

Plenary Lecture

The Evolution of the Use of PRA and Risk-Informed Decision-Making in Japan

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This year marks 33 years from the first PSAM conference that was held in Beverly Hills, California, in 1991. As it was stated at that time, and is still valid today, “The objective of these conferences is to promote rational decision making to assure safety and reliability and to optimize the use of resources for complex systems. This is to be achieved through the use of risk assessment and management methods.”

I will show a few photos from that first conference that set the stage of the conferences that followed.

The principal organizations that deal with nuclear power plant safety in Japan are the Nuclear Regulation Authority (NRA) whose fundamental mission is to protect the general public and the environment through rigorous and reliable regulations of nuclear activities. Another organization is the Atomic Energy Association (ATENA) that represents the industry and discusses regulatory issues with the NRA. The Nuclear Risk Research Center (NRRC) is also an industry organization whose mission is to assist nuclear operators and the nuclear industry in their continuous effort to improve the safety of nuclear facilities, that is, to manage the relevant risks by developing and employing modern methods of Probabilistic Risk Assessment (PRA), risk-informed decision making and risk communication.

The fundamental tool for rational decision-making is PRA. Unfortunately, PRA, until recently, was not taken seriously in Japan. Both the regulators and the industry have been focusing on regulatory-compliance for a long time. Moving to a risk-informed culture is not easy and takes time. An important first step was the Reactor Oversight Process (ROP) that was adopted by the NRA in 2020. Another important step was the issuance of the Strategic and Action plans by the industry.

To improve the PRA quality the industry established international expert reviews for two plants (Ikata 3 and Kashiwazaki-Kariwa 7). These reviews followed the ASME/ANS standards and the NEI PRA review process.

Another criticism of Japanese PRAs was that most of the CDF results were in the neighborhood of 10^{-6} per year. These results did not typically include fires and internal floods. A paper presented in the ASRAM2022 conference (Uchida et al) shows results from a fire PRA analysis that include a CDF of roughly 2×10^{-5} per year. In my opinion, this is a significant step forward away from the 10^{-6} culture.

Finally, the NRRC is making efforts to improve the PRA infrastructure in Japan, including the issuance of NRRC Guides on HRA, Fire PRA, and Data Collection; developing models for external events, as well as a PRA model for multi-unit sites.