

SECTION A. Project Title: In Situ Raman Spectroscopy for Determining Actinide Speciation and Concentration – Rensselaer Polytechnic Institute

SECTION B. Project Description

Rensselaer Polytechnic Institute proposes an innovative program to develop oxidation/corrosion resistant uranium silicide U_3Si_2 fuels by chemical doping/fillers to form a continuous borosilicate glass as a protective oxide layer with transformational fuel performance and accident tolerance. The chemical doping/fillers include boron or carbon showing effectiveness in improving high temperature oxidation resistance in transition metal silicides, and boron/silicon-containing compounds that can form a protective borosilicate glass layer. The project will also explore a truly transformational concept of using pre-formed borosilicate glass as sintering additives to promote fuel sinterability through liquid phase sintering and form a protective layer to enhance high temperature oxidation and corrosion resistance of uranium silicide fuels.

The key components of the research program include: (1) design of oxidation/corrosion resistant silicide fuels and materials synthesis; and (2) evaluation of high temperature oxidation and corrosion properties.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use/Radioactive Waste Generation – The lab is approved the RPI's Radiation Safety Office (RSO) for storage and use of radioisotopes (including UO_2 , UB_2 , and U_3Si_2). Experiments to be conducted during the project will involve handling uranium silicide powders including weighing and milling in a specifically designated glove-box and consolidation in a confined apparatus into dense ceramic pellets for characterization by spark plasma sintering. The quantities of processing and sintering depleted silicide pellets will be at the level of 1 gram. Samples will be stored in a carbon steel cabinet dedicated to this purpose and disposed following the guidance of the RPI RSO. There will be no radioactive waste stream from the lab. The procedures in handling, processing, and sintering uranium-contained dense ceramic pellets have been established and approved by the RPI RSO.

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 investigating oxidation/corrosion resistant uranium silicide fuels.

Approved by Jack Depperschmidt, DOE-ID NEPA Compliance Officer on 08/24/2016