U.S. NUCLEAR REGULATORY COMMISSION

DRAFT REGULATORY GUIDE DG-1391

Proposed Revision 1 to Regulatory Guide 1.163

Issue Date: November 2022
Technical Lead: Brian Lee

PERFORMANCE-BASED CONTAINMENT LEAK-TEST PROGRAM

A. INTRODUCTION

Purpose

This regulatory guide (RG) provides guidance on an acceptable performance-based leak-test program and leakage rate test methods, procedures, and analyses that may be used to comply with "Option B—Performance-Based Requirements" in Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities" (Ref. 1).

Applicability

This RG applies to reactor licensees and applicants subject to 10 CFR Part 50, Appendix J, and 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants" (Ref. 2).

Applicable Regulations

- 10 CFR Part 50 provides regulations for licensing production and utilization facilities.
  - 10 CFR 50.54(o) provides a condition that primary reactor containments shall meet the containment leakage test requirements in 10 CFR Part 50, Appendix J.
  - 10 CFR 50.55a specifies requirements for inservice inspection programs.
  - 10 CFR 50.90, "Application for amendment of license, construction permit, or early site permit," requires an application whenever a holder of a license desires to amend the license or permit.
  - 10 CFR Part 50, Appendix J, specifies requirements and acceptance criteria for preoperational and periodic testing of the leak tightness of the reactor containment and penetrations.

- 10 CFR Part 52 governs the issuance of early site permits, standard design certifications, combined licenses, standard design approvals, and manufacturing licenses for nuclear power facilities.
  - 10 CFR 52.79(a)(12) requires, in part, that combined license applicants describe the primary containment leak rate test program to ensure the requirements of 10 CFR Part 50, Appendix J, are met.

Related Guidance

- NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Chapter 6, "Engineered Safety Features," Section 6.2.6, "Containment Leakage Testing" (Ref. 3), gives guidance on an acceptable containment leakage rate testing program and leakage rate test methods, procedures, and analyses that may be used to comply with the requirements in 10 CFR Part 50, Appendix J.

- NUREG-1493, "Performance-Based Containment Leak-Test Program," issued September 1995 (Ref. 4), provides the technical basis to support rulemaking to revise the leakage rate testing requirements in Option B of Appendix J to 10 CFR Part 50.

Purpose of Regulatory Guides

The NRC issues RGs to describe methods that are acceptable to the staff for implementing specific parts of the agency's regulations, to explain techniques that the staff uses in evaluating specific issues or postulated events, and to describe information that the staff needs in its review of applications for permits and licenses. Regulatory guides are not NRC regulations and compliance with them is not required. Methods and solutions that differ from those set forth in RGs are acceptable if supported by a basis for the issuance or continuance of a permit or license by the Commission.

Paperwork Reduction Act

This RG provides voluntary guidance for implementing the mandatory information collections in 10 CFR Parts 50 and 52 that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et. seq.). These information collections were approved by the Office of Management and Budget (OMB), under control numbers 3150-0011 and 3150-0151, respectively. Send comments regarding this information collection to the FOIA, Library, and Information Collections Branch (T6-A10M), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by e-mail to Infocollects.Resource@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0011 and 3150-0151), Office of Management and Budget, Washington, DC, 20503.

Public Protection Notification

The NRC may not conduct or sponsor, and a person is not required to respond to, a collection of information unless the document requesting or requiring the collection displays a currently valid OMB control number.

Table of Contents

B. DISCUSSION

Reason for Revision

This revision of the guide (Revision 1) endorses the guidance in NEI 94-01, Revision 3-A, issued July 2012 (Ref. 5), for implementing Option B of Appendix J to 10 CFR Part 50, subject to the regulatory positions listed in Section C of this RG. This guidance includes (1) extending Type A test intervals up to 15 years and (2) extending Type C test intervals up to 75 months.

