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INTEGRATED LEAK RATE TEST
FOR ST. LUCIE NUCLEAR
POWER PLANT (UNIT #2)

TECHNICAL EVALUATION REPORT
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ABSTRACT

This Technical Evaluation Report is in support of the Florida Power and Light submittal of its Integrated Leak Rate Test (ILRT) - St. Lucie Plant No. 2. This report was prepared by Viking Systems International, Pittsburgh, PA under NRC Contract No. NRC-03-87-028, FIN No. D-1762. The review of the numbers and calculations for air mass and leakage percentage per day all agree with the numbers expressed in the report.

The ILRT results are satisfactory and within criteria established for the tests.

Considering that this report was prepared without the benefit of a site visit it has been assumed that the procedures applied in the test techniques were satisfactory.

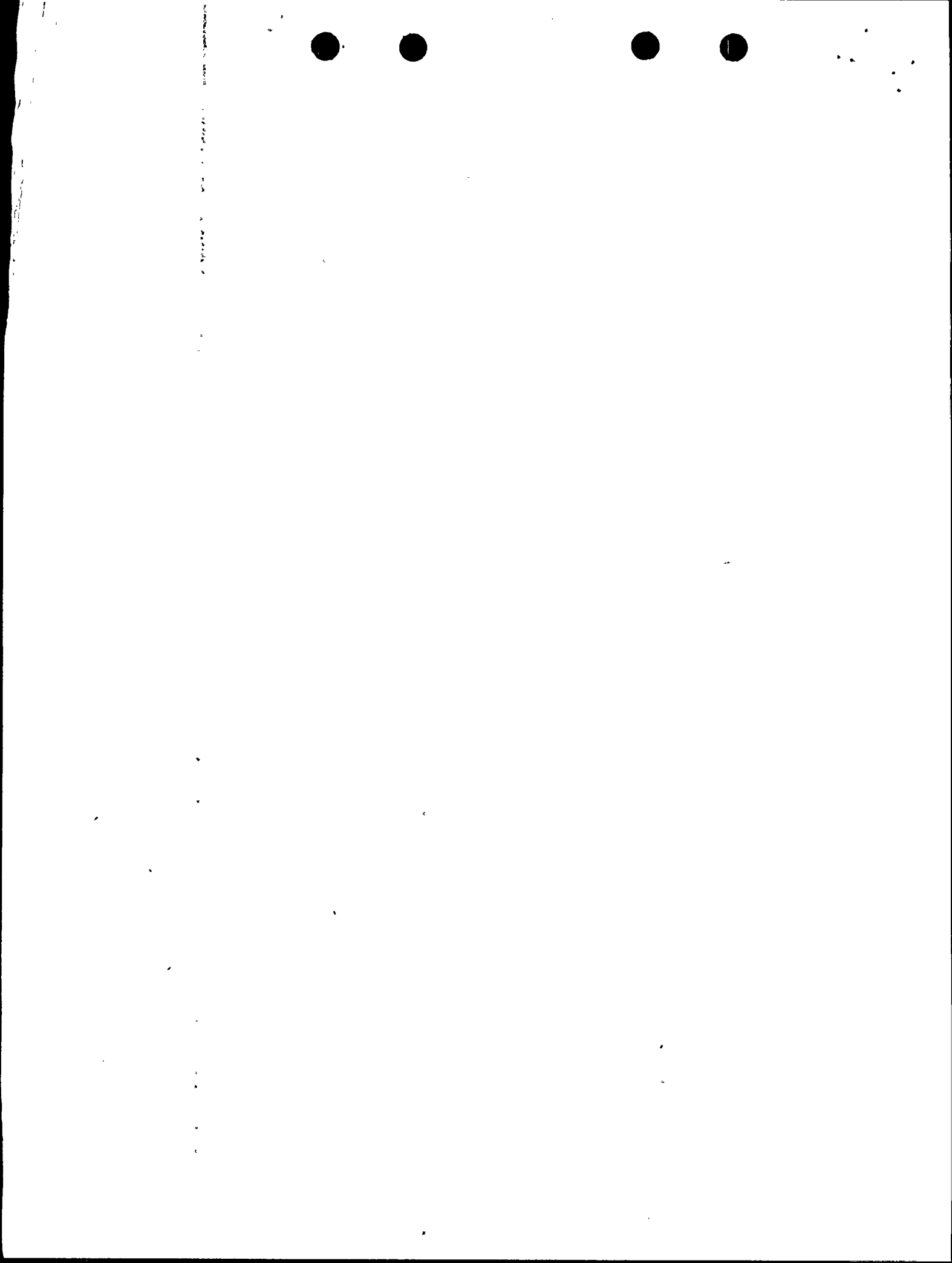


TABLE OF CONTENTS

	PAGE
SUMMARY	1
BACKGROUND	2
INTRODUCTION	3
TEST REVIEW & SUMMARY	4



SUMMARY

Based on the raw data, the review of the calculations and the resulting values of air mass and leakage percentage per day all agree with the values in the report submitted by Florida Power and Light. The report values for pressures 1 and 2, Resistance Humidity Detectors (RHD) 1 thru 10, and Resistance Temperature Detectors (RTD) 1 thru 40 all check out satisfactorily and as predictable except for RHD 1, which had a steady increase as the attached graph indicates. The average relative humidity for a 24 hour period, however, is satisfactory.

The ILRT results are satisfactory and within criteria established for the tests.

Considering that no site visit was performed in order to obtain and review the procedures used for the ILRT and the test equipment validation, it has to be assumed that the procedures were satisfactory. Additionally, it is assumed that the personnel conducting the test were qualified.

Background

Viking Systems International under Contract No. NRC 03-87-028 was asked to perform a review of the Florida Power and Light Integrated Leak Rate Test (completed May 17, 1986) Report and evaluate the test results. Based on this effort a Technical Evaluation Report (TER) was to be prepared documenting the test results and the adequacy of the test.

Due to the absence of a site visit the following assumptions had to be made:

- a. Test procedures were adequate
- b. Test equipment for check out and certification were appropriate for the test, and
- c. Personnel conducting the test were fully qualified.

The above limitations have to be considered in the appraisal of this report.

Introduction

