DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-17-067 R3

SECTION A. Project Title: Natrium Demonstration Reactor Support Revision 3

SECTION B. Project Description and Purpose:

Revision 3:

Revision 3 encompasses changes in scope given by modification #2 of INL's Natrium Support Program's governing agreements (21CRA11 and 21CRA15).

2.1 Steady-State Irradiation Testing (appended to existing scope described in Revision 1 and 2)

In addition to the Advanced Fuel Cycle (AFC)-4B, AFC-4D, Large Diameter Capsule (LDC)-1A, and LDC-1B irradiation tests, the program will execute an additional experiment campaign named LDC-B4C. The LDC-B4C is a non-fueled drop-in materials experiment that will irradiate Boron Carbide specimens utilizing the LDC-1B design. The LDC-B4C irradiation test entails the design, fabrication, and assembly of up to 10 capsules. These capsules will be irradiated in the Advanced Test Reactor (ATR) and sent to the Hot Fuel Examination Facility (HFEF) and the Irradiated Materials Characterization Laboratory (IMCL) for post-irradiation examination. Like the other steady-state ATR irradiation tests, LDC-B4C will incorporate cadmium thermal neutron filters to be replaced at the end of each irradiation cycle.

4.6 LDC-B4C material specimens

INL will examine the Boron Carbide material specimens irradiated under the LDC-B4C experiment campaign to understand its performance under steady-state irradiation conditions. These activities will occur in HFEF, IMCL, and Analytical Research Lab (ARL).

Revision 2:

Revision 2 encompasses changes in scope given by modification #1 of INL's Natrium Support Program's governing agreements (21CRA11 and 21CRA15).

2.1 Steady-State Irradiation Testing (appended to existing scope described in Revision 1)

In addition to the Advanced Fuel Cycle (AFC)-4B, AFC-4D, and Large Diameter Capsule (LDC)-1A irradiation tests, the program will execute an additional experiment campaign named LDC-1B. The LDC-1B irradiation test entails the design, fabrication, and assembly of 20 fueled capsule specimens. Most of these specimens will be irradiated in Advanced Test Reactor (ATR) and sent to the Hot Fuel Examination Facility (HFEF) and the Irradiated Materials Characterization Laboratory (IMCL) for post-irradiation examination. Like the other steady-state ATR irradiation tests, LDC-1B will incorporate cadmium thermal neutron filters to be replaced at the end of each irradiation cycle.

2.2. Transient Irradiation Testing (appended to existing scope described in Revision 1)

In addition to the sodium loop tests described in Revision 1, the program will also execute transient testing on encapsulated specimens using the Temperature Heat-sink Overpower Response (THOR) experiment vehicle. This additional testing includes the experiment design, fabrication, and assembly. The program will conduct a total of four tests using both irradiated (3) and unirradiated (1) fuel specimens.

4.6. LDC-1B Pins

INL will examine the specimens irradiated under the LDC-1B experiment campaign to understand the fuel performance characteristics of TerraPower's advanced fuel form. These activities will occur in HFEF, IMCL, and Analytical Research Lab (ARL).

6.0 SSHAC Project Management

The program will provide TerraPower with project management services for Contractor's Senior Seismic Hazard Analysis Committee (SSHAC) supporting the Natrium Demonstration Reactor project. The total amount of Transuranic (TRU) waste that will be generated will be 5 kg.

The experiments will be fabricated and assembled at Materials Fuels Complex (MFC), specifically Experimental Fuels Facility (EFF) and the Advanced Fuels Facility (AFF). Transportation of speciments to and from ATR, TREAT, and MFC will require vehicles, likely to be powered by internal combustion engines. The types of evolutions were covered in the original ECP, however; evolutions are expected to increase.

Revision 1:

Environmental Checklist (EC) INL-17-115 details much of the work in this revision. Work not covered under the original EC is specifically noted below.

TerraPower and other private industry partners endeavor to design, license, construct, and operate a sodium-cooled fast spectrum nuclear reactor demonstration plant called Natrium. The U.S. Department of Energy (DOE) supports Natrium through the Advanced Reactor Demonstration Program. TerraPower has also partnered with Idaho National Laboratory (INL) to provide critical research outcomes necessary for the Natrium demonstration.

