DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-21-076

SECTION A. Project Title: DNN NA-22 Pu Production Detection Reactor Venture

SECTION B. Project Description and Purpose:

The project Defense Nuclear Non-proliferation (DNN) NA-22 Plutonium (Pu) Production Detection Reactor Venture objective is to obtain metallic particulate from the cutting of depleted, natural, or low-enriched uranium samples (un-alloyed) from Britain's National Nuclear Laboratory (NNL) sampling of irradiated fuel from a Magnox Reactor and have Idaho National Laboratory (INL) replicate NNL cutting operations with unirradiated depleted, natural, or low enriched uranium to obtain particulate samples. The Magnox Reactor is British Government owned that is one of the last power generating Magnox reactors. NA-22 is funding NNL for the project. The samples observed from the project will be used for test cleaning, transferring, sub-sampling, and shipping operations between Idaho National Laboratory (INL), Lawrence Livermore National Laboratory (LLNL), and Los Alamos National Laboratory (LANL).

Overview:

The project will establish a clean containment to handle smears of irradiated and non-irradiated fuel. The pyrophoric (liable to ignite spontaneously on exposure to air) materials from the metal cuttings are to be obtained on the smears. The other part of the project will entail a radiological containment area for the trace Plutonium (Pu) and fission products that are to be expected.

Three types of samples will be handled; smears from irradiated Magnox fuel from NNL, smears from cutting EBR-II Blanket fuel, and smears from cutting unirradiated depleted uranium. NNL will cut Magnox fuel in an air-hot cell at NNL Sellafield using a low-speed saw and mineral oil-based cutting fluid. Smears will then be taken and shipped to INL The Smears will be limited quantity shipped via Royal air Force to Kirtland,OH than to Sandia National Laboratory and finally INL The same process will be done at INL at Fuels and Applied Science Building (FASB) to cut unirradiated depleted uranium fuel in air with cutting fluid to replicate NNL experiment. In addition, smears of irradiated fines of EBR-II blanket fuel that have been washed in the air cells to remove electrorefiner salt and residual sodium at the analytical lab will be transported to the Hot Fuels Examination Facility (HFEF) where they will be cut without cutting fluid, encapsulated in the argon cell environment and transported to CFA-625.

The containment or hood that is to be determined based upon competing work will be setup at CFA-625 as a temporary inert (Argon) glovebox for handling depleted uranium metal fines and spent metal fines fuel cutting operations. The glovebox will be a Cleatech portable isolation glovebox and will be placed under a fume hood. The Cleatech portable isolation glovebox is made from static dissipative acrylic and is equipped with an oxygen monitor. The bottom of the box will be a stainless-steel tray. Metal- X (NaCl fire extinguisher) will be used in case of metal fire extinguishing. The cutting fluid should be paraffin based and free of chlorine and sulphur. The cutting oil that is being considered is Ashburn Cutting Oil Synthetic Light Viscosity (SLV) and volumes should not exceed 5 mL per smear. Water should be removed from the cutting tools, dried, and then the cutting oil will replace the water coolant. The samples obtained will be milligram quantities of irradiated (depleted) and nonirradiated (natural abundance) uranium metal fuel (Focused Ion Beam (FIB) cubes, cuttings, etc.). Smears from the surfaces of cut irradiated Magnox reactor fuel from Britain's National Nuclear Laboratory will be sent to Hot Fuels Examination Facility (HFEF). The three options of smears that are being considered are:

