DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory

CX Posting No.: DOE-ID-INL-19-035

SECTION A. Project Title: MEITNER—eVinci™ Micro-Reactor R&D

SECTION B. Project Description and Purpose:

This environmental checklist (EC) replaces EC INL-19-036 and clarifies that the proposed action does not irradiate nuclear material specimens in a test reactor. Because potential materials and systems for the eVinci™ Micro Reactor have not been identified, designed, tested, or developed, reactor irradiation testing of materials is beyond the scope of this EC. If the proposed efforts identify such materials and a need for irradiation testing, additional analysis in compliance with the National Environmental Policy Act (NEPA) will be performed to evaluate and disclose the environmental impacts associated with irradiation activities.

Westinghouse Electric Company (Westinghouse), Idaho National Laboratory (INL), Los Alamos National Laboratory (LANL), and the National Nuclear Security Administration (NNSA) perform research for the "Self-Regulating, Solid Core Block (SCB) for an Inherently Safe Heat Pipe Reactor." Under the proposed action, Westinghouse, INL, Echogen Power Systems, Limited Liability Corporation (LLC), and the University of Pittsburgh (the University) employ modeling and simulation tools to evaluate the eVinci™ Micro Reactor Solid Core Block (SCB) self-regulating behavior that may contribute to the regulatory licensing basis. The proposed action tests key hardware to demonstrate SCB manufacturability and to validate modeling tools. The proposed action involves the following tasks:

Establish a Management Plan

Under the proposed action, Westinghouse, LANL, and INL establish a management plan guiding the following elements:

- Governance
- Communications
- Work authorization
- Issue resolution.

Phenomena Identification and Ranking Table (PIRT) Analysis

For this task, Westinghouse and INL complete a PIRT analysis for the eVinci™ Micro Reactor and design variants that might evolve throughout the project. Modeling and analysis at INL use standard neutronic and thermomechanical tools (Monte Carlo N-Particle [MCNP] transport code and ABAQUS modeling) to study reactor design sensitivity and optimization and to identify and avoid potential modeling issues before completing Multiphysics Object Oriented Simulation Environment (MOOSE) modeling and simulation (M&S). The PIRT analysis employs the following M&S efforts:

- Evaluating three-dimensional SCB thermo-mechanical performance (stress, strain, temperature, creep, irradiation dose, etc.) using MOOSE-BISON-MCNP
- Developing MOOSE-BISON-SOCKEYE-MCNP models to analyze eVinci™ heat pipe performance (fluid flow, axial temperature distributions, viscous-sonic-capillary-entrainment-burnout limits, operating margins, power lift, and heat pipe failure consequences)
- Using MOOSE-Reactor Excursion and Leak Analysis Program (RELAP7)-Analysis System (ANSYS) to assess power conversion performance (thermodynamic cycle efficiency, system temperatures and pressures, and heat exchanger design).

These M&S activities evaluate the following eVinci™ Micro Reactor design features:

- Monolith (fuel, heat pipes, axial reflectors and shields, moderator, primary heat exchangers, decay heat exchangers and embedded sensors) and monolith materials
- Normal and accident conditions
- Instrumentation and control (I&C) system (including a fiber optic sensor system)
- Power Conversion.

M&S evaluates eVinci™ Micro Reactor competitiveness using methods listed below:

- Use multi-point kinetics equation to delineate key challenges and impacts on reactor safety and operations
- Evaluate monolith limitations from thermal stress and creep induced by (a) thermal gradients with simultaneous random heat pipe failure; (b) load-following transients and (c) potential pellet monolith interaction from swelling
- Model and simulate the complete monolith thermal and neutronic interdependence by estimating accurately doppler, thermal expansion components, and time constants of feedback.

Project scope includes constructing, designing, testing, and verifying eVinci™ Micro Reactor simulation models using MOOSE and ANSYS multi-physics platforms coupled with various other codes to evaluate operational performance and expected transient behaviors during accident conditions (e.g., anticipated operational occurrences (AOOs), Design Basis Events (DBEs), and Beyond Design Basis Events (BDBEs)).

