

NRC INSPECTION MANUAL

PART 9900: 10 CFR GUIDANCE

50_54.CFR

10 CFR 50.54(0)
GUIDANCE RELATING TO THE APPLICATION OF
APPENDIX J - PRIMARY REACTOR CONTAINMENT LEAKAGE TESTING FOR
WATER-COOLED POWER REACTORS

A. PURPOSE

The purpose of this guidance is to clarify the NRC position concerning the application of 10 CFR 50.54(0), Appendix J - Requirements for Primary Reactor Containment Leakage Rate Testing.

NOTE: Responses given to licensees concerning specific Appendix J exemptions were on an individual plant basis. Therefore, the generic guidance provided herein is for inspector use only. Copies of this guidance should not be given to non-NRC personnel.

B. DISCUSSION

Paragraph 10 CFR 50.54 states in part that, "whether stated therein or not, the following shall be deemed in conditions in every license issued." Subparagraph (0) further states that primary reactor containments for water-cooled power reactors shall be subject to the requirements set forth in Appendix J.

The Office of Nuclear Reactor Regulation has requested licensees to submit details concerning those portions of 10 CFR 50, Appendix J, they are currently unable to meet. The requested information will be considered during the development of proposed revisions to Appendix J. It will also be used in evaluating the backfit provisions for existing facilities upon issuance of revised Appendix J.

Until further guidance is provided, or until a revised Appendix J is effective, or a specific exemption is granted to a given licensee, the following guidance applies regarding enforcement action:

1. The licensee must comply, insofar as technically feasible within the operational and testable limits of the system, with Appendix J. The inspector should carry as unresolved items those specific areas where the licensee cannot meet Appendix

J. Where it is technically feasible to meet Appendix J and the licensee does not, a citation should be made.

2. Even though it may not be technically feasible for the licensee to comply with all aspects of Appendix J, the licensee must meet the requirements of his Technical Specifications.

3. Because the correlation of leakage from the reduced pressure test to the leakage at full accident pressure is tedious and cannot be substantiated, efforts within NRC have been to urge all new facilities undergoing their first integrated leakage rate test to utilize only the test at Pa, design basis peak internal containment pressure.

When licensees make inquiries, ask opinions or indicate a desire to perform preoperational testing at Pa without performance of a reduced pressure test, they should be advised that such testing is acceptable to NRC. Where the preoperational tests were run at Pa and at a reduced pressure level, subsequent Type A tests may be performed at Pa.

The following technical guidance which was developed for the NRR review and evaluation of licensee requested exemption for Appendix J requirements applies to performance of testing:

1. Containment Air-Lock Testing. Appendix J, Section III.B.2, requires (a) that Type B tests shall be performed at a pressure not less than Pa, and (b) Section III.D.2 requires that air locks be tested at 6-month intervals and airlocks which are opened during such intervals be leak-tested after each opening.

NRC Position. When containment integrity is required, an air lock shall be tested within three days after being opened. When multiple entries are required, the air lock shall be tested within three days after the initial opening. The test pressure shall be applied between the doors, or in the case where dual seals are incorporated in the door design, the test pressure may be applied between the seals. In the event testing cannot be performed at Pa due to the design of the air lock, the test may be performed at the manufacturer's recommended maximum test pressure. This latter (seal) test is not intended to measure a leakage rate, but only to verify the seal integrity. The allowable leakage rate for a reduced pressure test shall be determined by relating the leakage rate at the test pressure to a leakage rate at the accident pressure, Pa.

Air locks which cannot be tested at Pa after being opened, when containment integrity is required, without the use of mechanical devices to seat the doors, shall be tested between the doors at Pa at 6-month intervals utilizing such devices.

2. Appendix J, Section II.H, states that the containment isolation valves included in the "Type C Tests" are those that:
 - a. Provide a direct connection between the inside and outside atmospheres of the primary reactor containment under normal operation, such as purge, ventilation, vacuum relief and instrument valves.

- b. Are required to close automatically upon receipt of a containment isolation signal in response to controls intended to effect containment isolation.
- c. Are required to operate intermittently under post-accident conditions.
- d. Are in mainsteam and feedwater piping and other systems which penetrate containment of direct-cycle boiling water power reactors.

NRC Position. Licensees can limit Type C testing to those valves as defined by Paragraph II.H of Appendix J. For example, the mainsteam valves on a PWR need not be included in Type C testing.

- 3. Appendix J, Section III.C.2, requires that valves, unless pressurized with fluid from a seal system shall be pressurized with air or nitrogen at a pressure of Pa.

NRC Position. For mainsteam isolation valves in boiling water reactors, a leak-rate test pressure less than Pa is acceptable. The test pressure shall be as stated in the Plant Technical Specifications.

- 4. Appendix J, Section III.C.1, requires that for Type C testing of isolation valves, the test pressure shall be applied in the same direction as that when the valve would be required to perform its safety function unless it can be determined that the results from the tests for a pressure applied in a different direction will provide equivalent or more conservative results.

NRC Position. Type C test performed with the pressure applied in a reverse direction from the direction of safety function will be considered to meet the requirements of Appendix J, Section III.C.1, when it can be demonstrated for each valve design that the leak test results are equivalent or more conservative than those test results obtained during testing in the direction of the containment function.

