
INSPECTION PROCEDURE 70368

PART 52, CONTAINMENT LEAK RATE TESTING PROGRAM (PROGRAMMATIC)

PROGRAM APPLICABILITY: 2504

70368-01 INSPECTION OBJECTIVE

01.01 To ascertain whether the licensee's program and procedures for the performance of Containment Integrated Leak Rate Tests (CILRTs) comply with regulatory requirements, guidance, and the licensee's commitments. This inspection procedure is for the review of the CILRT program under IMC 2504 prior to initial fuel load. Inspection procedures 70307, 70313, and 70323 provide guidance for the review of CILRT performance.

01.02 To evaluate the content of the licensee's CILRT procedures for compliance with programmatic requirements, prerequisites, and FSAR commitments. Inspection Procedure (IP) 70307, "Containment Integrated Leak Rate Test Procedure Review," provides guidance for verifying the technical adequacy of the CILRT testing procedures.

70368-02 INSPECTION REQUIREMENTS

02.01 Obtain an approved copy of the licensee's CILRT program documents and the procedures, which may include vendor procedures to be used in performing the CILRT. The licensee should make approved test procedures that satisfy the Final Safety Analysis Report (FSAR) testing commitments available no later than 60 days prior to the procedures being used for the pre-operational CILRT.

- a. Verify that the CILRT program documents include a description of the licensee's organizations responsible for the CILRT (including oversight, performance, and result evaluations), detailing the responsibilities and authorities of each position.
- b. Verify that the CILRT program documents include a summary description of the program and procedure revision process for the CILRT program documents and CILRT procedures. The revision process needs to consider the evaluation requirements used to review revisions and the approval process by appropriate personnel.

02.02 Review the CILRT program documents and CILRT procedures to verify that the following programmatic requirements and precautions are addressed:

- a. Verify that containment leakage program and CILRT procedures are up to date and match the commitments from licensing basis documents, including the FSAR, unique licensee commitments, NRC approved deviations from regulatory requirements, and latest applicable industry codes and standards.

Ensure that the licensee provided guidance in the procedures to verify that licensee personnel have inspected the containment in accordance with ASME Section III, Division 1, Subsection NE, and Article 5000 for metal containments, or, ASME III, Section III, Division 2, Subsection CC, Article 5000 for concrete containments.

- b. Interview licensee personnel performing the CILRT to determine if the licensee has been using the CILRT program requirements and implementing procedures.
- c. Review the following to verify that the licensee has considered the following in its program development. The following items can be located in the program documents and the CILRT procedures:
 - 1. The configuration control methodology for pre-test system line-ups: Verify that the licensee is prepared to align the plant systems as required for testing of all systems impacted during the accident scenario. Verify their configuration control methods to ensure the system alignment will not change prior to the CILRT.
 - 2. Calibration and testing of test equipment and supplies (onsite and offsite): Verify that the licensee or vendor has a process to ensure that all test equipment and supplies have been successfully calibrated and tested to the required standards and codes.
 - 3. Final post-test calibration of test equipment: Verify that the vendor/licensee performs and tracks a post-use calibration on all test equipment used for the CILRT.
 - 4. Personnel qualifications to perform the testing: Verify that licensee and/or vendor have a process to verify that personnel are qualified to perform the CILRT.
 - 5. Licensee oversight of vendor activities: Verify that the licensee has adequate oversight of vendors procured to perform the CILRT. Verify that the vendors selected are qualified to perform the CILRT and meet the licensee contractor requirements. In some cases, the vendors will also have sub-contracts and vendors under them.
 - 6. Verification of ILRT containment leakage equipment and software: Verify that the equipment and software selected for the performance of the CILRT are appropriate for the testing. Verify the software was developed in accordance with 10 CFR 50 Appendix B requirements and the licensee's quality assurance requirements.
 - 7. Accuracy of the software used for testing: Verify that the accuracy and error of software and test equipment used have been incorporated into the final calculations of containment leak rate.
 - 8. Volumetric equivalency calculations: Verify the process the licensee/vendor will use to ensure that the volumetric equivalency calculations are complete and correct and that the instrumentation is properly placed within containment for accuracy in test performance.

