211	0.202	0.216	0.211	0.214	0.208
7	90	0.211	0.202	0.216	0.212	0.214	0.208
8	105	0.211	0.203	0.217	0.212	0.214	0.208
9	120	0.211	0.202	0.216	0.212	0.214	0.208
10	135	0.211	0.204	0.217	0.212	0.214	0.209
11	150	0.212	0.204	0.217	0.212	0.214	0.208
12	165	0.211	0.203	0.217	0.213	0.215	0.208
13	180	0.212	0.205	0.217	0.213	0.215	0.208
14	195	0.212	0.204	0.217	0.213	0.215	0.209
15	210	0.212	0.203	0.217	0.213	0.215	0.209
16	225	0.212	0.204	0.218	0.213	0.215	0.209
17	240	0.212	0.204	0.218	0.213	0.215	0.209
18	255	0.212	0.205	0.218	0.213	0.216	0.209

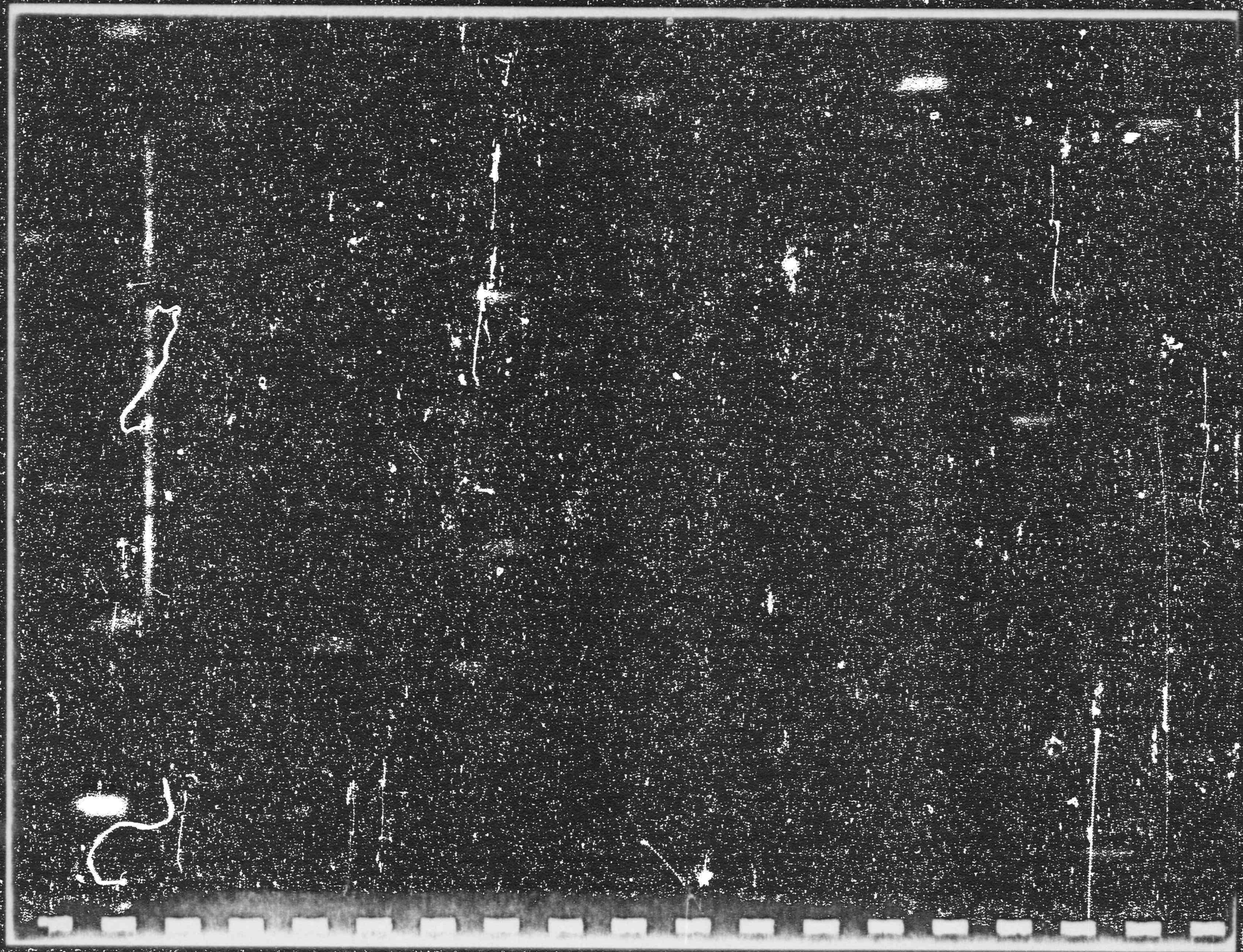
END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	HUM 8 FRACTION	HUM 9 FRACTION	HUM 10 FRACTION
1	0	0.227	0.220	0.223
2	15	0.227	0.220	0.222
3	30	0.227	0.220	0.223
4	45	0.227	0.220	0.223
5	60	0.227	0.220	0.223
6	75	0.228	0.220	0.223
7	90	0.228	0.220	0.223
8	105	0.228	0.221	0.223
9	120	0.228	0.221	0.223
10	135	0.228	0.221	0.223
11	150	0.228	0.221	0.224
12	165	0.228	0.221	0.224
13	180	0.228	0.221	0.224
14	195	0.228	0.221	0.224
15	210	0.229	0.221	0.224
16	225	0.229	0.222	0.224
17	240	0.229	0.222	0.224
18	255	0.229	0.222	0.224

END OF TABLE





TEMPERATURE STABILIZATION
STARTED AT 1400 HOURS ON APRIL 29, 1983
CONDUCTED FOR 4.00 HOURS

A	B	C	D	E
1400	93.468			
1415	93.169			
1430	92.956			
1445	92.775			
1500	92.633			
1515	92.506			
1530	92.382			
1545	92.277			
1600	92.165			
1615	92.069			
1630	91.976			
1645	91.888			
1700	91.807			
1715	91.726			
1730	91.654			
1745	91.578			
1800	91.512	0.489	0.295	0.194

A = TIME OF DAY IN MILITARY STANDARD

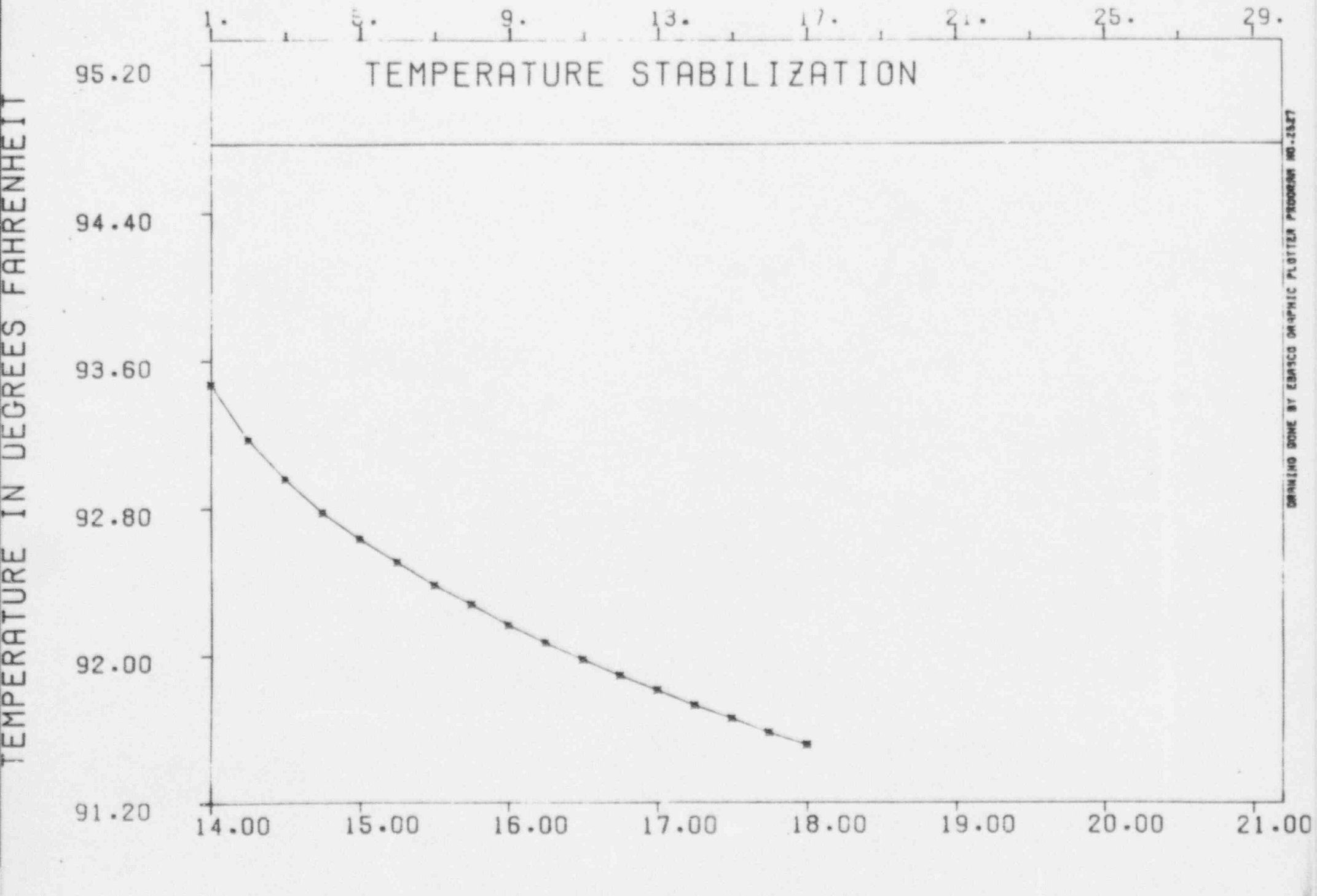
B = AVERAGE CONTAINMENT TEMPERATURE F

C = AVERAGE DIFFERENCE IN TEMP. OVER LAST 4 HOURS

D = AVERAGE DIFFERENCE IN TEMP. OVER LAST 1 HOUR

E = C - D

EBASCO SERVICES INCORPORATED



APPENDIX A-2

PEAK PRESSURE PLOT
COMPUTER GENERATED REPORT
INTEGRATED PARAGE WAVE TEST
PLOT

LOUISIANA POWER & LIGHT COMPANY
WATERFORD SES UNIT NO. 3

CONTAINMENT INTEGRATED LEAKAGE RATE TEST
LEAKAGE RATE MEASURED USING THE ABSOLUTE METHOD
LEAKAGE RATE COMPUTED USING THE MASS POINT METHOD

TEST PERIOD STARTED AT 1800 HOURS ON APRIL 29, 1983
TEST CONDUCTED FOR 24.00 HOURS

FREE SPACE VOLUME OF CONTAINMENT IS 2677000 CU FT
CONTAINMENT WAS PRESSURIZED TO 60.93 PSIA

INITIAL CONTAINMENT AIR WEIGHT 796185.0 LBS
FINAL CONTAINMENT AIR WEIGHT 795731.7 LBS
FITTED MASS POINT LEAKAGE RATE IS 0.0664 % PER DAY
UPPER LIMIT OF 95% CONFIDENCE LEVEL IS 0.068 % PER DAY
NRC MAXIMUM ALLOWABLE LEAKAGE RATE IS 0.375 % PER DAY

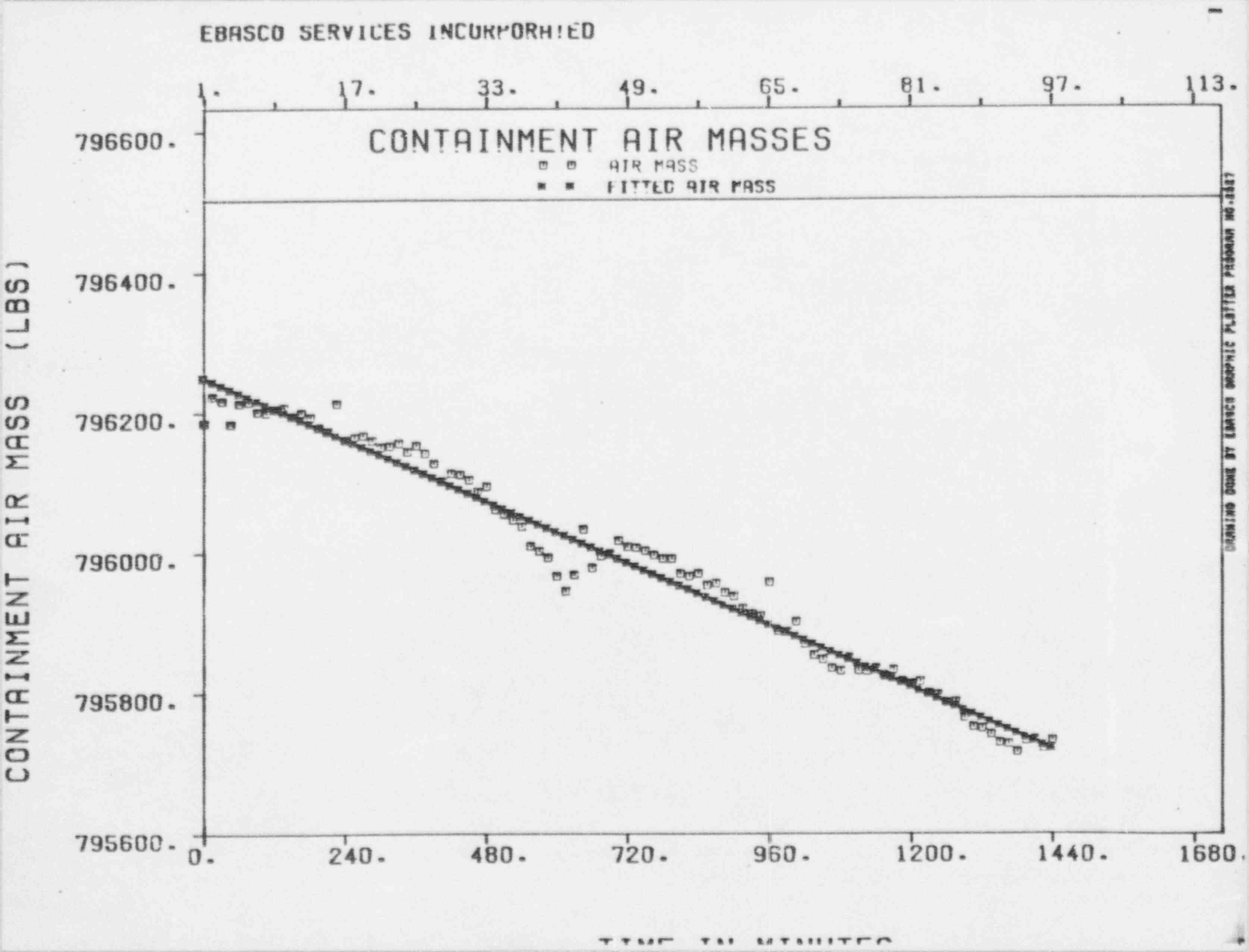
DESCRIPTION OF VARIABLES

AVG. TEM - CONTAINMENT MEAN TEMPERATURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RTD SENSOR INDICATIONS.
AVE. PRE - PRIMARY CONTAINMENT PRESSURE INDICATION.
VAP. PRE - CONTAINMENT VAPOR PRESSURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RHD SENSOR INDICATIONS.
LEAK SIM - SIMPLE TOTAL TIME LEAKAGE RATE.
LEAK MAS - LEAKAGE RATE COMPUTED FROM FIRST ORDER
REGRESSION OF AIR MASS DATA.
AIR MASS - CONTAINMENT AIR MASS.

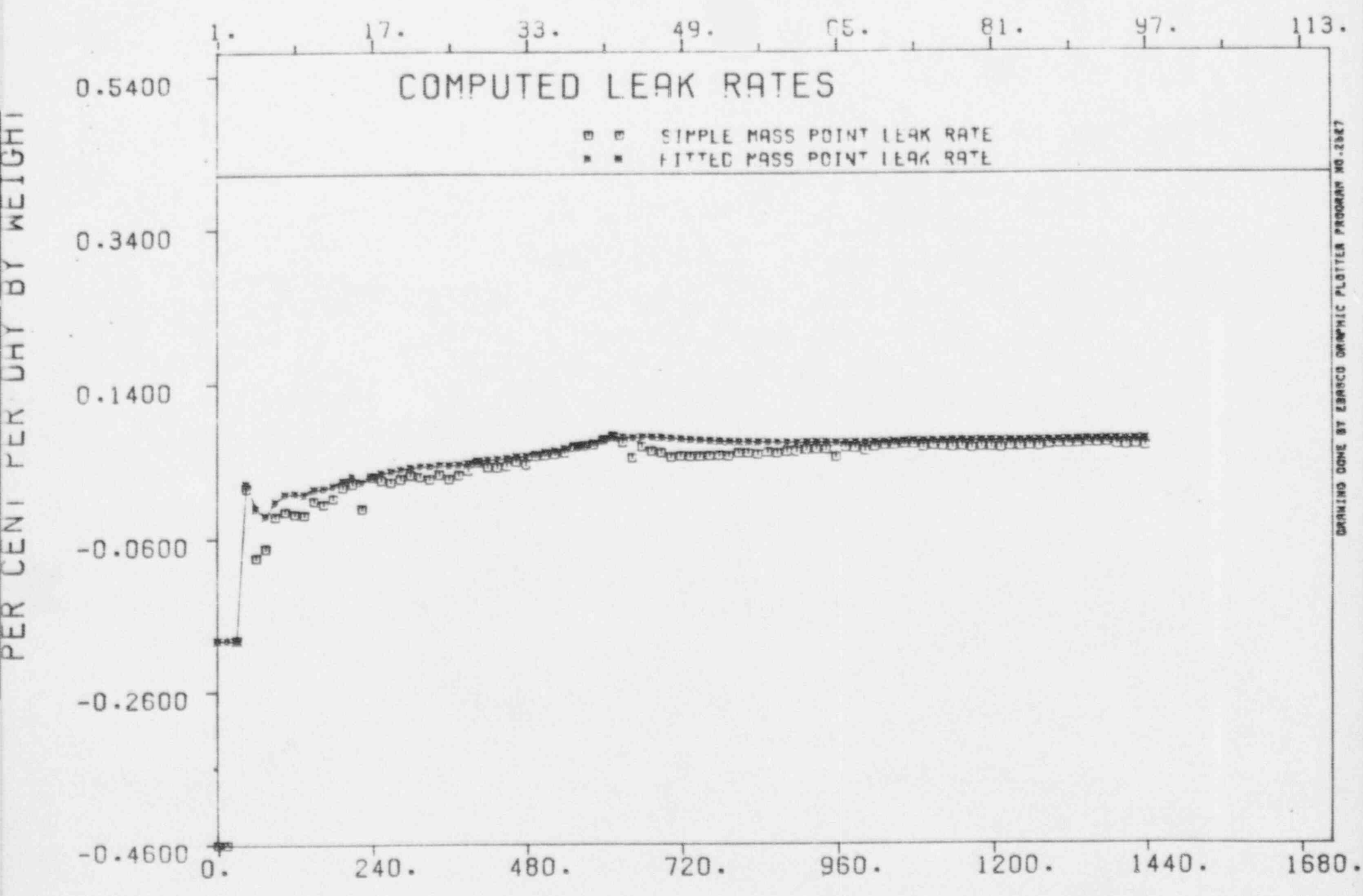
NOTE FOR TABULAR DATA -
TABLE VALUES OF ZERO SIGNIFY DATA IS
NOT APPLICABLE TO THE CALCULATION.

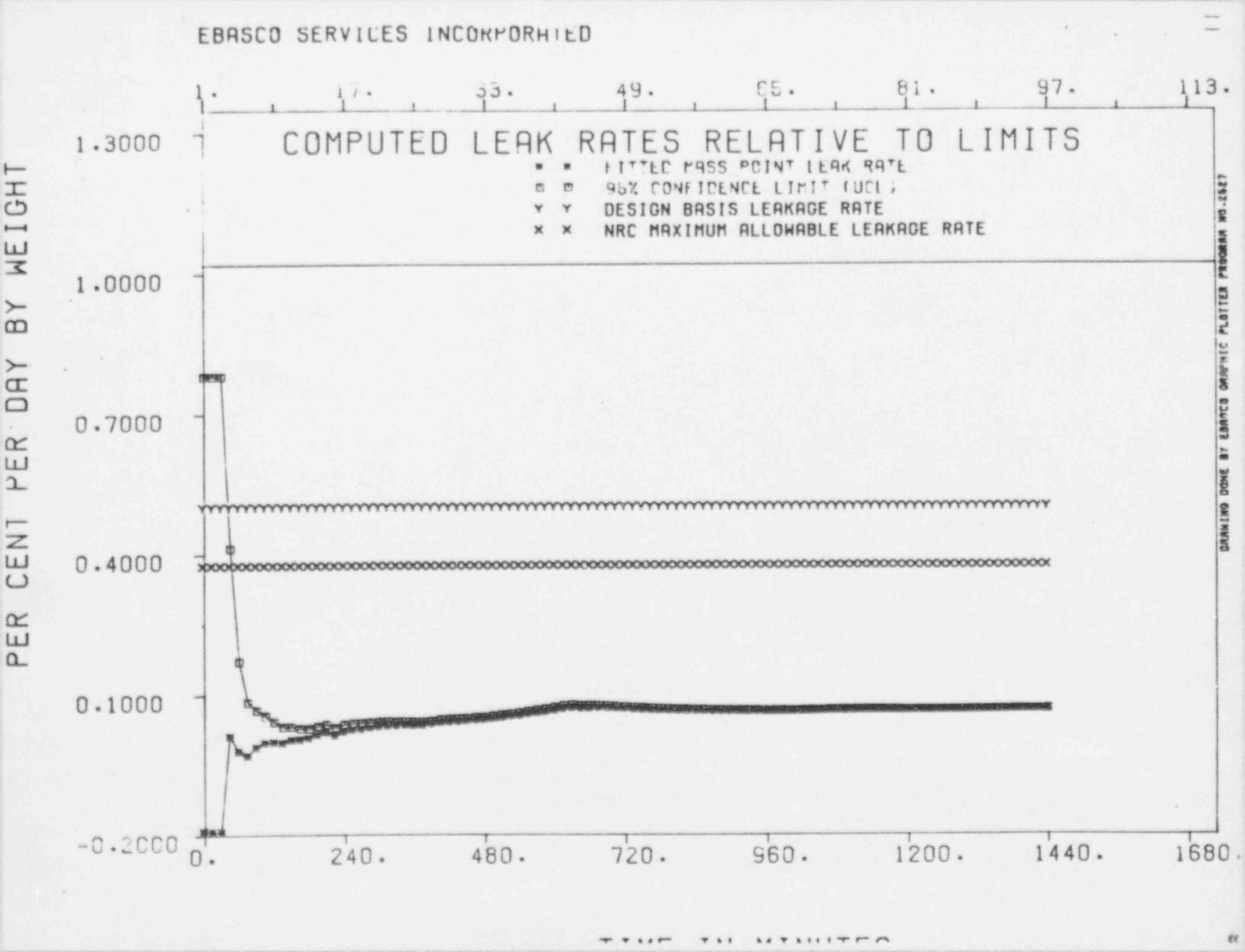
NOTE FOR CURVES -

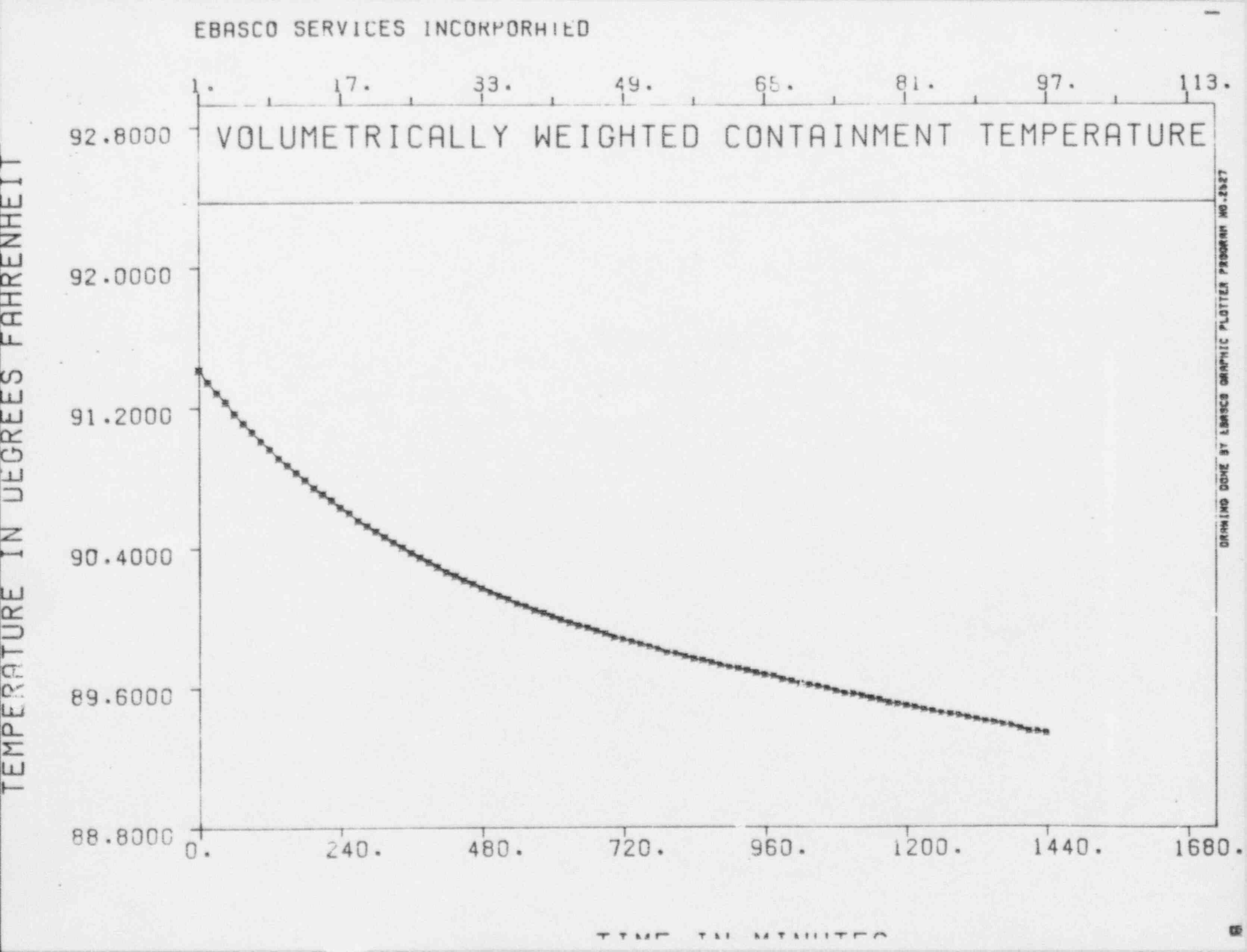
1. TOP ABSCISSA SCALE REPRESENTS SAMPLE NUMBERS.
2. AIR MASS IS THE CALCULATED CONTAINMENT AIR MASS AND FITTED AIR MASS IS THE LINEAR LEAST SQUARE FIT OF THE AIR MASSES.
3. SIMPLE MASS POINT IS THE TOTAL TIME LEAKAGE RATE AND FITTED MASS POINT IS THE LEAKAGE RATE COMPUTED FROM FIRST ORDER REGRESSION OF AIR MASS DATA.
4. UCL IS THE UPPER LIMIT OF THE 95% CONFIDENCE LEVEL OF AIR MASS DATA.

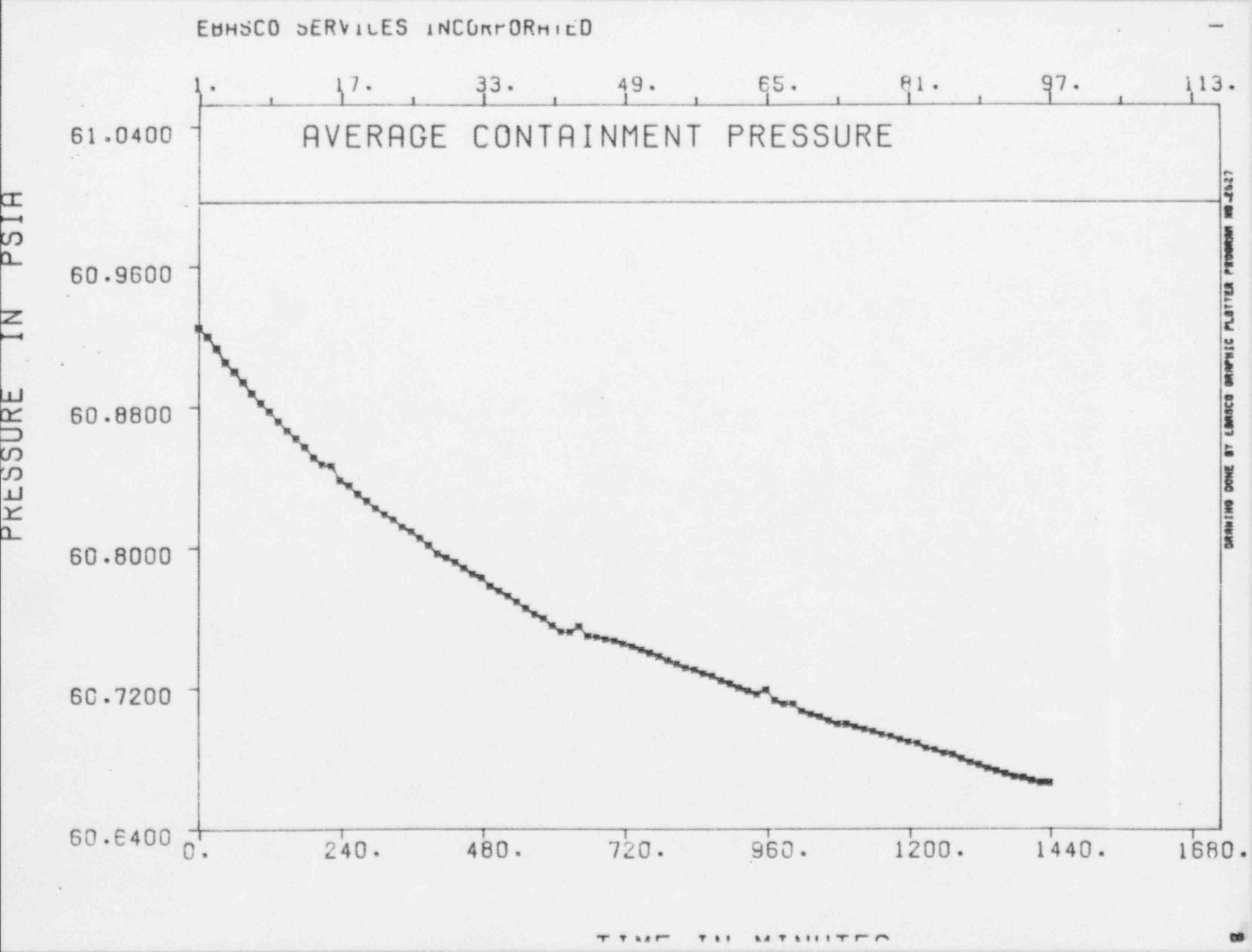

EBASCO SERVICES INCORPORATED
1.
17.
33.
49.
65.
81.
97.
113.
CONTAINMENT AIR MASSES
AIR MASS
FITTED AIR MASS
796600.
796400.
796200.
796000.
795800.
795600.
CONTAINMENT AIR MASS (LBS)
0.
240.
480.
720.
960.
1200.
1440.
1680.

EBASCO SERVICES INCORPORATED

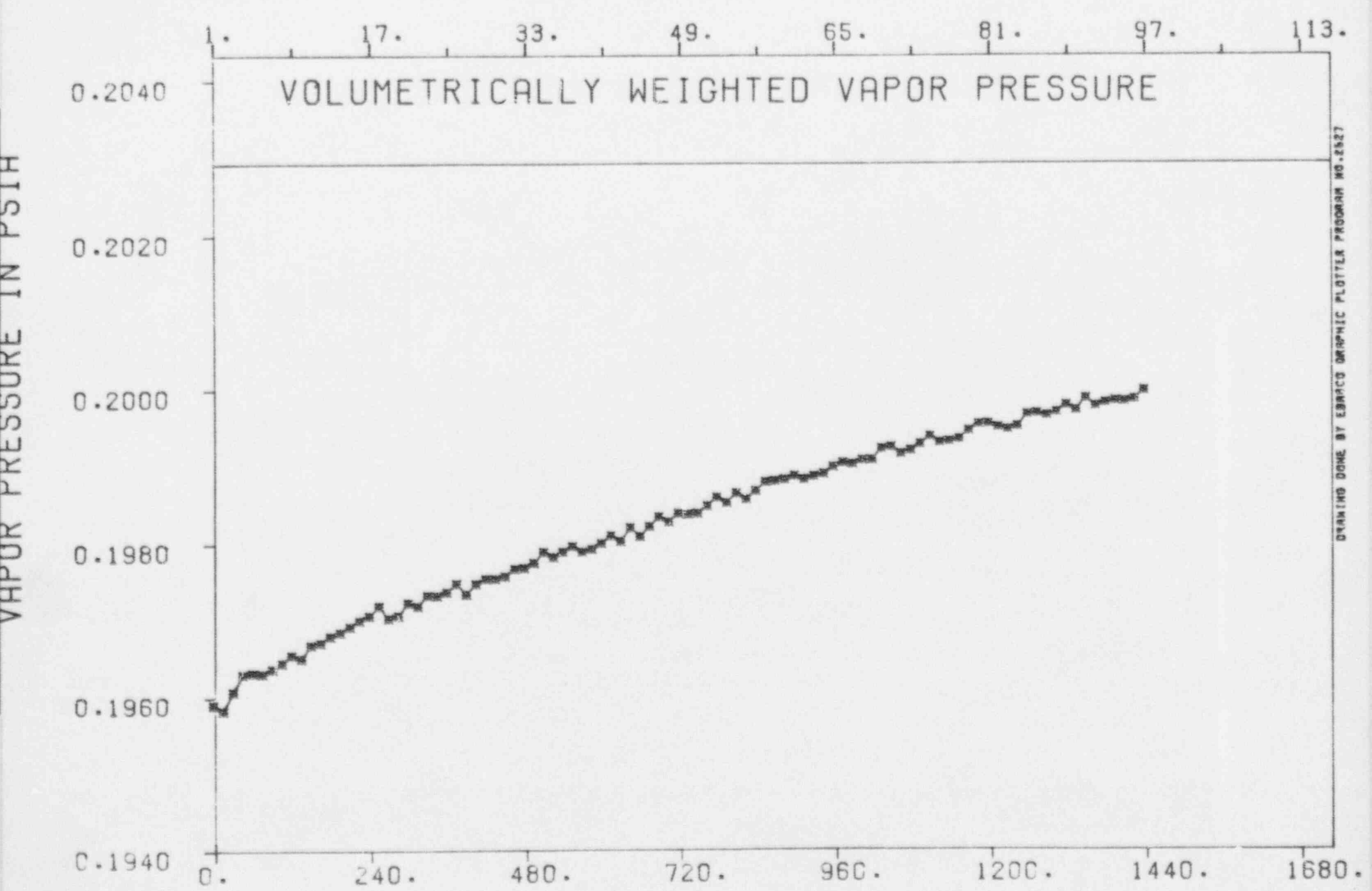



EBASCO SERVICES INCORPORATED
COMPUTED LEAK RATES RELATIVE TO LIMITS
FITTED MASS POINT LEAK RATE
95% CONFIDENCE LIMIT (UCL)
DESIGN BASIS LEAKAGE RATE
NRC MAXIMUM ALLOWABLE LEAKAGE RATE
PER CENT PER DAY BY WEIGHT
TIME IN MINUTES
1.
17.
33.
49.
65.
81.
97.
113.
1.3000
1.0000
0.7000
0.4000
0.1000
-0.2000
0.
240.
480.
720.
960.
1200.
1440.
1680.
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.2527


EBASCO SERVICES INCORPORATED
VOLUMETRICALLY WEIGHTED CONTAINMENT TEMPERATURE
TEMPERATURE IN DEGREES FAHRENHEIT
TIME IN MINUTES
1.
17.
33.
49.
65.
81.
97.
113.
92.8000
92.0000
91.2000
90.4000
89.6000
88.8000
0.
240.
480.
720.
960.
1200.
1440.
1680.
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.2527


EBHSCO SERVICES INCORPORATED
AVERAGE CONTAINMENT PRESSURE
PRESSURE IN PSIA
61.0400
60.9600
60.8800
60.8000
60.7200
60.6400
1.
17.
33.
49.
65.
81.
97.
113.
0.
240.
480.
720.
960.
1200.
1440.
1680.
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NB-2637

EBASCO SERVICES INCORPORATED



VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	AVG. TEM DEG. F	AVG. PRE PSIA	VAP. PRE PSIA	LEAK SIM PER CENT	LEAK MAS PER CENT	AIR MASS POUNDS
1	0	91.414	60.9252	0.1959	0.000	0.000	796185
2	15	91.344	60.9203	0.1958	-0.460	0.000	796223
3	30	91.284	60.9134	0.1961	-0.193	-0.193	796217
4	45	91.232	60.9054	0.1963	0.005	0.012	796184
5	60	91.164	60.9002	0.1963	-0.084	-0.020	796213
6	75	91.109	60.8942	0.1963	-0.073	-0.030	796215
7	90	91.060	60.8879	0.1964	-0.032	-0.012	796201
8	105	91.009	60.8823	0.1964	-0.025	-0.002	796200
9	120	90.962	60.8775	0.1965	-0.029	-0.001	796204
10	135	90.910	60.8719	0.1965	-0.030	-0.003	796207
11	150	90.869	60.8666	0.1967	-0.012	0.004	796195
12	165	90.825	60.8622	0.1967	-0.016	0.005	796200
13	180	90.784	60.8573	0.1968	-0.008	0.008	796193
14	195	90.738	60.8511	0.1968	0.006	0.015	796179
15	210	90.705	60.8471	0.1969	0.010	0.020	796173
16	225	90.668	60.8462	0.1970	-0.022	0.013	796213
17	240	90.630	60.8380	0.1971	0.019	0.021	796160
18	255	90.598	60.8349	0.1972	0.015	0.024	796164
19	270	90.554	60.8301	0.1970	0.012	0.026	796167
20	285	90.523	60.8262	0.1971	0.016	0.029	796159
21	300	90.492	60.8223	0.1972	0.021	0.031	796150
22	315	90.460	60.8188	0.1972	0.019	0.033	796151
23	330	90.428	60.8157	0.1973	0.016	0.033	796156
24	345	90.400	60.8117	0.1973	0.022	0.034	796143
25	360	90.369	60.8090	0.1974	0.016	0.034	796152
26	375	90.343	60.8053	0.1975	0.021	0.035	796141
27	390	90.317	60.8012	0.1973	0.027	0.036	796126
28	405	90.290	60.7965	0.1975	0.037	0.040	796101
29	420	90.260	60.7941	0.1975	0.031	0.041	796112
30	435	90.239	60.7917	0.1975	0.031	0.042	796110
31	450	90.214	60.7884	0.1976	0.033	0.043	796103
32	465	90.194	60.7850	0.1977	0.038	0.045	796086
33	480	90.170	60.7829	0.1977	0.034	0.046	796094
34	495	90.148	60.7781	0.1977	0.045	0.049	796061
35	510	90.127	60.7753	0.1979	0.046	0.051	796054
36	525	90.107	60.7724	0.1978	0.048	0.053	796046
37	540	90.082	60.7691	0.1979	0.050	0.055	796037
38	555	90.067	60.7653	0.1980	0.057	0.058	796009
39	570	90.043	60.7621	0.1979	0.058	0.060	796002
40	585	90.027	60.7596	0.1979	0.060	0.063	795992
41	600	90.007	60.7556	0.1980	0.066	0.065	795966
42	615	89.989	60.7520	0.1981	0.071	0.069	795944
43	630	89.972	60.7518	0.1980	0.062	0.070	795967
44	645	89.955	60.7550	0.1982	0.043	0.069	796032
45	660	89.943	60.7495	0.1981	0.057	0.070	795977
46	675	89.925	60.7489	0.1982	0.051	0.070	795994
47	690	89.910	60.7477	0.1983	0.049	0.069	795998
48	705	89.889	60.7467	0.1983	0.043	0.068	796016
49	720	89.879	60.7450	0.1984	0.045	0.067	796007
50	735	89.866	60.7434	0.1984	0.044	0.066	796006

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	AVG. TEM DEG. F	AVG. PRE PSIA	VAP. PRE PSIA	LEAK SIM PER CENT	LEAK MAS PER CENT	AIR MASS POUNDS
51	750	89.852	60.7416	0.1984	0.044	0.066	796002
52	765	89.838	60.7397	0.1985	0.045	0.065	795996
53	780	89.824	60.7378	0.1986	0.045	0.064	795990
54	795	89.803	60.7354	0.1985	0.044	0.064	795990
55	810	89.798	60.7334	0.1986	0.048	0.063	795969
56	825	89.780	60.7311	0.1986	0.048	0.063	795965
57	840	89.766	60.7299	0.1987	0.046	0.063	795969
58	855	89.757	60.7277	0.1988	0.049	0.062	795952
59	870	89.743	60.7264	0.1988	0.048	0.062	795955
60	885	89.729	60.7239	0.1988	0.050	0.062	795942
61	900	89.716	60.7222	0.1989	0.050	0.062	795937
62	915	89.708	60.7199	0.1988	0.052	0.062	795920
63	930	89.697	60.7181	0.1989	0.053	0.062	795912
64	945	89.682	60.7163	0.1989	0.053	0.062	795909
65	960	89.670	60.7188	0.1990	0.043	0.062	795957
66	975	89.663	60.7127	0.1990	0.055	0.062	795887
67	990	89.645	60.7106	0.1990	0.054	0.062	795887
68	1005	89.634	60.7106	0.1991	0.051	0.062	795901
69	1020	89.620	60.7066	0.1991	0.056	0.062	795869
70	1035	89.612	60.7047	0.1992	0.058	0.063	795853
71	1050	89.604	60.7033	0.1992	0.058	0.063	795847
72	1065	89.593	60.7011	0.1991	0.060	0.064	795834
73	1080	89.578	60.6992	0.1992	0.059	0.064	795831
74	1095	89.564	60.6992	0.1993	0.055	0.064	795850
75	1110	89.561	60.6975	0.1994	0.058	0.064	795831
76	1125	89.550	60.6961	0.1993	0.057	0.065	795830
77	1140	89.536	60.6949	0.1993	0.056	0.065	795834
78	1155	89.527	60.6931	0.1993	0.057	0.065	795823
79	1170	89.511	60.6922	0.1994	0.055	0.065	795832
80	1185	89.504	60.6903	0.1995	0.056	0.065	795816
81	1200	89.494	60.6889	0.1995	0.056	0.065	795813
82	1215	89.485	60.6881	0.1995	0.055	0.065	795816
83	1230	89.473	60.6855	0.1995	0.057	0.065	795799
84	1245	89.464	60.6844	0.1995	0.056	0.065	795797
85	1260	89.453	60.6825	0.1997	0.057	0.065	795786
86	1275	89.446	60.6818	0.1997	0.056	0.065	795787
87	1290	89.441	60.6795	0.1997	0.059	0.065	795765
88	1305	89.428	60.6772	0.1997	0.060	0.065	795751
89	1320	89.418	60.6759	0.1998	0.060	0.066	795749
90	1335	89.406	60.6739	0.1997	0.060	0.066	795741
91	1350	89.400	60.6725	0.1999	0.061	0.066	795729
92	1365	89.387	60.6709	0.1998	0.061	0.066	795727
93	1380	89.379	60.6692	0.1998	0.062	0.066	795715
94	1395	89.362	60.6686	0.1998	0.059	0.066	795731
95	1410	89.346	60.6669	0.1998	0.058	0.066	795734
96	1425	89.343	60.6657	0.1999	0.059	0.067	795721
97	1440	89.334	60.6656	0.2000	0.057	0.066	795732

