

**SECTION A. Project Title: Deployment and In-Pile Test of an Instrument for Real-Time Monitoring Thermal Conductivity Evolution of Nuclear Fuels – Idaho National Laboratory****SECTION B. Project Description**

The Idaho National Laboratory (INL) proposes to deploy a recently developed fiber-optic-based instrument in the MIT Research Reactor (MITR) to perform in-reactor thermal conductivity measurements of nuclear fuels. As thermal conductivity is closely related to structural defects generated by irradiation, values collected in post-irradiation-examination (PIE) environments are expected to be different from those collected on fuels in operation due to annealing of defects after reactor shutdown. Thus, there is a need to measure thermal conductivity of fuels in situ, in harsh in-reactor environments, to inform advanced fuel performance codes more fully. This project will make use of existing capabilities at INL, MITR, and MIT. The goal of this project is to perform insertion irradiation tests of the PTR instrument at MITR. Both instrument survivability and performance will be examined. The ultimate objective is to enable in-reactor measurement capability and make it available to the nuclear materials community. The primary tasks to accomplish this scope are given as follows: a) Adapt the current PTR instrument for the geometry of MITR in-core positions; b) Perform in-reactor thermal conductivity measurements at MITR; and c) Finalize the instrument to enable in-reactor thermal performance monitoring for the nuclear energy community. The instrument and protocol have the potential to become the standard characterization approach for determining in-reactor thermal conductivity and further, real-time microstructural monitoring.

**SECTION C. Environmental Aspects / Potential Sources of Impact**

Two pieces of depleted  $UO_2$  and two pieces of depleted U-Zr will be used as the testing samples in the MIT Research Reactor. They will be well sealed in the sample holder (part of the instrument) to test the real-time measurement capability of the instrument.

**SECTION D. Determine the Level of Environmental Review (or Documentation) and Reference(s):** Identify the applicable categorical exclusion from 10 CFR 1021, Appendix B, give the appropriate justification, and the approval date.

Note: For Categorical Exclusions (CXs) the proposed action must not: 1) threaten a violation of applicable statutory, regulatory, or permit requirements for environmental, safety, and health, including requirements of DOE orders; 2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities; 3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; 4) adversely affect environmentally sensitive resources. In addition, no extraordinary circumstances related to the proposal exist which would affect the significance of the action, and the action is not "connected" nor "related" (40 CFR 1508.25(a)(1) and (2), respectively) to other actions with potentially or cumulatively significant impacts.

References: B3.6 Siting, construction, modification, operation, and decommissioning of facilities for small-scale research and development projects; conventional laboratory operations (such as preparation of chemical standards and sample analysis); and small-scale pilot projects (generally less than 2 years) frequently conducted to verify a concept before demonstration actions, provided that construction or modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible). For purposes of this category, "demonstration actions" means actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment. Demonstration actions frequently follow research and development and pilot projects that are directed at establishing proof of concept.

Justification: The activity consists of inserting a developed instrument capable of measuring thermal conductivity of nuclear fuels in reactor into MITR for irradiation testing.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act)  Yes  No

Approved by Jason Anderson, DOE-ID NEPA Compliance Officer, on 08/20/2021.