9. Test equipment setup diagram: Review the test equipment setup diagram for accuracy and completion based on the volumetric equivalency calculations.
10. Volumetric impacts (i.e., calculation) due to temporary equipment left inside containment (e.g., toolboxes, scaffolding, etc.): Verify that the vendor or licensee has a process to consider all equipment being left inside containment during the CILRT and has factored the volumetric impacts of that equipment into the calculations of leak rate.
11. Removal of dangerous material (e.g., combustibles, lighting, etc.): Verify that the licensee or vendor established a process to have all potentially dangerous material removed from inside of containment prior to the CILRT.
12. Review of final test results and acceptance criteria: Review the process for which the licensee/vendor's acceptance of the final test results to ensure completeness and accuracy of the testing parameters and results.

02.03 Verify that all of the following prerequisites required to commence the CILRT are included in the licensee test procedure:

- a. For containment structures that are new construction (preparing to undergo the preoperational CILRT), the licensee satisfactorily performs the following tests:
 1. Pressure strength test (Structural Integrity Test): Structural integrity tests and pressure tests for strength (hydrostatic or pneumatic pressure) are required to be performed for new construction plants. These tests are performed to determine whether the containment structure complies with the requirements of ASME Section III. These test results shall be within specification prior to the initiation of leakage rate tests.
 2. Local leak rate test (LLRT): Prior to commencing the preoperational CILRT, the licensee should perform Type B and C LLRTs on all appropriate penetrations to ensure the containment integrity.
 3. Containment isolation system function test: Containment isolation system function tests shall be performed prior to the preoperational CILRT in order to verify that these systems operate properly and that they do not require any repairs or modifications.
- b. The licensee satisfactorily performs a general inspection of the accessible portions of the interior and exterior containment surfaces.
- c. The licensee performs the containment area survey for temperature differentials and humidity with sensing devices being placed in locations representative of their assigned sub volumes.
 1. The temperature survey of the containment structure is performed to permit the accurate measurement of containment temperatures and thermal variations in order to improve the accuracy of the overall weighted containment temperature. The survey should indicate where the temperature readings were taken for each sub volume, the conditions under which they were taken (e.g., fans operating or secured and heat loads in the area), and establish an acceptance criteria for the

final location of the sensor in each sub volume (e.g., placed where the temperature is within 2°F of the sub volume average).

This information ensures that the sensor location is representative of its assigned sub volume and furthermore, for ensuring that post pressurization temperature and pressure stabilization has occurred in containment to the extent necessary to permit an accurate leakage rate measurement.

2. If thermal variations are detected, the licensee may use fans or other means of air circulation may to equalize temperatures in these regions. In using these methods, caution must be employed during pressurization, as the load on these components is generally a function of air density. If the licensee uses fans for temperature equalization, verify that they are used during the CILRT as they were during the temperature survey.
- d. All test instruments are within calibration at the initiation of the CILRT.
1. All test equipment shall be calibrated over a normal range of conditions that will be experienced during the CILRT. Correction factors shall be determined for each sensing device prior to initiation of the CILRT.
 2. All calibrations shall be traceable to NIST Standards.
 3. Calibration of instruments used in the CILRT shall be performed within six months prior to the CILRT.
 4. Original position checks of all test equipment shall be performed after installation and prior to pressurization. These checks shall be performed within one month of commencing the CILRT.
- e. Vacuum release devices are verified to operate within 10 percent of their design pressures for internal and external loading to ensure containment protection from under pressure. Some containments may not require a vacuum release device.
- f. The containment structure is properly closed according to licensee procedure.

02.04 Verify that the CILRT procedure includes the performance of applicable plant system alignments for the CILRT to reflect the conditions that would exist after a design basis LOCA.

- a. The system alignments for the CILRT are performed to reflect the conditions that would exist after a design basis LOCA. System alignments include:
 1. All systems required to maintain the plant in a safe condition shall be operable and in their normal modes.
 2. Closed systems that would rupture as the result of a loss of coolant accident (LOCA) shall be vented to containment.
 3. Any system open to containment under post LOCA conditions shall be opened or vented to containment prior to and during the test.
 4. Any system that would be normally operating under post LOCA conditions is not required to be vented during the test.

