DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-18-012

SECTION A. Project Title: Westinghouse U3Si2 Lead Test Rod Fuel Fabrication

SECTION B. Project Description and Purpose:

The mission of the Accident Tolerant Fuel (ATF) program is to develop the next generation of Light Water Reactor (LWR) fuels with improved performance, reliability, and safety characteristics during normal operations and accident conditions. The ATF program focuses on applications in operating reactors or reactors with design certifications. Information from this Research, Development, & Demonstration (RD&D) may be applicable to the design of the next generation of LWRs. In collaboration with industry, Idaho National Laboratory (INL) is producing uranium silicide (U_3Si_2) fuel pellets for use in LWRs as a more accident resistant alternative to uranium oxide based fuels.

Westinghouse Electric Company, LLC (hereafter referred to as Westinghouse) is one of the fuel developers selected by the Department of Energy (DOE) to research ATFs. The company is working toward commercialization by implementing licensing for its ATF fuel product in three stages --1) lead test rods, 2) lead test assemblies, and 3) full regions. To support this effort, Westinghouse will insert lead test rods in Unit 2 of Exelon Generation's Byron plant in spring 2019. Under the proposed action, INL will manufacture, package, store, and ship U_3Si_2 ATF pellets to Westinghouse in Columbia, SC for the lead test rods for Byron-2. INL will manufacture and ship fuel pellets for four lead test rods (about 11.25 kg of U_3Si_2 ATF pellets).

The U_3Si_2 fuel pellets are about 7.8 mm in diameter and 10 mm in length. The basic fabrication process forms a binary button at target enrichment from depleted uranium (DU) and highly enriched uranium (HEU) via an arc melting process. Each button has a stoichiometric amount of silicon added prior to arc melting. After arc melting, the U_3Si_2 buttons are ground into powder, blended with a binder, pressed into fuel pellets, and sintered. Following sintering, a centerless grinder machines fuel pellets to the specified diameter. The pressing process establishes the final length of the fuel pellets. The fuel pellets then receive final inspection, chemical analysis, and interim packaging. Following quality checks, the fuel pellets are packaged and transferred to the Zero Power Physics Reactor (ZPPR) at the Materials and Fuels Complex (MFC, building MFC-775) or the Fuel Manufacturing Facility (FMF, MFC-704) for interim storage and final shipment.

The Experimental Fuels Facility (EFF) (MFC-794) is the primary manufacturing facility for the fuel pellets. Similar fuel manufacturing activities already occur in EFF. The facility has multiple contamination areas (CAs) designed for fuel manufacturing equipment. To support the proposed action, INL needs to perform minor modifications of CAs, remove and relocate equipment, and install new utilities at EFF.

Equipment installation and use in EFF consists of the following:

1. Install a 15-ton Carver hydraulic auto press(es)
2. Procure and install a new Tri-Arc Melter system in an existing CA
a) Connect the Tri-Arc Melter to ventilation to limit contamination spread
b) Expand or reconfigure the CA using partition material.
3. Procure and install a new sintering furnace system in the floor of the glovebox (the furnace will be accessed via the glovebox in order to maintain an inert atmosphere)
4. Procure other equipment for additional analyses (profilometer, optical comparator, fixturing, tables, etc.)
5. Procure specialty crucibles for the sintering process
6. Use inert atmosphere glovebox and analysis equipment including density measurement and optical measurement for accurate dimension verification
7. Install a new chiller and condensor for the sintering furnace
8. Install a drying system using the current plant air compressor and tank.

Modification of EFF and installation of new components for equipment operation includes the following:

1. Remove or relocate equipment from designated areas
2. Connect equipment to the high efficiency particulate air (HEPA) exhaust system
3. Run cooling lines to the Tri-Arc Melter and sintering furnace
4. Install electrical power to the Tri-Arc Melter system, sintering furnace, and chiller
5. Install gas supply to arc-melting furnce and sintering furnace
6. Install compressed air to the sintering furnace
7. Install a walkway to cover the sintering furnace power cable leads from the control panel
8. Install argon dewar and piping for the high density fuels glovebox and facility supply.

