

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

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CX Posting No.: DOE-ID-INL-22-088

SECTION A. Project Title: CRATER

SECTION B. Project Description and Purpose:

The Ceramic Advanced Thermal Evolution Research (CRATER) experiment is a fueled, instrumented capsule experiment to measure in-situ temperature and thermal conductivity of ceramic fuels. CRATER is part of the Aleu (Advanced Low Enriched Uranium) program to accelerate fuel performance irradiation data for identifying alternative high-assay, low enriched uranium (HALEU) fuel systems. The small diameter fuel specimens allow increased linear heat generation rates (LHGR) to simulate increased burnup in shorter irradiation times. Fuel specimens will contain an embedded thermal conductivity probe to measure the thermal conductivity as a function of irradiation time and burnup. Collection of in-situ data drastically decreases the time for follow on disassembly and Post-Irradiated Examination (PIE).

Two ceramic fuel types will be used, uranium mono-nitride (UN) and uranium mono-carbide (UC), with a third metallic fuel used for comparison (UMo). All three types of fuel specimens will be irradiated, at minimum, for one regular Advanced Test Reactor (ATR) cycle in a small B position. A target inner clad and fuel temperature of 300-450 °C will be used in the design. Enrichment of the fuel may vary to optimize the temperature and burnup for a single cycle. The three fuel specimens will use a stainless-steel cladding.

This experiment will generate data describing the thermal properties evolution of ceramic fuel designs to help mature fuel performance models and optimize reactor designs using this category of fuel. This experiment will demonstrate a new method for accelerated characterization of nuclear fuel properties to help hasten maturation of advanced fuel concepts.

The experiment will have hardware fabrication at the North Holmes Lab (NHL). There will be fuel fabrication at Fuel Manufacturing Facility (FMF) and a down blend of uranium at Fuels and Applied Science Building (FASB), machining at Experimental Fuels Facility (EFF). The assembly of the specimens will partake in the Test Train Assembly Facility (TTAF). The irradiation will be at ATR, and field capsules that amount to 0.0001 m3 will be shipped for PIE/assembly to Hot Fuels Examination Facility (HFEF). Typical anti-c clothing used on the reactor top and canal, and wipes utilized for glove box work that will approximate to be 2-4 rad bags as radiological waste. The 3 annular specimens will come out to be a total volume of 0.322 in3 and will be retained in the NSUF Nuclear Fuels and Materials Library at HFEF after PIE. The total volume for the entire experiment of the in-core material will be 0.0001 m3 and the lead-out material will be 0.006 m3. The in-core material will not be waste. experiments may not generate transuranic waste since the final waste container may not exceed 100 nCi/g of transuranic elements with half-lives greater than 20 years.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Fuel fabrication activities in FASB (MFC-787) are not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. The dose from this facility is tracked based on inventory on a quarterly basis by Operations and Environmental personnel.

Experiment irradiation will be performed at the ATR. The irradiation in the ATR is not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. ATR radionuclide emissions are sampled and reported in accordance with Laboratory Wide Procedure (LWP)-8000 and 40 CFR 61 Subpart H. All experiments will be evaluated by ATR Environmental Support and Services staff, prior to insertion in the ATR. All radionuclide release data (isotope specific in curies) directly associated with this experiment will be calculated and provided to ATR Programs Environmental Support organization.

The irradiated specimens will be delivered to the MFC HFEF for disassembly and then undergo routine PIE. All radionuclide release data associated with the PIE portion of this experiment will be recorded as part of the HFEF continuous stack monitor. The PIE examination in HFEF is not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H

Discharging to Surface-, Storm-, or Ground Water

N/A

Disturbing Cultural or Biological Resources

N/A

Generating and Managing Waste

Small amounts of hardware industrial waste will be generated from hardware fabrication at NHL. Radiological waste will be from the leadout hardware and will be discarded in the ATR waste streams. The specimens will be retained but the capsules will be discarded as radiological waste at HFEF, the total amount will have no impact.

Releasing Contaminants

When chemicals are used during the project there is the potential for releases that could impact the environment (air, water, soil).

Using, Reusing, and Conserving Natural Resources

All materials will be reused and recycled where economically practicable. All applicable waste will be diverted from disposal in the landfill where conditions allow.

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SECTION D. Determine Recommended Level of Environmental Review, Identify Reference(s), and State Justification: Identify the applicable categorical exclusion from 10 Code of Federal Regulation (CFR) 1021, Appendix B, give the appropriate justification, and the approval date.

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, or similar requirements of Department of Energy (DOE) or Executive Orders; (2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment or facilities; (3) disturb hazardous substances, pollutants, contaminants, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; (4) have the potential to cause significant impacts on environmentally sensitive resources (see 10 CFR 1021). In addition, no extraordinary circumstances related to the proposal exist that would affect the significance of the action. In addition, the action is not "connected" to other action actions (40 CFR 1508.25(a)(1)) and is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1608.27(b)(7)).

References:

Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement and Record of Decision (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203-SA-01 and DOE/EIS- 0203-SA-02) and the Amended Record of Decision (1996).

10 CFR 1021, Appendix B to subpart D, items B3.6, "Small-scale research and development, laboratory operations, and pilot projects."

Justification:

After PIE, irradiated test pin segments and PIE remnants will be stored with other similar DOE-owned irradiated materials and experiments at MFC, most likely in the HFEF or the Radioactive Scrap and Waste Facility (RSWF) in accordance with DOE's Programmatic SNF Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (FEIS) and ROD (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203-SA-01 and DOE/EIS-0203-SA-02) and the Amended Record of Decision (February 1996). Ultimate disposal of the irradiated test pin segments and PIE remnants will be along with similar DOE-owned irradiated materials and experiments currently at MFC. Irradiated sample debris and secondary waste could total as much as 20-30 Kg. Categorizing this material as waste is supported under Department of Energy Order (DOE O) 435.1, Att. 1, Item 44, which states "...Test specimens of fissionable material irradiated for research and development purposes only...may be classified as waste and managed in accordance with this Order..."

The proposed R&D activities are consistent with CX 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); 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 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 deployment."

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

Approved by Jason L. Anderson, DOE-ID NEPA Compliance Officer on: 10/12/2022