

SECTION A. Project Title: Combining Multi-Scale Modeling with Microcapsule Irradiation to Expedite Advanced Fuels Deployment – General Atomics**SECTION B. Project Description**

General Atomics (GA), in collaboration with Oak Ridge Idaho National Laboratory (ORNL) and the University of Tennessee, proposes a research and development project to characterize the fission gas release (FGR) and irradiation-induced swelling behavior of uranium carbide (UC) fuel using a fast-track accelerated fuel qualification approach. The specific objectives of the proposed project are to 1) develop a mechanistic understanding of irradiation-induced well and FGR in UC and 2) to identify and conduct targeted irradiation experiments and generate empirically-calibrated diffusion/swelling property models.

Samples of high-purity UC microspheres (also referred as UC kernels) will be fabricated using GA's carbon-infused sol gel process at its state-of-the-art bench-scale fuel fabrication facility. This facility builds upon the long history of the Tri-Structural Isotopic (TRISO) fuel and the Training, Research, Isotopes, General Atomics fuel development program.

The test samples will be irradiated in ORNL's innovative microcapsules at the High Flux Isotope Reactor (HFIR), and post-irradiation examination (PIE) will be conducted to measure swelling and FGR. The proposed work will complement other ongoing collaborations between GA and ORNL as part of the Advanced Fuels Campaign such as the DOE National Science User Facility (NSUF) program, wherein the microcapsule irradiation would be demonstrated.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use - Project will use low enriched uranium for fuel fabrication, on the order of 10 g U-235. Work Authorization already in place for handling of radiological materials and chemicals in lab.

Radioactive Material Use - Low level hotel waste will be generated (- 55 gallon barrel). Waste will be disposed of via commercial means (Philotechnics or similar outfit).

Mixed Waste Generation - Fuel process generates small amount (- 5 gallons) of mixed liquid waste (ammonium hydroxide and uranium). Waste will be disposed of via commercial means (Philotechnics or similar outfit).

Chemical Use/Storage - Fuel fabrication process uses chemicals such as carbon black and alcohols. Work Authorization already in place for handling of radiological materials and chemicals in lab.

The project will use radioactive material to perform irradiation experiments at ORNL. The ORNL facility staff will be responsible for monitoring, handling, and disposal of the radioactive material and wastes following existing standard operating procedures. All hazardous materials will be handled and disposed according to existing standard operating procedures and waste profile forms. The action would not create additional environmental impacts above those already permitted at ORNL.

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). 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 research aimed at investigating irradiation properties of uranium carbide fuel.

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

DOE-ID NEPA CX DETERMINATION

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on 09/27/2018