

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

SECTION A. Project Title: BWXT UN/SiC Irradiation Campaign

SECTION B. Project Description and Purpose:

The United States Congress passed the Nuclear Energy Innovation Capabilities Act (NEICA), which mandated the U.S. Department of Energy (DOE) to implement the Advanced Reactor Demonstration Program as a mechanism to invigorate the nuclear industry with respect to reactor development and deployment.

In mid 2020, the DOE released a Funding Announcement Opportunity (FOA) for the ARDP program which allowed participants to submit proposals for three areas of work shown below.

1. Advanced Reactor Demonstrations: which are expected to result in a fully functional advanced nuclear reactor within 7 years of award.
2. Risk Reduction for Future Demonstrations: which will resolve technical, operational, and regulatory challenges to prepare for future demonstrations.
3. Advanced Reactor Concepts: which will support innovative and diverse designs with the potential to commercialize concepts in the mid-2030s.

To support item 2 of Risk Reduction for Future Demonstrations, BWXT Technologies will partner with the Idaho National Laboratory (INL) and the Oak Ridge National Laboratory (ORNL) to submit an ARDP proposal. BWXT technologies wishes to develop and qualify a Uranium Mononitride (UN) tristructural isotropic (TRISO) particles embedded within a Silicon Carbide (SiC) matrix to support the development of Gas Cooled Advanced Reactors, specifically reactors that require a very small footprint. Within the BWXT proposal, INL was assigned the following work scope:

1. Irradiation Testing of TRISO fuel over a range of temperature and burnup
2. Post-Irradiation Examination of TRISO fuel
3. High-Temperature post-irradiation TRISO fuel safety testing in oxidizing conditions
4. Integrated Modeling and Simulation
5. Coupled Neutronics and Thermal Hydraulics Design and Analysis
6. High-Temperature Sensor Identification and Testing

The INL will support the BWXT effort with a team consisting of Subject Matter Experts (SMEs) and technical experts from the irradiation test group, the Advanced Gas Reactors (AGR) group, Modeling and Simulation, Experimental Design and the National Reactor Innovation Center (NRIC). The work will be completed at the Hot Fuels Examination Facility (HFEF), Energy Innovation Laboratory (EIL), Irradiated Materials Characterization Lab (IMCL).

The equipment that will be purchased for the project are: parts and consumables for the irradiation test train fabrication (graphite, stainless steel blanks, thermocouples), hardware and instrumentation for the fission gas system (piping, valves, flow controllers, pressure transducers, etc.); possibly upgraded computer systems, and consumables for PIE processes.

Given the unique quality of their FCM fuel, some new PIE methods may be required. However, how much is to be budgeted for the project and where the process will entail is still to be determined.

There will be rad waste generated during cutting/sizing of the experiment at ATR and from hot cell activities at MFC. In addition, the fuel itself will become waste at the end of the project. Some of the waste may be mixed waste, i.e., hazardous (e.g., acids) mixed with radioisotopes, depending on the type of PIE done at INL. Only during the irradiation, where any fission gas released will be vented up the ATR stack will air emissions will occur. The total activity would be very low compared to the steady state activity released from ATR during normal operation. There is a possibility that facilities would discharge possible irradiation and PIE activities cooling water to evaporation ponds. There will be no discharge to any sewer system.

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.

The proposed action has the potential to generate radiological and chemical emissions from 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. There will be no increase in radiological emissions. An Air Permit Applicability Determination (APAD) would not be required.

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 2020, the effective dose equivalent to the offsite maximally exposed individual (MEI) from all operations at the INL Site was calculated as .0617 mrem/yr, which is 0.625% 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,

DOE-ID NEPA CX DETERMINATION

Idaho National Laboratory

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

N/A

Generating and Managing Waste

There will be waste generated from the irradiated fuel, industrial, mixed, and low level waste that will be generated throughout the R&D process. This waste will be classified and disposed in accordance with INL procedures and DOE regulations and requirements.

The amount of TRU waste to generated is expected to be less than 1 cubic meter in volume.

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

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 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).

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

**DOE-ID NEPA CX DETERMINATION
Idaho National Laboratory**

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.

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: 08/31/2021