

**SECTION A. Project Title:** Joint Fuel Cycle Studies (JFCS) Program Revision 5

**SECTION B. Project Description and Purpose:**

**Revision 5:**

The JFCS program requires a Sintering capability that cannot currently be met with existing in-cell process equipment. A remote muffle furnace is required for performing sintering of pellets as part of the KAERI Voloxidation capability in HFEF.

1. **Assessment and Preparation:** Conduct a thorough analysis of the current hot-cell infrastructure to ensure it can accommodate the new sintering furnace with regards to size, weight, and operational requirements, including power and temperature tolerances.
2. **Design Modifications:** Implement necessary modifications to the furnace to facilitate remote handling within the hot-cell. This may include structural reinforcements/improvements, electrical integration modifications, and enhancements to the cover gas interface used to maintain an appropriate atmosphere during furnace operations.
3. **Furnace Procurement (COMPLETE):** The sintering furnace has been acquired and is available for in-person review. The furnace heater elements are compatible with Argon environments. The furnace is rated to 1700C, requires 208VAC 1 ph, 60A input, with a 60VAC, 150A output that will be routed through the hot-cell feedthrough.
4. **Installation:** Install the sintering furnace within the hot-cell, ensuring all connections (electrical, mechanical, and gas supply) are secure and meet the design specifications. At project start the electrical feedthroughs are anticipated to be 8.1053 and 8.1051, also utilized by the JFCS Casting and Sampling Furnace.
5. **Verification and Testing:** Perform comprehensive testing to confirm the functionality of the furnace and its integration with the hot-cell systems, including remote maintenance, remote operation capabilities, and safety features.

**Technical Approach:**

The technical approach focuses on ensuring a seamless integration of the sintering furnace into the hot cell, considering the unique challenges posed by remote handling. Key components of the technical approach include:

- Integration of remote handling and monitoring systems for the furnace operation.
- Electrical evaluation to ensure hot-cell electrical feedthroughs are adequately protected.
- Assurance that the intended research objectives can be achieved.

**Reason for Approach:**

The JFCS program requires a Sintering capability that cannot currently be met with existing in-cell process equipment.

A remote muffle furnace is required for performing sintering of pellets as part of the KAERI Voloxidation capability in HFEF. The off-the-shelf furnace has the following requirements:

- Shall be capable of holding temperatures between 1600 and 1700C for at least 10 hours.
- Shall be remotized for out-of-cell control and maintenance

- Shall have user-friendly interface for inputting parameters and monitoring the sintering process.
- Furnace shall be capable of operating in argon
- Shall incorporate over-temperature protection to prevent overheating

**Revision 4**

As part of the JFCS, automation research and development will be performed. This research includes working with robotic systems outside of hot cells and future work on development of radiation-hardened robotic systems. Research involves developing interface requirements with external equipment, using with surrogate materials (sand, ball bearings, dowel pins, metal rods and metal strips), and using non-powered hand tools.

**Revision 3**

As part of the Joint Fuel Cycle Studies (JFCS) program, 4 g of curium-244 oxide will be transferred from the Fuel Manufacturing Facility (FMF) to the Hot Fuels Examination Facility (HFEF). The material was pure Cm-244 oxide but has decayed and is now 75% Pu-240. A source term document, ECAR-4277, has been issued which describes the material. Due to nuclear safety constraints at HFEF, the powder will be bound in LiCl salt during the breakout process in the Transuranic Breakout Glovebox at FMF. The material will then be loaded into four separate GSAD containers and shipped in the 6M drum to HFEF. At HFEF, the material will be mixed with the spent fuel being received from the Idaho Nuclear Technology and Engineering Center (INTEC) in order to simulate the presence of Cm-244 seen in high burnup nuclear fuels. The materials will then be processed together through the JFCS recycling equipment in HFEF.

Material will be shipped from INTEC to the Materials and Fuels Complex (MFC) using the existing 6M package/fissionable material payload/container. The 6M package is a non-DOT approved container designed for transferring radioactive and/or fissionable materials. There are two 6M package sizes that could be used: 55 gallon and 110 gallon. Only one loaded 6M package payload is allowed during each shipment. The payload materials are identified as:

- Fissionable materials (with trace quantities of other radioactive materials)
- Curium.

