

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 50-293/84-38

Docket No. 50-293

License No. DPR-35

Priority -

Category C

Licensee: Boston Edison Company M/C Nuclear
800 Boylston Street
Boston, Massachusetts 02119

Facility Name: Pilgrim Nuclear Power Station

Inspection At: Plymouth, Massachusetts

Inspection Conducted: November 28-30, December 9-14, 1984

Inspectors:

DJ Vito
D. J. Vito, Reactor Engineer

1/9/85
date

Approved by:

L. H. Bettenhausen
L. H. Bettenhausen, Chief,
Test Programs Section, EPB

1/10/85
date

Inspection Summary: Inspection on November 28-30 and December 9-14, 1984
(Inspection Report No. 50-293/84-38)

Areas Inspected: Routine, announced inspection of the containment leakage testing program including procedure review of Containment Integrated Leak Rate Test (CILRT) and Local Leak Rate Test (LLRT) procedures, CILRT and LLRT test witnessing, CILRT and LLRT test results review, on-line primary containment leakage monitoring, followup to previous inspection findings, and general tours of the facility. The inspection involved 64 hours onsite by one region based inspector.

Results: No violations were identified.

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DETAILS

1. Persons Contacted

Boston Edison Company

- **G. Belmonte, Operations Quality Control
- T. Beneduci, I&C Supervisor
- **P. Cafarella, STA, ILRT Coordinator
- *P. Cormier, STA, LLRT Coordinator
- *J. Crowder, Senior Compliance Engineer
- N. Desmond, ILRT Shift Coordinator
- R. Fairbank, Engineer, Nuclear Engineering Department, Braintree, MA
- A. Felix, LLRT Technician
- **E. Graham, Compliance Group Leader
- R. Harzel, Quality Assurance
- E. Larsson, Quality Assurance
- **C. Mathis, Nuclear Operations Manager
- *J. Seery, Technical Functions Manager
- N. Simpson, Computer Technician
- T. Sullivan, Watch Engineer
- **S. Wollman, Safety and Performance Group Leader

Stone and Webster

- R. Bone
- J. Busa
- **R. Parry
- R. Samson

NRC

- **J. Johnson, Senior Resident Inspector
- *M. McBride, Resident Inspector

*Denotes those present at exit meeting on November 30, 1984.

**Denotes those present at exit meeting on December 14, 1984

2. Followup on Previous Inspection Findings

(Closed) Violation (50-293/82-04-02): Administrative control of drawing changes. The licensee had been cited for not initiating drawing changes in accordance with an approved procedure after identifying drawing errors during CILRT pre-test walkdowns. In response to this violation and other NRC concerns, the licensee initiated a large scale Performance Improvement Program (PIP). A part of this program is the Program Update for Drawings and Design (PUDD). The main purpose of PUDD is to assure that all drawings and design documents reflect the current status of plant structures, systems, and components. Although the drawing update is not complete, the inspector found that those changes which had been made were backed up by

appropriate documentation per Procedure 1.3.8, Document Control, Rev. 29, November 21, 1984. The inspector also found that drawing change requests for the remainder of the required drawing changes had been initiated in accordance with Procedure 1.3.8.

In addition to the drawing change documentation problem, the licensee was also cited for maintaining a procedure which was no longer to be used for local leak rate testing. The inspector verified that Procedure 8.7.1.8, Local Leak Rate Testing of Feedwater Check Valves (water collection method) had been retired on April 28, 1982.

Based on these findings, this item is closed.

(Open) Violation (50-293/82-04-03): Failure to include appropriate Test, Vent, and Drain (TV&D) Valves on plant drawings and valve lists. This is contrary to the requirements of 10 CFR 50, Appendix B, Criterion V, Technical Specification 6.8.A and ANSI-N18.7-1972.

The aforementioned PUDD Program was initiated by the licensee to incorporate the TV&D lines on plant drawings as well as other required drawing changes discovered via plant system walkdowns or caused by outage modifications. The inspector reviewed the plant Piping and Instrument Diagrams (P&ID's), LLRT and CILRT procedure diagrams and plant valve lineup checklists to determine if all the required drawing changes had been made. Although a large percentage of the required changes have been made, the inspector concluded that the PUDD program was several months from completion. Additional drawing changes, verifications, and final system walkdowns are yet to be performed by the licensee. This item will remain open until a more comprehensive assessment can be made of the effectiveness of the program, i.e., at or near the completion of the PUDD program.