This RG endorses Electric Power Research Institute (EPRI) Report No. 1009325, "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," Revision 2-A, subject to the applicable regulatory positions listed in Section C of this RG. EPRI Report No. 1009325, Revision 2-A provides a generic assessment of the risks associated with a permanent extension of the integrated leakage rate test (ILRT) surveillance interval to 15 years, and a risk-informed methodology/template to be used to confirm the risk impact of the ILRT extension on a plant-specific basis.

This revision also endorses American National Standards Institute (ANSI)/American Nuclear Society (ANS) 56.8-2020, "Containment System Leakage Testing Requirements" (Ref. 6), for acceptable industry standards on technical methods and techniques for performing Type A, B, and C tests. The staff has reviewed ANSI/ANS 56.8-2020 and found it to be technically consistent with the 2002 edition. **Error! Reference source not found.Error! Reference source not found.**

Licensees wishing to implement the methods, procedures, or analyses in this RG, will need to submit a license amendment request (LAR) to amend the Technical Specifications to reflect incorporation of this RG. Also, 10 CFR Part 50, Appendix J, Option B, Paragraph B.3, states, in part, that, "if the licensee chooses to deviate from methods approved by the Commission and endorsed in a regulatory guide … [t]he submittal for technical specification revisions must contain justification, including supporting analysis."

Background

Appendix J to 10 CFR Part 50 requires the following types of containment leakage tests:

- Type A tests: integrated leakage rate tests (ILRTs)
- Type B tests: leakage tests across each pressure-containing or leakage-limiting boundary for specified primary reactor containment penetrations including seals, gaskets, and expansion bellows
- Type C tests: leakage tests of containment isolation valves

Type B and C tests are also referred to as local leakage-rate tests (LLRTs).

Maximum allowable leakage rates (L_a) are calculated in accordance with 10 CFR Part 100, "Reactor Site Criteria." (Ref. 7) Allowable leakage rates are typically about 0.1 percent containment volume per day for pressurized water reactors and about 1 percent containment volume per day for boiling water reactors.

Appendix J has two options to determine test frequencies: Option A (prescriptive) and Option B (performance-based). Under Option A, three Type A tests are to be performed at approximately equal intervals during each inservice inspection period. The Option B performance-based requirements, issued

in 1995, allow licensees to replace prescriptive testing requirements with testing requirements based on leakage rate performance and a supporting plant-specific risk impact assessment. Option B also introduced a requirement for visual inspection of accessible portions of the containment before each Type A test and at a periodic interval between tests. Licensees usually satisfy this requirement through the containment inservice inspection program conducted in accordance with American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPV Code), Section XI, Subsections IWE and IWL (Ref. 8), as incorporated by reference and conditioned in 10 CFR 50.55a, "Codes and standards."

NUREG-1493 is a detailed study of the impacts, costs, and risk of the Appendix J requirements and provided the methodology used to determine the acceptability of extended testing intervals. Sensitivity analyses in NUREG-1493 and other studies show that light-water reactor accident risk is relatively insensitive to the containment leakage rate because the risk is dominated by accident sequences that result in failure or bypass of containment. Reducing the frequency of Type A tests over extended periods, including up to 15 years, was found to lead to an imperceptible increase in risk. The estimated increase in risk is very small because (1) ILRTs identify only a few potential containment leakage paths that cannot be identified by Type B and Type C testing, and (2) the leaks that have been found by Type A tests have been only marginally above existing requirements. Given the insensitivity of risk to the containment leakage rate and the small fraction of leakage paths detected solely by Type A testing, increasing the interval between ILRTs is possible with minimal impact on risk to the public.

The performance-based, "Option B," containment leak test program is characterized by three areas (1) leakage rate testing, (2) containment inspections, and (3) risk impact. The following subsections provide the technical basis for each of these focus areas.

Leakage Rate Testing

RG 1.163, Revision 0, (Ref. 9) issued in September 1995, endorsed, with limitations and conditions, Nuclear Energy Institute (NEI) NEI 94-01, Revision 0, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J" (Ref. 10). NEI 94-01 provided guidance for the extension of Type A test intervals from roughly 3 years to 10 years, the extension of Type B intervals (except for airlocks) from 24 months (2 years) to a maximum of 120 months (10 years), and the extension of Type C intervals from 24 months (2 years) to 60 months (5 years).

