INSPECTION PROCEDURE 70323

CONTAINMENT LEAK RATE TEST RESULTS EVALUATION

PROGRAM APPLICABILITY: 2513, 2515 (BASIC)

70323-01 INSPECTION OBJECTIVE

This procedure is designed to verify that the licensee has adequately performed, reviewed, and evaluated preoperational and operational Type A containment tests [containment integrated leak rate test (CILRT)] and Type B or C containment tests [local leak rate test (LLRT)] for preoperational and operational plants.

70323-02 INSPECTION REQUIREMENTS

02.01 Review the licensee's report titled "Reactor Containment Building Integrated Leak Test" to verify compliance with respect to the following items:

a. Type A Test

1. Verify that the "as found" [(AF) - initial containment condition] and "as left" [(AL) - final containment condition] results for each Type A test sequence performed are submitted, as applicable. The AF condition is not applicable to preoperational CILRTS.

2. Determine if the test results and the analyses and interpretation of the leakage rate test data adequately characterize the acceptability of the containment for the AF and AL Type A tests, including meeting the following criteria:

(a) Verify that the required leakage rate computations were properly performed.

(b) Ensure that the total measured leakage rate (Ltm/Lam) meets the required leakage rate acceptance criteria.

(c) Verify that Ltm(Lam) was corrected for random instrument errors.

(d) Determine if the proper LLRT correction factor was used to calculate the AF and AL leakage rates.

3. Review the results and analyses of the supplemental verification test used to demonstrate Type A test validity.

4. Ensure that Type A test which failed to meet the acceptance criteria is separately reported with the following information included:

   (a) an analysis and interpretation of the test data

   (b) the least-squares fit of the test data

   (c) the test instrumentation error analysis

   (d) a description of the structural conditions of the containment or components which contributed to the test failure

5. Check that the preoperational leak rate test report includes a schematic of the leakage rate measurement system, a description of the instrumentation used, and a discussion of the applicable test program.

b. Type B and C Tests

1. Verify that the results of Type B and C LLRTs performed since the last Type A test meet the required acceptance criteria.

2. Determine if the licensee has conducted an adequate summary analysis for the LLRTs performed.

3. Ensure that each Type B or C test that failed to meet the acceptance criteria is separately reported with the following information included:

   (a) an analysis and interpretation of the test data

   (b) the test instrumentation error analysis

   (c) a description of the component condition which contributed to the test failure.

c. Containment Structural Deterioration. Evaluate any reported containment structural deterioration and the corrective actions taken to correct it.

d. Time Requirement. Verify that the licensee's report was submitted approximately 3 months after the test was conducted.

02.02 Verify that the Type A test leakage rate calculated during the performance of IP 70313 from the test data is consistent with the licensee's reported result.

70323-03 INSPECTION GUIDANCE

General Guidance. This inspection procedure is designed to evaluate the acceptability of the containment integrated leakage rates as reported by the licensee for both the AF and AL conditions. These results will provide a good characterization of not only the current

containment leak-tight integrity but also of this condition with respect to time (i.e., how the leak rate changes while the containment ages). This information is necessary to ensure that the containment can and will maintain its leak-tight integrity in the event of a design basis loss of coolant accident.

03.01 Specific Guidance. This section is provided to supply a more detailed explanation of the source and method of implementation for each specific inspection requirement. The references for the applicable sources given in parenthesis after each requirement are listed in section 70323-04 of this procedure.

a. Inspection Requirement 02.01a1. In performing the periodic Type A test, the licensee is required to determine both the AF and AL conditions of the containment system. The preoperational Type A test requires the determination of only the AL condition. The AF condition is that at the time of reactor shutdown proceeding the Type A test. This test is performed to disclose the normal state of repair of the containment system and to determine if there is any abnormal deterioration occurring. The AL condition is that at the completion of the test sequence. This test is performed to ensure that the containment system is in a satisfactory state of repair prior to recommencing power operations.

   (refs: c-sections III.A.1 and V.B.2. and V.B.3., d, and h-sections 4.1 and 4.2)

b. Inspection Requirement 02.01a2(a)

   1. Two methods of performing the Type A test are currently approved: the absolute method and the reference-vessel method. However, due to inherent difficulties in performing the latter, the absolute method is used exclusively.

   2. Review the calculations included in the results and the analyses and interpretation sections. Verify that the basic calculations included are current and that the figures used make sense (i.e., order of magnitude). Verify that unit conversions (e.g., wt%/day, % allowable, SCFM, and SCCM) are included and were performed properly.

      (refs: c-section V.B.2. and 3., h-section 7, and k).

c. Inspection Requirement 02.01a2(b). For peak (Pa) and reduced (Pt) containment internal pressures the associated maximum allowable leakage rates (La/Lt) are defined in the licensee's technical specifications (TS) and operating license. The acceptance criteria are at a minimum as conservative as the following equation:

   $$Lam\ (Ltm) < 0.75\ La(Lt)$$

   and for the preoperational peak pressure test, Lam should also be less than or equal to Ld, where

Lam = total measured containment leakage rate at Pa
Ltm = total measured containment leakage rate at Pt
Ld = design leakage rate at Pa

The values for Lam(Ltm) in the above equation must include the LLRT correction factor and a value for random instrument error when determining if the CILRT was satisfactory.