Over the life of the project, INL will give TerraPower and its partners information regarding fuel performance testing, post-irradiation examination (PIE), fuel fabrication, and digital engineering.

The Program scope is outlined below.

1. PROGRAM MANAGEMENT

Program Management involves coordinating multiple projects supporting the Natrium demonstration. Program Management directs project execution to meet Program objectives.

2. FUEL PERFORMANCE TESTING

Fuel performance testing includes experiments, measurements, and capabilities to obtain data on Natrium's fuel performance model and licensing basis. The following sections discuss performance testing and anticipated waste streams:

2.1 Steady-state Irradiation Testing

Steady-state irradiation testing includes the continued irradiation of the AFC-4B, AFC-4D, and LDC-1A experiments in the Advanced Test Reactor (ATR). Irradiation hardware, operations, and analysis are included. This activity generates specimens for PIE. INL fabricates and irradiates experiment baskets containing a cadmium thermal neutron filter. At the end of each ATR irradiation cycle, the program will dispose of the used basket and use a new basket. This element is a continuation of efforts originally specified under CRADA No. 12-CR-24.

2.2 Transient Irradiation Testing (not covered under Original EC)

Transient irradiation testing includes flowing sodium loop transient tests at the Transient Reactor (TREAT) Test Facility to generate specimens representing expected design basis and beyond design basis accident conditions for Natrium. Scope includes experiment design, fabrication, and assembly. Tests use fresh (unirradiated) and previously irradiated fuel pins currently stored at INL. This activity involves three experiments using two separate sodium loops. INL will perform loop assembly and disassembly activities at the Hot Fuel Examination Facility (HFEF). After irradiation, INL will disassemble experiments to obtain specimens for PIE and dispose of the remaining sodium loop components.

2.3 Transient Furnace Testing (not covered under Original EC)

This activity designs, builds, and installs a furnace in the HFEF main hot cell to simulate transient temperatures and generate PIE specimens.

2.4 Fuel Property Measurements (not covered under Original EC)

Fuel property measurements give thermophysical property measurements of unirradiated fuel. The data inform computer-based fuel performance models for Natrium.

3.0 FUEL FABRICATION

Fuel fabrication includes projects to advance TerraPower's fuel technology. The following sections describe these activities and anticipated waste streams:

3.1 Annular Fuel Development

Annular fuel development creates methodology and procedures to fabricate annular metallic fuel using extrusion processes. Scope includes billet casting, extrusion, straightening and drawing, fuel slug heat treatment, fuel pin loading and bonding, characterization, and fabrication procedures. These processes would be performed using depleted uranium. The program expects to save some samples and dispose of or recycle the rest. INL will create fabrication processes for the lead test assembly. This activity is a continuation of work originally specified under Strategic Partnership Project (SPP) No. SPP 16809.

3.2 Lead Test Assembly Fabrication (not explicitly covered under Original EC)

Following annular fuel development, INL will fabricate nuclear fuel for insertion into a lead test assembly (LTA) of TerraPower's advanced fuel design. This activity includes providing the nuclear fuel, loading fuel into the fuel rods (up to 90 individual rods), closing the rods, and final assembly steps. INL would then ship the rods to a final assembly point then inserted into Natrium. The fuel is expected to be low-enriched uranium at less than 19.75 weight-percent uranium 235. This task would generate uranium-containing scrap. This activity continues efforts originally specified under Strategic Partnership Project (SPP) No. SPP 16809.

4.0 POST-IRRADIATION EXAMINATION

PIE gives data supporting Natrium's licensing documentation. INL will perform PIE on a variety of pins. The following sections describe these activities and anticipated waste streams:

4.1 Legacy Metallic Fuel Pins

INL will examine irradiated metallic fuel pins from the Experimental Breeder Reactor II (EBR-II) and the Fast Flux Test Facility (FFTF) to gather fuel performance data on fuel cladding chemical interaction (FCCI). INL will then deliver the data to TerraPower to support fuel performance modelling efforts. These activities are expected to complete at HFEF, the Analytical Laboratory (AL), and the Irradiated Materials Characterization Laboratory (IMCL). This activity continues efforts originally specified under CRADA No. 11-CR-19.

4.2 LDC-1A Pins

This activity performs a direct performance comparison of newly extruded metallic fuel slugs to legacy EBR-II injection cast fuel slugs at HFEF, AL, and IMCL. This activity continues efforts originally specified under CRADA No. 12-CR-24.