An EPRI report, "Type C Containment Isolation Valve Performance" (Ref. 11), reviewed extended interval testing of Type C containment isolation valves at plants implementing NEI 94-01, Revision 0, and found that their performance had improved compared to the performance of Type C valves tested under Appendix J, Option A. Moreover, the failure trend did not appear to increase with service time.

This revision of RG 1.163, Revision 1, provides revised guidance for licensees to request license amendments to implement an Option B program that would allow 15-year Type A test intervals and 75-month Type C test intervals, provided adequate performance is demonstrated and maintained. Extension of the test intervals is based on (1) an acceptable performance history and (2) a plant-specific probabilistic risk assessment establishing that the risk increase associated with the extended intervals is small. Generally, NEI 94-01, Revision 3-A describes that an acceptable performance history is the successful completion of two consecutive tests in which the leakage rate was acceptable.

Containment Inspections

Together, the licensee's 10 CFR Part 50, Appendix J, Option B containment leakage testing program (consisting of ILRTs and LLRTs) and the 10 CFR 50.55a containment inservice inspection

program (consistent with ASME BPV Code, Section XI, Subsections IWE and IWL (Ref. 12)) are intended to ensure that containment structural and leakage integrity are maintained.

Licensees approved for Option B, must perform a general visual inspection of accessible interior and exterior surfaces of the containment system for structural deterioration that may affect the containment leak-tight integrity before each Type A test and at a periodic interval between tests based on the performance of the containment system. For those plants that have extended Type A test intervals to 15 years, a general visual inspection should be conducted prior to each Type A test and during at least three other outages before the next Type A test. These inspections should be performed in conjunction or in coordination with the ASME BPV Code, Section XI, Subsections IWE and IWL inspections required under 10 CFR 50.55a.

An important element of performance-based approaches to testing is the monitoring of performance to ensure that requirements and expectations are met. NUREG-1493 considered approximately 180 ILRT reports of tests performed under the original deterministic test intervals. It found five ILRT failures that could not be detected by local leakage rate testing. Tests under the extended intervals permitted by the performance-based approach show similar results. In 2001, many licensees began to submit requests for one-time ILRT interval extensions beyond 10 years, and it was deemed appropriate to assess the risk involved in extending ILRT intervals beyond ten years. For the operating reactors that received approval for a one-time, 15-year ILRT interval, no test failures have been reported as of this RG's issuance. Based upon operating experience, the instances of through-wall corrosion and fatigue degradation of metallic liners and shells that have occurred have been detected by visual examinations under the IWE program, not by ILRTs.

Error! Reference source not found.

Risk Impact

EPRI Report 1009325, "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," Revision 2-A, issued October 2008 (Ref. 13), provides (1) a generic assessment of the risks associated with a permanent extension of the ILRT surveillance interval to 15 years and (2) a risk informed methodology/template to be used to confirm the risk impact of the ILRT extension on a plant-specific basis. The report uses probabilistic risk assessment (PRA) methods, in combination with ILRT performance data and other considerations, to justify the extension of the ILRT surveillance interval.

Plants that rely on containment overpressure for net positive suction head for emergency core coolant system injection for certain accident sequences should address this in the risk assessment, due to the impact on the core damage frequency with the extension of the ILRT interval. In the EPRI PRA model, the failure rates for valves are assumed not to increase with time so that the likelihood of failure is simply proportional to the inspection interval (i.e., it assumes no new modes of failure are introduced). The likelihood of corrosion degradation of the liner is assumed to increase with time of service. The base rate of corrosion failure is based on service experience, and sensitivity studies are used to estimate the impact of increased instances of corrosion failures.

In these risk impact assessments, the models that evaluate the change in risk from extending the test intervals are based on the assumption that the effects from incipient causes for equipment failures accumulate linearly over time. Large extensions of the surveillance intervals may not appropriately test for effects from unexpected failure modes or failure causes that behave nonlinearly with time. However, performance results from the extended test intervals up to 15 years that have been applied by licensees to date do not indicate that any new failure modes have been identified. Limiting the increase in the maximum test intervals to 15 years for Type A tests and 75 months for Type C tests is prudent. Continual licensee monitoring of the performance of these test intervals and the staggered performance of LLRT tests ensure licensees can appropriately identify trends and correct deficiencies.