5. Any system or component sensitive to damage from high pressures or pressure differentials shall be isolated or removed from containment.
 6. All other systems containing fluids that are or may become pressurized shall be depressurized and isolated from containment.
- b. All systems which are normally fluid filled and may be drained during a LOCA, or will not maintain their pressure integrity for 30 days after the accident shall be vented and drained to the extent necessary to expose the CIV seals to the containment atmosphere during the CILRT. Under either Option A or Option B of Appendix J, the licensee may choose to not vent or drain penetrations which would otherwise require it, if they perform Type B or C tests on the affected penetrations and add the measured leakage rates to the CILRT results.

02.05 Review the CILRT procedure and verify that the procedural requirements and precautions include the following items:

- a. The proper licensee response to all excessive leakage paths detected before or during the CILRT. Any excessive leakage path detected prior to commencement of the CILRT shall be measured through an LLRT, repaired, and then re-measured. Excessive leakage could be defined as that which would meet any of the following criteria:
1. Could potentially cause the failure of the Appendix J criteria for combined local leakage rates;
 2. Exceeds vendor specifications for the leakage of boundaries or valves, and;
 3. Exceeds the licensee's commitments for allowable leakage rates.
- b. Containment pressurization requirements:
1. The minimum and maximum pressurization for CILRTs. The pressure limits to be maintained while conducting CILRTs are specified in the licensee's TS.
 2. Isolation and venting of the pressurization source from containment upon reaching test pressure.
 3. Observation of pressure and temperature stabilization prior to commencing the leakage rate measurement. Upon completion of pressurizing the containment, sufficient time must be permitted prior to the leakage rate measurement so that temperature (T) and pressure (P) can equilibrate. Containment pressure will act as a damping harmonic function until P and T equilibrate, therefore, any measurements of P and T made for leakage rate calculations prior to this time would yield an erroneous leakage rate measurement due to this harmonic nature.

The criteria for P and T stabilization (e.g., equilibration) are:

- i. The stabilization time period must be at least 4 hours long.
- ii. The stabilization criteria are discussed and an example calculation provided in ANSI/ANS 56.8, Appendix E.

- c. Logging of required test parameters and observations. During the performance of the leakage rate test, the licensee is required to log containment pressure, temperature, dew point temperature, and liquid level (e.g., suppression pool or pressurizer level) on an hourly basis. All pertinent observations shall also be logged. Atmospheric pressure shall be recorded at the start of the test.
- d. Test data plot for absolute method leakage rate determinations.
 - 1. The leakage rate determined from absolute method leak rate calculations shall be determined periodically. Verify that the test data is plotted against time to obtain a statistically averaged leakage rate through a linear least squares fit of the data.
 - 2. This plotting of data is to be conducted continuously during the test to disclose any gross variations in data or leak rates. These variations could be indicative of an erroneous reading, failed test instrumentation, or a penetration failure.
- e. Test duration. The leakage rate test period shall extend to 24 hours of retained internal pressure for a preoperational test.
- f. Supplemental verification test leakage rate and test period.
 - 1. The maximum allowable leakage rate (L_a) is defined in 10 CFR 50, Appendix J and specified in the TS and operating license.
 - 2. In addition, the results of the CILRT shall be validated by the performance of the verification test, as described in reference ANSI/ANS-56.8-1994.
- g. Correction for LLRT penalty factors
- h. Determination of satisfactory test results for **as left (AL)** conditions.

70368-03 GENERAL INSPECTION GUIDANCE

The regulatory basis for CILRTs is found in Appendix J to 10 CFR Part 50, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," and the technical specifications (TS) for the facility. Appendix J to 10 CFR Part 50 has two options to determine test frequencies: Option A (Prescriptive) and Option B (Performance-Based). For Option A, type A tests shall be conducted in accordance with the provisions of the American National Standards N45.4-1972, "Leakage Rate Testing of Containment Structures for Nuclear Reactors," March 16, 1972, per 10 CFR 50, Appendix J. For Option B, the NRC provided guidance in Regulatory Guide (RG) 1.163; which endorses Nuclear Energy Institutes (NEI) 94-01, "Industry Guideline for Implementing Performance-based Option of 10 CFR Part 50, Appendix J," dated July 21, 1995. RG 1.163 references the methodology and acceptance criteria of ANSI/ANS-56.8-1994, "American National Standard for Containment System Leakage."