The shipment includes Cm-244, Cm-246, Pu-240, Pu-242, U-238, U-236, Th-234, and Th-232 in quantities less than or equal to those listed in the table below:

Table 1. Radionuclides in proposed shipment

Radionuclide	Moles	Grams
Cm-246	2.02E-03	4.97E-01
Cm-244	1.03E-02	2.53E+00
Pu-242	1.07E-05	2.58E-03
Pu-240	3.06E-02	7.33E+00
U-238	3.50E-10	8.33E-08

U-236	6.87E-05	1.62E-02
Th-234		

The dose consequence analysis is available in ECAR-1501. A free liquid limit of no more than 100 mL applies. The Cm-244 payload will be a solid due to mixing with LiCl salt and subsequent solidification into pucks.

**Revision 2**

Idaho National Laboratory (INL) analyzed the environmental impacts from implementing activities in CRADA 11-CR-13 for the Joint Fuel Cycle Studies (JFCS) program in environmental checklist (EC) INL-14-044. This revision to EC INL-14-044 clarifies project scope and proposed utilization of used commercial nuclear fuel.

INL is performing an ongoing kilogram-scale test of electrochemical recycling of used nuclear fuel, known as the Integrated Recycling Test (IRT), at the Materials and Fuel Complex (MFC) to study flowsheet options and the technical and economic feasibility and nonproliferation acceptability of electrochemical recycling of commercial light water reactor (LWR) fuel. The JFCS program includes fuel procurement, the IRT, critical gap research and development (R&D), and fuel rodlet fabrication and irradiation. These components are discussed below:

**Fuel Procurement**

The IRT process requires about 45 kilograms of used high-burnup LWR fuel or use as feedstock. This feedstock is not available at INL or other sites in the DOE complex. The original CRADA for the IRT proposed to use 25 individual pressurized water reactor (PWR) rods from the Byron Nuclear Generating Station in Illinois shipped to INL in a Nuclear Assurance Corporation legal-weight truck (NAC-LWT) cask and stored in the Hot Fuels Examination Facility (HFEF) hot cell.

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 Spent Nuclear Fuel (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 noncompliance issues will be resolved before this project begins, and INL will be able to accept the irradiated materials. If INL cannot accept the irradiated materials, the JFCS program proposes to complete project activities using about 35 kg of DOE-owned LWR fuel in dry storage at the Irradiated Fuel Storage Facility at Chemical Processing Plant (CPP) building 603 (CPP-603). The LWR fuel is low to intermediate burnup and does not meet the full requirements of the JFCS collaboration. Fluor Idaho will retrieve the fuel from storage and ship the material to MFC in the Nuclear Assurance Corporation (NAC) legal-weight truck (LWT) (NAC-LWT) cask using the Multi-purpose Haul Road on the INL Site. Shipments will not use public transportation routes. Table 2 describes the fuels proposed for shipment from CPP-603 to MFC.

Table 2. Summary of interim LWR fuel from CPP-603.

Current Container ID	Old Container ID	LWR Fuel Description	Burnup	Discharge Date	Enrichment
CAN-GSF-106-23	A-7	7 Saxton MAPI fuel rods	5 GWd/MT	1972	5.7%

		3 Saxton fuel rods	16.8, 15.6, 10.4 GWd/MT	1972	12.5%
CAN-GSF-106-19	I-1	16 Dresden rod sections from approx. 5 fuel rods	28 GWd/MT	1994	3.1%
CAN-GSF-107-29	I-8	3 Saxton MAPI fuel rods	5 GWd/MT	1972	5.7%
		2 Saxton fuel rods	16.0, 18.5 GWd/MT	1972	12.5%
CAN-GSF-107-21	J-4	15 Dresden rod sections from approx. 5 fuel rods	28 GWd/MT	1994	3.1%
CAGSF-106-13	J-7	4 Saxton fuel rods	16.7, 17.4, 16.7, 17.6 GWd/MT	1972	12.5%
CAN-GSF-107-03	K-4	2 HB Robinson fuel rods sectioned	28 GWd/MT	1974	3.1%
		2 Peach Bottom fuel rods sectioned	11.9 GWd/MT	1976	2.5%

**Integrated Recycling Test**

Modular Workstations

Modular workstations in the HFEF Argon Cell support equipment for the IRT. Two large workstations and a smaller intermediate table furnish operating space and power and instrumentation connections for replaceable equipment. Bins below the workstation operating surfaces supply storage for equipment not in use. Each workstation includes one integrated balance for mass tracking purposes.