The ILRT review was conducted from the data submitted in the report; data which was recorded at intervals of 15 minutes. The test was comprised of a 5.75 hour temperature stabilization phase, a 24.0 hour Integrated Leak Rate Test (ILRT) and a 4.0 hours Controlled Leak Rate Test (CLRT). The testing procedure was initiated at 0750 hour on May 16, 1986 and completed at 1650 hours on May 17, 1986.

The data consists of 40 RTD's, temperature readings, 2 pressure readings, and 10 RHD, relative humidity readings. The data was printed out for every 15 minutes of lapse time. The average temperature in degrees F, absolute pressure and relative humidity was recorded. The vapor pressure was also calculated and recorded.

The recorded points were utilized to complete the calculation to determine the weight of the air mass in the containment. The leakage was calculated on a percentage per day basis every quarter hour.



Test Review and Summary

The ILRT report was reviewed for both technical accuracy and clarity of presentation. The Viking calculated containment volume air mass weight leakages agreed with those given in the ILRT report values within significant figure round out. Small differences between the values for air mass weight leakages in the ILRT report and the Viking calculations are attributed to differences between the initial ILRT report values obtained by their computer and our present hand values. Such round off differences are of the order of a maximum of four pounds in total pressure values which were of the order of 450,000 pounds. The round off error was therefore less than 0.0009%.

The raw computer data given in the report was obtained in 15 minute intervals via a data accessing system. Such information was said to have been reviewed and verified by FP&L. As such, this preliminary verification, prior to our own assessment, tends to increase our confidence in the FP&L values.

The acceptance criteria for the proposed test was a leakage of 0.263% per day. The total results provided an overall leak rate of 0.076% and a least square fitted leak rate of 0.078% per day. The test leakage values were thus less than the criteria and are therefore acceptable.

The results of the ILRT were verified by the Controlled Leakage Rate

Test (CLRT). A superimposed flow of 11.47 SCFM was added to the leakage already present in the containment. This superimposed flow was equivalent to a leakage of 0.264 % per day. The CLRT was conducted for a four hour period. The measured CLRT leakage rate for this period was 0.322% per day. The target leakage for this test was $0.342 \pm 0.088\%$ per day. The test results were within the criteria.

