RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**306-8240**
SRP Section:	**06.02.06 - Containment Leakage Testing**
Application Section:	**6.2.6**
Date of RAI Issue:	**11/16/2015**

Question No. 06.02.06-2

10 CFR Part 50, Appendix J, requires preoperational and periodic containment leakage rate testing in accordance with the prescriptive requirements in Option A or the performance-based requirements in Option B. DCD Tier 2, Section 6.2.6, specifies the use of Option B for Type A, B, and C containment leakage rate testing. Regulatory guide (RG) 1.163, “Performance-Based Containment Leak-Test Program,” endorses NEI 94-01, Revision 0 for an acceptable method for complying with Option B. NEI 94-01 references ANSI/ANS 56.8-1994. DCD Tier 2, Section 6.2.4.2 and Section 14.2.1.120 reference that Type B and C leak rate testing is done in accordance with ANSI/ANS 56.8-1994. However, DCD Sections 6.2.4.4 and 6.2.6 reference that testing is done in accordance with ANSI/ANS 56.8 (Reference 31 which indicates 2002 version). The forward to ANSI/ANS 56.8-2002 states that it was issued as an update to the 1994 version of ANS standard and that its intended purpose is to consolidate the guidance from RG 1.163, NEI 94-01, and ANS 56.8-1994 into one document that could be referenced in the Technical Specifications. The NRC has not yet reviewed and accepted the 2002 version.

Submit ANSI/ANS 56.8-2002 for formal NRC review and approval and provide an explanation of how it comports with RG 1.163, NEI 94-01, and ANS 56.8-1994, or modify the DCD to reference ANSI/ANS 56.8-1994 throughout.

Response

The containment integrated leakage rate test (CILRT) discussed in DCD Tier 2, Subsections 6.2.4.4 and 6.2.6 conforms with 10 CFR Part 50, Appendix J, Option B (Reference 37), and follows the guidance of NRC RG 1.163. The test is performed in accordance with NEI 94-01 and ANSI/ANS 56.8-1994. The “November 2002” date of Reference 31 will be changed to “August 1994” in DCD Tier 2, Subsection 6.2.9.

Impact on DCD

DCD Tier 2, Subsection 6.2.9 will be revised, as indicated in the attachment associated with this response.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

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

31. ANSI/ANS 56.8, "Containment System Leakage Testing Requirement," American Nuclear Society, ~~November 2002~~ August 1994.

32. 10 CFR 20.1406, "Radiological Criteria for Unrestricted Use," U.S. Nuclear Regulatory Commission.

33. Regulatory Guide 4.21, "Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning," U.S. Nuclear Regulatory Commission.

34. 10 CFR Part 50, Appendix A, General Design Criterion 52, "Capability for Containment Leakage Rate Testing," U.S. Nuclear Regulatory Commission.

35. 10 CFR Part 50, Appendix A, General Design Criterion 53, "Provisions for Containment Testing and Inspection," U.S. Nuclear Regulatory Commission.

36. 10 CFR Part 50, Appendix A, General Design Criterion 54, "Systems Penetrating Containment," U.S. Nuclear Regulatory Commission.

37. 10 CFR Part 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors," Option B, "Performance-Based Requirements," U.S. Nuclear Regulatory Commission.

38. ASME Section III, Division 2, Article CC 2520, "Fracture Toughness Requirements for Materials," The American Society of Mechanical Engineers.

39. ASME Section III, Division 1, Article NE 2300, "Fracture Toughness Requirements for Material," The American Society of Mechanical Engineers.

40. NUREG-0800, Section 6.2.1.2, "Subcompartment Analysis," Rev. 3, U.S. Nuclear Regulatory Commission, March 2007.

41. NRC RG 1.141, "Containment Isolation Provisions for Fluid Systems."

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Question No. 06.02.06-4

10 CFR Part 50, Appendix J, Option B, Section V.B.3 requires justification; including supporting analyses if a licensee (applicant) chooses to deviate from methods endorsed in the regulatory guide. As noted in the above RAI questions, there appear to be implied exceptions. Further, DCD Tier 2, Chapter 16 Technical Specifications (TS) Bases Section B 3.6.1 states "…comply with 10 CFR 50, Appendix J, Option B..., as modified by approved exemptions." DCD Tier 2, Chapter 16 TS Section 5.5.16 has similar words related to RG 1.163. "

Please provide a list of any requested deviations or exemptions from Appendix J or RG 1.163 along with justification and supporting analyses in the DCD.