To control storage access and material traceability, INL will store raw materials needed for manufacture of fuel pellets in the ZPPR or FMF facility lockers or storage racks. Both the ZPPR and FMF facilities are high security areas and Hazard Category II nuclear facilities. There is adequate room in both ZPPR and the FMF facilities for interim storage, packaging, and shipment preparation of the fuel pellets. Raw materials for developing, testing, and manufacturing processes include approximately 0.5 kg of U235, 10.0 kg of DU, and 1.5 kg of silicon. DOE owns the uranium (both depleted and enriched) and will retain ownership throughout the life of the project. Westinghouse will provide commercial shipment “Bio-bottles” (and their associated shipping boxes) for interim-storage of the finished fuel pellets, and INL will ship Bio-bottles with finished fuel pellets to Westinghouse in the supplied shipping boxes.

Following irradiation in the Byron plant, in 2022 Westinghouse will ship the four irradiated lead test rods containing up to 11.25 kg of U_3Si_2 fuel pellets in a dedicated TN-106 cask to INL for destructive and non-destructive post irradiation examination (PIE) activities at the Hot Fuels Examination Facility (HFEF), Analytical Laboratory (AL), and Irradiated Materials Characterization Laboratory (IMCL) at MFC.

In April 1995, DOE completed the *Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement* (DOE/EIS-0203) (hereafter, 1995 EIS) (DOE 1995a). The 1995 EIS contains an analysis of the potential environmental impacts associated with managing DOE's complex-wide SNF Program from 1995 until 2035, and includes an analysis of a broad spectrum of fuel element designs.

In the June 1995 Record of Decision (ROD) for the 1995 PEIS, DOE selected Alternative 4a (Regionalization by Fuel Type) and decided to transport 165 Metric Tons of Heavy Metal (MTHM) in 1,940 planned shipments of SNF (including 575 Navy shipments) to the INL Site through the year 2035 [60 Federal Register (FR) 28680, June 1, 1995].

DOE issued an amended ROD in June 1996 for the 1995 PEIS, which lowered the number of planned shipments of SNF to the INL Site to 1,133 (575 shipments for the Navy and 558 planned shipments for DOE) (61 FR 9441, March 8, 1996).

At present, INL cannot accept irradiated fuel subject to the Idaho Settlement Agreement. It is anticipated that the noncompliance issues will be resolved by 2022, and the INL can accept the irradiated lead test rods. If INL cannot accept the irradiated lead test rods, another facility will complete PIE and other activities, and the project will revise this analysis.

The amount of irradiated fuel INL can receive remains subject to the limits established in the 1995 Agreement, —55 metric tons heavy metal (MTHM)—, and the INL Site has received 81 shipments of spent nuclear fuel that contained 27.8646 MTHM since 1995. DOE anticipates it will not reach the total number of shipments or MTHM limits identified in the MOA and amended ROD before 2035. The proposed action ships up to four irradiated lead test rods containing up to 11.25 kg of U3Si2 fuel pellets back to INL for PIE at MFC after irradiation in Unit 2 of Exelon Generation's Byron plant. Based on current planning, DOE anticipates the INL Site would receive less than 21 MTHM of additional SNF before 2035. Therefore, DOE would not exceed the 55 MTHM limit imposed through the Settlement Agreement by receiving the additional 0.0113 MTHM (up to 11.25 kg) of fuel pellets if DOE implements the proposed action.

The likely transportation route from the Byron Nuclear Power Station to INL overlaps the representative route used for the analysis of shipments of SNF from West Valley, New York, to the INL Site [primarily along Interstate 80 (1-80)] analyzed in the 1995 EIS. Only about 80 miles of the likely route from the Byron Nuclear Power Station to the INL Site were not covered in the analysis conducted for West Valley SNF shipments. The route from the Byron Nuclear Power Station to the INL Site is approximately 1,400 miles, or about 590 miles shorter than that used in the analysis for the West Valley shipments. Therefore, the analysis in the 1995 SNF EIS encompasses the transportation impacts of the proposed future shipments of irradiated lead test rods.

To complete the proposed action, 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). 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 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.

