



UNITED STATES  
 NUCLEAR REGULATORY COMMISSION  
 REGION II  
 101 MARIETTA STREET, N.W.  
 ATLANTA, GEORGIA 30323

Report No.: 50-261/87-09

Licensee: Carolina Power and Light Company  
 P. O. Box 1551  
 Raleigh, NC 27602

Docket No.: 50-261

License No.: DPR-23

Facility Name: H. B. Robinson

Inspection Conducted: April 5-10, 1987

Inspector:

*for Frank Jape*  
 H. L. Whitener

*5/18/87*

Date Signed

Approved by:

*Frank Jape*  
 F. Jape, Section Chief  
 Engineering Branch  
 Division of Reactor Safety

*5/18/87*

Date Signed

SUMMARY

Scope: This routine, announced inspection was conducted in the areas of containment leak rate testing including examination of test conditions; observation of the periodic integrated leak rate test; review of test procedures; independent evaluation of test results; and followup inspection of outstanding items.

Results: No violations and deviations were identified.

## REPORT DETAILS

### 1. Persons Contacted

#### Licensee Employees

G. P. Beatty, Manager, Robinson Nuclear Project Department  
R. E. Morgan, Plant General Manager  
D. R. Quick, Manager, Maintenance  
\*A. R. Wallace, Manager, Technical Support  
\*S. W. Farmer, ILRT, Senior Engineer  
\*D. A. Sayre, Acting Director, Regulatory Compliance  
\*S. A. Griggs, Regulatory Compliance

Other licensee employees contacted included integrated leak rate test personnel.

#### Other Organizations

Gilbert Associates  
R. E. Shirk, ILRT Engineering Consultant  
J. J. Blessing, ILRT Engineering Specialist

#### NRC Resident Inspectors

H. E. P. Krug, Senior Resident Inspector  
\*R. M. Latta, Resident Inspector

\*Attended exit interview

### 2. Exit Interview

The inspection scope and findings were summarized on April 10, 1987, with those persons indicated in paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

#### Items discussed included:

Unresolved Item 50-261/87-09-01, The Supplemental test did not meet the acceptance criteria based on a Total Time analysis. The licensee will request an exemption to Appendix J to allow evaluation of the Supplemental test by the Mass Point analysis method. This item has the potential to impact plant start up (paragraph 5.c.(3)(b)).

Inspector Followup Item, IFI 50-261/84-39-01, which concerned a modification to the local leak rate test rig was closed (paragraph 7).

The licensee did not identify as proprietary any of the materials provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Items

Unresolved items are matters about which more information is required to determine whether they are acceptable or may involve violations or deviations. One unresolved item identified during this inspection is discussed in paragraph 5.c.(3)(b).

5. Containment Integrated Leak Rate Test (CILRT) - Unit 2 (70313) (70307)

The inspector reviewed and witnessed test activities to determine that the primary containment integrated leak rate test was performed in accordance with the requirements of Technical Specification 4.4, Appendix J to 10 CFR 50, ANSI-N45.4 and test procedure EST-085, "Containment Integrated Leak Rate Test."

Selected sampling of the licensee's activities which were inspected included: (1) review of the test procedure to verify that the procedure was properly approved and conformed with the regulatory requirements; (2) observation of test performance to determine that test prerequisites were completed, special equipment was installed, instrumentation was calibrated, and appropriate data were recorded; and (3) preliminary evaluation of leakage rate test results to verify that leak rate limits were met.

Pertinent aspects are discussed in the following paragraphs.

a. General Observations

The inspector witnessed and reviewed portions of the test preparation, containment pressurization, temperature stabilization and data processing during the period of April 5-10, 1987. The following areas were inspected:

- (1) The test was conducted in accordance with an approved procedure.
- (2) Test prerequisites selected for review were found to be completed.
- (3) Selected plant systems required to maintain test control were found to be operational.
- (4) Special test instrumentation was reviewed and found to be installed and calibrated.

- (5) Data required for the performance of the containment leak rate calculations were recorded at 15-minute intervals.
- (6) Problems encountered during the test were described in the test event log.
- (7) Pressurized gas sources were reviewed for proper isolation and venting to preclude in-leakage or interference of out-leakage through containment isolation valves.
- (8) Temperature, pressure, dew point, and flow data were recorded at 15-minute intervals. Data were assembled and retained for final evaluation and analysis by the licensee. A final ILRT report will be submitted to the Office of Nuclear Reactor Regulation.

