Foreword

Special issue on UNF-ST&DARDS

Guest Editor

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This special issue of *Nuclear Technology* features invited, peer-reviewed papers on the Used Nuclear Fuel-Storage, Transportation & Disposal Analysis Resource and Data System (UNF-ST&DARDS). Commercial spent nuclear fuel (SNF) in the United States is stored at more than 70 currently operating and shut-down nuclear reactor sites. Many of these sites have more than one nuclear reactor as well as multiple SNF pools and dry storage pads. Inventory of SNF in the United States is approximately 78 000 metric tons of uranium (MTU), and U.S. commercial reactors are discharging approximately 2 000 MTU every year. This large volume of SNF inventory is also very diverse.

Additionally, on-site dry storage time is expected to extend beyond the 20 years specified in the original licenses of the dry storage systems and installations. Because of this extended storage time, SNF analyses must allow for uncertainties related to aging of structures, systems, and components at operating and shut-down reactor sites. Regardless of the length of the storage period, SNF must eventually be transported from the reactor sites to off-site interim storage facilities (ISFs) or to a geological repository. Realistic, time-dependent characterization of SNF and related systems (e.g., cask systems) is essential to (1) managing SNF during extended storage; (2) supporting a successful large-scale transportation campaign; (3) planning, designing, and operating ISFs; and (4) supporting the eventual geological disposition of SNF. UNF-ST&DARDS is being developed as a foundational resource for the U.S. Department of Energy Office of Nuclear Energy to streamline computational analysis capabilities for time-dependent characterization of SNF and related systems.

Development of UNF-ST&DARDS was initiated in 2012. Recently, the Radiation Safety Information Computational Center (RSICC) at Oak Ridge National Laboratory conducted the inaugural distribution of the UNF-ST&DARDS beta version for testing and evaluation. While receipt of the initial distribution is by invitation only, a broad release through RSICC is planned before the end of calendar year 2018. UNF-ST&DARDS incorporates the Unified Database (UDB), a comprehensive, controlled, domestic SNF system database integrated with nuclear analysis capabilities to support various objectives for SNF management and fuel cycle analyses. The UDB is designed to preserve various assembly-specific and system-specific (e.g., dry-cask-specific) information for generations and can even be used to inform future generations after final disposition of SNF. UNF-ST&DARDS performs automated assembly-specific and cask-specific nuclear safety analyses to help users quantify and understand the actual state of SNF and related systems. The automated analysis capability reduces user interaction and ensures the quality of the results. While SCALE and COBRA-SFS are the current nuclear and thermal safety analysis codes used by UNF-ST&DARDS, by design, UNF-ST&DARDS can use any nuclear analysis code for performing safety analyses.

This special issue presents topics on the key capabilities of UNF-ST&DARDS. The papers include (1) a general description of UNF-ST&DARDS and its development, (2) as-loaded cask-specific criticality analysis, (3) as-loaded cask-specific shielding analysis, (4) as-loaded cask-specific thermal analysis, (5) as-loaded cask-specific containment analysis, (6) automated report generation from the UDB, and (7) fuel cycle and system analysis applications of the UDB. Because UNF-ST&DARDS uses COBRA-SFS for thermal analyses, papers on COBRA-SFS theory and validations are also included. Planned future capabilities for UNF-ST&DARDS include assembly-specific performance analysis, automated shielding analysis for an entire facility, and an algorithm to optimize dry storage loading. Readers of *Nuclear Technology* will find these papers highly relevant for understanding SNF management–related issues and the UNF-ST&DARDS as-loaded analysis approach for discerning whether an issue is valid.

Finally, I would like to express my gratitude to the authors, reviewers, and *Nuclear Technology* staff members for their efforts in assembling this special issue.