

## Summary of the 19th Technical Advisory Committee (TAC) Meetings

**Date:** November 13(Monday) -16(Friday), 2023

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

**Attendees:**

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

**NRRC:** Dr. Apostolakis (Director) and the research staff of the NRRC

**Proceedings:**

In the 19<sup>th</sup> Technical Advisory Committee meeting, the following issues were reviewed:

Topic 1: Draft Guidelines for Containment Vessel Leak Rate Test

Topic 2: Good Practices in Risk-Informed Decision-Making by the Japanese Utilities

Topic 3: Fire Hazard Research Activities (Fire Event Data and Ignition Frequencies and Recent Regulatory Response)

Topic 4: Seismic Fragility Analysis Methods

The following meetings were held behind closed doors:

- Recent Activities by Risk-Informed Decision-Making Promotion Team
- Use of Risk Information in Aging Management and Life Extension
- Use of Artificial Intelligence (AI) and Machine Learning (ML) for Risk-Informed Applications
- Big Picture for Future NRRC Research Projects

**Monday, November 13th, 2023**

**Topic1: Draft Guidelines for Containment Vessel Leak Rate Test**

(NRRC) The NRRC has decided to incorporate the demand-based model, consistent with EPRI's method, instead of the time-based model for the CV failure probability estimation.

(TAC) Let's assume that one test was performed 7 years after fifteen annual periodical tests. In this case, one of the possible approaches to consider outliers is to average the data per plant rather than accumulating test counts for all plants.

(NRRC) Our approach exempts outliers as anomaly data due to long-term shutdowns and counts only data for normal-test frequencies of one test every outage or one test every three outages. Thus, considering the data for the two patterns is quite a logical treatment.

(TAC) When the industry adopts this approach, three things should be considered.

- CDF must be evaluated for full-scope (i.e. for all hazards and all modes) PRA.
- Evaluated values must have certain margins covering uncertainties.
- Criteria acceptable to the Japanese industry are needed.

(NRRC) The Guidance should be developed to show how to assess CDF and CFF with the current PRA model of the limited scope.

(TAC) A utility that applies to increase the test interval according to this Guidance should not face the risk that they must reduce the test interval when they complete their full-scope PRA. For example, a utility may use a limited-scope PRA to justify an increase to 15 years. If the CDF from their full-scope PRA is much higher, the utility would need to revise their request, because they can only justify a shorter test interval. That would reduce utility and NRA confidence in the risk-informed basis for this application.

(NRRC) Is an all-hazard, all-mode PRA model necessary for this evaluation? Are the limited-scope PRA models that the utilities have today not appropriate to use?

(TAC) The guidance must consider the total risk impact. Many plants in the U.S. were approved to implement test interval extensions with only PRAs that quantified internal-event CDF. These cases required quantitative evaluation from their PRA, supplemented with bounding quantitative estimates and qualitative consideration of the CDF contributions from hazards and operating modes that were not included in their PRA model.

**Monday, November 13th, 2023**

## **Topic 2: Good Practices in RIDM by the Japanese Utilities**

(TAC) Are these activities introduced in this meeting commonly implemented by all the Japanese utilities?

(NRRC) The educational programs are conducted by each utility, but we are unsure if the other activities are conducted by all the utilities.

(TAC) TAC wants to understand what kind of RIDM guidance the NRRC plans to develop to realize high-quality RIDM programs conforming to the international standard for all Japanese NPPs. TAC is interested in how the NRRC will take the leadership to develop the guidance for all the utilities to implement the activities that have not been shared among the industry. One way for the NRRC to develop the guidance is to sort out the best practices among all the activities conducted by the utilities. In addition, there are probably some activities that no utility has implemented that should be implemented.

The NRRC presented some good examples of risk-informed activities implemented by individual utilities; however, the presentation does not show what is the best and what should be applied to all the utilities.

(TAC) TAC knows the Atomic Energy Society of Japan has developed the IRIDM Standard. What are the contents?

(NRRC) The Standard contains reference information for the utilities' risk-informed applications. However, some parts of it are not yet sufficient for practical use.

(TAC) The guidance for the industry must show the basic elements of RIDM, that is, "WHAT (to do) " before everything and not "HOW (to do)." The overall framework and programs must be provided instead of specific numbers or detailed calculation methods. The guidance is used to confirm the consistency of the utilities' programs in, for example, the scope of the applications, no matter how they are implemented.

