DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-18-091

SECTION A. Project Title: Advanced Fuels: First-principles Modeling, Simulation and Experimental Study of Actinide Nitrides and Mixed Zirconium Nitrides – University of Nevada Las Vegas

SECTION B. Project Description

The University of Nevada Las Vegas (UNLV), in collaboration with Sandia National Laboratory (SNL), proposes to enhance understanding of the mechanisms and thermal-mechanical-chemical (TMC) parameters controlling the instant release fraction (IRF) and matrix dissolution of high-burnup (HB; burnup > 45 GWd/MTU) spent nuclear fuels (SNFs) and the subsequent formation, stability, and phase transformations of HB SNF alteration products under long-term storage and geological disposal conditions (*e.g.*, high-temperature storage, α-radiolysis). The proposed project draws on complementary expertise and research backgrounds from University and National Labs partners to (1) apply a combined *ab initio* modeling (UNLV and SNL) and experimental (UNLV) strategy investigating the high-temperature TMC mechanisms of alteration of HB SNF under α-radiolysis conditions, including He generation and pressure effects; (2) investigate the mechanistics of phase transformations of used nuclear fuel (UNF) degradation products under various conditions expected in storage and disposal, including oxidative systems; and (3) determine high-accuracy TMC parameters (such as heat capacity, bulk modulus, and thermal expansion) that are easily influenced by microstructures and porosity of complex uranyl-based phases formed in storage or geological disposal environments.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use – The proposed bench-scale research projects will involve the use of radioactive materials. Radiological protection will be provided through the UNLV Radiation Safety Office (RSO), in compliance with UNLV RSO guidelines, in accordance with all state and federal regulations. Planned exposures will not exceed UNLV RSO guidelines.

Radioactive Waste Generation – The proposed bench-scale research projects will involve the generation of radioactive waste. All radioactive waste will be accumulated, documented, and managed in compliance with the UNLV RSO guidelines, in accordance with all state and federal regulations. Projected waste streams are expected to be less than 1 m^3 per year, consisting primarily of potentially contaminated gloves, paper towels, etc.

Chemical Use/Storage – The proposed bench-scale research projects will involve the storage and use of chemicals. All chemicals will be stored, labeled, and used in accordance with the Risk Management and Safety (RMS) guidelines from the University RMS department.

Chemical Waste Disposal – The proposed bench-scale research projects will involve the generation of chemicals wastes, which will be accumulated, documented, and managed in compliance with UNLV RMS guidelines. The projected chemical waste streams generated from these projects is expected to be less than 10 liters per year and is expected to consist of solvents (acid, base, and/or organic) with trace amounts of rare earths and heavy metals. There is also likely to be small volumes (less than 5 m^3, compacted) of potentially contaminated material, such as gloves, paper towels, sample containers, etc., that may need to be managed.

Hazardous Waste Generation – The proposed bench-scale research projects will involve the generation of hazardous waste, which will be accumulated, documented, and managed in compliance with UNLV RMS guidelines. Based on the current research activities, the projected hazardous waste streams generated from these projects is expected to be less than 2 liters per year, and is expected to consist of solvents (acid, base, and/or organic) with trace amounts of rare earths and heavy metals. There is also likely to be small volumes (less than 5 m^3, compacted) of potentially contaminated material, such as gloves, paper towels, sample containers, etc., that may need to be managed.

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 activities aimed at enhancing the mechanistic detail of process models to reduce uncertainty in, and improve the technical bases of, safety cases and performance assessment (PA) analyses used for the long-term storage and geological disposal of HB UNFs.

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 08/14/2018