

**SECTION A. Project Title: Demonstration of a Methodology for Direct Validation of MARMOT Irradiation-Induced Microstructural Evolution and Physical Property Models Using U-10Zr – Texas A&M University****SECTION B. Project Description**

Texas A&M University, in collaboration with Idaho National Laboratory, proposes to demonstrate a methodology that enables the direct validation of microstructural evolution models for metallic nuclear fuel in MARMOT. The proposed work will seek to accomplish the following objectives: (1) Pre-Irradiation Characterization of U-10Zr Samples: X-ray diffraction computed tomography (XRD-CT) will provide 3D information on the initial state of the microstructure and Thermal Conductivity Microscopy (TCM) will provide high spatial resolution phase and inter-phase thermal property measurements. Standard pre-irradiation characterization (e.g., dimensions, density, x-ray diffraction, and electron microscopy) will also be performed. (2) Irradiation of the U-10Zr Samples in the Advanced Test Reactor (ATR): Sample irradiations will be performed in a configuration conforming as closely as possible to an existing and well-analyzed ATR experiment capsule design. The intent of this proposal is to insert four identical test capsules containing five types of miniature samples, (with replicates) that have been fully characterized. (3) Post-Irradiation Characterization of U-10Zr Samples: A selected sample set will be characterized using the same methodologies applied prior to irradiation. (4) MARMOT Assessment and Validation for mesoscale models: This project provides critical data needed for understanding the irradiation behavior of U-Zr fuels and for the validation of separate effects models in MARMOT for metal fuels. The data obtained will be used for validation of MARMOT gas bubble swelling and effective thermal conductivity models with respect to the disparate irradiation conditions made available in the samples.

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

Radioactive Material Use – The research involves working with depleted uranium. Texas A&M University has an environmental health and safety (EHS) office overseeing the lab practices and procedures.

Radioactive Waste Generation – All radioactive waste generated in this project will be disposed according to the EHS procedures at Texas A&M.

Mixed Waste Generation – Occasionally, mixed waste may be generated when activated materials are treated with acids or mixed with hazardous chemicals. The waste will be handled according to the EHS procedures at Texas A&M.

Chemical Use/Storage – Solvents such as ethanol will be used in sample preparation. They will be handled according to the EHS procedures at Texas A&M.

Chemical Waste Disposal – When chemicals are spent at Texas A&M, they will be disposed according to the EHS procedures.

Hazardous Waste Generation – Certain chemical procedures (i.e., acid etching) will involve the use of hazardous chemicals according to the EHS procedures at Texas A&M.

Industrial Waste Generation – Packaging waste (i.e., cardboard, paper, etc.) will be generated in the shipment and handling of samples.

Air Emissions – Fine particulates from the generation of small amounts of attrited material from the polishing of uranium metal will be captured by double high-efficiency particulate air (HEPA) filters in the facility suspect exhaust system.

Water/Well Use – Sample preparation may require a small amount of water, probably no more than 1 liter.

**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

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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). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial development.

Justification: The activity consists of university-scale research activities that provide the critical data needed for understanding the irradiation behavior of U-Zr fuels.

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

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on 08/06/2018