

# DOE-ID NEPA CX DETERMINATION

**SECTION A. Project Title: Fuel-to-Coolant Thermomechanical Behaviors Under Transient Conditions – University of Tennessee**

**SECTION B. Project Description**

The University of Tennessee (UT) proposes to enhance the prediction of thermo-mechanical fuel-to-coolant (F2C) heat transfer under transient conditions by using a coupled analysis and experiment approach. UT's effort is relevant to both high-burnup (> 62GWd/t) fuel applications and Accident Tolerant Fuel. The primary objectives of the proposal are to: 1) Enhance the mechanistic transient and radiation models for critical heat flux in safety analysis (TRACE and RELAP); and 2) Improve the mechanistic modeling of F2C heat transport by coupling thermo-mechanical analysis (BISON) to thermal hydraulic analysis (TRACE and RELAP5-3D). The researchers will develop, validate, and demonstrate a novel coupling of thermo-mechanical and thermal hydraulic tools that will result in much more accurate prediction of F2C heat transfer during Anticipated Operational Occurrences (AOOs) and Design Basis Accidents (DBAs). UT will also enhance the modeling of critical heat flux (CHF) in these tools by modifying the models to mechanistically account for transient, radiation induced activation effects, and material impacts. The scope of work has been sub-divided into six primary tasks: (1) integration of the transient, material, and radiation induced effects into CHF models; (2) validation of CHF models using separate effects test data from Oregon State University and integral effects test data from INL; (3) coupling of thermomechanical and hydrodynamic models; (4) sensitivity/gap analysis to support programmatic goals; (5) demonstration of coupled calculation for selected AOO, CRW and selected DBA, RIA (reactivity-initiated accident); and (6) final report.

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

The 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 occurring 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). For purposes of this category, "demonstration actions" means actions that are undertaken at a scale to show whether a technology would be viable on a larger scale and suitable for commercial deployment. Demonstration actions frequently follow research and development and pilot projects that are directed at establishing proof of concept.

Justification: The activity consists of an investigation to achieve mechanistic enhancement of modeling capabilities for F2C heat transfer for AOO and DBA scenarios.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act)  Yes  No

Approved by Jason Anderson, DOE-ID NEPA Compliance Officer, on 09/17/2021.