Summary of the 10th Technical Advisory Committee (TAC) Meeting

Date:	Nov. 5 – 9, 2018
Place:	Nuclear Risk Research Center (NRRC), Central Research Institute of Electric Power Industry
Participants:	
TAC:	Mr. Stetkar (Chair), Mr. Afzali, Dr. Chokshi, Mr. Miraucourt, Prof. Takada, Prof. Yamaguchi
NRRC:	Dr. Apostolakis (Head), Experts of the Nuclear Risk Research Center
Industry:	Experts of TEPCO Holdings, Shikoku EPCO for respective topics

Proceedings

All the topics were discussed in full session. In addition, an open discussion session took place. The open discussion included a lecture by Mr. Afzali on "Technology Inclusive Risk-Informed Performance-Based Licensing Basis Foundation."

November 5 (Mon.)

Topic 1: Overview of NRRC R&D Goals

- NRRC presented "Overview of NRRC R&D Goals".
- TAC members commented as follows:

- The Technical Advisory Committee (TAC) understands that this presentation covers the research projects that are considered as high priority by NRRC, and thus NRRC explained those projects. For the next presentation, TAC would like NRRC to explain all research programs in the same format (by making a one-page summary). It is possible that TAC may consider some topics that are currently deemed low-priority by NRRC as deserving a higher priority, but the current style may result in the loss of TAC opportunities to point out such matters.

1. Risk-Informed Decision Making (RIDM)

- Phase 2 of the strategic plan should clarify specific objectives and priorities for using RIDM (for example, the introduction of Risk-informed In-service Inspection (RI-ISI), On-Line Maintenance (OLM), etc.) and the action plan for those objectives.

2. PRA Method Improvement

- Considering the RIDM comments, priorities for the necessary NRRC research and development items (for example, Low Power and Shutdown PRA, spent fuel pool risk, external events other than natural phenomena) and the research schedule for those items should be examined, based on the industry action plan.
- Referring to NRRC resources, a system that can provide usefulness of outcomes

or incentives for researchers should be considered, for example, by thinking about the priority of research topics from the viewpoint of overall risk significance, and determining the direction of the research plan for FY 2019 and after.

- Even though it is important for NRRC to issue original guidance for specific use in Japan, adoption of proven guides that have been used in Japan and foreign countries should also be positively considered from the viewpoint of resource saving.
- In developing pilot studies for internal flooding, internal fires, and multi-unit PRA, the quality of the PRA model that is used for those studies should be strictly examined, so that the pilot studies maintain consistency with current progress for the development of a "good quality" PRA.

3. Natural External Events

- It is important to consider the fragility assessment with regards to the whole facility including the ground, buildings and equipment taken into account for the Seismic PRA.
- Floating debris should be considered comprehensively regardless of its size for the Tsunami PRA. The influence of intake plugging by waste such as entrained rubble, plastic bags, and silt, as well as impacts by ships on the ocean, should also be considered.
- A simultaneous tsunami and seismic disaster should be considered through collaboration among the seismic-related personnel.

November 6 (Tue.)

Topic 2: Fire PRA Guide

- NRRC presented current R&D status on “Fire PRA Guide”.
- TAC members commented as follows:

- The Fire PRA guide drafted by NRRC includes the US knowledge appropriately and has been improved greatly compared with NUREG/CR-6850. The guide clarifies a process that can detail risk-significant scenarios without applying predetermined screening criteria, and thus we can expect improved and more efficient implementation.
- TAC understands the necessity of the activities concerning fire frequency based on domestic operating experience, but it is difficult to quantify appropriate frequencies for the detailed categories, if the assessment period of the operation status is short and data is insufficient. The initial use of international data is highly recommended. Bayesian analysis methods can be used to update the international experience as more Japanese industry data are collected.
- The guide would be more useful by improving details such as providing guidance for walk-downs consistently and providing evidence for specific numerical values

introduced by the guide.

- A pilot study should be conducted, feedback concerning the guide provided, and revisions made to improve practical use of the guide and to provide high quality and realistic risk insights.

