DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-21-122 R1

SECTION A. Project Title: High Assay Low Enriched Uranium (HALEU) Fuel Fab

SECTION B. Project Description and Purpose:

Revision 1:

The U.S. Department of Energy (DOE) proposes to allocate approximately 10 Metric Tons (MT) of High-Assay Low-Enriched Uranium (HALEU) produced through the electrometallurgical treatment (EMT) process, and other small quantities of HALEU stored at Idaho National Laboratory (INL) available for research development & demonstration in support of the commercial nuclear industry and government agencies, including use in advanced reactors. HALEU is a term applied to uranium that is enriched in the uranium-235 (U-235) isotope to a value that is 5% to 20% of the total uranium. Private sector advanced nuclear reactor designs and advanced nuclear fuel designs call for use of HALEU, but currently no commercial facility manufactures HALEU.

DOE proposes to expand the fuel fabrication capability at INL to produce up to 10 MT of HALEU fuel at INL to meet near term needs. The production requires expansion of the fuel fabrication capability, including the purchase of new equipment and use of facilities at INL' s Materials and Fuels Complex (MFC) and possibly also Idaho Nuclear Technology and Engineering Center (INTEC).

Most of the available HALEU at INL is a product of the EMT of sodium-bonded spent nuclear fuel (SNF) that occurs in the Fuel Conditioning Facility (FCF) at the MFC at INL. The EMT process involves dissolving SNF rods in molten salt and extracting uranium and transuranic elements through electrolysis, then processing in a metal casting furnace to produce low-enriched uranium ingots.

DOE's support of advanced reactor development may include making available about 10 MT of HALEU feedstock for use as fuel by the commercial nuclear industry and government agencies for advanced reactor research, development, and demonstration activities. In support of commercial development of advanced nuclear fuels, DOE is proposing to designate approximately 5 MT of HALEU feedstock to the Oklo Inc. (Oklo) for fuel fabrication and reactor demonstration.

Oklo will use the material to produce nuclear fuel, and, contingent upon Oklo obtaining all appropriate licenses from the NRC, use the fuel for an Oklo demonstration reactor on the INL Site. Oklo, with the support of INL, will prepare and package produced fuel for storage at INL in preparation for use in the demonstration reactor. All Oklo activities will be performed on the Idaho National Laboratory site.

The Final Environmental Assessment (EA) for the Use of Department of Energy-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory (DOE/EA-2087, January 2019) provides an assessment of the DOE proposal to make approximately 10 MT of HALEU available for research development and demonstration in support of commercial nuclear industry and government agencies, including use in advance reactions (HALEU EA). The EA conservatively assumes that a total of 5,000 kg (5 MT) HALEU would be processed annually at the INL in support fuel development. The conservative assumptions of an annual HALEU fuel production of up to 5 MTHM/yr used in the HALEU EA provides a conservative estimation of annual airborne releases, potential accidents, and waste generation. As anticipated under the HALEU EA it is anticipated that approximately 10 metric tons of the enriched uranium would be processed at a rate of 5 MT per year at the INL. Assuming that Oklo would not produce more than 2,500 kg per year bounding condition, the proposed 5 MT of HALEU feedstock processed for development and demonstration would not exceed the estimated annual airborne releases, potential accidents, or waste generation analyzed in the EA (Table 1). It is assumed that potential construction impacts attributed to preparing facilities at MFC and/or INTEC for fuel production would occur regardless of HALEU access designation.

The following table describes the environmental resource areas analyzed in the HALEU EA in comparison to the potential impacts from the proposed 5 MT of HALEU feedstock designated for use by Oklo.

