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## INSPECTION PROCEDURE 70368

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### PART 52, CONTAINMENT LEAKAGE RATE TESTING PROGRAM (PROGRAMMATIC)

PROGRAM APPLICABILITY: 2504

#### 70368-01 INSPECTION OBJECTIVE

01.01 To ascertain whether the licensee procedure for the performance of Containment Integrated Leak Rate Tests (CILRTs) both prior to and after start of operations complies with regulatory requirements, guidance, and licensee commitments.

01.02 To evaluate the technical adequacy of the procedure to determine containment leak tight integrity.

#### 70368-02 INSPECTION REQUIREMENTS

02.01 Inspection Requirement. Obtain an approved copy of the licensee procedure to be used in performing the CILRT.

02.02 Inspection Requirement. Review all regulations, licensee commitments, technical specifications (TS) for the facility, and guidance pertaining to all CILRTs (Type A tests including "as left" (AL) conditions), including references in section 70368-05.

02.03 Inspection Requirement. 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 following tests shall be satisfactorily performed:

Tests	New construction
Pressure strength test	Yes
Local leak rate test (LLRT)	Yes
Containment isolation system function test	Yes

- b. A general inspection of the accessible portions of the interior and exterior containment surfaces shall be performed satisfactorily.
- c. The containment area survey for temperature differentials and humidity shall be or has been performed with sensing devices being placed in locations representative of their assigned subvolumes.
- d. All test instruments are within calibration at the initiation of the CILRT.

- e. Vacuum release devices shall be verified to operate within 10 percent of their design pressures for internal and external loading to ensure containment protection from under pressure.
- f. The containment structure shall be properly closed out according to licensee procedure.

02.04 Inspection Requirement. Ensure that each applicable plant system is to be aligned in accordance with one of the following criteria:

- a. All systems required to maintain the plant in a safe condition shall be operable and in their normal modes.
- b. Closed systems that would rupture as the result of a loss of coolant accident (LOCA) shall be vented to containment.
- c. Any system open to containment under post LOCA conditions shall be opened or vented to containment prior to and during the test.
- d. Any system that would be normally operating under post LOCA conditions is not required to be vented during the test.
- e. Any system or component sensitive to damage from high pressures or pressure differentials shall be isolated or removed from containment.
- f. All other systems containing fluids that are or may become pressurized shall be depressurized and isolated from containment.

02.05 Inspection Requirement. Review the CILRT procedure to determine if 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
- b. Containment pressurization requirements:
  - 1. The minimum and maximum pressurization for CILRTs
  - 2. Isolation and venting of the pressurization source from containment upon reaching test pressure
  - 3. Observation of pressure/temperature stabilization prior to commencing the leakage rate measurement
- c. Logging of required test parameters and observations
- d. Test data plot for absolute method leakage rate determinations
- e. Test duration

- f. Supplemental verification test leakage rate and test period
- g. Correction for LLRT penalty factors
- h. Determination of satisfactory test results for AL conditions.

## 70368-03 INSPECTION GUIDANCE

General Guidance. The proper performance of a CILRT requires an in-depth test procedure that provides detailed guidance for the alignment and operation of all systems and equipment inside and penetrating the primary containment. Without adequately aligning all systems, inaccurate leak rate results may be obtained, 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.

### Specific Guidance

03.01 Inspection Requirement 02.01. For the preoperational CILRT, an approved test procedure satisfying Final Safety Analysis Report (FSAR) testing commitments should be made available by the licensee approximately 60 days prior to its use.

03.02 Inspection Requirement 02.02.

- a. The regulatory basis for CILRTs is found in 10 CFR Part 50, Appendix J, Option B; Regulatory Guide 1.163; ANSI/ANS-56.8-1994; NEI 94-01; and the technical specifications (TS) for the facility.

In the unlikely case that a licensee uses Option A of 10 CFR Part 50, Appendix J to perform the CILRT, guidance is provided by ANSI N45.4-1972. Additional guidance is provided in ANSI/ANS-56.8-1994 as well as IE Bulletins 82-04 and 84-01 and IE Information Notices 79-33, 81-20, 82-40, and 83-23.

- b. The term Type A test is synonymous with CILRT. Type A tests are performed for preoperational plants and periodically for operational units. Preoperational 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 10CFR50, Appendix J. This test is performed to ensure that the containment leak tight integrity is satisfactory prior to commencing power operations.

03.03. Inspection Requirement 02.03a.

- a. 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 specified strength and design criteria of the TS. These test results shall be within specification prior to the initiation of leakage rate tests.
- b. Prior to commencing the preoperational CILRT, it is generally recommended that Type B and C LLRTs be performed on all appropriate penetrations to ensure the containment integrity.

- c. 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.

03.04. Inspection Requirement 02.03b.

- a. The inspector shall ensure that enough specific guidance is provided in the procedure to verify that personnel have inspected the containment in accordance with ASME Section III, Division 1, Subsection NE, Article 5000 for metal containments, or, ASME III, Section III, Division 2, Subsection CC, Article 5000 for concrete containments.
- b. A pre-service inspection of the accessible portions of the containment structure and components in accordance with ASME XI shall be performed to determine if there is any evidence of structural deterioration which may affect either the containment structural integrity or leak tight integrity. The CILRT shall not be performed until all repairs and retests are complete.

03.05. Inspection Requirement 02.03c.

- a. 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 subvolume, 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 subvolume (e.g., placed where the temperature is within 2°F of the subvolume average).

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

- b. If thermal variations are detected, fans or other means of air circulation may be used 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 fans are used for temperature equalization verify that they are used during the CILRT as they were during the temperature survey.

