

**SECTION A. Project Title:** Innovative Nuclear Materials - Outboard A (INM-OA) Irradiation Experiment

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

The purpose of the proposed action is to investigate the longevity and efficacy of proposed materials for fast reactors. The Innovative Nuclear Materials (INM) – Outboard A (INM-OA) is a non-fueled drop-in experiment that will irradiate material specimens in the Advanced Test Reactor (ATR). INM Program includes members from Oak Ridge National Laboratory, Idaho National Laboratory (INL), Pacific Northwest National Laboratory, and Argonne National Laboratory. Members will fabricate and deliver material specimens of interest to be irradiated in the experiment capsule. The INM program anticipates that the materials proposed for use in the irradiation capsules will include Inconel-625, SS 316, HT9 steel, ODS steel 14YWT, HEA and other non-fuel materials. The program will perform post-irradiation examination (PIE), including microscopy and mechanical testing, to obtain results on the effect of fast neutrons (microstructural damage by atom displacement) on materials physical properties.

The project includes the following tasks:

- **Design & Analysis:** The INM-OA project includes design and analysis of a capsule compatible with an Outboard A position in ATR and suitable for holding various material specimen types/sizes. INL will design a cadmium-lined basket (Cd-basket) to shroud the capsules from incidental thermal neutrons.
- **Fabrication & Assembly:** External fabrication shops will machine mockup material specimen holders to verify the fit and feasibility of the design. INL will fabricate up to 7 capsules and 5 dummy capsules to hold specimen fixtures. The North Holmes Laboratory (NHL) with support from the ATR machine shop will fabricate experiment hardware, capsules, and baskets. Members of the INM Program will fabricate all material specimens and deliver them to INL for assembly in the capsules. INL will also fabricate experiment hardware for final assembly, including end caps, plugs, springs, and spacers. INL will assemble the experiment capsules at the Test Train Assembly Facility (TTAF) using welding techniques. To verify welding procedures and parameters, the project may need practice pieces, collets, and gas mixtures. INL will fabricate up to 10 Cd-baskets for use in irradiation.
- **Irradiation:** INL will irradiate the 7 experiment capsules in the ATR for up to 15 cycles for varying lengths of time to investigate helium production and the effects of neutron damage (dpa) to materials of interest for fast reactors. The irradiation objectives are to reach up to 30 dpa for the different materials and achieve material temperatures around 600C. INL will use each Cd-basket for two irradiation cycles and then dispose of them.
- **Shipping:** INL will periodically remove the capsules and replace them with dummy capsules when experiment targets are met. Then INL will ship the capsules to the Materials & Fuels Complex (MFC) to undergo PIE. INL will load the shipping cask in the ATR canal area for shipment to MFC. The Hot Fuels Examination Facility (HFEF) or Sample Preparation Laboratory (SPL) will then receive and unload the cask.
- **Post-Irradiation Examination:** INL will perform PIE primarily at the Irradiated Materials Characterization Laboratory (IMCL) and SPL. INL may perform sizing activities in HFEF if necessary or could use equipment at the Electron Microscopy Laboratory (EML) in place of IMCL, depending on availability. The program anticipates needing the following PIE activities: scanning/transmission electron microscopy (SEM/TEM), focused ion beam (FIB), atom probe tomography (APT), and mechanical (tensile, hardness) testing.

This project involves the INM Program which includes members from Oak Ridge National Laboratory, Idaho National Laboratory, Pacific Northwest National Laboratory, and Argonne National Laboratory.

Waste will be generated in associated with this project. Samples may also be returned to INM Program specimen suppliers.

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

**Air Emissions**

Experiment irradiation and PIE will be performed at the ATR, HFEF, and IMCL. Air emissions would include minor amounts of radionuclides and toxic air pollutants. The irradiation in the ATR 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. 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 valuated by ATR Environmental Support and Services staff, prior to insertion in the ATR. All radionuclide release data (isotope specific in curies) directly associated with this experiment will be calculated and provided to ATR Programs Environmental Support organization. The irradiated specimens will be delivered to the MFC HFEF and IMCL 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 or the IMCL 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.

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

NA

**Disturbing Cultural or Biological Resources**

Cultural: Pursuant to the 2023 Programmatic Agreement, this federal undertaking does not trigger Section 106 review as the proposed activity results in no historic properties affected.

### Generating and Managing Waste

< 10 kg (Radiological Cd-baskets) managed as Mixed Low-Level Waste (MLLW- hazardous for Cadmium) and or Hazardous waste (Non-Radiological Cd baskets) and < 10 kg (irradiated capsules) managed as Low-Level Waste. Waste streams are expected to include industrial waste such as PPE, packaging material; and low-level radioactive waste PPE (LLW). All waste will be managed by WGS.

### Releasing Contaminants

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

NA

### 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:** B3.6 "Small-scale research and development, laboratory operations, and pilot projects"

**Justification:** 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); and 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 or developed area (where active utilities and currently used roads are readily accessible). Not included in this category are demonstration actions, meaning actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act)     Yes     No

Approved by Robert Douglas Herzog, DOE-ID NEPA Compliance Officer on: 4/25/2024