Response

DCD Tier 2, Chapter 16, Subsection 5.5.16 and TS B 3.6.1 do not have any deviations or exemptions from 10 CFR 50, Appendix J or RG 1.163. DCD Tier 2, Chapter 16, Subsection 5.5.16 and TS B 3.1.6 will be revised to clarify that there are no deviations or exemptions from 10 CFR 50, Appendix J or RG 1.163, as indicated in the attachment associated with this response.

Impact on DCD

DCD Tier 2, Chapter 16, Subsection 5.5.16 and TS B 3.6.1 will be modified, as indicated in the attachment associated with this response.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

Same as changes described in impact on DCD section.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

5.5 Programs and Manuals

5.5.15 Safety Function Determination Program (SFDP) (continued)

a. A required system redundant to the system(s) supported by the inoperable support system is also inoperable, or

b. A required system redundant to the system(s) in turn supported by the inoperable supported system is also inoperable, or

c. A required system redundant to the support system(s) for the supported systems (a) and (b) above is also inoperable.

The SFDP identifies where a loss of safety function exists. If a loss of safety function is determined to exist by this program, the appropriate Conditions and Required Actions of the LCO in which the loss of safety function exists are required to be entered. When a loss of safety function is caused by the inoperability of a single Technical Specification support system, the appropriate Conditions and Required Actions to enter are those of the support system.

5.5.16 Containment Leakage Rate Testing Program

a. A program shall establish the leakage rate testing of the containment as required by 10 CFR 50.54(o) and 10 CFR 50, Appendix J, Option B~~, as modified by approved exemptions~~. This program shall be in accordance with the guidelines contained in NRC RG 1.163, "Performance- Based Containment Leak-Test Program," dated September, 1995~~, as modified by the following exceptions~~:

~~1. The visual examination of containment concrete surfaces intended to fulfill the requirements of 10 CFR 50, Appendix J, Option B testing, will be performed in accordance with the requirements of and frequency specified by the ASME Section XI Code, Subsection IWL, except where relief has been authorized by the NRC.~~

~~2. The visual examination of the steel liner plate inside containment intended to fulfill the requirements of 10 CFR50, Appendix J, Option B, will be performed in accordance with the requirements of and frequency specified by the ASME Section XI Code, Subsection IWE, except where relief has been authorized by the NRC.~~

b. The calculated peak containment internal pressure for the design basis loss of coolant accident, P_a is 51.77 psig. The containment design pressure is 60 psig.

c. The maximum allowable containment leakage rate, L_a at P_a, shall be 0.1 % of containment air weight per day.

B 3.6 CONTAINMENT SYSTEMS

B 3.6.1 Containment

BASES

BACKGROUND

The containment consists of the concrete reactor building (RB), its steel liner, and the penetrations through this structure. The structure is designed to contain radioactive material that could be released from the reactor core following a design basis loss of coolant accident (LOCA). Additionally, this structure provides shielding from the fission products that could be present in the containment atmosphere following accident conditions.

The containment is a reinforced concrete structure with a cylindrical wall, a flat foundation mat, and a shallow dome roof. For containments with ungrouted tendons, the cylinder wall is prestressed with a post tensioning system in the vertical and horizontal directions, and the dome roof is prestressed using a three way post tensioning system. The inside surface of the containment is lined with a carbon steel liner to ensure a high degree of leak tightness during operating and accident conditions.

The concrete RB is required for structural integrity of the containment under design basis accident (DBA) conditions.

The steel liner and its penetrations establish the leakage limiting boundary of the containment. Maintaining the containment OPERABLE limits the leakage of fission product radioactivity from the containment to the environment. SR 3.6.1.1 leakage rate requirements comply with 10 CFR Part 50, Appendix J, Option B (Reference 4), ~~as modified by approved exemptions~~.

The isolation devices for the penetrations in the containment boundary are a part of the containment leak tight barrier. To maintain this leak tight barrier:

a. All penetrations required to be closed during accident conditions are either:

   1. Capable of being closed by an OPERABLE automatic containment isolation system.

   2. Closed by manual valves, blind flanges, or de-activated automatic valves secured in their closed positions, except as provided in LCO 3.6.3, “Containment Isolation Valves.”

