

# DOE-ID NEPA CX DETERMINATION

## Idaho National Laboratory

### SECTION A. Project Title: Thermophysical Properties of Molten Salts KAERI/INL CRADA

### SECTION B. Project Description and Purpose:

The Republic of Korea (ROK) Korea Atomic Energy Research Institute (KAERI) has active research programs in the utilization of civilian nuclear energy and nuclear fuel cycle. In this proposed collaboration, INL and KAERI will work together to further understand the thermophysical properties of molten salt systems of interest to molten salt reactor development.

The proposed study between INL and KAERI is five years in duration and is divided into four phases with an overall emphasis and priority on thermophysical properties of molten salts. All phases include a range of activities and each phase has an area of emphasis. Each phase has a planned duration of one to two years and implements a graded approach for determining thermophysical properties on molten salts. Thermophysical properties may include melt temperature, enthalpy, density, heat capacity, viscosity, and thermal diffusivity (conductivity). Phase A focuses on a simulant salt that is non-radioactive and includes a short study on a preliminary actinide-bearing salt. Properties of the non-radioactive salt will be determined on clean salt as well as salt containing surrogate fission products. Phase B focuses on making an actinide-bearing salt composition to be used in Phases B – D and making thermophysical property measurements on the actinide bearing salt both with and without fission product surrogates. Phase C has a specific focus on capsule irradiation in the Neutron Radiography Reactor (NRAD). Phase D has a specific focus on performing thermophysical property measurements on the irradiated salt from Phase C in the National Reactor Innovation Center (NRIC) Molten Salt Thermophysical Examination Capability (MSTEC). In total, Phase A – D will take 5 years to complete.

#### Phase A: Simulated Salt System

Task A1: Determine thermophysical properties on preliminary actinide-bearing salt. In Task A1, a salt specified will undergo thermophysical property measurements at Contractor operated facilities. The preliminary studies will provide information of what may be expected during studies on the Sponsor-specified salt system in Phase B.

Task A2: Properties determination of non-radioactive salt (no surrogate fission product). In Task A2, a non-radioactive salt system will be identified for investigation. At the facilities, a non-radioactive salt will be fabricated and ran through a series of thermophysical properties measurements in order to develop methods and develop baseline data and expectations.

Task A3: Properties determination of non-radioactive salt with surrogate fission products. Following upon the work of Task A2, additional non-radioactive salt will be fabricated with the addition of surrogate fission products. Thermophysical properties measurements will then be taken on this salt and compared with the data obtained on the non-irradiated salt from Task A2.

#### Phase B: Actinide-Bearing Salt System

Task B1: Fabricate actinide-bearing salt. In task B1, an actinide-bearing version of the salt used in Tasks A2 and A3 will be fabricated with and without surrogate fission products at a nuclear facility. Salt samples will be prepared and then readied for shipment to measurement locations.

Task B2: Properties determination of actinide bearing salt (no surrogate fission product). In series with Task B1, the actinide-bearing salt samples without surrogate fission products will undergo thermophysical properties measurements at facilities. Results will be compared to the Phase A data.

Task B3: Properties determination of actinide bearing salt with surrogate fission products. Following upon the work of Task B2, thermophysical properties measurements will be taken on the actinide-bearing salt containing surrogate fission products. The measurement data will be compared with the data obtained on the salt from Task B2.

#### Phase C: Capsule Irradiation in NRAD reactor

Task C1: Capsule irradiation of actinide-bearing salt. In Task C1 an irradiation test plan will be developed. Irradiation experiment hardware will be fabricated as needed based on a previously utilized design. Actinide-bearing salt without surrogate fission products from Phase B will be loaded in a capsule and installed in the experiment hardware. The experiment will then be inserted into the NRAD reactor for irradiation per the test plan.

#### Phase D: Property determination on irradiated salt

Task D1: Perform thermophysical property measurements on irradiated salt. Samples will be prepared, likely in the Hot Fuel Examination Facility, from the irradiated capsules. The samples will then be shipped to MSTEC at the Fuel Conditioning Facility for the initiation of thermophysical properties measurements on the irradiated salt samples.

Task D2: Continue thermophysical property measurements on irradiated salt. Task D2 will be a continuation of the work in Task D1. It will involve completion of the thermophysical properties measurements at MSTEC, all waste disposition activities, and final reporting.

The work will take place at Hot Fuels Examination Facility (HFEF), Fuels and Applied Science Building (FASB), Fuel Manufacturing Facility (FMF), Irradiated Materials Characterization Lab (IMCL) which are all at Materials and Fuels Complex (MFC), along with Engineering Development Laboratory (EDL), and ARL. The equipment that will be purchased will be minor hardware and crucibles.

The project will generate less than one cubic feet of Transuranic (TRU) waste. Small amounts of industrial waste along with low level waste from hot cell and glovebox work will also be generated. The project will generate less than one cubic feet of Transuranic (TRU) waste. Small amounts of industrial waste along with low level waste from hot cell and glovebox work will also be generated. No hazardous or radioactive mixed waste is anticipated to be generated.

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

# DOE-ID NEPA CX DETERMINATION

## Idaho National Laboratory

### Air Emissions

The samples prepared in HFEF from irradiated capsules will have minor air emissions. The minor amounts of air emissions produced from the sample preparation are consistent with the scope of work performed at HFEF.

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

N/A

### Disturbing Cultural or Biological Resources

N/A

### Generating and Managing Waste

Generation of waste includes less than one cubic foot of TRU waste. Low level waste from the hot cell and glovebox work will also be generated and disposed of properly according to WGS services. Additional standard industrial waste will be generated at a small scale.

### 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 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).

**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."

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,

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

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: 01/25/2022