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 1 DEG. F	TEMP 2 DEG. F	TEMP 3 DEG. F	TEMP 4 DEG. F	TEMP 5 DEG. F	TEMP 6 DEG. F
1	0	91.440	91.426	91.451	91.571	91.566	91.774
2	15	91.352	91.382	91.385	91.478	91.467	91.703
3	30	91.275	91.283	91.303	91.406	91.417	91.719
4	45	91.214	91.222	91.237	91.340	91.351	91.714
5	60	91.148	91.167	91.165	91.285	91.291	91.527
6	75	91.081	91.073	91.105	91.203	91.214	91.555
7	90	91.026	91.002	91.039	91.165	91.165	91.478
8	105	90.971	90.963	90.989	91.088	91.115	91.390
9	120	90.905	90.903	90.923	91.033	91.044	91.362
10	135	90.855	90.826	90.863	90.972	91.000	91.313
11	150	90.800	90.787	90.824	90.917	90.939	91.296
12	165	90.767	90.771	90.764	90.884	90.906	91.198
13	180	90.706	90.705	90.731	90.835	90.846	91.143
14	195	90.657	90.650	90.671	90.775	90.802	91.082
15	210	90.618	90.650	90.632	90.742	90.764	91.044
16	225	90.579	90.600	90.583	90.698	90.709	91.005
17	240	90.541	90.572	90.522	90.665	90.676	90.901
18	255	90.475	90.473	90.506	90.599	90.626	90.989
19	270	90.441	90.413	90.478	90.577	90.582	90.967
20	285	90.414	90.385	90.401	90.544	90.555	90.956
21	300	90.392	90.391	90.385	90.489	90.516	90.808
22	315	90.348	90.325	90.363	90.467	90.472	90.857
23	330	90.298	90.319	90.346	90.423	90.428	90.720
24	345	90.276	90.292	90.291	90.401	90.434	90.714
25	360	90.243	90.253	90.264	90.379	90.390	90.698
26	375	90.215	90.198	90.236	90.313	90.357	90.659
27	390	90.193	90.149	90.203	90.319	90.346	90.725
28	405	90.166	90.143	90.165	90.297	90.308	90.615
29	420	90.121	90.099	90.126	90.198	90.269	90.593
30	435	90.121	90.099	90.104	90.231	90.242	90.588
31	450	90.088	90.077	90.088	90.198	90.231	90.533
32	465	90.055	90.061	90.049	90.154	90.192	90.483
33	480	90.039	90.006	90.027	90.148	90.170	90.533
34	495	90.028	89.995	90.022	90.137	90.165	90.516
35	510	89.989	89.967	89.989	90.121	90.121	90.439
36	525	89.978	89.940	89.951	90.049	90.115	90.434
37	540	89.956	89.935	89.940	90.060	90.082	90.379
38	555	89.929	89.913	89.934	90.044	90.060	90.390
39	570	89.912	89.880	89.918	90.033	90.038	90.439
40	585	89.890	89.907	89.891	89.989	90.038	90.291
41	600	89.868	89.891	89.885	89.978	90.011	90.264
42	615	89.852	89.842	89.858	89.967	89.989	90.286
43	630	89.835	89.804	89.825	89.945	89.978	90.313
44	645	89.813	89.815	89.814	89.923	89.945	90.258
45	660	89.803	89.788	89.803	89.907	89.923	90.236
46	675	89.775	89.771	89.776	89.890	89.901	90.225
47	690	89.759	89.788	89.770	89.879	89.890	90.148
48	705	89.737	89.744	89.759	89.863	89.885	90.165
49	720	89.715	89.739	89.737	89.835	89.852	90.220
50	735	89.720	89.695	89.732	89.835	89.863	90.214

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 1 DEG. F	TEMP 2 DEG. F	TEMP 3 DEG. F	TEMP 4 DEG. F	TEMP 5 DEG. F	TEMP 6 DEG. F
51	750	89.698	89.717	89.694	89.819	89.852	90.140
52	765	89.687	89.668	89.677	89.797	89.819	90.088
53	780	89.671	89.673	89.677	89.792	89.786	90.104
54	795	89.649	89.635	89.644	89.731	89.792	90.033
55	810	89.632	89.641	89.623	89.742	89.770	90.176
56	825	89.611	89.570	89.633	89.742	89.742	90.104
57	840	89.589	89.581	89.623	89.726	89.720	90.121
58	855	89.589	89.652	89.617	89.715	89.709	89.995
59	870	89.572	89.554	89.573	89.698	89.720	90.027
60	885	89.561	89.565	89.573	89.671	89.698	90.005
61	900	89.545	89.548	89.551	89.665	89.698	89.956
62	915	89.539	89.521	89.551	89.660	89.676	89.967
63	930	89.517	89.488	89.562	89.638	89.665	90.027
64	945	89.506	89.521	89.535	89.649	89.643	89.879
65	960	89.490	89.483	89.502	89.534	89.627	89.945
66	975	89.490	89.488	89.497	89.616	89.622	89.962
67	990	89.468	89.450	89.475	89.594	89.605	89.956
68	1005	89.457	89.467	89.480	89.561	89.605	89.874
69	1020	89.435	89.510	89.469	89.567	89.572	89.808
70	1035	89.430	89.407	89.437	89.556	89.561	89.885
71	1050	89.424	89.423	89.437	89.534	89.561	89.868
72	1065	89.424	89.390	89.420	89.545	89.561	89.918
73	1080	89.386	89.352	89.393	89.495	89.539	89.852
74	1095	89.386	89.412	89.398	89.512	89.523	89.775
75	1110	89.369	89.369	89.376	89.506	89.523	89.835
76	1125	89.358	89.390	89.349	89.490	89.517	89.879
77	1140	89.358	89.341	89.360	89.468	89.490	89.874
78	1155	89.347	89.358	89.365	89.473	89.479	89.775
79	1170	89.314	89.390	89.354	89.435	89.473	89.725
80	1185	89.320	89.314	89.327	89.435	89.430	89.813
81	1200	89.309	89.309	89.327	89.435	89.446	89.703
82	1215	89.287	89.309	89.311	89.424	89.446	89.753
83	1230	89.303	89.303	89.278	89.424	89.440	89.659
84	1245	89.287	89.276	89.294	89.408	89.440	89.698
85	1260	89.270	89.309	89.272	89.358	89.413	89.698
86	1275	89.259	89.254	89.278	89.375	89.408	89.665
87	1290	89.248	89.265	89.240	89.353	89.369	89.769
88	1305	89.243	89.243	89.245	89.358	89.380	89.665
89	1320	89.243	89.211	89.251	89.325	89.386	89.659
90	1335	89.210	89.249	89.223	89.331	89.342	89.665
91	1350	89.199	89.167	89.223	89.314	89.353	89.681
92	1365	89.177	89.194	89.218	89.309	89.303	89.637
93	1380	89.188	89.178	89.196	89.309	89.309	89.615
94	1395	89.172	89.151	89.196	89.281	89.309	89.566
95	1410	89.155	89.151	89.201	89.276	89.292	89.560
96	1425	89.150	89.178	89.174	89.265	89.287	89.621
97	1440	89.133	89.145	89.174	89.243	89.270	89.549

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 7 DEG. F	TEMP 8 DEG. F	TEMP 9 DEG. F	TEMP 10 DEG. F	TEMP 11 DEG. F	TEMP 12 DEG. F
1	0	91.303	91.507	91.420	91.817	91.573	91.506
2	15	91.221	91.408	91.316	91.740	91.502	91.401
3	30	91.111	91.342	91.261	91.620	91.409	91.231
4	45	91.083	91.259	91.190	91.609	91.349	91.275
5	60	90.984	91.193	91.135	91.471	91.272	91.198
6	75	90.913	91.138	91.042	91.362	91.223	91.099
7	90	90.847	91.072	90.998	91.389	91.129	91.022
8	105	90.803	91.012	90.949	91.312	91.107	90.956
9	120	90.748	90.962	90.883	91.224	91.053	90.995
10	135	90.671	90.902	90.828	91.175	90.927	90.846
11	150	90.643	90.841	90.773	91.153	90.932	90.808
12	165	90.583	90.797	90.718	91.087	90.850	90.698
13	180	90.522	90.759	90.669	91.049	90.833	90.637
14	195	90.489	90.704	90.636	91.005	90.795	90.643
15	210	90.456	90.687	90.592	90.972	90.768	90.665
16	225	90.440	90.638	90.532	90.895	90.702	90.566
17	240	90.418	90.577	90.510	90.824	90.658	90.549
18	255	90.319	90.533	90.455	90.857	90.669	90.511
19	270	90.264	90.500	90.439	90.708	90.543	90.462
20	285	90.269	90.451	90.351	90.703	90.554	90.390
21	300	90.231	90.407	90.351	90.747	90.493	90.379
22	315	90.176	90.401	90.302	90.609	90.499	90.429
23	330	90.176	90.346	90.280	90.571	90.466	90.302
24	345	90.104	90.319	90.269	90.620	90.433	90.291
25	360	90.104	90.297	90.203	90.511	90.329	90.225
26	375	90.033	90.253	90.197	90.560	90.367	90.132
27	390	90.006	90.236	90.159	90.406	90.362	90.159
28	405	89.989	90.203	90.132	90.467	90.247	90.181
29	420	89.956	90.165	90.115	90.450	90.269	90.038
30	435	89.951	90.143	90.093	90.434	90.214	90.027
31	450	89.902	90.137	90.049	90.434	90.186	90.049
32	465	89.946	90.104	90.022	90.417	90.197	89.984
33	480	89.837	90.066	89.995	90.368	90.170	90.066
34	495	89.820	90.055	89.989	90.340	90.093	89.973
35	510	89.793	90.017	89.934	90.291	90.110	89.946
36	525	89.788	89.995	89.940	90.264	90.088	89.897
37	540	89.766	89.973	89.912	90.286	90.049	89.837
38	555	89.761	89.967	89.885	90.236	90.055	89.869
39	570	89.706	89.940	89.863	90.154	90.044	89.826
40	585	89.723	89.918	89.830	90.170	90.000	89.837
41	600	89.679	89.913	89.819	90.236	89.973	89.858
42	615	89.663	89.907	89.808	90.143	89.962	89.842
43	630	89.614	89.864	89.792	90.154	89.929	89.733
44	645	89.630	89.869	89.732	90.143	89.929	89.722
45	660	89.597	89.826	89.748	90.137	89.924	89.755
46	675	89.608	89.815	89.710	90.165	89.902	89.744
47	690	89.597	89.799	89.710	90.077	89.902	89.722
48	705	89.565	89.788	89.671	90.104	89.805	89.749
49	720	89.554	89.782	89.677	90.016	89.832	89.630
50	735	89.548	89.755	89.622	90.060	89.848	89.619

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 7 DEG. F	TEMP 8 DEG. F	TEMP 9 DEG. F	TEMP 10 DEG. F	TEMP 11 DEG. F	TEMP 12 DEG. F
51	750	89.527	89.733	89.639	90.022	89.805	89.608
52	765	89.516	89.706	89.639	90.000	89.810	89.679
53	780	89.494	89.711	89.639	90.011	89.772	89.673
54	795	89.483	89.706	89.622	89.956	89.799	89.515
55	810	89.461	89.690	89.584	89.935	89.745	89.570
56	825	89.418	89.673	89.600	90.000	89.794	89.537
57	840	89.418	89.652	89.567	89.929	89.729	89.542
58	855	89.434	89.619	89.562	89.869	89.739	89.662
59	870	89.402	89.619	89.540	89.896	89.701	89.504
60	885	89.391	89.608	89.540	89.907	89.674	89.477
61	900	89.391	89.592	89.524	89.853	89.669	89.581
62	915	89.363	89.570	89.502	89.896	89.669	89.581
63	930	89.336	89.543	89.507	89.853	89.653	89.499
64	945	89.385	89.575	89.474	89.804	89.663	89.477
65	960	89.347	89.554	89.474	89.798	89.615	89.455
66	975	89.320	89.532	89.480	89.755	89.620	89.477
67	990	89.298	89.510	89.458	89.782	89.625	89.461
68	1005	89.298	89.488	89.430	89.722	89.636	89.439
69	1020	89.314	89.472	89.430	89.733	89.604	89.390
70	1035	89.287	89.472	89.414	89.728	89.598	89.357
71	1050	89.298	89.461	89.376	89.777	89.522	89.455
72	1065	89.233	89.434	89.370	89.728	89.511	89.390
73	1080	89.233	89.418	89.381	89.728	89.501	89.303
74	1095	89.222	89.439	89.348	89.673	89.441	89.352
75	1110	89.217	89.434	89.354	89.684	89.522	89.341
76	1125	89.200	89.434	89.348	89.608	89.473	89.286
77	1140	89.189	89.374	89.337	89.673	89.517	89.395
78	1155	89.178	89.401	89.337	89.662	89.457	89.270
79	1170	89.217	89.363	89.304	89.640	89.425	89.286
80	1185	89.146	89.385	89.299	89.629	89.468	89.374
81	1200	89.135	89.341	89.310	89.629	89.408	89.352
82	1215	89.157	89.336	89.250	89.640	89.435	89.248
83	1230	89.129	89.341	89.239	89.613	89.425	89.210
84	1245	89.113	89.314	89.261	89.597	89.387	89.227
85	1260	89.108	89.320	89.239	89.553	89.365	89.199
86	1275	89.091	89.309	89.228	89.531	89.343	89.254
87	1290	89.075	89.281	89.228	89.531	89.392	89.194
88	1305	89.081	89.287	89.184	89.537	89.354	89.254
89	1320	89.053	89.265	89.195	89.542	89.349	89.210
90	1335	89.086	89.271	89.189	89.471	89.381	89.156
91	1350	89.059	89.249	89.173	89.575	89.300	89.134
92	1365	89.053	89.243	89.168	89.537	89.300	89.156
93	1380	89.075	89.227	89.135	89.499	89.327	89.178
94	1395	89.026	89.216	89.146	89.526	89.327	89.205
95	1410	89.004	89.183	89.151	89.488	89.256	89.161
96	1425	88.999	89.205	89.135	89.471	89.311	89.150
97	1440	88.993	89.194	89.096	89.422	89.256	89.167

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 13 DEG. F	TEMP 14 DEG. F	TEMP 15 DEG. F	TEMP 16 DEG. F	TEMP 17 DEG. F	TEMP 18 DEG. F
1	0	91.294	91.039	91.332	91.380	90.049	DELETED
2	15	91.239	91.039	91.255	91.314	90.038	DELETED
3	30	91.178	90.957	91.205	91.254	90.055	DELETED
4	45	91.134	90.902	91.145	91.171	90.000	DELETED
5	60	91.079	90.836	91.079	91.138	89.984	DELETED
6	75	91.024	90.775	91.007	91.105	89.962	DELETED
7	90	90.980	90.737	91.002	91.050	89.907	DELETED
8	105	90.942	90.676	90.925	91.006	89.901	DELETED
9	120	90.881	90.654	90.886	90.929	89.874	DELETED
10	135	90.837	90.605	90.837	90.896	89.858	DELETED
11	150	90.782	90.544	90.782	90.847	89.847	DELETED
12	165	90.754	90.533	90.721	90.808	89.836	DELETED
13	180	90.705	90.489	90.671	90.764	89.792	DELETED
14	195	90.661	90.423	90.644	90.731	89.792	DELETED
15	210	90.633	90.396	90.589	90.676	89.770	DELETED
16	225	90.589	90.346	90.589	90.627	89.754	DELETED
17	240	90.556	90.313	90.512	90.621	89.715	DELETED
18	255	90.518	90.319	90.495	90.555	89.688	DELETED
19	270	90.490	90.242	90.451	90.533	89.677	DELETED
20	285	90.463	90.225	90.413	90.539	89.650	DELETED
21	300	90.430	90.214	90.385	90.456	89.639	DELETED
22	315	90.391	90.192	90.358	90.423	89.584	DELETED
23	330	90.347	90.132	90.352	90.368	89.578	DELETED
24	345	90.341	90.143	90.297	90.368	89.584	DELETED
25	360	90.297	90.099	90.275	90.341	89.573	DELETED
26	375	90.275	90.071	90.248	90.308	89.551	DELETED
27	390	90.248	90.033	90.220	90.286	89.524	DELETED
28	405	90.231	90.011	90.182	90.253	89.502	DELETED
29	420	90.204	89.973	90.176	90.203	89.469	DELETED
30	435	90.171	89.962	90.127	90.209	89.463	DELETED
31	450	90.154	89.919	90.138	90.181	89.425	DELETED
32	465	90.116	89.913	90.105	90.154	89.436	DELETED
33	480	90.105	89.886	90.088	90.154	89.403	DELETED
34	495	90.083	89.859	90.039	90.104	89.387	DELETED
35	510	90.066	89.859	90.028	90.099	89.381	DELETED
36	525	90.050	89.837	90.006	90.055	89.370	DELETED
37	540	90.022	89.816	89.995	90.055	89.337	DELETED
38	555	90.006	89.778	89.978	90.011	89.343	DELETED
39	570	89.973	89.761	89.956	89.989	89.299	DELETED
40	585	89.967	89.745	89.929	90.027	89.315	DELETED
41	600	89.945	89.707	89.901	89.967	89.294	DELETED
42	615	89.923	89.712	89.890	89.929	89.266	DELETED
43	630	89.907	89.712	89.901	89.951	89.261	DELETED
44	645	89.885	89.669	89.863	89.890	89.255	DELETED
45	660	89.869	89.658	89.868	89.907	89.233	DELETED
46	675	89.858	89.658	89.846	89.896	89.211	DELETED
47	690	89.830	89.647	89.841	89.857	89.211	DELETED
48	705	89.819	89.636	89.808	89.841	89.200	DELETED
49	720	89.809	89.604	89.786	89.841	89.189	DELETED
50	735	89.798	89.582	89.775	89.841	89.189	DELETED

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	TEMP 13 DEG. F	TEMP 14 DEG. F	TEMP 15 DEG. F	TEMP 16 DEG. F	TEMP 17 DEG. F	TEMP 18 DEG F
51	750	89.781	89.609	89.753	89.825	89.173	DELETED
52	765	89.765	89.593	89.736	89.792	89.184	DELETED
53	780	89.759	89.544	89.742	89.759	89.151	DELETED
54	795	89.737	89.539	89.720	89.748	89.168	DELETED
55	810	89.721	89.533	89.720	89.748	89.107	DELETED
56	825	89.705	89.495	89.698	89.704	89.124	DELETED
57	840	89.694	89.485	89.692	89.693	89.118	DELETED
58	855	89.677	89.495	89.687	89.704	89.118	DELETED
59	870	89.666	89.495	89.665	89.693	89.113	DELETED
60	885	89.650	89.463	89.670	89.671	89.091	DELETED
61	900	89.644	89.457	89.643	89.660	89.091	DELETED
62	915	89.628	89.425	89.626	89.644	89.080	DELETED
63	930	89.628	89.425	89.610	89.633	89.069	DELETED
64	945	89.606	89.409	89.615	89.616	89.074	DELETED
65	960	89.595	89.414	89.588	89.622	89.064	DELETED
66	975	89.584	89.398	89.582	89.605	89.064	DELETED
67	990	89.579	89.392	89.560	89.594	89.058	DELETED
68	1005	89.551	89.392	89.549	89.567	89.020	DELETED
69	1020	89.546	89.365	89.566	89.556	89.047	DELETED
70	1035	89.546	89.338	89.555	89.561	89.014	DELETED
71	1050	89.524	89.354	89.555	89.545	88.998	DELETED
72	1065	89.530	89.333	89.522	89.507	88.992	DELETED
73	1080	89.519	89.327	89.516	89.539	88.976	DELETED
74	1095	89.502	89.316	89.516	89.507	88.959	DELETED
75	1110	89.497	89.300	89.500	89.468	88.976	DELETED
76	1125	89.486	89.305	89.484	89.501	88.965	DELETED
77	1140	89.480	89.289	89.462	89.496	88.965	DELETED
78	1155	89.464	89.273	89.467	89.496	88.910	DELETED
79	1170	89.442	89.284	89.478	89.463	88.932	DELETED
80	1185	89.437	89.268	89.418	89.413	88.943	DELETED
81	1200	89.442	89.230	89.445	89.435	88.921	DELETED
82	1215	89.426	89.251	89.434	89.435	88.921	DELETED
83	1230	89.415	89.240	89.390	89.419	88.916	DELETED
84	1245	89.409	89.219	89.407	89.402	88.910	DELETED
85	1260	89.404	89.186	89.401	89.397	88.888	DELETED
86	1275	89.393	89.208	89.390	89.391	88.866	DELETED
87	1290	89.393	89.181	89.363	89.402	88.888	DELETED
88	1305	89.371	89.192	89.374	89.430	88.888	DELETED
89	1320	89.365	89.197	89.357	89.364	88.850	DELETED
90	1335	89.360	89.159	89.363	89.364	88.877	DELETED
91	1350	89.349	89.148	89.357	89.370	88.839	DELETED
92	1365	89.338	89.164	89.335	89.353	88.861	DELETED
93	1380	89.338	89.143	89.324	89.320	88.850	DELETED
94	1395	89.294	88.644	89.247	89.309	88.850	DELETED
95	1410	89.278	88.633	89.253	89.276	88.844	DELETED
96	1425	89.272	88.616	89.236	89.298	88.834	DELETED
97	1440	89.256	88.633	89.236	89.282	88.844	DELETED

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 19 DEG. F	TEMP 20 DEG. F	TEMP 21 DEG. F	TEMP 22 DEG. F	TEMP 23 DEG. F	TEMP 24 DEG. F
1	0	89.864	DELETED	91.716	91.851	91.897	93.410
2	15	89.864	DELETED	91.617	91.736	91.765	93.344
3	30	89.842	DELETED	91.567	91.686	91.710	93.284
4	45	89.831	DELETED	91.496	91.598	91.666	93.135
5	60	89.804	DELETED	91.419	91.527	91.556	93.042
6	75	89.815	DELETED	91.358	91.494	91.529	92.910
7	90	89.777	DELETED	91.309	91.417	91.457	92.877
8	105	89.766	DELETED	91.237	91.346	91.391	92.783
9	120	89.766	DELETED	91.166	91.291	91.331	92.772
10	135	89.744	DELETED	91.122	91.252	91.320	92.668
11	150	89.728	DELETED	91.072	91.175	91.215	92.646
12	165	89.712	DELETED	91.023	91.137	91.182	92.624
13	180	89.695	DELETED	90.973	91.088	91.122	92.569
14	195	89.685	DELETED	90.918	91.038	91.072	92.453
15	210	89.668	DELETED	90.880	91.005	91.017	92.420
16	225	89.647	DELETED	90.841	90.950	90.979	92.398
17	240	89.647	DELETED	90.786	90.901	90.962	92.365
18	255	89.630	DELETED	90.753	90.862	90.902	92.382
19	270	89.598	DELETED	90.715	90.824	90.896	92.272
20	285	89.592	DELETED	90.665	90.796	90.891	92.211
21	300	89.592	DELETED	90.632	90.752	90.819	92.173
22	315	89.554	DELETED	90.610	90.703	90.753	92.129
23	330	89.543	DELETED	90.566	90.714	90.709	92.162
24	345	89.543	DELETED	90.550	90.654	90.693	92.068
25	360	89.505	DELETED	90.500	90.626	90.671	92.046
26	375	89.511	DELETED	90.462	90.582	90.671	92.068
27	390	89.483	DELETED	90.434	90.549	90.627	91.959
28	405	89.478	DELETED	90.418	90.533	90.583	91.959
29	420	89.467	DELETED	90.368	90.489	90.588	91.892
30	435	89.456	DELETED	90.352	90.456	90.506	91.865
31	450	89.429	DELETED	90.319	90.423	90.511	91.848
32	465	89.424	DELETED	90.297	90.412	90.511	91.848
33	480	89.413	DELETED	90.258	90.373	90.473	91.826
34	495	89.396	DELETED	90.264	90.368	90.423	91.799
35	510	89.386	DELETED	90.236	90.341	90.462	91.755
36	525	89.380	DELETED	90.209	90.313	90.418	91.777
37	540	89.364	DELETED	90.176	90.291	90.341	91.744
38	555	89.364	DELETED	90.165	90.264	90.352	91.689
39	570	89.347	DELETED	90.137	90.258	90.313	91.672
40	585	89.331	DELETED	90.121	90.231	90.302	91.661
41	600	89.320	DELETED	90.099	90.192	90.236	91.606
42	615	89.309	DELETED	90.082	90.187	90.231	91.601
43	630	89.299	DELETED	90.055	90.165	90.242	91.560
44	645	89.293	DELETED	90.044	90.148	90.192	91.628
45	660	89.277	DELETED	90.022	90.132	90.236	91.557
46	675	89.277	DELETED	90.000	90.110	90.159	91.551
47	690	89.271	DELETED	89.989	90.099	90.137	91.540
48	705	89.244	DELETED	89.967	90.066	90.115	91.507
49	720	89.250	DELETED	89.967	90.066	90.137	91.502
50	735	89.244	DELETED	89.945	90.060	90.148	91.463

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 19 DEG. F	TEMP 20 DEG. F	TEMP 21 DEG. F	TEMP 22 DEG. F	TEMP 23 DEG. F	TEMP 24 DEG. F
51	750	89.233	DELETED	89.929	90.038	90.110	91.469
52	765	89.222	DELETED	89.907	90.022	90.115	91.458
53	780	89.201	DELETED	89.879	90.016	90.027	91.425
54	795	89.195	DELETED	89.879	89.995	90.017	91.386
55	810	89.190	DELETED	89.879	89.984	90.044	91.392
56	825	89.184	DELETED	89.846	89.956	90.011	91.370
57	840	89.190	DELETED	89.830	89.956	90.006	91.375
58	855	89.179	DELETED	89.819	89.940	89.989	91.348
59	870	89.168	DELETED	89.813	89.929	89.978	91.337
60	885	89.168	DELETED	89.797	89.918	89.984	91.315
61	900	89.157	DELETED	89.786	89.901	89.940	91.293
62	915	89.141	DELETED	89.769	89.885	89.945	91.265
63	930	89.141	DELETED	89.780	89.885	89.940	91.249
64	945	89.130	DELETED	89.748	89.874	89.901	91.249
65	960	89.125	DELETED	89.726	89.852	89.951	91.238
66	975	89.125	DELETED	89.726	89.841	89.879	91.221
67	990	89.119	DELETED	89.704	89.819	89.863	91.210
68	1005	89.108	DELETED	89.698	89.808	89.874	91.210
69	1020	89.103	DELETED	89.676	89.808	89.830	91.199
70	1035	89.097	DELETED	89.654	89.781	89.863	91.188
71	1050	89.103	DELETED	89.649	89.764	89.813	91.150
72	1065	89.086	DELETED	89.638	89.775	89.824	91.183
73	1080	89.070	DELETED	89.638	89.764	89.824	91.161
74	1095	89.076	DELETED	89.632	89.737	89.769	91.122
75	1110	89.081	DELETED	89.632	89.737	89.780	91.122
76	1125	89.070	DELETED	89.599	89.720	89.775	91.117
77	1140	88.956	DELETED	89.572	89.698	89.726	91.100
78	1155	88.951	DELETED	89.588	89.693	89.759	91.100
79	1170	88.967	DELETED	89.561	89.682	89.715	91.089
80	1185	88.951	DELETED	89.555	89.677	89.704	91.089
81	1200	88.951	DELETED	89.539	89.671	89.709	91.029
82	1215	88.929	DELETED	89.539	89.644	89.693	91.034
83	1230	88.929	DELETED	89.523	89.633	89.682	91.029
84	1245	88.918	DELETED	89.506	89.633	89.715	91.023
85	1260	88.907	DELETED	89.512	89.633	89.704	91.023
86	1275	88.907	DELETED	89.495	89.622	89.687	91.007
87	1290	88.902	DELETED	89.490	89.600	89.632	90.990
88	1305	88.896	DELETED	89.473	89.583	89.632	90.979
89	1320	88.896	DELETED	89.462	89.583	89.687	90.957
90	1335	88.896	DELETED	89.462	89.561	89.605	90.974
91	1350	88.880	DELETED	89.462	89.561	89.605	90.957
92	1365	88.800	DELETED	89.446	89.556	89.599	90.952
93	1380	88.880	DELETED	89.413	89.556	89.572	90.946
94	1395	88.874	DELETED	89.413	89.539	89.566	90.913
95	1410	88.869	DELETED	89.396	89.523	89.539	90.902
96	1425	88.880	DELETED	89.402	89.512	89.544	90.941
97	1440	88.864	DELETED	89.396	89.507	89.533	90.891

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 25 DEG. F	TEMP 26 DEG. F	TEMP 27 DEG. F	TEMP 28 DEG. F	TEMP 29 DEG. F	TEMP 30 DEG. F
1	0	91.719	91.456	91.467	91.610	91.381	91.489
2	15	91.648	91.357	91.390	91.516	91.392	91.440
3	30	91.533	91.291	91.335	91.450	91.288	91.380
4	45	91.473	91.269	91.329	91.378	91.222	91.297
5	60	91.440	91.159	91.208	91.290	91.211	91.226
6	75	91.374	91.121	91.186	91.235	91.106	91.161
7	90	91.298	91.060	91.153	91.207	91.062	91.100
8	105	91.248	91.038	91.071	91.152	90.996	91.046
9	120	91.166	90.951	91.055	91.064	90.952	90.974
10	135	91.122	90.929	91.011	91.031	90.881	90.920
11	150	91.073	90.852	90.906	90.965	90.892	90.859
12	165	91.007	90.841	90.906	90.921	90.809	90.854
13	180	90.986	90.786	90.857	90.871	90.782	90.794
14	195	90.947	90.720	90.780	90.821	90.737	90.755
15	210	90.898	90.714	90.769	90.777	90.660	90.701
16	225	90.860	90.665	90.709	90.733	90.655	90.657
17	240	90.827	90.659	90.670	90.695	90.633	90.608
18	255	90.778	90.588	90.621	90.700	90.534	90.586
19	270	90.723	90.571	90.582	90.606	90.517	90.542
20	285	90.673	90.516	90.577	90.584	90.506	90.487
21	300	90.668	90.467	90.516	90.540	90.440	90.465
22	315	90.619	90.440	90.516	90.518	90.424	90.432
23	330	90.613	90.418	90.480	90.463	90.363	90.411
24	345	90.553	90.385	90.439	90.419	90.341	90.372
25	360	90.515	90.330	90.428	90.391	90.292	90.334
26	375	90.471	90.308	90.401	90.375	90.286	90.296
27	390	90.476	90.297	90.341	90.342	90.248	90.285
28	405	90.416	90.280	90.302	90.331	90.248	90.246
29	420	90.400	90.231	90.319	90.281	90.209	90.219
30	435	90.400	90.220	90.313	90.265	90.171	90.208
31	450	90.356	90.181	90.236	90.254	90.160	90.164
32	465	90.350	90.132	90.220	90.221	90.154	90.153
33	480	90.301	90.126	90.198	90.204	90.116	90.131
34	495	90.301	90.121	90.203	90.160	90.077	90.104
35	510	90.285	90.088	90.159	90.160	90.055	90.071
36	525	90.268	90.071	90.137	90.121	90.066	90.055
37	540	90.230	90.027	90.121	90.099	90.028	90.027
38	555	90.214	90.033	90.082	90.094	89.984	90.016
39	570	90.175	90.000	90.077	90.033	89.956	90.011
40	585	90.153	89.989	90.066	90.033	89.956	89.967
41	600	90.153	89.973	90.038	90.017	89.962	89.934
42	615	90.126	89.951	89.989	90.017	89.913	89.945
43	630	90.115	89.919	90.000	89.973	89.907	89.902
44	645	90.099	89.930	89.983	89.951	89.902	89.891
45	660	90.099	89.892	89.961	89.940	89.852	89.880
46	675	90.049	89.843	89.917	89.923	89.880	89.880
47	690	90.038	89.859	89.950	89.890	89.831	89.863
48	705	90.022	89.837	89.900	89.852	89.820	89.820
49	720	90.005	89.837	89.928	89.857	89.825	89.825
50	735	90.000	89.810	89.889	89.874	89.765	89.803

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	TEMP 25 DEG. F	TEMP 26 DEG. F	TEMP 27 DEG. F	TEMP 28 DEG. F	TEMP 29 DEG. F	TEMP 30 DEG. F
51	750	89.967	89.805	89.862	89.835	89.765	89.787
52	765	89.967	89.783	89.839	89.852	89.754	89.743
53	780	89.934	89.778	89.812	89.808	89.748	89.765
54	795	89.917	89.740	89.795	89.813	89.770	89.738
55	810	89.923	89.751	89.806	89.791	89.738	89.710
56	825	89.901	89.745	89.790	89.764	89.666	89.683
57	840	89.884	89.691	89.756	89.742	89.694	89.705
58	855	89.868	89.659	89.756	89.720	89.666	89.683
59	870	89.840	89.713	89.745	89.753	89.656	89.656
60	885	89.840	89.675	89.718	89.725	89.677	89.661
61	900	89.824	89.648	89.723	89.676	89.656	89.656
62	915	89.802	89.648	89.695	89.687	89.628	89.628
63	930	89.840	89.648	89.718	89.665	89.612	89.595
64	945	89.774	89.642	89.673	89.676	89.590	89.595
65	960	89.785	89.610	89.673	89.692	89.595	89.584
66	975	89.769	89.626	89.668	89.643	89.584	89.579
67	990	89.741	89.583	89.629	89.616	89.530	89.557
68	1005	89.736	89.561	89.607	89.605	89.568	89.568
69	1020	89.703	89.566	89.596	89.588	89.541	89.524
70	1035	89.719	89.556	89.635	89.577	89.546	89.524
71	1050	89.692	89.545	89.601	89.566	89.524	89.513
72	1065	89.692	89.523	89.618	89.572	89.519	89.481
73	1080	89.692	89.534	89.574	89.566	89.470	89.497
74	1095	89.681	89.528	89.540	89.544	89.459	89.497
75	1110	89.659	89.501	89.546	89.511	89.486	89.486
76	1125	89.642	89.485	89.540	89.517	89.442	89.464
77	1140	89.642	89.485	89.524	89.517	89.426	89.448
78	1155	89.620	89.458	89.529	89.495	89.437	89.453
79	1170	89.598	89.436	89.491	89.511	89.431	89.426
80	1185	89.593	89.420	89.502	89.473	89.410	89.415
81	1200	89.571	89.420	89.480	89.478	89.410	89.431
82	1215	89.582	89.436	89.463	89.456	89.377	89.415
83	1230	89.582	89.409	89.468	89.456	89.399	89.382
84	1245	89.582	89.382	89.468	89.418	89.382	89.382
85	1260	89.532	89.398	89.452	89.434	89.382	89.366
86	1275	89.516	89.371	89.468	89.401	89.388	89.366
87	1290	89.549	89.388	89.441	89.396	89.371	89.355
88	1305	89.516	89.371	89.424	89.396	89.322	89.349
89	1320	89.516	89.344	89.408	89.358	89.327	89.327
90	1335	89.494	89.312	89.385	89.358	89.317	89.317
91	1350	89.499	89.333	89.380	89.363	89.311	89.317
92	1365	89.505	89.290	89.363	89.352	89.306	89.306
93	1380	89.466	89.322	89.391	89.330	89.284	89.306
94	1395	89.444	89.322	89.369	89.352	89.278	89.278
95	1410	89.444	89.295	89.358	89.319	89.251	89.267
96	1425	89.428	89.274	89.341	89.303	89.267	89.251
97	1440	89.455	89.268	89.336	89.303	89.245	89.273

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 31 DEG. F	TEMP 32 DEG. F	TEMP 33 DEG. F	TEMP 34 DEG. F	TEMP 35 DEG. F	TEMP 36 DEG. F
1	0	91.458	91.303	91.325	91.015	91.499	91.276
2	15	91.359	91.253	91.264	90.949	91.389	91.210
3	30	91.321	91.187	91.204	90.916	91.362	91.155
4	45	91.266	91.143	91.072	90.883	91.268	91.122
5	60	91.277	91.061	91.094	90.851	91.202	91.045
6	75	91.134	91.034	91.067	90.807	91.169	91.001
7	90	91.156	90.951	91.012	90.763	91.104	90.952
8	105	91.178	90.913	90.907	90.741	91.093	90.913
9	120	91.084	90.885	90.907	90.708	91.043	90.875
10	135	90.974	90.847	90.847	90.648	91.071	90.831
11	150	91.090	90.803	90.797	90.642	91.016	90.770
12	165	90.935	90.748	90.803	90.587	90.966	90.710
13	180	90.952	90.770	90.726	90.560	90.955	90.682
14	195	90.908	90.720	90.682	90.527	90.878	90.638
15	210	90.814	90.654	90.660	90.494	90.862	90.611
16	225	90.930	90.616	90.605	90.488	90.862	90.561
17	240	90.765	90.555	90.566	90.461	90.813	90.528
18	255	90.787	90.495	90.533	90.434	90.818	90.506
19	270	90.638	90.533	90.517	90.406	90.796	90.468
20	285	90.688	90.495	90.445	90.346	90.736	90.451
21	300	90.732	90.484	90.434	90.351	90.703	90.402
22	315	90.649	90.407	90.407	90.313	90.703	90.358
23	330	90.572	90.407	90.401	90.285	90.758	90.347
24	345	90.539	90.374	90.313	90.263	90.637	90.319
25	360	90.611	90.401	90.319	90.241	90.609	90.281
26	375	90.594	90.319	90.291	90.209	90.620	90.253
27	390	90.512	90.291	90.269	90.203	90.593	90.226
28	405	90.517	90.280	90.242	90.165	90.544	90.204
29	420	90.528	90.275	90.192	90.148	90.593	90.176
30	435	90.457	90.220	90.198	90.148	90.538	90.143
31	450	90.462	90.170	90.198	90.110	90.472	90.127
32	465	90.413	90.170	90.132	90.071	90.467	90.105
33	480	90.347	90.137	90.110	90.049	90.395	90.083
34	495	90.336	90.104	90.104	90.033	90.428	90.061
35	510	90.297	90.088	90.077	90.022	90.450	90.039
36	525	90.352	90.104	90.055	90.000	90.357	90.011
37	540	90.297	90.049	90.038	89.973	90.417	90.000
38	555	90.259	90.022	90.027	89.923	90.450	89.989
39	570	90.242	90.011	90.000	89.934	90.357	89.951
40	585	90.215	90.006	89.973	89.907	90.351	89.945
41	600	90.154	90.000	89.967	89.902	90.335	89.918
42	615	90.204	90.006	89.940	89.847	90.302	89.896
43	630	90.209	89.973	89.929	89.880	90.269	89.890
44	645	90.154	89.918	89.907	89.830	90.253	89.874
45	660	90.088	89.918	89.907	89.852	90.351	89.852
46	675	90.143	89.924	89.863	89.836	90.225	89.852
47	690	90.105	89.907	89.880	89.803	90.247	89.825
48	705	90.116	89.886	89.858	89.814	90.220	89.797
49	720	90.099	89.848	89.836	89.770	90.192	89.781
50	735	90.055	89.837	89.809	89.754	90.187	89.770

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	TEMP 31 DEG. F	TEMP 32 DEG. F	TEMP 33 DEG. F	TEMP 34 DEG. F	TEMP 35 DEG. F	TEMP 36 DEG. F
51	750	90.094	89.826	89.809	89.765	90.236	89.748
52	765	90.072	89.869	89.787	89.716	90.132	89.737
53	780	90.050	89.902	89.776	89.732	90.121	89.731
54	795	90.033	89.842	89.776	89.743	90.115	89.742
55	810	90.011	89.848	89.754	89.699	90.176	89.709
56	825	89.989	89.771	89.737	89.661	90.176	89.698
57	840	89.995	89.793	89.726	89.683	90.077	89.688
58	855	89.946	89.820	89.726	89.666	90.060	89.660
59	870	89.967	89.771	89.705	89.644	90.060	89.649
60	885	89.935	89.733	89.672	89.623	89.995	89.633
61	900	89.864	89.717	89.677	89.639	90.066	89.622
62	915	89.929	89.701	89.661	89.617	90.099	89.633
63	930	89.875	89.684	89.644	89.595	90.082	89.616
64	945	89.897	89.684	89.639	89.601	90.049	89.605
65	960	89.869	89.679	89.633	89.595	90.033	89.578
66	975	89.848	89.668	89.612	89.584	90.044	89.561
67	990	89.848	89.635	89.601	89.573	90.016	89.567
68	1005	89.880	89.690	89.579	89.551	90.005	89.556
69	1020	89.782	89.641	89.584	89.557	89.984	89.534
70	1035	89.831	89.652	89.568	89.535	89.913	89.529
71	1050	89.810	89.641	89.573	89.530	89.989	89.518
72	1065	89.799	89.592	89.562	89.502	89.962	89.507
73	1080	89.782	89.603	89.546	89.519	89.897	89.501
74	1095	89.793	89.624	89.524	89.497	89.897	89.496
75	1110	89.782	89.565	89.530	89.475	89.875	89.490
76	1125	89.723	89.559	89.502	89.458	89.973	89.468
77	1140	89.733	89.554	89.497	89.447	89.891	89.463
78	1155	89.744	89.548	89.480	89.453	89.891	89.435
79	1170	89.684	89.526	89.475	89.453	89.864	89.424
80	1185	89.701	89.548	89.469	89.431	89.820	89.435
81	1200	89.706	89.521	89.442	89.431	89.869	89.413
82	1215	89.690	89.543	89.453	89.415	89.820	89.402
83	1230	89.706	89.521	89.437	89.387	89.820	89.397
84	1245	89.657	89.472	89.426	89.382	89.799	89.386
85	1260	89.619	89.483	89.420	89.393	89.761	89.391
86	1275	89.679	89.467	89.393	89.382	89.831	89.370
87	1290	89.646	89.499	89.387	89.371	89.837	89.370
88	1305	89.657	89.428	89.393	89.365	89.788	89.353
89	1320	89.630	89.467	89.365	89.360	89.793	89.342
90	1335	89.592	89.445	89.371	89.365	89.712	89.331
91	1350	89.592	89.423	89.360	89.316	89.831	89.326
92	1365	89.576	89.450	89.354	89.322	89.684	89.331
93	1380	89.559	89.407	89.338	89.305	89.717	89.304
94	1395	89.570	89.379	89.333	89.311	89.755	89.320
95	1410	89.565	89.418	89.333	89.311	89.717	89.282
96	1425	89.538	89.374	89.322	89.300	89.684	89.304
97	1440	89.581	89.434	89.311	89.278	89.690	89.265