No deviations or violations were identified during this review.

b. Procedure Review (70307)

Portions of EST-085, "Containment Integrated Leak Rate Test," dated March 20, 1987, were reviewed to verify that test controls, valve alignments and acceptance criteria were specified. The inspector concluded that the test controls were detailed and adequate; the test acceptance criteria conformed to Appendix J of 10 CFR 50, including data analysis by the Total Time analysis method; and the valve alignments and valve restoration were specified in detail in attachments 8.2 and 8.8, respectively. The review of the valve alignment (Attachment 8.2) consisted of verifying that the vent and drain specifications for the systems were acceptable. A detailed valve by valve comparison of penetration alignment with plant design drawings was not performed at this time.

c. Containment Integrated Leak Rate (CILRT) Performance (70313)

(1) Method

A 24-hour containment integrated (Type A) leak rate test and an 11-hour supplemental leak rate test were performed on the Unit 2 primary containment at a reduced pressure of 21 psig. Both Total Time and Mass Point linear regression analyses were used by the licensee to determine the leak rate and 95% upper confidence limit (UCL). Leakage analysis was based on data taken at 15-minute intervals for a minimum of 24 hours. Although both analyses were required by the test procedure the Total Time analysis is the method currently specified by Appendix J.

Systems status during the test were as follows:

- |                      |   |
|----------------------|---|
| (a) RHR              | In shutdown cooling mode and operating. |
| (b) Steam Generators | In wet layup.                           |
| (c) SI Accumulators  | Depressurized.                          |
| (d) Primary System   | Vented at the high point vent.          |
| (e) Fan Coolers      | Secured - no forced flow.               |

(2) Test Description

After completion of the containment inspection, the containment was pressurized to the leakage rate test pressure, of 21 psig. Significant test events extracted from the test log were as follows:

<u>Date</u>	<u>Time</u>	<u>Event</u>
4/6	0103	Pressurization of the containment was initiated.
	1130	Pressurization of the containment was secured at 36.77 psia.
	1200	Temperature stabilization was initiated.
	1630	Containment air temperature met the stabilization criteria.
	1700	The start time for the Type A test was declared.
		Dew cell DPTE-5 was deleted and the weighting factor was assigned to DPTE-6.
	2100	WD 1966, vent valve in hydrogen supply line to RCDT was incorrectly aligned and resulted in an excessive leakage (0.122 wt.%). The valve was closed.

4/7	1700	Type A was terminated. The leak rate was 0.0285 wt.% per day (Total Time Analysis).
	1715	Supplemental test was started. An imposed leakage rate of 2.39 scfm (0.0727 wt.% day) was established.
4/8	0415	The supplemental test was terminated after 11 hours with the composite leak rate outside of the $\pm 0.25$ Lt limit by Total Time analysis. Mass Point analysis was within the limits.

(3) Test Results

(a) Type A Test

The allowable reduced pressure test leakage (Lt) for H. B. Robinson is a 0.0707 wt.%/day. Therefore, the test acceptance limit of 0.75 Lt as required by Appendix J is 0.053 wt.%/day. Although the official test analysis method required by Appendix J is the Total Time analysis, the licensee processed the data by both the Total Time and the Mass Point analysis methods. Test results for the 24-hour test period of 1700 hours, April 6 to 1700 hours April 7, 1987 are shown below in weight percent per day (wt.%/day).

	<u>Mass Point</u>	<u>Total Time</u>
Leak Rate	0.039	0.0285
95% UCL	0.0408	0.0347

Based on these results, the Type A test is within the acceptance limit of 0.75 Lt (0.053 wt.%) for both calculational methods.

The inspector calculated weighted averages for containment temperature, pressure and vapor pressure using the weighting factors and individual sensor data for a sample of data sets to verify agreement with the weighted averages and mass calculations generated by the licensee's computer program. Subsequently, the mass points generated by the licensee's program were used by the inspector to calculate the leak rate, and the 95% upper confidence leak rate. The inspector's calculations agreed with the licensee's calculations.

## (b) Supplemental Test

Appendix J requires that a supplemental test be performed to verify the accuracy of the Type A test and ability of the CILRT instrumentation to measure a change in leak rate. An acceptable supplemental test method is described in Appendix C of ANSI-N45.4-1972, as follows:

A known leak rate ( $L_o$ ) is imposed on the containment and the measured composite leak rate ( $L_c$ ) must equal, within  $0.25L_t$ , the sum of the measured Type A leak rate ( $L_{tm}$ ) plus the known leak rate ( $L_o$ ).

The acceptance criteria is expressed as follows:

$$L_o + L_{tm} - 0.25L_t < L_c < L_o + L_{tm} + 0.25L_t$$

An eleven hour supplemental test starting at 1715 hours on April 7, was performed by the imposed leak rate method described in Appendix C to ANSI-N45.4-1972. The licensee's results calculated by both the Total Time and Mass Point analysis methods are shown below in wt.%/day:

	<u>Mass Point</u>	<u>Total Time</u>
$L_{tm}$	0.039	0.0285
$L_o$	0.0727	0.0727
$.25L_t$	0.0177	0.0177
$L_c$	0.101	0.123

Using these values in the acceptance criteria yields the following:

Mass Point:  $0.094 < L_c < 0.1294$   
 $L_c = 0.101$  wt.%/day meets these acceptance limits.