Consideration of International Standards

The International Atomic Energy Agency (IAEA) works with member states and other partners to promote the safe, secure, and peaceful use of nuclear technologies. The IAEA develops Safety Requirements and Safety Guides for protecting people and the environment from harmful effects of ionizing radiation. This system of safety fundamentals, safety requirements, safety guides, and other relevant reports, reflects an international perspective on what constitutes a high level of safety. To inform its development of this RG, the NRC considered IAEA Safety Requirements and Safety Guides pursuant to the Commission's International Policy Statement (Ref. 14) and Management Directive and Handbook 6.6, "Regulatory Guides" (Ref. 15).

The following IAEA Safety Requirements and Guides were considered in the update of the Regulatory Guide:

- IAEA Safety Guide SSG-53, "Design of the Reactor Containment and Associated Systems for Nuclear Power Plants," issued 2019 (Ref. 16)

Documents Discussed in Staff Regulatory Guidance

This RG endorses, with exceptions and clarifications, the use of one or more codes or standards developed by external organizations, and other third party guidance documents. These codes, standards and third party guidance documents may contain references to other codes, standards or third party guidance documents ("secondary references"). If a secondary reference has itself been incorporated by reference into NRC regulations as a requirement, then licensees and applicants must comply with that standard as set forth in the regulation. If the secondary reference has been endorsed in a RG as an acceptable approach for meeting an NRC requirement, then the standard constitutes a method acceptable to the NRC staff for meeting that regulatory requirement as described in the specific RG. If the secondary reference has neither been incorporated by reference into NRC regulations nor endorsed in a RG, then the secondary reference is neither a legally-binding requirement nor a "generic" NRC approved acceptable approach for meeting an NRC requirement. However, licensees and applicants may consider and use the information in the secondary reference, if appropriately justified, consistent with current regulatory practice, and consistent with applicable NRC requirements.

C. STAFF REGULATORY GUIDANCE

NEI 94-01, Revision 3-A, provides methods acceptable to the NRC staff for complying with the provisions of Option B in Appendix J to 10 CFR Part 50, subject to the following regulatory positions. Licensees wishing to use this RG should follow the regulatory positions identified in Section C of this RG in lieu of the "Limitations and Conditions" identified in the safety evaluation appended to NEI 94-01, Revision 3-A.

1. NEI 94-01, Revision 3-A, references ANSI/ANS-56.8-2002, "Containment System Leakage Testing Requirements" (Ref. 17), for detailed descriptions of the technical methods and techniques used for performing Types A, B, and C tests under Option B of Appendix J to 10 CFR Part 50. The NRC staff agrees with the methodology used in ANSI/ANS-56.8-2002 as well as the most recent methodology used in ANSI/ANS-56.8-2020 and accepts these as references for how licensees should perform the tests. The NRC staff has one condition for licensees referencing these standards. Specifically, for calculating the Type A leakage rate, the licensee should use the performance leakage rate definition in NEI 94-01, Revision 3-A, in lieu of that in ANSI/ANS-56.8-2002 or ANSI/ANS-56.8-2020. The definition contained in NEI 94-01, Revision 3-A, is more inclusive because it considers excessive leakage in the performance determination.

2. The licensee should submit a schedule of containment inspections to be performed before and between Type A tests as part of the LAR submittal for a Type A test interval extension.

3. The LAR should address the areas of the containment structure potentially subject to degradation. Specifically, the licensee should identify inaccessible areas of containment and describe consideration of inspections or viable, commercially available nondestructive examination (NDE) to monitor these areas for degradation. Specific areas identified that should be addressed include a number of containment pressure-retaining boundary components (e.g., seals and gaskets of mechanical and electrical penetrations, bolting penetration bellows) and a number of the accessible and inaccessible areas of the containment structures (e.g., moisture barriers, steel shells, and liners backed by concrete, inaccessible areas of ice-condenser containments that are potentially subject to corrosion). In addition, the LAR should also address such inaccessible degradation-susceptible areas in plant-specific inspections, using viable, commercially available NDE methods (such as boroscopes, guided wave techniques, etc.).