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 37 DEG. F	TEMP 38 DEG. F	TEMP 39 DEG. F	TEMP 40 DEG. F	PRES 1 PSIA	HUM 1 FRACTION
1	0	90.198	90.435	90.902	DELETED	60.925	0.263
2	15	90.192	90.396	90.803	DELETED	60.920	0.264
3	30	90.176	90.374	90.825	DELETED	60.913	0.265
4	45	90.165	90.347	90.792	DELETED	60.905	0.266
5	60	90.137	90.308	90.720	DELETED	60.900	0.267
6	75	90.115	90.281	90.698	DELETED	60.894	0.267
7	90	90.088	90.248	90.698	DELETED	60.888	0.268
8	105	90.071	90.231	90.621	DELETED	60.882	0.269
9	120	90.066	90.198	90.605	DELETED	60.878	0.269
10	135	89.995	90.165	90.577	DELETED	60.872	0.270
11	150	90.011	90.149	90.517	DELETED	60.867	0.270
12	165	90.000	90.116	90.484	DELETED	60.862	0.271
13	180	89.973	90.094	90.467	DELETED	60.857	0.272
14	195	89.962	90.050	90.412	DELETED	60.851	0.272
15	210	89.929	90.033	90.390	DELETED	60.847	0.273
16	225	89.912	90.022	90.374	DELETED	60.846	0.273
17	240	89.912	89.989	90.352	DELETED	60.838	0.274
18	255	89.891	89.967	90.324	DELETED	60.835	0.274
19	270	89.858	89.962	90.275	DELETED	60.830	0.275
20	285	89.836	89.907	90.275	DELETED	60.826	0.275
21	300	89.836	89.880	90.236	DELETED	60.822	0.275
22	315	89.819	89.852	90.231	DELETED	60.819	0.276
23	330	89.787	89.841	90.203	DELETED	60.816	0.277
24	345	89.770	89.819	90.170	DELETED	60.812	0.277
25	360	89.765	89.792	90.176	DELETED	60.809	0.277
26	375	89.732	89.759	90.126	DELETED	60.805	0.277
27	390	89.732	89.776	90.143	DELETED	60.801	0.278
28	405	89.699	89.726	90.104	DELETED	60.797	0.279
29	420	89.677	89.721	90.093	DELETED	60.794	0.278
30	435	89.661	89.688	90.060	DELETED	60.792	0.279
31	450	89.666	89.650	90.055	DELETED	60.788	0.279
32	465	89.617	89.661	90.055	DELETED	60.785	0.280
33	480	89.628	89.633	90.016	DELETED	60.783	0.280
34	495	89.595	89.611	89.984	DELETED	60.778	0.280
35	510	89.590	89.617	89.973	DELETED	60.775	0.281
36	525	89.562	89.584	89.962	DELETED	60.772	0.281
37	540	89.557	89.546	89.962	DELETED	60.769	0.281
38	555	89.540	89.573	89.956	DELETED	60.765	0.281
39	570	89.535	89.535	89.923	DELETED	60.762	0.281
40	585	89.519	89.518	89.918	DELETED	60.760	0.281
41	600	89.502	89.513	89.891	DELETED	60.756	0.282
42	615	89.491	89.469	89.880	DELETED	60.752	0.282
43	630	89.486	89.480	89.863	DELETED	60.752	0.282
44	645	89.453	89.464	89.847	DELETED	60.755	0.283
45	660	89.453	89.453	89.858	DELETED	60.750	0.283
46	675	89.442	89.425	89.841	DELETED	60.749	0.283
47	690	89.426	89.431	89.825	DELETED	60.748	0.284
48	705	89.415	89.398	89.809	DELETED	60.747	0.284
49	720	89.409	89.409	89.787	DELETED	60.745	0.284
50	735	89.387	89.365	89.798	DELETED	60.743	0.284

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	TEMP 37 DEG F	TEMP 38 DEG F	TEMP 39 DEG F	TEMP 40 DEG F	PRES 1 PSIA	HUM 1 FRACTION
51	750	89.393	89.376	89.776	DELETED	60.742	0.284
52	765	89.376	89.365	89.781	DELETED	60.740	0.284
53	780	89.354	89.371	89.770	DELETED	60.738	0.285
54	795	89.344	89.332	89.748	DELETED	60.735	0.285
55	810	89.327	89.354	89.738	DELETED	60.733	0.285
56	825	89.322	89.354	89.743	DELETED	60.731	0.286
57	840	89.311	89.321	89.710	DELETED	60.730	0.286
58	855	89.311	89.327	89.699	DELETED	60.728	0.286
59	870	89.294	89.305	89.721	DELETED	60.726	0.286
60	885	89.289	89.299	89.694	DELETED	60.724	0.286
61	900	89.278	89.272	89.688	DELETED	60.722	0.286
62	915	89.278	89.278	89.666	DELETED	60.720	0.286
63	930	89.240	89.283	89.666	DELETED	60.718	0.287
64	945	89.251	89.228	89.666	DELETED	60.716	0.287
65	960	89.245	89.250	89.634	DELETED	60.719	0.287
66	975	89.240	89.239	89.645	DELETED	60.713	0.287
67	990	89.201	89.234	89.623	DELETED	60.711	0.288
68	1005	89.212	89.212	89.601	DELETED	60.711	0.287
69	1020	89.201	89.195	89.612	DELETED	60.707	0.288
70	1035	89.212	89.179	89.606	DELETED	60.705	0.288
71	1050	89.185	89.190	89.590	DELETED	60.703	0.288
72	1065	89.163	89.206	89.590	DELETED	60.701	0.288
73	1080	89.179	89.184	89.590	DELETED	60.699	0.288
74	1095	89.163	89.157	89.557	DELETED	60.699	0.289
75	1110	89.158	89.152	89.557	DELETED	60.697	0.289
76	1125	89.152	89.163	89.568	DELETED	60.696	0.289
77	1140	89.108	89.130	89.541	DELETED	60.695	0.289
78	1155	89.119	89.174	89.546	DELETED	60.693	0.289
79	1170	89.119	89.102	89.524	DELETED	60.692	0.289
80	1185	89.108	89.091	89.513	DELETED	60.690	0.290
81	1200	89.097	89.113	89.519	DELETED	60.689	0.289
82	1215	89.103	89.097	89.497	DELETED	60.688	0.290
83	1230	89.097	89.070	89.513	DELETED	60.685	0.290
84	1245	89.070	89.075	89.492	DELETED	60.684	0.290
85	1260	89.065	89.080	89.486	DELETED	60.682	0.290
86	1275	89.059	89.059	89.486	DELETED	60.682	0.290
87	1290	89.048	89.080	89.481	DELETED	60.679	0.290
88	1305	89.043	89.053	89.459	DELETED	60.677	0.291
89	1320	89.043	89.031	89.448	DELETED	60.676	0.291
90	1335	89.037	89.042	89.448	DELETED	60.674	0.291
91	1350	89.021	89.015	89.459	DELETED	60.672	0.291
92	1365	89.015	88.976	89.420	DELETED	60.671	0.291
93	1380	89.010	88.966	89.431	DELETED	60.669	0.291
94	1395	88.999	89.009	89.431	DELETED	60.669	0.292
95	1410	88.993	88.971	89.415	DELETED	60.667	0.292
96	1425	88.988	88.960	89.404	DELETED	60.666	0.292
97	1440	88.982	88.987	89.410	DELETED	60.666	0.292

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	HUM 2 FRACTION	HUM 3 FRACTION	HUM 4 FRACTION	HUM 5 FRACTION	HUM 6 FRACTION	HUM 7 FRACTION
1	0	0.263	0.253	0.274	0.270	0.272	0.265
2	15	0.263	0.254	0.274	0.271	0.272	0.266
3	30	0.264	0.255	0.275	0.272	0.272	0.266
4	45	0.266	0.257	0.275	0.272	0.273	0.267
5	60	0.266	0.258	0.276	0.273	0.273	0.267
6	75	0.267	0.258	0.276	0.273	0.273	0.267
7	90	0.267	0.258	0.276	0.274	0.274	0.268
8	105	0.268	0.260	0.277	0.275	0.275	0.268
9	120	0.269	0.260	0.277	0.275	0.275	0.269
10	135	0.269	0.261	0.278	0.275	0.276	0.269
11	150	0.270	0.261	0.278	0.276	0.276	0.270
12	165	0.271	0.262	0.278	0.276	0.276	0.270
13	180	0.271	0.263	0.279	0.277	0.276	0.271
14	195	0.272	0.263	0.279	0.277	0.277	0.271
15	210	0.272	0.264	0.280	0.278	0.277	0.271
16	225	0.273	0.264	0.280	0.278	0.277	0.272
17	240	0.273	0.265	0.280	0.279	0.278	0.272
18	255	0.274	0.265	0.280	0.279	0.278	0.273
19	270	0.274	0.266	0.281	0.279	0.278	0.273
20	285	0.274	0.266	0.281	0.279	0.279	0.273
21	300	0.276	0.266	0.282	0.280	0.279	0.274
22	315	0.275	0.267	0.282	0.280	0.279	0.273
23	330	0.276	0.267	0.282	0.280	0.280	0.275
24	345	0.277	0.267	0.282	0.280	0.280	0.274
25	360	0.277	0.268	0.283	0.281	0.280	0.275
26	375	0.278	0.268	0.283	0.281	0.281	0.275
27	390	0.277	0.269	0.283	0.281	0.281	0.275
28	405	0.277	0.269	0.284	0.282	0.281	0.276
29	420	0.279	0.269	0.284	0.282	0.282	0.276
30	435	0.278	0.269	0.284	0.282	0.281	0.276
31	450	0.279	0.269	0.284	0.282	0.282	0.277
32	465	0.279	0.270	0.285	0.282	0.282	0.277
33	480	0.279	0.271	0.285	0.283	0.282	0.277
34	495	0.280	0.271	0.285	0.283	0.283	0.277
35	510	0.280	0.271	0.285	0.283	0.283	0.278
36	525	0.281	0.271	0.286	0.284	0.283	0.278
37	540	0.281	0.271	0.286	0.284	0.283	0.278
38	555	0.281	0.272	0.286	0.284	0.284	0.278
39	570	0.281	0.272	0.286	0.284	0.284	0.279
40	585	0.281	0.272	0.287	0.284	0.284	0.278
41	600	0.282	0.273	0.287	0.285	0.284	0.279
42	615	0.282	0.273	0.287	0.285	0.285	0.279
43	630	0.282	0.273	0.287	0.285	0.285	0.279
44	645	0.282	0.273	0.288	0.285	0.285	0.280
45	660	0.282	0.273	0.288	0.285	0.285	0.280
46	675	0.283	0.273	0.288	0.286	0.285	0.280
47	690	0.284	0.274	0.288	0.286	0.285	0.280
48	705	0.283	0.274	0.288	0.286	0.286	0.280
49	720	0.284	0.274	0.288	0.286	0.286	0.280
50	735	0.284	0.275	0.288	0.286	0.287	0.281

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE UMBER	DELTA MINS	HUM 2 FRACTION	HUM 3 FRACTION	HUM 4 FRACTION	HUM 5 FRACTION	HUM 6 FRACTION	HUM 7 FRACTION
51	750	0.284	0.275	0.289	0.286	0.286	0.281
52	765	0.284	0.275	0.289	0.287	0.286	0.281
53	780	0.285	0.275	0.289	0.287	0.287	0.282
54	795	0.284	0.275	0.289	0.287	0.287	0.282
55	810	0.285	0.275	0.289	0.287	0.287	0.282
56	825	0.285	0.275	0.289	0.287	0.287	0.282
57	840	0.285	0.276	0.289	0.287	0.288	0.283
58	855	0.286	0.276	0.289	0.288	0.287	0.282
59	870	0.286	0.276	0.290	0.288	0.288	0.283
60	885	0.286	0.276	0.290	0.288	0.288	0.282
61	900	0.286	0.276	0.290	0.288	0.288	0.283
62	915	0.286	0.276	0.291	0.288	0.288	0.283
63	930	0.286	0.277	0.290	0.288	0.288	0.283
64	945	0.287	0.277	0.291	0.288	0.288	0.283
65	960	0.287	0.277	0.291	0.288	0.289	0.284
66	975	0.287	0.277	0.291	0.289	0.289	0.284
67	990	0.287	0.277	0.291	0.289	0.289	0.283
68	1005	0.288	0.278	0.291	0.289	0.289	0.284
69	1020	0.287	0.278	0.291	0.289	0.289	0.284
70	1035	0.288	0.278	0.291	0.289	0.290	0.284
71	1050	0.288	0.278	0.292	0.289	0.290	0.284
72	1065	0.288	0.278	0.292	0.289	0.290	0.285
73	1080	0.288	0.279	0.292	0.290	0.290	0.285
74	1095	0.289	0.278	0.292	0.290	0.290	0.285
75	1110	0.288	0.279	0.292	0.290	0.290	0.285
76	1125	0.288	0.279	0.292	0.290	0.291	0.285
77	1140	0.289	0.279	0.292	0.290	0.290	0.285
78	1155	0.289	0.279	0.293	0.290	0.291	0.285
79	1170	0.289	0.279	0.293	0.291	0.291	0.286
80	1185	0.289	0.280	0.293	0.291	0.291	0.286
81	1200	0.290	0.280	0.293	0.291	0.291	0.286
82	1215	0.290	0.280	0.293	0.291	0.291	0.286
83	1230	0.289	0.280	0.293	0.291	0.291	0.286
84	1245	0.290	0.280	0.293	0.291	0.292	0.286
85	1260	0.290	0.281	0.293	0.291	0.292	0.286
86	1275	0.290	0.281	0.294	0.291	0.292	0.287
87	1290	0.290	0.281	0.294	0.291	0.292	0.286
88	1305	0.291	0.281	0.294	0.291	0.292	0.287
89	1320	0.291	0.282	0.294	0.292	0.292	0.287
90	1335	0.291	0.281	0.294	0.292	0.292	0.287
91	1350	0.291	0.282	0.294	0.292	0.293	0.287
92	1365	0.291	0.281	0.294	0.292	0.293	0.287
93	1380	0.291	0.281	0.295	0.292	0.293	0.287
94	1395	0.291	0.282	0.295	0.292	0.293	0.287
95	1410	0.291	0.282	0.295	0.293	0.293	0.288
96	1425	0.291	0.282	0.295	0.293	0.293	0.288
97	1440	0.292	0.282	0.295	0.293	0.293	0.288

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	HUM 8 FRACTION	HUM 9 FRACTION	HUM 10 FRACTION
1	0	0.294	0.286	0.291
2	15	0.294	0.286	0.291
3	30	0.294	0.286	0.291
4	45	0.295	0.286	0.291
5	60	0.295	0.287	0.291
6	75	0.295	0.287	0.292
7	90	0.295	0.287	0.291
8	105	0.296	0.287	0.292
9	120	0.296	0.288	0.292
10	135	0.296	0.288	0.292
11	150	0.296	0.288	0.292
12	165	0.297	0.288	0.292
13	180	0.296	0.289	0.293
14	195	0.297	0.289	0.293
15	210	0.297	0.289	0.293
16	225	0.297	0.289	0.293
17	240	0.298	0.289	0.293
18	255	0.298	0.290	0.294
19	270	0.298	0.290	0.294
20	285	0.298	0.290	0.294
21	300	0.298	0.290	0.294
22	315	0.298	0.290	0.294
23	330	0.299	0.291	0.295
24	345	0.299	0.291	0.294
25	360	0.299	0.291	0.295
26	375	0.299	0.291	0.295
27	390	0.299	0.291	0.295
28	405	0.299	0.292	0.295
29	420	0.300	0.292	0.295
30	435	0.300	0.292	0.295
31	450	0.300	0.292	0.295
32	465	0.300	0.292	0.295
33	480	0.301	0.292	0.296
34	495	0.301	0.293	0.296
35	510	0.301	0.293	0.296
36	525	0.301	0.293	0.296
37	540	0.301	0.293	0.296
38	555	0.301	0.293	0.297
39	570	0.301	0.294	0.296
40	585	0.302	0.294	0.297
41	600	0.302	0.294	0.297
42	615	0.302	0.294	0.297
43	630	0.302	0.294	0.297
44	645	0.302	0.294	0.298
45	660	0.302	0.294	0.297
46	675	0.302	0.295	0.297
47	690	0.303	0.295	0.298
48	705	0.303	0.295	0.298
49	720	0.303	0.295	0.297
50	735	0.303	0.295	0.298

VARIABLE TABLE SUMMARY (CONTINUED)

SAMPLE NUMBER	DELTA MINS	HUM 8 FRACTION	HUM 9 FRACTION	HUM 10 FRACTION
51	750	0.303	0.295	0.298
52	765	0.303	0.295	0.298
53	780	0.303	0.295	0.298
54	795	0.303	0.296	0.298
55	810	0.304	0.296	0.298
56	825	0.304	0.296	0.299
57	840	0.304	0.296	0.299
58	855	0.304	0.296	0.299
59	870	0.304	0.296	0.299
60	885	0.305	0.296	0.299
61	900	0.305	0.296	0.299
62	915	0.305	0.297	0.299
63	930	0.305	0.297	0.299
64	945	0.305	0.297	0.299
65	960	0.305	0.297	0.299
66	975	0.305	0.297	0.300
67	990	0.305	0.297	0.299
68	1005	0.305	0.297	0.299
69	1020	0.305	0.297	0.300
70	1035	0.305	0.298	0.300
71	1050	0.306	0.298	0.300
72	1065	0.306	0.298	0.300
73	1080	0.306	0.298	0.300
74	1095	0.306	0.298	0.300
75	1110	0.306	0.298	0.301
76	1125	0.306	0.298	0.301
77	1140	0.306	0.298	0.300
78	1155	0.306	0.298	0.300
79	1170	0.307	0.298	0.300
80	1185	0.307	0.299	0.301
81	1200	0.307	0.299	0.301
82	1215	0.307	0.299	0.301
83	1230	0.307	0.299	0.301
84	1245	0.307	0.299	0.301
85	1260	0.307	0.299	0.301
86	1275	0.307	0.299	0.302
87	1290	0.307	0.299	0.301
88	1305	0.307	0.299	0.301
89	1320	0.308	0.299	0.301
90	1335	0.308	0.299	0.301
91	1350	0.308	0.300	0.302
92	1365	0.308	0.300	0.302
93	1380	0.308	0.300	0.302
94	1395	0.308	0.300	0.302
95	1410	0.308	0.300	0.302
96	1425	0.308	0.300	0.302
97	1440	0.308	0.300	0.302

END OF TABLE

APPENDIX B.3.

PEAK PRESSURE ILRT
COMPUTER GENERATED REPORT
CONTROLLED LEAKAGE RATE TEST
(CLRT)

APPENDIX B.3.

PEAK PRESSURE ILRT
COMPUTER GENERATED REPORT
CONTROLLED LEAKAGE RATE TEST
(CLRT)

LOUISIANA POWER & LIGHT COMPANY
WATERFORD SES UNIT NO. 3

CONTAINMENT INTEGRATED LEAKAGE RATE TEST
SUPPLEMENTAL VERIFICATION TEST
LEAKAGE RATE MEASURED USING THE ABSOLUTE METHOD
LEAKAGE RATE COMPUTED USING THE MASS POINT METHOD

TEST PERIOD STARTED AT 1945 HOURS ON APRIL 30, 1983
TEST CONDUCTED FOR 5.50 HOURS

FREE SPACE VOLUME OF CONTAINMENT IS 2677000 CU FT
CONTAINMENT WAS PRESSURIZED TO 60.64 PSIA

INITIAL VERIFICATION AIR WEIGHT 795501.0 LBS
FINAL VERIFICATION AIR WEIGHT 794478.6 LBS
FITTED MASS POINT LEAKAGE RATE IS 0.572 % PER DAY

LC = 0.572 LAM = 0.066 L0 = 0.499

$$L0 + LAM - .25LA < LC < L0 + LAM + .25LA$$

$$0.499 + 0.066 - 0.125 < 0.572 < 0.499 + 0.066 + 0.125$$

$$0.440 < 0.572 < 0.690$$

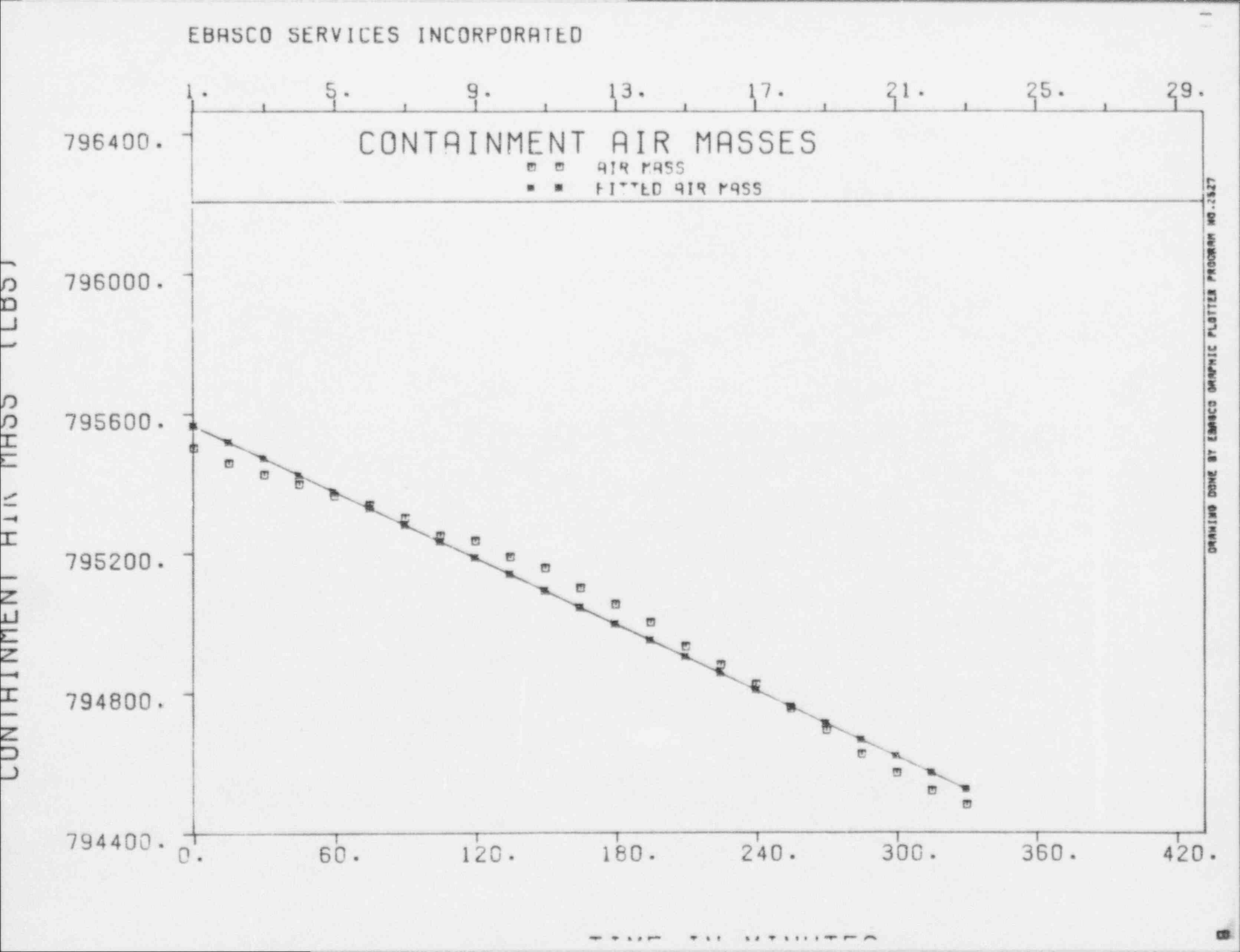
LC =FITTED CLRT MASS POINT LEAKAGE RATE
LAM =FITTED ILRT MASS POINT LEAKAGE RATE
L0 =SUPERIMPOSED LEAKAGE DURING VERIFICATION TEST
LA =CONTAINMENT DESIGN LEAKAGE RATE

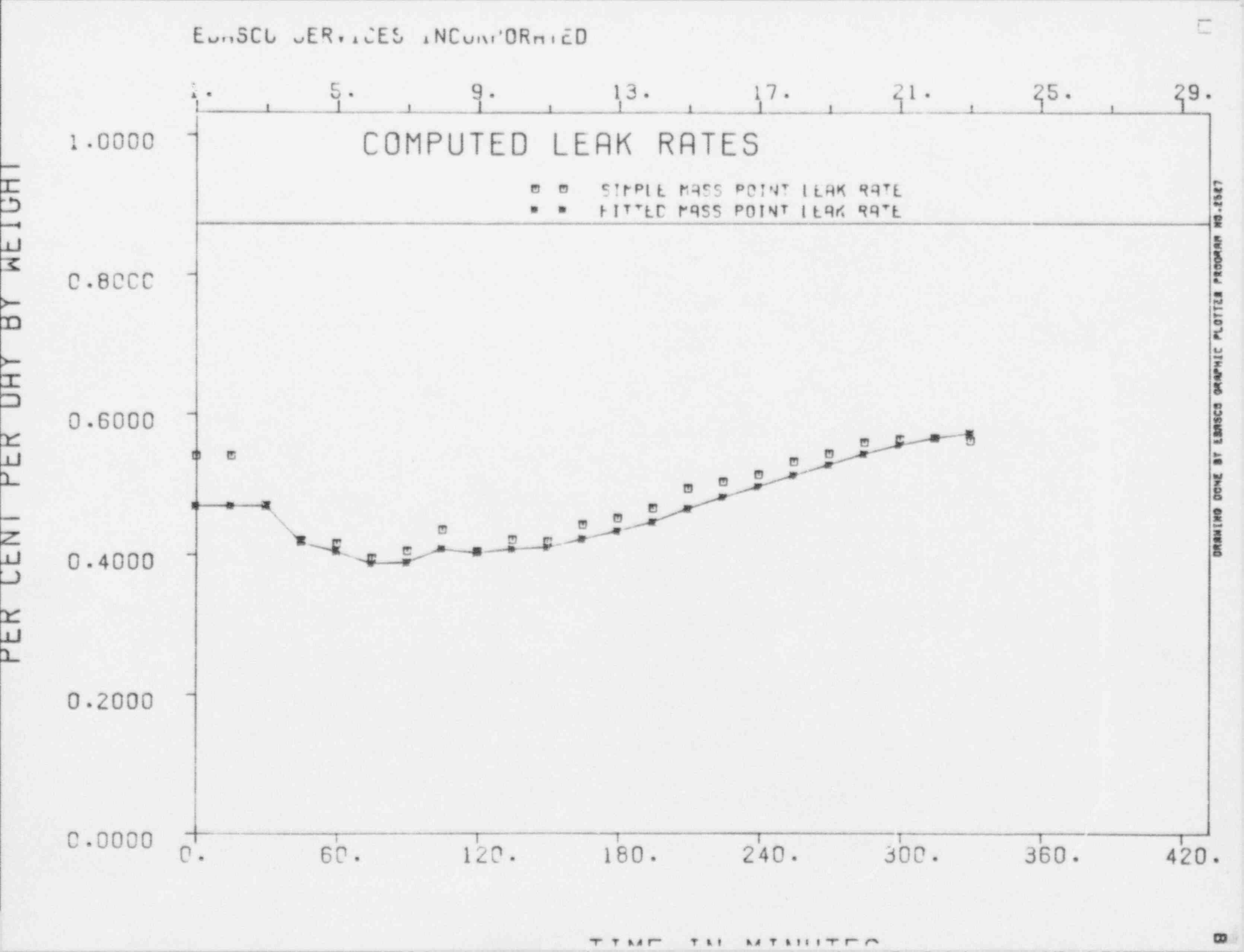
DESCRIPTION OF VARIABLES

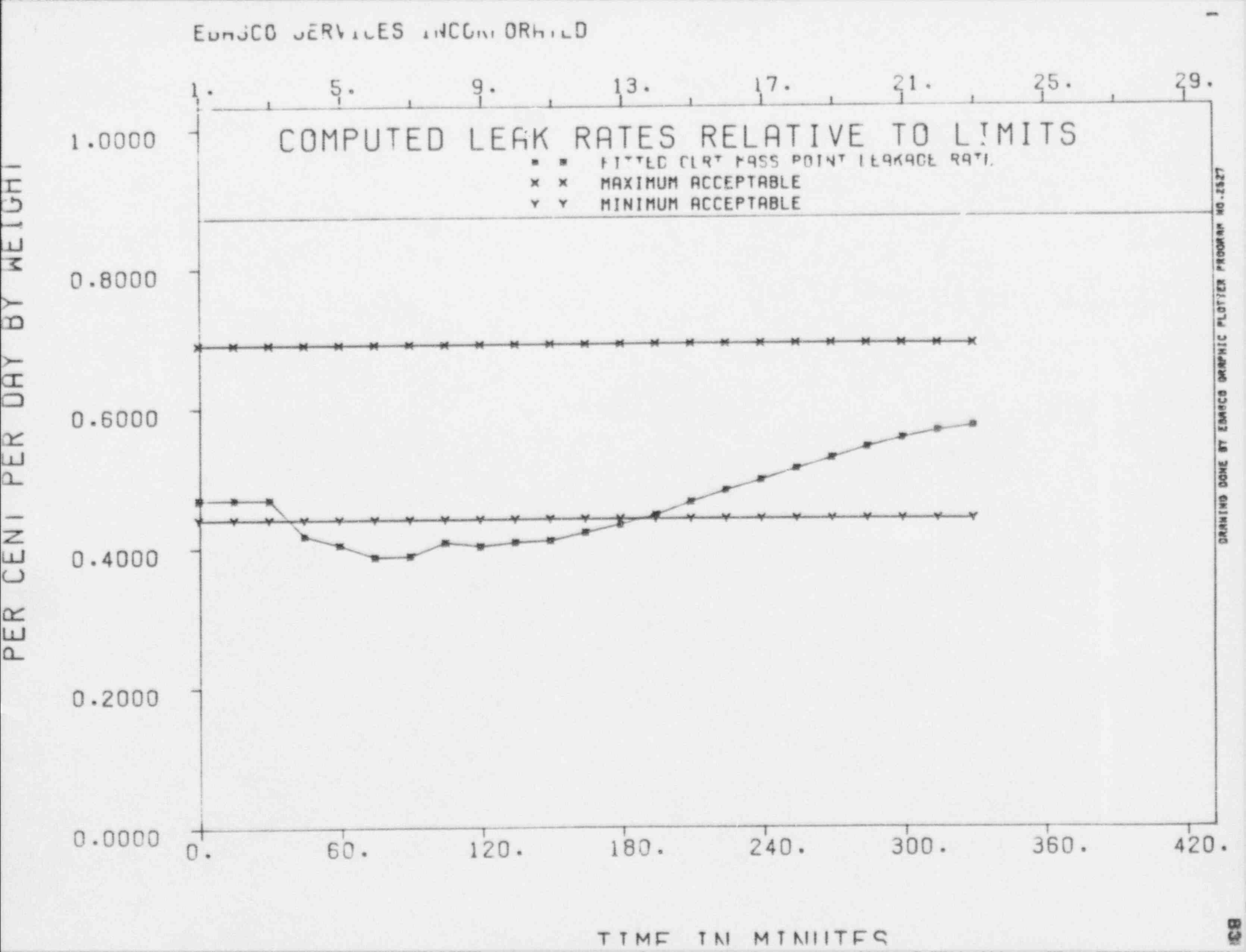
AVG. TEM - CONTAINMENT MEAN TEMPERATURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RTD SENSOR INDICATIONS.
AVE. PRE - PRIMARY CONTAINMENT PRESSURE INDICATION.
VAP. PRE - CONTAINMENT VAPOR PRESSURE CALCULATED
FROM VOLUMETRICALLY WEIGHTED RHD SENSOR INDICATIONS.
LEAK SIM - SIMPLE TOTAL TIME LEAKAGE RATE.
LEAK MAS - LEAKAGE RATE COMPUTED FROM FIRST ORDER
REGRESSION OF AIR MASS DATA.
AIR MASS - CONTAINMENT AIR MASS.

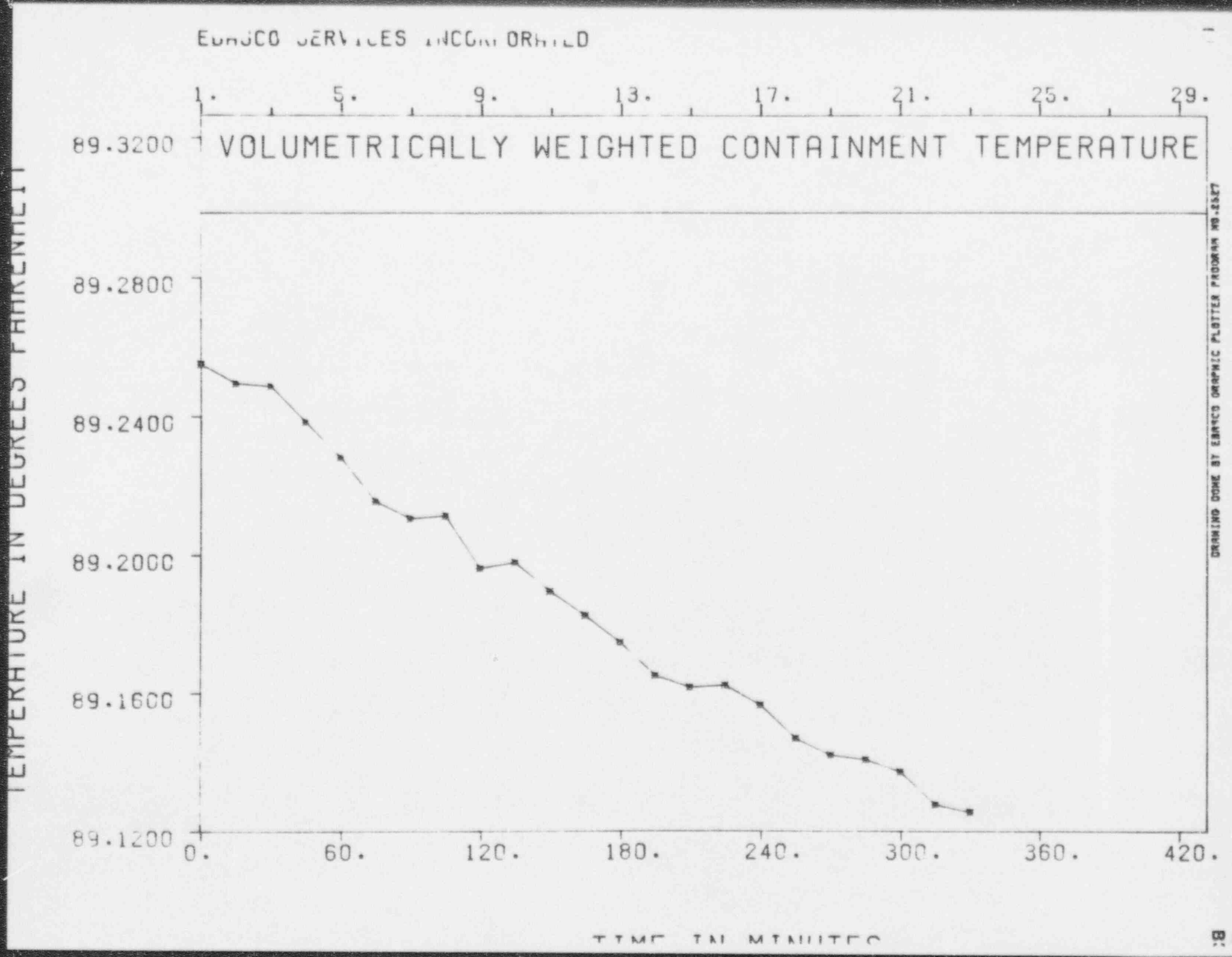
NOTE FOR TABULAR DATA -
TABLE VALUES OF ZERO SIGNIFY DATA IS
NOT APPLICABLE TO THE CALCULATION.
2. SENSOR HAS BEEN DELETED FROM THE SCAN.

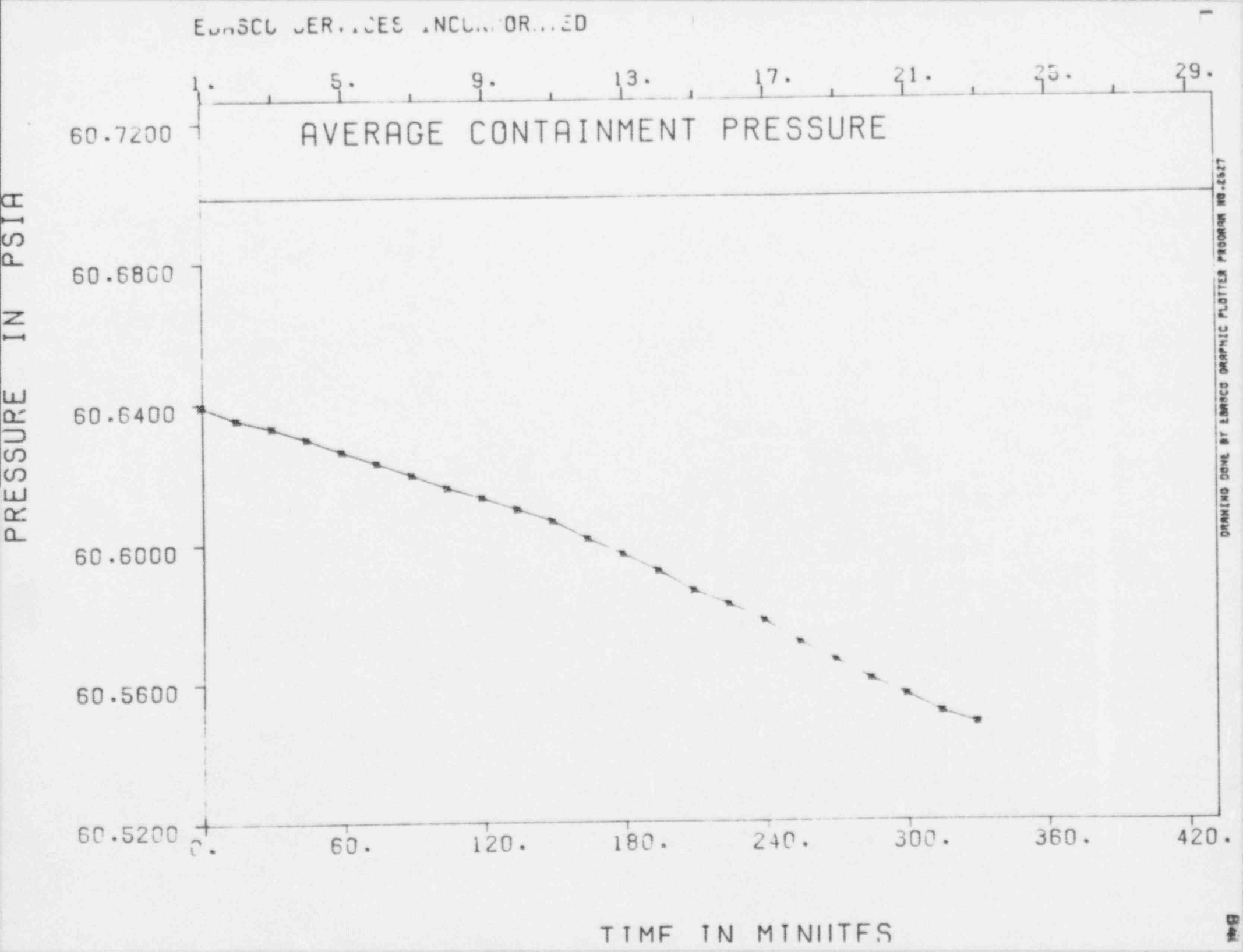
NOTE FOR CURVES -
1. TOP ABSCISSA SCALE REPRESENTS SAMPLE NUMBERS.
2. AIR MASS IS THE CALCULATED CONTAINMENT AIR
MASS AND FITTED AIR MASS IS THE LINEAR LEAST
SQUARE FIT OF THE AIR MASSES.
3. SIMPLE MASS POINT IS THE TOTAL TIME LEAKAGE
RATE AND FITTED MASS POINT IS THE LEAKAGE RATE
COMPUTED FROM FIRST ORDER REGRESSION OF AIR MASS DATA.
4. UCL IS THE UPPER LIMIT OF THE 95%
CONFIDENCE LEVEL OF AIR MASS DATA.

