DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-18-080

SECTION A. Project Title: Understanding Molten Salt Chemistry Relevant to Advanced Molten Salt Reactors through Complementary Synthesis, Spectroscopy, and Modeling – University of Tennessee

SECTION B. Project Description

The University of Tennessee, in collaboration with Oak Ridge National Laboratory (ORNL) and University of California Riverside, proposes to synthesize and purify UCl_3/UCl_4 in NaCl, LiCl, and $MgCl_2$; validate experimental methodology by comparing physical (e.g. viscosity, density, heat capacity) and spectroscopic (UV-vis) data with literature sources; apply x-ray absorption fine structure spectroscopy, analysis of the pair distribution function, and neutron diffraction to investigate the uranium coordination environment and its influence on NaCl, LiCl, and $MgCl_2$ structure; computationally investigate the structure, excited states, and chemical reactivity of UCl_3/UCl_4 in NaCl, LiCl, and $MgCl_2$ through molecular dynamics, time dependent density functional theory, and ab initio molecular dynamics studies; and synthesize, characterize, and simulate UCl_3/UCl_4 in $NaCl/MgCl_2$ and $LiCl/MgCl_2$ eutectic mixtures.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use – The proposed research will involve characterizing molten salts containing appreciable fractions (~30%) of depleted uranium (U-238). Work will be performed in a designated radiochemical lab and the sample size is anticipated to be less than 1 gram, including mass of the non-radioactive salt. Numerous administrative, engineering, and individual controls are implemented for handling and disposal of such radioactive samples, as are articulated in pertinent training courses, standard operating procedures, and radiological work permits at both locations where research will be performed.

Radioactive Waste Generation – Small quantities (grams) of low-activity radioactive waste will be generated, but as most experiments involve replicative characterization of the same material with different techniques, waste can be minimized. Radioactive waste will be disposed of in accordance with well-established protocols implemented at the institutions where the waste is generated.

Mixed Waste Generation – Small quantities of mixed radiological waste will be generated due to working with radiological samples. Disposal will follow well-established protocols implemented at the institutions where the mixed waste is generated.

Chemical Use/Storage – Chemicals (grams of high purity salts, milligrams of rare earth metals) will be used and stored in accordance with established protocols implemented at the institutions where the research is being performed.

Chemical Waste Disposal – Chemicals (grams of high purity salts, milligrams of rare earth metals) that have not been contacted with radiological material will be disposed of in appropriate waste streams in accordance with established protocols implemented at the institutions where the research is being performed.

Hazardous Waste Generation – Hazardous waste in this instance refers exclusively to the mixed and radiological wastes mentioned previously.

SECTION D. Determine the Level of Environmental Review (or Documentation) and Reference(s): Identify the applicable categorical exclusion from 10 CFR 1021, Appendix B, give the appropriate justification, and the approval date.

Note: 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, including requirements of DOE orders; 2) require siting and construction or major expansion of waste storage, disposal, recovery, or treatment facilities; 3) disturb hazardous substances, pollutants, contaminants, or CERCLA-excluded petroleum and natural gas products that pre-exist in the environment such that there would be uncontrolled or unpermitted releases; 4) adversely affect environmentally sensitive resources. In addition, no extraordinary circumstances related to the proposal exist which would affect the significance of the action, and the action is not "connected" nor "related" (40 CFR 1508.25(a)(1) and (2), respectively) to other actions with potentially or cumulatively significant impacts.

References: 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); and 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 or developed 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 development.

Justification: The activity consists of university-scale research aimed at understanding molten salt chemistry.

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

Approved by Jason Sturm, DOE-ID NEPA Compliance Officer on 08/06/2018