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RAI No.: **306-8240**

SRP Section: **06.02.06 - Containment Leakage Testing**

Application Section: **6.2.6**

Date of RAI Issue: **11/16/2015**

Question No. 06.02.06-7

DCD Tier 2, Section 6.2.6 specifies the use of Appendix J, Option B, for Type A, B, and C containment leakage rate testing. Regulatory Guide (RG) 1.163 endorses NEI-01, Revision 0 for an acceptable method for complying with Option B. NEI references ANS/ANS 56.8-1994. Standard Review Plan (SRP) Section 6.2.6 and ANS-56.8 (Section 6.2) specify that all containment isolation valves (CIVs) are to be tested so that the test pressure is applied in the same direction that would occur in a design basis accident (DBA), unless such testing would give equivalent or more conservative results.

In order to ensure compliance with this guidance, please provide (or indicate where in the DCD application it is provided):

1) A list of those CIVs that will be locally (Type C) leakage rate tested with test pressure applied in a direction opposite to that which would occur in a DBA.

2) For each CIV identified in 1), above, please justify that any Type C containment leakage test results conducted in such manner will result in equivalent or more conservative test results.

3) Also, provide DCD figures that are complete and meet the Type C test requirements and guidance related to test direction or provide the required exemption requests and justification.

Response

The CIVs listed in Table 6.2.4-1 will be tested with test pressure applied in the same direction as that which would result from a DBA, except for VQ-V0012, V0013, V0032, and V0033 of Reactor Containment Bldg. Purge System. These four valves are a type of butterfly valve with concentric stem and non-tapered seat, and can be tested in the reverse direction according to ANSI/ANS 56.8-1994, 6.2, (1). The test direction of these CIVs will be shown on Figure 6.2.4-1

on the applicants markups associated with the response to RAI 306-8240, Question 06.02.06-5 and individual system piping and instrumentation diagrams (P&IDs).

Impact on DCD

Please refer to the attachment associated with RAI 306-8240, Question 06.02.06-5.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

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Application Section:	**6.2.6**
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Question No. 06.02.06-10

Appendix J, Option A, Section III.A.1(a), requires that no repairs or adjustments be made to the containment prior to the performance of the containment integrated leakage rate test (CILRT) so that the containment can be tested in as close to the “as is” condition as practical. Under Option B, RG 1.163 endorses NEI 94-01, Revision 0 (with certain exceptions), which provides similar guidance in Section 8.0 and 9.0.

Provide information in the DCD that during the period between the initiation of the containment inspection and the performance of the Type A test, no repairs or adjustments shall be made so that the containment can be tested to the “as-is” condition as practical.

Response

The information for the test prerequisite that no repairs or adjustments be made to the containment prior to the performance of the containment integrated leakage rate test will be added to DCD Tier 2, Subsection 6.2.6.1, as indicated in the attachment associated with this response.

Impact on DCD

DCD Tier 2, Subsection 6.2.6.1 will be revised, as indicated in the attachment associated with this response.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

detection and correction of leak paths through the containment without pressurizing the entire containment structure. These local leakage rate tests are the Type B and C tests described in Subsections 6.2.6.2 and 6.2.6.3.

b. The accessible interior and exterior surfaces of the containment structures and components are inspected for any evidence of structural deterioration that may affect either the containment structural integrity or leak-tightness. Any evidence of structural deterioration is corrected before the Type A test is performed.

c. Following the completion of the Type C tests, the containment isolation valves are positioned to their normal operational position and subsequently repositioned to their post-accident position by normal methods with no accompanying adjustment. The normal and post-accident positions of the containment isolation valves are listed in Table 6.2.4-1.

d. During preoperational testing, a structural integrity test is performed prior to the CILRT.

f. During the period between initiation of the containment inspection and performance of the Type A test, no repairs or adjustments shall be made so that the containment can be tested in as close to the "as-is" condition as practical.

e. Test instruments are calibrated prior to the CILRT.

The pathways of venting and draining are established as follow:

a. Systems that are isolated following a LOCA are properly isolated, drained, or vented to reflect their worst potential status to provide reasonable assurance that the Type A test results reflect LOCA conditions.

b. Portions of the fluid systems that are a part of the reactor coolant pressure boundary and are opened directly to the containment atmosphere due to the accident conditions.

c. Portions of the closed systems inside the containment that penetrate the containment and could be postulated to rupture as a result of a LOCA are vented to the containment atmosphere.