Fuel Decladding Equipment

INL processes used nuclear fuel rods as feedstock for the IRT. Processing requires used nuclear fuel rod storage, handling, sectioning, and de-cladding. The de-clad fuel is sieved to remove fines, and some fines are manipulated to demonstrate and test processing methods. Some higher burnup cladding sections will be processed to demonstrate methods to reduce fuel holdup.

Oxide Reduction System

The project electrochemically reduces de-clad used fuel to metallic form in the oxide reduction system. The reduction process tests the 'universal' basket concept, i.e. a loaded basket is processed through the oxide reduction, distillation, and electrorefining systems without unloading. The reduction system is designed to allow testing of scalability features such as multiple electrodes and variations in basket thickness or electrode spacing. The anode system has the flexibility to test materials, geometries, immersion depths, and off-gas capture settings. An oxide reduction system has been designed,

constructed, tested, and installed, and operates as a part of the (IRT).

#### Electrorefining System

The project electrorefines processed fuel from the oxide reduction system to recover purified low-enriched uranium (LEU). Transuranic elements accumulate in the electrorefining salt, and a liquid cadmium cathode (LCC) extracts a uranium/transuranic/rare earth product to acquire feedstock to manufacture fuel rodlets. The electrorefining vessel also allows the project to test features important to scalability.

#### Distillation Systems

After oxide reduction and electrorefining, INL separates salts from metallic products and cadmium and salt from the uranium/transuranic/rare earth products via vacuum distillation. HFEF has two remote distillation systems to maintain the IRT processing schedule.

#### Sampling/Casting Furnace

Casting transuranic fuel slugs is an objective of the IRT, and a variety of metallic products require sampling. Material losses, remote reliability, and scalability are important for long-term success of electrochemical recycling processes. The project samples and casts fuels in HFEF, and fabricates fuel in a glovebox at the Fuel Manufacturing Facility (FMF).

### **Critical Gap Research and Development**

#### Head End Processes

The method for processing used fuel is important to subsequent processes. Critical gap studies evaluate and select fuel preparation methods used in the IRT and include design development, testing, cutting methods, and handling fuel pieces. Potential measurement methods to determine input accountancy are important to determine nonproliferation acceptability. R&D includes additional studies for processing fuel fines, such as agglomeration or sintering, or the examination of off-gasses produced from processing. Prior research indicates high burnup fuels may display increasing fuel hold up in the cladding. Proposed research also evaluates methods to reduce fuel hold-up.

Current technology for electrolytic reduction utilizes platinum anodes, but other materials, such as iridium or conductive ceramics, have the potential to deliver cost and durability advantages. Anode material testing focuses on the performance of iridium electrodes in surrogate salt systems.

Experiments support system design and troubleshoot oxide reduction system operations in the IRT. This research evaluates construction materials and system behavior and characteristics during different operating scenarios. Testing uses non-radioactive surrogates and depleted uranium (DU).

#### Electrorefining & Liquid Cadmium Cathode Operations

This activity tests a scaled-up prototype electrorefining system with molten salt and uranium dendrites. This allows challenges and performance limitations to be identified before remote equipment fabrication and installation and allows trouble-shooting of remote process operations. Testing includes evaluating the impact of process parameters, system design, and construction materials. Testing uses non-radioactive surrogates and DU.

The LCC approach recovers a product combined of uranium, transuranic, and residual rare earth materials during the IRT. Ongoing studies explore the impact of process parameters, system design, and construction materials. Studies use non-radioactive surrogates, DU, and transuranic (TRU) elements and utilize equipment and materials already on-Site at MFC. Studies also analyze anode residue.

#### Product Conditioning

In the recovery of the uranium/TRU/rare earth product via LCC technology, the rare earth contamination may be higher than the desired concentration in the metal fuel. Ongoing, jointly-planned experiments explore the feasibility of ways to reduce the concentration of rare earths in uranium/TRU/rare earth products. Studies use non-radioactive surrogates, depleted uranium, and TRU elements and utilize equipment and materials at MFC.

