Technical Advisory Committee of the Nuclear Risk Research Center
Central Research Institute of Electric Power Industry
1-6-1 Otemachi, Chiyoda-ku, Tokyo, 100-8126 Japan

May 26, 2025

Dr. George Apostolakis
Director, Nuclear Risk Research Center
Central Research Institute of Electric Power Industry
1-6-1 Otemachi, Chiyoda-ku
Tokyo, 100-8126 Japan

SUBJECT: RISK-INFORMED CONTAINMENT VESSEL LEAK RATE TESTING GUIDELINE

Dear Dr. Apostolakis:

During the 22nd meeting of the Technical Advisory Committee of the Nuclear Risk Research Center (NRRC), May 19-23, 2025, we met with representatives of the NRRC staff to discuss the guidance for implementation of risk-informed containment vessel leak rate testing programs at Japanese nuclear power plants. This letter report documents our review of the guidance in Report NR24002, "Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan," Draft Revision 2, dated April 2025.

CONCLUSIONS AND RECOMMENDATIONS

1. Draft Revision 2 of Report NR24002, "Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan" contains enhancements that adequately resolve the comments and recommendations in our January 13, 2025 letter report.

2. The Guideline should be issued for use.

3. Trial applications of the guidance should be performed for a PWR unit and a BWR unit. The trial applications should be conducted in parallel with the planned activities to include this risk-informed testing option in an NRA-approved update to Japan Electric Association Code JEAC4203-2017.

BACKGROUND

This Guideline provides the methods and guidance to support a risk-informed alternative to the Type A containment vessel leak rate testing (CVLRT) intervals that are specified in Japan Electric Association Code JEAC4203-2017. Implementation

of this risk-informed, performance-based initiative will be a very important achievement for the Japanese nuclear industry. It will demonstrate how risk information, in combination with objective performance goals, can be used to provide assurance of continued high reliability of the containment function, while reducing radiation doses to utility personnel and improving overall plant availability.

We have had several briefings and information exchanges on this topic with the NRRC staff, and we have reviewed draft versions of the supporting methods and guidance. Our January 13, 2025 letter report on "Interim Review of Risk-Informed Containment Vessel Leak Rate Testing Guideline" contained several important conclusions about the guidance for the scope of the supporting analyses, quantitative evaluation methods, risk metrics, and acceptance criteria. We also summarized a few recommended enhancements for specific elements of the guidance.

The NRRC research team has updated the guidance to address our comments and recommendations. This report summarizes our review of the current Guideline, with primary emphasis on the changes since our January 2025 letter report.

DISCUSSION

Draft Revision 2 of Report NR24002, "Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan" contains enhancements that adequately resolve the comments and recommendations in our January 2025 letter report. The Guideline should be issued for use.

We understand that the Japan Electric Association (JEA) is currently reviewing these methods and guidance to support the inclusion of an alternative risk-informed Type A containment leak rate testing interval option in a planned update to JEAC4203-2017. The JEA guidance must be approved by the Nuclear Regulation Authority (NRA) before it can be used by the utilities to change the test intervals.

This initiative is an important advancement in the Japanese nuclear industry's implementation of risk-informed, performance-based management of plant safety. The Guideline contains comprehensive guidance and methods that support an integrated application of the fundamental principles of risk-informed decision-making.

Experience has shown that these types of initiatives benefit significantly from the performance of trial applications at one or more power plants. Those trial applications provide valuable practical experience with the use of the methods and guidance, and integration of the assessment results to support the risk-informed, performance-based testing program. The trial applications often result in refinements of the methods and guidance that are difficult to anticipate without that practical experience.

Trial applications of the methods and guidance in Report NR24002 should be conducted to provide this valuable experience and feedback. Considering the differences in the current testing requirements, one trial application should be performed for a PWR unit, and one application should be performed for a BWR unit.

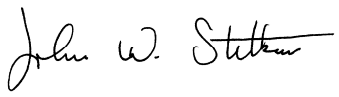
Each application should exercise all elements of the guidance. The intent is to demonstrate and document the plant-specific quantitative and qualitative information that is needed to support an actual change to the testing interval, including possible enhancements of compensatory measures to provide increased confidence that the risk will be managed effectively.

The trial applications will identify any needed enhancements to the final guidance before it is implemented by all utilities. It is highly beneficial to learn from this experience. Therefore, the trial applications should be conducted in parallel with the planned activities to include this risk-informed testing option in an NRA-approved update to JEAC4203-2017.