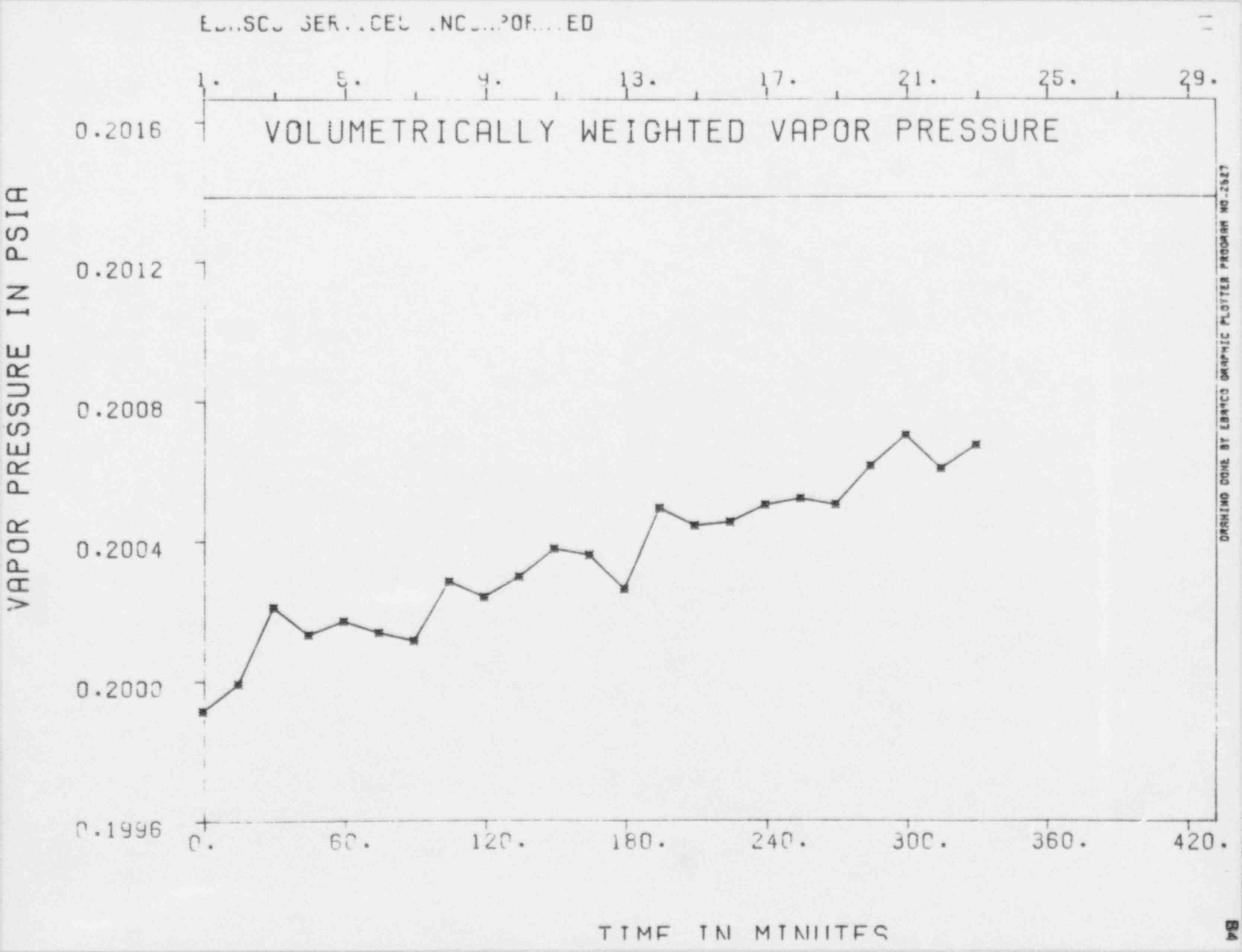

EBASCO SERVICES INCORPORATED
CONTAINMENT AIR MASSES
AIR MASS
FITTED AIR MASS
CONTAINMENT AIR MASS (LBS)
796400.
796000.
795600.
795200.
794800.
794400.
1.
5.
9.
13.
17.
21.
25.
29.
0.
60.
120.
180.
240.
300.
360.
420.
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.2927


EnSCO SERVICES INCORPORATED
COMPUTED LEAK RATES
SIMPLE MASS POINT LEAK RATE
FITTED MASS POINT LEAK RATE
PER CENT PER DAY BY WEIGHT
1.0000
0.8000
0.6000
0.4000
0.2000
0.0000
1.
5.
9.
13.
17.
21.
25.
29.
0.
60.
120.
180.
240.
300.
360.
420.
DRAWING DONE BY ENSCO GRAPHIC PLOTTER PROGRAM NO.4567


EDMSCO SERVICES INCORPORATED
COMPUTED LEAK RATES RELATIVE TO LIMITS
FITTED CLRT PASS POINT LEAKAGE RATE
MAXIMUM ACCEPTABLE
MINIMUM ACCEPTABLE
PER CENT PER DAY BY WEIGHT
TIME IN MINUTES
1.0000
0.8000
0.6000
0.4000
0.2000
0.0000
0.
60.
120.
180.
240.
300.
360.
420.
1.
5.
9.
13.
17.
21.
25.
29.
DRAWING DONE BY EDMSCO GRAPHIC PLOTTER PROGRAM NO.2527


EBASCO SERVICES INCORPORATED
VOLUMETRICALLY WEIGHTED CONTAINMENT TEMPERATURE
TEMPERATURE IN DEGREES FAHRENHEIT
89.3200
89.2800
89.2400
89.2000
89.1600
89.1200
1.
5.
9.
13.
17.
21.
25.
29.
0.
60.
120.
180.
240.
300.
360.
420.
TIME IN MINUTES
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.4367


EBASCO SERVICES INCORPORATED
AVERAGE CONTAINMENT PRESSURE
PRESSURE IN PSIA
60.7200
60.6800
60.6400
60.6000
60.5600
60.5200
1.
5.
9.
13.
17.
21.
25.
29.
0.
60.
120.
180.
240.
300.
360.
420.
TIME IN MINUTES
DRAWING DONE BY EBASCO GRAPHIC PLOTTER PROGRAM NO.4527


VOLUMETRICALLY WEIGHTED VAPOR PRESSURE
VAPOR PRESSURE IN PSIA
TIME IN MINUTES
0.2016
0.2012
0.2008
0.2004
0.2000
0.1996
0.
60.
120.
180.
240.
300.
360.
420.
1.
5.
9.
13.
17.
21.
25.
29.

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	AVG. TEM DEG. F	AVG. PRE PSIA	VAP. PRE PSIA	LEAK SIM PER CENT	LEAK MAS PER CENT	AIR MASS POUNDS
1	0	89.255	60.6393	0.1999	0.000	0.000	795501
2	15	89.250	60.6354	0.2000	0.540	0.000	795456
3	30	89.249	60.6330	0.2002	0.469	0.469	795423
4	45	89.238	60.6297	0.2001	0.420	0.418	795397
5	60	89.228	60.6261	0.2002	0.415	0.404	795363
6	75	89.215	60.6227	0.2001	0.394	0.387	795338
7	90	89.211	60.6193	0.2001	0.405	0.388	795300
8	105	89.211	60.6157	0.2003	0.435	0.408	795249
9	120	89.196	60.6128	0.2002	0.404	0.402	795233
10	135	89.198	60.6096	0.2003	0.420	0.407	795187
11	150	89.190	60.6063	0.2004	0.418	0.410	795155
12	165	89.183	60.6012	0.2004	0.442	0.421	795099
13	180	89.175	60.5967	0.2003	0.451	0.433	795053
14	195	89.165	60.5919	0.2005	0.465	0.446	795000
15	210	89.162	60.5862	0.2004	0.492	0.464	794930
16	225	89.162	60.5822	0.2005	0.502	0.480	794877
17	240	89.157	60.5775	0.2005	0.512	0.495	794823
18	255	89.147	60.5713	0.2005	0.530	0.511	794754
19	270	89.142	60.5661	0.2005	0.542	0.526	794693
20	285	89.141	60.5607	0.2006	0.558	0.542	794623
21	300	89.137	60.5562	0.2007	0.563	0.555	794568
22	315	89.128	60.5513	0.2006	0.565	0.565	794518
23	330	89.125	60.5481	0.2007	0.561	0.572	794479

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 1 DEG. F	TEMP 2 DEG. F	TEMP 3 DEG. F	TEMP 4 DEG. F	TEMP 5 DEG. F	TEMP 6 DEG. F
1	0	89.067	89.075	89.070	89.161	89.199	89.489
2	15	89.057	89.085	89.070	89.161	89.216	89.456
3	30	89.051	89.047	89.059	89.166	89.183	89.495
4	45	89.040	89.031	89.048	89.150	89.183	89.533
5	60	89.035	89.026	89.021	89.150	89.172	89.484
6	75	89.029	89.026	89.021	89.128	89.166	89.429
7	90	89.018	89.015	88.993	89.133	89.166	89.445
8	105	89.007	89.026	89.004	89.117	89.161	89.401
9	120	89.007	88.987	88.999	89.111	89.144	89.440
10	135	88.985	89.009	88.999	89.117	89.128	89.445
11	150	88.991	89.004	88.988	89.106	89.139	89.440
12	165	88.969	88.944	88.972	89.078	89.139	89.505
13	180	88.980	88.955	88.966	89.106	89.128	89.478
14	195	88.963	88.982	88.966	89.089	89.111	89.363
15	210	88.952	88.971	88.950	89.057	89.084	89.374
16	225	88.958	88.977	88.950	89.084	89.106	89.368
17	240	88.952	88.938	88.950	89.073	89.095	89.373
18	255	88.947	88.938	88.955	89.084	89.084	89.352
19	270	88.947	88.938	88.944	89.062	89.095	89.401
20	285	88.947	88.900	88.928	89.051	89.084	89.423
21	300	88.941	88.911	88.955	89.024	89.067	89.379
22	315	88.941	88.917	88.944	89.024	89.062	89.368
23	330	88.925	88.938	88.939	89.040	89.057	89.302

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 7 DEG. F	TEMP 8 DEG. F	TEMP 9 DEG. F	TEMP 10 DEG. F	TEMP 11 DEG. F	TEMP 12 DEG. F
1	0	88.896	89.113	89.053	89.352	89.191	88.998
2	15	88.901	89.118	89.025	89.368	89.126	89.009
3	30	88.917	89.096	89.014	89.390	89.197	89.003
4	45	88.857	89.080	89.003	89.362	89.121	89.031
5	60	88.879	89.080	88.998	89.357	89.137	89.003
6	75	88.857	89.064	88.987	89.346	89.159	88.960
7	90	88.852	89.064	88.981	89.221	89.164	88.987
8	105	88.901	89.058	88.976	89.341	89.175	88.954
9	120	88.814	89.047	88.981	89.319	89.110	88.971
10	135	88.830	89.042	88.949	89.302	89.142	88.981
11	150	88.830	89.053	88.976	89.341	89.066	88.981
12	165	88.787	89.031	88.921	89.226	89.104	88.922
13	180	88.781	89.042	88.959	89.275	89.077	88.949
14	195	88.847	89.031	88.938	89.237	89.039	88.905
15	210	88.787	89.015	88.954	89.226	89.099	88.943
16	225	88.814	89.004	88.932	89.313	89.077	88.965
17	240	88.787	89.004	88.905	89.292	89.077	88.900
18	255	88.776	89.004	88.888	89.221	89.028	88.900
19	270	88.760	89.020	88.927	89.253	89.050	88.932
20	285	88.749	88.982	88.921	89.259	89.050	88.889
21	300	88.760	88.982	88.894	89.237	89.039	88.883
22	315	88.760	88.987	88.883	89.155	89.077	88.900
23	330	88.765	88.966	88.894	89.248	89.099	88.873

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 13 DEG. F	TEMP 14 DEG. F	TEMP 15 DEG. F	TEMP 16 DEG. F	TEMP 17 DEG. F	TEMP 18 DEG. F
1	0	89.179	88.584	89.181	89.172	88.779	DELETED
2	15	89.174	88.573	89.170	89.189	88.768	DELETED
3	30	89.163	88.551	89.159	89.178	88.784	DELETED
4	45	89.163	88.546	89.148	89.167	88.779	DELETED
5	60	89.158	88.530	89.159	89.172	88.740	DELETED
6	75	89.141	88.519	89.132	89.145	88.740	DELETED
7	90	89.125	88.524	89.126	89.150	88.751	DELETED
8	105	89.130	88.519	89.121	89.139	88.719	DELETED
9	120	89.119	88.524	89.115	89.128	88.719	DELETED
10	135	89.114	88.486	89.110	89.150	88.697	DELETED
11	150	89.114	88.492	89.121	89.123	88.702	DELETED
12	165	89.103	88.486	89.088	89.090	88.719	DELETED
13	180	89.097	88.513	89.088	89.117	88.719	DELETED
14	195	89.086	88.470	89.077	89.090	88.719	DELETED
15	210	89.081	88.486	89.066	89.117	88.719	DELETED
16	225	89.081	88.443	89.071	89.106	88.724	DELETED
17	240	89.070	88.454	89.077	89.090	88.708	DELETED
18	255	89.070	88.443	89.055	89.073	88.691	DELETED
19	270	89.054	88.486	89.060	89.052	88.686	DELETED
20	285	89.059	88.459	89.071	89.084	88.691	DELETED
21	300	89.048	88.454	89.033	89.084	88.691	DELETED
22	315	89.037	88.443	89.055	89.057	88.669	DELETED
23	330	89.043	88.448	89.033	89.063	88.691	DELETED

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 19 DEG. F	TEMP 20 DEG. F	TEMP 21 DEG. F	TEMP 22 DEG. F	TEMP 23 DEG. F	TEMP 24 DEG. F
1	0	88.831	DELETED	89.303	89.430	89.479	90.814
2	15	88.809	DELETED	89.297	89.419	89.446	90.787
3	30	88.836	DELETED	89.281	89.402	89.479	90.842
4	45	88.815	DELETED	89.270	89.391	89.468	90.787
5	60	88.793	DELETED	89.259	89.386	89.446	90.781
6	75	88.804	DELETED	89.265	89.375	89.429	90.770
7	90	88.793	DELETED	89.248	89.359	89.418	90.765
8	105	88.771	DELETED	89.248	89.364	89.446	90.770
9	120	88.787	DELETED	89.243	89.348	89.418	90.754
10	135	88.798	DELETED	89.232	89.353	89.440	90.748
11	150	88.766	DELETED	89.232	89.337	89.435	90.743
12	165	88.771	DELETED	89.215	89.337	89.429	90.743
13	180	88.760	DELETED	89.210	89.331	89.380	90.721
14	195	88.766	DELETED	89.204	89.320	89.385	90.704
15	210	88.771	DELETED	89.193	89.326	89.380	90.699
16	225	88.760	DELETED	89.188	89.315	89.385	90.688
17	240	88.760	DELETED	89.188	89.304	89.380	90.704
18	255	88.755	DELETED	89.193	89.320	89.363	90.726
19	270	88.749	DELETED	89.177	89.276	89.369	90.688
20	285	88.755	DELETED	89.149	89.298	89.325	90.693
21	300	88.744	DELETED	89.177	89.287	89.385	90.693
22	315	88.722	DELETED	89.166	89.282	89.352	90.655
23	330	88.738	DELETED	89.160	89.265	89.358	90.682

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 25 DEG. F	TEMP 26 DEG. F	TEMP 27 DEG. F	TEMP 28 DEG. F	TEMP 29 DEG. F	TEMP 30 DEG. F
1	0	89.351	89.171	89.241	89.220	89.163	89.153
2	15	89.356	89.160	89.252	89.220	89.191	89.163
3	30	89.340	89.182	89.214	89.237	89.185	89.153
4	45	89.334	89.160	89.225	89.226	89.185	89.136
5	60	89.334	89.160	89.236	89.193	89.120	89.147
6	75	89.307	89.133	89.214	89.193	39.109	89.125
7	90	89.312	89.144	89.230	89.182	89.103	89.120
8	105	89.318	89.149	89.203	89.193	89.142	89.109
9	120	89.312	89.117	89.158	89.154	89.120	89.114
10	135	89.318	89.144	89.181	89.165	89.142	89.092
11	150	89.279	89.133	89.169	89.160	89.071	89.098
12	165	89.268	89.144	89.192	89.171	89.109	89.081
13	180	89.268	89.138	89.164	89.127	89.054	89.043
14	195	89.263	89.084	89.147	89.121	89.065	89.109
15	210	89.257	89.111	89.169	89.099	89.098	89.071
16	225	89.257	89.111	89.142	89.105	89.071	89.071
17	240	89.257	89.079	89.147	89.099	89.081	89.071
18	255	89.246	89.095	89.164	89.077	89.065	89.076
19	270	89.224	89.079	89.120	89.121	89.021	89.038
20	285	89.218	89.100	89.147	89.105	89.071	89.054
21	300	89.274	89.051	89.120	89.094	89.065	89.038
22	315	89.218	89.089	89.125	89.083	89.049	89.038
23	330	89.218	89.057	89.109	89.094	89.032	89.043

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE UMBER	DELTA MINS	TEMP 31 DEG. F	TEMP 32 DEG. F	TEMP 33 DEG. F	TEMP 34 DEG. F	TEMP 35 DEG. F	TEMP 36 DEG. F
1	0	89.489	89.303	89.234	89.179	89.630	89.227
2	15	89.450	89.303	89.234	89.218	89.581	89.205
3	30	89.361	89.298	89.223	89.163	89.565	89.200
4	45	89.183	89.314	89.218	89.152	89.619	89.189
5	60	89.250	89.276	89.207	89.163	89.587	89.183
6	75	89.445	89.281	89.190	89.147	89.592	89.178
7	90	89.385	89.325	89.201	89.152	89.597	89.156
8	105	89.445	89.265	89.190	89.136	89.625	89.161
9	120	89.385	89.243	89.179	89.125	89.538	89.139
10	135	89.418	89.298	89.179	89.125	89.554	89.145
11	150	89.396	89.260	89.158	89.130	89.570	89.145
12	165	89.407	89.254	89.152	89.130	89.570	89.123
13	180	89.385	89.216	89.141	89.108	89.603	89.128
14	195	89.380	89.232	89.141	89.103	89.592	89.145
15	210	89.353	89.227	89.147	89.114	89.543	89.095
16	225	89.369	89.238	89.158	89.097	89.527	89.117
17	240	89.374	89.238	89.130	89.097	89.548	89.101
18	255	89.320	89.205	89.136	89.081	89.527	89.095
19	270	89.358	89.189	89.108	89.097	89.472	89.079
20	285	89.336	89.194	89.108	89.086	89.472	89.084
21	300	89.358	89.227	89.097	89.065	89.527	89.084
22	315	89.325	89.162	89.103	89.048	89.581	89.084
23	330	89.309	89.173	89.097	89.075	89.445	89.057

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	TEMP 37 DEG. F	TEMP 38 DEG. F	TEMP 39 DEG. F	TEMP 40 DEG. F	PRES 1 PSIA	HUM 1 FRACTION
1	0	88.939	88.900	89.366	DELETED	60.639	0.293
2	15	88.922	88.922	89.360	DELETED	60.635	0.293
3	30	88.922	88.894	89.349	DELETED	60.633	0.294
4	45	88.917	88.883	89.333	DELETED	60.630	0.294
5	60	88.917	88.878	89.349	DELETED	60.626	0.293
6	75	88.906	88.872	89.322	DELETED	60.623	0.294
7	90	88.911	88.872	89.327	DELETED	60.619	0.294
8	105	88.889	88.856	89.317	DELETED	60.616	0.294
9	120	88.895	88.883	89.306	DELETED	60.613	0.294
10	135	88.895	88.829	89.295	DELETED	60.610	0.294
11	150	88.873	88.823	89.306	DELETED	60.606	0.294
12	165	88.884	88.867	89.311	DELETED	60.601	0.294
13	180	88.868	88.840	89.295	DELETED	60.597	0.294
14	195	88.868	88.829	89.278	DELETED	60.592	0.295
15	210	88.868	88.812	89.284	DELETED	60.586	0.295
16	225	88.857	88.818	89.278	DELETED	60.582	0.295
17	240	88.868	88.779	89.267	DELETED	60.577	0.295
18	255	88.857	88.823	89.278	DELETED	60.571	0.295
19	270	88.846	88.812	89.267	DELETED	60.566	0.295
20	285	88.840	88.851	89.256	DELETED	60.561	0.295
21	300	88.835	88.801	89.273	DELETED	60.556	0.295
22	315	88.835	88.779	89.267	DELETED	60.551	0.295
23	330	88.835	88.779	89.267	DELETED	60.548	0.295

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	HUM 8 FRACTION	HUM 9 FRACTION	HUM 10 FRACTION
1	0	0.309	0.301	0.302
2	15	0.309	0.301	0.303
3	30	0.309	0.301	0.302
4	45	0.309	0.301	0.303
5	60	0.309	0.301	0.303
6	75	0.309	0.301	0.303
7	90	0.309	0.301	0.303
8	105	0.309	0.301	0.303
9	120	0.309	0.302	0.303
10	135	0.310	0.302	0.303
11	150	0.310	0.302	0.303
12	165	0.310	0.302	0.303
13	180	0.310	0.302	0.304
14	195	0.310	0.302	0.303
15	210	0.310	0.302	0.303
16	225	0.310	0.302	0.304
17	240	0.310	0.302	0.304
18	255	0.310	0.302	0.304
19	270	0.310	0.302	0.304
20	285	0.310	0.302	0.304
21	300	0.310	0.302	0.304
22	315	0.310	0.303	0.304
23	330	0.311	0.303	0.304

END OF TABLE

VARIABLE TABLE SUMMARY

SAMPLE NUMBER	DELTA MINS	HUM 2 FRACTION	HUM 3 FRACTION	HUM 4 FRACTION	HUM 5 FRACTION	HUM 6 FRACTION	HUM 7 FRACTION
1	0	0.292	0.283	0.296	0.294	0.294	0.289
2	15	0.293	0.283	0.296	0.294	0.294	0.289
3	30	0.294	0.284	0.296	0.294	0.294	0.288
4	45	0.293	0.284	0.296	0.294	0.294	0.289
5	60	0.293	0.284	0.296	0.294	0.295	0.289
6	75	0.294	0.284	0.296	0.294	0.295	0.289
7	90	0.293	0.284	0.296	0.294	0.294	0.289
8	105	0.294	0.284	0.297	0.294	0.295	0.289
9	120	0.294	0.285	0.296	0.295	0.295	0.289
10	135	0.294	0.284	0.297	0.295	0.295	0.289
11	150	0.294	0.285	0.297	0.295	0.295	0.290
12	165	0.294	0.285	0.297	0.295	0.295	0.290
13	180	0.293	0.285	0.297	0.294	0.295	0.289
14	195	0.295	0.285	0.297	0.295	0.295	0.290
15	210	0.295	0.285	0.297	0.295	0.296	0.290
16	225	0.295	0.285	0.297	0.295	0.295	0.290
17	240	0.295	0.285	0.297	0.295	0.296	0.291
18	255	0.295	0.286	0.297	0.295	0.296	0.290
19	270	0.294	0.285	0.297	0.295	0.296	0.291
20	285	0.295	0.286	0.298	0.296	0.296	0.291
21	300	0.295	0.286	0.298	0.296	0.296	0.291
22	315	0.295	0.286	0.298	0.295	0.296	0.291
23	330	0.295	0.286	0.298	0.296	0.296	0.291

END OF TABLE

APPENDIX C.

[illegible] AND VOLUMETRIC WEIGHTING FACTORS

RTD VOLUMETRIC WEIGHTING FACTORS

RTD SENSOR NUMBER	REDUCED PRESSURE ILRT FRACTION	PEAK PRESSURE ILRT FRACTION
1	0.02513	0.02513
2	0.02513	0.02513
3	0.02513	0.02513
4	0.02815	0.02815
5	0.02815	0.02815
6	0.02815	0.02815
7	0.02815	0.02815
8	0.02815	0.02815
9	0.02815	0.02815
10	0.02815	0.02815
11	0.02815	0.02815
12	0.02815	0.02815
13	0.01883	0.01883
14	0.01883	0.01883
15	0.01883	0.01883
16	0.01883	0.01883
17	0.01940	0.03110
18	0.01940	DELETED
19	0.01940	0.03110
20	0.01940	DELETED
21	0.03278	0.03278
22	0.03278	0.03278
23	0.03278	0.03278
24	0.03278	0.03278
25	0.03278	0.03278
26	0.03278	0.03278
27	0.03278	0.03278
28	0.03278	0.03278
29	0.03278	0.03278
30	0.03278	0.03278
31	0.01883	0.01883
32	0.01883	0.01883
33	0.01883	0.01883
34	0.01883	0.01883
35	0.01883	0.01883
36	0.01883	0.01883
37	0.01940	0.03110
38	0.01940	0.03110
39	0.01940	0.03110
40	0.01940	DELETED

RHD VOLUMETRIC WEIGHTING FACTORS

RHD SENSOR NUMBER	REDUCED PRESSURE ILRT FRACTION	PEAK PRESSURE ILRT FRACTION
1	0.15654	0.15654
2	0.15654	0.15654
3	0.15654	0.15654
4	0.09215	0.09215
5	0.09215	0.09215
6	0.09215	0.09215
7	0.09215	0.09215
8	0.05392	0.05392
9	0.05392	0.05392
10	0.05392	0.05392

ENTERGY

Entergy Operations, Inc.

R. F. Burski

W3F1-91-0447
A4.05
QA

August 12, 1991

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Reactor Containment Building Integrated Leak Rate Test

Gentlemen:

In accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50, Appendix J - Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, please find attached the summary technical report detailing results of the second periodic Type A Integrated Leak Rate Test performed for Waterford 3.

Included in the report is a description of the instrumentation and the supplemental test method. Also contained in the report is a presentation of the leakage rate tests data along with an analysis demonstrating the acceptability of the containment leakage rate in meeting the prescribed acceptance criteria.

Should you have any questions or comments in this matter, please contact me or T.J. Gaudet at (504) 739-6666.

Very truly yours,

R.F. Burski

RFB/BRL/ssf
Attachment

(w/Attachment)
cc: R.D. Martin, NRC Region IV
NRC Resident Inspectors Office

(w/o Attachment)
cc: D.L. Wigginton, NRC-NRR
R.B. McGehee
N.S. Reynolds

9108150042

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION

UNIT 3

REACTOR CONTAINMENT BUILDING

INTEGRATED LEAK RATE TEST

FINAL REPORT

Prepared By:

BCP Technical Services, Inc.

June, 1991

TABLE OF CONTENTS

1.0 SUMMARY

The second periodic integrated leakage rate test (ILRT) on Waterford SES Unit 3 containment was sucessfully completed on May 12, 1991. All acceptance criteria specified in the test procedure (Ref. 1) were satisfied. Test results and acceptance criteria are listed below.

Parameter	Results	Acceptance Limits(s)
95% upper confidence limit (UCL) on total time leakage rate (including additional)	0.0731 wt%/day	<0.375 wt%/day
Total time leakage rate trend extrapolated to 24 hours	0.0672	<0.375
Mean of the measured leakage rates over the final 5 hours	0.0694	<0.500
Verification leakage rate	0.5443	0.4611 - 0.7111
As found 95% UCL (test result plus minimum pathway improvements)	0.0858	<0.375

Containment pressurization started at 7:38 a.m. on May 10, 1991 and was stopped at 6:54 p.m. on the same day when containment pressure had reached 46 psig. Following an extended temperature stabilization period, (See Section 4.0, Chronology and Events), the start of the eight (8) hour (minimum) test period was declared at 5:30 p.m. on May 11. The test ended at 1:30 a.m. on May 12 and the verification leakage was imposed. The verification test was started at 2:45 a.m., following a mandatory one hour stabilization period, and ended at 6:45 a.m. Containment pressure stayed between 46 and 44 psig throughout the stabilization, test and verification phases.

The ILRT was conducted in accordance with a controlled procedure (Ref. 1) which incorporated the requirements of the FSAR (Ref. 2), the Technical Specification (Ref. 3), Appendix J to 10CFR50 (Ref. 4) and BN-TOP-1 (Ref. 5). ANSI/ANS 56.8 (Ref. 6) was used for informational guidance on certain aspects of the test. Valves on piping systems penetrating containment were aligned as specified in Ref. 2,

with the exception of those on shutdown cooling and fire protection lines. Fire protection was left in service to satisfy Fire Protection Program (UNT - 005 -013) requirements and a penalty was taken on minimum pathway leakage through the penetrations.

A structural examination of the exterior and interior surfaces of the containment vessel was performed in conjuction with the ILRT as required by Ref. 3. No evidence of degradation was found.

2.0 DESCRIPTION OF CONTAINMENT

The containment vessel completely encloses the entire reactor coolant system to ensure no leakage of radioactive materials to the environment in the unlikely event of a loss of coolant accident.

The containment system incorporates a free-standing containment vessel surrounded by a low leakage reinforced concrete shield building. A four foot annular air space is provided between the outer wall of the containment vessel and the inner wall of the shield building to allow filtration of any containment vessel leakage during accident conditions to minimize off-site doses.

The free-standing containment vessel is a two inch thick circular cylinder, with a one inch thick hemispherical dome and two inch thick ellipsoidal bottom. The overall vessel dimensions are: 140 foot diameter by 240.5 foot high. The vessel wall thickness is increased to a minimum of four inches adjacent to all penetrations and openings. The vessel is fabricated of ASME-SA 516 Grade 70 fully killed pressure vessel quality steel plate. The net free volume of the containment is 2,677,000 cubic feet.

The containment vessel structure includes one personnel airlock, one emergency escape airlock, one fuel transfer tube, one equipment maintenance hatch, and one seal-welded construction hatch. All process piping and electrical penetrations are welded directly to the containment vessel nozzles, with the exception of the main steam, main feedwater, and fuel transfer tube penetrations. These penetrations are provided with testable expansion bellows to allow for thermal growth or building differential motion.

The containment vessel is designed and constructed in accordance with the requirements for class MC vessels contained in Section III, Subsection NE of the ASME Code, 1971 Edition including Summer 1971 Addenda and Code cases 1431, 1454-1 and 1517, as approved by the USNRC Regulatory Guides 1.84 and 1.85. The containment vessel is code stamped in accordance with Paragraph NE-8000 of Section III of the ASME Boiler and Pressure Vessel Code. The containment vessel and all penetrations are designed to limit leakage to less than 0.5 percent by weight of the containment air mass per day at a design pressure of 44 psig. The calculated peak accident pressure for the design basis accident at Waterford SES Unit No. 3 is 44 psig at 263 degrees Fahrenheit.

3.0 PROCEDURE AND METHODOLOGY

The leakage rate test was conducted by aligning containment systems in the specified post-accident configuration, pressurizing the containment to the design basis accident pressure of 44 (+3, -0) psig, measuring containment atmospheric conditions, and calculating the out leakage of the air using the atmospheric condition data. These activities are described in detail in the following paragraphs.

3.1 Containment Preparation

Systems penetrating containment were aligned in the specified post-accident configuration except that systems required to maintain the plant in a safe condition were aligned to perform the safety function. Systems postulated to rupture as a result of the accident were vented inside and outside of containment (with the exceptions noted above). Isolation valves were closed. The reactor coolant system was vented to containment atmosphere through the pressurizer. The safety injection tanks were vented to ensure that slow in or out leakage would not occur. The reactor drain tank and pressurizer relief tanks were vented for the same reason as well as to provide protection against external pressure. Sources of compressed gasses within the containment (fire extinguishers, accumulators, etc.) were removed, vented or fitted with pressure gages to determine gas loss. A complete listing of valve lineups, temporary gage installations, and items removed from containment is included in Ref. 1.

Items unable to withstand ILRT pressure were removed from the containment. These are identified in Ref. 1. The breakers feeding many equipment items were racked (or locked) out to protect the containment against major water injections as well as to prevent events which could invalidate leakage rate test results. A complete listing of breaker lineups is contained in Ref. 1. Prior to pressurization, the inside and outside surfaces of the containment were examined for evidence of structural deterioration which might limit pressure retaining capacity.

All fans and containment lighting were shut off prior to pressurization. This was done to eliminate point sources of heat which could effect the response of the temperature measuring instruments. Instrumentation was installed prior to containment closure.

A containment temperature/humidity survey was done prior to final instrument placement to verify that significant temperature gradients existed only in the vertical direction and that water vapor is uniformly dispersed throughout the containment. RTD and RHD locations were specified on the basis of these assumed conditions. Wet and dry bulb temperatures were measured at several azimuths on the -4, 21, 46, and 95 foot levels, and at both ends and the middle of the polar crane girder catwalk.

Dry bulb temperature was found to vary significantly only with elevation as assumed. Water vapor pressure as determined from wet and drybulb temperatures was found to be essentially constant throughout the containment, which confirmed the assumption of a uniform dispersion of water vapor. Survey numerical results are included in the offical test copy of Ref 1.

Local (type B and C) leakage rate tests were completed prior to the start of the integrated leakage rate test. Results of all local tests performed since the first periodic ILRT are included in the Appendix.

3.2 Pressurization

The containment was pressurized at a rate of about 4 psi/hour using oil free compressors with an aggregate capacity of 13,550 SCFM. The discharge air was passed through two trains of aftercooler/moisture separator units and refrigerated air dryers. Plant chilled water was used for cooling. Pressurization air was dried to minimize the probability of moisture condensation in containment during the ILRT. Pressurization was stopped at

46 psig. This allowed an adequate margin (2 psi) for pressure decay due to cooling of the air which had been heated well above the equilibrium temperature during pressurization.

3.3 Test Measurements, Instrumentation and Air Mass Calculation

The containment atmosphere condition data required to calculate leakage rate were provided by two (2) vibrating cylinder manometers, forty (40) resistance temperature detectors (RTD) and ten (10) resistance humidity detectors (RHD). The performance characteristics of these devices are listed in Table 2.1. The vibrating cylinder manometers were connected to the containment atmosphere through a penetration dedicated to the leakage rate test. The RTD's and RHD's were hung at well dispersed elevations and azimuths within the containment. Table 2.2 identifies the locations of these devices.

Wiring from the RTD's and RHD's was connected through containment electrical penetrations to conditioning electronics located in the reactor auxiliary building. The vibrating cylinder manometers were connected to the conditioning electonics via 20 ma current loops. Output from the conditioning electronics was connected to a multiplexer which was, in turn, wired to the plant computer. The temperature, relative humidity (R.H.) and pressure data, in degrees Fahrenheit, % R.H. and psia units respectively, were output by the plant computer to the ILRT computer (an IBM PC/System 2), at fifteen (15) minute intervals via a serial interface.

Water vapor pressure is determined from temperature and R.H. data. Each RHD was installed adjacent to an RTD. The BCP Technical Services, Inc., ILRT program contains an algorithm to calculate the saturation pressure corresponding to the temperature indicated by the RTD. Partial pressure of the water vapor at the RHD/RTD location is determined as the product of saturation pressure and R.H. The program then calculates volume weighted mean temperature and vapor pressure using the weighting factors listed in Table 2.2. The mass of the air within the containment is computed using equation (1) which is a formulation of the ideal gas law.

$$M = (P - P_v) V/RT \quad (1)$$

Where:

M = Total mass of dry air in the containment, lbm.
P = Absolute pressure of the air/water vapor mixture, lb/sq. ft.
P_v = Absolute pressure of the water vapor, lb/sq. ft.

V = Containment free air volume, cu. ft.
R = Gas constant for air, lbf-ft/lbm - degree R.
T = Volume weighted mean containment temperature, degree R.

Water vapor pressure is subtracted from total pressure in an effort to ensure that air mass and, consequently, leakage rate are not affected by evaporation or condensation.

The magnitude of the leakage induced during the verification test was measured using a float type flowmeter throttled at the output. The characteristics of this device are listed in Table 2.1.

All instrumentation was laboratory calibrated prior to the test. Following installation of the RTD's and RHD's, in situ performance was checked to verify end to end system calibration. RTD performance was checked by inserting the sensing elements in an ice bath and verifying that the plant computer displayed a temperature within one (1) degree Fahrenheit of the bath temperature. RHD performance was checked using a psychometer. Dewpoint temperatures were calculated for the psychometer wet and drybulb readings and for the RTD and RHD readings displayed by the plant computer. The two dewpoint temperatures were verified to be within five (5) degrees Fahrenheit of each other.

Containment gage pressure was measured with a conventional dial type pressure gage. The performance characteristics of this gage are listed in Table 2.1

3.4 Leakage Rate Calculations

Leakage rate was calculated using both the total time and the mass point methods. The mass point method, as described in Ref. 6, defines leakage rate as the slope of a straight line fitted to air mass vs. time data sets, by the method of least squares. The total time method, as described in Ref. 5, is based on the premise the leakage rate varies linearly with time, and defines the leakage rate as the ordinate of the leakage rate versus time at the end of the test. The leakage rate versus time line is fitted by the method of least squares to measured leakage rate/time data sets. Measured leakage rate for any time, t_i is the initial air mass (at t_o) less the air mass at t_i divided by (t_i-t_o).

The 95% upper confidence limit (UCL) on the calculated leakage rate must be less than the acceptance limit (0.375% mass loss per day). The UCL is always greater than the calculated leakage rate and increases with the scatter of the air mass data away from a straight line trend with time. The 95% UCL is effectively described by the following statement. If the leakage rate test is performed a very large number of times under identical conditions, 95% of the calculated leakage rates (no two of which will be exactly the same) will be less than the 95% UCL*.

The test procedure requires the total time calculation. Results of the mass point calculation are reported to provide additional information.

* The derivation of total time UCL in Ref. 5 introduces added conservatism into the calculation. What is referred to as a 95% UCL in that document does, in fact, provided a much higher (than 95%) level of confidence.

4.0 CHRONOLOGY AND EVENTS

Containment preparation including instrument installation and valve lineups were completed by 5:50 a.m. on May 10, 1991. Prior to the start of pressurization RTD 29 was declared inoperable due to cabling problems. RTD 29's volume fraction was equally distributed to the two (2) vertically adjacent RTD's 27 and 30. Pressurization was started at 7:38 a.m., following final containment closure and sign off of procedure prerequisites. Pressurization was stopped at 6:54 p.m. on the same day when pressure had reached 46 PSIG.

During the temperature stabilation period, preliminary leakage rate calculations indicated excessive leakage of approximately 2.9 wt%/day. The major portion of the leakage was observed at the refueling water storage pool access hatch. Air was leaking through the Safety Injection Sump Recirculation line valves SI-602 A and B. These valves are not classified as containment isolation valves and are not required to be vented for the ILRT per FSAR Table 6.2-32. Initial hand tightening of the valves reduced the leakage to approximately 0.6 wt%/day. No other significant leakage paths were identified. At 4:00 p.m. on May 11, additional hand tightening of SI-602 B reduced the leakage to approximately 0.06 wt%/day.

The eight (8) hour (minumum) test period started at 5:30 p.m. on May 11 after verifying that the temperature stabilization criteria (Ref. 5) had been satisfied during the preceeding four (4) hour period. The test ended at 1:30 a.m. on May 12. Verification flow was established just prior to 1:45 a.m. The four (4) hour verification test was started at 2:45 a.m., following a mandatory one hour stabilization period (Ref. 5), and ended at 6:45 a.m.

Containment depressurization started 8:17 a.m. The depressurization rate was maintained below 6 PSI/hour to satisfy Ref. 1 requirements. The containment was opened when zero pressure was reached at 6:15 p.m. on May 12.

5.0 TEST RESULTS

The eight (8) hour (minimum) leakage rate test was started at 5:30 p.m. on May 11, 1991. Temperature stabilization criteria were satisfied prior to the test as shown on Table 4.1. Temperature decay is illustrated graphically in Figure 4.1. Containment pressure at the start of the test was 44.2 PSIG. All original test data is filed with the official test copy of Ref. 1.

5.1 Total Time Leakage Rate

Containment leakage rate was quite small. The computed 95% UCL on the total time leakage rate was 0.0718 wt%/day which is less than one fifth of the procedure acceptance limit of 0.375 wt%/day (Table 4.2) and showed a decreasing trend. All total time measured rates were below 0.375 wt%/day. Therefore, all total time acceptance criteria were met. Test duration was 8 hours. Pressure and temperature decay during the 8 hour test are shown graphically on Figures 4.2 and 4.3 respectively. Air mass change is shown graphically on Figure 4.4, which is discussed later in Section 5.2.

The fire protection penetrations (60 and 61), the ILRT pressurization line penetration (63) and ILRT pressure sense line penetration (65) were not aligned in the specified post-accident configuration during the ILRT. The minimum pathway leakage through these penetrations must be added to the total time UCL to compensate for the nonconservative valve lineups. These minimum pathway leakages are listed below.

PENETRATION	Leakage, SCCM		
60	1620		
61	351		
63	710		
65	20		
Total	2701 SCCM	=	0.0013 wt%/day

Adding the total minimum pathway leakage to the calculated total time 95% UCL of 0.0718 wt%/day yields the adjusted total time 95% UCL of 0.0731 wt%/day.

Changes in the accumulator pressures were too small to affect leakage rate in the least significant figure. Pressures are recorded in the official test copy of Ref. 1. RCS level dropped only slightly, but no correction for falling level is allowed. Sump and tank levels did not change.

Following the 8 hour test, a 38 SCFM (equal to La = 0.5 wt%/day) leak was imposed on the containment through a flowmeter following a one hour stabilization period. The new leakage rate was determined for a 4 hour test duration. The calculated total time leakage rate of 0.5443 wt%/day fell within the acceptance limits of 0.4611 and 0.7111 wt%/day as shown on Table 4.3. Successful completion of the verification test demonstrates the validity of the leakage rate computational methods. The acceptance criterion for the verification test is stated as:

$$L_a + L_o - .25\,L_o \leq L_c \leq L_a + L_o + .25\,L_o$$

where:

L_a is the total time leakage rate calculated for the 8 hour test = 0.0672

L_o is the imposed leakage rate = 0.5189

*L_a is the maximum allowable Leakage rate = 0.500

L_c is the rate calculated during the verification test

It must be shown that the results of the leakage rate test would have been acceptable had the test been performed prior to any repairs being made during the local leakage rate testing program. This is shown by adding minimum pathway leakage improvements to the total time 95% UCL. Total minimum pathway improvements sum to 26,324.5 SCCM which is equivalent to 0.0127 wt%/day. Adding this to the total time 95% UCL of 0.0731 wt%/day (includes additions for penetrations 60,61,63 and 65) results in a theoretical as found (before repairs) leakage rate of 0.0858 wt%/day. This is well below even the as left acceptance limit of 0.375 wt%/day. Local leakage rate test results are included in the Appendix.

* The leakage rate prior to a return to power must be less than .75 La. This allows 0.25 La for increases in leakage rate during the operation cycles between leakage rate tests.

