

Summary of the 20th Technical Advisory Committee (TAC) Meeting

Date: May 27(Monday)-30(Thursday), 2024

Place: Nuclear Risk Research Center (NRRC),
Central Research Institute of Electric Power Industry

Participants:

TAC: Mr. Stetkar (Chair), Mr. Afzali, Dr. Chokshi, Mr. Miraucourt, Dr. Takada,
and Dr. Yamaguchi

NRRC: Dr. Apostolakis (Director), and
Research staff of the Nuclear Risk Research Center

Proceedings:

In the 20th Technical Advisory Committee meetings, the following issues were reviewed:

- “Overview of NRRC Research Plan for FY2025 –Risk-informed Decision-making (RIDM) Promotion–”
- “Overview of NRRC Research Plan for FY2025 –Risk Assessment Research–”
- “Overview of NRRC Research Plan for FY2025 –External Natural Event Research–”
- “Revision of the Draft Guidelines for Risk-Informed On-Line Maintenance (OLM)” *
- “Collection of Japanese Industry Equipment Failure Data and Quantification of Generic Equipment Failure Rates” *
- “Methods for Evaluating Correlated Seismic Fragilities” *

The following meetings were held closed.

- “Draft Guidelines for Risk-Informed Containment Vessel Leak Rate Testing(CVLRT)” *
- “Experience from the Noto Peninsula Earthquake on January 1, 2024” *
- “Briefing on Good Practices for Risk-Informed Decision-Making (RIDM)”*

Note: The meetings of the agenda items marked with an asterisk (*) were attended online by electric power companies.

Monday, May 27, 2024

Topic 1. Overview of NRRC Research Plan for FY2025 –RIDM Promotion–

TAC’s advice and comments are as follows.

- **Full-scope PRA**

The goal of the Japanese nuclear industry, which was established about 10 years ago, is to develop a good quality, full-scope Level 2 PRA that is consistent with the international state of practice. Level 1 and 2 PRA for various internal and external hazards need to be performed in an integrated manner for all plant states. TAC has already issued letters recommending the development of full-scope Level 1 and Level 2 PRA methods based on

the PRA models of Ikata Unit 3 and Kashiwazaki-Kariwa Unit 7.

- **Peer reviews and reviewer training**

The NRRC needs to train Japanese reviewers capable of strict reviews. The U.S. reviewer training processes set certification requirements. Similarly, the Japanese peer review guidance needs to include reviewer certification guidance.

In the early 90s, when PRA peer reviews started in the U.S., peer reviews were conducted mostly by consultants who were involved in model and method development at that time. The NRRC may want to develop experience with PRA model systems, technical skills, and review methods to support "perfect" independent peer reviews; however, no guidance, methods, or reviewers are perfect. Japan has 40 years of PRA experience. Consultants and manufacturers could be readily available as experts for the first peer reviews, while additional independent experts are being trained.

Topic 2. Overview NRRC Research Plan for FY2025 –Risk Assessment Research–

TAC's advice and comments are as follows.

- **Fire PRA**

When using deep learning technology for fire propagation analysis, be careful not to make up artificial "information" that may be misleading. Fire PRA needs a lot of human judgments, which are difficult to teach AI.

- **Spent Fuel (SFP) PRA**

For the SFP-PRA development, the researchers should clarify how the time difference from cladding failure until the start of fuel melting affects the PRA models for accident progression. If the impact is small and the risk-benefit is marginal, the research and tests on cladding burst phenomena should be given a lower priority.

- **Human Reliability Analysis (HRA)**

Human reliability data should be collected consistently throughout the industry irrespective of BWRs and PWRs.

- **Multi-hazard PRA**

Research on different hazard combinations should be promoted, not only on earthquakes and tsunamis.

Topic 3. Overview NRRC Research Plan for FY2025 –External Natural Event Research–

TAC's advice and comments are as follows.

- **Seismic PRA**

It is important to have a well-documented report of the model plant seismic PRA by the end of Phase 2 of the project. A milestone should be set for issuing the report by the end of FY2024 or the beginning of FY2025.

- **Tsunami PRA**

The development of a tsunami PRA implementation guide should be included in the

roadmap and study implementation items. Issuing the guide should be listed as a milestone around FY2025.

•**Tornado and High-Wind PRA**

The development plan of a tornado PRA for domestic plants in FY2025 should include a milestone for issuing a guide.

•**Volcanic ash-fall PRA**

It is necessary for the PRA to examine how effective the filter replacement work is against volcanic ash-fall impacts on the air intake systems. The actions to replace or clean filters should be included in the human reliability analyses (HRA). The HRA should account for the ash-fall density and duration, the number of filters, and the needed manpower. It is also necessary to assess long-duration volcanic ash-fall hazards because the ash-fall phenomenon may continue for several weeks.

Tuesday, May 28, 2024

Topic 4. Revision of the Draft Guidelines for On-Line Maintenance (OLM)

TAC's advice and comments are as follows.

- In discussions on OLM with the NRA, it is important to get the NRA's approval to perform planned maintenance at power. Specifically, it is important to get permission to carry out maintenance that is not specified in the Technical Specifications using risk information.
- The revised guidelines additionally incorporate multiple OLM outages of individual components and simultaneous OLMs of multiple systems during the same operating cycle. What brought these additions to the guidelines?
- It may be more prudent to first implement the scope of OLM as described in the initial guidance, and obtain useful industry and NRA experience before the scope is expanded.
- TAC will review the revised guidelines for their technical adequacy.

Tuesday, May 28, 2024

Topic 5. Collection of Japanese Industry Equipment Failure Data and Quantification of Generic Equipment Failure Rates

TAC's advice and comments are as follows.

- Regarding the screening out rules e and f, let's assume that a component has two failure modes, failure to open and failure to close. Some failure mechanisms cause both failure modes. In this case, screening by failure modes can only collect either one of the modes.
- Plant-specific failure rates are obtained from Bayesian updates of the industry generic failure rates using plant-specific failure data. When the methodology is used to derive the industry data, you should check if the data from a single "outlier" plant has a significant effect on the generic failure rates. One or two outliers will not affect the estimated failure rates for a large plant population with many years of data; however,

they can significantly affect the estimation for a small plant population such as those in Japan (27 plants for 7 years).

- When the industry pooled data and Jeffreys' non-informative prior are used in the Bayesian update, the difference in the estimated failure rates between zero failures and one failure is a factor of three, and that between zero failures and two failures is a factor of five. If you have a lot of failure data, as observed in the U.S. for 100 units in more than 25 years, the effect of the Jeffreys' non-informative prior on the failure rate estimation is reduced.

Wednesday, May 29, 2024

Topic 6. Methods for Evaluating Correlated Seismic Fragilities

TAC's advice and comments are as follows.

- The seismic fragility evaluation methodology considering the seismic correlations, which was applied to SRVs in this study, should be developed to also apply to other types of equipment and general PRA applications.
- The methodology must be consistent with the multi-unit PRA methodology.
- Now that the methodology has been developed for calculating the seismic fragilities considering correlations, it is important to study how to determine correlation coefficients.

Thursday, May 30, 2024

Exit Meeting [Closed]