

DOE-ID NEPA CX DETERMINATION

SECTION A. Project Title: Experimental Investigations of HTGR Fission Product Transport in Separate-effect Test Facilities Under Prototypical Conditions for Depressurization and Water-ingress Accidents – Texas A&M University

SECTION B. Project Description

Texas A&M University proposes to establish a highly coordinated experimental and computational effort to deepen the physical understanding and address long-standing modeling inaccuracies related to fission product (FP) source terms and transport in a High Temperature Gas-cooled Reactor (HTGR). The proposal will have a direct impact into industry modeling practices, as it will use metal and graphite components and adapt current designs of industry partners. The researchers propose a coordinated experimental and computational effort to investigate and characterize the following: 1) Quantities of FPs being washed-off, lifted-off, and vaporized from plateout surfaces for a wide spectrum of reactor depressurization and water-ingress accidents. Moreover, effects of primary coolant gas impurities (CO, CO₂, water vapor and water) during blowdown tests will be investigated; and 2) Transport of liquid and solid aerosol FPs in the primary coolant system at prototypical conditions. A broad spectrum of gas impurities (water vapor, CO, and CO₂), flow regimes (laminar to turbulence), and temperature effects (non-uniform distribution, temperature gradient) will be considered. The proposed specific tasks are: 1) Experimentally investigate the multi-physics, multi-species, flow and heat transfer among the coolant flow, FPs (gas, solid/liquid aerosols) and solid interfaces of reactor components; 2) Perform Large Eddy Simulations (LES) coupling with Lagrangian particle tracking and molecular dynamics (StarCCM+, COMSOL) using conditions from experimental facilities in Task 1; 3) Implement FP models from PADLOC-POLO and DAMD codes into MELCOR, perform calculations for experimental facilities in Task 1, and compare against experimental and computational fluid dynamics (CFD) results and 4) Derive advanced numerical models and correlations needed for FPs using the high-fidelity CFD results.

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 understand the physics of plateout, liftoff and washoff of FPs consisting of gases and particulates emanating from surface as dust, and to characterize the transport and inventory of FPs in HTGRs under normal operating and accident conditions.

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 09/10/2021.