5.2 Mass Point Leakage Rate

Mass point calculations generally provide a more realistic estimate of true leakage rate than do total time calculations (total time, as defined in Ref. 5, is always applied to a test with a duration under twenty four (24) hours since the 95% UCL is a very conservative upper bound on leakage rate). Mass point results are listed below for information.

Mass Point calculated leakage rate	=	**0.0669 wt%/day**
Mass Point 95% UCL	=	**0.0679 wt%/day**
Mass Point verification upper limit	=	0.7108 wt%/day
Mass Point verification calculated rate	=	0.5468 wt%/day
Mass Point verification lower limit	=	0.4608 wt%/day

Complete mass point data is contained in Tables 4.4 and 4.5

Figure 4.4 is a plot of air mass versus time. The plot includes the line fitted to the mass data and a line which represents a leakage rate of 0.375 wt%/day (0.75 La). The slope of the line fitted to the mass data is the calculated leakage rate. Figure 4.5 is a plot of air mass versus time during the verification test. The plot includes the line fitted to the mass data and lines representing the upper and lower acceptance limits on calculated

verification leakage rate. In both figures, the plotted air masses show very little divergence about the fitted line.

5.3 Shield Building Examination

Reference 3 requires that the exterior and interior surfaces of the shield building be examined in conjunction with the ILRT to determine structural condition. The examination was performed prior to pressurization. No evidence of abnormal deterioration was found.

6.0 REFERENCES

1. Surveillance Procedure PE-005-001, Containment Integrated Leak Rate Test, Revision 3.

2. Final Safety Analysis Report, Section 6.2.6 and 3.8.2.7.

3. Technical Specifications, Section 4.6.1.2 a/b/c/f, 4.6.1.6 and 4.6.6.3.

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

5. Bechtel Topical Report, BN-TOP-1, Testing Criteria For Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants, Revision 1, November, 1972.

6. ANSI/ANS 56.8 - 1981, Containment System Leakage Testing Requirements

7. (Reference cited in Appendix J) ANSI N45.4 - 1972, Leakage Rate Testing Of Containment Structures for Nuclear Reactors.

TABLES AND FIGURES

TABLE 2.1

TEST INSTRUMENTATION PERFORMANCE CHARACTERISTICS

Precision Manometer

Make and Model:	Volumetrics PPM 1000
Range:	0-100 PSIA
Absolute Accuracy:	0.015% reading + .005% F.S.
Resolution:	0.0001 PSIA

Resistance Temperature Detector

Make and Model:	Burns WPPOG1-5 1/2-3-A
Range:	Calibrated from 32 degrees Fahrenheit to 120 degrees Fahrenheit
Absolute Accuracy:	0.1 degrees Fahrenheit
Resolution:	0.01 degrees Fahrenheit

Resistance Humidity Detector

Make and Model:	PhysChem Research Model B
Range:	0-100% relative humidity
Absolute Accuracy:	2% R.H.
Resolution:	0.01% R.H.

Flow Meter

Make and Model:	Brooks Model 1110-10K3B1A
Range:	8 - 75 SCFM
Absolute Accuracy:	1% F.S.

Pressure Gage

Make and Model:	Heise Model CM
Range:	0-100 PSIG
Absolute Accuracy:	1% F.S.

TABLE 2.2

RTD/(RHD)	(1) El.,Ft.	(2) Rad. Ft.	AZ, degree	(3) Volume Fraction
1	195.0	7.5	20	.0271
2	176.5	23.0	140	.0281
3	170.0	28.5	260	.0273
4	158.5	38.0	20	.0263
5/(1)	184.5	16.0	60	.0289
6	153.5	42.5	100	.0274
7	148.5	46.5	140	.0281
8/(2)	164.0	33.5	180	.0298
9	138.5	49.5	220	.0288
10	133.5	49.5	260	.0288
11/(3)	143.5	49.5	300	.0286
12/(7)	128.5	49.5	340	.0288
13	38.5	59.0	230	.0201
14/(6)	73.5	49.5	260	.0278
15	48.5	49.5	300	.0227
16	68.5	49.5	340	.0274
17	23.5	63.5	210	.0201
18	18.5	52.5	230	.0201
19	13.5	52.0	290	.0201
20	8.5	49.5	320	.0180
21	123.5	49.5	20	.0288
22	118.5	49.5	60	.0284
23	113.5	49.5	100	.0284
24	103.5	49.5	140	.0284
25/(5)	108.5	49.5	180	.0284
26	98.5	49.5	180	.0284
27	88.5	49.5	220	.0426
28/(10)	93.5	49.5	260	.0284
29	83.5	49.5	300	.0000 (5)
30	78.5	49.5	340	.0426
31	30 (4)	48.0	10	.0241
32	58.5	52.5	30	.0236

TABLE 2.2

Continued

RTD/(RHD)	(1) El.,Ft.	(2) Rad. Ft.	AZ, degree	(3) Volume Fraction
33/(4)	53.5	49.5	70	.0236
34	33.5	57.5	110	.0201
35	63.5	49.5	140	.0266
36	43.5	64.0	200	.0201
37/(8)	3.5	61.5	20	.0148
38	-1.5	49.5	70	.0129
39	-6.1	49.5	100	.0154
40/(9)	27.5	49.5	170	.0201

Notes:

1. Reference elevations: Lowest Level (-) 11 ft.; Spring line (+) 138 ft.; Top hemisphere (+) 208 ft.

2. Containment radius = 70 ft.

3. Containment free air volume = 2,677,000 cu. ft. All RHD's have volume fractions of 0.1.

4. RTD hung in refueling cavity.

5. RTD 29 was inoperable. Its original volume fraction of .0284 was equally distributed between RTD's 27 and 30.

6. As installed elevations, radius, and azimuths are +/- 3 ft., +/- 5 ft. and +/- 5 degrees, respectively.

TABLE 4.1

WATERFORD 3 - 1991 ILRT
TEMPERATURE STABILIZATION REPORT
Start Time = 1330 511
* = stabilization criterion satisfied

data set	elapsed time, hr	temperature T, deg F	dT1 avg dT (1 hr)	dT4 avg dT (4 hr)	ANSI dT1-dT4 avg (2 hr)	BN-TOP-1 dT avg (2 hr)	or d(dT)
1	0.00	77.267					
2	0.25	77.253					
3	0.50	77.243					
4	0.75	77.233					
5	1.00	77.218	-0.049				
6	1.25	77.209	-0.044				
7	1.50	77.200	-0.043				
8	1.75	77.188	-0.045				
9	2.00	77.181	-0.038			-0.043*	0.013*
10	2.25	77.174	-0.035			-0.039*	0.007*
11	2.50	77.165	-0.035			-0.039*	0.002*
12	2.75	77.165	-0.023			-0.034*	0.028*
13	3.00	77.161	-0.019			-0.028*	0.011*
14	3.25	77.160	-0.014			-0.025*	0.016*
15	3.50	77.155	-0.009			-0.022*	0.015*
16	3.75	77.154	-0.011			-0.017*	0.011*
17	4.00	77.151	-0.010	-0.029	0.019*	-0.015*	0.007*

TABLE 4.2

WATERFORD 3 - 1991 ILRT
TOTAL TIME LEAKAGE RATE REPORT

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	measured rate (%/day)	leakage rate (%/day)	ucl rate (%/day)
17	1730	511	0.00	788408.89	0.0000	0.0000	0.0000
18	1745	511	0.25	788403.07	0.0708	0.0708	0.0708
19	1800	511	0.50	788396.59	0.0749	0.0749	0.0749
20	1815	511	0.75	788391.56	0.0703	0.0718	0.1059
21	1830	511	1.00	788387.13	0.0662	0.0678	0.0841
22	1845	511	1.25	788381.11	0.0676	0.0670	0.0775
23	1900	511	1.50	788372.84	0.0732	0.0695	0.0814
24	1915	511	1.75	788366.63	0.0735	0.0712	0.0818
25	1930	511	2.00	788361.70	0.0718	0.0715	0.0807
26	1945	511	2.25	788357.99	0.0689	0.0706	0.0790
27	2000	511	2.50	788352.83	0.0683	0.0697	0.0775
28	2015	511	2.75	788342.60	0.0734	0.0708	0.0784
29	2030	511	3.00	788339.01	0.0709	0.0708	0.0779
30	2045	511	3.25	788330.47	0.0734	0.0715	0.0784
31	2100	511	3.50	788323.53	0.0742	0.0723	0.0789
32	2115	511	3.75	788320.46	0.0718	0.0723	0.0786
33	2130	511	4.00	788317.66	0.0694	0.0717	0.0780
34	2145	511	4.25	788310.68	0.0703	0.0715	0.0775
35	2200	511	4.50	788306.43	0.0693	0.0711	0.0770
36	2215	511	4.75	788304.19	0.0671	0.0703	0.0763
37	2230	511	5.00	788297.31	0.0679	0.0698	0.0757
38	2245	511	5.25	788290.11	0.0689	0.0696	0.0753
39	2300	511	5.50	788286.27	0.0679	0.0692	0.0748
40	2315	511	5.75	788281.23	0.0676	0.0689	0.0743
41	2330	511	6.00	788274.58	0.0681	0.0686	0.0739
42	2345	511	6.25	788270.90	0.0672	0.0683	0.0735
43	0	512	6.50	788266.36	0.0667	0.0679	0.0730
44	15	512	6.75	788258.78	0.0677	0.0678	0.0727
45	30	512	7.00	788251.21	0.0686	0.0677	0.0726
46	45	512	7.25	788249.22	0.0670	0.0675	0.0723
47	100	512	7.50	788239.49	0.0688	0.0675	0.0722
48	115	512	7.75	788241.12	0.0659	0.0672	0.0718
49	130	512	8.00	788228.78	0.0685	0.0672	0.0718

Allowable leakage rate, La	=	0.5000 %/day
75% La	=	0.3750 %/day
Total time leakage rate	=	0.0672 %/day
Total time UCL	=	0.0718 %/day

TABLE 4.3

WATERFORD 3 - 1991 ILRT
TOTAL TIME LEAKAGE RATE REPORT
VERIFICATION

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	measured rate (%/day)	leakage rate (%/day)
54	245	512	0.00	788025.96	0.0000	0.0000
55	300	512	0.25	787977.23	0.5937	0.5937
56	315	512	0.50	787935.21	0.5528	0.5528
57	330	512	0.75	787890.43	0.5504	0.5440
58	345	512	1.00	787836.98	0.5756	0.5596
59	400	512	1.25	787797.38	0.5569	0.5557
60	415	512	1.50	787752.91	0.5544	0.5526
61	430	512	1.75	787709.80	0.5502	0.5491
62	445	512	2.00	787664.61	0.5503	0.5471
63	500	512	2.25	787615.06	0.5562	0.5481
64	515	512	2.50	787570.86	0.5544	0.5483
65	530	512	2.75	787525.38	0.5544	0.5486
66	545	512	3.00	787483.53	0.5507	0.5477
67	600	512	3.25	787442.59	0.5467	0.5460
68	615	512	3.50	787393.88	0.5500	0.5456
69	630	512	3.75	787350.19	0.5488	0.5451
70	645	512	4.00	787307.34	0.5472	0.5443

Upper limit on leakage rate	=	0.7111 %/day
Total time leakage rate	=	0.5443 %/day
Lower limit on leakage rate	=	0.4611 %/day

TABLE 4.4

WATERFORD 3 - 1991 ILRT
MASS POINT LEAKAGE RATE REPORT

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	leakage rate (%/day)	ucl rate (%/day)
17	1730	511	0.00	788408.89	0.0000	0.0000
18	1745	511	0.25	788403.07	0.0708	0.0708
19	1800	511	0.50	788396.59	0.0749	0.0952
20	1815	511	0.75	788391.56	0.0712	0.0782
21	1830	511	1.00	788387.13	0.0670	0.0735
22	1845	511	1.25	788381.11	0.0667	0.0706
23	1900	511	1.50	788372.84	0.0702	0.0751
24	1915	511	1.75	788366.63	0.0722	0.0763
25	1930	511	2.00	788361.70	0.0723	0.0754
26	1945	511	2.25	788357.99	0.0708	0.0737
27	2000	511	2.50	788352.83	0.0697	0.0723
28	2015	511	2.75	788342.60	0.0711	0.0738
29	2030	511	3.00	788339.01	0.0711	0.0733
30	2045	511	3.25	788330.47	0.0720	0.0741
31	2100	511	3.50	788323.53	0.0729	0.0750
32	2115	511	3.75	788320.46	0.0728	0.0745
33	2130	511	4.00	788317.66	0.0719	0.0737
34	2145	511	4.25	788310.68	0.0715	0.0731
35	2200	511	4.50	788306.43	0.0709	0.0725
36	2215	511	4.75	788304.19	0.0699	0.0716
37	2230	511	5.00	788297.31	0.0693	0.0710
38	2245	511	5.25	788290.11	0.0690	0.0706
39	2300	511	5.50	788286.27	0.0686	0.0701
40	2315	511	5.75	788281.23	0.0682	0.0696
41	2330	511	6.00	788274.58	0.0680	0.0693
42	2345	511	6.25	788270.90	0.0677	0.0689
43	0	512	6.50	788266.36	0.0673	0.0685
44	15	512	6.75	788258.78	0.0672	0.0683
45	30	512	7.00	788251.21	0.0673	0.0683
46	45	512	7.25	788249.22	0.0671	0.0681
47	100	512	7.50	788239.49	0.0672	0.0681
48	115	512	7.75	788241.12	0.0668	0.0678
49	130	512	8.00	788228.78	0.0669	0.0679

Allowable leakage rate, La	=	0.5000 %/day
75% La	=	0.3750 %/day
Mass point leakage rate	=	0.0669 %/day
Mass point UCL	=	0.0679 %/day

TABLE 4.5

WATERFORD 3 - 1991 ILRT
MASS POINT LEAKAGE RATE REPORT
VERIFICATION

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	leakage rate (%/day)
54	245	512	0.00	788025.96	0.0000
55	300	512	0.25	787977.23	0.5937
56	315	512	0.50	787935.21	0.5528
57	330	512	0.75	787890.43	0.5465
58	345	512	1.00	787836.98	0.5662
59	400	512	1.25	787797.38	0.5598
60	415	512	1.50	787752.91	0.5556
61	430	512	1.75	787709.80	0.5513
62	445	512	2.00	787664.61	0.5493
63	500	512	2.25	787615.06	0.5512
64	515	512	2.50	787570.86	0.5517
65	530	512	2.75	787525.38	0.5520
66	545	512	3.00	787483.53	0.5509
67	600	512	3.25	787442.59	0.5486
68	615	512	3.50	787393.88	0.5483
69	630	512	3.75	787350.19	0.5477
70	645	512	4.00	787307.34	0.5468

Upper limit on leakage rate	=	0.7108 %/day
Mass point leakage rate	=	0.5468 %/day
Lower limit on leakage rate	=	0.4608 %/day

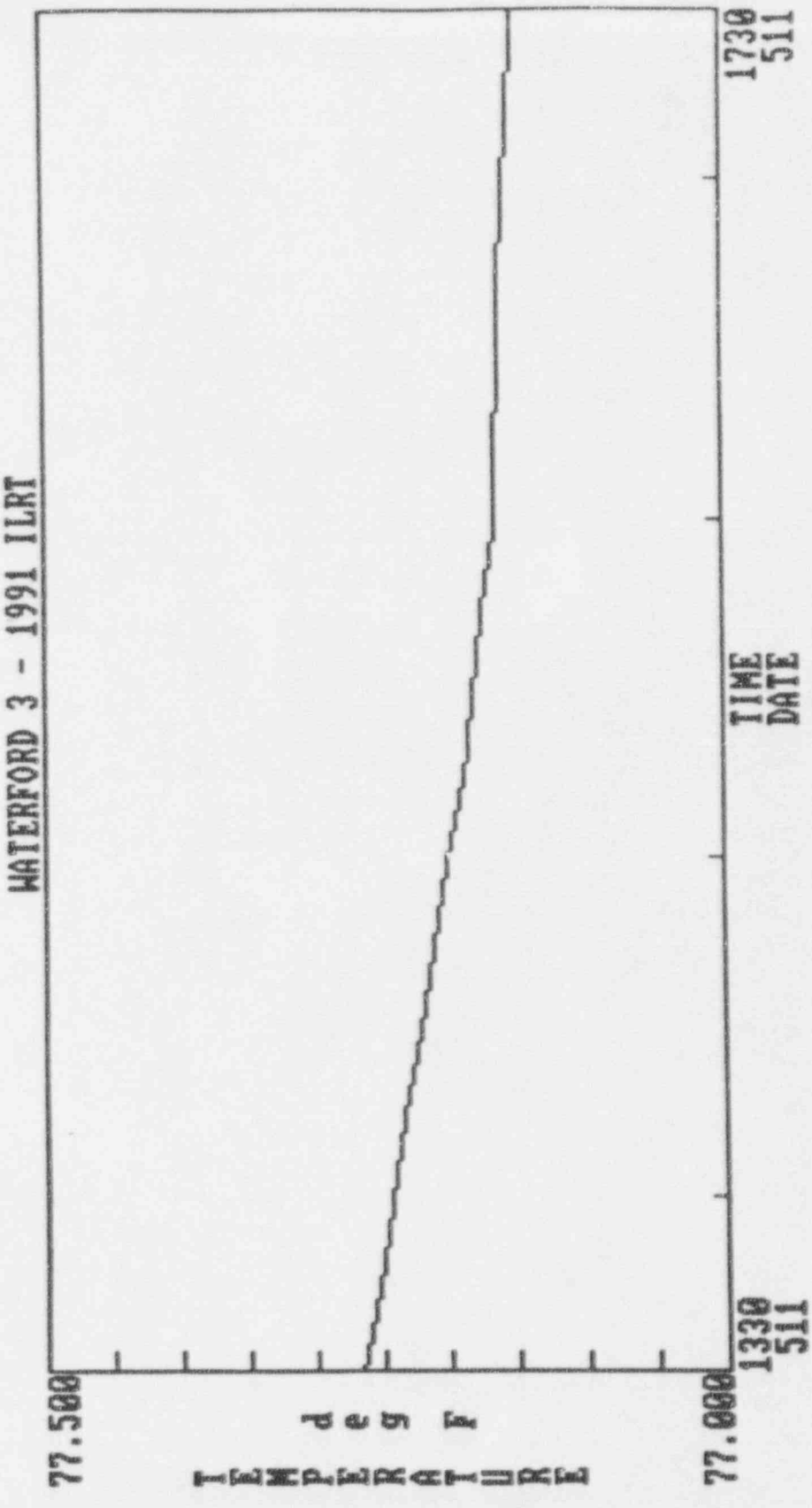


FIGURE 4.1
TEMPERATURE STABILIZATION

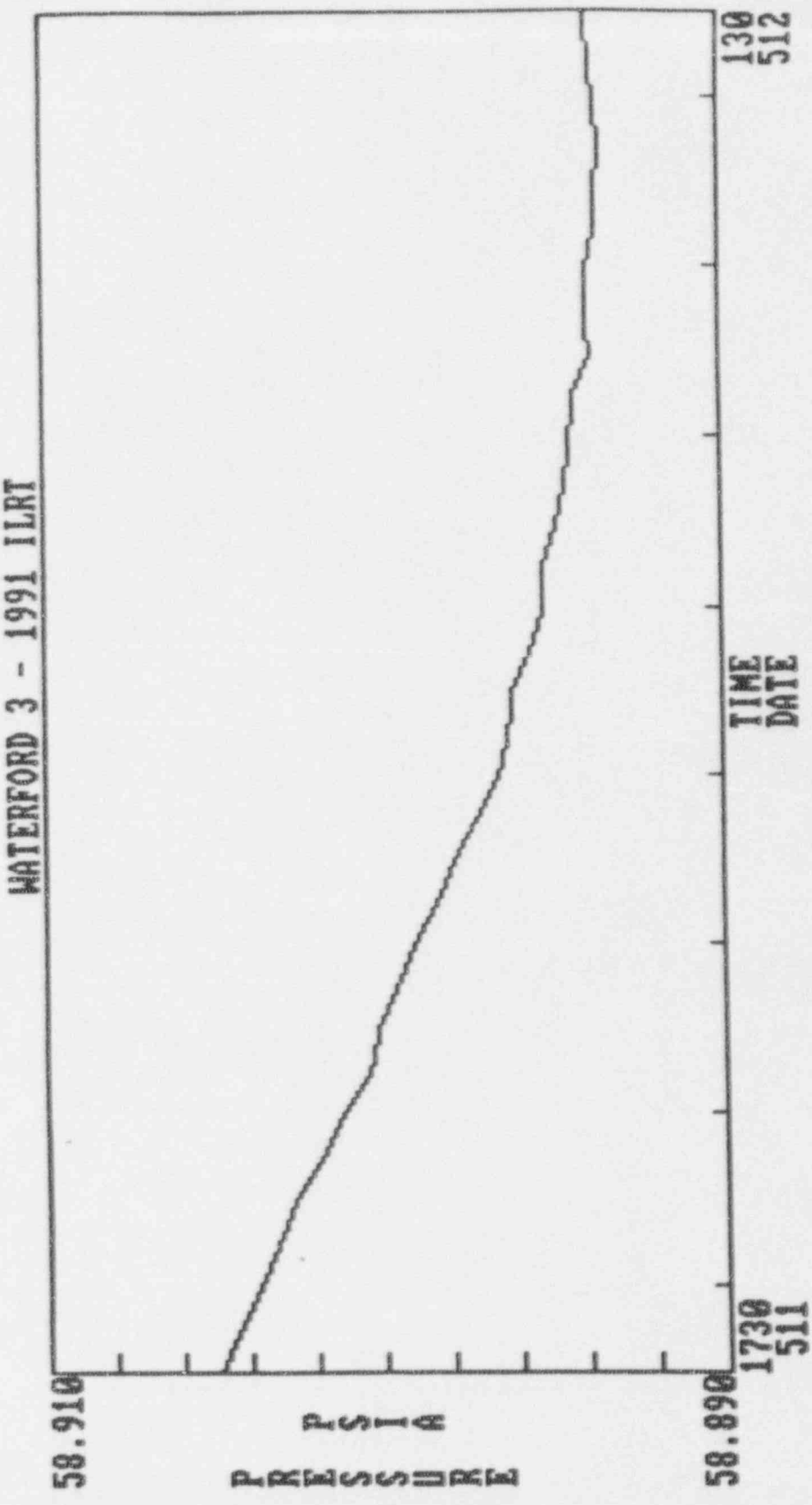


FIGURE 4.2
TEST PRESSURE vs TIME

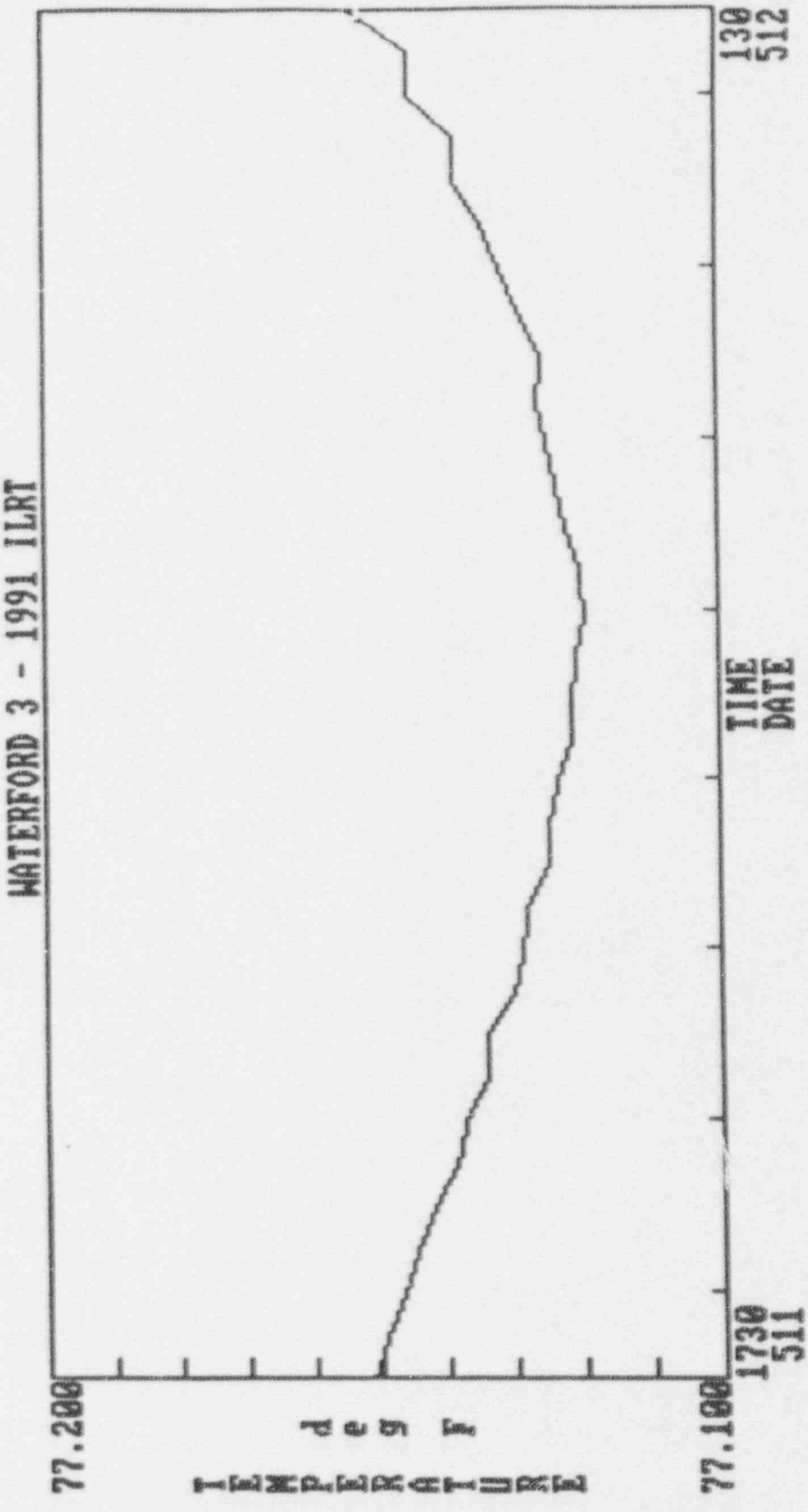


FIGURE 4.3
TEST TEMPERATURE vs TIME

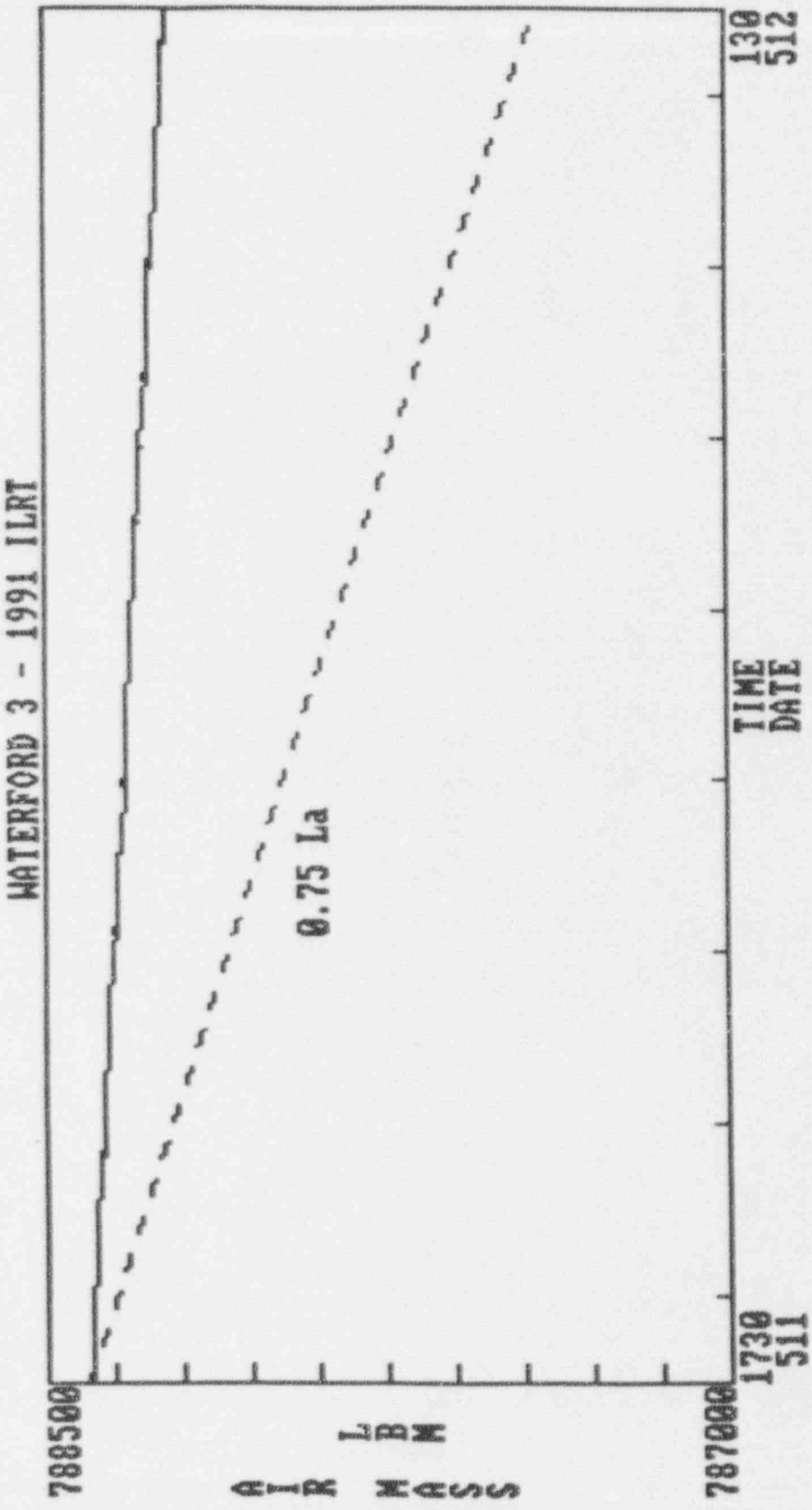


FIGURE 4.4
AIR MASS vs. TIME

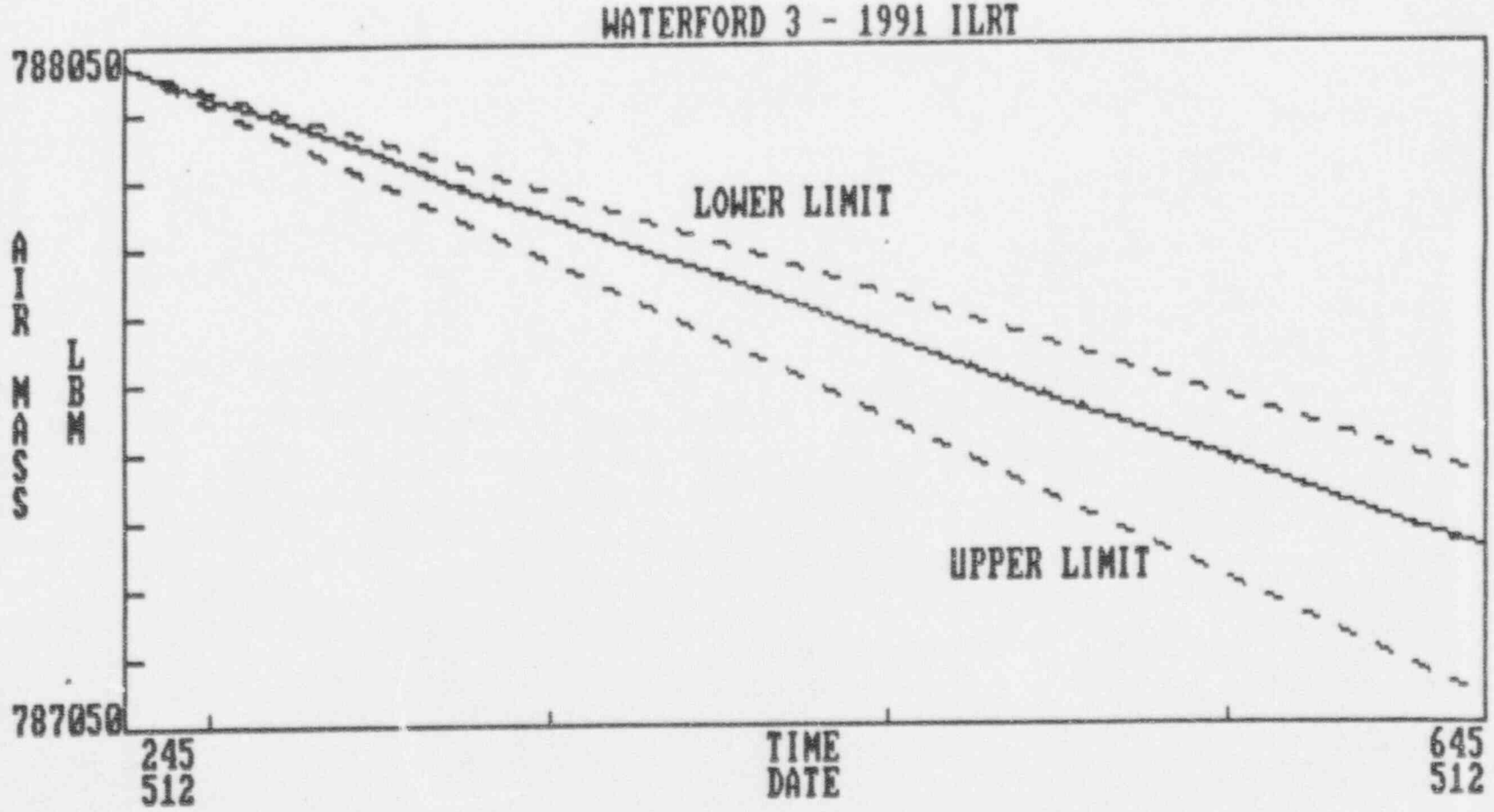


FIGURE 4.5
VERIFICATION AIR MASS vs. TIME

APPENDIX I

LOCAL LEAK RATE TEST RESULTS

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT. PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
101	NA	3.0	891001	3.0	891001
		0.43	910325	0.43	910325
102	NA	5.5	891001	5.5	891001
		12.8	910325	12.8	910325
104	NA	7.3	891001	7.3	891001
		0.15	910323	0.15	910323
106	NA	5.5	891001	5.5	891001
		0.22	910323	0.22	910323
107	NA	0	891004	0	891004
		0.96	910329	0.96	910329
108	NA	7.3	891001	7.3	891001
		0	910323	0	910323
109	NA	3.6	891001	3.6	891001
		1.0	910325	1.0	910325
110	NA	1.8	890926	1.8	890926
		0	910323	0	910323
111	NA	3.1	890928	3.1	890928
		0.12	910328	0.12	910328
112	NA	2.9	890928	2.9	890928
		1.84	910328	1.84	910328
113	NA	2.1	890928	2.1	890928
		0.22	910329	0.22	910329
114	NA	0	890926	0	890926
		0	910319	0	910319
115	NA	0	890926	0	890926
		0	910319	0	910319
116	NA	0	890926	0	890926
		0	910319	0	910319
117	NA	1.9	890926	1.9	890926
		1.2	910323	1.2	910323

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT. PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
118	NA	3.8	891001	3.8	891001
		0.04	910325	0.04	910325
119	NA	0	890926	0	890926
		0.1	910319	0.1	910319
120	NA	0	890925	0	890925
		0.1	910320	0.1	910320
121	NA	1.9	890929	1.9	890929
		4.5	910326	4.5	910326
122	NA	2.0	890927	2.0	890927
		1.6	910321	1.6	910321
123	NA	3.6	890926	3.6	890926
		0.11	910322	0.11	910322
124	NA	2.0	890928	2.0	890928
		0.36	910327	0.36	910327
125	NA	0	890927	0	890927
		0.34	910321	0.34	910321
126	NA	2.0	890928	2.0	890928
		0	910329	0	910329
127	NA	2.3	890928	2.3	890928
		0	910327	0	910327
128	NA	0	890925	0	890925
		0	910320	0	910320
129	NA	0.3	890925	0.3	890925
		0	910320	0	910320
130	NA	0	890927	0	890927
		0	910321	0	910321
131	NA	4.1	890926	4.1	890926
		0.11	910322	0.11	910322
132	NA	4.1	890926	4.1	890926
		0	910322	0	910322

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT. PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
133	NA	0	890928	0	890928
		0.06	910327	0.06	910327
134	NA	5.5	891001	5.5	891001
		0	910326	0	910326
135	NA	0.3	890925	0.3	890925
		0.1	910320	0.1	910320
136	NA	1.5	890925	1.5	890925
		0	910320	0	910320
137	NA	2.3	890929	2.3	890929
		0.38	910326	0.38	910326
138	NA	2.4	891002	2.4	891002
		0	910323	0	910323
139	NA	2.3	890929	2.3	890929
		0	910326	0	910326
140	NA	2.3	890927	2.3	890927
		0.7	910321	0.7	910321
141	NA	2.3	890928	2.3	890928
		0.12	910328	0.12	910328
142	NA	0	890927	0	890927
		0	910321	0	910321
143	NA	0	890928	0	890928
		0.12	910327	0.12	910327
144	NA	3.6	890928	3.6	890928
		3.91	910328	3.91	910328
145	NA	0.3	890925	0.3	890925
		0.05	910320	0.05	910320
146	NA	0	890926	0	890926
		0	910319	0	910319
147	NA	2.4	890929	2.4	890929
		0	910325	0	910325

TYPE B LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
148	NA	2.3	890929	2.3	890929
		0.05	910326	0.05	910326
149	NA	2.3	890928	2.3	890928
		0	910328	0	910328
151	NA	0	890927	0	890927
		0	910320	0	910320

TYPE B LOCAL LEAK RATE TEST SUMMARY

PEN NO.	BELLOW	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
1	MS-1	20	891002	20	891002
		533	910321	533	910321
2	MS-2	41	891010	41	891010
		62	910409	62	910409
3	FW-1	40	891011	40	891011
		40	910409	40	910409
4	FW-2	28.8	891010	28.8	891010
		40	910409	40	910409
25	FUEL XFER TUBE	20	891102	20	891102
		473	910326	473	910326
32	SI-602A	0	891003	0	891003
		795	910318	795	910318
33	SI-602B	0	891003	0	891003
		24	910318	24	910318
43	BM	0	891003	0	891003
		38	910318	38	910318

TYPE B LOCAL LEAK RATE TEST SUMMARY

DESCRIPTION	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
FUEL XFER TUBE BLIND	86	891103	86	891103
FLANGE "O" RING	20	910501	20	910501
MAINTENANCE HATCH	4	880521	4	880521
GASKET INNERSPACE	0	881028	0	881028
	2.5	881106	78	881114
	3	891111	3	891111
	2.53	900201	2.53	900201
	4.3	901013	4.3	901013
	8.7	910316	8.7	910316
	20	910509	20	910509
PERSONNEL AIR LOCK	35,150	880521	35,150	880521
	9600	881029	9600	881029
	13,605	890419	13,605	890419
	28,000	890717	28,000	890717
	0	890811	0	890811
	0	900420	0	900420
	1054	900920	1054	900920
	4030	910307	4030	910307
	7720	910506	7720	910506
ESCAPE AIR LOCK	0	880513	0	880513
	2600	881028	2600	881028
	512	890418	512	890418
	0	891109	0	891109
	60	900418	60	900418
	920	900921	920	900921
	1001	910308	1001	910308
	460	910503	460	910503

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
7	PMU-151	15.5	890925	15.5	890925
		40	910319	40	910319
	PMU-152	6.5	890925	6.5	890925
		2.2	910318	2.2	910318
8	SA-908	20	891030	20	891030
		1100	910326	35	910426
	SA-909	3060	891030	1460	891107
		1100	910326	1100	910326
9	IA-910	20	891029	20	891029
		125	910424	125	910424
	IA-909	740	891029	740	891029
		811	910424	706	910424
10	CAP-103/	17,000	880518	17,000	880518
	CAP-104	16,500	880825	16,500	880825
		11,100	881027	11,100	881027
		355,000	890127	48,000	890128
		94,600	890512	18,700	890513
		20,300	890921	20,300	890921
		221,600	891101	16,000	891104
		18,880	891107	18,880	891107
		13,600	900129	13,600	900129
		15,190	900501	15,190	900501
		4180	901009	4180	901009
		16,730	910108	16,730	910108
		12,470	910425	12,470	910425
11	CAP-203/	400	880518	400	880518
	CAP-204	1500	880825	1500	880825
		1300	881027	1300	881027
		1100	890127	1100	890127
		375	890512	375	891512
		500	890715	500	890715
		>400,000	891102	506	891107
		1000	900131	1000	900131
		717	900501	717	900501
		92.8	900816	92.8	900816
		523	901009	523	900109
		1208	900110	1208	910110
		685	910501	685	910501

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
12	CVR-101	170	891004	170	891004
		666	910329	666	910329
12	CVR-102	70	891004	70	891004
		82	910329	82	910329
13	CVR-201	10,800	890927	2120	891108
		2280	910320	2120	910504
	CVR-202	7900	890927	270	891106
		207	910320	25	910504
14	NG-157	142	890927	142	890927
		2770	910320	155	910420
	NG-158	28	890927	28	890927
		2250	910320	170	910420
23	CC-641	171,700	891007	350	891101
		478	910325	478	910325
	CC-644	300,000	891007	4560	891031
		5070	910325	20	910420
24	CC-710	11,500	891007	55	891104
		20	910328	20	910328
	CC-713	810	891007	810	891007
		256	910328	256	910328
26	CVC-103	180	891005	180	891005
		21.5	900130	21.5	900130
		653	910323	653	910323
	CVC-109	2600	881030	2600	881030
		1272	891005	1272	891005
		18,560	910323	2210	910429
28	PSL-105	20	891002	20	891002
		20	910320	20	910320
	PSL-107	20	891002	20	891002
		20	910320	20	910320
29	PSL-203	267	890928	20	891017
		10,020	910320	21	910423
	PSL-204	13,210	890928	20	891017
		27,500	910320	20	910502
30	PSL-303	54,100	890929	25	891021
		13,270	910323	72	910424

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
30	PSL-304	243,700	890929	2030	891021
		27.5	900323	27.5	910323
31	GWM-104	4200	890928	3680	891107
		917	910321	290	910426
	GWM-105	3800	890928	3630	891107
		901	910321	170	910426
42	SP-105	20	890930	20	890930
		20	910420	20	910420
	SP-106	20	890930	20	890930
		20	910420	20	910420
43	BM-109	20	891003	20	891003
		60.2	910329	60.2	910329
	BM-110	20	891003	20	891003
		20	910329	20	910329
44	RC-606	20	890930	20	890930
		20	910321	20	910321
	CVC-401	20	890930	20	890930
		20	910321	20	910321
45	CAR-101B	100	891004	100	891004
		20	910327	20	910327
	CAR-102B	20	891004	20	891004
		20	910327	20	910327
46	CAR-101A	20	891004	20	891004
		20	910327	20	910327
	CAR-102A	20	891004	20	891004
		20	910327	20	910327
47	CAR-200B/	850	890928	685	891103
	CAR-201B/	13,000	910326	560	910416
	CAR-202B				
48	CAR-201A/	100	890928	112.5	891109
	CAR-202A	150	910327	155	910416
49A	ARM-109	12	890925	12	890925
		85	910321	85	910321
	ARM-110	12	890925	12	890925
		85	910321	85	910321

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
49B	ARM-103	9	890925	9	890925
		84	910321	84	910321
	ARM-104	92	890925	92	890925
		233	910329	233	910329
51	FS-405	1150	891105	1150	891105
		2950	910430	100.5	910506
	FS-406	880	891105	880	891105
		990	910430	990	910430
59	SI-343	180	891002	180	891002
		20	910429	20	910429
	SI-344	0	891002	0	891002
		20	910429	20	910429
60	FP-601A	2400	890929	4240	891108
		2055	910422	2055	910422
	FP-602A	262,000	890929	750	891108
		3070	910422	1620	910426
61	FP-601B	40	890930	40	890930
		635,440	910319	4059	910412
	FP-602B	250,000	890930	175	891108
		4600	910319	351	910412
62	FS-415	173,000	891106	20	891106
		35	910327	35	910327
	FS-416	173,000	891106	20	891106
		45	910327	45	910327
63	LRT-109/	890	891106	890	891106
	BLIND FLANGE	20	910317	1420	910513
65A	LRT-201	17	890923	17	890923
		20	910318	20	910513
	LRT-202	17	890923	17	890923
		20	910318	20	910513
65B	LRT-203	11	890923	11	890923
		20	910318	20	910318
	LRT-204	11	890923	11	890923
		20	910318	20	910318
66A	HRA-109A	0	890927	0	890927

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	AS FOUND (SCCM)	DATE (YYMMDD)	AS LEFT (SCCM)	DATE (YYMMDD)
66A	HRA-109A	25	910323	25	910323
	HRA-110A	0	890927	0	890927
		19.5	910323	19.5	910323
66B	HRA-126A	20	890927	20	890927
		245	910325	245	910325
	HRA-128A	31	890927	31	890927
		630,697	910325	850	910415
67A	HRA-109B	7.5	890927	7.5	890927
		1100	910323	1100	910323
	HRA-110B	7	890927	7	890927
		1100	910323	1100	910323
67B	HRA-126B	20	890927	20	890927
		4.8	910323	4.8	910323
	HRA-128B	21,400	890927	20	891018
		1100	910323	1100	910323
71	CMU-244	4.1	891009	0.2	891105
		199	910415	199	910415
	CMU-245	20	891009	20	891009
		8350	910415	8350	910415

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MIDDLE SOUTH UTILITIES SYSTEM

August 23, 1988

W3P88-1283
A4.05
QA

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Reactor Containment Building Integrated Leak Rate Test

In accordance with the requirements of the Code of Federal Regulations, Title 10, Part 50, Appendix J - Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, enclosed please find the summary technical report detailing results of the first periodic Type A Integrated Leak Rate Tests performed for Waterford 3.