The term Type A test is synonymous with CILRT. Licensees perform Type A tests for pre-operational plants and periodically for operational units. Pre-operational testing is only

concerned with determining the AL containment condition. The AL condition is the leakage rate at the completion of the test sequence that meets the acceptance criteria as defined in Appendix J to 10 CFR Part 50. The licensee performs this test to ensure that the containment leak tight integrity is satisfactory prior to commencing power operations.

The proper performance of a CILRT requires test procedure **that** provide detailed guidance for the alignment and operation of all systems and equipment inside and penetrating the primary containment. Without adequately aligning all systems, leak rate results may be **inaccurate**, which might misrepresent the containment's leak tight integrity. Therefore, the inspector should develop a thorough understanding of CILRT practices and procedures prior to the performance of this review.

ANSI N45.4-1972 provides guidance if a licensee uses Option A of 10 CFR Part 50, Appendix J to perform the CILRTs. ANSI/ANS-56.8-1994, Bulletins 82-04 and 84-01 and Information Notices 79-33, 81-20, 82-40, and 83-23 provide additional guidance.

70368-04 RESOURCE ESTIMATE

The staff estimates this IP to take 80 hours of direct inspection effort. Use the following breakdown of inspection hours as guidance to direct and adjust inspector efforts:

04-01 Review of regulations, licensee commitments, and guidance pertaining to performing the CILRTs. Estimate: 24 hours.

04-02 Review of licensee test procedures to verify they include prerequisites necessary to perform the CILRTs. Estimate: 12 hours.

04-03 Review of plant alignment information. Estimate: 8 hours.

04-04 Review of CILRT procedure for requirements and precautions. Estimate: 8 hours.

04-05 Review of licensee and vendor program activities. Estimate: 28 hours

70368-05 PROCEDURE COMPLETION

The goal of the inspections conducted within this IP is to verify that the CILRT program exists and meets the requirements of the regulations, guidance and licensee commitments. Specifically, the CILRT program must address pressure strength tests, local leak rate tests, and containment isolation system functional tests. The target of this IP is to review the procedures for these tests, as well as for the CILRT.

This procedure is complete upon satisfactory inspection results verifying that the CILRT program adequately documents the program necessary to perform all required CILRTs.

70368-06 REFERENCES

10 CFR 50, Appendix A, Criteria 52, 53, 54, 55, 56, and 57.

10 CFR 50, Appendix J.

Regulatory Guide 1.11, Rev. 1, "Instrument Lines Penetrating Primary Reactor Containment," March 2010.

Regulatory Guide 1.68, Rev. 3, "Initial Test Program for Water- Cooled Nuclear Power Plants," March 2007.

Regulatory Guide 1.141, Rev. 1, "Containment Isolation Provisions for Fluid Systems," July 2010.

Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program," September 1995.

See Regulatory Guide 1.163 Periodic Review, ADAMS Accession No. ML14266A616, 12/2014, which provides the current NRC guidance on extending the Type A and Type C test intervals beyond those provided in NEI 94-01, Rev 0 July 1995.

NEI 94-01, Rev. 3-A, June 2011, "Nuclear Energy Institute, Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J", ADAMS Accession No. ML12221A202.

See Safety Evaluation Report for NEI 94-01, Rev 3-A, ADAMS Accession No. ML121030286, which found this revision to the topical report acceptable for referencing subject to two limitations and conditions relating to test intervals.

ANSI N45.4-1972, "Leakage-Rate Testing of Containment Structures for Nuclear Reactors."

ANS-56.2 ANSI N271-1976, "Containment Isolation Provisions for Fluid Systems."

ANSI/ANS-56.8-1994, "Containment System Leakage Testing Requirements."

NUREG-0800, Standard Review Plan, part 6.2.6, Containment Leakage Testing.

Inspection Procedure 93815, Part 52, Operational Programs Implementation.

END

Attachment: Revision History for IP 70368

Attachment

Revision History for IP 70368

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment Resolution and Closed Feedback Form Accession Number (Pre-Decisional, Non-Public Information)
N/A	ML112510299 11/07/2011 CN 11-029	Initial issue to support inspections of operational programs described in IMC 2504, Construction Inspection Program – Inspection of Construction and Operational Programs. Completed 4 year historical CN search.	N/A	N/A
N/A	ML17097A593 06/26/17 CN 17-013	Revised to reflect insights and refinements to the inspection procedure as well as editorial updates and revisions. Addressed reviewers' comments.	N/A	ML17097A589