DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-17-067

SECTION A. Project Title: NuSTEM: Nuclear Science, Technology and Education for Molten Salt Reactors – Texas A&M University

SECTION B. Project Description

Texas A&M University, in collaboration with the University of Wisconsin, proposes to further the utilization of nuclear power through molten salt reactor systems with their safety attributes and reduced transuranic waste. The objectives of this effort are:
1. To enable and develop the new technology needed for the advancement of molten salt reactors,
2. To develop the next generation of nuclear experts and inform and attract young people into science, technology engineering and mathematics.
The technical thrusts associated with the project objectives are:
Materials and Corrosion Science research aims at achieving following major goals: (1) to optimize material properties for both fuel salts and structural components; (2) to develop predictive models to describe material behaviors under various conditions (irradiation, stress, oxidation and corrosion); and (3) to develop a fundamental understanding of failure mechanisms. All these MCS research tasks are integrated and described below.
Sensor Developments research aims at development and demonstration of chemical and thermal sensors employing optical and electrochemical techniques. We plan to develop insitu optical spectroscopy, electrochemical methods, and combined optical-electrochemical methods to investigate chemical composition, salt acidity, temperature, and other chemical and physio-chemical properties of molten salts that are important for the operation of molten salt reactors, and the monitoring of long-term materials degradation. Manufacturing methods and materials will be explored for miniaturization of the probe for use in-reactor, and in-loop (ex-core). A sensor prototype will be built and tested.
Modeling, Multiphysics Simulation, and Uncertainty Quantification will deal with the modeling and computational challenges in MSRs assessment. Specific models will be developed for effective delayed neutrons fraction calculations; the impact of bubble formation in the slat will be investigated. Reduced-order models will be developed to allow for rapid design optimization.
Thermal hydraulic science will study pumps and compact heat exchangers for MSRs. An additional thrust will be the investigation of passive heat removal.
35cl(n,p) cross-section measurements will correct a deficiency in evaluated nuclear data files for the (n,p) reaction on Cl-35 in the fast spectrum range.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use – Some of the test salts will be produced containing depleted or natural uranium. No other radioactive isotopes will be used. Chemical surrogates will be used for fission product simulation (e.g., natural cesium will be used in place of cesium 137). The university and the Environmental Health and Safety (EHS) office oversee the lab practices and procedures. The Fuel Cycle and Materials Laboratory (FCML) and the Particle Accelerator Laboratory (PAL) are both permitted to handle radioactive material under the EHS jurisdiction.

Radioactive Waste Generation – Working with uranium will generate low level waste (gloves, wipes, etc.) as well as residual radioactive materials. All radioactive waste generated in this project will be disposed according to the EHS procedures at the university.

Mixed Waste Generation – Some chemical mixtures of salts (e.g., uranium and beryllium salt mixtures) and other compounds may contain hazardous and radioactive waste. Post-use separations will be performed, when possible, but some mixed waste will accumulate. On occasion, mixed waste may be generated when materials are treated with acids or mixed with hazardous chemicals. This waste will be handled according to the EHS procedures at the university.

Chemical Use/Storage – Chemicals will be used according to the EHS procedures at the university.

Chemical Waste Disposal – chemical waste will be disposed according the EHS procedures at the university.

Hazardous Waste Generation – Certain chemical procedures (such as acid etching) will involve the use of hazardous chemicals according to EHS procedures at the university.

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.

B3.10 Siting, construction, modification, operation, and decommissioning of particle accelerators, including electron beam accelerators, with primary beam energy less than approximately 100 million electron volts (MeV) and average beam power less than approximately 250 kilowatts (kW), and associated beamlines, storage rings, colliders, and detectors, for research and medical purposes (such as proton therapy), and isotope production, within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible), or internal modification of any accelerator facility regardless of energy, that does not increase primary beam energy or current. In cases where the beam energy exceeds 100MeV, the average beam power must be less than 250 kW, so as not to exceed an average current of 2.5 milliamperes (mA).

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

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 07/19/2017