03.06. Inspection Requirement 02.03d.

- a. 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.
- b. All calibrations shall be traceable to NIST Standards.

- c. Calibration of instruments used in the CILRT shall be performed within 6 months prior to the CILRT.
- d. 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.

03.07. Inspection Requirement 02.04.

- a. The system alignments for the CILRT are performed to reflect the conditions that would exist after a design basis LOCA.
- b. To ensure proper system alignment for the preoperational CILRT, and to identify those penetrations whose local leakage is required to be added to the CILRT results, review all recommended lineups for systems penetrating the primary containment. Verify that no inadvertent leakage barriers exist.
- c. Closure of containment isolation valves (CIVs) for the CILRT shall be accomplished by normal operation without any exercising (valve cycling) or adjustments (e.g., no tightening of the valve packing after closure by the motor).
- d. Repairs to any maloperating or leaking CIVs are to be made as necessary.
- e. 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 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.

03.08. Inspection Requirement 02.05a.

- a. Any excessive leakage path detected prior to commencement of the CILRT shall be measured through an LLRT, repaired, and then remeasured. 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. Any excessive leakage path detected during the CILRT, including the supplemental verification test, may be blanked off during the test and repaired after completion of the CILRT (per section 03.08.c of this procedure).
- c. If a penetration leaks excessively and cannot be repaired prior to the CILRT, or leaks excessively during the CILRT, it may be blanked off. The AL integrated leakage rate must be adjusted to compensate for the leakage that will exist

through this penetration after its repair. This is accomplished by adding the post repair local leak rate of this penetration to the CILRT results.

03.09 Inspection Requirement 02.05c.1.

- a. The pressure limits to be maintained while conducting CILRTs are as follows:

$$P_d \geq P \geq 0.96P_a$$

Where:

P is the CILRT test pressure (at any time during the test)

P<sub>d</sub> is the containment system design pressure

P<sub>a</sub> is the calculated peak internal containment pressure related to the design basis accident and specified in the TS or associated bases.

For those plants with a P<sub>a</sub> of 25 psig or less, the minimum test pressure for the duration of the CILRT shall be P<sub>a</sub> - 1 psig.

- b. All LLRTs performed for component repairs in conjunction with the CILRT are to be conducted at P<sub>a</sub>.

03.10 Inspection Requirement 02.05c.3. 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 (equilibration) are:

- a. The stabilization time period must be at least 4 hours long.
- b. The containment atmosphere is assumed to be stabilized for CILRT purposes when the following criteria are simultaneously met:

The absolute value of the difference between L<sub>2h</sub> and L<sub>1h</sub> shall be less than or equal to 0.25L<sub>a</sub>,

L<sub>1h</sub> shall be greater than or equal to zero and shall be less than the allowable leakage rate (L<sub>a</sub>),

where:

L<sub>1h</sub> is the estimate of the leakage rate, derived from the least squares slope and intercept using the mass data over the last hour (percent/24 h).

L<sub>2h</sub> is the estimate of the leakage rate, derived from the least squares slope and intercept using the mass data over the last two hours (percent/24 h).

The stabilization criteria are discussed and an example calculation provided in ANSI/ANS 56.8, Appendix E

03.11 Inspection Requirement 02.05d. During the performance of the leakage rate test, the licensee is required to log containment pressure, temperature, dewpoint 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.

03.12 Inspection Requirement 02.05e.

- a. 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.
- b. 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.
- c. Collection of plant and technical data shall be sufficient for an independent review of the primary containment leakage rate test results. Data should also include LLRT results performed since the last CILRT; a listing of all test exceptions taken, and data set rejections. Test data should be sufficient to clearly state if the test has passed or failed the acceptance criteria.

03.13 Inspection Requirement 02.05f. The leakage rate test period shall extend to 24 hours of retained internal pressure for a preoperational test.

03.14 Inspection Requirement 02.05i.

- a. The maximum allowable leakage rate ( $L_a$ ) is defined in 10 CFR 50, Appendix J and specified in the TS and operating license. Prior to declaring the as-left CILRT to be successfully completed, the test data shall be shown to meet all of the following criteria:
  1. The CILRT leakage rate Upper Confidence Limits (UCL), plus the required LLRT additions as described in sections 3.2.2, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.7, and 3.2.10 of ANSI/ANS-56.8-1994, shall not exceed  $0.75L_a$ . This combined value shall be reported as the as-left CILRT leakage rate.
  2. The limits on curvature and the data scatter as described in section 5.7 of ANSI/ANS-56.8-1994, shall be satisfied for the last hour or the last four consecutive data sets (whichever is longer).
  3. The CILRT duration shall be at least 24 hours for a preoperational test, at least 8 hours for a periodic test, and shall consist of a minimum of 30 data sets taken at approximately equal time intervals during the test period.
- b. 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.

## 70368-04 INSPECTION RESOURCES

For planning and budget purposes, this IP shall require 36 hours of direct inspection effort. However, modifications to the required time may be warranted. The following breakdown of inspection hours should be used as guidance to direct and adjust inspector efforts:

04-01 Review of regulations, licensee commitments, and guidance pertaining to performing the CILRTs. Estimate: 12 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: 4 hours.

## 70368-05 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.

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."

NEI 94-01, Rev. 0, July 1995, "Nuclear Energy Institute, Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J"

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

Inspection Procedure 93815, Part 52, Operational Programs Implementation

## 70368-06 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 test(s), local leak rate test(s), and containment isolation system functional test(s).

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.

END

Attachment 1

Revision History for IP 70368

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
N/A	11/07/2011 CN 11-029 ML112510299	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.	None	N/A	N/A