Resource Area	Bounding Condition identified in the HALEU EA	Potential Impacts from designating 5 MT of HALEU feedstock to Oklo	Is there a difference in Environmental Impact?
Air Emissions – Nonradiological	Anticipated that nonradiological emissions during operations for 10 MT would be no greater than 9.7 grams of toxic emissions. be minimal during operational stages	Assuming 5 MT would be processed a year, potential impacts from nonradiological air emissions would be approximately 4.9 grams of toxic emissions	No. Potential impacts would be no greater than impacts previously analyzed
Air Emissions - Radiological	Anticipated that potential highest potential dose to the nearest publicly accessible location from 5 MT of feedstock processed annually would be 5.4 mrem/year, to a collocated worker would be 48 mrem/year, and an anticipated no adverse human health impacts attributed to contaminated soils	Assuming 5 MT would be processed a year, the potential impacts from radiological air emissions would be the same as analyzed in the EA	No. Potential impacts during anticipated normal operations would be well below the 10 mrem/year dose standard for a member of the public and well below the 5,000 mrem dose standard for a collocated worker.
Waste Generation	The volume of various LLW generated during routine operations are expected to be less than 20 m^3 per year; TRU waste generation is expected to be less than 1 m^3 per year. the additional radiological waste disposal is less than a 2.5% increase in the volume sent to off-site disposal facilities each year.	Assuming 5 MT would be processed a year, the potential impacts from waste generation would be the same as analyzed in the EA	No. Potential impacts anticipated are not appreciably different from current waste generation at the INL site.
Biological Resources	Soil concentrations/BCG ratios from radiological emissions when 5 MT of feedstock are processed annually would not cumulatively exceed 1 under DOE-STD-1153-2019	Assuming 5 MT would be processed a year, the potential impacts to biological resources would be the same as analyzed in the EA	No. Modeling shows that potential soil concentration/BCG ratios from radiological emissions do not cumulatively exceed 1 for terrestrial animals or plants; therefore, no adverse impacts to terrestrial biota attributed to contaminated soil.
Potential Accidents	Under a hypothetical accident the anticipated total effective dose to a collocated worker would be 997 mrem with an LCF of 4.09 x 10^{-4}; to an offsite member of the public 29.4 mrem with an LCF of 1.62 x 10^{-5}.	Assuming 5 MT would be processed a year, the potential impacts from an offset condition or accident would be the same as analyzed in the EA	No. Any accidental release of radioactive material is anticipated to be low. Potential dose from a collocated worker or an offsite member of the public would most likely be reduced through the use of engineered and administrative controls.
Transportation	Any transport of HALEU feedstock, fuel alloy, and cast or clad fuel would occur solely on the INL site on roadways controlled by INL security. The transport of feedstock would in solid form and in a quantity less than analyzed in DOE/EA-1772 (Haul Road EA)	The transport of material between facilities to support the 5 MT designated to Oklo is not expected to change from that analyzed in the HALEU EA	No. HALEU feedstock would be transported in solid form; therefore, no significant airborne release is postulated from spill and impact of solid uranium
Destructive Acts	Accident analyses are evaluated based on conservative assumptions using parameters resulting in the highest postulated dose to workers and public receptors; therefore, any act of sabotage would be expected to result in consequences that would be bounded by the results of a potential accident	The consequences of any destructive act would be similar to the potential accidents analyzed in the HALEU EA regardless of the designation of the HALEU feedstock.	No. INL routinely employs a variety of measures to mitigate the likelihood and consequences of intentional destructive acts

Based on the supplement analysis of the HALEU EA, the proposed designated of 5 MT of HALEU feedstock to Oklo for fuel fabrication does not constitute a substantial change from what was previously analyzed, and there are no significant circumstances or information relevant to environmental concerns. Therefore, the HALEU EA, a presently published, provides the environmental review and bounding analysis for the proposed action.

Original ECP:

The objective of this work is to develop High Assay Low Enriched Uranium (HALEU) Fuel that includes, modifying an existing building for a new mission, feedstock development, and production of fuel. Oklo, inc., is creating a process that will allow a mix of process development and fabrication of the metallic fuel. The detailed steps, equipment and process will be developed to allow fabrication of the fuel. All the processes will take place at the Materials and Fuels Complex (MFC) located at Idaho National Laboratory (INL). The project is expected to be done at Radioactive Liquid Waste Treatment Facility (RLWTF) which is located at Materials Fuels Complex (MFC)-798. The first stages of development will evaluate the fuel fabrication process and evaluate the design and fit inside the MFC building. The fuel type will be metal based fuel. MFC-798 will be repurposed for renovation. MFC-798 has sufficient power supply to support the project needs along with the existing stack that will be sufficient for the project air emissions. The fuel source and gloveboxes won't require additional shielding. Scrap fuel will be recycled to the greatest extent possible and interim storage will utilize the existing vault space available in MFC. Fuel fabrication equipment and fuel production costs will be funded by a third party Oklo, Inc. Oklo, inc., will supply extensive gloveboxes, filtering, furnaces, casting, machining, and welding equipment based on mature INL processes equipment. Possible waste streams from the project include: chemical process waste, radioactive waste, potential purification waste and metal nuclear fuel waste.