Included in the report is a description of the instrumentation and the supplemental test method. Also contained in the report is a presentation of the leakage rate tests data along with an analysis demonstrating the acceptability of the containment leakage rate in meeting the prescribed acceptance criteria.

Should you have any questions or comments in this matter, please contact me or L.W. Laughlin at (504) 464-3499.

Very truly yours,

R.F. Burski
Manager
Nuclear Safety & Regulatory Affairs

RFB:BGM:ssf

Enclosure

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Waterford 3 ILRT Report

WATERFORD STEAM ELECTRIC STATION

UNIT 3

REACTOR CONTAINMENT INTEGRATED LEAK RATE TEST

FINAL REPORT

Prepared By:

Westinghouse Electric Corporation

May, 1988

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1.0 SUMMARY AND DESCRIPTION OF CONTAINMENT

SUMMARY

The first periodic integrated leakage rate test (ILRT) on the Waterford SES Unit 3 containment was successfully completed on May 23, 1988. All acceptance criteria specified in the test procedure (Ref. 1) were satisfied. Test results and acceptance criteria are listed below.

Parameter	Result	Acceptance Limit(s)
95% upper confidence limit (UCL) on total time leakage rate (including additions)	0.116 wt%/day	<0.375wt%/day
Total time leakage rate trend extrapolated to 24 hours	<0.051	<0.375
Mean of the measured leakage rates over the final 5 hours	<0.16	<0.500
Verification leakage rate	0.534	0.440-0.690
As found 95% UCL (test result plus minimum pathway improvements)	0.123	<0.375

Containment pressurization started at about 2:10 a.m. on May 22, 1988 and was stopped at about 1:50 p.m. on the same day when containment pressure had reached 46 psig. Containment atmosphere mean temperature met the stability criteria within the four (4) hour mandatory stabilization period and the start of the eight (8) hour (minimum) test period was declared at 6:00 p.m. The test was ended at 2:15 a.m. on May 23 and the verification leakage was imposed. The verification test was started at 3:45 a.m., following a mandatory one hour stabilization period, and ended at 8:00 a.m. Containment pressure stayed between 46 and 44 psig throughout the stabilization, test and verification phases.

The ILRT was conducted in accordance with a controlled procedure (Ref. 1) which incorporated the requirements of the FSAR (Ref. 2), the Technical Specifications (Ref. 3), Appendix J to 10CFR50 (Ref. 4) and BN-TOP-1 (Ref. 5). ANSI/ANS 56.8 (Ref. 6) was used for informational guidance on certain aspects of the test. Valves on piping systems penetrating contaminant were aligned as specified in Ref. 2, with the exception of those on the shutdown cooling and fire protection lines. Fire protection was left in service to satisfy Ref. 3 requirements and a penalty was taken on minimum pathway leakages through the penetrations.

A structural examination of the exterior and interior surfaces of the containment vessel was performed in conjunction with the ILRT as required by Ref. 3.

Summary (cont)

No evidence of degradation was found. However, the examination did reveal six I-Beam construction supports in the annulus that extended radially from the shield building to the containment vessel with no clearance between the beams and the vessel. An engineering evaluation was performed which concluded that the structural integrity of the containment vessel was not impaired by the presence of the construction supports (Ref. 8). The beams were removed prior to performance of the ILRT.

DESCRIPTION OF CONTAINMENT

The containment vessel completely encloses the entire reactor and reactor coolant system to ensure no leakage of radioactive materials to the environment in the unlikely event of a loss of coolant accident.

The containment system incorporates a freestanding containment vessel surrounded by a low leakage reinforced concrete shield building. A four foot annular air space is provided between the outer wall of the containment vessel and the inner wall of the shield building to allow filtration of any containment vessel leakage during accident conditions to minimize off-site doses.

The freestanding containment vessel is a two inch thick circular cylinder, with a one inch thick hemispherical dome and two inch thick ellipsoidal bottom. The overall vessel dimensions are: 140 foot diameter by 240.5 foot high. The vessel wall thickness is increased to a minimum of four inches adjacent to all penetrations and openings. The vessel is fabricated of ASME-SA 516 Grade 70 fully killed pressure vessel quality steel plate. The net free volume of the containment vessel is 2.677 x 10 to the sixth cubic feet.

The containment vessel structure includes one personnel airlock, one emergency escape airlock, one fuel transfer tube, one equipment maintenance hatch, and one seal-welded construction hatch. All process piping and electrical penetrations are welded directly to the containment vessel nozzles, with the exception of the main steam, main feedwater, and fuel transfer tube penetrations. These penetrations are provided with testable expansion bellows to allow for thermal growth or building differential motion.

The containment vessel is designed and constructed in accordance with the requirements for class MC vessels contained in Section III, Subsection NE of the ASME Code, 1971 Edition including Summer 1971 Addenda and Code cases 1431, 1454-1 and 1517, as approved by USNRC Regulatory Guides 1.84 and 1.85. The containment vessel is code stamped in accordance with Paragraph NE-8000 of Section III of the ASME Boiler and Pressure Vessel Code. The containment vessel and all penetrations are designed to limit leakage to less than 0.5 percent by weight of the contained air mass per day at the design pressure of 44 psig. The calculated peak accident pressure for the design basis accident at Waterford SES Unit No. 3 is 44 psig at 263 degrees Fahrenheit.

2.0 PROCEDURE AND METHODOLOGY

The leakage rate test was conducted by aligning containment systems in specified post-accident configurations, pressurizing the containment to the design basis accident pressure of 44 (+3, -0) psig, measuring containment atmospheric conditions, and calculating the out leakage of air using the atmospheric condition data. These activities are described in detail in the following paragraphs.

2.1 Containment Preparation

Systems penetrating containment were aligned in the specified post-accident configurations except that systems required to maintain the plant in a safe condition were aligned as required to perform the safety functions. Systems postulated to rupture as a result of the accident were vented inside and outside of containment (with the exceptions noted above). Isolation valves were closed. The reactor coolant system was vented to containment atmosphere through the pressurizer. The safety injection tanks were vented to ensure that slow in or out leakage would not occur. The reactor drain tank and pressurizer relief tanks were vented for the same reason as well as to provide protection against external pressure. Sources of compressed gasses within the containment (fire extinguishers, accumulators, etc.) were removed, vented or fitted with pressure gages to determine gas loss. A complete listing of valve lineups, temporary gage installations, and items removed from containment is included in Ref. 1.

Items unable to withstand ILRT pressure were removed from the containment. These are identified in Ref. 1. The breakers feeding many equipment items were racked (or locked) out to protect the containment against major water injections as well as to prevent events which could invalidate leakage rate test results. A complete listing of breaker lineups is contained in Ref. 1. Prior to pressurization, the inside and outside surfaces of the containment were examined for evidence of structural deterioration which might limit pressure retaining capacity.

All fans and containment lighting were shut off prior to pressurization. This was done to eliminate point sources of heat which could affect the response of the temperature measuring instruments. Instrumentation was installed prior to containment closure.

A containment temperature/humidity survey was done prior to final instrument placement to verify that significant temperature gradients exist only in the vertical direction and that water vapor is uniformly dispersed throughout the containment atmosphere. RTD and RHD locations were specified on the basis of these assumed conditions. Wet and dry bulb temperatures were measured at several azimuths on the -4, 21, 46, and 95 foot levels, at both ends and the middle of the polar crane girder catwalk, and at various elevations on the stairs and ramp leading from elevation 46 to elevation 200.

2.1 Containment Preparation (cont)

Dry bulb temperature was found to vary significantly only with elevation as assumed. Water vapor pressure as determined from wet and drybulb temperatures was found to be essentially constant throughout the containment which confirmed the assumption of a uniform dispersion of water vapor. Survey numerical results are included in the official test copy of Ref. 1.

Local (type B and C) leakage rate tests were completed prior to the start of the integrated leakage rate test. Results of all local tests performed since the preoperational ILRT are included in the Appendix.

2.2 Pressurization

The containment was pressurized at a rate of about 4 psi/hour using oil free compressors with an aggregate capacity of 13,800 SCFM. The discharge air was passed through two trains of aftercooler/moisture separator units and refrigerated air dryers. Plant chilled water was used for cooling. Pressurizing air was dried to minimize the probability of moisture condensation in containment during the ILRT. Pressurization was stopped at 46 psig. This allowed an adequate margin (2 psi) for pressure decay due to cooling of the air which had been heated well above the equilibrium temperature during pressurization.

2.3 Test Measurements, Instrumentation and Air Mass Calculation

The containment atmospheric condition data required to calculate leakage rate were provided by one (1) quartz bourdon tube manometer*, forty (40) resistance temperature detectors (RTD) and ten (10) resistance humidity detectors (RHD). The performance characteristics of these devices are listed in Table 2.1. The quartz bourdon tube manometer was connected to the containment atmosphere through a penetration dedicated to the leakage rate test. The RTD's and RHD's were hung at well dispersed elevations and azimuths within the containment. Table 2.2 identifies the locations of these devices.

Wiring from the RTD's and RHD's was connected through containment electrical penetrations to conditioning electronics located in the auxiliary building. Output from the conditioning electronics was connected to a multiplexer which was, in turn, wired to the plant computer. The temperature and relative humidity (R.H.) data, in degrees Fahrenheit and % R.H. units were output by the plant computer to a printer. Precision manometer readings were manually recorded. Time, pressure, temperature, and R.H. data were manually entered into the ILRT computer (an IBM PC/System 2) at fifteen (15) minute intervals.

* A second unit provided backup data.

2.3 Test Measurements, Instrumentation and Air Mass Calculation (cont)

The ILRT computer program converts manometer readings to true pressure using the manometer calibration table. Water vapor pressure is determined from temperature and R.H. data. Each RHD was installed adjacent to an RTD. The program contains an algorithm to calculate the saturation pressure corresponding to the temperature indicated by the RTD. Partial pressure of the water vapor at the RHD/RTD location is determined as the product of saturation pressure and R.H. The program then calculates volume weighted mean temperature and vapor pressure using the weighting factors listed in Table 2.2. The mass of the air within the containment is computed using equation (1) which is a formulation of the ideal gas law.

$$M = (P - Pv)\ V/RT \qquad (1)$$

Where:

M = Total mass of dry air in the containment, lbm.
P = Absolute pressure of the air/water vapor mixture, lb/sq. ft.
Pv = Absolute pressure of the water vapor, lb/sq. ft.
V = Containment free air volume, cu. ft.
R = Gas constant for air, lbf-ft/lbm - degree R.
T = Volume weighted mean containment temperature, degree R.

Water vapor pressure is subtracted from total pressure in an effort to ensure that air mass and, consequently, leakage rate are not affected by evaporation/condensation.

The magnitude of the leakage induced during the verification test was measured using a float type flowmeter throttled at the outlet. The characteristics of this device are listed in Table 2.1.

All instrumentation was laboratory calibrated prior to the test. Following installation of the RTD's and RHD's, in situ performance was checked to verify end to end system calibration. RTD performance was checked by inserting the sensing elements in an ice bath and verifying that the plant computer displayed a temperature within one (1) degree Fahrenheit of the bath temperature. RHD performance was checked using a psychrometer. Dewpoint temperatures were calculated for the psychrometer wet and drybulb readings and for the drybulb reading and the R.H. displayed by the plant computer. The two dewpoint temperatures were verified to be within five (5) degrees Fahrenheit of each other.

Containment gage pressure was measured with a conventional dial type pressure gage. The performance characteristics of this gage are listed in Table 2.1.

2.4 Leakage Rate Calculations

Leakage rate was calculated using both the total time and the mass point methods. The mass point method, as described in Ref. 6, defines leakage rate as the slope of a straight line fitted to air mass/time data sets by the method of least squares. The total time method, as described in Ref. 5, is based on the premise that leakage rate varies linearly with time, and defines the leakage rate as the ordinate of the leakage rate versus time line at the end of the test. The leakage rate versus time line is fitted by the method of least squares to measured leakage rate/time data sets. Measured leakage rate for any time, ti, is the initial air mass (at to) less the air mass at ti divided by (ti-to).

The 95% upper confidence limit (UCL) on the calculated leakage rate must be less than the acceptance limit (0.375% mass loss per day). The UCL is always greater than the calculated leakage rate and increases with the scatter of the air mass data away from a straight line trend with time. The 95% UCL is effectively described by the following statement. If the leakage rate test is performed a very large number of times under identical conditions, 95% of the calculated leakage rates (no two of which will be exactly the same) will be less than the 95% UCL*.

The test procedure requires the total time calculation. Results of the mass point calculation are reported to provide additional information.

* The derivation of total time UCL in Ref. 5 introduces added conservatism into the calculation. What is referred to as a 95% UCL in that document does, in fact, provide a much higher (than 95%) level of confidence.

3.0 CHRONOLOGY AND EVENTS

3.1 Chronology

Containment preparations including instrument installation and valve lineups were completed by twelve midnight on May 21, 1988. Pressurization was started at about 2:10 a.m. on May 22 following final containment closure and sign off of procedure prerequisites. Pressurization was stopped at about 1:50 p.m. on the same day when pressure had reached 46 PSIG.

The eight (8) hour (minimum) test period started at 6:00 p.m. following a mandatory (Ref. 5) four (4) hour temperature stabilization period. The test was ended at 2:15 a.m. on May 23. The additional fifteen minutes of test time resulted from a delay in obtaining air samples needed for analysis prior to venting verification flow to the auxiliary building. Verification flow was established just prior to 2:45 a.m. The verification test was started at 3:45 a.m., following a mandatory (Ref. 5) one hour stabilization period, and ended at 8:00 a.m. The four and a quarter (4.25) hour duration satisfied the Ref. 5 requirement that the length of the verification test be one half that of the leakage rate test.

Containment depressurization started shortly after completion of the verification test. The depressurization rate was maintained below 6 PSI/hour to satisfy Ref. 1 requirements. The containment was opened when zero pressure was reached late on May 23.

3.2 Events

No significant events occurred during the ILRT. During the eight and a quarter (8.25) hour test the data for temperature sensor number 35 was noted to be erratic. This sensor was assigned a zero volume fraction and its previously assigned fraction (0.236) was allocated equally to vertically adjacent sensors 16 and 32. Also, during the 8.25 hour test, R.H. sensors 1, 3, and 5 were noted to indicate erratic or excessive vapor pressure changes. The volume fractions for these sensors were set to zero and the remaining R.H. sensors assigned equal volume fractions (3 @ 0.1428 and 4 @ 0.1429). R.H. sensors 6 and 10 were removed from the verification calculation during the verification test due to erratic indications. Remaining sensors 2, 4, and 7 - 9 were assigned volume fractions of 0.2 for the verification test.

4.0 TEST RESULTS

The eight (8) hour (minimum) leakage rate test was started at 1800 hours on May 22, 1988, approximately four (4) hours and ten (10) minutes after stopping pressurization. Temperature stabilization criteria were satisfied prior to the test start as shown on Table 4.1. Containment pressure at the start of the test was 45.2 PSIG as shown on Table 4.1. Temperature decay is illustrated graphically in Figure 4.1. All original test data is filed with the official test copy of Ref. 1.

4.1 Total Time Leakage Rate

Containment leakage rate was quite small. The computed 95% UCL on the total time leakage rate was 0.116 wt%/day which is less than one third of the procedure acceptance limit of 0.375 wt%/day as shown on Table 4.2. The total time calculated value was 0.051 wt%/day (Table 4.2) and showed a decreasing trend. All total time measured rates were below 0.375 wt%/day. Therefore, all total time acceptance criteria were met. Test duration was 8.25 hours. Pressure and temperate decay during the 8.25 hour test are shown graphically on Figures 4.2 and 4.3. Air mass change is shown graphically on Figure 4.4, which is discussed in Section 4.2.

The fire protection penetrations (60 and 61) and the ILRT pressure sense line penetration (65) were not aligned in the specified post-accident configuration during the ILRT. The minimum pathway leakage through these penetrations must be added to the total time UCL to compensate for the nonconservative lineups. These minimum pathway leakages are listed below.

PEN	Leakage, SCCM
60	0
61	210
65	0
Total	210 SCCM = .0001 wt%/day

The total minimum pathway leakage is too small to change the computed total time 95% UCL of 0.116 wt%/day in the least significant figure.

Changes in accumulator pressures were too small to affect leakage rate in the least significant figure. Pressures are recorded in the official test copy of Ref. 1. RCS level dropped slightly, but no correction for falling levels is allowed. Sump and tank levels did not change.

4.1 Total Time Leakage Rate (cont)

Following the 8.25 hour test, a 38 SCFM (equal to La = 0.5 wt%/day) leak was imposed on the containment through a flowmeter following a one hour stabilization period. The new leakage rate was determined for a 4.25 hour test duration. The calculated total time leakage rate of 0.520 wt%/day fell within the acceptance limits of 0.430 and 0.680 wt%/day as shown on Table 4.3. Successful completion of this verification test demonstrates the validity of the leakage rate computational methods. The acceptance criterion for the verification test is stated as:

$$Ltt + Lo - .25\ La \leq Lc \leq Ltt + Lo + .25\ La$$

where: Ltt is the total time leakage rate calculated for the 8.25 hour test = .051

Lo is the imposed leak = 0.504

La is the maximum allowable leakage rate* = 0.500.

Lc is the rate calculated during the verification test

It must be shown that the results of the leakage rate test would have been acceptable had the test been performed prior to any repairs being made during the local leakage rate testing program. This is shown by adding minimum pathway leakage improvements to the total time 95% UCL. Total minimum pathway improvements sum to 14,400 SCCM which is equivalent to 0.007 wt%/day. Adding this to the total time 95% UCL of 0.116 results in a theoretical as found (before repairs) leakage rate of 0.123 wt%/day. This is well below even the as left acceptance limit of 0.375 wt%/day. Local leakage rate test results are included in the Appendix.

* The leakage rate prior to a return to power must be less than .75 La. This allows 0.25 La for increases in leakage rate during the operating cycle between leakage rate tests.

4.2 Mass Point Leakage Rate

Mass point calculations generally provide a more realistic estimate of true leakage rate than do total time calculations (total time, as defined in Ref. 5, is always applied to a test with a duration under twenty four (24) hours since the 95% UCL is a very conservative upper bound on leakage rate). Mass point results are listed below for information.

Mass Point calculated leakage rate = 0.061 wt%/day
Mass Point 95% UCL = 0.070 wt%/day

Mass Point verification upper limit = 0.690 wt%/day
Mass Point verification calculated rate = 0.540 wt%/day
Mass Point verification lower limit = 0.440 wt%/day

Complete mass point data is contained in Tables 4.4 and 4.5.

Figure 4.4 is a plot of air mass versus time. The plot includes the line fitted to the mass data and a line which represents a leakage rate of 0.375 wt%/day (0.75 La). The slope of the line fitted to the mass data is the calculated leakage rate. Figure 4.5 is a plot of air mass versus time during the verification test. The plot includes the line fitted to the mass data and lines representing the upper and lower acceptance limits on calculated verification leakage rate. In both figures, the plotted air masses show very little divergence about the fitted line. However, in Figure 4.5, the divergence is much less during the last 6.25 hours of the test than during the first two hours. This is discussed further in the following section.

4.3 Results Analysis

Since the true containment leakage rate is quite small, the calculated value is significantly influenced by any minor differences between actual and indicated changes in containment atmospheric conditions. Changes in total pressure and temperature are generally determined quite accurately since the devices used to measure these quantities incorporate very basic physical principles. The smooth changes in pressure and volume weighted mean temperature* over the entire time at pressure as shown in Figures 4.6 and 4.7, support the conclusion that changes in these variables are adequately determined. The instrumentation used to determine the partial pressure of water vapor incorporates somewhat more complex physical principles and generally provides data which exhibits some unexpected characteristics.

* RTD number 35 exhibited erratic behavior and was eliminated from leakage rate calculations. The volume fraction assigned to RTD 35 was distributed equally to RTD's 32 and 16, which are at elevations adjacent to that of 35.

4.3 Results Analysis (cont)

Figures 4.8 through 4.10 show changes in volume weighted mean vapor pressure over the entire time at pressure. The plot in Figure 4.8 is based on equal volume fractions assigned to all R.H. sensor locations. The plot exhibits large and unexpected changes in vapor pressure. In fact, since the containment was dry at the start of pressurization, and since no R.H. sensor ever indicated more than 91% R.H., no evaporation or condensation is expected. Therefore, calculated mean vapor pressure should be proportional to total pressure after some period of stabilization.

During the 8.25 hour test, R.H. sensors 1, 3, and 5 indicated excessively large or erratic changes in vapor pressure. The volume fractions for these sensors were set to zero and leakage rate was calculated with the remaining sensors equally weighted. Figure 4.9 is a plot of vapor pressure with R.H. sensors 2, 4, and 6 - 10 equally weighted. The variation in vapor pressure over the test period is reasonable except for the instability between 1800 and 2000 hours.

During the verification test, R.H. sensors 6 and 10 indicated sudden large increases in vapor pressure. The volume fractions for these sensors were set to zero and the verification calculations were done using a volume fraction of 0.2 for each of the remaining sensors (2, 4, and 7 - 9). Figure 4.10 plots vapor pressure calculated using these volume fractions. The fractional change in vapor pressure over the final twelve (12) hours of the plot is essentially the same as the fractional change in total pressure, as expected.

Based on the above discussion, it may be concluded that true leakage rate is better approximated by calculations based on total pressure unless there is evidence of evaporation or condensation within the containment. Tables 4.6 and 4.7 list the mass point 8.25 hour test and verification results for total pressure calculations. These compare to the corrected pressure calculations as noted below.

Mass Point Parameter	Calculation Result	
	Total Pressure	Corrected Pressure
Leakage Rate	.035 wt%/day	.061 wt%/day
95% UCL	.039 wt%/day	.069 wt%/day
Difference	.004 wt%/day	.008 wt%/day
Verification Upper Limit	.664 wt%/day	.690 wt%/day
Verification Rate	.524 wt%/day	.540 wt%/day
Verification Lower Limit	.414 wt%/day	.440 wt%/day
Deviation From Midpoint	.015 wt%/day	.025 wt%/day)

4.3 Results Analysis (cont)

The total pressure results have better statistics in that deviation between calculated rate and UCL is smaller and deviation between verification rate and midpoint (between upper and lower limits) is smaller. These points are illustrated graphically in Figures 4.11 and 4.12. The air mass data in Figure 4.11 deviates less from the fitted line than does that in Figure 4.4 (corrected pressure calculations). Differences in the verification test plots, Figures 4.5 and 4.12, are less noticeable.

Table 4.8 is a total time report for the total pressure calculation. The corrected pressure calculation gives a much higher estimate of the 95% UCL as restated below.

Total Time 95% UCL

Total Pressure	Corrected Pressure
0.067 wt%/day	0.116 wt%/day

Therefore, leakage rates reported in the summary and in Section 4.1 are concluded to be very conservative estimates of the true values.

4.4 Shield Building Examination

Reference 3 requires that the exterior and interior surfaces of the shield building be examined in conjunction with the ILRT to determine structural condition. The examination was performed prior to pressurization. No evidence of deterioration was found.

5.0 REFERENCES

1. Surveillance Procedure PE-5-001, Containment Integrated Leakage Rate Test, Revision 1.

2. Final Safety Analysis Report, Sections 6.2.6 and 3.8.2.7.

3. Technical Specifications, Sections 4.6.1.2 a/b/c, 4.6.1.6 and 4.6.6.3.

4. Code of Federal Regulations, Title 10, Part 50, Appendix J, Primary Reactor Containment Leakage Testing For Water-Cooled Power Reactors.

5. Bechtel Topical Report, BN-TOP-1, Testing Criteria For Integrated Leakage Rate Testing of Primary Containment Structures For Nuclear Power Plants, Revision 1, November, 1972.

6. ANSI/ANS 56.8 - 1981, Containment System Leakage Testing Requirements.

7. (Reference cited in Appendix J) ANSI N45.4 - 1972, Leakage Rate Testing Of Containment Structures For Nuclear Reactors.

8. PEIR #70996, Evaluation of Construction I-Beam Supports in Annulus.

6.0 TABLES AND FIGURES

TABLE 2.1

TEST INSTRUMENTATION PERFORMANCE CHARACTERISTICS

Precision Manometer

Make and Model: Mensor Quartz Manometer
Range: 0-100 PSIA
Tracking Error: .004 PSI over test range

Resistance Temperature Detector

Make and Model: Burns WPPOG1-5 1/2-3-A
Range: Calibrated from 32 degrees Fahrenheit to 120 degrees Fahrenheit
Tracking Error: 0.01 degrees Fahrenheit over test range

Resistance Humidity Detector

Make and Model: PhysChem Research Model B
Range: 0-100% relative humidity
Tracking Error: 2.1% R.H.

Flow Meter

Make and Model: Brooks Model 1110-10K3B1A
Range: 8 - 75 SCFM
Absolute Accuracy: 1% F.S.

Pressure Gage

Make and Model: Heise Model CM
Range: 0-100 PSIG
Absolute Accuracy: 0.1 PSI

TABLE 2.2

RTD/(RHD)	(1) El.,Ft.	(2) Rad. Ft.	AZ, degree	(3) V.F.
1	195.0	7.5	20	.0271
2	176.5	23.0	140	.0281
3	170.0	28.5	260	.0273
4	158.5	38.0	20	.0263
5/(1)	184.5	16.0	60	.0289
6	153.5	42.5	100	.0274
7	148.5	46.5	140	.0281
8/(2)	164.0	33.5	180	.0298
9	138.5	49.5	220	.0288
10	133.5	49.5	260	.0288
11/(3)	143.5	49.5	300	.0286
12/(7)	128.5	49.5	340	.0288
13	38.5	59.0	230	.0201
14/(6)	73.5	49.5	260	.0278
15	48.5	49.5	300	.0227
16	68.5	49.5	340	.0274
17	23.5	63.5	210	.0201
18	18.5	52.5	230	.0201
19	13.5	52.0	290	.0201
20	8.5	49.5	320	.0180
21	123.5	49.5	20	.0284
22	118.5	49.5	60	.0284
23	113.5	49.5	100	.0284
24	103.5	49.5	140	.0284
25/(5)	108.5	49.5	180	.0284
26	98.5	49.5	180	.0284
27	88.5	49.5	220	.0284
28/(10)	93.5	49.5	260	.0284
29	83.5	49.5	300	.0284
30	78.5	49.5	340	.0284
31	30 (4)	48.0	10	.0241
32	58.5	52.5	30	.0236
33/(4)	53.5	49.5	70	.0236
34	33.5	57.5	110	.0201
35	63.5	49.5	140	.0236
36	43.5	64.0	200	.0201
37/(8)	3.5	61.5	20	.0148
38	-1.5	49.5	70	.0129
39	-6.1	49.5	100	.0154
40/(9)	27.5	49.5	170	.0201

Table 2.2 (cont)

Notes:
1. Reference elevations: Lowest Level (-) 11 ft.; Spring line (+) 138 ft.; Top hemisphere (+) 208 ft.
2. Containment radius = 70 ft.
3. Containment free air volume = 2,677,000.00 cu. ft. All RHD's have volume fractions of 0.1. See Section 4.3 for redistributions required by instrument malfunctions.
4. RTD hung in refueling cavity.
5. As installed elevations, radii, and azimuths are +/-3 ft, +/-5 ft, and +/- 5 degrees, respectively.

TABLE 4.1

WATERFORD 3/1988 ILRT STABILIZATION

DATA SUMMARY REPORT

data set	time	date	temperature deg F	pressure psia	vapor pressure psia	dry air mass lbm
1	1351	522	96.0128	60.5250	0.5309	780113.7
2	1400	522	95.5269	60.4389	0.5260	779739.0
3	1415	522	94.5313	60.3447	0.5124	780089.5
4	1430	522	93.8458	60.2788	0.4973	780393.1
5	1445	522	93.3334	60.2292	0.4993	780441.8
6	1500	522	92.9218	60.1876	0.5004	780464.9
7	1515	522	92.5751	60.1522	0.5035	780450.9
8	1530	522	92.2881	60.1218	0.5028	780468.1
9	1545	522	91.9941	60.0944	0.5001	780560.4
10	1600	522	91.8034	60.0691	0.5029	780462.4
11	1615	522	91.5712	60.0458	0.5030	780484.4
12	1630	522	91.3850	60.0225	0.5044	780423.8
13	1645	522	91.1664	60.0043	0.5056	780478.9
14	1700	522	91.0300	59.9850	0.5040	780440.5
15	1715	522	90.8512	59.9678	0.5053	780450.8
16	1730	522	90.7202	59.9506	0.5039	780429.5
17	1745	522	90.5555	59.9344	0.5011	780487.4
18	1800	522	90.4089	59.9192	0.5032	780467.1

Temperature change 1600 - 1700 = .77 degrees Fahrenheit/hour

Temperature change 1700 - 1800 = .62 degrees Fahrenheit/hour

Average rate of change = (.62 + .77)/2 = .695 degrees Fahrenheit/hour
< 1.0 degrees Fahrenheit/hour

Second difference = .77 - .62 = .15 degrees Fahrenheit/hour^2 < .5 degrees F/hour^2

TABLE 4.2

WATERFORD 3/1988 ILRT TEST AT 46 PSIG

TOTAL TIME LEAKAGE RATE REPORT

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	measured rate (%/day)	leakage rate (%/day)	ucl rate (%/day)
1	1800	522	0.00	781491.4	0.0000	0.0000	0.0000
2	1815	522	0.25	781477.4	0.1715	0.1715	0.1715
3	1830	522	0.50	781435.2	0.3453	0.3453	0.3453
4	1845	522	0.75	781447.6	0.1793	0.2359	1.8053
5	1900	522	1.00	781423.2	0.2095	0.2186	0.7500
6	1915	522	1.25	781400.6	0.2231	0.2192	0.5450
7	1930	522	1.50	781395.4	0.1965	0.2058	0.4489
8	1945	522	1.75	781401.8	0.1572	0.1800	0.3822
9	2000	522	2.00	781355.6	0.2085	0.1857	0.3620
10	2015	522	2.25	781346.6	0.1976	0.1856	0.3419
11	2030	522	2.50	781334.6	0.1926	0.1841	0.3251
12	2045	522	2.75	781354.2	0.1533	0.1706	0.3009
13	2100	522	3.00	781336.7	0.1584	0.1624	0.2831
14	2115	522	3.25	781329.9	0.1526	0.1549	0.2676
15	2130	522	3.50	781338.4	0.1342	0.1445	0.2508
16	2145	522	3.75	781340.4	0.1236	0.1340	0.2349
17	2200	522	4.00	781338.3	0.1176	0.1244	0.2205
18	2215	522	4.25	781324.4	0.1206	0.1175	0.2093
19	2230	522	4.50	781322.1	0.1155	0.1110	0.1991
20	2245	522	4.75	781320.4	0.1105	0.1048	0.1895
21	2300	522	5.00	781327.2	0.1009	0.0980	0.1797
22	2315	522	5.25	781320.1	0.1002	0.0923	0.1713
23	2330	522	5.50	781330.3	0.0900	0.0859	0.1624
24	2345	522	5.75	781316.3	0.0935	0.0811	0.1556
25	0	523	6.00	781315.2	0.0902	0.0765	0.1493
26	15	523	6.25	781315.2	0.0866	0.0722	0.1434
27	30	523	6.50	781310.6	0.0854	0.0683	0.1382
28	45	523	6.75	781318.6	0.0786	0.0641	0.1326
29	100	523	7.00	781302.6	0.0828	0.0611	0.1287
30	115	523	7.25	781296.6	0.0825	0.0585	0.1255
31	130	523	7.50	781293.4	0.0811	0.0560	0.1225
32	145	523	7.75	781269.4	0.0880	0.0548	0.1214
33	200	523	8.00	781296.6	0.0748	0.0522	0.1182
34	215	523	8.25	781278.4	0.0793	0.0505	0.1163

Allowable leakage rate, La = 0.5000 %/day
75% La = 0.3750 %/day
Total time leakage rate = 0.0505 %/day
Total time UCL = 0.1163 %/day

TABLE 4.3

WATERFORD 3/1988 ILRT VERIFICATION
TOTAL TIME LEAKAGE RATE REPORT

VERIFICATION

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	measured rate (%/day)	leakage rate (%/day)
5	345	523	0.00	781084.3	0.0000	0.000
6	400	523	0.25	781029.3	0.6757	0.676
7	415	523	0.50	780986.3	0.6023	0.602
8	430	523	0.75	780974.8	0.4483	0.462
9	445	523	1.00	780931.9	0.4683	0.432
10	500	523	1.25	780870.1	0.5264	0.458
11	515	523	1.50	780854.6	0.4704	0.444
12	530	523	1.75	780804.9	0.4906	0.447
13	545	523	2.00	780751.4	0.5114	0.458
14	600	523	2.25	780700.2	0.5245	0.472
15	615	523	2.50	780653.6	0.5293	0.483
16	630	523	2.75	780624.4	0.5138	0.486
17	645	523	3.00	780571.8	0.5249	0.492
18	700	523	3.25	780515.8	0.5374	0.501
19	715	523	3.50	780473.6	0.5361	0.507
20	730	523	3.75	780428.1	0.5376	0.512
21	745	523	4.00	780384.8	0.5373	0.516
22	800	523	4.25	780340.8	0.5375	0.520

Upper limit on leakage rate = 0.6795 %/day
Total time leakage rate = 0.5196 %/day
Lower limit on leakage rate = 0.4295 %/day

TABLE 4.4

WATERFORD 3/1988 ILRT TEST AT 46 PSIG

MASS POINT LEAKAGE RATE REPORT

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	leakage rate (%/day)	ucl rate (%/day)
1	1800	522	0.00	781491.4	0.0000	0.0000
2	1815	522	0.25	781477.4	0.1715	0.1715
3	1830	522	0.50	781435.2	0.3453	1.2039
4	1845	522	0.75	781447.6	0.2132	0.4735
5	1900	522	1.00	781423.2	0.2042	0.3251
6	1915	522	1.25	781400.6	0.2121	0.2845
7	1930	522	1.50	781395.4	0.1990	0.2497
8	1945	522	1.75	781401.8	0.1704	0.2190
9	2000	522	2.00	781355.6	0.1836	0.2229
10	2015	522	2.25	781346.6	0.1863	0.2172
11	2030	522	2.50	781334.6	0.1860	0.2109
12	2045	522	2.75	781354.2	0.1694	0.1963
13	2100	522	3.00	781336.7	0.1609	0.1851
14	2115	522	3.25	781329.9	0.1533	0.1753
15	2130	522	3.50	781338.4	0.1420	0.1642
16	2145	522	3.75	781340.4	0.1307	0.1531
17	2200	522	4.00	781338.3	0.1209	0.1429
18	2215	522	4.25	781324.4	0.1149	0.1353
19	2230	522	4.50	781322.1	0.1092	0.1283
20	2245	522	4.75	781320.4	0.1038	0.1218
21	2300	522	5.00	781327.2	0.0974	0.1148
22	2315	522	5.25	781320.1	0.0925	0.1090
23	2330	522	5.50	781330.3	0.0864	0.1026
24	2345	522	5.75	781316.3	0.0825	0.0978
25	0	523	6.00	781315.2	0.0789	0.0934
26	15	523	6.25	781315.2	0.0753	0.0892
27	30	523	6.50	781310.6	0.0724	0.0855
28	45	523	6.75	781318.6	0.0687	0.0814
29	100	523	7.00	781302.6	0.0667	0.0786
30	115	523	7.25	781296.6	0.0651	0.0763
31	130	523	7.50	781293.4	0.0636	0.0742
32	145	523	7.75	781269.4	0.0637	0.0736
33	200	523	8.00	781296.6	0.0616	0.0712
34	215	523	8.25	781278.4	0.0607	0.0697

Allowable leakage rate, La = 0.5000 %/day
75% La = 0.3750 %/day
Mass point leakage rate = 0.0607 %/day
Mass point UCL = 0.0697 %/day

TABLE 4.5

WATERFORD 3/1988 ILRT VERIFICATION
MASS POINT LEAKAGE RATE REPORT

VERIFICATION

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	leakage rate (%/day)
5	345	523	0.00	781084.3	0.0000
6	400	523	0.25	781029.3	0.6757
7	415	523	0.50	780986.3	0.6023
8	430	523	0.75	780974.8	0.4563
9	445	523	1.00	780931.9	0.4415
10	500	523	1.25	780870.1	0.4826
11	515	523	1.50	780854.6	0.4660
12	530	523	1.75	780804.9	0.4712
13	545	523	2.00	780751.4	0.4861
14	600	523	2.25	780700.2	0.5014
15	615	523	2.50	780653.6	0.5131
16	630	523	2.75	780624.4	0.5138
17	645	523	3.00	780571.8	0.5186
18	700	523	3.25	780515.8	0.5265
19	715	523	3.50	780473.6	0.5314
20	730	523	3.75	780428.1	0.5353
21	745	523	4.00	780384.8	0.5380
22	800	523	4.25	780340.8	0.5399

Upper limit on leakage rate = 0.6897 %/day
Mass point leakage rate = 0.5399 %/day
Lower limit on leakage rate = 0.4397 %/day

TABLE 4.6

WATERFORD 3/1988 ILRT TOTAL PRESSURE CALC

MASS POINT LEAKAGE RATE REPORT

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	leakage rate (%/day)	ucl rate (%/day)
17	1800	522	0.00	787077.5	0.0000	0.0000
18	1815	522	0.25	787063.6	0.1690	0.1690
19	1830	522	0.50	787051.0	0.1615	0.1983
20	1845	522	0.75	787046.3	0.1295	0.1842
21	1900	522	1.00	787045.9	0.0983	0.1477
22	1915	522	1.25	787035.4	0.0936	0.1234
23	1930	522	1.50	787038.3	0.0780	0.1050
24	1945	522	1.75	787036.6	0.0669	0.0899
25	2000	522	2.00	787020.4	0.0704	0.0882
26	2015	522	2.25	787021.6	0.0675	0.0818
27	2030	522	2.50	787017.4	0.0652	0.0769
28	2045	522	2.75	787033.7	0.0537	0.0691
29	2100	522	3.00	787021.9	0.0497	0.0633
30	2115	522	3.25	787004.6	0.0519	0.0636
31	2130	522	3.50	787007.6	0.0510	0.0611
32	2145	522	3.75	787025.5	0.0445	0.0555
33	2200	522	4.00	787006.6	0.0437	0.0534
34	2215	522	4.25	786994.8	0.0449	0.0536
35	2230	522	4.50	786991.6	0.0457	0.0534
36	2245	522	4.75	787013.5	0.0417	0.0497
37	2300	522	5.00	786996.6	0.0410	0.0482
38	2315	522	5.25	786998.4	0.0396	0.0463
39	2330	522	5.50	787004.9	0.0373	0.0439
40	2345	522	5.75	786987.1	0.0374	0.0433
41	0	523	6.00	786992.5	0.0364	0.0420
42	15	523	6.25	787013.3	0.0332	0.0392
43	30	523	6.50	786996.6	0.0320	0.0377
44	45	523	6.75	786987.9	0.0316	0.0369
45	100	523	7.00	786976.1	0.0321	0.0370
46	115	523	7.25	786963.2	0.0332	0.0380
47	130	523	7.50	786967.1	0.0337	0.0382
48	145	523	7.75	786944.9	0.0354	0.0399
49	200	523	8.00	786975.9	0.0347	0.0390
50	215	523	8.25	786955.9	0.0351	0.0391

