

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

SECTION A. Project Title: NSUF-CCZ-RIA Experiment at TREAT

SECTION B. Project Description and Purpose:

The Investigation of degradation mechanisms of Cr-coated Zirconium Alloy Cladding (CCZ) in Reactivity Initiated Accidents (RIA) at the Nuclear Science User Facilities (NSUF) consists of performing RIA irradiations and experimental analysis of thermal, mechanical, and microstructural response of Cr-coated zirconium alloy fuel cladding in comparison with uncoated Zr-alloy coating. The experimental data will be used to develop new criteria for failure mechanisms/models of the Cr-coated ATF cladding designs. The project will be completed at four NSUF facilities in 4 years.

The four NSUF facilities and associated resources needed to perform the proposed research are available at the partnering NSUF laboratory (INL) and are outlined below:

1. The Fuel Fabrication Facilities, INL – Loading Cr-coated Zircaloy-4 cladding tubes with UO₂ pellets, final welding of Cr-coated Zr-alloy cladding tubes, and construction of irradiation test vehicle.
2. The Transient Reactor Test Facility (TREAT), INL – Pulse-type irradiation in water environment involving high energy deposition imposed on the cladding/fuel system in a MSERTTA capsule.
3. The Hot Fuel Examination Facility (HFEF), INL - Neutron radiography and load frame tests to evaluate mechanical properties.
4. The Irradiated Materials Characterization Laboratory (IMCL) facility, INL – Capsule deconstruction, visual inspection of tested cladding tubes, optical and electron microscopy-based characterization of irradiated samples and associated sample preparation

At fuel fabrication facilities, the coated cladding tubes will be loaded with UO₂ pellets and endcaps will be welded onto the cladding. Initial irradiations will involve fresh fuel with simulated high burnup characteristics that include prehydrided cladding and use of oversized UO₂ fuel pellets. The tests will be conducted at different pulse widths to determine if a pulse width dependence or threshold on different failure modes can be determined. Tests down to approximately 50 milliseconds (ms) can be performed at the TREAT facility.

Work in Phase one involves the assembly of the fresh fuel tests which includes hydrogen charging the zirconium alloy tubes using a furnace at the INL Research Center (IRC) and grinding pellets to specific sizes at the Experimental Fuels Facility (EFF). INL may also explore subcontracting options to produce pre-hydrided cladding with the desired characteristics. The specialty ground pellets will then be inserted into the rods and welded shut. The assembled rods will be loaded into test capsules and filled with water at 200°C and sealed shut. Approximately 8 capsules will be assembled.

Following capsule assembly, they will be shipped to the TREAT reactor where they will be irradiated in transient conditions. Following irradiations, the capsules will be sent to Hot Fuel Examination Facility (HFEF) or Irradiated Materials Characterization Laboratory (IMCL) for disassembly and post transient characterization which will include non-destructive and destructive analysis. Samples sent directly to IMCL will not contain transuranic isotopic concentrations above the TRU waste threshold.

After Post Irradiation Examination (PIE), irradiated test pin segments and PIE remnants will be stored 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 will be along with similar DOE-owned irradiated materials and experiments currently at MFC. Categorizing this material as waste 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, 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 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 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 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 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 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.

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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).

SECTION C. Environmental Aspects or Potential Sources of Impact:

Air Emissions

The proposed action has the potential to generate radiological and chemical emissions from irradiation in TREAT and PIE at MFC (HFEF and IMCL). 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) would not be required.

The TREAT 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. TREAT radionuclide emissions are sampled and reported in accordance with Laboratory Wide Procedure (LWP)-8000 and 40 CFR 61 Subpart H.

The irradiated specimens will be delivered to the MFC HFEF for disassembly and then undergo routine PIE at IMCL. All radionuclide release data at HFEF and IMCL will be recorded as part of their continuous stack monitors. These activities are considered routine and 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 2019, the effective dose equivalent to the offsite maximally exposed individual (MEI) from all operations at the INL Site was calculated as .0559 mrem/yr, which is 0.5% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from the INL site. 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/EIS-0203). 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 EIS.

Discharging to Surface-, Storm-, or Ground Water

N/A

Disturbing Cultural or Biological Resources

MFC-720/TREAT is eligible for listing on the National Register of Historic Places (NRHP) and is considered a Category 1 historic property; as such, all project activities associated with the building must undergo cultural resource review (CRR).

Generating and Managing Waste

In addition to disposal of the irradiated fuel that will be generated as described above, industrial, mixed, and low level waste will be generated throughout the R&D process. This waste will be classified and disposed in accordance with INL procedures and DOE regulations/requirements.

The amount of TRU waste to generated is anticipated to be less than 2 kgs.

Releasing Contaminants

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 the 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.

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

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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."

Final Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the Resumption of Transient Testing of Nuclear Fuels and Materials (DOE/EA-1954, February 2014).

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 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."

DOE evaluated the environmental impacts of transient irradiations in the TREAT reactor, including 1) transporting experiment materials between MFC and TREAT, 2) pre- and post-irradiation radiography, 3) PIE of test components at HFEF or other MFC facilities, and 4) waste generation and disposal in the Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) for the Resumption of Transient Testing of Nuclear Fuels and Materials (DOE/EA-1954, February 2014).

After PIE, irradiated test pin segments and PIE remnants will be stored 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 will be along with similar DOE-owned irradiated materials and experiments currently at MFC. Irradiated sample debris and secondary waste could total as much as 20-30 Kg. 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...".

NEPA coverage for the transportation and disposal of waste to WIPP are 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 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 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.

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

Approved by Jason Anderson, DOE-ID NEPA Compliance Officer on: 05/26/2021