



Department of Energy
Office of Science
Washington, DC 20585

March 3, 2019

Dr. Marc Kastner
Science Philanthropy Alliance
480 S. California Avenue #304
Palo Alto, California 94306

Dear Dr. Kastner:

The U.S. Department of Energy (DOE) has maintained long-term stewardship of neutron capabilities for the Nation. The combination of the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR), under the auspices of Basic Energy Sciences (BES) in the Office of Science, has provided the U.S. scientific community with leading neutron capabilities in support of DOE's missions in science, energy, environment, and national security.

To maintain international leadership in neutron science, the 2016 Basic Energy Sciences Advisory Committee (BESAC) Facility Prioritization study acknowledged the critical scientific importance and mission relevance of expanding the SNS with the Proton Power Upgrade (PPU) and the addition of the Second Target Station (STS). Following the report recommendation, BES has worked with Oak Ridge National Laboratory to address the issues identified by the prioritization report, including improvements of the target design, leading to achievement of sustained SNS operation at its full design power of 1.4 MW in 2018.

With the planning process for both the PPU and STS projects under way in 2019, I am writing to seek the input of BESAC on the long-term strategy concerning HFIR, which complements SNS and is among the highest-flux reactor-based sources in the world. With HFIR entering its 6th decade, its long-term future requires careful thought and planning, especially in the context of the U.S. domestic high-performance neutron research facilities.

This charge is also in part informed by the 2018 "Neutrons for the Nation" report, commissioned by the American Physical Society's Panel on Public Affairs, which focuses on the competing goals of reducing nuclear proliferation risk while maintaining intense controlled sources of neutrons for vital scientific and industrial work. The report highlighted the continued need for the U.S. to support its diversity of neutron R&D capabilities, as well as to initiate planning for a new generation of high-performance research reactors.

I am asking BESAC to form a subcommittee to assess the **scientific justification** for a U.S. domestic high-performance reactor-based research facility, taking into account current international plans and existing domestic facility infrastructure. The following questions serve as the framework for the study:



- What is the merit and significance of the science that could be addressed by a high-performance, steady-state reactor, and what is its importance in the overall context of research in materials sciences and related disciplines?
- What are the capabilities of other domestic and international facilities, existing and planned, to address the science opportunities afforded by such a domestic research reactor?
- What are the benefits to other fields of science and technology and to industry of establishing such a capability in the U.S.? In particular, consider applications such as isotope production, materials irradiation, neutron imaging, dark matter research, and neutron activation for trace element analysis.
- What are the strengths and limitations of a steady-state research reactor compared to a pulsed spallation neutron source for science, engineering, and technology? What functions currently performed by research reactors can be assumed by spallation neutron sources?
- Are there feasible upgrade paths for HFIR to provide world-leading capabilities in serving the Office of Science missions well into the future? What can we learn from the experience at the Institut Laue-Langevin?
- Can Low Enriched Uranium (LEU) and High Assay LEU (HALEU) fuels (defined as <20% enriched U-235) replace Highly Enriched Uranium fuels in research reactors while preserving the needed characteristics of neutrons produced by steady-state reactors? What R&D would be needed to support LEU and HALEU fuels development?

In assembling a subcommittee, please consider members from other Office of Science and DOE Federal Advisory Committees, including the Nuclear Science Advisory Committee, the Fusion Energy Science Advisory Committee, the Defense Programs Advisory Committee, and the Nuclear Energy Advisory Committee. We look forward to the results of your review and any recommendations that result from this study.

I would appreciate receiving a written report by July 31, 2020.

Sincerely,



J. Stephen Binkley
Deputy Director for Science Programs
Office of Science