Option 1: Cotton Sterile Nasal Smears. The cotton swabs are sterile swabs that are contained in a polyethene plastic sheath with a red cap. The cotton swab can be removed from the plastic sheath and broke such that the swab falls into the clean container. Figure 1 shows the cotton smear and plastic sheath that would be used. NNL would swipe the surface of the fuel with the smear in the hot cell, place it into the sheath, seal the plastic sheath into a double encapsulated brass (non-sparking) container and ship it to INL. Brass will contain lead; nonleaded options were considered but were not friendly towards machining processes. At INL the smear is removed from the container under a clean inert argon glovebox and would be cleaned with toluene to remove the cutting oils. Or if washing is not needed, the tip of the smear will be broken off. After obtaining the smear, it will be put into a clean double encapsulation brass container (see Figure 2). The brass containers are sealed with an indium foil gasket to maintain a leak tight seal and are shipped to LANL and LLNL. For this option, each lab LLNL and LANL, would receive one smear with toluene washing and one without toluene washing for evaluation. The two extra smears would be used as trial samples and sent to INL staff for evaluation to determine if the particulate is metal or has been oxidized in the cutting/handling process. The project will supply 6 swabs and 12 canisters to encapsulate the smear samples.

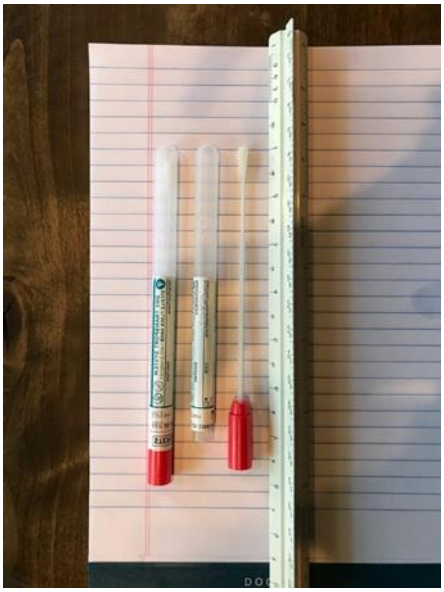

Figure 1. Cotton Sterile Nasal Smear and Polyethylene plastic containers

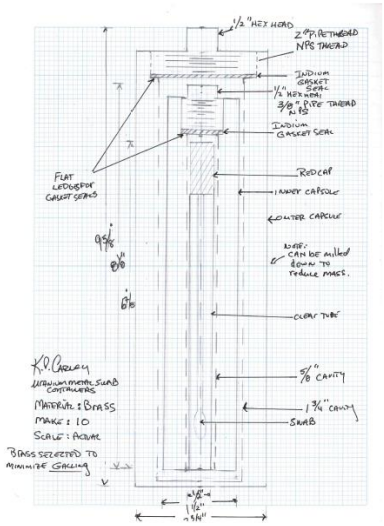

Figure 2. Inner and outer brass capsules with indium foil gaskets for leak-tight shipment of uranium metal samples

Option 2: Quartz Fiber Whatman Smear. The advantage of the Quartz in the Whatman smear compared to the cotton smear is that it is not combustible. The same methodology of the cotton smear sample will be used to obtain the metal samples for the Quartz Fiber Whatman Smear; however, the sampling media is on high purity Quartz Whatman filter paper. The filter paper will be contained in a brass base and held in place with a brass ring. The brass lid screws over the smear and makes an airtight seal using an indium gasket. The samples are transported to INL from NNL. The holders/ samples will be shipped to Central Facilities Area (CFA)-625 for handling. Then, within an inert atmosphere glovebox, the samples will be removed from the previous canister it was shipped in from NNL, washed with toluene if needed, and repackaged into new brass containers and shipped to LANL and LLNL. There will be 4 Whatman smears in 8 brass canisters with indium wire gaskets (one inner and one outer holder each with indium wire gaskets).

Option 3: Direct sampling of the cutting oil (not ideal due to complexity of dealing with the liquid sample along with disposal and filtering). The oil samples will be collected with a disposable pipet. The pipets will be deposited into Saville vials, sealed in brass canisters with indium gaskets and shipped to CFA-625. At CFA-625, the samples will be filtered using high purity Quart Whatman filters, rinsed with toluene, and the filtrate will be evaporated and sealed in leak tight brass containers as with the other options. This option will provide 4 Savillex vials and eight brass capsules (4 inner and 4 outer) each with indium foil gaskets for shipment to CFA. One sample will be shipped to LLNL, one to LANL, and the third will be retained from examination by INL staff to determine if the sample is still metal or oxidized. The brass capsules for all options will be made at the MFC Machine Shop.

