



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

Report Nos.: 50-325/88-16 and 50-324/88-16

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

Docket Nos.: 50-325 and 50-324

License Nos.: DPR-71 and DPR-62

Facility Name: Brunswick 1 and 2

Inspection Conducted: March 24-30, 1988

Inspectors: H. L. Whitener 5-11-88
 H. L. Whitener Date Signed

B. B. Desai 5-11-88
 B. B. Desai Date Signed

Approved by: F. Jape 5/18/88
 FOR F. Jape Section Chief Date Signed
 Engineering Branch
 Division of Reactor Safety

SUMMARY

Scope: This routine, announced inspection was in the areas of witnessing the Unit 2 primary containment integrated leak rate test (CILRT), review of the CILRT procedure, evaluation of the CILRT results, and review of the as-found leak rate for the primary containment.

Results: No violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *M. S. Blinson, Senior ISI Specialist
- C. R. Dietz, General Manager
- *E. R. Eckstein, Manager, Technical Support
- *J. R. Holder, Outage Manager
- M. T. Long, Engineering Technician
- *R. M. Pouik, Compliance Project Specialist

Other persons contacted included leak rate test personnel.

Other Organizations

United Energy Services Corporation

- *R. Shirk, Leak Rate Test Engineer
- B. Black, Leak Rate Test Specialist

NRC Resident Inspector

- *W. Ruland, Senior Resident Inspector

*Attended exit interview

2. Exit Interview

The inspection scope and findings were summarized on March 30, 1988, with those persons indicated in paragraph 1 above. The inspectors described the areas inspected and discussed in detail the inspection findings. The inspector identified this test as a failed test. With two failed Type A tests in succession, Unit 2 remains on the accelerated Type A test schedule. No dissenting comments were received from the licensee.

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

3. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

4. Unresolved Item

Unresolved items were not identified during this inspection.

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

The inspectors reviewed and witnessed test activities to determine that the primary containment integrated leak rate test (CILRT) was performed in accordance with the requirements of Appendix J to 10 CFR 50, ANSI-N45.4-1972, test procedure PT-20.5, "Integrated Primary Containment Leak Rate Test", the criteria of BN-TOP-1, Revision 1-1972, for a short duration test, and ANSI/ANS 56.8 (exemption to Appendix J to allow Mass Point analysis).

Selected sampling of the licensee's activities which were inspected included: (1) review of test procedures to verify that the procedures were 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 inspectors witnessed and reviewed portions of the test preparation, temperature stabilization, and data processing during the period of March 24-30, 1988. The inspectors' observations included the following:

- (1) The test was conducted in accordance with an approved procedure. Procedure changes and test discrepancies were properly documented in the 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) Controls for preventing pressurized air sources inside containment or externally pressurized penetrations were established in the test procedure.
- (6) Instructions and documentation for venting, draining, and isolation of systems were established in the test procedure.

- (7) Problems encountered during the test were described in the test event log.
- (8) A containment temperature survey was performed to determine representative locations of instruments.
- (9) An in-situ check of CILRT instruments was performed prior to the test.
- (10) Selected procedure valve alignments reviewed against system drawings to verify correct boundary alignment were adequate.
- (11) Selected valve positions observed by the inspectors to verify conformance to the procedure were adequate.
- (12) Temperature, pressure, humidity, and flow data were recorded at 15-minute intervals. Data were assembled and retained for final evaluation and analysis by the licensee. A final leak rate test report will be submitted to the Office of Nuclear Reactor Regulation pursuant to Paragraph V of Appendix J to 10 CFR 50.

b. Procedure Review and Observations (70307) Units 1 and 2

Portions of PT 20.5, Revision 16, "Integrated Primary Containment Leak Rate Test", dated March 15, 1988, were reviewed to verify that test conditions, test controls, valve alignments and acceptance criteria were specified. The inspectors concluded that test conditions and controls were specified in detail in the text; valve alignments and valve restoration were specified in detail in Table 2; and system venting and draining was specified in Table 1.

Permanent Revisions 15, 16, 17, and 18 to the test procedure were reviewed. These changes related to: (1) clarifying and improving test instructions, (2) implementing plant modifications and license amendments, and (3) accommodating changes in associated support procedures.

The inspectors concluded that these changes are within the limitations of 10 CFR 50, Appendix J.

