

Foreword

Special Issue Featuring Papers from the 2024 Best Estimate Plus Uncertainty International Conference (BEPU 2024)

Guest Editors

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The 2024 Best Estimate Plus Uncertainty International Conference (BEPU 2024) was organized by Nuclear and Industrial Engineering (NINE) of Lucca, Italy, with principal sponsors being the CNNC Key Laboratory for Severe Accident Research in Nuclear Power Safety and Électricité de France. The conference was originally scheduled to be held in 2020; however, the meeting was postponed due to the COVID-19 pandemic. The meeting was held in Lucca, Italy, May 19–23, 2024, at the Real Collegio.

Historically, the BEPU series of meetings has focused on uncertainty evaluation methodologies and the need for consistent use of experimental data and uncertainties. BEPU 2024 sought to build upon previous meetings and expand the focus in two separate areas: (1) industrial applications and licensing and (2) research and development.

The application of BEPU methodologies still faces challenges in the licensing space but could be critical for the development and rapid deployment of advanced, small modular, and micro reactors. The use of BEPU approaches in probabilistic risk assessments for severe accident analysis continues to be explored for regulatory use. BEPU methods have also been extended for use in multiscale, multiphysics simulations, and the challenge of the application of BEPU methods for these highly coupled simulations continues to be an area of interest. Research in the development and application of sensitivity and uncertainty quantification methods, processes, and codes continues to be a field of study within BEPU and extended to include machine learning methods for uncertainty analyses.

A total of 104 papers were presented at BEPU 2024. Five plenary sessions were held with invited speakers from China, the United States, and the European Union. Nine panel discussions were given as a part of the technical

program to facilitate a dialogue among experts in the field, and a total of 18 technical sessions covered both licensing and regulatory issues as well as research and development.

This special issue of *Nuclear Technology* contains nine papers from the conference covering many of the topics and themes, including licensing aspects of BEPU, severe accident analyses, uncertainty and sensitivity analyses, and uses of machine learning, to name a few. Each paper in this special issue was peer reviewed and recommended by the technical session chairs as exemplary work. It is our hope that this special issue captures the importance and promise of the BEPU methodology and stimulates further applications and research in the area.

BEPU 2024 was chaired by Dr. Kostadin Ivanov of North Carolina State University and Dr. Francesco D'Auria of the University of Pisa. Dr. Mike Modro of NINE was the honorary chair of the meeting. Dr. Robert Martin of the U.S. Nuclear Regulatory Commission and Dr. Alessandro Petrucci of NINE served as the technical program chairs, while Dr. Ji Xing of China Nuclear Power Engineering and Dr. Timothy Valentine of Oak Ridge National Laboratory were the steering committee chairs. The conference would not have been a success if not for the contributions of the technical and steering committee members as well as the technical reviewers. A special thank-you is reserved for the staff of NINE that organized and managed all logistical issues with hosting the meeting in Lucca, Italy.

Finally, we would like to extend our gratitude to Dr. Yassin Hassan, editor of *Nuclear Technology*, and David Strutz, production manager at the American Nuclear Society, for their guidance, professionalism, and patience in the production of this special issue.