The scope of work required to achieve this objective includes the following:

1. Providing project and construction management oversight.

2. Provide construction support including safety, quality, subsurface investigation, RadCon, and field supervision.

3. Developing the engineering and design documents.

4. Production of HALEU at the Fuel Conditioning Facility (FCF) for use in the fuel production.

5. Perform Documented Safety Analysis (DSA), produce environmental documents, permits and other required studies and reports.

6. Perform Contractor Readiness Assessment (CRA).

7. Perform Operational Readiness Assessment (ORA).

8. Testing and startup.

9. Subcontracting the demolition, construction, and equipment installation at MFC-798 that includes:

a. Remove and replace block wall.

b. Demolish tanks and associated piping, walkways, and pumps.

c. Demolish exhaust and supply ducting.

d. Demolish High Efficiency Particulate Air (HEPA) filtration systems.

e. Demolish electrical.

f. Perform building modifications to support fuel fabrication.

g. Update electrical configuration to meet HALEU fuel production.

h. Install new backup generator.

i. Install new ventilation and exhaust systems including HEPA filters, dampers, ducting, controls, cooling systems, and other miscellaneous. items.

j. Install gloveboxes to support two production lines. Gloveboxes include casting glovebox, loading glovebox, and grouting/waste glovebox.

k. Install equipment to support fuel fabrication including, casting furnace, work tables, cranes and lifts, machining equipment, settling furnace, storage racks, welders, vacuum system, and other miscellaneous equipment.

l. Build transportation and storage containers.

m. Disposal of waste materials.

BEA will provide the resources for all engineering, project management, and construction management resources. It is anticipated that fuel fabrication will be completed in 8 years. The gloveboxes and furnaces are long lead items and will be procured early to support the project team. Transuranic Waste (TRU) will be generated in MFC-798. There is an estimate of 0.000768% or of 0.0384 kg per 5000 kg of fuel fabricated to be TRU waste from the input fuel from EBR-II exposed stock.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

Air emissions are expected. The off gas that will be distributed will be the same as the existing metal fuel fabrication. The air emissions through the existing stack will be the same, however the volume of fuel produced could be larger than previous developmental samples. An Air Permitting Applicability Determination will need to be prepared to cover the new activity.

Discharging to Surface-, Storm-, or Ground Water

N/A

Disturbing Cultural or Biological Resources

N/A

Generating and Managing Waste

Waste will be generated. The work that will be done includes creating metal nuclear fuel waste. Other waste that will be generated will be chemical process waste, radioactive waste through process loss, and potential purification waste (fission products removed from the fuel in the process). The total generation of waste is expected to be 5000 kg. Approximately 0.0384 kg TRU waste per 5000 kg fuel fabricated will be generated. TRU waste will be generated in MFC-798 RLWTF.

Releasing Contaminants

Through the repurposing of the MFC-798 building, typical C&D waste is to be expected. Any waste from C&D that involves drainage into the sewer will be handled within disposal limits within the facility's permit. 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

All materials will be reused and recycled where economically practicable. All applicable waste will be diverted from disposal in the landfill where conditions allow. Scrap fuel will be recycled to the greatest extent possible.

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."

Final Environmental Assessment for the Use of Department of Energy-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory (DOE/EA-2087) [January 2019].

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 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, December 2014).

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."

"Final Environmental Assessment for Use of DOE-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory (DOE/EA-2087 January 2019)."

NEPA coverage for the transportation and disposal of waste to WIPP are found in the 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.

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: 01/23/2023