DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-19-061

SECTION A. Project Title: Innovative In-situ Analysis and Quantification of Corrosion and Erosion of 316 Stainless Steel in Molten Chloride Salt Flow Loops – University of Wisconsin – Madison

SECTION B. Project Description

The University of Wisconsin - Madison (UWM), in collaboration with Oak Ridge National Laboratory (ORNL) and TerraPower LLC, proposes to investigate *in-situ* individual and synergistic effects of corrosion, irradiation, and mechanical stress on 316 stainless steel (SS) exposed to a molten chloride salt flow to predict component service lifetimes and design limits. The tasks associated with this project are (1) Production of radioisotopes in 316 SS tubes and coupons; (2) Procurement and use of a natural convection micro-loop platform (supplied by TerraPower) to test irradiated SS tubing samples using the Thin Layer Activation (TLA) technique under small flow conditions; (3) Performance of tests under larger salt flow rates (up to approximately 60 gallons/minute) to validate use of TLA applied to molten salts; (4) Study the effect of thermo-mechanical treatments and pre-irradiation on 316 SS erosion; (5) Post-irradiation characterization and analysis of tubes/coupons; and (6) Integration of the results into a 316 SS lifetime model. Existing cyclotron laboratory facilities at UWM will be used, while the natural convection micro-loop platform will be supplied by TerraPower, and tests under high-flow conditions will use existing equipment at ORNL.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use and Radioactive Waste Generation – Stainless steel ¼" tube sections (approximately 1 cm in height) will be irradiated by 16 MeV protons at the University of Wisconsin Medial Physics Cyclotron Laboratories. Limited resulting activation is expected. The irradiated piece will be installed by trained personnel wearing dosimetry and following strict procedures previously approved by the Environmental Health Safety (EHS) offices at UWM. The micro-loop will be installed in a dedicated laboratory with strict and secured access. The micro-loop can be operated behind a thick lead shield such that no personnel exposure is expected during operations. Finally, the used salt will be dumped into a specific canister and safely stored until the activity of the isotopes decays to non-hazardous levels (approximately 1 to 1.5 years). Similarly, a gamma survey of the micro-loop after corrosion tests will be performed to assess the health hazards associated with post corrosion test micro-loop operations.

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 activities to study the effects of radiation damage on advanced reactor fuel microstructure.

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 08/26/2019