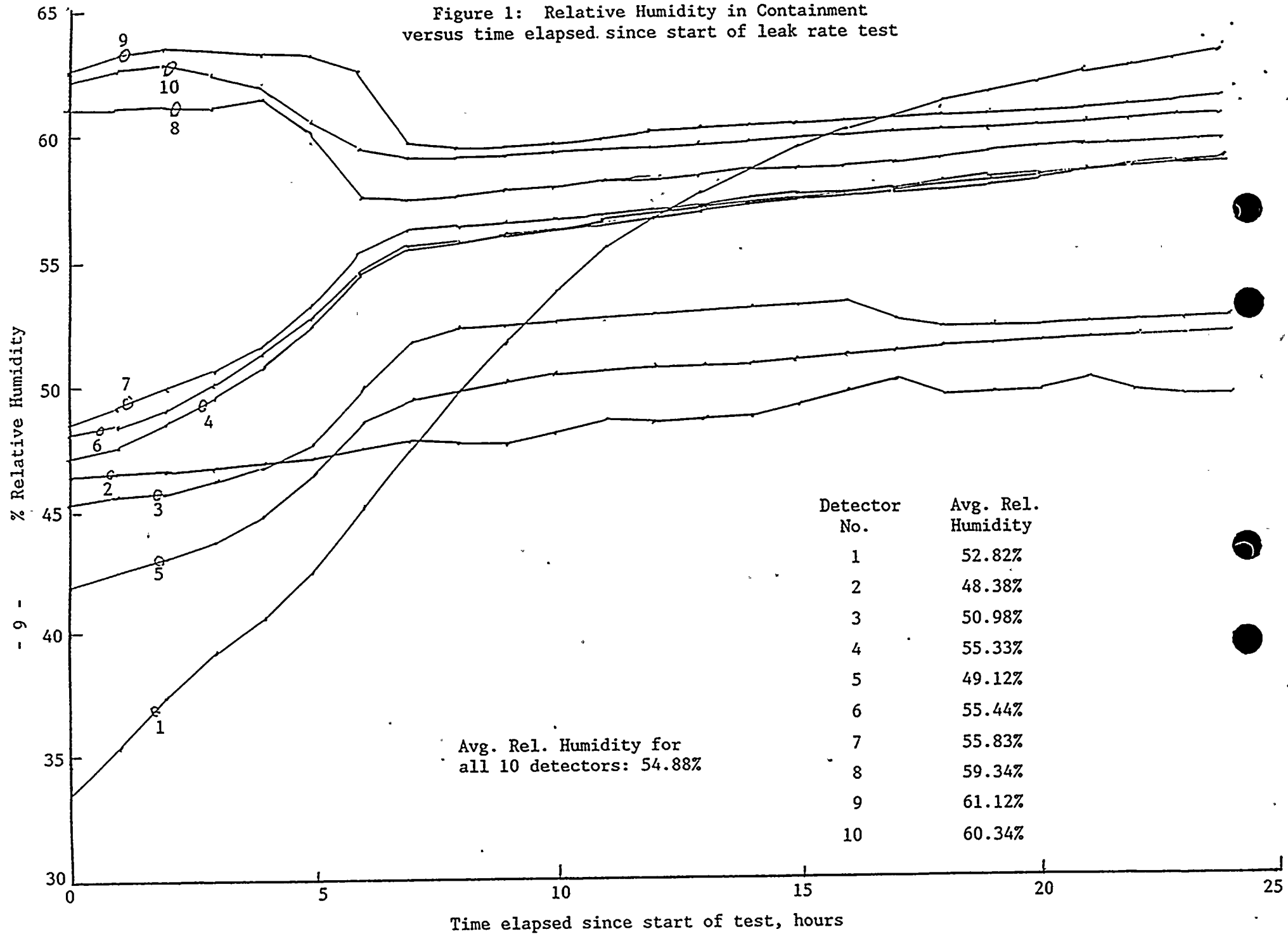
The values for humidity obtained from the relative humidity detector RHD #1 indicated a wide variation during the course of the ILRT. The values increased from 33.62% RH at ILRT test initiation to 63.9% near the end of the ILRT test. The relative humidity, according to this detector was apparently still rising.

Such extreme variation in relative humidity is not in accord with relative humidities obtained from the other relative humidity detectors and therefore appears anomalous. This individual anomaly does not appreciably affect the overall test results, as may be seen in figure 1 where the average relative humidity is 54.88%.

Since no site visit was made, test equipment certification and personnel qualifications were assumed to comply with test quality assurance requirements. The consistency of the results tend to confirm this assumption.