After PIE at INL, the irradiated sample segments and PIE remnants generated from this research and development activity would be stored with other similar DOE-owned irradiated materials and experiments at MFC, most likely in HFEF or the Radioactive Scrap and Waste Facility (RSWF). Ultimate disposal of the irradiated sample segments and PIE remnants would be along with similar DOE-owned irradiated materials and experiments currently at MFC which are generated from other research and development activities.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

The proposed action has the potential to generate radiological and chemical emissions. Air emissions are anticipated to be minor, and concentrations would not exceed the existing monitored air emissions from HFEF. Small quantities of volatilized fission products and fission gas emissions would be released to the HFEF Main Cell environment, and the potential radiological releases to the Main Cell would be consistent with other in-cell processes. Facility operations would control particulate emissions via high-efficiency particulate air filtration and would monitor emissions using a continuous emissions monitoring system.

The Experimental Fuels Facility (EFF-East) (MFC-794) is the primary manufacturing facility for the fuel pellets. Similar fuel manufacturing activities already occur in EFF, however APAD INL-13-001 will be revised to update the equipment list in the facility and to account for slight differences in

enriched uranium concentrations. The proposed action has the potential to generate radiological and chemical emissions from the destructive and non-destructive post irradiation examination (PIE) at the Hot Fuels Examination Facility (HFEF), Analytical Laboratory (AL), and Irradiated Materials Characterization Laboratory (IMCL) at MFC. Air emissions are anticipated to be minor, and concentrations would not exceed the existing monitored air emissions from these facilities.

In 2016, the effective dose equivalent to the offsite MEI from all operations at the INL Site was calculated as 1.43 E-02 millirem/yr, which is 0.14% of the 10-mrem/yr federal standard. 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 1995a, Volume 2, Table 5.7-4). 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 PEIS and DOE/EA-1148.

Generating and Managing Waste

Radiological waste types associated with the proposed action include less than 1 m^3 of transuranic (TRU) waste. After the proposed destructive examinations, it likely that no SNF would remain. The types of wastes associated with the proposed action are consistent with operations analyzed in the 1995 EIS. For the alternative selected in the 1995 EIS ROD (Regionalization by Fuel Type), the potential increases in operational wastes from selected SNF management activities were as follows (DOE 1995a, Table 5.14-1 of Appendix B):

- LLW: 7,060 cubic feet per year, and
- TRU waste: 32 cubic meters per year.

The wastes that would result from the proposed action would be managed and disposed in accordance with current waste management practices. Currently, the majority of INL Site LLW is disposed at the Nevada National Security Site (NNSS). The LLW generated from the proposed action accounts for much less than 1 percent of the LLW generated by present-day INL Site operations and shipped to the NNSS for disposal. The quantity of LLW generated from the proposed action is inconsequential in comparison with the 46.7 million cubic feet NNSS anticipates to receive from activities at other DOE sites.

Onsite disposal of LLW was selected in the 1995 EIS, although the decision on siting and construction of a new disposal facility, if needed, was deferred until development of a project definition and appropriate NEPA review. If project LLW is classified as remote-handled LLW (RH-LLW), it would be disposed at the RH-LLW Facility at INL as 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). The amount of RH-LLW potentially generated from the proposed action (involving up to 20 kg of fuel) would be a small fraction of the estimated average annual volume of 150 m^3 of remote-handled LLW analyzed in the 2011 EA the RH-LLW Facility.

With regard to TRU wastes, the proposed action would require the use of the HFEF Hot Cell, which contains both defense- and nondefense-related materials and contamination. Because it would be impractical to clean out any defense-related contamination, wastes associated with the proposed action could be eligible for disposal at WIPP.

Releasing Contaminants

While work is expected to be performed in controlled environments such as a hood or glovebox, contaminant release to the atmosphere is possible. Air emissions are discussed above.

All chemicals utilized by the project would be managed in accordance with laboratory procedures.

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.

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"

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)

Final Environmental Impact Statement for the Waste Isolation Pilot Plant (DOE/EIS-0026, October 1980) and Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant (SEIS-I) (DOE/EIS-0026-FS, January 1990)

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, September 1997)

Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (DOE/EIS-0243) and supplemental analysis (SA) (DOE/EIS-0243-SA-01).

Final Environmental Assessment and Finding of No Significant Impact 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, December 2011)

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."

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 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 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 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.

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 Sturm, DOE-ID NEPA Compliance Officer on: 3/15/2018