

Foreword

Special issue on the Computational and Experimental Benchmarking for Transient Fuel Testing Integrated Research Project

Guest Editor

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In 2018, the Transient Reactor Test (TREAT) Facility was restarted. This now-operational facility brings world-class transient fuel testing capabilities back to the United States. Among a number of parallel efforts prior to the TREAT Facility's restart, a U.S. Department of Energy (DOE) Integrated Research Project (IRP) was funded for the purpose of benchmarking the TREAT Facility with several goals in mind:

1. to produce a comprehensive evaluation of existing TREAT Facility neutronics data using next-generation reactor core neutronics codes in accordance with established guidelines per the International Handbook of Evaluated Reactor Physics Benchmark Experiments (IRPhEP)
2. to perform a benchmark using ready-use computational fluid dynamics tools against that of a sodium loop experiment historically collected in the TREAT Facility
3. to design, develop, and test a new experimental thermal-hydraulic system of a representative TREAT Facility water flow loop and to benchmark the data collected against that produced via RELAP5-3D and TRACE
4. to develop a comprehensive instrumentation plan for the TREAT Facility by benchmarking performance of advanced in-pile instruments in the Massachusetts Institute of Technology Research Reactor (MITR) and the TREAT Facility.

The integrated team brought together collaborating members from three universities (Oregon State University, the University of Michigan, and Massachusetts Institute of Technology), three national laboratories (Idaho National Laboratory, Argonne National Laboratory, and Oak Ridge National Laboratory), and two industry partners (TerraPower and Harris Thermal Transfer Products).

A brief summary of accomplishments resulting from this IRP includes two filed patents, more than 40 conference papers, two published benchmark reports through IRPhEP, a new representative thermal-hydraulic test facility alike the in-pile pressurized water reactor water flow loop for the TREAT Facility, and the first advanced instruments tested within the TREAT Facility core upon its restart.

The collaborators had significant support from countless parties, including the operational and technical staff at the TREAT Facility, to ensure that their outcomes most impactfully aligned with program needs. Last, the collaborators would like to acknowledge the fiscal support of the DOE's Office of Nuclear Energy under work package identification number NU-15-OR-OSU-0701-01.

This special issue of *Nuclear Technology* is dedicated to disseminating the scholarly outcomes that resulted from this Computational and Experimental Benchmarking for Transient Fuel Testing IRP. The papers presented herein align directly with the four objectives of the funded IRP and present results acquired via novel approaches in modeling and experimentation related to benchmarking the TREAT Facility reactor while utilizing advanced instrumentation.