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**US High Performance Research Reactor Preliminary Design
Milestone for Conversion to Low Enriched Uranium Fuel**

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ABSTRACT

US reactors that regularly refuel with highly enriched uranium (HEU) have undertaken conversion to low-enriched uranium (LEU) using a high-density alloy of uranium-10 weight% molybdenum (U-10Mo) that is under development under the US High Performance Research Reactor (USHPRR) portion of the NNSA Reactor Conversion program. The USHPRR consists of eleven US national laboratories, uranium processing plants and universities working with a commercial fuel fabricator to convert five reactors and an associated critical assembly. Since feasibility designs were completed in 2009 for all USHPRR, in the last year all five USHPRR have now completed LEU designs including three Preliminary Safety Analysis Reports (PSARs).

The three USHPRR reactors regulated by the US Nuclear Regulatory Commission (NRC) are at the University of Missouri (MURR), Massachusetts Institute of Technology (MITR), and the National Institute of Standard and Technology (NBSR). Each has now each completed a PSAR for conversion to LEU fuel. As a part of Reactor Conversion Pillar work led by Argonne and these reactor organizations, the final two PSARs were submitted to the NRC by MURR and MITR by the end of 2017. In 2018, the two USHPRR reactors regulated by the US Department of Energy (DOE) at the Idaho National Laboratory (ATR) and the Oak Ridge National Laboratory (HFIR) completed optimized conceptual designs, with ATR confirming a ‘base fuel’ design of the same fabrication complexity as required for MURR, MITR and NBSR. Along with available U-10Mo designs, HFIR has evaluated an option to convert on available U_3Si_2 fuel at a ‘standard’ 4.8 gU/cm³ density. However, HFIR conversion will require additional fuel qualification due to the complex fuel design containing boron and since HFIR exceeds existing silicide qualification limits.

USHPRR design and safety bases are discussed along with the steps for future work to demonstrate fabrication at a commercial scale. Irradiation testing specific to each USHPRR will then be performed for final SARs required before conversion to LEU fuel.