4.3 AFC-4B/D Pins

INL will perform PIE to understand performance characteristics of TerraPower's advanced fuel forms at HFEF, AL, and IMCL. This element is a continuation of efforts originally specified under CRADA No. 12 CR-24.

4.4 Transient Irradiation Test Pins (not covered under Original EC)

INL will examine the fuel pins tested at TREAT.. These activities are expected to complete at HFEF, AL, and IMCL.

4.5 Transient Furnace Test Pins (not covered under Original EC)

INL will examine the fuel pins tested under accident-like thermal conditions in the transient furnace. These activities are expected to complete at HFEF, AL, and IMCL

5.0 DIGITAL ENGINEERING (NOT COVERED UNDER ORIGINAL EC)

Digital Engineering (DE) refers to transforming engineering processes using static documents to fully coupled, interconnected computer tools. INL will assist TerraPower in implementing DE processes and tools for Natrium. This primarily involves consulting efforts in the early stages of the program and is expected to be further refined in each successive budget period. The INL team will initially work with TerraPower to define the needed DE tools and processes to satisfy the Natrium project's needs.

Original EC:

This environmental checklist (EC) replaces the following ECs:

INL-11-070 (OA 12)

INL-11-070 (OA 12) R1

INL-11-070 (OA 8 & 12) R2

INL-12-063 (OA 10 & 12)

INL-13-046

TerraPower aims to develop a sustainable an economic nuclear energy system while reducing proliferation risks and to create new options to convert low-level waste (LLW) into energy resources. The purpose of this program is to compile data to contribute to TerraPower's understanding of metallic fuel irradiation behavior, fabrication, and fast reactor structural materials for development of the Traveling Wave Reactor (TWR) design.

Idaho National Laboratory (INL) conducts test pin (uranium-fueled clad experiments similar to a fast reactor fuel rod) fabrication, irradiation testing, and post-irradiation examination (PIE) activities to research a commercial-scale metal fuel fabrication process for manufacture of TerraPower's TWR core. TerraPower research and development (R&D) activities at INL are listed below:

• Purchase and install equipment in the Materials and Fuel Complex (MFC) Experimental Fuels Facility (EFF), building MFC-794 and the Fuels and Applied Science Building (FASB), MFC-787 to develop a process to fabricate TerraPower test pins

• Characterize un-irradiated fuel to confirm fuel development and examine irradiation performance

•Fabricate test pins for irradiation testing at the Advanced Test Reactor (ATR)

•Ship test pins to and from ATR

•Perform PIE on irradiated test pins to provide data needed for TerraPower fuel qualification.

Fuel Fabrication Development

Metallic Fuel

INL performs metal fuel fabrication techniques at EFF, FASB and the Fuels Manufacturing Facility (FMF) to develop specifications for fabricating test pin fuel slugs for irradiation testing and to assess fuel characteristics.

INL evaluates fabrication techniques and develops test pin specifications using depleted uranium (DU).

INL performs the following TerraPower fuel fabrication research efforts at MFC:

• Equipment procurement, installation (including facility modifications for equipment installation), and demonstration testing

•Arc melting, fuel alloying, casting, and preparation

•Casting system design, fabrication, and installation

•Metal fuel extrusion, drawing, and heat treatment.

The EFF casting system is an enclosed uranium casting system, and includes an induction furnace which casts a single fuel billet at a time and is capable of reaching temperatures of at least 1450ºC (2642ºF) and melting up to about 3 kg of uranium. The system uses a fume hood.

Viability of potential fuel coating is demonstrated by fabricating refractory metal book molds and test coupons. Following each casting run, mold coatings are inspected for coating integrity. Representative sections are mounted and characterized using optical microscopy and Energy Dispersive X-ray Spectroscopy (EDS) or Electron Probe Micro Analyzer (EPMA). Baseline fuel microstructure is characterized before heat-treating at intermediate processing points and after full heat treatment. Characterization is performed using optical microscopy (OM) or scanning electron microscope (SEM), and texture is analyzed via x-ray diffraction (XRD) or Electron Backscatter Diffraction (EBSD).

