DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-20-090 R1

SECTION A. Project Title: High Burnup Experiments in Reactivity Initiated Accidents (HERA) Revision 1

SECTION B. Project Description and Purpose:

Revision 1: The Static Environment Rodlet Transient Test Apparatus–General Atomics–Silicon Carbide (SERTTAGA-SiC) experiments are a series of in-pile reactivity-initiated accident (RIA) transient irradiations that will take place at the Transient Reactor Test facility (TREAT) at INL. The experiments are extremely similar to the HERA series, with the primary differences being the rodlet length (~10 inches instead of ~6 inches for HERA) and cladding material (General Atomics proprietary silicon carbide/silicon carbide composite instead of zirconium alloy for HERA).

INL will be fabricating the fuel pellets and shipping them to General Atomics, which will grind the pellets to size, fabricate the cladding material, and incorporate the pellets and cladding into rodlets. All pellets will consist of fresh fuel; there will be no handling or usage of pre-irradiated fuel material.

There will be 5 total capsules. The capsule bodies are spares from the HERA project; finish machining of these capsules will likely take place at North Holmes Laboratory (NHL). Instrumentation assembly, if applicable, is anticipated to take place at the Energy Innovation Laboratory (EIL), while fueled capsule assembly is expected to take place at the Advanced Fuels Facility (AFF). Following irradiation, it is expected that the capsules will be sent to the Hot Fuel Examination Facility (HFEF) for disassembly and PIE activities.

Waste will include:

- Metal shavings/general machining detritus (most likely at NHL) at < 1lb
- Industrial (EIL, AFF, HFEF) less than 5 gallons
- Hazardous N/A
- Radioactive Rodlets (HFEF) 5 rodlets, less than 1 lb
- Low level less than 1 kg
- Mixed N/A
- PPE, wipes (EIL, AFF) less than 5 gallons
- TRU less than 1 kg

No samples will be collected. No equipment will be purchased.

Original ECP:

The High-Burup Experiments in Reactivity-Initiated Accidents (HERA) experiments consists of performing in-pile reactivity-initiated accident (RIA) irradiations that will take place at the Transient Reactor Test facility (TREAT) at INL.

Initial irradiations (Phase I) will involve fresh fuel with simulated high burnup characteristics that include prehydrided cladding and use of oversized UO2 fuel pellets. The tests will be conducted at different pulse widths to determine if a pulse width dependence or threshold on different failure modes can be determined. Tests down to approximately 50 milliseconds (ms) can be performed at the TREAT facility.

Work in Phase one involves the assembly of the fresh fuel tests which includes hydrogen charging the zirconium alloy tubes using a furnace at the INL Research Center (IRC) and grinding pellets to specific sizes at the Experimental Fuels Facility (EFF). INL may also explore subcontracting options to produce pre-hydrided cladding with the desired characteristics. The specialty ground pellets will than be inserted into the rods and welded shut. The assembled rods will be loaded into test capsules and filled with water and sealed shut. Approximately 4-6 capsules will be assembled.

Following capsule assembly they will be shipped the TREAT reactor where they will be irradiated in transient conditions. Following irradiations the capsules will be sent to Hot Fuel Examination Facility or Irradiated Materials Characterization Laboratory for disassembly and post transient characterization which will include non-destructive and destructive analysis.

Follow on irradiations (Phase II) will involve RIA testing of previously irradiated material irradiated in a commercial nuclear reactor. These tests will validate findings from the fresh fuel tests and investigate fuel failure and core coolability thresholds at high burnup.

It is anticipated in the HERA project that 25 previously irradiated fuel pins from the Byron Nuclear Generating station will have been shipped to INL as a separate activity. Work on HERA will involve the non destructive and destructive characterization of 2 of the rods in the shipment as well as the preparation of 4 rod segments for transient testing in TREAT. Rod segments will be refabricated with new endcaps and diagnostic equipment and loaded into water capsules in the HFEF hot cell. After which they will be shipped to TREAT and irradiated in transient conditions.

Some of the prehydrided (unirradiated) cladding may also be sent to other research facilities for analogue experiments. All material and waste generated from these activities that is transferred outside of INL will remain external to INL, where waste will be handled utilizing the guidelines at those facilities as appropriate.

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. 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...".