In the course of the generic review of the implementation of the leak testing requirements of Appendix J, it has been concluded that exemptions from the requirements of the regulations are not necessary for reverse direction testing, provided that the licensees could make a determination that the results of testing in the opposite direction would provide equivalent or more conservative results. Further, it is required that the licensees document the bases for these determinations and arrange to have this documentation available at the plant site for review by the NRC Regional inspectors.

Specific acceptance criteria are difficult to delineate due to the wide variation in valve designs. However, prototypical

test results in both directions, valve internal arrangements, and design specifications from the valve manufacturer are good indicators of the equivalence or conservatism of reverse direction testing. The Regional inspectors should use this kind of information to judge the adequacy of the licensees' determination of equivalence or conservatism. Should the inspector have significant doubts regarding the adequacy of reverse direction leak testing for specific valves, the matter should be referred to Headquarters. This referral should include the basis for the inspector's uncertainty, a complete description of the valves in question, the basis for the licensee's determination, and the system in which the valve functions.

5. Appendix J, Section III.C.2.a, requires that valves, unless pressurized with a seal system, shall be pressurized with air or with nitrogen at a pressure of Pa.

NRC Position. Appendix J requires air or nitrogen to be used as the test fluid for conducting Type C tests which necessitates draining liquid-filled systems. This requirement is intended to simulate the condition of the system following a postulated Loss-of-Coolant-Accident (LOCA) where the leakage barriers (e.g., valves, gaskets, and seals) may be exposed to the containment atmosphere. There are a number of liquid-filled systems, however, that are specifically designed to remain intact following a LOCA. These include the emergency core cooling system and the containment heat removal system. For those systems that are designed to engineered safety feature criteria and for which there is assurance that the system will be liquid-filled following a LOCA, liquid leakage should be distinguished from containment atmosphere leakage. Therefore, these systems can be hydrostatically tested to demonstrate that the fluid inventory is sufficient to maintain a water seal for the duration of the accident. A liquid leakage limit can then be assigned for these systems. This criterion is similar in concept to a valve seal-water system criterion and will provide equivalent isolation protection.

For this type of testing, radiological analysis should be performed to demonstrate that the liquid leakage limits do not result in significant doses such that their summation would be greater than the 10 CFR Part 100 guidelines.

6. Appendix J, Section III.A.1.a, requires that if during a Type A test, potentially excessive leakage paths are identified which will interfere with satisfactory completion of the test or which will result in the Type A test not meeting the acceptance criteria, the Type A test shall be terminated and the leakage through such paths shall be measured using local leakage testing methods. Repairs and/or adjustments to equipment shall be made and a Type A test shall be performed.

NRC Position. If, during the performance of Type A test, identifiable local leakage occurs to the extent that it could

cause failure of the Type A test, e.g., through penetrations or isolation valves, the leak may be isolated and the Type A test continued until completion.

A containment penetration which is isolated during a Type A test must have a design which will permit local leak testing of all potential leakage paths through the penetration.

Local leakage rates measured before and after repair must be reported, and the sum of the post-repair leakage rate and the Type A test results must meet the Appendix J allowable leakage rate ($0.75 L_a$).

However, the difference in Type B and C test results before and after the repair of local leaks may not be deducted from the Type A test result in order to achieve an acceptable containment integrated leak rate.

If the addition of the local leakage to the Type A test leakage results in a Total Measured Leakage (L_{am}) which exceeds $0.75 L_a$ or by including 95 percent confidence interval, exceeds L_a , the Type A test shall be repeated, Type B and C leak rate testing and repair prior to containment I.L.R.T. is also considered to be acceptable.

7. Appendix J requires that containment penetrations whose design incorporates resilient seals, gaskets, sealant compounds, piping penetrations fitted with metal seal assemblies, shall be tested to detect local leaks at each refueling, but in no case at intervals greater than two years at pressure P_a (personnel air locks excepted).

NRC Position. For those plants in which typical penetrations such as equipment hatches, penetration bellows, or electrical penetrations are not designed to permit local leak testing, those penetrations shall be tested in conjunction with the Type A containment integrated leak test as specified in the Technical Specifications.

8. Appendix J, Section III.A.1(a) specifies that a containment inspection shall be performed as a prerequisite to the performance of Type A tests.

NRC Position. A prerequisite to starting the CILRT should be verification that all containment liner weld channels are vented. The channels should be vented throughout the performance of the CILRT.

9. Appendix J, Section V.B.3. requires the licensee to submit a report for each periodic containment leak rate test which includes a summary analysis of the Type B and Type C tests that were performed since the last Type A test. Notwithstanding this requirement, paragraph C.2.a(2)(c) of Regulatory Guide 1.16 states that prompt notification with written followup is required whenever the facility is operated with unacceptable Type B and Type C containment leak rate test

results. Because Technical Specification (TS) requirements for Type B and Type C tests do not include typical action statement language, this requirement may not be uniformly interpreted by all licensees.

NRC Position. The intent of this requirement is that prompt reporting with written followup must be made for those Type B and Type C tests which are found to have unacceptable leak rates at a time when containment integrity is required as described in the TS. On the other hand, thirty day written reports should be submitted whenever unacceptable Type B and Type C test results are detected and containment isolation is not required.

END