The FP&L report stated that the inspection of internal and external containment structures was performed prior to containment pressurization as required by the proposed leakage test. It is assumed that such an

Figure 1: Relative Humidity in Containment versus time elapsed since start of leak rate test



inspection was performed. The review of the raw data and the results of the types "B" and "C" local leakage rate test were completed by FP&L personnel and appear acceptable as stated in the FP&L Leak Rate Test Report. The test procedures for testing piping, electrical penetrations, air lock seals and door operating mechanisms can be assumed to comply with the technical specifications for the site and that the latest test results are recorded in the ILRT report.

The inspection of the containment structures both internal and external are indicated as being completed prior to the pressurization of the containment. Review of the data for types "B" and "C" local leakage rate tests have been completed and are acceptable for ILRT.

Inspection and review of alignment of valves and breakers for test condition are required to complete the testing without causing a mishap during the duration of the testing. The procedures for completing the above operation were not available for review; verification that all equipment was properly set up and checked off for future references could therefore not be properly performed by this review. The inspection of containment made no mention of any repairs that were required before continuing the ILRT.

A preliminary review of FSAR sections and Technical Specification for the Leak Rate Test has been performed to check if the methodology of the test is consistent with that in the report. There still remains a need to perform a review of containment penetrations and opening leakage results leading up to actual ILRT. A site visit would have provided the

opportunity to obtain the required information to complete a comprehensive report on the ILRT.

The raw data used in the FP&L report is stated to have been obtained at 15 minute intervals. Exactly how such data was collected is not clear. From the FP&L description of the data collection methodology, it is suggested that the raw data was collected on a data logger and transmitted to the computer at 15 minute intervals. The question remains of how 15 minutes of accumulation of data was handled before transfer to the computer, is unanswered. Was an average of the data transferred or was the last data point simply transferred? Also, details of how the computer performed the calculation for vapor pressure changes and mass leakage rates obtained from pressure readings are not given.

Since the data was reviewed and verified by FP&L personnel as the test progressed, the raw data in the tables printed in the report were used without modification for their calculation. A recalculation of the data agrees with the report and varies only in the last number which is the result of rounding off the numbers.

A review of FSAR requirements compared with the procedure for ILRT confirms that all requirements were met or exceeded.

The ILRT report calculations for air mass and leakage rate per day, are satisfactory and meet all criteria for this test.

Specific Comments on the ILRT Report

Comment 1 - Page 1 of the ILRT Report

"The ILRT Test was performed at a pressure in excess of the designated test pressure specified in the Final Safety Analysis Report".

The values of the designated test pressure and the actual test pressures should be specified in the next sentence of the report. It would not then be necessary to look up test pressures in data tables and FSAR sections.

Comment 2 - Page 2 of the ILRT Report, Line 14

Change "killed" to annealed or chilled. What is intended?

Comment 3 - Page 3 of the ILRT Report

A general form of the gas law equation is given.

Provide the specific gas equation and also provide units for the various parameters, i.e. pressure in psia, volume in feet³, etc.

Comment 4 - Page 3 of the ILRT Report

This is the wrong "discrete".

Comment 5 - Page 4 of the ILRT Report

General equations are given, i.e. "(% RH)_j

$$\int \begin{matrix} \text{Steam} \\ \text{Table} \\ \text{TLocal}_j \end{matrix} = P_{vj}$$

Specify the functionality between the relative humidity and local steam table temperature values. Such specifications and amplification make the report more easily understood.

Comment 6 - Page 6 of the ILRT Report, Line 6

Correct typing error "if" to is.

Comment 7 - Page 7 of the ILRT Report

"Containment air mass is determined from mass weighted sensor readings as described in EPRI report NP-2726".

The methodology should be provided and referenced.

Comment 8 - Page 8 of the ILRT Report

"Sample rejection based on the Chauvenet criteria may be used in analysis".

Amplification of the Chauvenet criteria, presumably a statistical technique whereby certain data can be excluded, would be helpful. At a minimum the "Chauvenet criteria" should be stated as a statistical technique for determining data rejection criteria.

General Comments on Clarity

Throughout the report and on the graphs, a distinction is made between raw data and "fitted" data. An explanation of the term "fitted" data should be made. Presumably, the data has been fitted via a least squares statistical technique to determine the best fit of the data to a mathematical representation.