

# DOE-ID NEPA CX DETERMINATION

## SECTION A. Project Title: Ni-based ODS Alloys for Molten Salt Reactors – North Carolina State University

## SECTION B. Project Description

North Carolina State University (NC State), in collaboration with the University of California-Berkeley (UC-Berkeley), the University of Idaho (U of I), Idaho National Laboratory (INL), and the University of Oxford (Oxford), proposes to study the mechanical properties of oxide dispersion strengthened (ODS) nickel (Ni) alloys. Based on the chemistry of molten salt reactors (MSRs), reactor vessel materials need to be corrosion resistant as well as irradiation resistant and have desirable mechanical properties at high operating temperatures. The tasks associated with this project are: 1) Design and manufacture of Ni-based ODS alloy and processing of batches; 2) Microstructural characterization; 3) Mechanical properties characterizations and deformation mechanisms; 4) Irradiation response of the materials; 5) Electrochemistry measurements for corrosion rate and corrosion mechanism; and 6) Report all findings to DOE in report and publishing of results. NC State has advanced analytical electron microscopy facilities for pre and post characterization experiments. UC-Berkeley has the processing capability to make the alloys of interest with the desired microstructures and the mechanical testing labs to measure the mechanical properties of interest at the temperatures of interest. U of I and INL have the equipment and computation platform tools for molten salts handling and electrochemistry for corrosion. Oxford will make available irradiation, mechanical testing and APT facilities. Equipment will be fabricated for testing of modelled scenarios and used in existing laboratory facilities.

## SECTION C. Environmental Aspects / Potential Sources of Impact

Chemical Use/Storage and Chemical Waste Disposal – Chemicals used will be eutectic alkaline metal fluoride salt mixture LiF-NaF-KF (46.5-11.5-42 mol %) less than 1.5 kg. Perchloric acid mixed with methanol may be used for electropolishing of the alloy for sample preparation, less than 1 L of the acid is stored and usage and disposal of the chemical will be handled according to EHS regulations of the institution. The chemical waste will be from eutectic alkaline metal fluoride salt mixture LiF-NaF-KF (46.5-11.5-42 mol %) and the ESH protocols will be followed to properly dispose of it. From the powder metallurgy, waste is not expected to be generated as the powders are consolidated into the actual alloy to be characterized.

## 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 research activities to investigate the chemical and radiological resistance of Ni-ODS alloys for MSR applications.

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 09/16/2019