

Technical Advisory Committee of the Nuclear Risk Research Center  
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**SUBJECT: INTERNAL FLOODING PRA GUIDE**

Dear Dr. Apostolakis:

During the 23rd meeting of the Technical Advisory Committee of the Nuclear Risk Research Center (NRRC), November 17-21, 2025, we met with representatives of the NRRC staff to discuss methods and guidance for analyses of the risk from internal floods at Japanese nuclear power plants. This letter report documents our review of the guidance in "Internal Flooding PRA Guide for Use by the Japanese Nuclear Industry," dated September 2025.

Mr. Afzali worked closely with the NRRC research teams to support their development of several important elements of this Guide. He did not participate in our deliberations for this letter report.

## **CONCLUSIONS AND RECOMMENDATIONS**

1. The analytical methods in the Guide are consistent with the best international state-of-practice for evaluation of the risk from internal flooding events. The guidance provides a systematic process to develop, refine, and document the internal flooding models and their supporting analyses.
2. A pilot plant application of all tasks in the Guide should be performed for at least one Japanese nuclear power plant, with its current design and configuration.

## **BACKGROUND**

Internal floods are often an important contribution to nuclear power plant risk. That contribution depends very strongly on the plant-specific design, physical layout, routing of pipes, operating and maintenance practices, and flood mitigation programs. Therefore, it is very important that each plant should include a comprehensive

analysis of internal floods in a good-quality full-scope probabilistic risk assessment (PRA).

A comprehensive understanding of the risk from internal floods and its contributors allows utility decision-makers to develop programs, practices, and possible plant modifications that will effectively manage the risk and improve plant safety. It also supports implementation of important risk-informed applications such as on-line maintenance, inservice inspection programs, and other industry or plant-specific initiatives; use of risk information to address regulatory inspections and other issues; and discussions with public stakeholders.

## **DISCUSSION**

The NRRRC Guide is based primarily on analytical methods that were developed by the Electric Power Research Institute (EPRI). Those methods have been used in numerous evaluations of the risk from internal floods in U.S. nuclear power plants. The NRRRC methods and guidance benefit from practical lessons learned from use of the EPRI guidance in the U.S. and from NRRRC experience with a preliminary assessment of the risk from internal floods for a Japanese "model plant" configuration.

The Guide supports a comprehensive evaluation of the risk from all flooding sources in each plant area. It emphasizes use of the PRA models for internal initiating events as the foundation for the internal flooding plant response model. The hierarchy of Flooding Sources, Flooding Mechanisms, and Flooding Modes provides a coherent framework for the identification of flood initiating events and their causes, and quantification of their frequencies. The scenario-based context of the Flood Propagation Event Trees (FPETs) provides a structured process to derive, document, and quantify the functional impacts from each flood. The methodology provides a systematic, risk-informed approach to progressively refine the models and analyses for the most risk-significant flood areas and scenarios. These analytical methods and guidance are consistent with the best international state-of-practice for evaluation of the risk from internal flooding events.

The Guide emphasizes the importance of plant walkdowns to compile crucial location-specific information to support the flooding analyses. We agree fully with that emphasis. Section 1.4 of Volume 1 and the more detailed walkdown guidance in Chapter 01, Chapter 03, and Appendix C of Volume 2 describe three types of walkdowns that are typically performed to derive progressively more detailed information as the analyses are refined. The first type of walkdown is a Plant Familiarization Walkdown, which is performed to compile information to support the initial analyses. However, the discussion of "Verification of Information Accuracy" in Section 1.4 of Volume 1 seems to over-emphasize reliance on plant drawings and design documents as the primary source of information to support those initial analyses, in lieu of a thorough Plant Familiarization Walkdown. Analysts may misinterpret the intent of that discussion. Drawings and documents can certainly provide useful introductory information about the plant. However, they should not be used as a surrogate for the information that is obtained from a comprehensive walkdown.

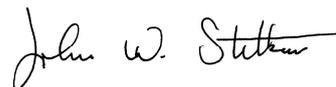
A preliminary demonstration of internal flooding risk analysis methods has been performed for a "model plant" that is based on a Japanese plant design. Experience from that study was used to support elements of the NRRC methods and guidance. However, the "model plant" study did not systematically apply all of the analysis tasks and methods that are recommended in the Guide.

Experience has shown that guidance for complex analyses like a comprehensive evaluation of internal flooding risk often benefits significantly from the performance of trial applications at one or more power plants. The trial applications provide valuable practical experience with the use of the methods and guidance. They often result in refinements that are difficult to anticipate without that experience.

A pilot plant application of all tasks in the Guide should be performed for at least one Japanese nuclear power plant, with its current design and configuration. To better understand how some tasks may be affected by plant-specific design features, layout, operating and maintenance practices, and maturity of the available PRA models, it is generally preferable to perform pilot plant applications for more than one plant (e.g., a PWR and a BWR). The pilot plant application should be a complete demonstration of how the guidance is used in practice, and not a comparative assessment of general similarities and differences with the "model plant" study and its results. The pilot plant applications will identify any needed enhancements to the final guidance before it is implemented by all utilities.

We look forward to further discussions on this important topic, and to learn how the Guide will be revised to account for the experience and lessons learned from the trial applications.

Sincerely,



John W. Stetkar  
Chairman

## REFERENCES

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