Demonstrate Monolith Manufacturability

Westinghouse and LANL develop monolith prototypes to demonstrate the monolith manufacturing capability and evaluate material performance. Westinghouse fabricates monolithic blocks using vacuum diffusion bonding (VDB) followed by block diffusion-brazing, and LANL utilizes Powder Bed Fusion and Directed Energy variants of laser advanced manufacturing. The current baseline material is SS316L. Other candidate materials include P91, and, potentially, TZM. Future research needs involving temperature, irradiation, and prototype fabrication only consider candidate materials having reasonable ultimate tensile strength and elongation.

The task includes destructive and tensile testing on prototype block materials. The Westinghouse Churchill Facility and LANL characterize the materials. LANL ion irradiates qualified material samples to characterize material behavior before and after irradiation. Ion irradiation uses a particle accelerator and not a nuclear reactor.

Thermo-mechanical evaluations assess thermal expansion, thermal conduction, creep behavior, and irradiation behavior. Initial experiments complete these evaluations using samples that undergo tensile testing at 25ºC, 300ºC and 600ºC. The project also evaluates stress relaxation properties using strain rate jump tests during tensile testing at 600ºC. Characterizing sample microstructures uses several methods such as Transmission Electron Microscope/Scanning Transmission Electron Microscopy (TEM/STEM). The project completes testing in a priority order, and removes materials not showing promise during temperature testing from further evaluation.

The proposed testing ultimately identifies a single block material to study block thermal expansion. Data from sensors embedded in the prototype block verifies and validates the M&S codes and identifies material deviation pre and post ion irradiation and block deformation correlation factors.

The PIRT analysis may identify additional data needs for design activities and model validation such as reactor irradiation data for the eVinci™ Micro Reactor materials and systems. If the analysis identifies reactor irradiation data needs, the project will develop an irradiation plan, design irradiation experiments, and fabricate and irradiate sample specimens. Irradiating samples using a test reactor, such as the Advanced Test Reactor (ATR) at INL, characterizes fuel system performance through the end of life irradiation. In addition to M&S, INL would plan and irradiate experiments for the eVinci™ Micro Reactor SCB materials, including experiments on monolith, fuel, heat pipe (wick, sodium), and metal hydride moderator materials. As previously noted, it is presently unknown if such testing is needed, and if the proposed analysis identifies a need for irradiation testing, additional analysis in compliance with the National Environmental Policy Act (NEPA) will be performed to evaluate and disclose the environmental impacts.

If the analysis identifies a need for unfueled irradiation experiments using only structural materials, then an approved drop-in capsule design may be used in ATR.

Key tasks for this phase are listed below:

- Review PIRT results and identify irradiation data needs and develop an irradiation plan (if needed)
- Coordinate with National Scientific User Facilities to identify a reactor and initial irradiation experiments
- Design experiment hardware (or select from approved test vehicles) and perform engineering analysis supporting experiment insertion
- Fabricate the irradiation specimens (Westinghouse or LANL provide specimens, and INL supports fabrication).

Irradiating specimens at INL typically includes post-irradiation examination (PIE) at the Materials and Fuels Complex (MFC) including the Hot Fuels Examination Facility (HFEF), the Analytical Laboratory (AL), Electron Microscopy Laboratory (EML), and the Irradiated Materials Characterization Laboratory (IMCL) and includes various non-destructive and destructive examinations. HFEF examinations include neutron radiography, visual inspection, element contact profilometry, dimensional measurements, precision gamma scan, fission gas release analysis, metallography, and retained fission gas testing. The AL examinations include burn-up analysis and immersion density. EML examinations include microstructural analysis (Focused Ion Beam [FIB], SEM, and TEM). IMCL examinations include microstructural analysis (FIB, TEM, and EPMA). These activities are consistent with the current missions of these facilities.

After PIE, INL stores irradiated test segments and PIE remnants with other similar DOE-owned irradiated materials and experiments at MFC, most likely in the HFEF or the Radioactive Scrap and Waste Facility (RSWF) in accordance with DOE's Programmatic SNF Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (FEIS) and ROD (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203-SA-01 and DOE/EIS-0203-SA-02) and the Amended Record of Decision (February 1996). Ultimate disposal of the irradiated test pin segments and PIE remnants occurs along with similar DOE-owned irradiated materials and experiments currently at MFC. Because the need for irradiation testing and PIE is unknown, total amounts of irradiated sample debris and secondary waste are also unknown. However, categorizing this material as waste is supported under Department of Energy Order (DOE O) 435.1, Att. 1, Item 44, which states "…Test specimens of fissionable material irradiated for research and development purposes only…may be classified as waste and managed in accordance with this Order...".