INL also evaluates capabilities to bond metallic fuel, weld end-caps, and install wire-wraps to support fabrication of test pins. Some TerraPower test pins have a fuel and sodium (Na) bond. Na-bonding development takes place in EFF. Inspection techniques include radiography, eddy-current testing, ultrasonic testing, and destructive evaluation (e.g., clad stripping).

Other activities in EFF include testing of end-cap welding equipment in an inert glovebox or enclosure and development, fabrication, procurement, and installation of equipment for wire-wrapping test pins.

Annular Fuel

INL researchs fabrication methods using surrogate materials such as DU and alloy 422 (cladding tube).

Slug Fitting

INL evaluates different methods of fitting slugs in cladding. Metallographic examinations of the fuel/cladding/barrier composite is performed to evaluate Fuel Cladding Chemical Interaction (FCCI) barrier damage.

INL also fabricates DU annular fuel slugs for Y-12 development activities. These fuel slugs are beta-quenched. In order to support beta-quench and FCCI barrier development activities, INL fabricated about 50 prototypical DU annular alloyed fuel slugs. INL performs fuel slug heat-treatments at the INL.

In addition, INL proposes to assemble and ship six transmission electron microscope (TEM) specimen packet tubes to Los Alamos National Laboratory (LANL). LANL will ship 16 unirradiated packet tubes (16 caps + 16 tubes) and six sets of 30 irradiated TEM specimens per set (all Department of Energy (DOE)-owned specimens) to EFF. INL will prepare the weld specification, weld inspection plan, and weld procedures necessary to complete the assembly and welding task. Six to 10 of the 16 packet tubes and caps will be used for weld parameter testing and spares. Unirradiated packet tubes and caps used during weld testing will be disposed as unirradiated waste.

INL will assemble six packet tubes each containing 30 irradiated TEM specimens. The highest measured dose rate per set on the six sets of 30 irradiated TEM specimens was 60 milli-Roentgen/hour (mR/hr) on contact and 2 mR/hr at 30 centimeters (gamma radiation). INL will load the packet tubes with the TEM specimens, cap the packet tubes, weld the caps to the tubes, perform helium leak test to verify hermetic seal, and perform the applicable quality assurance inspections. The irradiated specimens and packet tube components will be assembled and welded in an inert atmosphere (helium) glove box at EFF at MFC.

INL will package and ship the six welded and tested TEM specimen packet tubes to LANL in compliance with all applicable DOE/U.S. Department of Transportation (DOT) requirements.

Extrusion Development

INL develops generic extrusion technology for fuel slug fabrication and to support test pin manufacture. INL alloys, casts, and prepares DU fuel billets for extrusion process development. Alloying and casting of fuel billets is a combined process that uses the vacuum induction melting (VIM) and gravity casting system.

INL performs extrusion experiments to define the fabrication process for both fuel slug forms. Experiments are designed to address key features of the extrusion process and fuel slug product, such as the following:

• Area Reduction Ratio

• Fuel Billet and Tooling Lubricant

• Extrusion Temperature

• Extrusion Rate

• Die Design and Lifetime

• Fuel Slug Diameter

• Fuel Slug Straightness

• Fuel Slug Surface Condition

• Microstructure.

INL performs drawing experiments on the fuel slugs to evaluate product or process enhancements (e.g., for straightening), characterizes the extrusion fuel billets and fuel slugs, and verifies the manufacturing process. Characterization and development of test pins requires analytical chemistry using inductively coupled plasma – mass spectroscopy (ICP/MS) in the MFC Analytical Lab (AL).

Characterization of two un-irradiated archive DOE-owned U-10Zr test pins, one from Experimental Breeder Reactor II (EBR-II) and one from the Fast Flux Test Facility (FFTF) is also part of INL's TerraPower efforts.

Irradiation Testing

After fabrication development, INL fabricates test pins for irradiation to evaluate designs and qualification. Approximately 50-100 test pins will be fabricated using approximately 12 Kg of DOE-owned highly enriched uranium (HEU) of varying enrichments. DOE owns and has responsibility for the HEU and test pins at all times. Test pins range from one inch up to five feet in length. Fabrication activities are performed in FASB and EFF.

After fabrication, INL packages and ships test pins from MFC to ATR for irradiation. After irradiation, the test pins are packaged and shipped back to MFC for PIE. DOT compliant shipping containers are used for shipments to and from MFC.