A sample of valve alignments in the test procedure which establish the test boundary were reviewed in detail against up to date plant drawings to verify conformance with 10 CFR 50, Appendix, J. The valve alignments which were compared with plant drawings included the following plant systems:

- NSS System Isolation Valves Page 42
- NSS System Boundary Valves Page 43*

- Reactor Recirculation System Isolation Valves	Page 44
- CAC System, Isolation Valves	Page 45, 46
- CAC System Boundary Valves	Page 47, 48 *
- Containment Atmospheric Monitoring System Isolation Valves	Page 49, 50*
- RWCU System Isolation Valves	Page 69
- RWCU System Boundary Valves	Page 69
- Instrument Air System Isolation Valves	Page 70
- Instrument Air System Boundary Valves	Page 70, 71, 72, 73*

In the above table the page number refers to the pages in the procedure where the system valve alignments are listed. An asterisk by the page numbers indicates verification of a portion of the valve listing. No valve misalignments were identified in this review.

In addition, the inspectors verified the position of selected valves during a walkdown of the 52 ft. level of the drywell.

Based on the sample review, the inspectors concluded that valve alignments conform to Appendix J requirements and the alignments were adequately implemented.

c. Containment Integrated Leak Rate Test (CILRT) Performance - Unit 2 (70313)

(1) Method

The integrated leak rate test was performed at the calculated accident pressure (Pa) by the absolute test method. Acceptance criteria were included in the test procedure for Mass Point, Total Time and Short Duration testing in accordance with the specifications of ANSI/ANS-56.8-1981, "Containment System Leakage Testing Requirements"; ANSI-N45.4-1972, "Leakage-Rate Testing of Containment Structures for Nuclear Reactors"; and, BN-TOP-1, Revision 1-1972, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants", respectively.

The computer program for analysis of test data was provided by United Energy Services Corporation. The program included capability for analysis of test data according to the Mass Point, Total Time or Short Duration test methodologies. The test analysis was performed using the Mass Point Methodology. The test duration was 24 hours.

The licensee had obtained an exemption to 10 CFR 50, Appendix J to allow the use of the Mass Point methodology. The exemption, Amendment No. 144 to License No. DPR-62, was effective as of February 17, 1988.

(2) Description

Values bounding the test conditions were as follows:

Containment Volume	294981 cubic feet
Accident Pressure (Pa)	49 psig
Maximum Allowable Leakage (La)	0.5 wt. % per day

System conditions for performance of the integrated leak rate test were as follows:

Reactor Vessel	-	Vented to containment atmosphere: water level at about 235 inches.
RHR System	-	One loop operating in the shutdown cooling mode.
Containment Ventilation System	-	Fans tripped: No forced air flow.
Containment Isolation System	-	Vented, drained, and aligned per procedure PT 20.5

After the structural inspection, the containment was pressurized to 65 psia. The following table gives a brief description of test events extracted from the test log book.

<u>Date</u>	<u>Time</u>	<u>Event</u>
3/25	1920	Started pressurization of the primary containment.
3/26	0443	Secured pressurization of containment at 50.5 psig.
	0500	Stabilization period started.
	0900	Four hour stabilization completed. Type A test initiated.

<u>Date</u> (cont'd)	<u>Time</u>	<u>Event</u>
3/26	1140	Leakage survey teams identified packing leakage on valves E 11-F021 (air), CAC-V17 (air) and B21-F032B (water). Leak rate still under evaluation: no repairs made at this time.
	1330	Adjusted RHR cooling flow.
	1630	Increased RHR flow.
	2245	RHR loop B put into shutdown cooling mode. Vessel level dropped about 4 inches.
3/27	0745	Terminated Type A test for the following reasons: <ol style="list-style-type: none"> 1. Over the previous 15 hours the leak rate had tended to stabilize in the range of 0.41 to 0.39 wt.% per day. Acceptance limit is 0.375 wt.% per day. 2. Reactor Vessel water level was decreasing and approaching a LCO limit. 3. Large swings in primary system temperature appeared to be adversely effecting the leakage rate since there was no forced air flow.
	1200	Reactor vessel water level raised to 235 inches, sumps pumped, RHR loop B returned to ILRT line up, packing leaks on valves E11-F021A and CAC-V17 repaired. Type A test restarted.
	2130	CAC header was indicating 12 psig. The licensee decided to pressurize the header to quantify leakage through valve CAC-V4: started pressurizing.
	2335	CAC header at 44 psig: started depressurizing.
3/28	0145	CAC header depressurized and left at 12 psig.