In addition, irradiation and PIE projects at INL use the HFEF hot cell which contains both defense and nondefense related materials and contamination. Project materials come into contact with defense related materials. It is impractical to clean out defense related contamination, and therefore, waste associated with this type of activity 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 is 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 transuranic (TRU) waste at the generator-storage facilities would be conducted. DOE analyzed transuranic (TRU) waste management activities in the Final Waste Management Programmatic Environmental Impact Statement (WM PEIS) (DOE/EIS-200-F, May 1997). The WM PEIS analyzes environmental impacts at the potential locations of treatment and storage sites for TRU waste; SEIS-II addresses impacts associated with alternative treatment methods, the disposal of TRU waste at WIPP and alternatives to that disposal, and the transportation to WIPP.

Packaging, repackaging, transportation, receiving, and storing used nuclear fuel and R&D for used nuclear fuel management is covered by DOE's Programmatic Spent Nuclear Fuel (SNF) Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (EIS) and Record of Decision (DOE/EIS-0203, 1995) and supplemental analyses (DOE/EIS-0203-SA-01 and DOE/EIS-0203-SA-02) and the Amended Record of Decision (February 1996). The analyses include impacts related to transportation to, storage of, and research and development related to used nuclear fuel at the INL (see Tables 3.1 of the SNF Record of Decision (May 30, 1995) and Table 1.1 of the Amended Record of Decision [February 1996].

The environmental impacts of transferring low level waste (LLW) from the INL Site 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 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 low level waste (LLW) and mixed low level waste (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 potential for transportation accidents was analyzed in the SNF EIS (Section 5.1.5 and Appendix I-5 through I-10) and in the FRR EIS (Sections 4.2.1 and 4.2.2).

In addition to disposal of irradiated fuel specimens, industrial, mixed, and low level waste could be generated if the PIRT analysis identifies additional data needs for design activities and model validation such as reactor irradiation data for the eVinciTM Micro Reactor materials and systems. This could include grinding and polishing consumables, plastics, sleeves, and swipes needed for radiological and contamination control, construction waste for facility modifications and equipment installation, molds, and sample residue from analytical chemistry. This waste would be classified and disposed in accordance with INL procedures and DOE regulations/requirements and analyzed in additional NEPA analysis if irradiation at INL is deemed necessary.

Heat Pipe Design, Modeling and Prototyping

As part of this task, LANL modifies an available transient heat pipe software simulation model for implementing multi-physics software tools. Westinghouse supplies the model reference design and fabricates project-designed prototype heat pipe wicks for maximum heat pipe heat loads. Wick design considers load and vapor density imbalances and wick surface activation enhancing wetting and effective passivation inhibiting corrosion. This task also studies performance and lifetime issues associated with design and affordable manufacture of advanced, high power density wicks having a large length to diameter ratio. LANL completes a separate effects test and characterizes double ended and variable heat pipe conductance at various reactor heat conditions. Projecting a heat pipe array from both reactor ends doubles the area available for the heat pipe to transfer heat. The length condensate travels through the heat pipe wick from the heated to cooled zones increases reactor power throughput by up to a factor of four. Such enhanced performance is key to scaling heat pipe cooled micro reactors to higher power density.

Supercritical CO_2 Power Cycle Transient Model, Design and Optimization

Westinghouse explores a supercritical carbon dioxide (sCO_2) power conversion system for integration with the eVinci™ Micro Reactor. Design work includes developing a transient power cycle model integrated with the MOOSE or ANSYS framework. This task determines total plant performance and demonstrates controls to show autonomous load following operation of the reactor and power cycle.

The first step of this task completes a design point analysis to determine cycle architecture and the size of major equipment (heat exchangers and turbomachinery). The task also performs initial power cycle optimization based on boundary conditions and heat source and cooling sink characteristics using a multivariate nonlinear optimization MATLAB code with associated component cost models and cost database.

