

DOE-ID NEPA CX DETERMINATION

SECTION A. Project Title: Development of a Mechanistic Hydride Behavior Model for Spent Fuel Cladding Storage and Transportation – Pennsylvania State University

SECTION B. Project Description

Pennsylvania State University proposes to develop the capability to model the hydride behavior and its impact on cladding ductility for BISON and FRAPCON by following the microstructure based modeling approach taken by the NEAMS program. The principle task will be to correctly describe the development of hydride microstructure. The final macroscale models will undergo rigorous validation against existing data as well as new data collected as part of this project. Experiments include using heated cladding tubes that are precharged with hydrogen and placed in swirling water to create a temperature gradient. This gradient will induce a gradient in the hydrogen distribution within the cladding tube, which will be characterized after the experiment. The hydride precipitation and dissolution models in BISON and in MARMOT will be validated against existing data and new data collected in this project. The precipitation and dissolution temperatures predicted by MARMOT will be validated against data collected using high-energy synchrotron radiation diffraction, with a focus on determining the impact of texture and alloying elements. The hydride microstructure predicted by MARMOT will be validated against microstructures characterized from samples with various textures exposed to temperature cycling and different applied stresses.

SECTION C. Environmental Aspects / Potential Sources of Impact

Pennsylvania State University has procedures in place to handle any waste that will be generated through this project. The action would not create additional environmental impacts above those already permitted 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.

Justification: The activity consists of university-scale research aimed at investigating hydride behavior and its impact on fuel cladding ductility.

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 06/29/2017