

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 30, 2023

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: PRELIMINARY NRRC RESEARCH PLAN FOR FISCAL YEAR 2024

Dear Dr. Apostolakis:

During the 18th meeting of the Technical Advisory Committee of the Nuclear Risk Research Center (NRRC), May 15-19, 2023, we met with the NRRC staff to review the proposed preliminary research plan for fiscal year 2024. The purpose of our review was to provide comments on the technical merits of the research plan and its relevance for supporting the NRRC's current mission.

This letter report marks a change to the schedule for our research plan reviews. Our discussions with the NRRC management and research staff have provided us with a better appreciation of the time and effort that are involved with development of the annual research plan, including consultations and approvals by the Japanese industry sponsors. We understand that our technical input and recommendations will be more timely and effective when they are provided while the research plan is in its formative stages. This is especially important for your consideration of our initial technical input on proposed innovative methods and major new research projects. Therefore, beginning with this report, we will now conduct our annual review of the proposed preliminary research plan in May, rather than November.

CONCLUSIONS AND RECOMMENDATIONS

1. The overall scope of the preliminary research plan for fiscal year 2024 and the technical objectives of the individual projects within each major research area remain consistent with the NRRC short-, intermediate-, and long-term goals.
2. We are pleased that the preliminary plan includes our recommended research activity to develop methods and practical guidance for the integration of PRA models and aggregation of results to provide a full-scope assessment of the overall plant risk and its contributors. This is a challenging task. The guidance will enhance the utilities' consistent use of the PRA to support their risk-informed decision-making programs, discussions with the Nuclear Regulation Authority,

and communications with the public. We look forward to regular interactions with the research teams as this project progresses.

3. During our review, we identified three individual research activities that merit additional attention in the preliminary plans for fiscal year 2024 and subsequent years. Our recommendations for those activities are summarized in the Discussion section of this report.

BACKGROUND

One of the most important objectives of the research plan is to present the technical context of the research needs, including the rationale for prioritization and scope of the research, current state of knowledge, and potential contributions and significance of the research to the goals of the center. Our review of the preliminary research plan focused on the objectives of each research project and its supporting tasks, the technical relationships and relative priorities among those activities, and any major needs for additional research. We did not review the technical details of individual research activities or their completion milestones, except as needed to understand how those activities are integrated throughout the plan. We will comment separately on the technical elements of individual research projects in our future detailed reviews of those projects.

DISCUSSION

During this review, we were briefed on continuing and planned projects in each research area, the major technical tasks in each project, the current status of each task, known or potential problem issues, and the estimated schedule for completion of each task.

A relatively short time has passed between our November 2022 review of the final research plan for fiscal year 2023 and the research teams' efforts to begin preparation of the preliminary plan for fiscal year 2024. Therefore, details of most research projects and supporting tasks have not changed significantly, with only updates to their progress and completion schedules. During our discussions, the research teams confirmed that specific research tasks will incorporate recommendations from our November 27, 2022 letter report. The overall scope of research for fiscal year 2024 and the technical objectives of the individual projects within each major research area remain consistent with the NRRC short-, intermediate-, and long-term goals.

Based on our review of the preliminary research plans and our discussions with the research teams, we offer the following recommendations for further assessments of three individual research activities.

(1) Development of Risk-Informed Decision-Making Guidance

A continuing research activity involves the development of guidance for the utilities' implementation of an infrastructure and programs that will support integrated risk-informed decision-making (RIDM) in all aspects of plant operations and management.

RIDM is an effective process in which risk insights obtained from a PRA model are used in combination with prescriptive and deterministic inputs as well as good engineering practices, consideration of operating experience, and sound management oversight to improve safety while increasing operational flexibility. In the United States, there are a number of different programs that benefit from the RIDM concepts, practices, and principles. The two main categories are:

- Category 1 - Voluntary and required Risk-Informed Performance-Based (RIPB) programs that are used to meet regulatory requirements. Examples of voluntary programs include Risk-Informed Inservice Inspection (RI-ISI), Risk-Informed Allowed Completion Times (also known as "RIPB AOT" or "Initiative 4b"), RIPB Surveillance Frequency Program (also known as "Initiative 5b"), RIPB Fire Protection Program, Risk-Informed Categorization of Structures, Systems, and Components (SSCs), etc. Use of a voluntary RIPB program to meet regulatory requirements necessitates Nuclear Regulatory Commission (NRC) approval via a License Amendment and is typically undertaken when an NRC-endorsed RIPB program is available. An example of a regulatory-required RIPB program is the suite of programs that are needed to support meeting the 10 CFR 50.65 Maintenance Rule requirements.
- Category 2 - Voluntary RIPB programs that do not require regulatory approval and are primarily used to improve efficiency and enhance the safety-focused effectiveness of operational programs. Examples of such programs include use of risk insights for (a) operator training, (b) prioritizing items in the corrective action program, (c) internal quality control related inspections, (d) plant staff awareness of risk-sensitive plant configurations, etc.