(Closed) Violation (50-293/82-11-01): During the previous CILRT at Pilgrim, the licensee was cited for manipulating a valve after the start of the test. This is contrary to the requirements of 10 CFR 50, Appendix J, Section III.A.1.(a). The inspector verified that the CILRT Procedure (8.1.7.4.2, Primary Containment Integrated Leak Rate Test, Revision 2, 12/13/84) reflected this Appendix J requirement. In addition, the inspector verified that this procedural requirement was followed during the performance of the current test.

Based on these findings, this item is closed.

(Open) Unresolved Item (50-293/83-23-02): Validity of Secondary Containment Leak Rate Testing. This item is a result of questions from the resident inspector with regard to the method and validity of leak rate testing done on the secondary containment (reactor building). Technical Specification 4.7.c requires that this testing shall demonstrate the existence of a vacuum of greater than 0.25 inches of water with one train of the Standby Gas Treatment System operating at a flow of no less than 4000 SCFM under calm wind conditions. Previous test procedures used by the licensee did not consider the effect of wind on the test manometer readings nor did they state any precautions or test method changes to be considered if winds of greater than 5 mph exist. The licensee has contacted with MIT and CYGNA

to analyze the current procedure and test method and provide conclusions as to its validity and conformance with applicable requirements. The inspector performed an independent review of the test procedure (8.7.3, Secondary Containment Leak Rate Test, Rev. 15, 11/2/84), the BECO Nuclear Engineering Department evaluation of the test method, portions of the MIT and CYGNA evaluations (the completed reports were not available during the inspection), and previous test results. The inspector made the following conclusions:

- (1) The simple averaging of the four (4) manometers used in testing is in question. The effect of manometer placement on resulting test differential pressure readings has not been addressed. The manometers are not placed symmetrically around the reactor building and one is located within a building damper housing.
- (2) The current procedure measures the average differential pressure generated by the operation of the SGTS train and subtracts from it the average initial (baseline) reading of the manometers. The inspector questioned as to whether this method actually measured the differential pressure between the inside and outside of the reactor building or if it only measured the change in differential pressure from the initial condition. As an initial response to this concern, the licensee has added a precaution to the current procedure to limit the average initial baseline manometer reading to $\pm 0.1'' \text{ H}_2\text{O}$. The inspector asked if this precaution could be amended to limit the individual baseline manometer readings to $\pm 0.1'' \text{ H}_2\text{O}$. This would ensure that the final differential pressure reading for each manometer would always be negative. The licensee agreed to consider this change to the procedure. The inspector reemphasized however, that this change does not resolve the question of subtracting the baseline readings from the final readings.
- (3) The engineering analysis performed by the BECO Nuclear Engineering Department does provide insight into determining the most possible sources of building exfiltration. The inspector concluded however, that it is not obvious (as is stated in the BECO NED Evaluation) that the predictability of the external variables which generate the building exfiltration profile (wind effect, stack effect, and heat effect) and the consequent initial baseline manometer readings is sufficient justification for subtracting the baselines from the final manometer readings. The empirical verification of the effects of these external variables should be used to determine probable locations of exfiltration. The test procedure should then be amended to assure the exfiltration is limited in these locations in addition to the remainder of the reactor building. The licensee agreed that more evaluation should be performed to determine the actual reactor building exfiltration profile and how this information should be used in leakage testing. The licensee has committed to providing the final MIT and CYGNA reports to NRC as well as any further test methodology evaluations which are performed.

- (4) The results of the most recent test, performed on October 28, 1984, indicate that there is no safety concern at this time. The final differential pressures for each manometer would be greater than $-0.25'' \text{ H}_2\text{O}$, even without subtracting off the initial baselines. These test results show an improvement over previous test results. This can be attributed to a large amount of maintenance done during the current outage on the reactor building dampers as well as to the painting of the inside of the reactor building.

Based on these findings, this item will remain open pending further evaluations by the licensee and subsequent NRC review.