<u>Date</u> (cont'd)	<u>Time</u>	<u>Event</u>
3/28	1200	Type A test terminated. Leak rate is 0.307 wt.% per day and UCL is 0.312 wt.% per day. These values meet the acceptance limit.
	1215	Supplemental test initiated. Imposed leak rate is 4.4 scfh, uncorrected.
	1615	Supplemental test terminated. $L_c = 0.687$ wt.% per day.

d. Test Analysis and Results

(1) Type A Test

The Technical Specification for Brunswick Unit 2 specifies the allowable containment leakage rate as 0.5 wt.% per day of the containment volume of 294981 cu. ft. at the calculated accident pressure (Pa) of 49 psig. Therefore the acceptance limit for the integrated leak rate (Type A) test (0.75 La) is 0.375 wt.% per day.

Analysis of 24 hours of data, from 1200, 3/27 to 1200, 3/28, using the Mass Point methodology yields a leak rate of 0.3066 wt.% per day. The calculated leak rate at the upper 95% confidence limit (UCL) is 0.3123 wt.% per day. The UCL was calculated according to the method of ANSI/ANS 56.8. Based on this method the Type A test is within the acceptance limit of 0.75 La (0.375 wt.% day).

The inspectors 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 inspectors to calculate the leak rate, and the 95% upper confidence leak rate. The inspectors' calculations agreed with the licensee's calculations.

(2) Supplemental Test

Appendix J requires that a supplemental test be performed to verify the accuracy of the Type A test and the 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 $\pm 0.25 L_a$, the sum of the measured Type A leak rate (L_m) plus the known leak rate (L_o).

The acceptance criteria is expressed as:

$$L_o + L_{am} - 0.25 L_a < L_c < L_o + L_{am} + 0.25 L_a$$

A four hour supplemental test was performed by the imposed leak rate method described in Appendix C to ANSI-N45.4-1972. The following values in units of wt.%/day were obtained using Mass Point analysis.

Mass Point (wt.%/day)

Lam	0.3066
Lo	0.4905
0.25 La	0.125
Lc	0.6868

Using these values in the acceptance criteria yields the following:

$$0.6721 \leq 0.6868 \leq 0.9221$$

$L_c = 0.6868$ satisfies the above inequality and therefore, the supplemental test is acceptable.

The inspectors concluded that the "as left" containment leak rate meets the Appendix J and Technical Specification 4.6. requirements.

6. Status of Containment Leak Rate Testing
 - a. Integrated Leak Rate Test - Unit 2

As discussed above, the licensee completed successful Type A and supplemental tests starting at 1200 hours March 27, 1988. Prior to this time a Type A test was run from 0900 hours March 26, to 0845 hours March 27. During this test the licensee experienced problems in maintaining the reactor water temperature constant. With no forced air flow, the changing heat source affected the stabilization of the containment atmosphere. However, the Mass Point leak rate appeared to stabilize in the range of 0.39 to 0.4 wt.% per day over the last 16 hours of the test. When the test was terminated at 0745 hours on March 27 the Mass Point leak rate was 0.395 and the UCL was 0.398 wt.% per day. While these leak rates are less than the Technical Specification allowable leakage of L_a (0.5 wt.% per day), they do exceed the Appendix J Type A acceptance leak rate of 0.75 L_a (0.375 wt.% per day). Prior to restarting the Type A test the licensee pumped out the sumps, raised the reactor vessel water level and repaired packing leakage on two valves, E11-F021A and CAC-V17. Since leakage repair was made in order to meet the Appendix J leak rate acceptance limit, the inspectors identified this test as a failed integrated leak rate test at the exit interview. Unit 2

remains on an accelerated test schedule requiring a Type A test at each refueling outage until two Type A tests in succession are performed successfully. This matter was discussed with licensee management at the exit interview.

b. Local Leak Rate Tests Unit 2 (61720) (70313)

The inspectors reviewed preliminary results of the Type B and C tests to determine if leakage repairs would result in a failed "as-found" leakage. Although preliminary, the summations indicated no extremely large penetration leak rates were identified except the drywell head seal and feedwater Penetrations 9A and 9B which could not be pressurized. Visual examination of the drywell head seals showed the outer seal was damaged while the inner seal appeared intact. The licensee concluded that no significant leakage from the drywell would have occurred due to the inner seal. Analysis of the cause of the outer seal failure is still in progress. In Penetration 9A only one valve (inside check valve F010A) was leaking severely. The outboard valve (F032A) leak rate was only 4 scfh. In penetration 9B, both isolation valves were leaking severely and could not be pressurized. This would exceed a leak rate of L_a by the minimum path leak rate analysis and results in an "as found" leak rate which exceeds the allowable limits of $0.75 L_a$. The inspectors concluded that the "as found" leakage condition of the containment represents a failed test according to the requirements of 10 CFR 50, Appendix J, Paragraph III.A.5.(b), and III.A.6.(b).