

Editorial

Lessons Learned from the Fukushima Accident: An Integrated Perspective

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The unprecedented damage and radiological release at the Fukushima Dai-ichi Nuclear Power Station, which were brought about by the extreme natural disaster including earthquake and subsequent tsunami, exposed a number of potential nuclear plant vulnerabilities. This special issue is aimed at the lessons learned from the Fukushima accident of March 11, 2011, in Japan so that they can be applied to further improve nuclear plant safety.

Management of nuclear plant safety, that is, “safety management,” can be accomplished through an integrated approach consisting of three elements: (1) by managing risk before an accident occurs, that is, risk management; (2) by preventing an abnormality from escalating into an accident or mitigating the consequence of an accident, that is, accident management; and (3) by minimizing the impacts of the radiological accident on the public, critical social infrastructures, and environment, that is, emergency management. The articles included in this special issue can also be viewed from a perspective of safety management in the light of the lessons from the Fukushima accident.

The articles by S. Park et al. and J.-Y. Kim et al. address the element of “risk management.” The former shows a novel approach to prioritize accident precursors using the techniques of analytic hierarchy process (AHP) and Bayesian belief network (BBN). A case study was conducted by applying this approach to the Fukushima lessons as identified in the accident analysis report by the Korean Nuclear Society. The latter article analyzes the anomalous behavior of fuel pellets and claddings following loss of coolant accidents (LOCAs) under various conditions, such as partial malfunctions of

control rods resulting in different levels of heat generation and failure of the emergency core cooling system (ECCS).

The element of “accident management” is touched upon by four articles, including a couple by S.-W. Lee et al. The first article by S.-W. Lee et al. discusses the coping capability of APRI400 pressurized water nuclear power plants against an extended station blackout as experienced during the Fukushima accident, demonstrating the effectiveness of an external water injection strategy for steam generators. Another article by S.-W. Lee et al. investigates the effectiveness of a mitigating strategy to maintain containment integrity against overpressurization scenarios in a 1000 MWe PWR with large dry containment by use of a containment filtered venting system (CFVS).

As reliable information is essential for accident management, the article by M. Yoo et al. discusses the result of their pioneering research to develop an instrument transmitter protecting device against high-temperature condition during severe accidents. M. C. Kim reviews the beyond design basis events (BDBEs) at Fukushima with a focus on the accident information and systems operation, emphasizing the need for implementation of mitigating strategies to cope with BDBEs in a cost-effective manner, together with reliable information under harsh environment and development of operator support systems for extreme events.

Finally, “emergency management,” which is oftentimes viewed as the last defense barrier among the three elements of safety management, is addressed by M. Hussain et al. in an article on intervention distances for urgent protective actions.

We believe that this special issue provides interesting information on each element of safety management but, even more, it points to the fact that more research is needed for further enhancement of nuclear safety especially against beyond-design basis accidents from external events.

As a final remark, we would like to acknowledge the outstanding contributions of all the authors and the accurate and timely collaboration of both the authors and the reviewers. To all of them goes our sincere professional appreciation and personal gratitude.

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