3. Containment Local Leakage Rate Testing

3.1 Documents Reviewed

- Procedure 8.7.1.3, Local Leak Rate Test Program, Revision 12, 9/27/84
- Procedure 8.7.1.5, Local Leak Rate Testing of Primary Containment Penetrations and Isolation Valves, Revision 22, 9/27/84
- Procedure 8.7.1.6, Local Leak Rate Testing of Main Steam Isolation Valves, Revision 11, 11/9/84
- Procedure 8.7.1.7, Leak Rate Testing of Personnel Air Lock Door Seals, Revision 9, 11/9/83
- Selected System Piping and Instrument Drawings

3.2 Scope of Review

The inspector reviewed the above listed documents to determine compliance with the regulatory requirements of Appendix J to 10 CFR 50, Technical Specifications and applicable industry standards and with station administrative guidelines. The inspector also witnessed selected local leak rate testing activities and held discussions with the licensee regarding the documentation of test results, the repair and retesting following failed tests, and the relationship of these items to the "As-Found" and "As-Left" conditions of containment as applied to CILRT results. Further details are discussed below.

3.3 Procedure Review

The procedures reviewed were technically accurate and in conformance with the regulatory requirements of Appendix J to 10 CFR 50 and applicable industry standards. The LLRT coordinator and associated licensee personnel have made a concerted effort via plant system walkdowns to assure that the valve lineups used for local leak rate testing are accurate and in accordance with leakage testing requirements. The inspector verified a number of these valve lineups during tours of the drywell, torus room, and reactor building. No unacceptable conditions were identified.

3.4 Test Witnessing

On November 29, 1984, the inspector witnessed the post-maintenance leakage testing of RHR "B" Injection Isolation Valve MO-1001-29B. This valve had undergone several previous repairs and consequent test failures. The inspector verified the documentation of the test result, the maintenance and repair of the valves, and QA involvement in repair and testing. The inspector also verified the documentation of the "As-Found" results for the previous tests performed. The test was conducted in accordance with an approved procedure and the results were acceptable.

On December 11, 1984, the inspector witnessed the local leak rate test on the drywell airlock following the pre-CILRT containment inspection. The initial test attempt failed with a leak rate of approximately 21 SLM. The problem was later determined to be a tie wrap caught in the inner airlock door seal. After removal of the tie wrap, both the inner door seal test and the integrated airlock leakage test were repeated with successful results.

The inspector observed that the personnel performing the tests were familiar with the test equipment and the use of the procedure. No unacceptable conditions were identified.

3.5 LLRT Instrument Calibration

The inspector reviewed the calibration records for the flow transmitters, square root extractors, and pressure gages used in the LLRT test rigs. The instruments were appropriately calibrated and were marked with current calibration stickers. No unacceptable conditions were identified.

3.6 Test Results

The inspector reviewed the LLRT results summary and discussed analysis of the test results and the status of repairs and retests with the licensee. The "As-Found" and "As-Left" leak rate for every test done on each penetration isolation valve are documented by the licensee in both the LLRT summary and in the CILRT test report. However, the licensee does not total the initial "As-Found" leak rates for determination of a specific "As-Found" total containment leak rate related to the CILRT result. The licensee's position is that "As-Found" leakage is appropriately included in the CILRT report because a list of initial LLRT "As-Found" leakages is included as an appendix. As such, sufficient information is available in the CILRT report to calculate an "As-Found" CILRT result. The licensee has reported to the NRC that the LLRT allowed leakage total (0.6 La) was exceeded (LER 83-065, 12/12/83, HPCI Exhaust Check Valve LLRT 2301-45 Failure). Subsequent LLRT failures discovered during the outage are to be included in a supplemental LER. This documentation however, does not sufficiently indicate the failure of containment in the "As-Found" condition. LLRT failures of both the inboard and outboard check valves

of both feedwater lines as well as the "As-Found" LLRT failures of 7 of the 8 Main Steam Isolation Valves indicate a high likelihood that containment integrity had been degraded during the previous operating cycle. This constitutes an "As-Found" CILRT failure and, in consideration of previous CILRT results at Pilgrim, necessitates the performance of another CILRT at the next refueling outage. The licensee acknowledged this and stated that a CILRT had been scheduled for the next refueling outage.

During the current outage, the licensee has replaced a number of valves (approximately 60) which have had a history of leakage problems. Other modifications have included the installation of new soft seats in the feedwater check valves as well as major overhauls of the MSIV's. The effectiveness of this valve betterment program will be evaluated during subsequent LLRT programs. The inspector had no further questions at this time.