Total Time:  $0.0835 < L_c < 0.1189$

$L_c = 0.123$  wt.%/day is not less than the upper boundary limit of  $0.1189$  wt.%/day. Therefore, by the Total Time method, the composite leak rate ( $L_c$ ) does not meet the Supplemental test acceptance limits.

The test was terminated at 0415 hours on April 8, with the above results. The licensee concluded that there was sufficient technical justification on which to base a request for an exemption to the Appendix J requirement that the Total Time method be used in analysis of leak rate test

results. Consequently, the licensee will request NRR's approval to use the Mass Point analysis which yields acceptable test results.

Paragraph III.A.3(b) of Appendix J to 10 CFR 50 requires that if the Supplemental test is not within the acceptance limits, the reason shall be determined, corrective action taken and a successful Supplemental test performed. Some considerations involved in the licensee's decision to request an exemption rather than continue the test or rerun the test were as follows:

- 1) The reason the test was not successful was not an inability to measure the leak rate but rather was due to the weighted dependency of the test result on the initial data point, inherent in the Total Time method, coupled with the pattern of data scatter which occurred in the first hour and repeatedly through the test. Based on the assumption that the containment leakage is constant during a test, the Total Time analysis method consists of statistically averaging, by linear - regression techniques, a series of two point leak rates obtained by determining the slope between the initial mass data point and each of the succeeding mass data points. In this case, the first three data points following the initial data point indicated successively higher containment masses and consequently, negative leak rates of -0.14, -0.09 and -0.068 wt.%/day, respectively. As a result, the curve of the two-point leak rates on which the least square fit is performed, rose sharply, from -0.14 to 0.06 wt.%/day, in the first hour of the test. In the remaining ten hours, the curve trended slightly upward and flattened out at an average leak rate of about 0.092 wt.%/day over the last five hours of the test. A least square fit of a straight line to a curve such as described above will always yeild a calculated leak rate higher than the measured leak rate.
- 2) There were indications that the leak rate calculated by the Total Time analysis would eventually fall within the acceptance limits. The calculated leak rate based on the least square fit of the two-pont total time leak rate data indicated a decrease of about 0.001 wt.%/day per hour over the last two hours of the test. The licensee estimated that to demonstrate a stabilized leak rate within the acceptance limits by the Total Time method could require an additional ten hours of critical path time while certain test data indicated the test was already meeting the acceptance limits.

Specifically, by the Mass Point analysis the leak rate, in the range of 0.095 to 0.1 wt./day, met the acceptance limits defined by the Mass Point method over the last eight hours of the test. Also, the two-point Total Time leak rates, which are not affected by previous data sets, indicate an average leak rate of about 0.092 wt./day over the last five hours of the test and is within the acceptance limits defined by the Total Time method.

From the evaluation, the licensee concluded: 1) that there was no corrective action to be taken which could reduce the critical path waiting time and the associated economic impact using the Total Time method; 2) that to rerun the test using Total Time analysis would involve the same risk with no assurance that similar conditions would not result in a long test period; and 3) that there was sufficient information available to justify acceptability of the test results on a technical basis by Mass Point analysis.

The inspector reviewed the test results and concluded that convergence of the total time calculated least square fit leak rate to the test limits was delayed by the recurring large negative leak rates early in the test. Examination of the mass data showed that the scatter although somewhat cyclic in nature was not large. Overall, the mass data exhibited a linear trend which could be reasonably fitted by a straight line least square fit. The Mass Point leak rate was consistent during the Supplemental test at 0.1 wt./day and satisfies the acceptance limits for the Mass Point analysis.

At the exit interview, the inspector informed the licensee that the Containment Leak Rate Test including the Supplemental test must be successfully performed prior to plant start up. A successful Supplemental test was not performed by the Total Time analysis method as required by Appendix J. Acceptance of the Type A test and the Supplemental test on the basis of the Mass Point analysis requires an exemption to Appendix J. Failure to obtain the exemption or a delay in the exemption could result in retesting or could impact the plant start up schedule. The licensee acknowledged his understanding and stated that the exemption request was already in preparation.

This matter was identified as an unresolved item as follows:

Unresolved Item 50-261/87-09-01: verify that an exemption to Appendix J to allow acceptance of the 1987 Type A and Supplemental test on the basis of Mass Point analysis is obtained prior to final acceptance of the Containment Leak Rate Test and before plant start up.

6. As Found Leak Rate

The licensee performed the Type A test on the containment prior to making any repairs or adjustments to the containment boundary. Consequently, the Type A leak rate of 0.047 wt.%/day is the "as found" containment leakage and passes the Appendix J limit of 0.75 Lt of 0.053 wt.%/day.

7. Review of Outstanding Item

Closed - Inspector Followup Item 50-261/84-39-01 concerned the potential for make up air flow to bypass the flowmeter on the local leak rate test rig. The inspector examined the test rig during this inspection and determined that the test rig has been modified to provide for isolation and venting of the bypass air supply. This item is closed.