Allowable leakage rate, La = 0.5000 %/day
75% La = 0.3750 %/day
Mass point leakage rate = 0.0351 %/day
Mass point UCL = 0.0391 %/day

TABLE 4.7

WATERFORD 3/1988 ILRT TOTAL PRESSURE CALC
MASS POINT LEAKAGE RATE REPORT

VERIFICATION

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	leakage rate (%/day)
55	345	523	0.00	786713.3	0.0000
56	400	523	0.25	786657.7	0.6787
57	415	523	0.50	786616.6	0.5903
58	430	523	0.75	786605.1	0.4464
59	445	523	1.00	786557.1	0.4453
60	500	523	1.25	786497.6	0.4851
61	515	523	1.50	786479.6	0.4709
62	530	523	1.75	786431.1	0.4751
63	545	523	2.00	786381.9	0.4854
64	600	523	2.25	786325.9	0.5014
65	615	523	2.50	786282.1	0.5117
66	630	523	2.75	786251.3	0.5124
67	645	523	3.00	786200.5	0.5163
68	700	523	3.25	786152.0	0.5210
69	715	523	3.50	786127.6	0.5184
70	730	523	3.75	786078.4	0.5185
71	745	523	4.00	786016.9	0.5231
72	800	523	4.25	785984.9	0.5240

Upper limit on leakage rate = 0.6641 %/day
Mass point leakage rate = 0.5240 %/day
Lower limit on leakage rate = 0.4141 %/day

TABLE 4.8

WATERFORD 3/1988 ILRT TOTAL PRESSURE CALC

TOTAL TIME LEAKAGE RATE REPORT

data set	time	date	elapsed time (hrs)	dry air mass (lbm)	measured rate (%/day)	leakage rate (%/day)	ucl rate (%/day)
17	1800	522	0.00	787077.5	0.0000	0.0000	0.0000
18	1815	522	0.25	787063.6	0.1690	0.1690	0.1690
19	1830	522	0.50	787051.0	0.1615	0.1615	0.1615
20	1845	522	0.75	787046.3	0.1267	0.1313	0.2575
21	1900	522	1.00	787045.9	0.0964	0.1005	0.1518
22	1915	522	1.25	787035.4	0.1027	0.0918	0.1429
23	1930	522	1.50	787038.3	0.0796	0.0760	0.1150
24	1945	522	1.75	787036.6	0.0714	0.0638	0.0987
25	2000	522	2.00	787020.4	0.0871	0.0635	0.1110
26	2015	522	2.25	787021.6	0.0757	0.0595	0.1067
27	2030	522	2.50	787017.4	0.0733	0.0564	0.1033
28	2045	522	2.75	787033.7	0.0486	0.0467	0.0896
29	2100	522	3.00	787021.9	0.0565	0.0421	0.0842
30	2115	522	3.25	787004.6	0.0684	0.0423	0.0879
31	2130	522	3.50	787007.6	0.0609	0.0407	0.0867
32	2145	522	3.75	787025.5	0.0423	0.0352	0.0791
33	2200	522	4.00	787006.6	0.0541	0.0337	0.0779
34	2215	522	4.25	786994.8	0.0594	0.0338	0.0795
35	2230	522	4.50	786991.6	0.0582	0.0337	0.0804
36	2245	522	4.75	787013.5	0.0411	0.0305	0.0759
37	2300	522	5.00	786996.6	0.0493	0.0295	0.0748
38	2315	522	5.25	786998.4	0.0459	0.0281	0.0731
39	2330	522	5.50	787004.9	0.0403	0.0261	0.0703
40	2345	522	5.75	786987.1	0.0479	0.0257	0.0702
41	0	523	6.00	786992.5	0.0432	0.0247	0.0690
42	15	523	6.25	787013.3	0.0313	0.0221	0.0654
43	30	523	6.50	786996.6	0.0379	0.0208	0.0639
44	45	523	6.75	786987.9	0.0405	0.0202	0.0633
45	100	523	7.00	786976.1	0.0442	0.0202	0.0637
46	115	523	7.25	786963.2	0.0481	0.0207	0.0650
47	130	523	7.50	786967.1	0.0449	0.0209	0.0655
48	145	523	7.75	786944.9	0.0522	0.0219	0.0675
49	200	523	8.00	786975.9	0.0387	0.0213	0.0666
50	215	523	8.25	786955.9	0.0450	0.0215	0.0670

Allowable leakage rate, La = 0.5000 %/day
75% La = 0.3750 %/day
Total time leakage rate = 0.0215 %/day
Total time UCL = 0.0670 %/day

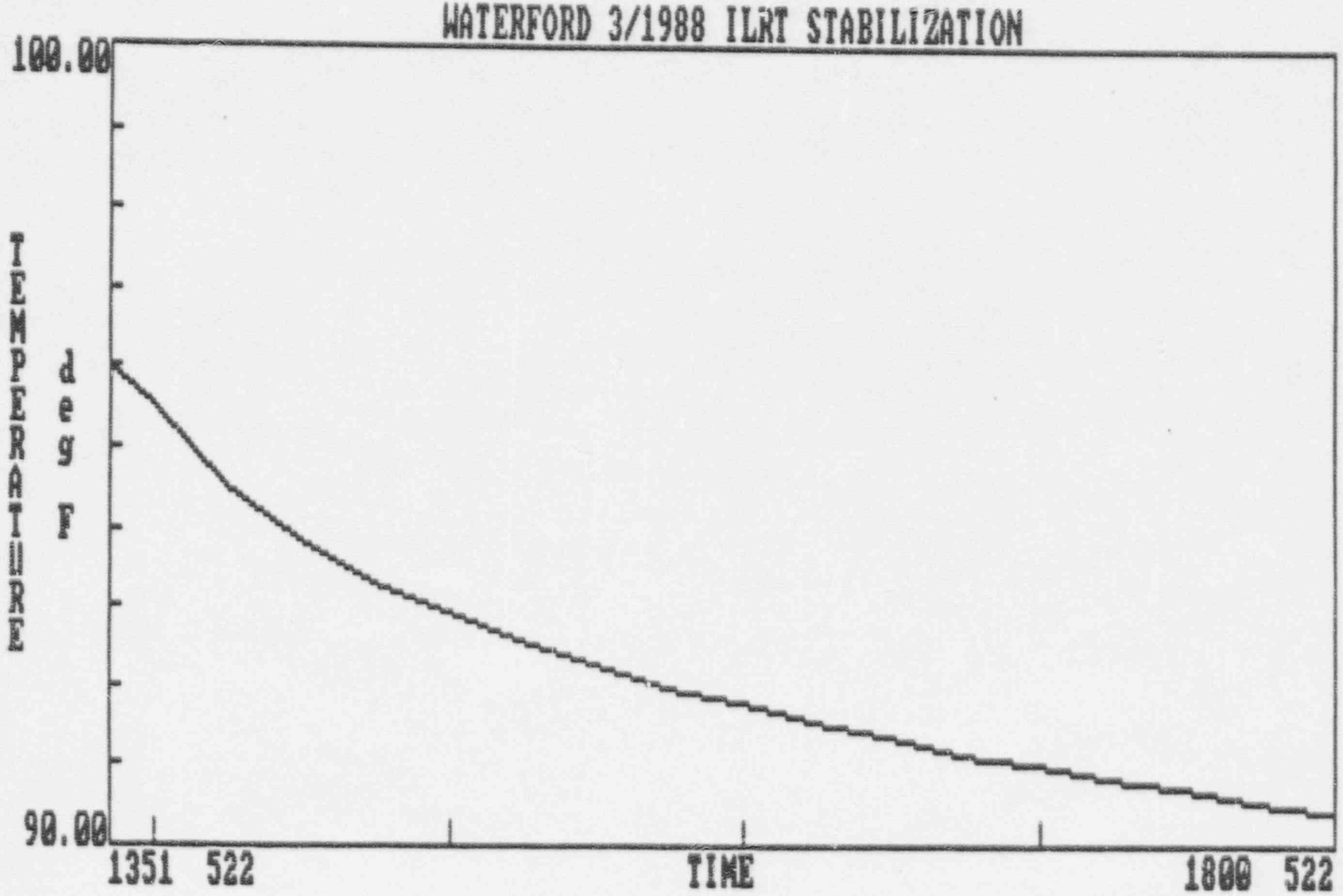
WATERFORD 3/1988 ILRT STABILIZATION
100.00
90.00
TEMPERATURE
deg F.
1351 522
TIME
1800 522

FIGURE 4.1

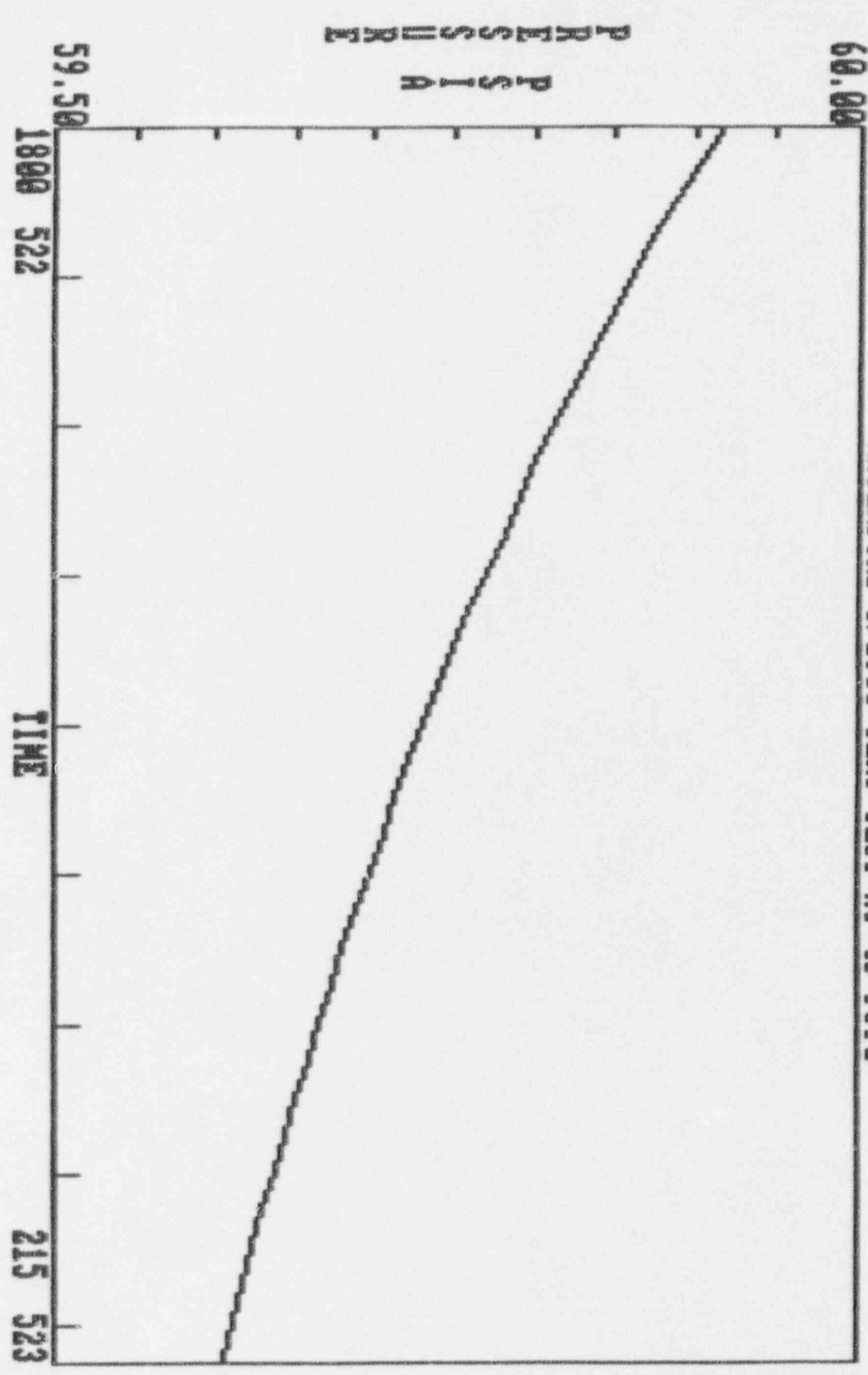
WATERFORD 3/1988 ILRT TEST AT 46 PSIG
PRESSURE PSIA
60.00
59.50
1800
522
TIME
215
523

FIGURE 4.2

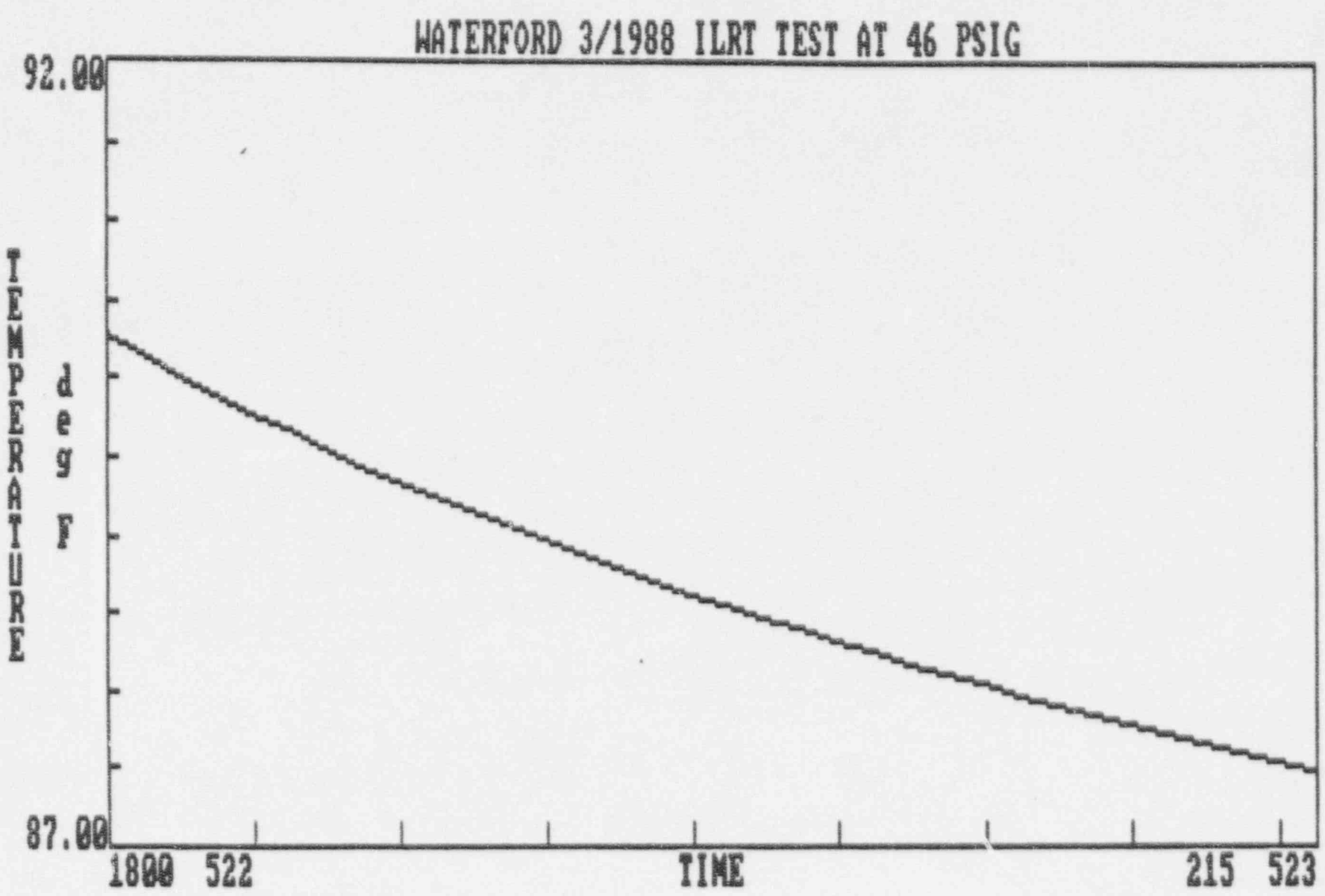
WATERFORD 3/1988 ILRT TEST AT 46 PSIG
92.00
87.00
TEMPERATURE
deg F
1800 522
TIME
215 523

FIGURE 4.3

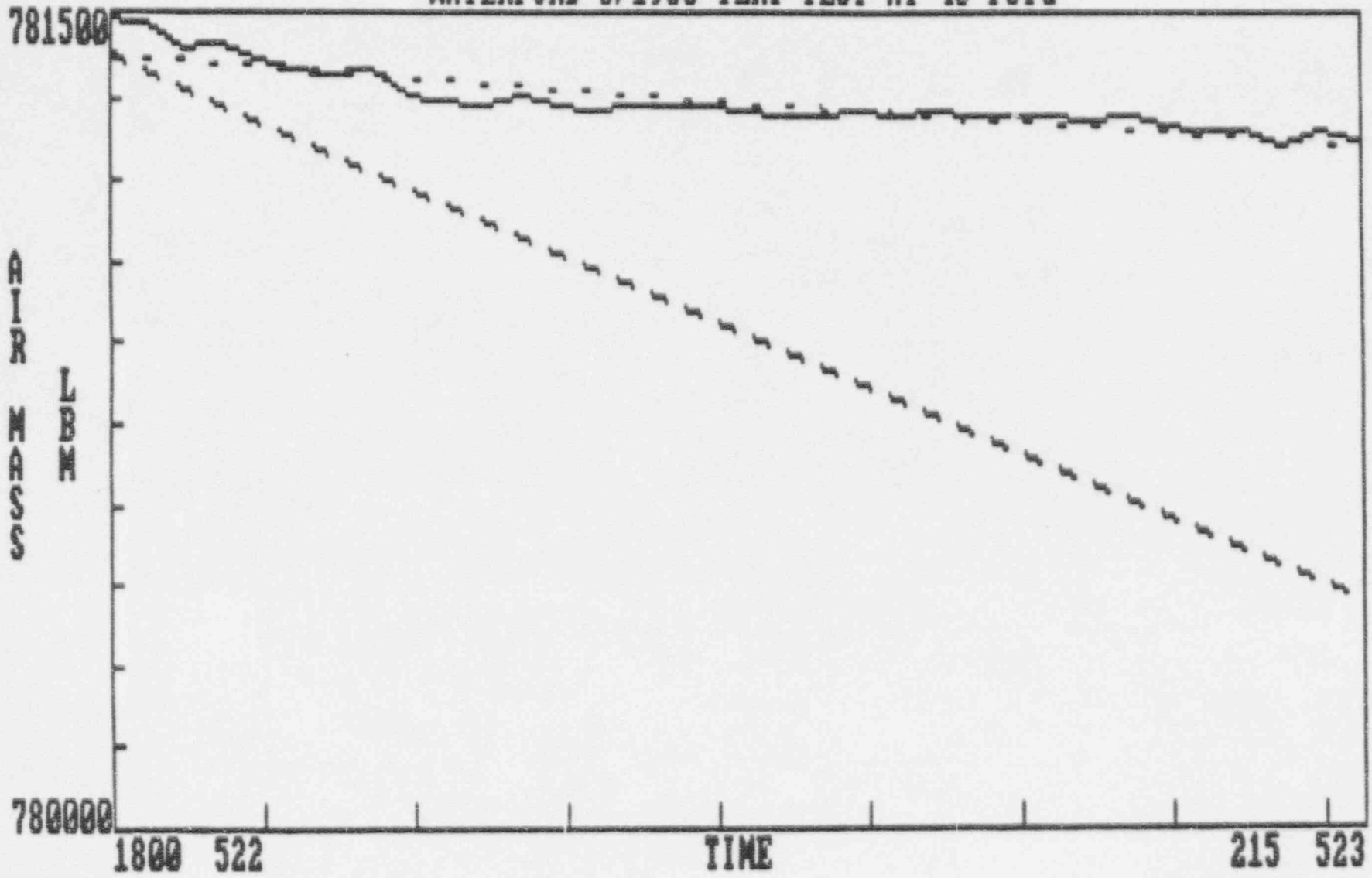
WATERFORD 3/1988 ILRT TEST AT 46 PSIG
781500
780000
AIR MASS
LBM
1800 522
TIME
215 523

FIGURE 4.4

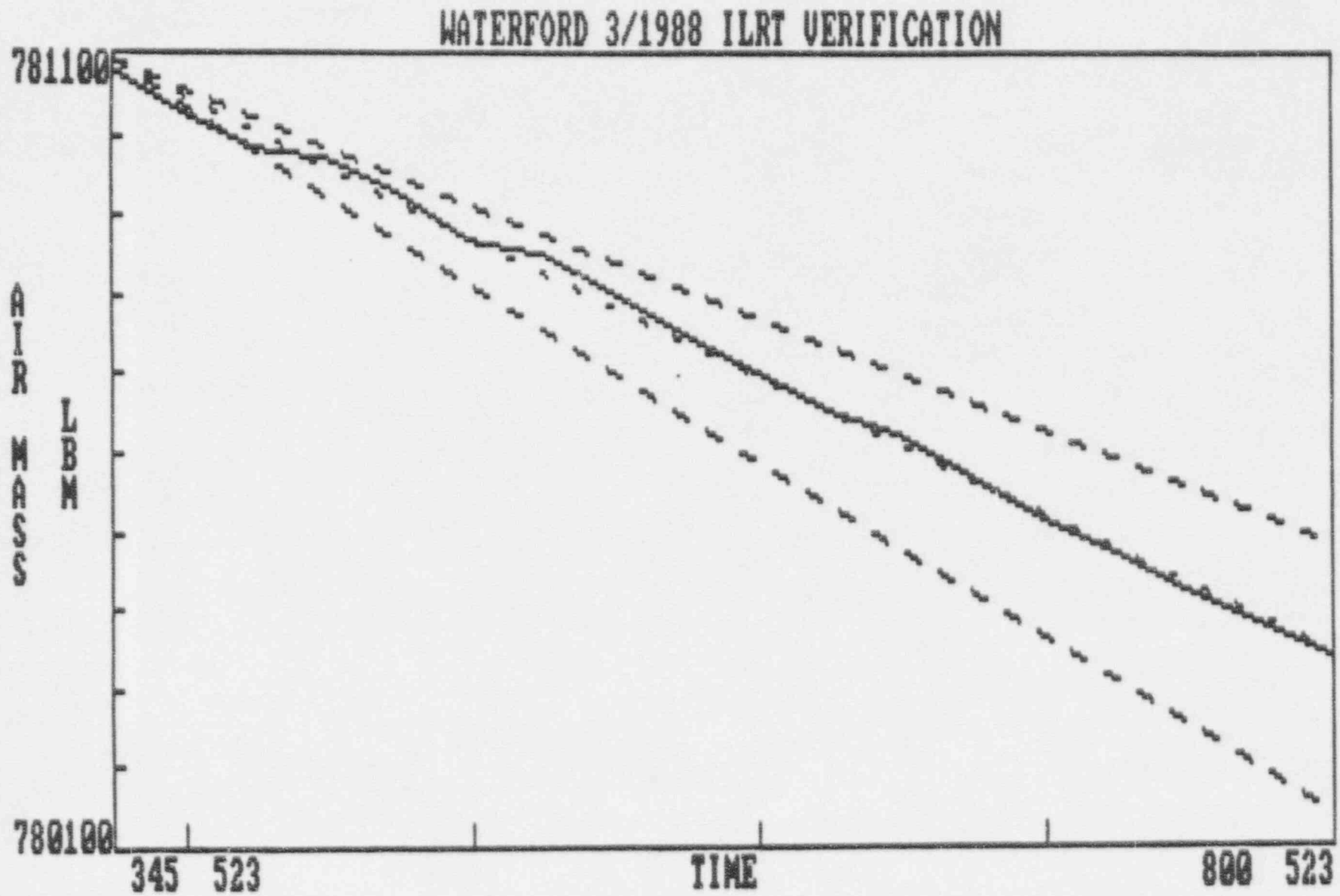
WATERFORD 3/1988 ILRT VERIFICATION
781100
780100
AIR MASS LBM
345 523
TIME
800 523

FIGURE 4.5

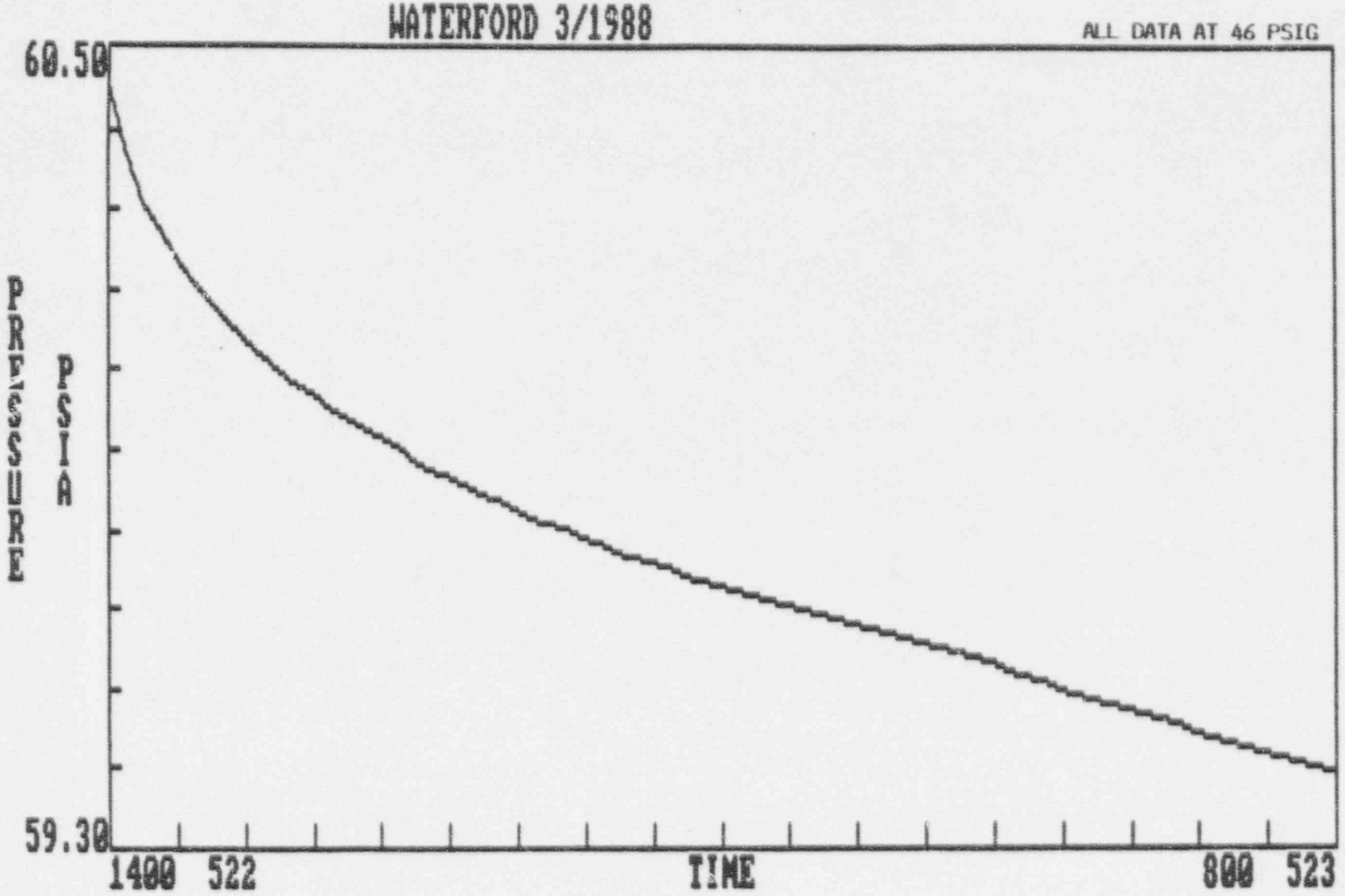
WATERFORD 3/1988
ALL DATA AT 46 PSIG
60.50
59.30
PRESSURE PSIA
1400 522
TIME
800 523

FIGURE 4.6

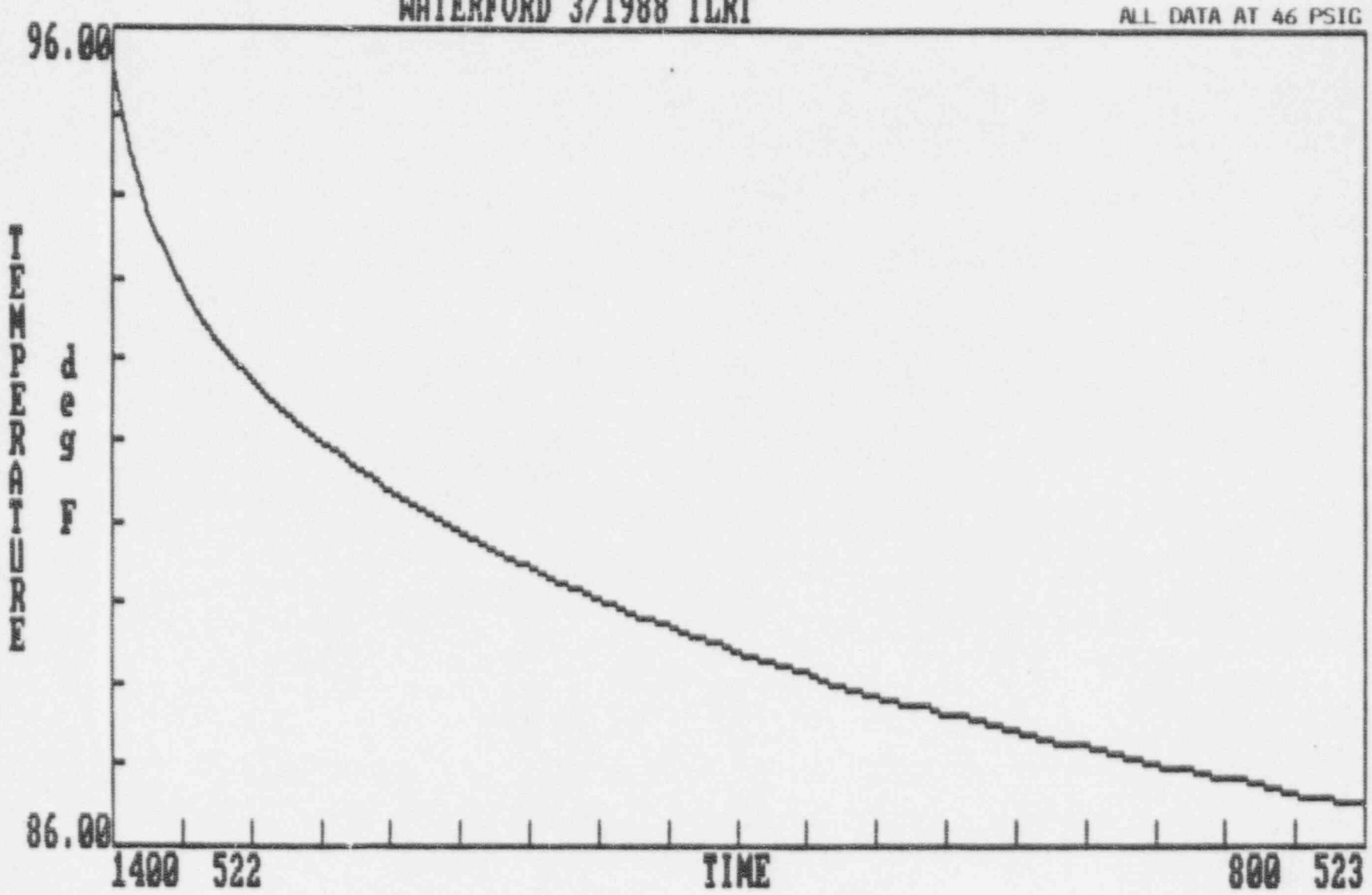
WATERFORD 3/1988 ILRT
ALL DATA AT 46 PSIG
96.00
86.00
TEMPERATURE deg F
1400 522
TIME
800 523

FIGURE 4.7

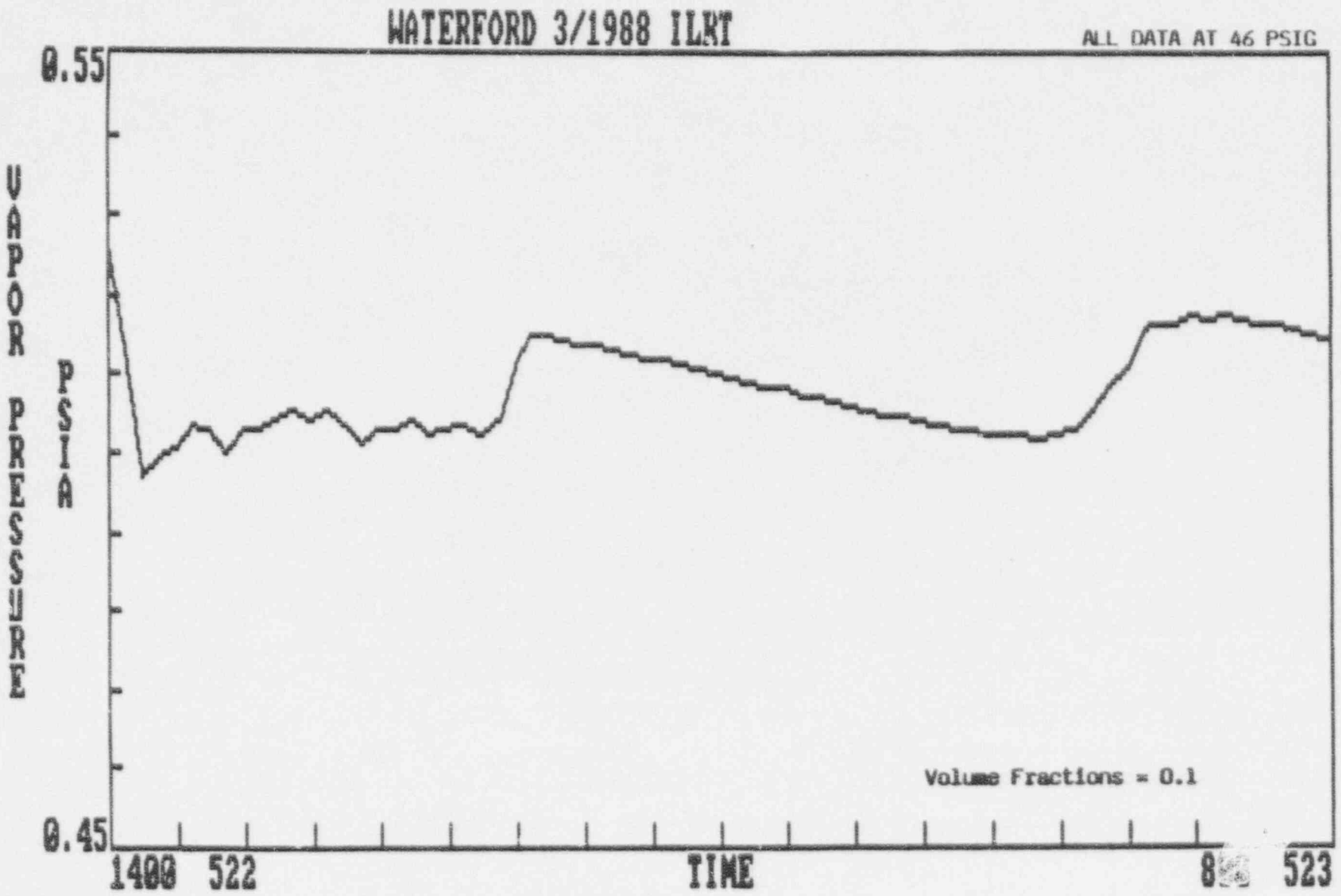
WATERFORD 3/1988 ILRT
ALL DATA AT 46 PSIG
0.55
VAPOR PRESSURE
PSIA
0.45
Volume Fractions = 0.1
1400
522
TIME
523

FIGURE 4.8

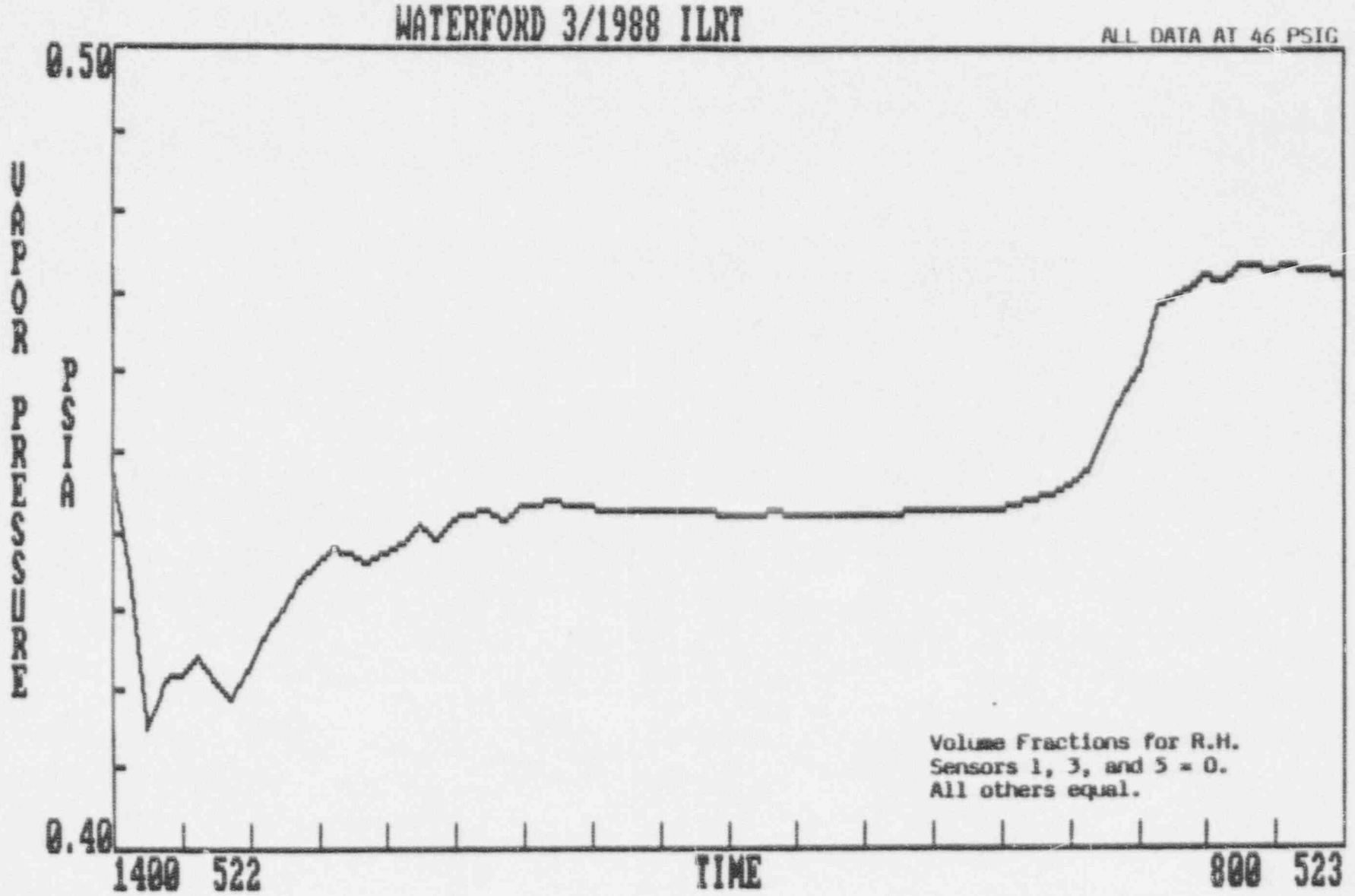
WATERFORD 3/1988 ILRT
ALL DATA AT 46 PSIG
0.50
0.40
VAPOR PRESSURE
PSIA
Volume Fractions for R.H.
Sensors 1, 3, and 5 = 0.
All others equal.
1400 522
TIME
800 523

FIGURE 4.9

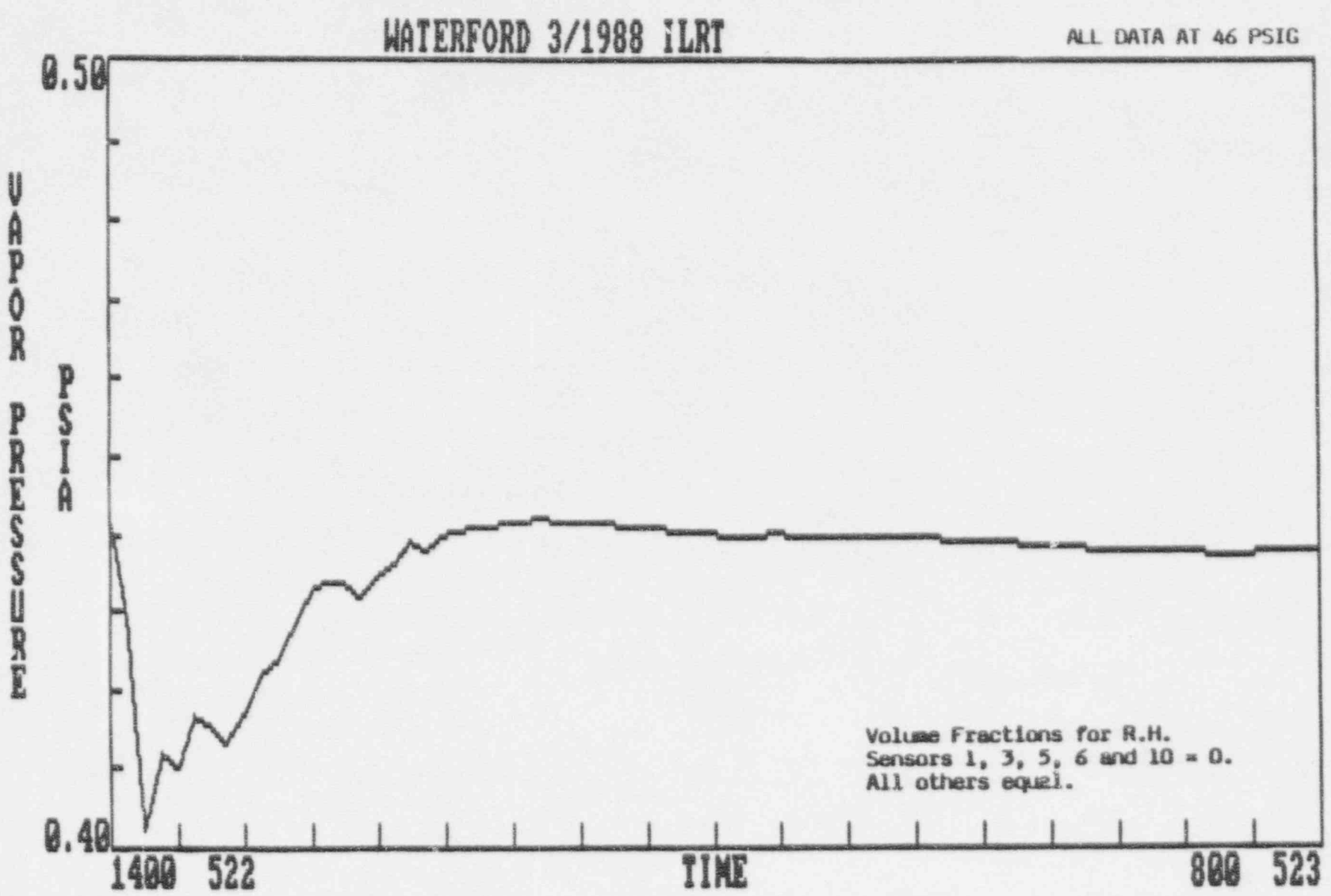
WATERFORD 3/1988 ILRT
ALL DATA AT 46 PSIG
0.50
0.40
VAPOR PRESSURE PSIA
Volume Fractions for R.H.
Sensors 1, 3, 5, 6 and 10 = 0.
All others equal.
1400 522
TIME
800 523