Error! Reference source not found.

4. As part of the LAR submittal, the licensee should provide information about any tests and inspections following major modifications to the containment structure, as applicable. The regulation at 10 CFR 50.55a(b)(2)(ix)(J) states, in part, that "[w]hen applying IWE–5000 to Class MC pressure-retaining components, any major containment modification or repair/replacement must be followed by a Type A test to provide assurance of both containment structural integrity and leak-tight integrity prior to returning to service." The revisions to the Type A interval described in NEI 94-01, Revision 3-A and this RG are limited to Type A testing for the purposes of satisfying Appendix J, and if licensees intend to depart from 50.55a(b)(2)(ix)(J), then licensees should submit an alternative request before implementation in accordance with 10 CFR 50.55a(z).

5. The normal Type A test interval should be less than 15 years. If a licensee desires to use the provision of Section 9.1 of NEI 94-01, Revision 3-A, related to extending the ILRT interval beyond 15 years, the licensee should demonstrate in a LAR that the extension is necessary due to an unforeseen emergent condition (see Regulatory Issue Summary 2008–27, "Staff Position on

Extension of the Containment Type A Test Interval Beyond 15 Years Under Option B of Appendix J to 10 CFR Part 50," dated December 8, 2008 (Ref. 18)).

6. For new reactor plants licensed under 10 CFR Part 52, applications requesting a permanent extension of the performance-based ILRT surveillance interval to 15 years, should be deferred until after the construction and testing of containments for that design have been completed and applicants have confirmed the applicability of NEI 94-01, Revision 3-A, and EPRI Report No. 1009325, Revision 2-A, including the use of past containment ILRT data.

7. When using the methodology in EPRI Report No. 1009325, Revision 2-A to permanently extend the ILRT interval to 15 years, the licensee should submit documentation indicating that the technical adequacy of the PRA used to support its performance-based Appendix J program is consistent with the guidance in RG 1.200, "Acceptability of Probabilistic Risk Assessment Results for Risk-Informed Activities," (Ref. 19), relevant to the ILRT extension application. RG 1.200 describes one acceptable approach for determining whether a base PRA, in total or the parts that are used to support an application, is sufficient to provide confidence in the results, such that the PRA can be used in regulatory decision-making for light-water reactors. A minimum of Capability Category I of the ASME PRA standard should be applied as the standard for assessing PRA quality for ILRT extension applications, since approximate values of core damage frequency (CDF) and large early release frequency (LERF) and their distribution among release categories are sufficient to support the evaluation of changes to ILRT frequencies. The assessment of external events may be taken from existing analyses, previously submitted to, and approved by the NRC staff, or from another alternate method of assessing an order of magnitude estimate for the contribution of the external event to the impact of the changed interval.

8. When using the methodology in EPRI Report No. 1009325, Revision 2-A to permanently extend the ILRT interval to 15 years, the licensee should submit documentation indicating that the estimated risk increase associated with extending the ILRT surveillance interval to 15 years is small. The methodology should quantitatively evaluate the risk impact of the ILRT extension. The most relevant risk metric is LERF, since the Type A test does not generally impact CDF. RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," (Ref. 20) provides guidance for determining the risk impact of plant-specific changes to the licensing basis. Additional risk metrics—including the increase in population dose and the increase in conditional containment failure probability—are also evaluated in EPRI Report No. 1009325, Revision 2-A to help ensure that the key safety principles in RG 1.174 are met.

9. The methodology in EPRI Report No. 1009325, Revision 2-A, is acceptable, except for the calculation of the increase in expected population dose (per year of reactor operation). To make the methodology acceptable, the average leak rate for the pre-existing containment large leak rate accident case (accident case 3b) used by the licensees should be 100 La [wt%/24-hour] instead of 35 La.