Topic 3: Internal Flooding

- NRRC presented the current R&D status on "Internal Flooding".
- TAC members commented as follows:

- If the internal flooding simulator is described in the guide, its functions and analytical accuracy should be examined.
- Takahama Unit 3 is considered as a pilot site, but the pilot study should be done at multiple plants with different configurations. Carrying out multiple pilot studies leads to the enhancement of the general usability of the guide.
    - Many of the PWRs are already restarting, but the BWRs are still in the process of the business licensing stage. NRRC is planning to carry out the pilot study targeting a single unit in a PWR plant first, considering the resources of NRRC and electric utilities.
- How large is the framework for collecting data on flooding frequency? In particular, detailed information such as the flood source (affected system, pipe rupture or connection failure, etc.), cause of the flood (pipe break, human error, etc.), water leakage modes, the amount of leakage, etc. is necessary for category setting.
    - NRRC has established a framework where NRRC and utility members participate. However, information such as leakage rates and calibers seems to be highly limited. NRRC has been collecting detailed information to the maximum possible extent.
- According to the project schedule, the plant walk-down is planned after the desk study, but it would be more effective to do the plant walk-down first. In the plant walk-down, the survey should be done also from the viewpoint of seismically induced flooding.
- Does the Human Reliability Analysis (HRA) guide issued by NRRC apply to HRA tasks in the internal flooding analysis guidance?
    - Currently, NRRC's HRA guide has not been referred to explicitly. NRRC wants to deal with this issue during the revision of the guide.
- TAC is concerned that practical application of methods to derive the Zone of Influence (ZOI) of flooding would be complicated due to many combinations of parameters.
    - NRRC will try to add an additional appendix on how to apply this method practically during the revision of the guide.

Topic 4: Level 2-3 PRA related methodology

- NRRC presented current R&D status on "Level 2-3 PRA related methodology".
- TAC members commented as follows:

＜Level 2 PRA＞

- Benchmark analysis of fission product behavior in containment vessels and reactor buildings, and accumulation of experimental verification data are time-consuming issues requiring a large budget. These activities should be promoted in an international framework.
    - NRRC is participating in the Benchmark Study of the Accident at Fukushima Daiichi Nuclear Power Station (BSAF) project promoted by OECD / NEA, and conducting research activities related to verification analysis using the MAAP code in the international framework. Regarding the experimental research for fission product behavior in the building shown in the Phase 2 research after 2022, we would like to judge implementation carefully in light of the results of the research conducted up until the year 2021, and trends in international collaborative research.
- Regarding the Level 2 PRA methodology in the Phenomenological Relationship Diagram (PRD) method, NRRC should describe and demonstrate the effectiveness and usefulness of this methodology, such as the point that the Level 2 evaluation can be carried out simply without conducting large-scale thermal-hydraulic calculations using the MAAP code.

＜Level 3 PRA＞

- As for the local topography effect on Level 3 PRA results, its influence may grow depending on the combination of risk indices (Latent Cancer Fatality (LCF) and Early Fatality (EF)) and the evacuation model. Although it depends on decisions by electric utilities, NRRC should apply the Level 3 PRA methodology at a specific site and carefully investigate the practical value of insights.

November 7 (Wed.)

Topic 5: PRA Pilot Project (Ikata Unit 3)

- NRRC presented the current status of the "PRA Pilot Project, Ikata Unit 3".
- TAC members commented as follows:

- The comments from the external expert review to be considered not only in PWRs but also BWRs should be shared and addressed throughout the industry.
- The topic of "Perform best estimate success criteria analyses" was discussed at past TAC meetings. NRRC should store up such topics so that you can keep these issues in mind for reviews of other PRAs to be conducted in the future.
- Regarding the success criteria, was there any difference between the comments received in the external review and the results of the self-review conducted in

advance? When there are differences between them, it is important to consider the reason for the differences, not only in this example.