Following the design point analysis, the proposed action develops preliminary power cycle controls using quasi-steady state modeling. The proposal identifies control states as a function of the power cycle architecture and the eVinci™ Micro Reactor requirements. Control states include a cold system state, minimum idle (running but not producing power), full power, and shutdown state. The task identifies required control elements (valve or turbomachinery speed control) based on system transitions from each control state and develops a preliminary control logic document. This forms the transient model basis and the controls development.

Based on design point analysis results and quasi-steady state modeling, the project develops a transient cycle model (completed in the GT software Suite, with Simulink based controls) for integration with other system models. This task develops major equipment performance specifications and selects pipe sizes and materials. It also develops detailed power cycle process and instrumentation diagrams (PID) and required subsystems (inventory control, seal conditioning, bearing supply) for developing a 3D power cycle model and evaluating cost estimates. In addition, this task establishes control architecture and hardware, instrumentation, preliminary load lists, and an electrical single line diagram. This task concludes with preliminary power cycle design and costs and the sCO2 power cycle timeline projections.

Instrumentation and Control (I&C) Architecture and Design

The I&C architecture and design task develops a functional reactor I&C system meeting the eVinci™ Micro Reactor functional requirements. The I&C system interfaces with reactor subsystems and gives real time information on reactor operation, power conversion operation, micro grid operation, and integration. The I&C system design uses a phased approach as it provides discrete sub tasks and opportunities for challenge and design reviews.

This task defines I&C functions and performance requirements, including logical processing and interfaces. It considers instrument types, ranges, resilience to radiation and environmental factors, sizing, positioning, and installation in the reactor system, and how these factors correlate to reactor control. This work analyzes requirements and specifies hardware, logic, software and interface details to produce the I&C system. During this phase, the project creates detailed hardware drawings and identifies I&C system assembly, then procures hardware and assembles the target system. Software code is written according to design specifications and installs software code onto target hardware. Testing then verifies the system satisfies functional and performance requirements.

In conjunction with I&C architecture, the project analyzes reactor performance in the frequency domain. Creating dynamic models in the frequency domain is based on models developed for reactor neutronics and thermal behavior in previous tasks. This analysis determines design stability and required response performance. The physics-based models developed from this task validate target hardware controller performance.

This step also refines I&C architecture and produces a prototype to demonstrate the I&C system functional logic and platform viability. The working prototype also integrates advanced fiber optic sensor signals, sCO2 power conversion system, microgrid management system, and remote monitoring and control station. Completing the prototype reduces I&C system risk by proving key design aspects before designing and building a larger system.

Fiber Optic Sensor Development

This task integrates distributed and Fiber Bragg Grating (FBG) point sensor arrays in the micro-reactor prototype to give measurement solutions used to monitor reactor safety and optimize the control scheme. The project constructs the micro-reactor core monolith components using diffusion bonding and brazing, which integrates fiber sensors (FBG sensor arrays and distributed fiber sensors) in selected heat pipe sections.

Sensor fabrication and testing: The University of Pittsburgh builds upon current radiation-resistant, single point FBG sensors and distributed fiber sensor technologies including University fiber optic design and specification Background Intellectual Property. The University also develops a laser fabrication process producing at least 100-point sensors in one fiber and distributing fiber sensors along one fiber to achieve 2-cm spatial resolution temperature and strain measurements.

Sensor integration and testing: Following University fiber sensor fabrication, the University metalizes the fiber sensor for integration into the heat-pipe assembly prototype by Westinghouse and the University. Westinghouse constructs the heat-pipe assembly prototype by diffusion bonding and brazing stainless-steel plates, which embeds fiber sensor embedment along any heat pipe radial section. Westinghouse embeds the fiber sensors at the reactor face or at end facets on both heat pipe ends.

To integrate sensors, the University removes excessive surface materials and polishes the surface for bonding or brazing using a Wire Electrical Discharge Machine (EDM). Westinghouse and the University both perform this task, which includes Westinghouse and University Background Intellectual Property.