10. As part of the LAR submittal, the licensee should provide an evaluation if containment overpressure is relied upon for net positive suction head (NPSH) for emergency core cooling system (ECCS) injection for certain accident sequences. If the plant relies on containment overpressure for NPSH for ECCS injection for certain accident sequences, the plant may experience an increase in CDF as a result of the proposed change in the ILRT interval. For these plants, the ILRT evaluation should consider the impacts on both CDF and LERF and compare them with the risk acceptance guidelines in RG 1.174. RG 1.174 gives guidance for determining the risk impact of plant-specific changes to the licensing basis. EPRI Report No. 1009325,

Revision 2-A, provides that in the case where containment overpressure may be a consideration, that licensees should (1) examine their NPSH requirements to determine whether containment overpressure is required (and assumed to be
available) in various accident scenarios and (2) adjust the PRA model to account for this requirement if accident scenarios could be impacted by a large containment failure that eliminates the necessary containment overpressure. The combined impacts on CDF and LERF will be considered by the NRC staff in the ILRT evaluation and compared with the risk acceptance guidelines in RG 1.174.

11. The post-outage report described in NEI 94-01, Revision 3-A should include the margin between the LLRT leakage rate summation and its regulatory limit. If there are adverse trends in the Type B and Type C leakage rate summation, the licensee should include a statement in the LAR indicating that it will develop corrective actions to restore the margin to an acceptable level.

12. Use of the 9-month extension specified in NEI 94-01, Revision 3-A, Section 10.1, for eligible Type C valves should only be used for nonroutine emergent conditions. It should not be used for valves categorically restricted, those valves with a history of leakage, or any valves held to either a less than maximum interval or to the base refueling cycle interval.

13. The licensee should provide in the post-outage report a conservative estimate of the potential understatement in the Type B and Type C leakage rate totals and its acceptability determined as part of the trending specified in NEI 94-01, Revision 3-A, Section 12.1, “Report Requirements.”

14. When routinely scheduling any LLRT interval beyond 60 months and up to 75 months, the trending or monitoring of the primary containment leakage-rate testing program should include an estimate of the amount of understatement in the Type B and Type C total, and this estimate should be included in a licensee’s post-outage report. The report should include the reasoning and determination of the acceptability of the extension, demonstrating that the LLRT totals calculated represent the actual leakage potential of the penetrations.

D. IMPLEMENTATION

The NRC staff may use this RG as a reference in its regulatory processes, such as licensing, inspection, or enforcement. However, the NRC staff does not intend to use the guidance in this RG to support NRC staff actions in a manner that would constitute backfitting as that term is defined in 10 CFR 50.109, "Backfitting," and as described in NRC Management Directive 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests," (Ref. 21), nor does the NRC staff intend to use the guidance to affect the issue finality of an approval under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants." The staff also does not intend to use the guidance to support NRC staff actions in a manner that constitutes forward fitting as that term is defined and described in Management Directive 8.4. If a licensee believes that the NRC is using this RG in a manner inconsistent with the discussion in this Implementation section, then the licensee may file a backfitting or forward fitting appeal with the NRC in accordance with the process in Management Directive 8.4.

REFERENCES [1]

The References section applies to versions of the documents available at the time of this RG's issuance. Licensees or applicants using this RG should check all referenced documents to ensure no change has occurred since issuance of the RG.

1. *U.S. Code of Federal Regulations* (CFR), "Domestic Licensing of Production and Utilization Facilities," Part 50, Chapter 1, Title 10, "Energy."

2. CFR, "Licenses, Certifications, and Approvals for Nuclear Power Plants," Part 52, Chapter 1, Title 10, "Energy."

3. U.S. Nuclear Regulatory Commission (NRC), NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition," Washington, DC.

4. NRC, NUREG-1493, "Performance-Based Containment Leak-Test Program," NUREG-1493, July 1995. (ADAMS Accession No. ML20093H445).

5. Nuclear Energy Institute (NEI), NEI 94-01, Revision 3-A, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," July 2012. (ML12221A202).