4. Containment Integrated Leak Rate Test

4.1 Documents Reviewed

- Procedure 8.1.7.4.1, Primary Containment Integrated Leak Rate Test Preparations, Revision 1, 12/7/84
- Procedure 8.1.7.4.2 Primary Containment Integrated Leak Rate Test, Revision 2, 12/13/84
- CILRT Log Book
- CILRT Computer Program
- CILRT Instrumentation Documentation (Calibration Records and Volume Fraction Calculations)
- Test Results
- Selected Piping and Instrument Drawings

4.2 Scope of Review

The inspector reviewed the above listed documents for technical adequacy and to determine compliance with the regulatory requirements of Appendix J to 10 CFR 50, Technical Specifications and applicable industry standards. The inspector witnessed a large portion of the activities related to the CILRT and the subsequent verification test. The inspector also performed an independent calculation of the test results.

4.3 Procedure Review

The inspector reviewed the "as-run" copies of Procedures 8.1.7.4.1 and 8.1.7.4.2 with related changes, attachments and test log for technical adequacy and for consistency with regulatory requirements, guidance, and licensee commitments. Review of procedure acceptance criteria, test methods, and references indicated adequate conformance with Appendix J to 10 CFR 50. However, the procedure did state that the CILRT verification test could be performed using either the superimposed leak or the mass step change method. The inspector informed the licensee that the use of the mass step change method does not meet the specific requirement of 10 CFR 50, Appendix J, Section III.A.3.(b) to "...establish accurately the change in leakage rate between the Type A and the supplemental test". The licensee deferred to the inspector's position and performed the supplemental verification test using the superimposed leak method. The procedure also referenced and was in general conformance with ANSI/ASN 56.8-1981, Containment System Leakage Testing Requirements.

The CILRT valve lineups were reviewed to ensure that systems were properly vented and drained to expose the containment isolation valves to containment atmosphere and test differential pressure with no artificial boundaries. Several of the valve lineups were verified by the inspector during tours taken before and during the performance of the CILRT, both inside and outside of containment. The test log and test data were maintained in accordance with the procedure.

No unacceptable conditions were identified.

4.4 CILRT Instrumentation

The inspector reviewed the calibration records for the resistance temperature detectors, dewcells and the precision pressure detectors. The calibrations met applicable accuracy requirements and were traceable to the National Bureau of Standards.

During a review of RTD and dewcell weighting factors, the inspector discovered that the licensee had found an error in the previous CILRT RTD volume fraction calculations and had performed a recalculation in 1982, following the previous CILRT. Further investigation revealed that neither the CILRT procedures nor the assigned volume fractions in the process computer had been changed. Prior to the start of the test, the licensee changed the CILRT procedures and assigned the proper volume fractions in the process computer accordingly. The total volume changed from 271,900 cubic feet to 262,208 cubic feet. The inspector independently calculated the new volume fractions and obtained the same numbers generated by the licensee. The inspector also verified that the newly calculated value of total volume was used in the CILRT computer program.

4.5 Test Witnessing/Chronology

A large portion of the CILRT and subsequent verification test was witnessed by the inspector. Inspector observations of licensee test performance and test control are delineated in Section 4.6 of this report. The test chronology was as follows:

Test Chronology

12/11/84	0200	Commenced containment inspection.
	0330	Completed containment inspection.
	1700	Completed local leakage testing on drywell airlock.
	2100	Discovered calibration problems with dew-cells. Reentered drywell for recalibration.
12/12/84	0430	Commenced pressurization of containment.
	0930	Reached test pressure of 38.5 psia. Began temperature stabilization period.
	1300	During leak searches, discovered crack in vent line off of HPCI Exhaust to Torus. Licensee attempts to measure leak while continuing test.
	1330	Completed temperature stabilization period. Acceptance criteria met. Commenced taking data for CILRT.
	2100	HPCI Exhaust Line Vent Connection leak is estimated to be approximately 5 gpm. Measured CILRT leakage is still within acceptance criterion.
12/13/84	1300	Completed taking data for CILRT. Measured leakage (L_{tm}) = 0.342 wt %/day. Measured leakage at 95% Upper Confidence Limit (UCL) = 0.347 wt %/day. UCL + type C leakage additions = 0.373 wt %/day. Acceptance criterion = 0.75 L_t = 0.596 wt %/day.
	1510	Commenced data collection for superimposed leak verification test. Imposed Leak - 3.33 SCFM 0.713 wt %/day

1910 Completed data collection for verification test. Measured verification test leakage = 0.934 wt %/day. Result is within acceptance criteria band ($0.857 < x < 1.254$)

4.6 Test Performance/Control

The test was performed strictly within the procedural guidelines. Procedural precautions were adhered to, especially those related to manipulation of containment boundaries after the commencement of testing. The licensee had been previously cited for performing valve manipulations after the start of testing. Since no such actions were taken during the current test, the inspector informed the licensee that Violation 50-293/82-11-01 would be closed.

