Foreword

Special issue on the National Criticality Experiments Research Center

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I am honored to introduce this special issue of *Nuclear Science and Engineering* dedicated to and in honor of the 10th operational anniversary of the Department of Energy's (DOE's) and the National Nuclear Security Administration's (NNSA's) National Criticality Experiments Research Center (NCERC).

NCERC is located at the Nevada National Security Site (NNSS) and operated by Los Alamos National Laboratory (LANL). NCERC is the United States' flagship, multifunctional criticality experiments facility. It is one of the DOE's two remaining operational critical experiments facilities. NCERC's significant fissile material inventory and world-class expertise support a variety of nuclear security missions, including nuclear criticality safety research and training, nuclear emergency response, nuclear nonproliferation, and support for other government agencies, making it the only critical experiments facility of its kind in the Western Hemisphere.

NCERC can trace its history back to the World War II days of the Manhattan Project's "Project Y," located at Los Alamos, New Mexico. The need for determining the critical mass for fissile materials and how that mass is affected by surrounding materials and conditions was evident during the early days of Project Y. Following two separate fatal accidents over the course of a year, in 1946, it also became evident that a way to conduct these experiments remotely was necessary to ensure the safety of the experimenters.

Thus began an era of remotely operated critical experiments at Los Alamos's Pajarito Canyon, designated as Technical Area 18. Eventually, the facility became known as the Los Alamos Critical Experiments Facility (LACEF). For over 50 years, LACEF conducted an astounding number of experiments, which contributed to a variety of programs related to the application of nuclear science and engineering, including space nuclear propulsion, basic measurement of nuclear parameters, kinetic behavior of chain-reacting systems, nuclear weapons safety, nuclear criticality safety, development of radiation detectors, and training for the next generation of nuclear scientists and engineers.

In the early 2000s, the DOE decided to relocate the LACEF materials and equipment to the Device Assembly Facility at the NNSS, formerly known as the Nevada Test Site. LANL staff began the arduous task of safely and securely disassembling and relocating the LACEF equipment and materials while working with NNSS staff to implement the necessary facility modifications and technical safety bases required to restart the operations.

On June 15, 2011, Planet was the first of the four criticality assembly machines relocated from LACEF to achieve criticality at NCERC. During the first 10 years of NCERC operations, more than 750 days of operations have been performed utilizing the critical assemblies, and an additional 500-plus days of subcritical operations have been performed in the NCERC high bays. Nearly 50 critical experiments and 20 subcritical experiments have been performed. These experiments have provided valuable information for criticality safety as well as other application areas (nuclear energy, nonproliferation, nuclear security, and others). The following papers in this special issue of *Nuclear Science and Engineering* describe the history and use of the four critical experiments machines and the assembly and measurement of radiation test objects for a variety of nuclear applications. Recent successes at NCERC include design and testing of the Kilopower Reactor Using Stirling Technology (KRUSTY) prototype space reactor for potential use for future crewed missions to the moon and Mars, validation testing of the criticality accident alarm system to be

installed at NNSA's new Uranium Processing Facility, and plutonium and high-enriched uranium experiments that are helping us to fill neutron cross-section data gaps in the thermal and epithermal energy ranges. The applications of these measurements are limitless.

Please join us in celebrating the 10-year anniversary of that momentous NCERC criticality milestone and in celebrating the experimentalists at NCERC, who continue to dedicate their careers to the pursuit of achievements in nuclear science and engineering.