

SECTION A. Project Title: Evaluation of Accident Tolerant Fuels Surface Characteristics in Critical Heat Flux Performance – Virginia Commonwealth University**SECTION B. Project Description**

The Virginia Commonwealth University proposes to perform separate-effects tests of several of the ATF concepts under consideration to investigate the impact of cladding surface characteristics in CHF under normal and anticipated off-normal conditions. This proposal plans to complement these separate-effect experiments with the design of system-wide experiments. The experimental results will be used to develop enhanced models or correlations for the prediction of CHF that will be implemented in the various subchannel analysis codes currently licensed for core thermal-hydraulics analysis (VIPRE, LYNXT, FRACG, COBRA) as appropriate. Project objectives include:

1. Characterize the cladding surfaces of the ATF concepts under study (porosity, roughness, contact angle and wetting characteristics, etc.) using advanced materials examination techniques such as scanning electron microscopy (SEM), focused ion beam (FIB), atomic force microscopy, X-ray diffraction, etc.
2. Conduct a series of CHF experiments, at low and high pressure, with advanced temperature and fluid measurement instrumentation (optical fibers, ultrasonic Doppler imaging, PIV, high speed camera, magnetic flow sensors and hot wires) to obtain high fidelity qualitative and quantitative measurements for the thermal-hydraulic behavior of the ATF cladding under evaluation.
3. Design a series of high fidelity full-scale system experiments of the considered ATF concepts as independent data for the verification and validation of the new CHF models, making use of an advanced instrument assembly custom designed to investigate two phase flow at system-scale.

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 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 accident tolerant fuels surface characteristics in critical heat flux performance.

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 07/10/2017