

DOE-ID NEPA CX DETERMINATION

SECTION A. Project Title: High-Resolution Measurements and Advanced Modeling for Design and Optimization of Advanced Small Modular Reactor Steam Generators – Texas A&M University

SECTION B. Project Description

Texas A&M University proposes to establish a highly coordinated, high-fidelity turbulence experimental and computational effort to deepen the physical understanding and address critical issues related to flow-induced vibrations (FIVs) occurring in Small Modular Reactor (SMR) Helical Coil Steam Generators (HCSG). The proposal will have a direct impact into industry practices as it will use current industry designs and can be further expanded to allow parametric and sensitivity studies that will ultimately support the design and optimization of SMR HCSGs and other reactor types using heat exchangers/SGs. The proposal will also leverage, while expanding greatly in capability, existing facilities, making optimal use of federal investments. The proposed project includes a coordinated experimental and computational effort to achieve the following goals: (a) High-fidelity single/two-phase measurements & simulations for multi-parameters: pressure drops, heat and mass transfers, FIV effects for various SG designs to support the extension of operation life for compact, high efficiency heat exchangers (HXs)/SGs, and SG design optimization to reduce FIV; and (b) A unique set of databases and advanced numerical models allowing the determination, verification and validation of new correlations of flow and heat transfer, and the optimization of SMR HCSG designs. The objective of the proposed work is to acquire targeted experimental measurements and high-fidelity numerical simulations coupled structural mechanics with single- and two-phase fluid flow and heat transfer in SMR HCSGs, and then use the extensive database to derive numerical models, correlations, and reduced order models (ROMs) needed for the advanced simulation tools (Nek5000, StarCCM+, Abaqus, Diablo) to accurately predict FIV effects of various SMR HCSG designs.

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 develop advanced correlations and ROMs, acquired for SMR HCSG current designs and further expanded configurations, to support the extension of operation life for compact, high efficiency HXs/SGs, and SG design optimization to reduce FIV.

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.