# Molten Salt Reactor Experiment Benchmark Evaluation

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**ABSTRACT:**

The fluid-fueled Molten Salt Reactor (MSR) is one of the six advanced concepts selected by the 2002 Generation IV roadmap as a technology meriting future research and development. Research and development of MSRs has been conducted worldwide since then, with a larger effort starting in 2012 in China to develop and construct a new MSR test reactor. Noticeably, a MSR was actually built and operated, providing data that could be used to validate modern simulation models. The Molten Salt Reactor Experiment (MSRE) at the Oak Ridge National Laboratory (ORNL) went critical in 1965 and was operated until 1969. It was built to demonstrate key features of the molten salt fluid fuel reactors and to prove the practicality of the MSR technology. The experimental program included a variety of criticality and reactivity measurements at zero- and full-power operation for molten-salt fuels using $^{235}U$ or $^{233}U$ as fissile material. The wide range of experimental data and documentation available from the MSRE program constitutes a unique and extensive collection of experimental data for this class of advanced reactor concepts. The International Reactor Physics Benchmark Experiment Evaluation Project (IRPhEP) collects reactor physics experimental data from nuclear facilities worldwide and evaluates those data to develop qualified benchmark data sets for validation of computational methods and techniques. Currently the IRPhEP handbook does not contain any benchmark set related to MSR technology, which is a deficiency that has been specifically noted as a knowledge gap of high priority. The objective of this proposed project is to employ the data archive on the MSRE and develop a set of high-quality MSR reactor physics benchmarks for inclusion in the IRPhEP handbook. Validation of modern neutronic and depletion simulation codes with these data can increase confidence in their application to a wider range of problems and improve the ability to assess fuel cycle options and claims for MSR.