

SECTION A. Project Title: Direct heating of chemical catalysts for hydrogen and fertilizer production using microreactors – Kansas State University**SECTION B. Project Description**

Kansas State University (KSU) proposes to develop a novel, integration approach to deliver process heat from microreactors by directly heating the catalyst particles in a moving packed bed heat exchanger (MPBHX). In this design, the tube side of the MPBHX can be a heat pipe or secondary molten salt coolant as in several microreactor concepts. Whereas the final heat dispatch carriers will be moving catalyst particles in form of granular flows which upon heating will enter the chemical reactor for enabling the high temperature chemical reaction of interest. The proposed work will involve the design integration of this MPBHX with microreactors along with its safety and economic assessment. This design will be compared to the alternative or conventional methods to dispatch high temperature process heat from nuclear thermal systems. The microreactors are uniquely suited for remote deployment to provide thermal or electrical energy needs. The proposed project will explore the technical and economic feasibility of these microreactors integrated with chemical processes for agricultural applications such as hydrogen to operate combines and other farm equipment, and ammonia for use as a fertilizer. To achieve the proposed objectives, work scope will be divided into five tasks: Task 1 involving compatibility studies between microreactors and process heat end use; Task 2 will be design, validation and economic evaluation of the integration of MPBHXs with microreactors- with an end goal of defining MPBHX demonstration plan with MAGNET; Task 3 will involve comparison with alternative molten salt based integration to deliver process heat; Tasks 4 and 5 will involve assessing microreactor/MPBHX end use for hydrogen generation potential and sustainable agriculture.

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 improve the end-use integration of microreactors via the examination of the secondary or tertiary heat transport medium to be solid particulates or granulated media.

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 08/31/2021.