The IRT requires four distillation operations. Distillation system design issues require confirmation, including evaluating the performance of stainless steel for the pressure boundary for distillation up to 1200°C. Ongoing investigations confirm the design and materials for the distillation system and test the performance of advanced crucible materials for distillation operations. Initial screening uses uranium, and final testing uses uranium/transuranic/rare earth products.

A high-temperature distillation furnace separates salt and consolidates the dendritic uranium product into an ingot. Initial scoping experiments have been successful at separating salt and metals at atmospheric pressure by a porous bed, with a short residence time. These characteristics and system compactness have the potential to improve product purity, process monitoring, and safeguards opportunities. These tests use non-radioactive surrogates and DU.

### Fuel Fabrication

Engineering-scale fuel fabrication is critical to commercialization of electrochemical recycling. Weld inspection is a challenging technology that must be perfected for remote application. The project tests ultrasonic and laser weld inspection systems and evaluates alternative approaches to qualify the welding process based on statistical analysis of process parameters. These tests utilize only non-radioactive materials.

The properties of some metal fuel alloys need to be characterized. The project performs fuel alloy fabrication and analysis in the MFC Casting Laboratory. Casting studies use several fuel variations to evaluate potential products in the IRT. These studies use non-radioactive surrogates, DU, and TRU elements and use equipment and materials at MFC. Cast fuel sample characterization methods include dilatometry, differential scanning calorimetry, and laser flash thermal diffusivity.

Studies also evaluate in-reactor cladding performance. Metal fuel integrity could be limited by the interaction of fuel constituents and fission products with the cladding, commonly described as fuel cladding chemical interaction (FCCI). Studies are needed to verify the performance of barrier materials that mitigate FCCI, especially in the case of TRU and rare-earth-bearing metal fuel. The project produces, irradiates, and evaluates barrier cladding samples.

### Fundamental Properties and Waste Forms

Activities to increase fundamental knowledge of molten salt systems include studies to evaluate 1) electrochemical or thermophysical characteristics of molten solutions and 2) technology to monitor process conditions inside molten salt electrochemical systems. These studies use non-radioactive surrogates, DU, and TRU elements and equipment and materials at MFC.

Identification and demonstration of waste forms is critical to the feasibility of electrochemical recycling. The IRT evaluates the most feasible and cost effective options for fission product concentration and immobilization from the electrochemical recycling of used LWR fuel. These evaluations involve waste experts from INL, KAERI, Pacific Northwest National Laboratory (PNNL), and Argonne National Laboratory (ANL). Once processes have been defined, laboratory-scale waste forms may be fabricated, if necessary, from fission product streams for characterization and testing. Fission product concentration and waste form processes would be optimized for application to the IRT.

In the IRT, some iodine enters the oxide reduction vessel with used fuel. Experiments have shown that I<sub>2</sub> has the potential to be released with O<sub>2</sub> during the reduction process. Improved understanding of how to capture this iodine, either as a gas or by capture within the molten salt, is critical to understanding the mass balance of fission product in a real process. Studies evaluate methods to better understand I<sub>2</sub> release during the reduction process and quantitatively capture the iodine from the off-gas stream in a surrogate salt system. The project also examines methods to extract iodine and tellurium from the molten salt. The feasibility of getter materials to selectively absorb reactive fission products will be tested in a surrogate salt system.

These studies use non-radioactive surrogates, DU, and TRU elements and equipment and materials at MFC.

### Argonne National Laboratory Activities

Argonne National Laboratory (ANL) in Illinois performs supporting research on fundamental properties and waste forms and head-end processes, with similar work scope to that described above. These activities use only non-radioactive surrogates, DU or very limited amounts of TRU materials in authorized radiological facilities at ANL. These activities will be conducted with materials already located at ANL and will not involve shipment of any materials between ANL and INL.

### Fuel Rodlet Fabrication and Irradiation

Fuel rodlet fabrication and irradiation activities focus on the production of one or more transuranic-bearing fuel rodlets, irradiation in the Advanced Test Reactor (ATR), and post-irradiation examination (PIE) at MFC. After PIE at INL, the irradiated sample segments and PIE remnants 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) in accordance with DOE's Programmatic Spent Nuclear Fuel (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 sample segments and PIE remnants would be along with similar DOE-owned irradiated materials and experiments currently at MFC.

Packaging, repackaging, transportation, receiving, and storing used nuclear fuel and research and development for used nuclear fuel management is within the scope of 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]).