(refs: c-section III.A)

d. Inspection Requirement 02.01a2(c). Licensees are required to correct Ltm (Lam) for random instrument errors through addition of the calculated absolute value of the error. Though no particular method is generally required, some licensees have committed in their TS to the application of Upper Confidence Limits (UCL) set at a 95% probability in order to account for the instrument error. The UCL is a value calculated by measuring the standard deviation from the slope of the least squares linearization of the test data within which a certain fraction of all values may be reasonably expected to lie.

(refs: c-section III.A.3(c), k-section 5.74)

e. Inspection Requirement 02.01a2(d)

1. If repairs and/or adjustments were performed on containment components during this outage prior to the completion of the Type A test, the change in local leak rate for these components must be used to determine the total integrated leak rate. This is done by conducting LLRTs on the affected components to determine the minimum pathway leakage before and after the repairs/adjustments. The difference in minimum pathway leakage is then added to the Type A test result to obtain the required AF result. The minimum pathway leakage would be the smaller leakage rate for in-series valves tested individually, one-half the leakage rate for in-series valves tested in parallel. This differential of the leakage is the LLRT correction factor.

2. If the minimum pathway leakage for a penetration cannot be determined, then the AF Type A test is considered a failure.

3. If a barrier cannot be tested (e.g., will not hold pressure) in the direction that pressure would normally be applied when in performance of its safety function, then it may be validly tested from the opposite direction. However, it must be proven that the test results obtained in the opposite direction will provide equivalent or more conservative results. This proof should be included in the test report.

4. All LLRTs performed to compensate a Type A test for repairs/adjustments shall be performed at the Type A test pressure.

(refs: c-sections III.A and B, k-section 6.)

f. Inspection Requirement 02.01a3

1. A supplemental integrated leak rate verification test is required to be performed to validate the Type A test. No set method of verification test is prescribed, but the test must be conducted over a sufficient duration to yield a change in leakage rate from the Type A test result. The leakage rate shall be determined from the slope of the linear least squares fit of the graph of leakage rate versus time. Enough data points must be taken to give an accurate leakage rate result. To prove the Type A test acceptable, the following criteria must be met:

$|Lam(Ltm) - (Lc - Lo)| \leq 0.25\ La(Lt)$, where

Lam(Ltm) is the raw integrated leakage rate obtained with no corrections for instrument errors or LLRT correction factors included unless repairs or adjustments were made in between the times of the performance of the two tests,

Lc is the composite leakage rate measured during the verification test, and

Lo is the known orifice leakage rate or the negative of the controlled pump back injection rate of the verification test.

2. The comparison of the Type A test results and the verification test results should be done using raw data. No instrument error or LLRT correction factors should be included unless repairs or adjustments were made in between the times of performance of the two tests.

(refs: c-sections III.A.3(b), h, k).

g. Inspection Requirement 02.01a4. Each Type A (AF and AL) test failure must be addressed in a separate section of the licensee's report. Adequate analysis must be performed to determine if the cause was a "single time" failure or a chronic problem. Test failures will impact the scheduling for future Type A tests.

(refs: c-section III.A.6 and V.B.3).

h. Inspection Requirement 02.01a5. A statement as to which leak rate test method is used is essential as this method shall be normally used for all operational Type A tests.

(refs: c-section III.A.3.(b) and V.B.2).

i. Inspection Requirement 02.01b

1. LLRTs are not always independent of CILRTs. Due to the relationship between these tests as outlined in 03.01e1,

extensive information is required to determine the effect that local leak rates and singular component deterioration have on the overall containment integrated leak rate.

2. If abnormal deterioration of containment structural components is discerned, an evaluation of the possible causes should be carried out in an effort to ensure the maintenance of proper containment integrity.

(refs: c, h, and k).

j. Inspection Requirement 02.01b1

1. The combined leakage rate for all penetrations and valves subjected to Type B and C tests during a complete leak rate test sequence shall be less than 0.60 La. A complete leak rate test sequence would be that in which every boundary required to be Type B or C tested by the TS, has been tested.

2. If any valve or penetration cannot be pressurized for a Type B or C test, then the sum of the LLRT leak rates is by definition > 0.60 La.

(refs: c-sections III.B.3 and III.C.3)

70323-04 REFERENCES

a. 10 CFR 50.73.

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

c. 10 CFR 50, Appendix J.

d. Memorandum for R. J. Mattson to J. H. Sniezak, "Clarification of Appendix J Requirements - Definition of Type A Test Failures," January 11, 1982.

e. Regulatory Guide 1.11, "Instrument Lines Penetrating Primary Reactor Containment," March 10, 1971.

f. Regulatory Guide 1.141, "Containment Isolation Provisions for Fluid Systems," April 1978.

g. ANSI N18.1-1971, "Selection and Training of Nuclear Power Plant Personnel."

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

i. ANSI/ANS-3.1 1981, "Selection, Qualification, and Training of Personnel for Nuclear Power Plants."

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

k. ANSI/ANS-56.8-1981, "Containment System Leakage Testing Requirements."

l. Topical Report BN-TOP-1, Revision 1, "Testing Criteria for Integrated Leakage Rate Testing of Primary Containment Structures for Nuclear Power Plants," November 1, 1972, Bechtel Corporation.

END