6. ANSI/ANS-56.8-2020, "Containment System Leakage Testing Requirements," American Nuclear Society, LaGrange Park, IL, December 11, 2020.

7. CFR, "Reactor Site Criteria," Part 100, Title 10.

8. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPV Code), Section XI, Subsections IWE, "Requirements for Class MC and Metallic Liners of Class CC Components of Light-Water Cooled Plants."

9. NRC, Regulatory Guide (RG) 1.163, "Performance-Based Containment Leak-Test Program," Washington, DC, September 1995.

10. NEI, NEI 94-01, Revision 0, "Industry Guideline for Implementing Performance-Based Option of 10 CFR Part 50, Appendix J," Washington, DC, July 21, 1995.[2] (ML11327A025).

11. Electric Power Research Institute (EPRI) Report 1022599, "Type C Containment Isolation Valve Performance," Palo Alto, CA, March 2011. (ML110970450).

---

1 Publicly available NRC published documents are available electronically through the NRC Library on the NRC's public Web site at http://www.nrc.gov/reading-rm/doc-collections/ and through the NRC's Agencywide Documents Access and Management System (ADAMS) at http://www.nrc.gov/reading-rm/adams.html. The documents can also be viewed online or printed for a fee in the NRC's Public Document Room (PDR) at 11555 Rockville Pike, Rockville, MD. For problems with ADAMS, contact the PDR staff at 301-415-4737 or (800) 397-4209; fax (301) 415-3548; or e-mail pdr.resource@nrc.gov.

2 Publications from the Nuclear Energy Institute (NEI) are available at their Web site. http://www.nei.org/, or by contacting the headquarters at Nuclear Energy Institute, 1776 I Street NW, Washington DC 20006-3708, Phone: 202-739-800, Fax 202-785-4019.

12. American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code (BPV Code), Section XI, Subsections IWL, "Requirements for Class CC Concrete Components of Light-Water Cooled Plants."

13. EPRI Report 1009325, "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," Revision 2-A, Palo Alto, CA, October 2008.[3]

14. NRC, "Nuclear Regulatory Commission International Policy Statement," *Federal Register*, Vol. 79, No. 132, July 10, 2014, pp. 39415–39418.

15. NRC, Management Directive (MD) 6.6, "Regulatory Guides," May 2, 2016. (ML18073A170)

16. International Atomic Energy Agency (IAEA), IAEA Safety Guide SSG-53, "Design of the Reactor Containment and Associated Systems for Nuclear Power Plants," Vienna, Austria, 2019.[4]

17. American National Standards Institute (ANSI)/American Nuclear Society (ANS), ANSI/ANS-56.8-2002, "Containment System Leakage Testing Requirements," American Nuclear Society, LaGrange Park, IL, November 27, 2002. [5]

18. NRC, Regulatory Issue Summary 2008-27, "Staff Position on Extension of the Containment Type A Test Interval Beyond 15 Years Under Option B of Appendix J to 10 CFR Part 50," Washington, DC, December 8, 2008. (ML080020394)

19. NRC, RG 1.200, "Acceptability of Probabilistic Risk Assessment Results for Risk-Informed Activities," Washington, DC.

20. NRC, RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Washington, DC.

21. NRC, MD 8.4, "Management of Backfitting, Forward Fitting, Issue Finality, and Information Requests," Washington, DC.

3 Copies of Electric Power Research Institute (EPRI) standards and reports may be purchased from EPRI, 3420 Hillview Ave., Palo Alto, CA 94304; telephone (800) 313-3774; fax (925) 609-1310.

4 Copies of International Atomic Energy Agency (IAEA) documents may be obtained through their Web site, WWW.IAEA.Org/, or by writing the International Atomic Energy Agency, P.O. Box 100 Wagramer Strasse 5, A-1400 Vienna, Austria.

5 Copies of American Nuclear Society (ANS) standards may be purchased from the ANS Web site (http://www.new.ans.org/store/) or by writing to: American Nuclear Society, 555 North Kensington Avenue, La Grange Park, Illinois 60526, U.S.A., Telephone 800-323-3044.