Upon the receipt of the NNL container, the containers containing the swabs will be opened after the plastic wrapped shipping container is disposed of in a metal can with proper sealing. The only combustible materials will be the swab with the metal fines and the plastic container that holds the swab and toluene. Containment is to ensure minimization of the risk of oil draining off the particle or oil being wicked away from the smear exposing the particle to air which could oxidize the particle. If the particle is oxidized, then there is a possibility of igniting it. The Magnox fuel that will be used contains radiation hazards due to the Uranium at natural abundance with Pu inbred and fission products. The Pu mass in the EBR-II blanket and Magnox fuels are expected to be 4 to

5 micrograms Pu-239 (0.3 microcuries) and 50 nanograms Pu-241/Pu-242. The transfer of the swabs and associated particulate is expected to be quantitative, as such this amount of material that will be disposed in steel containers will not generate TRU waste.

Depleted uranium is dangerous if inhaled, ingested, or enters the human body through explosions. All "waste" (brass capsules from NNL" will be stored for disposal in metal cans. When the transfers are complete and all samples are sealed in airtight metal containers, the toluene will also be sealed in an airtight metal container. The toluene that is used for cleaning the oil is transferred to a capped glovebox where it is then brought to a fume hood and opened for the toluene to evaporate. The glovebox is brought to an air atmosphere where it will slowly oxidize any metal particulate that may have escaped or have been contaminated from the swabs during the transfer process. This is the recommended method to denature uranium metal particulate. After the glovebox is brought to an air environment, the top to the toluene container will be removed and the toluene is evaporated under a blanket of argon gas in an air hood by slowly introducing air through a syringe underneath the argon blanket. Once the toluene is evaporated, the air will be admitted into the vial and finally the vial will be rinsed with 3 M of HNO_3 to dissolve any remaining particulate. The acid waste will be solidified and disposed as low-level waste. The glovebox will be repurposed for other N&HS programs. Materials purchased for the project are the Cleatech glovebox, gloves, valves and fittings. vacuum pump (oil-less), and Argon gas.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

There will be inert argon gas emissions that are approximately 440 cubic feet (two cylinders) emitted and approximately less than 100 mL of liquid toluene emitted as well. The cutting of brass and uranium metal will also be emitted. The emissions are filtered to trap radioactive particulate.

Discharging to Surface-, Storm-, or Ground Water

N/A

Disturbing Cultural or Biological Resources

N/A

Generating and Managing Waste

There will be waste generated. The toluene and glovebox decontamination waste. The glovebox decontamination waste will be solidified nitric acid (radioactive - 1 liter) and will be disposed of as low-level waste. Other low-level waste includes Kim wipes, Whatman smears, glovebox gloves, bag material, zip-lock bags, plastic containers from (nasal) swabs, and 2 L volume brass canisters. Project activites will not generate TRU waste.The nitric acid waste will be neutralized, solidified, and disposed of in Radioanalytical Chemistry Lab (RCL) and analytical laboratory. Any spills that can occur will be minor and would only contain a maximum amount of 25 mL Toluene in the glovebox. The spills we be adsorbed and evaporated in the glovebox.

Releasing Contaminants

Whenever chemicals are used there is a potential for spills.

Using, Reusing, and Conserving Natural Resources

Brass turnings from manufacturing capsules will be collected by machine shop and recycled. The brass turnings will generate about 1/2 pound of weight, at the MFC Machine shop. These turnings will be submitted to recylcle. Brass Capsules will be transferred to LLNL and LANL. Two to four will be used at INL for Mock-up and require disposal.

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: 10 CFR 1021, Appendix B to subpart D, items 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."

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: 06/22/2021