The inspector also commented that the CILRT test director's decision to perform leak searches during the temperature stabilization period was prudent and timely. Early control of the leaking water from the HPCI Exhaust Line vent connection not only provided for early quantification of the leakage but contributed to personnel safety and ALARA considerations. Access to the Reactor Building was appropriately limited by the test director during both the CILRT and the supplemental verification test.

No unacceptable conditions were identified.

4.7 Test Results Review

The calculated leakage rate at the 95% Upper Confidence Limit (UCL) was 0.347 wt %/day. The leakage correction for Type C penetrations in use or isolated during the CILRT totalled 0.0257 wt %/day. The sum of these values (0.373 wt %/day) reflects the "As-Left" integrated leak rate and is below the allowable limit of $0.75 L_t$ (0.596 wt %/day). The inspector performed an independent calculation of the test results using a sample of raw data from the test to estimate the accuracy of the licensee's leak rate calculations. The results were as follows:

	<u>L_{tm} (mass pt.)</u>	<u>UCL (mass pt.)</u>
Pilgrim	0.342	0.347
NRC	0.338	0.345

The inspector concluded that the licensee's calculations were appropriately performed and accurate and that the test was successful.

The CILRT was followed by a successful superimposed leak verification test. The licensee imposed a leak of 3.33 SCFM or 0.713 wt %/day on the existing leak. The measured verification test leak was 0.934 wt %/day. The test result was within the acceptance criteria band ($0.857 < x < 1.254$). The inspector also verified this result by independent calculation.

No unacceptable conditions were identified.

5. Continuous Containment Leak Rate Monitoring

The inspector reviewed Daily Log Test #30 - Containment Gross Leakage (from Procedure 2.1.15, Daily Surveillance Log, Revision 53, 10/3/84) and related test results to determine licensee compliance with Technical Specification 4.7.2.g.

This test generates a daily log of nitrogen makeup to the drywell. If an excessive amount of makeup is required for a particular test, it is an indication of containment leakage. After review of some test results, the inspector commented that due to the almost daily venting of containment during previous periods of operation, the leakage trending capability of this test is suspect. The licensee stated that a large amount of work has been done during the current outage in an effort to limit the amount of air which may be injected into the drywell during normal operation. The instrument air system has been entirely reworked and pre-op tested. The air lines to the MSIV's and SRV's have been converted to the use of nitrogen. Also, the licensee has stated that instrument air will be isolated from containment during operation (following the startup sequence). Only nitrogen makeup to the drywell will be employed during normal operation.

The inspector commented that these modifications should provide more opportunities for the licensee to use Daily Log Test #30 in a meaningful way during the upcoming operating cycle. These test results will be reviewed during a future inspection.

6. Independent Calculations

The inspector performed independent calculations of the new containment RTD volume fractions as well as of the test results of the CILRT and subsequent verification test. Details are included in Sections 4.4 and 4.7 of this report.

7. QA/QC Involvement

Both local leak rate testing and integrated leak rate testing activities were monitored by plant QA/QC personnel. The inspector verified this through discussions with the QC monitoring and QA audit personnel covering the test activities, by observation of their monitoring activities, and by review of their checklists. The inspector concluded that QA/QC coverage of containment leakage testing activities at Pilgrim is appropriately planned, technically useful and comprehensive, and appropriately documented. No unacceptable conditions were identified.

8. Tours

The inspector made several tours of the drywell, torus room, reactor building, and other areas of the facility to observe containment leakage testing activities, component tagging, other work in progress, and general house-keeping. No unacceptable conditions were identified.

9. Exit Meeting

A meeting was held on November 30, 1984 and on December 14, 1984 to discuss the scope and findings of the inspection as delineated in this report. At no time during this inspection was written information provided to the licensee.