Advanced Fuel Cycle Experiments

TerraPower develops low smeared density (SD) annular slugs composed of pure, lightly doped, or alloyed U mechanically-bonded to a ferritic-martensitic steel cladding, such as HT-9. INL develops irradiation experiments to be included with Advanced Fuel Cycle (AFC) experiments. INL fabricates experiment capsules with rodlets and various fuel 'slugs' to be installed in the AFC-Outboard A (AFC-OA) test trains and irradiated in the Advanced Test Reactor (ATR). These experiments are designated AFC-4B and AFC-4D. The first experiment, LDC-1A, evaluates rodlets containing sodium bonded U-10Zr fuel slugs fabricated by extrusion to test performance of a new capsule designed by INL.

Proposed Experiment Matrices

AFC-4 Experiment--AFC-4 are small rodlets of advanced annular metallic U-based alloy fuel and HT-9 cladding that incorporates a fuel cladding chemical interaction (FCCI) barrier. AFC-4 rodlets use standard AFC-OA capsules and contain two 0.75-inch long annular fuel slugs for a total fuel column height of approximately 1.5 inches. Fuel slug U enrichment is determined to meet the target linear heat generation rates (LHGR) and peak cladding temperatures. Rodlets are filled with helium (He).

The LDC-1 rodlets contain single or multiple U-10Zr sodium bonded alloy fuel slugs with a total fuel column height of = 2 inches. Individual metallic U 10Zr alloy fuel slugs are about 1 to 2 inches long. Fuel slug enrichments are determined to meet the target temperatures, subject to the maximum enrichment of available material. The rodlets are sodium bonded to the fuel slug.

If feasible, INL will instrument one capsule with a thermocouple or equivalent device for real-time monitoring of the outer rodlet cladding temperature (LDC-1B). INL will perform an initial feasibility study and add additional LDC-1B scope to this EC if needed.

Experiment objectives of LDC-1A are:

1) Fabricate EBR-II Mark-IV diameter, 75% smear density test rodlets using extruded metallic uranium alloy fuel slugs sodium bonded to HT 9 cladding. Some rodlets may contain injection cast fuel from historic EBR-II archive material.

2) Measure axial and radial swelling, fission gas release, and characterize microstructure evolution, FCCI, fuel relocation at a burn-up of at least 1.7 x 1021 f/cc (approximately 4.5 atom % heavy metal burn-up).

Post-Irradiation Examination

INL performs PIE on irradiated test pins at various MFC facilities including HFEF, the AL, Electron Microscopy Laboratory (EML), and the Irradiated Materials Characterization Laboratory (IMCL). In addition to new experiments, PIE is performed on historic irradiated Fast Flux Test Facility (FFTF) ACO-3 and Series III Driver Metal Fuel Fabrication Qualification Tests (MFF) and EBR-II X496 test pins.

PIE includes various non-destructive and destructive examinations. HFEF examinations include neutron radiography, visual inspection, element contact profilometry, dimensional measurements, precision gamma scan, fission gas release analysis, metallography, and retained fission gas testing. The AL examinations include burn-up analysis and immersion density. EML examinations include microstructural analysis [Focused Ion Beam (FIB), SEM, and TEM]. IMCL examinations include microstructural analysis (FIB, TEM, and EPMA). These activities are consistent with the current missions of these facilities. Other PIE facilities at MFC may be used as capabilities are developed.

Storage and Disposition

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...".

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), 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 LLW from the INL Site to the Nevada National Security Site were analyzed in the 2014 Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (DOE/EIS-0426) and DOE's Waste Management Programmatic EIS (DOE/EIS-200). The fourth Record of Decision (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 LLW and MLLW disposal sites.

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).

In addition to disposal of the irradiated fuel that will be generated as described above, industrial, mixed, and low level waste will be generated and will include grinding and polishing consumables, other plastics, sleeves, and swipes needed for radiological and contamination control, construction waste for facility modifications and equipment installation, molds, and sample residue from analytical chemistry. This waste will be classified and disposed in accordance with INL procedures and DOE regulations/requirements. It is estimated industrial waste could be as much as 100 kg (~75 m3), mixed waste as much as 1 m3 (<1kg), and low level waste as much as 25 m3 (15kg).