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 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.

There is the potential to generate low level waste (LLW). 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 (NTS) 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 mixed low-level waste (MLLW) disposal sites. The SA considers additional waste streams, beyond those considered in the 1996 NTS EIS, which may be generated at or sent to the Nevada National Security Site for management.

The impacts of transporting spent fuel, special nuclear materials, and research fuels between MFC and other INL Site facilities using the Multi-Purpose Haul Road were analyzed Final Environmental Assessment for the Multipurpose Haul Road Within the Idaho National Laboratory Site (DOE/EA-1772).

The JFCS project involves research and development work to test and refine various aspects of separations process activities. Research from the project would be used to support the development of processes to separate and recover materials such as plutonium and uranium. The project does not call for the separation of plutonium or uranium isotopes for production purposes. Because the project is for research and development of separations processes rather than for production purposes, the project does not constitute reprocessing.

Project personnel verify with the program environmental lead (PEL) that the scope, environmental aspects, and work activities are bounded by the environmental impacts analysis of this environmental checklist (EC), and revise this EC as necessary.

## **SECTION C. Environmental Aspects or Potential Sources of Impact:**

### **Air Emissions**

Rev. 5. The addition of the new furnace would not cause additional throughput of material, but will be capable of heating the JFCS material to a higher temperature for sintering, however the volatiles would already have evolved prior to sintering, so now new emissions are expected. The proposed action has the potential to generate radiological and chemical emissions from irradiation in ATR and the destructive and non-destructive PIE at MFC. Air emissions are anticipated to be minor, and concentrations would not exceed the current monitored air emissions from these facilities. An Air Permit Applicability Determination (APAD) may be required. Contact the appropriate facility Program Environmental Lead (PEL) to determine if an APAD is needed.

Experiment irradiation will be performed at the ATR. The irradiation activities in the ATR 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. ATR radionuclide emissions are sampled and reported in accordance with Laboratory Wide Procedure (LWP)-8000 and 40 CFR 61 Subpart H. All experiments will be evaluated by Environmental Support and Services staff. All radionuclide release data (isotope specific in curies) directly associated with this proposal will be calculated and provided to the Environmental Support organization.

The irradiated specimens will be delivered to the MFC HFEF for disassembly and then undergo routine PIE. All radionuclide release data associated with the PIE portion of this experiment will be recorded as part of the HFEF continuous stack monitor. The PIE examination in HFEF is not a modification in accordance with Idaho Administrative Procedures Act (IDAPA) 58.01.01.201 and 40 Code of Federal Regulation (CFR) 61 Subpart H.

In 2017, the effective dose equivalent to the offsite MEI from all operations at the INL Site was calculated as 8.02 E-03 mrem/yr (8.02 E-08 Sievert/yr), which is 0.08% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from the INL site. The additional increment in emissions from the proposed action would not significantly change the total site-wide MEI dose. Therefore, the emissions are bounded by the analysis in the 1995 EIS, which estimated the annual cumulative doses to the maximally exposed worker, offsite maximally exposed individual (MEI), and the collective population from DOE's decision to implement the preferred alternative (DOE 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.

### **Discharging to Surface-, Storm-, or Ground Water**

NA

### **Disturbing Cultural or Biological Resources**

ATR (building TRA-670), CPP-603, and HFEF (MFC-785) are eligible for nomination to the National Register of Historic Places. Modifications have the potential to impact historic resources.

Cultural: Pursuant to the 2023 Programmatic Agreement, this federal undertaking is excluded from Section 106 review and the proposed activity results in no historic properties affected.

### **Generating and Managing Waste**

Total project waste volume from the research and development performed on the used fuel feedstock is projected to be less than 1 m<sup>3</sup>. The BEA Waste Management Program and MFC Waste Generator Services (WGS) staff would be consulted for characterization and disposition pathways determination for the generated wastes.

The following are the expected waste streams that may be generated during JFCS activities:

- Irradiated Hardware – Fuel rod plenums would be removed and isolated during head-end activities. These materials would be maintained for research activities in the hot cell until they are determined to be no longer needed, at which time they would undergo waste characterization. Expected waste form is RH-LLW.
- Integrated Recycling Test (IRT) Off-Gases – Fission product gases would be captured in selective filters, and noble gases would be released to the hot cell atmosphere. Expected waste form for the filters is RH-LLW.
- Metal Waste – Distilled metals from the electrorefiner separations process and zircaloy fuel cladding hulls may be combined and retained for metal waste form research that may be defined later in the project. Expected waste form is RH-TRU.
- LiCl-KCl and LiCl Salt Waste Forms – Fission products are removed from the LiCl-KCl and LiCl salts and stabilized in respective waste forms.



