

SECTION A. Project Title: Experiments and Computations to Address the Safety Case of Heat Pipe Failures in Special Purpose Reactors – University of Michigan

SECTION B. Project Description

The University of Michigan (UM), in collaboration with Idaho National Laboratory (INL), proposes to study the thermo-mechanical stresses on the core structure of a heat pipe micro-reactor following failure of multiple heat pipes. This project explores the application of heat pipe technology to very small modular reactors (vSMRs). Liquid metal (typically sodium [Na], potassium [K], or NaK) heat pipes can operate at very high temperatures and are fully passive heat removal devices. The tasks associated with this project are: 1) Scaling study and pre-test simulations for the design of the experimental facility – using INL software; 2) Construction of the experimental facility – at UM; 3) Definition and execution of experimental campaign – conduct separate effects tests (sonic, vapor pressure, entrainment and boiling limits) to validate and adjust the software models; 4) Validation (and further improvement) of the code suite; and 5) Development of a set of recommendations for heat pipe micro-reactors safety case. Experimental equipment will be constructed at UM and existing laboratory facilities will be used.

SECTION C. Environmental Aspects / Potential Sources of Impact

Industrial Waste Generation – The total amount of aluminum oxide to be used in the facility could be estimated at 125 kg. It will be partially in powder and partially in sheet form. This material will be permanently used as part of the experimental facility (insulation). Waste associated with aluminum oxide will be created only during facility assembly (scrap after cutting). Associated waste will be disposed of through the University of Michigan's Environment, Health and Safety office.

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 research activities to investigate the thermo-mechanical stresses on the core structure of a heat pipe micro-reactor following failure of multiple heat pipes.

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 09/16/2019