Topic 6: PRA Pilot Project (KK Unit 7)

- NRRC presented the current status of the "PRA Pilot Project, KK Unit 7".
- TAC members commented as follows:

- You should perform a documented self-assessment to learn from the disparities with the results of the external review.
  - The current expert reviews are being conducted during our model enhancement. We are planning to conduct a self-assessment before the peer review after the As-Is model is completed.

Topic 7: PRA Peer Review Guide

- NRRC presented the current status of the "PRA Peer Review Guide".
- TAC members commented as follows:

- The PRA standard to which the peer review guide conforms should be clarified. It is confusing to refer to both the ASME / ANS standard and the AESJ standard. The guide should not refer to both standards until it is confirmed that the AESJ standard is consistent with the ASME / ANS standard.
- It is most important to clarify at an early stage the definition of the PRA peer review.
- Consideration of the PRA standard and peer review guide will doubtless continue, but, in parallel, pilot applications of the peer review process should be conducted.
- Currently, external expert review is based on the ASME / ANS standard, but in the long term, domestic PRAs will comply with the AESJ standard. For this purpose, the AESJ standards committee is examining the definition of "What to do" as a standard In collaboration with the ASME / ANS Joint Committee on Nuclear Risk Management (JCNRM) through the Japan International Working Group (JIWG), consistency with the ASME / ANS standard will be discussed. From this point of view, the peer review guide should be configured according to the AESJ standard.
  - Clarify the objective of the draft guide, since it is not clear whether to aim for a short-term perspective or prepare for a long-term response.
- How is the regulatory authority going to be involved in PRA peer review?
  - The PRA of the utilities will be disclosed to the regulators. Regarding the review of PRA to be disclosed, the regulators are reserving their intent, but utilities are requesting that the PRA be reviewed by peer review consistent with the reviews in the United States.
  - Since it will take time for improvement of utilities' PRAs, spot-like reviews by regulators may be conducted during that time.

- In the United States, NRC Regulatory Guide 1.200 is based on the ASME / ANS standard. So, above all, it is necessary to identify the subject standard and certify it mutually with the regulators.

Topic 8: RIDM Template

- NRRC presented current the R&D status of the "RIDM Template".
- TAC members commented as follows:

- Increase the number of specific cases so that personnel at the nuclear power plant can easily understand them. This is very important.
- Clarify the purpose of the template. Clarify how to use it.

Topic 9: Seismic Level 1 PRA

- NRRC presented the current status of the "Seismic Level 1 PRA".
- TAC members commented as follows:

<Project Plan of Seismic PRA>

- Though it is required to enhance details of each technical issue in the R&D of PRA, it is also preferable to proceed with the R&D to expand the range of PRA applications. For example, add PRA for fire caused by seismic events in addition to the fire PRA.
- You should proceed with the scope of the seismic PRA with a view to Level 2 PRA. A valid reason why it is limited to Level 1 PRA is required.

<Fragility Analysis: Equipment>

- Research of fatigue as a failure mode is interesting. If there will be any further progress, we would like it to be introduced at future TAC meetings.
- We would like to hear about the progress of the seismic experience database at the next TAC meeting.

<Discussion Point>

- It is inevitable that different kinds of PRA software are used at each site. When multiple sites are subject to a model project for seismic PRA, the particular software used at each site should be utilized for the seismic analysis. A particular plant should always use the same PRA software for all models (e.g., internal events, internal fires, internal floods, seismic events, tsunamis, high winds, other external events, etc. for full-power, low power, and shutdown modes). It is extremely important that the same system logic models and basic event names must be used throughout the entire PRA.

<Current status of Ikata SSHAC level-3 project>

- After finishing the Senior Seismic Hazard Analysis Committee (SSHAC) project for the Ikata NPP, the next step will be conducted, including what kind of guide should be prepared with a view to expansion of SSHAC to other sites.

November 8 (Thu.)

Topic 10: Exit Meeting

TAC and NRRC had a discussion on how to organize future meetings.

November 9 (Fri.)

Committee internal meeting