# DOE-ID NEPA CX DETERMINATION
# Idaho National Laboratory



CX Posting No.: DOE-ID-INL-22-005

**SECTION A. Project Title:** TPBAR Materials Irradiation Separate-Effects Testing 4 (TMIST-4) Experiment

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

TMIST-4 Materials Radiation Separate Effects Test will be a lead-out experiment irradiated in the B-2 position in the Advanced Test Reactor (ATR). The experiment will consist of four capsules distributed axially within an irradiation test vehicle (i.e., test train). Two capsules, referred to as getter capsules, will contain tritium-loaded getters within sealed inner capsules. Two capsules, referred to as reference capsules, will contain inner capsules that permit internal flow of an externally supplied tritium-laden gas. Each capsule will be connected to a temperature control system that operates by varying the composition of the helium/neon gas mixture. Each capsule will contain one to two thermocouples to provide real-time, in-situ temperature measurements. The temperature control/sweep gas will collect all the released tritium and transfer it out of the reactor for "real-time" analysis via sampling and measuring tritium activity using ion chambers. The experiment parameters will also be monitored remotely using the Nuclear Data Management and Analysis System. The intention for this experiment design is to leverage the existing TMIST-2 test train design where possible to minimize budget and schedule. TPBAR Materials Irradiation Separate-Effects Testing -2 (TMIST-2) is under the EC INL-08-091. TPBAR Materials Irradiation Separate-Effects Testing-1 (TMIST-1) is the original Environmental Checklist (INL-08-003) that determined the oxidation rate of the tritium-producing burnable absorber rods (TPBAR) liner specimens (zirconium and zirconium alloys) as a function of temperature and water vapor pressure during irradiation. TPBAR Materials Irradiation Separate-Effects Testing 3 (TMIST-3) is found under ATRP-11-025 and determines the tritium release kinetics and speciation from various LiALO2 pellet geometries. The specific set of experiments were designated under TMIST-3A and TMIST-3B. The objective of TMIST-4 is to experimentally determine the tritium partial pressure over the getter in a simulated TPBAR service environment. Comparison of tritium release from the reference capsules with known tritium pressure and getter capsules with unknown tritium pressure should quantify the magnitude of an irradiation effect. Results from this experiment are expected to provide additional insight regarding getter performance during irradiation and improve predictive modeling capabilities for TPBARs.

The TMIST-4 capsules will be fabricated at PNNL. After irradiation at INL, the experiment test train will be shipped by INL to PNNL where PIE will be performed. INL will manage all activities except for PIE. Thermocouples will be installed in the center of the capsules then brazed by INL. PNNL will send INL mockup capsule bulkheads for braze practice. TMIST-4 is an instrumented lead experiment that will be irradiated in the B-2 position of ATR during cycles 175A and 175B. The experiment should be irradiated in two sequential normal (non-PALM) cycles to simplify design considerations that would be necessary to allow for experiment removal and reinstallation. Lobe power and length of cycle restrictions are not known. Irradiation unit charges will apply, and no as-run/projection analysis or flux wire measurements are anticipated between cycles. After irradiation is complete TMIST-4 will be moved from ATR and placed in the ATR canal for the short-term isotopes to decay.

TMIST-4 will require sizing in the Dry Transfer Cubicle (DTC) at ATR prior to loading into the DTC cask insert (CI). After decay in the ATR canal, TMIST-4 will be moved from the canal area to the DTC using the ATR-1 handling cask. A sizing dry run will be performed in the DTC to ensure the actual sizing is completed without issues. Sizing will be performed pursuant to a detailed operating procedure (DOP). The experiment will be loaded into a basket which will be loaded into the DTC cask insert with a modified lid which will be loaded into the 10-160B cask. Shipment of irradiated experiment from the ATR Complex to PNNL will be made using the 10-160B shipping cask. Cribbing will be needed to hold the DTCCI in the 10-160B, but conditions may be able to use that from TMIST-3A. A TMIST-4 source term/decay heat evaluation will be necessary for shipment. No future transfers or shipment needs beyond initial experiment insertion are anticipated. An induction brazing machine will be purchased, used during assembly, and retained for future use after the project is complete (not waste). Experiment gas system equipment will be purchased, used during operation of the experiment, and discarded afterwards. This includes pressure transmitters, flow meters, flow controllers, solenoid valves, ion chambers, ion chamber control panels, gas analyzers, gas panel heaters, etc. While TMIST-4 will utilize existing support equipment previously installed for TMIST-3, some equipment modifications may be necessary. These modifications will occur pursuant to ATR work orders. Future support equipment installation needs beyond initial experiment insertion, Management Self-Assessment, and Readiness Assessment are not anticipated. Support equipment installation will be performed at the Advanced Test Reactor.