Research is ongoing to develop an appropriate waste form. The salts would be maintained at HFEF as in-process material used for ongoing research work on waste form development. Expected waste form is RH-TRU.

- Sampling Waste – Samples that are delivered to the Analytical Laboratory (AL) for radiochemical analysis would become waste when the material has been accumulated to the point where it can be removed from HFEF in a waste can, has been terminated from safeguards and transitioned to waste management. This waste would be managed as typical AL remote-handled waste. Expected waste form is RH-TRU.
- Legacy Equipment – The pieces of equipment that do not have a future mission at completion of the project would become legacy equipment subject to disposal. Expected waste forms are RH-TRU and RH-LLW.
- Miscellaneous Radioactive Wastes – Waste generated on a routine basis within radiation areas and hot cells. Expected waste form is CH-LLW.
- Miscellaneous Hazardous Waste – Waste generated during chemistry activities and typical excess chemical waste generated at the AL. Expected waste form is hazardous waste.

### Releasing Contaminants

Chemicals will be used and will be submitted to chemical inventory lists with associated Safety Data Sheets (SDSs) for approval prior to use. The Facility Chemical Coordinator will enter these chemicals into the INL Chemical Management Database. All chemicals will be managed in accordance with laboratory procedures. When dispositioning surplus chemicals, project personnel must contact the facility Chemical Coordinator for disposition instructions.

Although not anticipated, there is a potential for spills when using chemicals or fueling equipment. In the event of a spill, notify facility environmental staff. If environmental staff cannot be contacted, report the release to the Spill Notification Team (208-241-6400). Clean up the spill and turn over spill cleanup materials to WGS.

### 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.

### Environmental Justice

According to the CEQ Climate and Economic Justice Screening Tool, the INL site as well as the Research and Education Campus in Idaho Falls, ID are located in U.S. Census tracts that are identified as disadvantaged communities. Census tracts identified as disadvantaged meet or exceed socioeconomic, environmental, health, or demographic thresholds identified by CEQ. Given that activities analyzed in this document will happen within the boundaries of existing DOE/INL land and/or facilities where there are no permanent residents, any impacts to Environmental Justice in surrounding communities are anticipated to be negligible.

**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 for the Multipurpose Haul Road Within the Idaho National Laboratory Site (DOE/EA-1772, 2010).

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).

**DOE-ID NEPA CX DETERMINATION**  
**Idaho National Laboratory**

**Justification:** Based on the purpose and need and description of the proposed action and potential environmental impacts, the proposed action fits within the class of actions that is listed in Appendix B CX B3.6. There are no extraordinary circumstances related to the proposed action that may affect the significance of the environmental effects of the proposal. The proposed action has not been segmented to meet the definition of a categorical exclusion. This proposal is not connected to other actions with potentially significant impacts (40 CFR 1508.25(a)(1)), is not related to other actions with individually insignificant but cumulatively significant impacts (40 CFR 1508.27(b)(7)) and is not precluded by 40 CFR 1506.1 or 10 CFR 1021.211 concerning limitations on actions during preparation of an environmental impact statement.

Authorizing the proposed action will not (1) threaten a violation of applicable statutory, regulatory, or permit requirements for environment, safety, and health, including DOE and/or Executive orders; (2) require siting of new facilities or expansion of existing facilities; (3) disturb hazardous substances, pollutants, or contaminants; (4) adversely affect environmentally sensitive resources; or (5) involve genetically engineered organisms, synthetic biology, governmentally designated noxious weeds, or invasive species.

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.

The impacts of transporting spent fuel, special nuclear materials, and research fuels between MFC and other INL Site facilities using the Multi-Purpose Haul Road were analyzed Final Environmental Assessment for the Multipurpose Haul Road Within the Idaho National Laboratory Site (DOE/EA-1772).

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).

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Approved by Jason L Anderson, DOE-ID NEPA Compliance Officer on: 9/30/2024