Utilization of the voluntary Category 1 RIPB programs is subject to a regulatory framework that is still maturing in Japan. The NRRC should continue its support for enabling the currently-envisioned voluntary Category 1 RIPB programs, while monitoring regulatory framework evolution.

We recommend that the NRRC research team should focus their near-term activities on the development of guidance to enable utilities to take advantage of Category 2 RIPB programs. These are equally important as Category 1 voluntary RIPB programs and can be implemented sooner. These processes provide a consistent, transparent, and balanced approach to safety and operational flexibility, while allowing optimization of resources. Improved safety is achieved by providing information that increases the plant staff's awareness of factors that influence overall plant risk (e.g., equipment failures, personnel actions, maintenance configurations, etc.). A comprehensive understanding of a plant's risk profile also allows prioritization and effective use of resources to address the more risk-significant SSCs and issues, while conserving resources that might be inappropriately applied to less risk-significant concerns. Development of guidance for Category 2 RIPB

programs and implementation of those programs at each plant will also allow the NRRC research team, the utilities, and industry organizations to become experienced in the practical use of RIDM concepts and the supporting programmatic elements such as use of an integrated decision-making panel.

(2) Spent Fuel Risk Assessment

We are pleased that the preliminary research plan includes a more explicit activity for the development of methods and guidance for an evaluation of the risk from damage to stored spent fuel. The scope of these analyses includes fuel damage (Level 1 risk) and offsite releases (Level 2 risk). A trial application of the methods is currently planned to begin in fiscal year 2026.

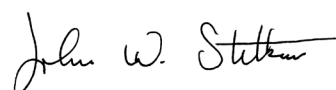
The preliminary plan and individual research tasks continue to focus on evaluation of the risk only during low power and shutdown plant operating states. In our letter reports for the fiscal year 2022 and 2023 research plans, we explained why it is important for the scope of this research to integrate the analyses of spent fuel risk with the PRA models for damage to fuel in the reactor core during full power, low power, and shutdown modes. Beginning in fiscal year 2024, the scope of this research should include development of methods and models for an integrated evaluation of the risk from spent fuel damage during all plant operating modes.

(3) High Wind Risk Assessment

The research teams confirmed that they have completed the development of methods and models for the evaluation of hazards from high winds and missiles that are generated by tornadoes. The preliminary research plan for fiscal year 2024 includes development of methods to evaluate those hazards from typhoons. The preliminary plan also indicates that one task for fiscal year 2024 involves a trial application of a detailed PRA for tornado damage at a Japanese plant site. Experience has shown that integration of the high-wind analyses into a full-scope PRA requires similar analysis techniques and models for tornadoes and typhoons. To demonstrate these techniques and to gain important practical experience for the analyses of both hazards, the scope and schedule for the planned trial application should include an evaluation of the risk from both tornadoes and typhoons.

We look forward to our continuing interactions with the NRRC research team to review the overall research program and individual research projects, and to help the NRRC and the Japanese nuclear industry achieve their goals of comprehensive risk-informed decision-making.

Sincerely,



John W. Stetkar
Chairman

REFERENCES

1. "NRRC Overview: Preliminary Research Program for FY2024, RIDM Promotion," Presentation to NRRC Technical Advisory Committee, May 15, 2023, Proprietary.
2. "NRRC Overview: Research Program for FY2024, Risk Assessment," Presentation to NRRC Technical Advisory Committee, May 15, 2023, Proprietary.
3. "NRRC Overview: Research Program for FY2024, External Natural Events," Presentation to NRRC Technical Advisory Committee, May 15, 2023, Proprietary.
4. Technical Advisory Committee of the Nuclear Risk Research Center, "Proposed NRRC Research Plan for Fiscal Year 2023," November 27, 2022.
5. Technical Advisory Committee of the Nuclear Risk Research Center, "Proposed NRRC Research Plan for Fiscal Year 2022," December 30, 2021.