(TAC) What impedes the promotion of RIDM in Japan? In the previous TAC discussion, the NRRC said that was because the regulator won't support RIDM. However, while individual utilities have some voluntary RIDM activities, why is the introduction of RIDM not progressing for all utilities?

(Director) The NRA is certainly an impediment, but it is not the only problem. A long history of taking a deterministic approach hinders a deterministic culture from changing. Thus, activities to deepen understanding of PRA such as what it is and what benefits it offers are required. It is also important to organize and promote what can be done without NRA approval.

(TAC) The utilities did not seem to be able to convince the NRA of the benefits of RIDM at the recent NRA-CNO Opinion Exchange Meeting.

(TAC) The Japanese utilities seem to be inward-looking and to be working separately on their programs.

(Director) The NRRC needs to work closely with ATENA and JANSI. The NRRC also needs not only to develop the guidance but also to promote and implement RIDM together with the whole industry.

(NRRC) How advanced does TAC think the Japanese utilities are in the RIDM activities compared to the other countries?

(TAC) RIDM in Japan is not necessarily lagging globally but is certainly far behind that in the U.S. However, even in the U.S., each utility used to separately conduct its activities. Nevertheless, the U.S. has corrected this situation by having INPO evaluate utilities on RIDM and publicize best practices. In Japan, it is important for the NRRC not to get too caught up in the development of PRA and RIDM methodology, but to keep insisting that the utilities actively utilize RIDM.

(TAC) In Europe, the organization called WANO considers how to correct the situation in which each utility separately conducts its own activities. In Japan, WANO peer review can be one of the effective measures. It is also effective to establish a system of cooperation among the utilities if they can conduct activities voluntarily.

(TAC) It is not appropriate for TAC to judge if each of the Japanese RIDM activities is good or bad. That is not our role as technical advisors to the NRRC. However, All TAC can point out is that simply sharing information doesn't make all the utilities implement good practices. The first step in promoting RIDM is to identify good practices from the utilities' activities and have all the utilities implement them. In addition, a certain degree of internal regulation and control is necessary for all utilities to implement good practices. To do this, the NRRC must first take the lead in developing the guidance on what the utilities should do. Then, it is necessary to decide who will take the initiative in having utilities implement good practices (ATENA or the NRRC?) and who will provide oversight of the implementation status (INPO plays the role in the U.S. Then, JANSI or the NRRC in Japan?)

(TAC) Incentives for RIDM as well as enforcement are important for the utilities to perform good practices. TAC suggests that the NRRC should encourage the most influential organizations to have the utilities implement RIDM by giving them clear incentives.

**Tuesday, November 14th, 2023**

**Topic 3: Fire Hazard Research Activities (Fire Event Data and Ignition Frequencies and Recent Regulatory Response)**

(TAC) Fire events that involve human-caused fires and transient combustibles should be counted separately by the plant operational state because workload and workplaces are different in between the shutdown state and the at-power state of the plants.

(TAC) Fire ignition frequencies should be classified by location because the frequencies, especially human-caused and transient combustible fire frequencies, differ between the turbine buildings and the reactor buildings.

(TAC) Why does the database not quantify electrical cabinet fire frequencies according to the detailed cabinet categories in the NRRC Fire PRA Guide?

(NRRC) This analysis does not classify the electric-cabinet fire events by combustible material quantity or size. This is reasonable to avoid too many fire-source categories with zero events.

(TAC) The hierarchical Bayesian method is used to quantify fire ignition frequencies in the United States. In general, a hierarchical Bayesian analysis will typically result in larger uncertainties than the empirical Bayesian method. This is because the hierarchical method better accounts for the plant-to-plant variability in the data.

**Wednesday, November 15th, 2023**

**Topic 4: Seismic Fragility Analysis Methods**

(TAC) If the seismic fragility analysis demonstrates piping-system failures can be screened out from major risk sources, that will greatly contribute to the advancement of PRA. Updated estimations of piping-system seismic capacities to realistic values probably result in the more risk importance of other equipment failures than that of piping-system failures. The NRRC should utilize RIDM in its research planning to prioritize research subjects appropriately.

(NRRC) We have determined that the research program of seismic fragility analysis has a high priority as a result of RIDM. We will use the RIDM process to decide on appropriate research targets to avoid consuming too many resources for research prioritization.

**Thursday, November 16th, 2023**

**EXIT Meeting (minutes undisclosed)**