

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

SECTION A. Project Title: Diffusion Couple Test

SECTION B. Project Description:

Toshiba is investigating an innovative nuclear waste burning system by fast reactor using Uranium (U)-free metallic fuel. U-free metallic fuel is considered a promising technology to burn Transuranic (TRU) fuel in fast reactors. The U-free metallic fuel has high Plutonium (Pu) content which can cause significant chemical interaction with cladding material and result in fuel pin failure. Two metal systems have been identified that could reduce the interaction. However, the effectiveness of these materials for the uranium-free metallic fuel has not been tested.

The purpose of this research and development activity (diffusion couple test using Pu-40/Zirconium [Zr] metallic fuel alloy) is to examine the effectiveness of barrier systems as the chemical interaction barrier of cladding for U-free metallic fuel. The proposed action would assemble, heat treat, and characterize two diffusion couples containing U-free Pu-40Zr metallic fuel alloy (currently stored at Idaho National Laboratory's (INL's) Materials and Fuels Complex (MFC) Fuel Manufacturing Facility (FMF) (MFC-704)) and cladding materials with barrier systems. The plutonium alloy was originally defined and produced for testing as a non-fertile fuel alloy under fuel cycle Research and Development (R&D) (AFC-1). Associated activities such as test planning and preparation, waste disposal and reporting would also be performed. Characterization would include sectioning, polishing, and performing scanning electron microscopy (SEM) on interfaces between the fuel alloy and the cladding materials containing the barriers.

After developing a test plan, the following activities would take place as part of the proposed action:

Preparation of diffusion couple test

The sample is stored in FMF. Preparations for shipping to the Analytical Laboratory (AL) would be performed in the FMF glovebox. The sample pellet may be sawed or sectioned in the in the FMF glovebox prior to shipping.

Preparation of the diffusion couple test would occur in the AL Fresh Fuels Glovebox as follows:

1. Polish pellets of the U-free metal fuel alloy and claddings with a barrier system
2. Wrap the pellets in tantalum foil
3. Assemble the pellets in the jig
4. Set torque based on past experience with similar experiments.

Diffusion couple test

The prepared experiments would be transferred from FMF to the MFC Analytical Laboratory fresh fuel glovebox and inserted into a vacuum furnace or dry, high-purity argon filled furnace. One diffusion couple test would be done while heating the diffusion couple assembly to 700°C for more than 100 hours. The impurities in the atmosphere would be monitored during the test.

Examination of post diffusion couple test

Examination after the diffusion couple test would be conducted in the Electron Microscopy Laboratory at MFC as follows:

1. Disassemble the jig
2. Section and mount the section(s) for SEM examination
3. Perform the SEM examination including energy dispersive spectroscopy.

Final report

A final report would be produced and provided to the customer.

National Environmental Policy Act (NEPA) coverage for the transportation and disposal of defense-related TRU waste to the Waste Isolation Pilot Plant (WIPP) are found in Final Waste Management Programmatic Environmental Impact Statement [WM PEIS] (Department of Energy [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 Record of Decision (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 WM PEIS. 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 (SEIS-II also includes potential transportation between generator sites).

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions - This work has the potential to generate small amounts of metallic and radioactive emissions. The oven atmosphere would be monitored for impurities. Potential radioactive emissions would be reported through the Rad National Emission Standards for Hazardous Air Pollutants (NESHAPS) process. An Air Permit Applicability Determination (APAD) will be needed to evaluate non-radiological emissions not covered under an existing APAD or permit.

Generating and Managing Waste - This work is expected to generate small amounts of defense-related TRU waste (2.5 g of waste per sample and a total of 2 samples). All Solid Waste will be managed through Waste Generator Services (WGS).

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Using, Reusing, and Conserving Natural Resources - All materials would be reused and/or recycled where economically practicable and as accepted by the customer. All applicable waste would be diverted from disposal in the landfill where conditions allow. In addition, the project would practice sustainable acquisition, as appropriate and practicable, by procuring construction materials that are energy efficient, water efficient, are bio-based in content, environmentally preferable, non-ozone depleting, have recycled content, or are non-toxic or less-toxic alternatives (<https://sftool.gov/green-products/0?agency=7>).

SECTION D. Determine the Recommended Level of Environmental Review (or Documentation) and Reference(s): Identify the level 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 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 item B3.6 "Small-scale research and development, laboratory operations, and pilot projects"

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)

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."

The impacts of transporting and disposing of waste resulting from defense activities that was placed in retrievable storage pursuant to a 1970 Atomic Energy Commission policy (see Section 1.2) and TRU waste that was reasonably expected to be generated by ongoing activities and programs was analyzed in DOE/EIS-0026 (October 1980) and the Final Supplement Environmental Impact Statement for the Waste Isolation Pilot Plant (SEIS-I) (DOE/EIS-0026-FS, January 1990).

NEPA coverage for the transportation and disposal of waste to WIPP are found in 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. DOE has analyzed TRU waste management activities in 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. (SEIS-II also includes potential transportation between generator sites.)

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

Approved by Jack Depperschmidt, DOE-ID NEPA Compliance Officer on: 2/10/2015