

DOE-ID NEPA CX DETERMINATION

SECTION A. Project Title: Statistical modeling of the effect of microstructural heterogeneity on the irradiation behavior of TRISO fuel buffer layer

SECTION B. Project Description

The University of Wisconsin-Madison (UW) proposes to conduct multiscale modeling and experiments in order to achieve a mechanistic understanding of and develop a predictive model for the stochastic tearing behavior in the tristructural isotropic (TRISO) fuel particle buffer layer. Buffer samples from representative Advanced Gas Reactor (AGR)-1 and AGR-2 particles will be used in the proposed experiments. A surrogate particle, ZrX05-26T, will be used to mitigate the challenge of dealing with radioactive materials. All particles have been fabricated in the Coated Particle Fuel Development Laboratory at Oak Ridge National Laboratory (ORNL). Method development for all characterization and property evaluation will be established using surrogate particles at UW. Once established, exploration of fresh AGR-1 and AGR-2 particles will be performed with the uranium-bearing kernel removed. The samples will then be characterized and statistical modeling will be developed.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use: In this project both surrogate and AGR-1 & 2 fuel particles will be used. The surrogate fuel particles have no uranium (U) bearing materials and are thereby non-radioactive. The U-bearing kernels of AGR-1 & 2 particles will be removed at ORNL before being used in the proposed experiments. To ensure safety handling of all materials, they are regarded as radioactive in case of residual U-bearing materials. To minimize the transport and spreading of potential radioactive materials, surrogate fuel particles will be tested. The samples will then be sent to ORNL and carry out the testing of AGR-1 & 2 particles with no U-bearing kernels at ORNL. ORNL collaborators work frequently in the Low Activation Materials Design and Analysis Laboratory (LAMDA) at ORNL. The LAMDA laboratory houses a suite of modern materials characterization and testing systems which can accommodate radiological materials such as fueled TRISO particles. The LAMDA facility has numerous radiological controls in place to support nuclear materials analysis.

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 activities to prepare and characterize samples TRISO fuel particles to model tearing behavior.

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 8/10/2020