Sensor testing and interrogation: After embedding fiber sensors in stainless steel plates and brazing/bonding with the heat pipe, the University and Westinghouse evaluate sensor-fused “smart” heat pipe temperature and radiation resistance by testing sensors at temperature at least 100°C higher than normal operating temperatures (i.e. 750°C) enabling use of an accelerated aging test to evaluate fiber sensor longevity and stability and measure sensor performance. Based on the integrated sensor, the University and Westinghouse evaluate, purchase, and assemble a system to continuously measure temperature across the heat pipe face and monitor strain at selected points to gauge micro-reactor performance during normal and transient operations. Westinghouse and the University jointly perform this task using both Westinghouse and the University Background Intellectual Property.

Moderator Characterization

The proposed action quantifies temperature gradient induced hydrogen diffusion in the Yttrium lattice. For this task, LANL measures hydrogen diffusivity using Doppler imaging and other conventional measurements and examines control migration and reactive feedback of micro-engineered barriers or clads.

eVinci™ Micro Reactor Factory Modeling and Design

In this task, Westinghouse identifies eVinci™ Micro Reactor fabrication based on the prototypes built in previous tasks by utilizing the part breakdown structure, i.e. how the reactor parts and components are assembled using the reactor’s CAD model. Mapping the fabrication steps creates a factory process design template, which tracks material flow and fixed (machine, salaried labor, etc.) and operating costs (hourly labor, tooling), with respect to time. Mapping also leads to integrated process-based cost model (PBCM) software, which integrates a production model and a market demand model. The PBCM model analyzes life cycle costs of each reactor and evaluates factory fabrication risks. This task then runs and optimizes the PBCM model in terms of (i) maximizing throughput, (ii) minimizing inventory and (iii) minimizing operational cost to identify and characterize balanced factory operation. The project evaluates the factory operation strategy using capacity ramp-up profile, cost/unit profile for annual production volume, time to fabricate each reactor, throughput constraints, and scalability ranges. The PBCM serves as a pseudo techno-economic model to validate an overall business case.

Final Report

Westinghouse, LANL and INL prepare a final report that includes the following:

1) Computer-based modeling and simulation tools and their interfaces to model the eVinci™ Micro Reactor
2) An integrated production model and a market demand model
3) Using micro-engineered barriers or clads to control migration and its reactivity feedback;
4) Performance of an interrogation system to continuously measure temperatures across the heat pipe face and along the SCB to create a 3D temperature and strain rendering map
5) I&C architecture, functional logic, and viability
6) Preliminary power cycle controls developed using quasi-steady state modeling
7) Heat pipe wick maximum heat load optimization coupled to the heat exchangers
8) Phenomena Identification and Ranking Table (PIRT) analysis for the eVinci™ Micro-Reactor.

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

The proposed MS and software development at INL will not produce air emissions. Radiological and chemical emissions could be generated from ATR irradiation and PIE if project tasks identify the need for reactor irradiation data. While currently unknown, air emissions are anticipated to be minor, and concentrations would likely not exceed the current monitored air emissions from INL facilities. An Air Permit Applicability Determination (APAD) will be required.

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 are evaluated by Environmental Support and Services staff. All radionuclide release data (isotope specific in curies) directly associated with any future irradiation will be calculated and provided to the Environmental Support organization and evaluated in additional NEPA analysis as required.

All radionuclide release data associated with future PIE needed for completion of the proposed tasks will be recorded as part of the HFEF continuous stack monitor. 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.

Generating and Managing Waste

Before irradiating samples in ATR (to be determined), a waste management plan (for the irradiated materials) would be developed. Additional NEPA analysis would identify the amounts and types of waste to be generated.

Releasing Contaminants

Chemicals will be used and 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. In the event of a spill, notify facility PEL. If the PEL 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.

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, B3.6, "Small-scale research and development, laboratory operations, and pilot projects" and B3.10 "Particle accelerators"

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, Sept. 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).

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;"

CX B3.10, “Siting, construction, modification, operation, and decommissioning of particle accelerators, including electron beam accelerators, with primary beam energy less than approximately 100 million electron volts (MeV) and average beam power less than approximately 250 kilowatts (kW), and associated beamlines, storage rings, colliders, and detectors, for research and medical purposes (such as proton therapy), and isotope production, within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible), or internal modification of any accelerator facility regardless of energy, that does not increase primary beam energy or current. In cases where the beam energy exceeds 100 MeV, the average beam power must be less than 250 kW, so as not to exceed an average current of 2.5 milliamperes (mA).”

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).

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: 6/04/2019