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US High Performance Research Reactor Fuel Element Specifications

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ABSTRACT

Five US reactors are in the process of converting from the use of highly enriched uranium (HEU) to low-enriched uranium (LEU) fuel under the US High Performance Research Reactor (USHPRR) program using a high-density alloy of uranium-10 weight% molybdenum (U-10Mo) that is under development. The Reactor Conversion (RC) Pillar teams at several national laboratories are leading the effort to prepare the fuel element specifications and drawings that will be used by the Fuel Qualification (FQ) and Fuel Fabrication (FF) Pillars to demonstrate irradiation performance of the LEU fuel and fuel fabrication at a commercial scale for the proposed designs.

As of 2018, all five reactors have completed designs of their LEU fuel elements and three of them – the National Institute of Standards and Technology Reactor (NBSR), Massachusetts Institute of Technology Reactor (MITR), and the University of Missouri Research Reactor (MURR) – have already submitted their Preliminary Safety Analysis Reports (PSARs) to their regulator.

The historic development of the LEU U-10Mo monolithic fuel element specifications is presented. Oak Ridge National Laboratory completed an initial specification for a HFIR feasibility design, followed by a specification prepared by Idaho National Laboratory for ATR for Conceptual Design. More recently, fuel specifications and drawings for MITR and MURR conversion elements that are consistent with the PSARs have been completed in collaboration with the FF Pillar and the fuel fabricator. The preparation of the fuel specifications and drawings for the NBSR conversion element design and integration of all USHPRR LEU fuel specifications will also be discussed.