Experience has also shown that these types of initiatives benefit substantially if the utilities and the regulator develop a mutual understanding of the methods and guidance, and how they are used in practice to support the final risk-informed decisions. This initiative would benefit substantially from periodic briefings and information exchanges with the NRA staff throughout the execution of each trial application.

We look forward to our continuing interactions with the NRRC staff as this important risk-informed initiative progresses to its final implementation.

Sincerely,



John W. Stetkar
Chairman

REFERENCES

1. United States Code of Federal Regulations, 10 CFR 50, Appendix J, "Primary Reactor Containment Leakage Testing for Water-Cooled Power Reactors, Option B – Performance-Based Requirements."

2. Electric Power Research Institute, EPRI 1018243, "Risk Impact Assessment of Extended Integrated Leak Rate Testing Intervals," Revision 2-A of EPRI 1009325, October 2008.

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

4. Japan Electric Association Nuclear Standards Committee, JEAC4203-2017, "Implementation Guidelines for Containment Vessel Leak Rate Test," 2017.

5. United States Nuclear Regulatory Commission, NUREG-1855, "Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decisionmaking", Revision 1, March 2017.

6. United States Nuclear Regulatory Commission, Regulatory Guide 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 3, January 2018.

7. International Atomic Energy Agency, IAEA-TECDOC-1909, "Considerations on Performing Integrated Risk Informed Decision Making," 2020.

8. Atomic Energy Society of Japan, Standard AESJ-SC-S012E:2019, "Implementation Standard Concerning Integrated Risk-Informed Decision Making for the Continuous Safety Improvements in Nuclear Power Plants: 2019," March 2022.

9. United States Nuclear Regulatory Commission, Regulatory Guide 1.163, "Performance-Based Containment Leak-Test Program", Revision 1, June 2023.

10. Nuclear Risk Research Center, "Draft Guidelines for Containment Vessel Leak Rate Test," Presentation to NRRC Technical Advisory Committee, May 2023, Proprietary.

11. Technical Advisory Committee of the Nuclear Risk Research Center, "Risk-Informed Changes to Containment Vessel Leak Rate Testing Interval," May 24, 2023.

12. Nuclear Risk Research Center, "Risk-Informed Containment Vessel Leak Rate Test (CVLRT) Program," Presentation to NRRC Technical Advisory Committee, November 2023, Proprietary.

13. Nuclear Risk Research Center, Study Report SE00000, "Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan," February 2024, Proprietary.

14. Stetkar, J. W., "Comments and Questions on Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan, Draft Study Report SE00000," February 27, 2024, Confidential.

15. Nuclear Risk Research Center, "Draft Guidelines for Risk-Informed Containment Vessel Leak Rate Testing (CVLRT)," Presentation to NRRC Technical Advisory Committee, May 2024, Proprietary.

16. Nuclear Risk Research Center, Study Report NR24002, "Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan," August 2024, Proprietary.

17. Nuclear Risk Research Center, "Draft Report for Risk-Informed Containment Vessel Leak Rate Testing (CVLRT)," Presentation to NRRC Technical Advisory Committee, November 2024, Proprietary.

18. Stetkar, J. W., "Comments and Questions on Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan, CRIEPI Report NR24002, August 2024," November 19, 2024, Confidential.

19. Technical Advisory Committee of the Nuclear Risk Research Center, "Interim Review of Risk-Informed Containment Vessel Leak Rate Testing Guideline," January 13, 2025.

20. Nuclear Risk Research Center, "TAC Report Titled 'Interim Review of Risk-Informed Containment Vessel Leak Rate Testing Guideline' (13 January 2025)," January 21, 2025.

21. Nuclear Risk Research Center, Study Report NR24002, "Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan," Draft Revision 1, January 2025, Proprietary.

22. Nuclear Risk Research Center, "Response to Chairman Stetkar's Comments on the CVLRT Report," March 14, 2025, Confidential.

23. Nuclear Risk Research Center, Study Report NR24002, "Feasibility Study on Risk-Informed Reactor Containment Vessels Test Interval Extension in Japan," Draft Revision 2, April 2025, Proprietary.

24. Nuclear Risk Research Center, "Final Report on the Risk-Informed Containment Leak Rate Test (CVLRT) Guidelines," Presentation to NRRC Technical Advisory Committee, May 2025, Proprietary