In addition, to complete proposed work activities, it is necessary for the project to use the HFEF hot cell which contains both defense and nondefense related materials and contamination. Project materials will come into contact with defense related materials. It is impractical to clean out defense related contamination, and therefore, waste associated with project activities is eligible for disposal at the Waste Isolation Pilot Plant (WIPP). National Environmental Policy Act (NEPA) coverage for the transportation and disposal of waste to WIPP are found in Final Waste Management Programmatic Environmental Impact Statement [WM PEIS] (DOE/EIS-0200-F, May 1997) and Waste Isolation Plant Disposal Phase Supplemental EIS (SEIS-II) (DOE/EIS-0026-S-2, Sept. 1997), respectively. The 1990 ROD also stated that a more detailed analysis of the impacts of processing and handling transuranic (TRU) waste at the generator storage facilities would be conducted. The Department has analyzed transuranic (TRU) waste management activities in the Final Waste Management Programmatic Environmental Impact Statement (WM PEIS) (DOE/EIS-200-F, May 1997). The WM PEIS analyzes environmental impacts at the potential locations of treatment and storage sites for TRU waste; SEIS-II addresses impacts associated with alternative treatment methods, the disposal of TRU waste at WIPP and alternatives to that disposal, and the transportation to WIPP.

Packaging, repackaging, transportation, receiving, and storing used nuclear fuel and R&D for used nuclear fuel management is covered by DOE's Programmatic Spent Nuclear Fuel (SNF) Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (EIS) 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 (February 1996). The analyses include those impacts related to transportation to, storage of, and research and development related to used nuclear fuel at the INL (see Tables 3.1 of the SNF Record of Decision (May 30, 1995) and Table 1.1 of the Amended Record of Decision [February 1996].

The environmental impacts of transferring low level waste from the INL to the Nevada National Security Site were analyzed in the 1996 Nevada Test Site EIS (DOE/EIS-0243) and supplemental analysis (SA) (DOE/EIS-0243-SA-01) and DOE's Waste Management Programmatic EIS (DOE/EIS-200). The fourth ROD (65 FR 10061, February 25, 2000) for DOE's Waste Management Programmatic EIS established the Nevada National Security Site as one of two regional low-level waste (LLW) and mixed low level waste (MLLW) disposal sites. The SA considers additional waste streams, beyond those considered in the 1996 NTS EIS, that may be generated at or sent to the Nevada National Security Site for management.

The potential for transportation accidents was analyzed in the SNF EIS (Section 5.1.5 and Appendix I-5 through I-10) and in the FRR EIS (Sections 4.2.1 and 4.2.2).

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

The proposed action has the potential to generate radiological and chemical emissions from irradiation in TREAT and the destructive and nondestructive PIE at MFC. Air emissions are anticipated to be minor, and concentrations would not exceed the current monitored air emissions from these facilities. An Air Permit Applicability Determination (APAD) may be required.
The TREAT irradiation activities are not modifications in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H. TREAT 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 Environmental Support and Services staff. All radionuclide release data (isotope specific in curies) directly associated with this proposal will be calculated and provided to the 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. In 2019, the effective dose equivalent to the offsite maximally exposed individual (MEI) from all operations at the INL Site was calculated as 5.59 E-02 mrem/yr, which is 0.56% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from the INL site. The additional increment in emissions from the proposed action would not significantly change the total site-wide MEI dose. Therefore, the emissions are bounded by the analysis in the 1995 EIS, which estimated the annual cumulative doses to the maximally exposed worker, offsite maximally exposed individual (MEI), and the collective population from DOE's decision to implement the preferred alternative (DOE/EIS-0203). The potential air emissions and human health impacts associated with the proposed action would be smaller than and are bounded by the impacts presented in the 1995 EIS.

Discharging to Surface-, Storm-, or Ground Water

NA

Disturbing Cultural or Biological Resources

Cultural Resources: This activity does not trigger Section 106 review as it has little to no potential to cause effects to historic properties.

Generating and Managing Waste

In addition to disposal of the irradiated fuel that will be generated as described above, industrial, and low level waste will be generated throughout the R&D process. This waste will be classified and disposed in accordance with INL procedures and DOE regulations/requirements.

The amount of TRU waste to generated is anticipated to be less than 1 kgs.

Releasing Contaminants

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

Using, Reusing, and Conserving Natural Resources

Project description indicates materials will need to be purchased or used that require sourcing materials from the environment. Being conscientious about the types of materials used could reduce the impact to our natural resources.

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:

B3.6 "Small-scale research and development, laboratory operations, and pilot projects"

Justification:

B3.6 Small-scale research and development, laboratory operations, and pilot projects. 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 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: 8/9/2023