Technical Advisory Committee of the Nuclear Risk Research Center
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SUBJECT: STATUS REPORT ON REVIEW OF IKATA PROBABILISTIC RISK ASSESSMENT MODELS

Dear Dr. Apostolakis:

During the second meeting of the Technical Advisory Committee of the Nuclear Risk Research Center (NRRC), January 19-23, 2015, we met with representatives of the Federation of Electric Power Companies (FEPC), Shikoku Electric Power Company, Ltd. (SEPCO), and their contractor, Mitsubishi Heavy Industries, Ltd. (MHI) to begin our review of the probabilistic risk assessment (PRA) models for the Ikata Nuclear Power Plant.

BACKGROUND

Ikata Unit 3 is the lead unit to focus NRRC support, research, and guidance for the development of a plant-specific Level 2 PRA that initially evaluates the risk from internal initiating events, seismic events, and tsunamis during reactor power operation. The eventual goal is to extend that PRA to include a full-scope evaluation of the risk from all internal events, all external hazards, and all major radiological sources during all operating modes for all units at the site.

Our November 1, 2014, letter report on "Suitability of Models for Ikata Site Probabilistic Risk Assessment" concluded that the event sequence models that have been developed to support the Ikata Unit 3 Periodic Safety Review process provide a good technical foundation for extension and eventual development of a full-scope Level 2 PRA. We also noted that we will perform periodic reviews of all technical tasks in the PRA, its supporting analyses, and results, and report our conclusions and recommendations to the NRRC project team.

This letter report summarizes our approach for performing the initial reviews and the current status of those reviews.

DISCUSSION

The primary intent of our reviews is to understand the scope and key technical elements of the current Ikata Unit 3 PRA models. We will then recommend possible enhancements and extensions of those models to support the development of a full-scope Level 2 PRA that is consistent with the international state-of-practice in PRA methods, models, and technical quality.

Because the Ikata units have different designs, it is important for us to understand how those differences affect the PRA models for each unit. For example, the differences may affect how the models for each unit are eventually integrated to develop a site-level PRA, or how severe external events affect the risk at each unit. Therefore, our review also includes some elements of the Unit 2 PRA models. This will improve our understanding of the differences between the units and ensure that our recommendations for Unit 3 are also appropriate for the other units and an eventual site-level risk assessment.

We have started a detailed review of the Unit 3 and Unit 2 event trees. We will also review examples of the Unit 3 fault trees. To understand the scope, level of detail, and technical quality of the current Ikata PRA models, we requested the following information to support our initial review efforts.

- Unit 3 Level 1 event trees for internal initiating events during power operation
- Unit 2 Level 1 event trees for internal initiating events during power operation
- Fault trees for Unit 3 Auxiliary Feedwater system, High Pressure Injection system, and their support systems

We received the event trees and fault trees in late December 2014. We also discussed these models with the Ikata PRA team during this Committee meeting.

It is our experience that the most effective reviews require an active exchange of focused technical information. That exchange cannot be accomplished in a simple "one-pass" question and answer session. The review questions often address complex technical issues and subtle plant-specific dependencies that are not easy to understand from the first examination of the models. Feedback from the PRA team is also vital to clarify areas of possible confusion and to explain the reasons for specific modeling simplifications or assumptions. Therefore, our reviews will involve more in-depth questions and answers than can be effectively discussed during the limited time for our full Committee briefings.

Completion of the Event Tree Reviews

We have prepared a list of detailed questions about the Unit 3 event trees. These questions are intended to clarify our understanding of the event sequence models, associated assumptions, supporting analyses, and plant-specific design features. Some of these questions may address proprietary elements of the PRA models and analyses, or security-related information about the Ikata plant design. We request that these questions be forwarded to SEPCO, and we request a written response to each item. We also request that SEPCO should identify any proprietary or security-related information that cannot be released to the public. We expect to receive the

answers to these questions in time for our next planned meeting in May. At that meeting, we will resolve any remaining open questions or necessary clarifications. We will then report our technical conclusions and our recommendations for possible refinements or enhancements to the event trees.

We will follow the same process for our review of the Unit 2 event trees. That review will focus primarily on functional and logical differences between the Unit 3 and Unit 2 models, so we can understand the reasons for those differences. We hope to also complete that review before our May meeting. However, we acknowledge that resolution of our questions about the Unit 2 models has lower priority than Unit 3.

Completion of the Unit 3 Fault Tree Reviews

We intend to review only a sample of the Unit 3 fault trees. Our experience from numerous reviews has shown that the most effective way for us to understand the scope, level of detail, and technical quality of the PRA models is to perform a relatively comprehensive review of the event trees and a focused review of the fault trees for one or two representative systems. Our reviews of those fault trees will also include the respective support systems (e.g., AC power, DC power, actuation signals, cooling water, room cooling and ventilation, etc.) to check how those systems and dependencies are integrated into the PRA. This broad review of the event trees, complemented by deep "vertical slices" through the system fault trees, typically provides a good understanding of how the PRA models are developed and their important supporting assumptions.

Our review of the Unit 3 fault trees will follow the same question and answer process that is summarized above for the event trees. However, the fault trees are quite large, and we have not yet examined their details. Therefore, we may limit our initial review of those models to only one of the two front-line systems (i.e., Auxiliary Feedwater or High Pressure Injection) and its associated support systems. This will facilitate more timely input to the PRA team and receipt of their responses for our May meeting. The scope and detail of any additional fault tree reviews will then be guided by the findings from our initial efforts.

These reviews are in progress. We plan to complete them in time for our next report in May. We will examine other key technical elements of the Unit 3 PRA, such as the analyses of initiating events, success criteria, data, and human reliability, after we understand the fundamental event tree and fault tree logic models.

Sincerely,

John W. Stetkar
Chairman

REFERENCES

1. "Suitability of Models for Ikata Site Probabilistic Risk Assessment," Technical Advisory Committee letter report to Dr. George Apostolakis, November 1, 2014.

2. "Ikata Unit 3 Probabilistic Risk Assessment, Level 1 Event Trees," Shikoku Electric Power Co. Ltd., December 26, 2014, Proprietary.

3. "Ikata Unit 2 Probabilistic Risk Assessment, Level 1 Event Trees," Shikoku Electric Power Co. Ltd., December 26, 2014, Proprietary.

4. "Ikata Unit 3 Probabilistic Risk Assessment, Fault Trees for Auxiliary Feedwater System, High Pressure Injection System, and Support Systems," Shikoku Electric Power Co. Ltd., December 26, 2014, Proprietary.

5. "Selection of Initiating Events for Ikata Unit 3 PRA for Internal Event at Power," Shikoku Electric Power Co. Ltd. Presentation to NRRC Technical Advisory Committee, January 20, 2015.

6. "Ikata Unit 3 Level 1 PRA for Internal Events at Power Event Trees," Shikoku Electric Power Co. Ltd. Presentation to NRRC Technical Advisory Committee, January 19, 2015, including Confidential materials.

7. "Ikata Unit 2 PRA for Internal Events at Power Event Trees," Shikoku Electric Power Co. Ltd. Presentation to NRRC Technical Advisory Committee, January 20, 2015, including Confidential materials.

8. "Ikata Unit 3 Level 1 PRA for Internal Events at Power Fault Trees," Shikoku Electric Power Co. Ltd. Presentation to NRRC Technical Advisory Committee, January 20, 2015, including Confidential materials.