DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-20-052

SECTION A. Project Title: Highly Compact Steam Generators for Improved Economics of Small Modular Reactors – Massachusetts Institute of Technology

SECTION B. Project Description

The Massachusetts Institute of Technology (MIT) proposes to design and build a compact steam generator test section that can be easily modified for different flow paths and geometries. It will be placed into a modified existing loop. The test section will allow the determination of the flow regime via high speed video, the heat transfer coefficient measurement via thermocouples and infrared thermography, as well as traditional measurements of flow rate, temperature, and pressure. Various flows, temperatures, and pressures will be tested to make up the experimental matrix as well as investigating performance problems and solutions. The results of the experiments will be used to develop flow regime maps and associated heat transfer coefficient models to inform modeling efforts and computational fluid dynamics (CFD). The resulting models will be used to develop concepts for compact steam generator (CSG) systems that could be deployed in small modular reactors (SMRs). The working fluid for the phase change in the heat exchanger will be a refrigerant such as R-134a to keep the pressure and temperature manageable. The hot channels will use water.

SECTION C. Environmental Aspects / Potential Sources of Impact

Chemical Use/Storage / Chemical Waste Disposal – A refrigerant such as R134a is planned to be used for the flow loop as the working fluid, which will need to be recovered and disposed of due to the global warming potential of the fluid. One 30 lb cylinder is expected to last for the entire experiment, and the MIT Environmental Health and Safety Office has mechanisms in place for handling and disposing of chemicals. The PI also holds an EPA 608 universal certification and an EPA 609 certification for refrigerant handling.

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 an investigation into compact cooling loops for small modular reactors.

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 8/3/2020