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Guest Editorial

Greeting From the President-Elect of JSME



Chikako Iwaki

On behalf of the Japan Society of Mechanical Engineers (JSME), I would like to extend my warmest wishes for a Happy New Year to everyone involved with ASME's *Journal of Nuclear Engineering and Radiation Science*. I would also like to express my sincerest respect for your dedication to advancing the nuclear energy field. We are excited about working with you in the upcoming year.

The impact of climate change caused by global warming is becoming more evident every year. In the summer of 2024, the global average temperature reached its highest level on record, following a similar increase in 2023. Japan also experienced record-breaking temperatures in 2024, making it the hottest summer ever observed since statistical recording began in 1898. The year 2024 was also distinguished by a notable increase in the frequency of heavy rainfall events across Japan, which resulted in significant damage. Observational data from the Japan Meteorological Agency indicate that the rate of increase is greater for heavier rains. Globally, to move away from fossil fuels in this changing environment, it is evident that nuclear power is assuming a more significant role than ever before. In Japan, although the environment surrounding nuclear power has changed drastically since the Fukushima Daiichi Nuclear Power Plant (NPP) accident, it can be argued that we are now at a new turning point.

Because Japan is a country with limited natural resources, the fundamental aim of its energy policy is to construct a multilayered energy supply structure that simultaneously fulfills the "three Es" (energy security, economic efficiency, and environmental friendliness) while guaranteeing safety. The Sixth Strategic Energy Plan, which was approved by the Cabinet in 2021, aims to achieve carbon neutrality by 2050 and sets challenging targets such as reductions of 46% or even 50% by 2030. To achieve this, it has been stated that nuclear power generation, which is particularly effective in meeting the three Es, must be used to its fullest extent.

In the Sixth Strategic Energy Plan, the Japanese government explicitly states its intention to restart NPPs after the Nuclear Regulatory Authority certifies that they comply with the new regulatory standards, which are the most stringent in the world. Moreover, the government will implement measures concerning the management of spent nuclear fuel and the nuclear fuel cycle. The plan stipulates that the government will promote the advancement of fast reactor and small modular reactor technologies by collaborating internationally and establishing the fundamental technology for hydrogen production using high-temperature gas reactors by 2030.

Furthermore, since Autumn 2021, there have been significant changes to the energy situation, including rising fuel prices, turmoil in the international energy market, and a constrained domestic electricity supply and demand. In consideration of the aforementioned circumstances, the Cabinet approved the Basic Policy for the Realization of Green Transformation (GX) and the GX Promotion Strategy in 2023. In addition to promoting the restart of NPPs, the policy includes the development and construction of next-generation innovative reactors incorporating new safety mechanisms, concrete plans to replace NPPs that have been designated for decommissioning with next-generation innovative reactors on their premises, an extension of the reactor operating period to 60 years to maximize the use of existing NPPs, and addressing back-end issues such as final disposal under government leadership.

In line with these strategies, it can be posited that the future nuclear R&D landscape in Japan will be shaped by three pivotal areas of focus: first, the decommissioning and reconstruction of the Fukushima site; second, the pursuit of continuous safety enhancements; and third, the fostering of innovative advancements.

As decommissioning of the Fukushima Daiichi NPP is an extremely challenging and rare task, international cooperation has been pursued through a range of frameworks. The process is being carried out in a step-by-step manner, in accordance with the mid- to long-term roadmap, with the objective of completing the decommissioning within 30 to 40 years. Investigations conducted so far have already provided information on the distribution of fuel debris and access routes to this debris. In October 2024, a fuel debris removal test was successfully conducted by inserting and lowering a telescopic arm-type sampling device, marking a significant advancement toward the next phase of the project. In the future, it

will be crucial to establish and consistently implement a decommissioning process, and to conduct analysis of the collected debris that will provide important information on the progression of the accident. It will be increasingly important to convene an interdisciplinary team of national and international experts to pool their wisdom.

In terms of safety enhancements, many efforts have been carried out based on lessons learned following the accident at the Fukushima Daiichi NPP. We have clarified technical issues, particularly risk assessment, that include a wide range of scenarios, including external factors and uncertainties in the assessment of the progression of severe accident events. To further improve safety, it is essential to incorporate the latest national and international findings and to continue working to address the technical challenges identified. Implementation of these initiatives can be important in that they not only enhance the safety of current and future reactors but also facilitate the resolution of key issues, including those related to technology transfer and human resource development.

Finally, in terms of innovation, to achieve meaningful progress in the field of nuclear energy, it is necessary to move beyond the current approach to R&D. It will be necessary to ensure not only the highest levels of safety but also to meet various new societal demands, including the production of carbon-free hydrogen and the utilization of heat. Additionally, novel solutions must be devised to accommodate the increase in renewable energy sources while ensuring co-existence with them. Furthermore, digital transformation, including the use of big data and AI, will create new value, such as extending plant operation cycles and improving inspection efficiency. These pioneering technologies will surely inspire the younger generation and promote the nurturing of young researchers and engineers.

To accelerate the objectives described above, it is essential to integrate and fuse the fields of individual researchers and to establish a forum for information sharing and discussion that transcends organizations and countries. International conferences and journals are examples of vehicles for this transcendence.

The international conference ICONE is definitely a success case. Since I was a young engineer, I have been participating in this conference and discussing and examining my research results while being stimulated by advanced overseas research. Furthermore, my professional relationships with experts in the field continue to be a valuable asset. ICONE presents a variety of engaging initiatives, such as a student competition organized by the students themselves, as well as different support systems for young people. ICONE32 will be held this year, and it is my hope that all of you, especially young people, will take advantage of this wonderful opportunity.

Last but not least, ASME's *Journal of Nuclear Engineering and Radiation Science* plays an extremely important role as a platform that allows experts to discuss the development of nuclear technology and the effective use of nuclear energy. We hope that this journal will contribute to the further development of nuclear engineering as the leading international nuclear engineering journal in the world. JSME will contribute to the creation and enervation of a space where researchers and engineers can improve their technologies and where various disciplines can be fused and integrated to create innovation. To this end, we look forward to furthering our collaboration with ASME, an important partner.

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