Management activities will occur within Engineering Research Office Building (EROB). All non-radioactive waste that will be generated from fabrication and assembly activties is to be expected. The fabrication will occur mostly at North Holmes Laboratory, but fabrication may occur at the Advanced Test Reactor Fabrication Shop. This waste consists of metal (e.g., stainless steel, aluminum, copper) from machining, fabrication, and mockups. It will also include rags used with solvents (e.g., acetone, ethanol) to clean components after fabrication and prior to assembly. The total waste of non-radioactive waste that is expected to be generated is approximately 100 lb.

Low-level radioactive waste will be generated from disposing of contaminated experiment hardware after completion of the project. The equipment consists of test train and support hardware (primarliy stainless steel, additional to small amounts of aluminum, copper, and brass). Further generation is from gas system equipment (e.g., stanless steel panels, tubing, valves, and fittings; copper tubing; brass valves and fittings, pressure transmitters, flow meters, flow controllers, solenoid valves, ion chambers, ion chamber control panels, gas analyzers, gas panel heaters, etc. The total weight expected to be generated of radioactive waste is approximately 500 lb.

Incidental waste will also be generated for the experiments activities and will be managed per the facility in which it was created. Experimental components will not be considered waste until they are no longer needed for the experiments. Mixed waste generation is not anticipated but may occur. All waste associated with this experiment may include low-level radioactive, mixed, hazardous, or industrial waste per environmental requirements.

Non-radioactive emissions will be generated during assembly activities. This includes fumes generated from welding and brazing processes, as well as inert gas (e.g., helium) used to test experiment systems prior to operation. These fumes and gases will be exhausted through the TRA-1626, "Test Train Assembly Facility" (TTAF) high-bay industrial ventilation system.

Radioactive emissions will be generated during assembly and operation of tritium bottle preparation. Potentially small quantities of airborne tritium may be generated during experiment assembly (during gas bottle preparation at TRA-666, "STAR Facility/Tritium Lab," and during welding & brazing at TTAF). Tritium laden gas will be generated during experiment operation to maximize tritium production and exhausted through the ATR radioactive ventilation system stack.

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

**Air Emissions**

Air emissions are to be expected from irradiation where fission gas will be released and vented up to the ATR stack. The activity will not exceed any air regulations that are permitted for ATR. Radioactive emissions are expected during assembly and operation of the experiment using tritium producing tritium laden gas and will be exhaused through the ATR radioactive ventilation system stack regarding the APAD permitted for the ATR facility. Non-radioactive emissions that include fumes generated from welding and brazing processes along with inert gas (helium) will be exhausted through the TRA-1626 "Test Train Assembly Facility (TTAF) high bay industrial ventilation system regarding the APAD permitted for the facility. Emissions of regulated air pollutants, including radionuclides such as tritium are expected to be far below limits established in APAD 01-79.

The ATR irradiation activities 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.

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

N/A

**Disturbing Cultural or Biological Resources**

N/A

**Generating and Managing Waste**

Generation of waste includes low-level radioactive waste from disposal of contaminated experiment hardware such as stainless-steel panels, tubing, valves, and fittings; copper tubing; brass valves and fittings, pressure transmitters, flow meters, flow controllers, solenoid valves, ion chambers, ion chamber control panels, gas analyzers, gas panel heaters, etc. The total waste generated of low-level radioactive waste would approximately be 500 lb. Non-radioactive waste will also be generated from fabrication and assembly activities which includes stainless steel, aluminum, copper and dirty rags with solvents such as acetone and ethanol to clean fabrication components. Non-radioactive metals will be recycled to the extent possible. The total estimate of non-radioactive waste is approximately 100 lb. Other waste generated includes incidental waste that is associated with facility management practices and consists of radiological or cold waste determined per the facility criterion.

**Releasing Contaminants**

Project personnel will manage all chemicals used of procured in accordance with company procedure.

**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)).

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**References:** 10 CFR 1021, Appendix B to subpart D, items B3.6, "Small-scale research and development, laboratory operations, and pilot projects" and categorical exclusion B1.31 "Installation or relocation of machinery and equipment".

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."

B1.31 Installation or relocation of machinery and equipment. "Installation or relocation and operation of machinery and equipment (including, but not limited to, laboratory equipment, electronic hardware, manufacturing machinery, matinenance equipment, and health and safety equipment), provided that uses of the installed or relocated items are consistent with the general missions of the receiving structure. Covered actions include modifications to an existing building, within or contguous to a previously disturbed or developed area, that are necessary for equipment installation and relocation. Such modifications would not appreciably increase the footprint or height of the existing building or have the potential to cause significant changes to the type and magnitude of environmental impacts."

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: 03/15/2022