FIGURE 4.10

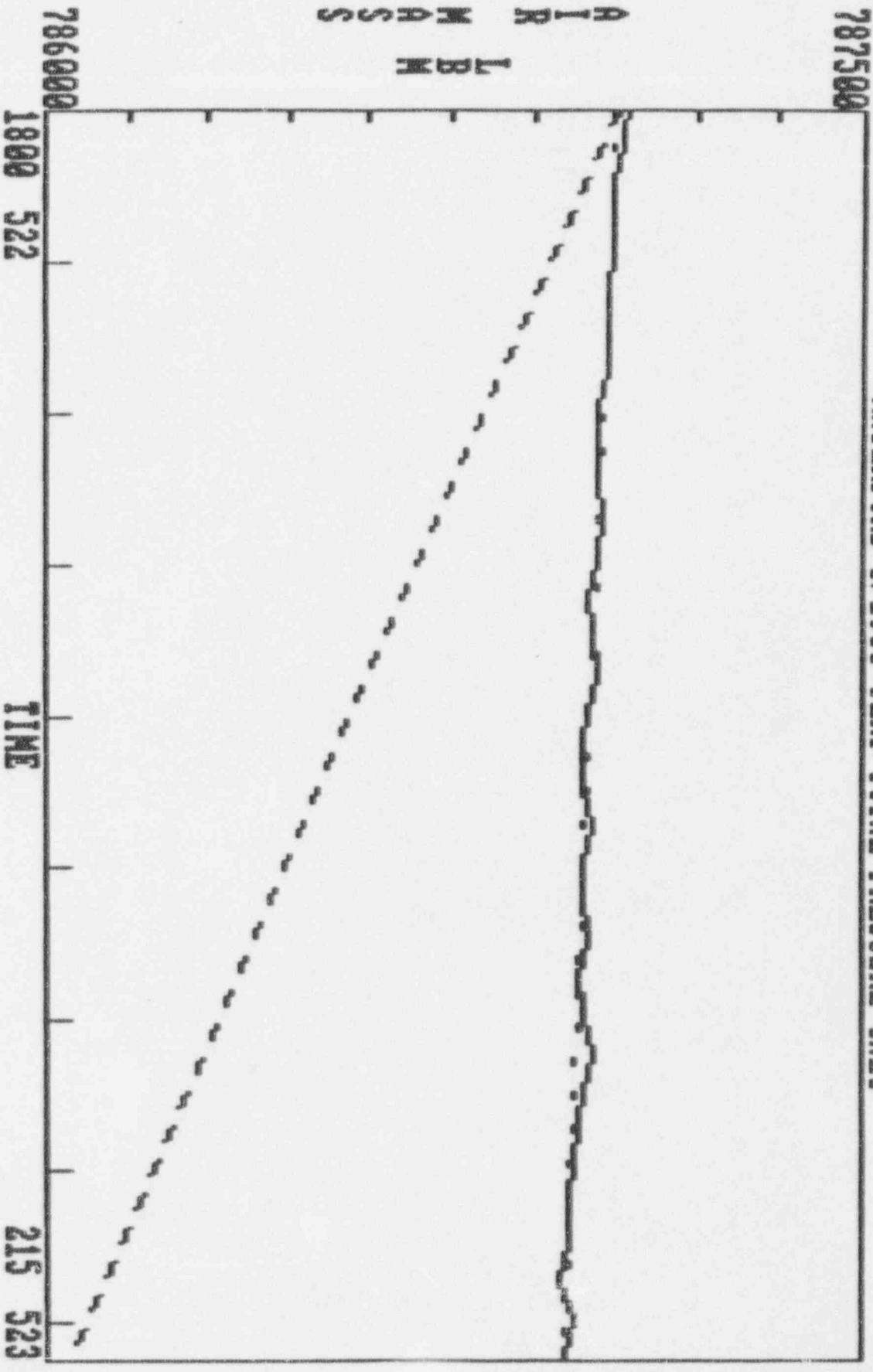
WATERFORD 3/1988 ILRT TOTAL PRESSURE CALC
AIR MASS LBM
787500
786000
1800
522
TIME
215
523

FIGURE 4.11

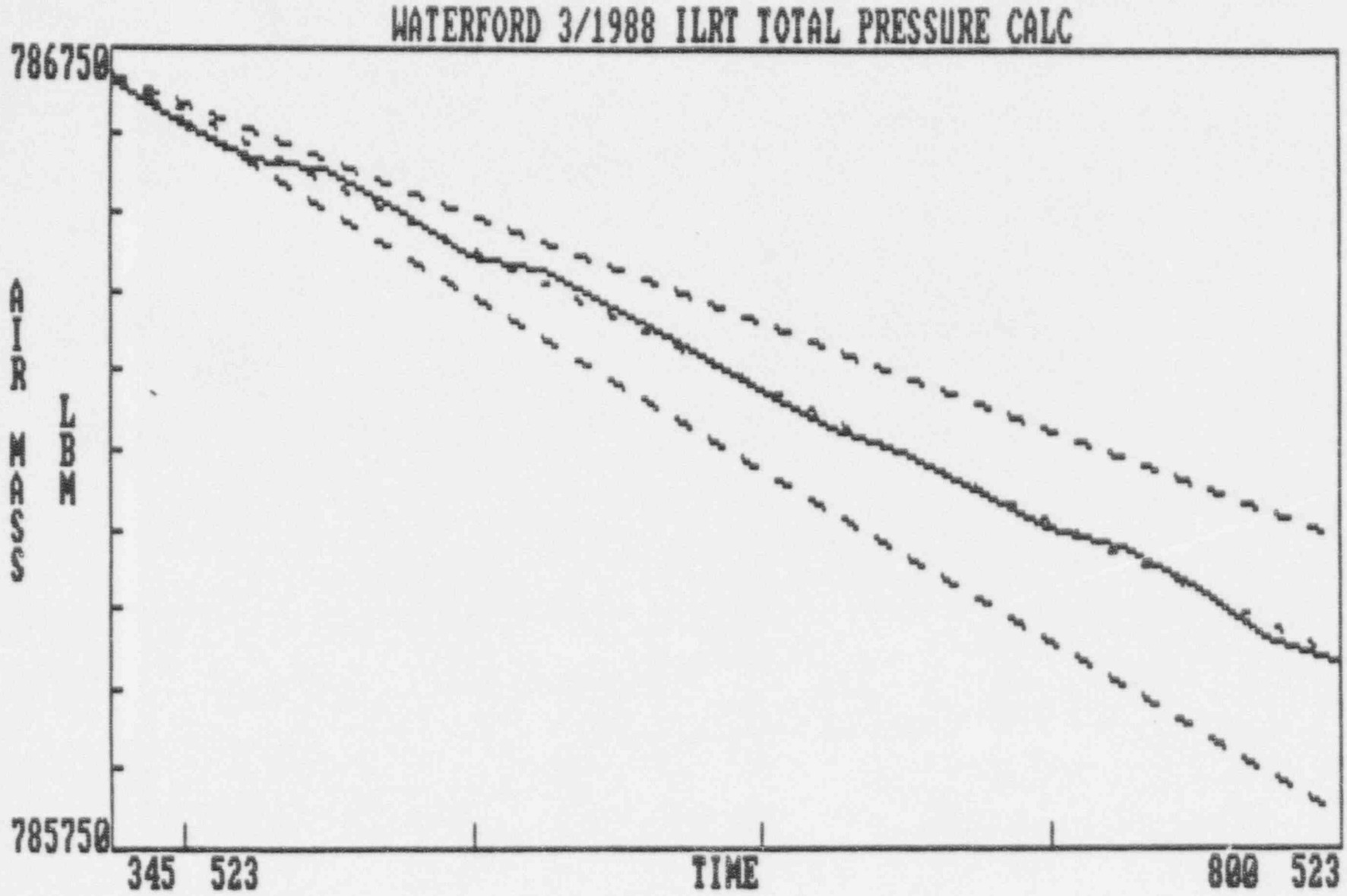
WATERFORD 3/1988 ILRT TOTAL PRESSURE CALC
786750
785750
AIR MASS
LBM
345
523
TIME
800
523

FIGURE 4.12

APPENDIX

LOCAL LEAKAGE RATE TEST RESULTS

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
7	PMU-151	0	0	840420
		0	0	861201
		0	0	880405
7	PMU-152	0	0	840420
		3,000	0	861231
		100	100	880405
8	SA-908	0	0	840425
		160	160	860314
		0	0	870105
		150	150	880415
8	SA-909	60	60	840425
		135	135	860314
		160	160	870105
		370	370	870415
9	IA-909	7,000	0	840509
		2,200	990	860321
		700	700	870107
		1,500	1,070	880517
9	IA-910	>20,000	>20,000	840426
		11,000	30	840927
		>20,000	10	860319
		>50,000	0	870113
		0	0	880509
10	CAP-103	2,500	2,500	840515
		OFF SCALE	15,200	850117
		>21,000	9,510	850514

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
10	CAP-103	11,500	11,500	850816
		5,900	5,900	851213
		6,600	6,600	860312
		3,200	3,200	860710
		>65,000	10,000	870120
		18,000	18,000	870414
		18,000	18,000	870527
		70,000	10,900	870904
		10,800	10,800	871211
		11,600	11,600	880321
		12,400	12,400	880322
		17,000	17,000	880518
10	CAP-104	2,500	2,500	840515
		OFF SCALE	15,200	850117
		>21,000	9,510	850514
		11,500	11,500	850816
		5,900	5,900	851213
		6,600	6,600	860312
		3,200	3,200	860710
		>65,000	10,000	870120
		18,000	18,000	870414
		18,000	18,000	870527
		70,000	10,900	870904
		10,800	10,800	8701211
		11,600	11,600	880321
		12,400	12,400	880322

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
10	CAP-104	17,000	17,000	880518
11	CAP-203	OFF SCALE	2,700	840526
		OFF SCALE	21,000	850115
		7,900	7,900	850514
		10,600	10,600	850816
		2,000	2,000	851214
		2,600	2,600	860314
		7,000	7,000	860711
		640	640	870118
		520	520	870414
		650	650	870527
		650	650	870904
		1,000	1,000	871211
		3,300	3,300	880320
		400	400	880518
11	CAP-204	OFF SCALE	2,700	840526
		OFF SCALE	21,000	850115
		7,900	7,900	850514
		10,600	10,600	850816
		2,000	2,000	851214
		2,600	2,600	860314
		7,000	7,000	860714
		640	640	870118
		520	520	870414
		650	650	870527
		650	650	870904

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
11	CAP-204	1,000	1,000	871211
		3,300	3,300	880320
		400	400	880413
12	CVR-101	OFF SCALE	150	840507
		920	920	861208
		2,050	2,050	880413
12	CVR-102	130	130	840413
		>60,000	560	870108
		2,000	2,000	880413
13	CVR-201	OFF SCALE	2,100	840507
		7,000	3,900	870109
		5,100	2,100	880515
13	CVR-202	60	60	840413
		560	560	861208
		1,900	1,900	870109
		120	0	880514
14	NG-157	0	0	840425
		105	105	840605
		2,000	10	860317
		95	95	861206
		300	300	880407
		870	400	880416
		400	120	880419
14	NG-158	OFF SCALE	115	840507
		2,600	225	860317
		40	40	861206

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
14	NG-158	120	120	880407
23	CC-641	200	200	870113
		120	120	880427
23	CC-644	1,300	1,300	870113
		665,449	120	880428
24	CC-710	4,200	4,200	870116
		18,600	2,000	880502
24	CC-713	0	0	870116
		0	0	880429
26	CVC-103	OFF SCALE	>20,000	840425
		OFF SCALE	3,200	840515
		1,500	1,500	840518
		10	10	840618
		0	0	861219
		2,400	2,400	880413
26	CVC-109	40	40	840425
		1,500	110	870110
		269,011	15,000	880516
28	PSL-105	0	0	840418
		0	0	870108
		5,100	40	880503
		40	0	880510
28	PSL-107	OFF SCALE	0	840509
		0	0	870108
		0	0	880407
		0	0	880504

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
29	PSL-203	10	10	840417
		145	145	861218
		45	45	870108
		42,000	30	880421
29	PSL-204	0	0	840417
		410	0	870108
		0	0	880407
30	PSL-303	45	45	840417
		0	0	861223
		29,200	40	880425
30	PSL-304	50	50	840417
		6,900	105	870105
		2,800	50	880425
31	GWM-104	100	100	840510
		0	0	861210
		860	330	880422
31	GWM-105	100	100	840510
		0	0	861210
		0	0	880408
42	SP-105	0	0	840406
		0	0	861210
		170	170	880409
42	SP-106	0	0	840406
		0	0	861210
		120	120	880409
43	BM-109	35	35	840427

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
43	BM-109	0	0	861215
		0	0	880412
43	BM-110	40	40	840427
		0	0	861215
		0	0	880412
44	RC-606	0	0	840412
		0	0	861211
		170	0	880506
44	CVC-401	0	0	840412
		0	0	861211
		0	0	880430
		0	0	880505
45	CAR-101B	275	275	840409
		0	0	861209
		250	250	880412
45	CAR-102	0	0	840409
		0	0	861209
		160	160	880412
46	CAR-101A	180	180	840410
		0	0	861209
		300	300	880412
46	CAR-102A	0	0	840409
		25	25	861209
		160	160	880412
47	CAR-200B	120	120	880423
		120	120	880516

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	LEAKAGE (sccm) AS LEFT	DATE (YYMMDD)
47	CAR-201B	140	140	840410
		68,000	0	870116
		580	0	880413
		120	120	880423
		120	120	880516
47	CAR-202B	140	140	840410
		68,000	0	870116
		580,500	120	880516
48	CAR-201A	130	130	840410
		22,000	1,000	870106
		1,300	100	870113
		10,000	0	880423
48	CAR-202A	130	130	840410
		22,000	1,000	870106
		1,300	100	870113
		10,000	0	880423
49A	ARM-109	10	10	840404
		0	0	861211
		0	0	880406
49A	ARM-110	10	10	840404
		0	0	861211
		0	0	880406
49B	ARM-103	20	20	840404
		OFF SCALE	0	861211
		0	0	880406
49B	ARM-104	OFF SCALE	120	840524

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
49B	ARM-104	40	40	850114
		80	80	861206
		1,400	120	880416
51	FS-405	0	0	840504
		0	0	870114
		0	0	880514
51	FS-406	14,000	0	840514
		55	55	870114
		0	0	880504
59	SI-343	20	20	840423
		0	0	861215
		0	0	880409
59	SI-344	0	0	840423
		0	0	861215
		280	280	880409
60	FP-601A	OFF SCALE	145	840529
		0	0	861202
		139,000	12,100	880403
		12,100	0	880421
60	PACKING	4,200	120	880421
60	FP-602A	0	0	840512
		2,100	2,100	861218
		1,200	1,200	870117
		1,900	0	880421
61	FP-601B	2,500	2,500	840512
		6,100	0	840531
		10	10	860326

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (accm) AS FOUND	LEAKAGE (accm) AS LEFT	DATE (YYMMDD)
61	FP-601B	180	180	861212
		380	380	880406
	PACKING	4,200	0	880416
61	FP-602B	OFF SCALE	1,700	840529
		300	300	861212
		3,700	300	870118
		3,500	210	880416
62	FS-415	0	0	840420
		0	0	870114
		0	0	880514
62	FS-416	0	0	840420
		0	0	870114
		0	0	880514
63	LRT-109	0	0	840330
		0	0	870115
		660	660	870517
		600	600	880523
63	BLIND FLAN	0	0	840330
		0	0	870115
		660	660	880517
		600	600	880523
65A	LRT-201	10	10	840403
		0	0	861124
		0	0	880404
		0	0	880523
65A	LRT-202	10	10	840403

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
65A	LRT-202	0	0	861129
		0	0	880404
		0	0	880523
65B	LRT-203	2	2	840403
		0	0	861124
		0	0	880404
65B	LRT-204	5	5	840403
		0	0	861129
		0	0	880404
66A	HRA-109A	10	10	840405
		0	0	861205
		0	0	880502
66A	HRA-110A	10	10	840405
		0	0	861205
		0	0	880502
66B	HRA-126A	10	10	840405
		10	10	860311
		0	0	861205
		0	0	880421
66B	HRA-128A	400	10	840524
		>20,000	18,000	860314
		18,000	2,300	860315
		2,300	985	860315
		985	870	860317
		870	10	860317
		27	27	861205

TYPE C LOCAL LEAK RATE TEST SUMMARY

PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
66B	HRA-128A	60	60	880421
67A	HRA-109B	0	0	840404
		0	0	861205
		0	0	880504
67A	HRA-110B	0	0	840404
		0	0	861205
		0	0	880504
67B	HRA-126B	15	15	840331
		10	10	860311
		0	0	861205
		0	0	880428
67B	HRA-128B	OFF SCALE	150	840525
		2,600	1,500	860315
		1,500	210	860315
		180	0	861231
		80	80	880428
71	CMU-244	0	0	840504
		0	0	861202
		0	0	880411
71	CMU-245	0	0	840504
		110	110	861203
		0	0	880411

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
101		0.01	0.01	840424
		.00	.00	860314
		.07	.07	861207
		.01	.01	880412
102		.00	.00	840424
		5.70	5.70	860314
		9.84	9.84	861208
		5.90	5.90	880411
104		.00	.00	840424
		.00	.00	860314
		.11	.11	861207
		.10	.10	880412
106		.00	.00	840424
		.00	.00	860314
		.11	.11	861207
		.10	.10	880412
107		.00	.00	840424
		.00	.00	860311
		.00	.00	861209
		.10	.10	880412
108		.00	.00	840424
		.00	.00	860315
		.00	.00	861209
		.10	.10	880412
109		.05	.05	840423
		.07	.07	860314

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
109		.30	.30	861206
		.30	.30	880411
110		.01	.01	840330
		.00	.00	860309
		.12	.12	861204
		.20	.20	880407
111		.06	.06	840414
		.32	.32	860310
		.14	.14	861205
		.10	.10	880408
112		.03	.03	840416
		.32	.32	860310
		.13	.13	861205
		.10	.10	880408
113		.03	.03	840413
		.08	.08	860310
		.14	.14	861205
		.10	.10	880407
114		.05	.05	840328
		.22	.22	860306
		.07	.07	861202
		.30	.30	880405
115		.00	.00	840327
		.17	.17	860306
		.06	.06	861202
		.10	.10	880405

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
116		.00	.00	840327
		.17	.17	860306
		.07	.07	861202
		.30	.30	880405
117		.03	.03	840330
		.00	.00	860310
		.13	.13	861204
		.20	.20	880401
118		.02	.02	840423
		.07	.07	860314
		.32	.32	861206
		.30	.30	880411
119		.08	.08	840328
		.09	.09	850112
		.22	.22	860306
		.12	.12	861201
		.10	.10	880405
120		.15	.15	840328
		.23	.23	860308
		.22	.22	861202
		.10	.10	880405
121		.05	.05	840416
		2.90	2.90	860312
		3.88	3.88	861206
		1.20	1.20	880408
122		.02	.02	840404

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
122		.42	.42	860309
		.45	.45	861204
		.30	.30	880407
123		.02	.02	840405
		.00	.00	860309
		.45	.45	861204
		.20	.20	880407
124		.04	.04	840411
		.13	.13	860311
		.04	.04	860313
		.58	.58	861204
		.40	.40	880408
125		.02	.02	840410
		.06	.06	860308
		.13	.13	861204
		.10	.10	880406
126		.00	.00	840414
		.08	.08	860310
		.13	.13	861205
		.10	.10	880407
127		.03	.03	840411
		.05	.05	860311
		.58	.58	861205
		.40	.40	880408
128		.05	.05	840329
		.23	.23	860308

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
128		.14	.14	861202
		.10	.10	880405
129		.20	.20	840328
		.23	.23	860308
		.21	.21	861202
		.10	.10	880405
130		.00	.00	840411
		.06	.06	860308
		.00	.00	861204
		.30	.30	880407
131		.04	.04	840404
		.42	.42	860309
		.49	.49	861204
		.20	.20	880407
132		.03	.03	840405
		.42	.42	860309
		.00	.00	861204
		.20	.20	880407
133		.04	.04	840412
		.05	.05	860311
		.29	.29	861205
		.10	.10	880408
134		.00	.00	840423
		2.40	2.40	860313
		4.33	4.33	861206
		1.10	1.10	880411

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
135		.09	.09	840329
		.16	.16	860307
		.15	.15	861202
		.10	.10	880405
136		.02	.02	840328
		.23	.23	860308
		.22	.22	861202
		.10	.10	880405
137		.21	.21	840416
		.00	.00	860312
		.29	.29	861205
		.10	.10	880408
138		.13	.13	840330
		.00	.00	860309
		.15	.15	861204
		.30	.30	880407
139		.02	.02	840417
		.00	.00	860312
		.07	.07	861206
		.20	.20	880411
140		.08	.08	840404
		.42	.42	860309
		.00	.00	861204
		.30	.30	880407
141		.01	.01	840413
		.08	.08	860310

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
141		.15	.15	861205
		.20	.20	880407
142		.04	.04	840411
		.06	.06	860309
		.15	.15	861204
		.20	.20	880406
143		.03	.03	840412
		.05	.05	860311
		.30	.30	861205
		.10	.10	880408
144		.24	.24	840416
		.32	.32	860310
		.59	.59	861205
		.40	.40	880408
145		.08	.08	840329
		.16	.16	860303
		.15	.15	861202
		.10	.10	880405
146		.00	.00	840327
		.17	.17	860306
		.08	.08	861201
		.10	.10	880405
147		.01	.01	840417
		.00	.00	860312
		.08	.08	861206
		.20	.20	880411

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
148		.03	.03	840417
		.07	.07	860314
		.07	.07	861206
		.20	.20	880411
149		.03	.03	840416
		.32	.32	860310
		.14	.14	861205
		.10	.10	880408
151		.02	.02	840410
		.06	.06	860308
		.14	.14	861204
		.20	.20	880406
EQUIPTMENT	HATCH	620.00	620.00	840530
		.00	.00	850111
		10.00	10.00	850120
		100.00	100.00	850228
		10.00	10.00	850619
		10.00	10.00	850907
		2.65	2.65	851007
		100.00	100.00	851214
		10.00	10.00	860320
		10.00	10.00	860325
		17.00	17.00	860716
		13.00	13.00	860718
		10.00	10.00	870119
		3.00	3.00	870131

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
EQUIPTMENT HATCH		1.80	1.80	870927
		4.50	4.50	871005
		1.80	1.80	880402
		4	4	880521
PERSONNEL LOCK		2,000	2,000	840802
		5,200	5,200	850130
		5,800	5,800	850621
		6,300	6,300	851123
		10,200	10,200	860522
		38,549	38,549	861019
		10,200	10,200	870118
		8,100	8,100	870630
		14,000	14,000	871106
		19,800	19,800	880401
ESCAPE LOCK		100	100	840803
		100	100	850215
		100	100	850708
		760	760	851222
		14	14	860622
		1,950	1,950	870109
		2,200	2,200	870627
		660	660	871103
25 FUEL TRANS TUBE FLANGE		25	25	850111
		10	10	860118
		0	0	880519
1 BELLOWS NEXT TO LINER		0	0	840606

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
1 BELLOWS NEXT TO LINER		0	0	861221
		1,100	1,100	880415
1 BELLOWS NEXT TO SHIELD WALL		0	0	840606
		0	0	861222
		0	0	880415
2 BELLOWS NEXT TO LINER		0	0	840606
		0	0	861220
		0	0	880415
2 BELLOWS NEXT TO SHIELD WALL		0	0	840606
		0	0	861220
		0	0	880415
3 BELLOWS NEXT TO LINER		0	0	840606
		0	0	861221
		0	0	880415
3 BELLOWS NEXT TO SHIELD WALL		0	0	840606
		0	0	861221
		0	0	880415
4 BELLOWS NEXT TO LINER		0	0	840606
		0	0	861220
		0	0	880415
4 BELLOWS NEXT TO SHIELD WALL		0	0	840606
		0	0	861220
		0	0	880415
25 BELLOWS		0	0	840419
		0	0	870117
		0	0	880514

TYPE B LOCAL LEAK RATE TEST SUMMARY

ELECT PEN NO.	VALVE NO.	LEAKAGE (sccm) AS FOUND	AS LEFT	DATE (YYMMDD)
32	PIPE GUARD ASSY	0	0	840418
		0	0	861217
		0	0	880409
43	PIPE GUARD ASSY	0	0	840420
		0	0	861217
		0	0	880409

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of	)	
	)	
ENTERGY OPERATIONS, INC.	)	Docket No. 50-382
	)	
(Waterford Steam Electric Station, Unit No. 3)	)	

EXEMPTION

I.

Entergy Operations, Inc. (the licensee), is the holder of Facility Operating License No. NPF-38, which authorizes operation of the Waterford Steam Electric Station, Unit No. 3 (Waterford). The license provides, among other things, that Waterford is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (the Commission) now and hereafter in effect.

The Waterford facility consists of a pressurized water reactor located in St. Charles Parish, Louisiana.

II.

In its letter dated May 7, 1993, the licensee requested an exemption from the Commission's regulations. The subject exemption is from a requirement in Appendix J to 10 CFR Part 50 that a set of three Type A tests (Containment Integrated Leakage Rate Tests, or CILRTs) be performed, at approximately equal intervals, during each 10-year service period. The exemption applies to the first 10-year service period; subsequent service periods are not changed. In another letter, also dated May 7, 1993, the

licensee applied for an amendment to Operating License No. NPF-38 to change certain provisions of the Waterford Technical Specifications (TSs).

The Type A test is defined in 10 CFR Part 50, Appendix J, Section II.F, as a "test intended to measure the primary reactor containment overall integrated leakage rate (1) after the containment has been completed and is ready for operation, and (2) at periodic intervals thereafter." The 10-year service period begins with the inservice date. TS 4.6.1.2.a requires that the Type A tests be conducted during shutdown at 40±10 month intervals in each 10-year service period. This TS incorporates the requirements of Section III.D.1.(a) of Appendix J with regard to performing three Type A tests at approximately equal intervals during each 10-year service period. The first CILRT testing interval was 32 months, and the second was 36 months. The time interval between CILRTs should be about 40 months based on performing three such tests at approximately equal intervals during each 10-year service period. Since refueling outages do not necessarily occur at 40-month intervals, a permissible variation of 10 months (25 percent variation) is typically authorized in the technical specifications issued with an operating license to permit flexibility in scheduling the CILRTs.

The proposed revision to the Waterford TSs associated with the licensee's May 7, 1993, request for a one-time exemption would change the TSs by extending the surveillance requirements of TS 4.6.1.2.a and its associated Bases. The extension would allow the third Type A CILRT within the first 10-year service period to be conducted during the Cycle 7 refueling outage. This TS change is a one-time schedular extension of the

third maximum interval from 50 months to 54 months. It does not affect the second 10-year service period.

With respect to the subject exemption request, the NRC staff notes that the first and second CILRTs of the set of three tests for the first 10-year service period for Waterford were conducted in May 1988 and May 1991. This represents testing intervals of 32 and 36 months from the inservice date of September 1985. The third of the first set of three CILRTs will be scheduled for Refueling Outage 7, projected to start in October 1995, pending approval of the exemption request. The current third test period in the first 10-year service period will actually be exceeded by approximately 4 months.

Data from the first (May 1988) and second (May 1991) CILRT at Waterford 3 indicates that most of the measured leakage is from the containment penetrations and not from the containment barrier. The "as-left" leakage rate was well below the 10 CFR Part 50 Appendix J limit. Both Appendix J and TS requires that the leakage rate be less that 75% of L_a to allow for deterioration in leakage paths between tests. The allowable leakage rate, L_a, is 0.5 wt.%/day. Therefore, the established acceptable limit is <0.375 wt.%/day. The "as-left" leakage rates for the first two CILRTs were 0.116 and 0.0731 wt.%/day, which is well below the acceptance limit. The Type B and C test (Local Leakage Rate Test or LLRT) program also provides assurance that containment integrity has been maintained. LLRTs demonstrate operability of components and penetrations by measuring penetration and valve leakage. Additionally, there have been no modifications made to the plant that could adversely affect the test results.

The licensee further notes that the performance of a fourth test in the first 10-year service period to meet the requirements of the TSs and Appendix J would result in additional radiation exposure to personnel. Omitting the test will result in additional dose savings by eliminating contamination and by reducing exposure from venting and draining and from setups and restorations of instrumentation required to perform the test. These factors and the costs associated with a fourth test for a 4-month difference in interval time are not offset by the benefits of the fourth test.

For the reasons set forth above, the NRC staff concludes that this deviation from the 10-year service period ending September 1995 is not significant in terms of complying with the safety or scheduling requirements of Section III.D.1.(a) of Appendix J. Accordingly, the staff finds that the additional test would not provide substantially different information and that the intent of Appendix J is met. Therefore, the subject exemption request meets the special circumstances of 10 CFR 50.12(a)(2)(ii), in that the fourth test is not necessary to achieve the underlying purpose of the rule.

On this basis, the NRC staff finds that the licensee has demonstrated that special circumstances are present as required by 10 CFR 50.12(a)(2). Further, the staff also finds that extending the service period will not present an undue risk to the public health and safety; since the licensee has justified the leaktight integrity of the containment based on previous leakage test results, the staff concludes that a one-time extension of approximately 4 months beyond the maximum permitted third test interval within the first 10-year service period will not have a significant safety impact.

III.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, an exemption is authorized by law and will not endanger life or property or the common defense and security and is otherwise in the public interest and hereby grants the following exemption with respect to a requirement of 10 CFR Part 50, Appendix J, Section III.D.1(a):

For the Waterford Steam Electric Station, Unit 3, the current third test period within the first 10-year service period may be extended by approximately 4 months, so that the third periodic Type A test may be performed during the Cycle 7 refueling outage.

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of the subject exemption will not have a significant effect on the quality of the human environment (58 FR 34829).

This Exemption is effective upon issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

Jack W Roe

Jack W. Roe, Director
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

Dated at Rockville, Maryland
this 12th day of August 1993

ENTERGY

Entergy Operations, Inc.

R. F. Burski

W3F1-93-0041
A4.05
PR

May 7, 1993

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Request For Exemption to 10 CFR Part 50 Appendix J Section III.D.1(a)

Gentlemen:

Entergy Operations Incorporated, holder of Facility Operating License NPF-38 which authorizes operation of the Waterford 3 Steam Electric Station hereby requests a one-time exemption to the Commission's regulations. The exemption request is submitted in accordance with the provisions of 10 CFR 50.12 and facilitates our proposed Technical Specification Change Request (TSCR) NPF-38-135, submitted as a separate licensing action via letter W3F1-93-0034 dated May 7, 1993.

The subject exemption is from a requirement in Appendix J to 10 CFR part 50 which requires a set of three Type A tests (Containment Integrated Leakage Rate Tests or CILRT) be performed at approximately equal intervals during each 10-year service period. The exemption would allow the third Type A test interval of the first 10-year service period to be slightly greater than that required by existing criteria and is necessary to avoid the performance of an additional CILRT within this time frame. The NRC has previously approved a similar exemption request as indicated in the Federal Register (58 FR 12602) dated March 5, 1993.

DESCRIPTION

Type A tests are defined in 10 CFR Part 50 Appendix J Section II.F as "tests intended to measure the primary reactor containment overall integrated leakage rate (1) after the containment has been completed and is ready for operation, and (2) at periodic intervals thereafter." The periodic retest schedule for Type A tests is prescribed by 10 CFR Part 50 Appendix J Section III.D.1(a): "After the preoperational leakage rate tests, a set of three

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Type A tests shall be performed, at approximately equal intervals during each 10-year service period. The third tests of each set shall be conducted when the plant is shutdown for the 10-year plant inservice inspections."

The Waterford 3 Technical Specifications (TS) 4.6.1.2.a requires that three Type A test be conducted at 40 $\pm$ 10 month intervals. This Surveillance incorporates the requirements of Appendix J Section III.D.1(a). The time required to perform the CILRTs necessitates that they be performed during refueling outages. The time interval between CILRTs should be about 40 months based on performing three such tests at approximately equal intervals during each 10-year service period. Since refueling outages do not necessarily occur coincident with a 40 month interval, a permissible variation of 10 months (i.e., a 25 percent variation) is authorized in the TS to permit flexibility in scheduling.

Per ASME Section XI IWA-2400(a), the 10-year service period begins with the inservice date . The first and second CILRTs of the first 10-year service period for Waterford 3, were conducted in May 1988 and May 1991 respectively. This represents testing intervals of 32 and 36 months based on an inservice date of September 1985. This would indicate that the third of the first set of three CILRTs be performed during Refuel 6 (scheduled for March 1994) which will be 34 months after the preceding test. However, this would not meet the TS and CFR requirement to perform the third CILRT during shutdown for the 10-year inservice inspection interval. ASME Section XI IWA-2400(c) allows the 10-year inspection interval to be decreased or extended by as much as one year. Thus, performing the third CILRT during Refuel 6 would not meet this criteria while the Refuel 7 projected start date of October 1995 is well within these bounds. In order to comply with the TS criteria and CFR requirements Waterford 3 would be forced to perform an extra CILRT within the first 10-year service period.

To avoid performing a fourth CILRT, we are proposing that the third CILRT for the first 10-year service period be scheduled for November 1995 during Refuel 7 which is currently projected to begin in October 1995. This will allow compliance with all other criteria and represents a one-time extension of approximately four months beyond the maximum permitted TS CILRT test interval which is based on the Appendix J requirement.

The benefit of not performing an additional CILRT is a reduction in personnel radiation exposure. A dose savings will be realized from eliminating contamination, reducing exposure for venting and draining, and from setup and restoration of instrumentation required to perform the test.

Data from the first (May 1988) and second (May 1991) CILRTs at Waterford 3 indicates that most of the measured leakage is from the containment penetrations and not from the containment barrier. Penetration and valve leakage, is measured by the performance of Type B and C tests (Local Leakage Rate Test or LLRT).

The LLRT program is not altered by this request, therefore, containment integrity will continue to be verified by LLRTs. In addition, the data from the previous CILRTs illustrates that the "as-left" leakage rate was well below the acceptance limits established in 10 CFR Part 50 Appendix J, and Technical Specifications. The allowable leakage rate, L_a, is 0.5 wt. %/day, however, Appendix J and TS require that the leakage rate be less than 75% of L_a to allow for deterioration in leakage paths between tests. Therefore, the acceptance limit is <0.375 wt. %/day. The "as left" leakage rates for the first two CILRTs were 0.116 and 0.0731 wt. %/day which is well below the acceptance limit.

Additionally, there have been no modifications made to the containment structure since the last CILRT that could adversely affect the test results.

ENVIRONMENTAL CONSIDERATIONS

This exemption request involves the use of facility components located within the restricted area, as defined in 10 CFR part 20, and changes a surveillance requirement. Entergy Operations Incorporated, has determined that this request does not involve:

(1) A significant hazard consideration, as described in our amendment application TSCR NPF-38-135, dated May 7, 1993;

(2) A significant change in the types or significant increase in the amounts of any effluents that may be released offsite;

(3) A significant increase in individual or cumulative occupational radiation exposure.

Accordingly, this request meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c) (9). Pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with this exemption request.

CONCLUSION

Due to the leaktight integrity of the containment as justified by previous leakage test results, a one-time extension of approximately 4 months beyond the maximum permitted CILRT test interval will not have a significant safety impact. Based on the reasons set forth above, we believe that the subject exemption meets the underlying purpose of the rule which requires three Type A tests be performed in a 10-year period, and therefore may be authorized in accordance with 10 CFR 50.12(a)(2)(ii).

Should you have any questions or comments concerning this request, please contact Paul Caropino at (504) 739-6692.

Very truly yours,

R.F. Burski

R.F. Burski
Director
Nuclear Safety

RFB/PLC/dc

cc: J.L. Milhoan, NRC Region IV
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 22, 1993

Docket No. 50-382

Mr. Ross P. Barkhurst
Vice President Operations
Entergy Operations, Inc.
Post Office Box B
Killona, Louisiana 70066

Dear Mr. Barkhurst:

SUBJECT: ENVIRONMENTAL ASSESSMENT RELATED TO A REQUEST FOR EXEMPTION FROM THE REQUIREMENTS OF SECTION III.D.1.(a) OF APPENDIX J TO 10 CFR PART 50 - WATERFORD STEAM ELECTRIC STATION, UNIT NO. 3 (TAC NO. M86484)

Enclosed for your information is a copy of an Environmental Assessment and Finding of No Significant Impact. The assessment relates to Entergy Operations, Inc.'s request dated May 7, 1993, for an exemption from the requirements of Section III.D.1.(a) of Appendix J to 10 CFR Part 50.

This Environmental Assessment has been forwarded to the Office of the Federal Register for publication.

Sincerely,

David L. Wigginton, Senior Project Manager
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation

Enclosure:
Environmental Assessment

cc w/enclosure:
See next page

9307020129

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UNITED STATES NUCLEAR REGULATORY COMMISSION

ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION, UNIT 3

DOCKET NO. 50-382

ENVIRONMENTAL ASSESSMENT AND FINDING OF

NO SIGNIFICANT IMPACT

The U. S. Nuclear Regulatory Commission (the Commission) is considering issuance of an exemption from the requirements of Section III.D.1.(a) of Appendix J to 10 CFR Part 50 to Entergy Operations, Inc. (the licensee), for the Waterford Steam Electric Station, Unit 3, located in Saint Charles Parish, Louisiana.

ENVIRONMENTAL ASSESSMENT

Identification of Proposed Action

The proposed action would grant an exemption from Section III.D.1.(a) of Appendix J to 10 CFR Part 50, which requires a set of three Type A tests (containment integrated leak rate tests, or CILRTs) be performed, at approximately equal intervals, during each 10-year service period. This licensee request is for a one-time exemption from the requirement that the third Type A test of the first 10-year service period be performed at the required interval during the service period. The exemption would extend the third interval by approximately 4 months within the first 10-year service period.

The proposed action is in accordance with the licensee's request for exemption dated May 7, 1993.

The Need for the Proposed Action

The proposed exemption is needed because the licensee's current refueling outage schedule requires the third CILRT for the first 10-year service period be performed at 54 months, which is not consistent with the "approximately equal interval" provision of Appendix J or with the technical specification (TS) requirement of 40±10 month intervals. (CILRTs are generally performed coincident with refueling outages due to the time required for their performance.) The first and second CILRT testing intervals for the first 10-year service period were 32 and 36 months. Without this exemption, the licensee would be required to perform the third CILRT at a 34-month interval and perform an additional (fourth) CILRT during the refueling outage for the first 10-year inspection. The licensee has also requested a one-time change to the TS; this will be addressed by a separate NRC action.

Environmental Impacts of the Proposed Action

The Commission's staff has determined that granting the proposed exemption would not significantly increase the probability or amount of expected primary containment leakage and that containment integrity would thus be maintained. The current requirement in Section III.D.1.(a) that three Type A tests be performed would continue to be met, except one interval (at Refueling Outage 7) will be longer than the approximately equal interval and would also be longer than specified in the Waterford TS. Consequently, the probability of accidents would not be increased, nor would the post-accident radiological releases be greater than previously determined. Neither would the proposed exemption otherwise affect radiological plant effluents. Therefore, the Commission's staff concludes

that there are no significant radiological environmental impacts associated with the proposed exemption.

With regard to potential nonradiological impacts, the proposed exemption involves a change to surveillance requirements. It does not affect nonradiological plant effluents and has no other environmental impact. Therefore, the Commission concludes that there are no significant nonradiological environmental impacts associated with the proposed exemption.

Alternative to the Proposed Action

As an alternative to the proposed action, the staff considered denial of the proposed action. Denial of the application would result in no change in current environmental impacts. The environmental impacts of the proposed action and the alternative action are similar.

Alternative Use of Resources

This action does not involve the use of any resources not previously considered in the "Final Environmental Statement related to the operation of Waterford Steam Electric Station, Unit No. 3," dated September 1981.

Agencies and Persons Consulted

The staff consulted with the State of Louisiana regarding the environmental impact of the proposed action.

FINDING OF NO SIGNIFICANT IMPACT

The Commission has determined not to prepare an environmental impact statement for the proposed exemption.

Based upon the foregoing environmental assessment, we conclude that the proposed action will not have a significant effect on the quality of the human environment.

For further details with respect to this action, see the request for amendment dated May 7, 1993, which is available for public inspection at the Commission's Public Document Room, 2120 L Street, NW., Washington, DC, and at the local public document room located at the University of New Orleans Library, Louisiana Collection, Lakefront, New Orleans, Louisiana 70122.

Dated at Rockville, Maryland, this 22nd day of June 1993

FOR THE NUCLEAR REGULATORY COMMISSION

Terence L. Chan, Acting Director
Project Directorate IV-1
Division of Reactor Projects - III/IV/V
Office of Nuclear Reactor Regulation