The NEPA staff or PEL will complete this section with help from the technical points of contact (TPOC). Check applicable environmental aspects and discuss potential environmental impacts.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Air Emissions (Describe Impact) The proposed action has the potential to generate radiological and chemical emissions from fuel fabrication activities from MFC's FASB, EFF, and FMF and from irradiation in ATR and TREAT. In addition, the destructive and non-destructive PIE at MFC's IMCL, HFEF, ARL, and EML will generate emissions. Air emissions are anticipated to be minor, and concentrations would not exceed the current monitored/calculated air emissions from these facilities.

MFC performs metal fuel fabrication techniques at EFF, FASB, and the Fuels Manufacturing Facility (FMF) to develop specifications for fabricating test pin fuels slugs for irradiation testing and to assess fuel characteristics. Fuel fabrication at MFC in these facilities 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.

Experiment irradiation will be performed at ATR and TREAT. The irradiation activities in the ATR and TREAT 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.

The irradiated specimens will be delivered to the MFC's HFEF for disassembly and then undergo routine PIE at MFC facilities, (IMCL, Analytical Research Laboratory (ARL), and EML). All radionuclide release data associated with the PIE portion of this experiment is covered by either PTC or APAD. The PIE examination at MFC 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.

Emissions from these facilities are covered by either PTC or APAD. Radionuclide emissions are sampled/calculated and reported in accordance with Laboratory Wide Procedure (LWP)-8000 and 40 CFR 61 Subpart H.

Discharging to Surface-, Storm-, or Ground Water

NA

Disturbing Cultural or Biological Resources

Cultural: Pursuant to the 2023 Programmatic Agreement, this federal undertaking does not trigger Section 106 review as the proposed activity has no potential to cause effects to historic properties. TREAT (MFC-720) and HFEF (MFC-785) are eligible for nomination to the National Register of Historic Places. Modifications have the potential to impact historic resources. A cultural review (CRR) is required.

Generating and Managing Waste

TRU Waste: Irradiated sample debris and PIE waste may generate TRU waste and mixed TRU waste. Irradiated sample debris and secondary waste may total as much as 5 kg. Final packaging of irradiated sample debris and PIE waste may result in low-level waste instead of TRU waste. Project personnel would work with WGS to characterize and properly dispose of all waste.

In addition to disposal of the irradiated fuel that will be generated as described above; Industrial Waste: Non RCRA regulated waste and Non radioactive waste estimated industrial waste could be as much as 100 kg (~75m3) Low Level Waste (LLW): Generated and will include Rad contaminated grinding and polishing consumables, other plastics, sleeves, and swipes needed for radiological and contamination control, construction waste for facility modifications and equipment installation, molds. LLW as much as 25 m3 (15 kg). Sample waste: Residue from analytical chemistry will be classified and disposed in accordance with INL procedures and DOE regulations/requirements. Mixed Low Level waste (MLLW): as much as 1 m3 (<1kg): Hazardous and Rad contaminated.

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

NA

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:

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."

DOE evaluated the environmental impacts of transient irradiations in the TREAT reactor, including 1) transporting experiment materials between MFC and TREAT, 2) pre- and post-irradiation radiography, 3) PIE of test components at HFEF or other MFC facilities, and 4) waste generation and disposal in the Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the Resumption of Transient Testing of Nuclear Fuels and Materials (DOE/EA-1954, February 2014). 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...”.

Transportation, receiving, and storing used nuclear fuel, as well as, research and development 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 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 analysis includes 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 EIS limits the number of shipments to the INL, and the proposed activities would fall within the limits of the EIS.

The potential for transportation accidents has already been analyzed in the SNF EIS (Section 5.1.5 and Appendix I-5 through I- 10). 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 TRU waste at the generator-storage facilities would be conducted. The Department has analyzed 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.

The environmental impacts of transferring LLW from the INL Site to the Nevada National Security Site were analyzed in the 2014 Final Site-Wide Environmental Impact Statement for the Continued Operation of the Department of Energy/National Nuclear Security Administration Nevada National Security Site and Off-Site Locations in the State of Nevada (DOE/EIS-0426) and DOE's Waste Management Programmatic EIS (DOE/EIS-200). The fourth Record of Decision (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 LLW and MLLW disposal sites.

Onsite disposal of RH-LLW was analyzed in the Final Environmental Assessment for the Replacement Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the Department of Energy's Idaho Site (DOE/EA-1793, 2011).

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: 6/15/2023