DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-21-097

SECTION A. Project Title: Fusion of Distributed Fiber Optics, Acoustic NDE, and Physics Based AI for Spent Fuel Monitoring – University of Pittsburgh

SECTION B. Project Description

The University of Pittsburgh proposes to leverage the fusion between fiber optic (FO) distributed acoustic sensing and acoustic nondestructive evaluation (NDE) with AI- classification frameworks to quantitatively characterize internal state of dry cask storage systems (DCSS) external to the canister, without introducing additional risks. Distributed temperature and acoustic FO sensing will be combined with acoustic NDE using piezoelectric transducers to access maximum information about operational condition of DCSS systems without penetrating canister walls. Physics-based simulations and reduced order modeling will be coupled with experiments using model facilities to train and apply AI-classification frameworks for efficient, accurate interpretation of acoustic and temperature sensing data. The objective will be to develop novel NDE-based characterization tools capable of providing robust information about operational state of health and risk profile for DCSS, including information about gas composition, pressure, canister integrity, leakage, and temperature. The overall technical approach includes: (1) Distributed Fiber Optic Sensor Technology, (2) Advanced Acoustic NDE Methods, (3) Physics-Based Modeling and AI Framework of Acoustic Signatures, and (4) Laboratory and Field Validations.

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 a method for efficacious NDE monitoring of DCSS by employing external distributed fiber optic sensing (DFOS) and piezoelectric sensors while requiring no penetration or opening of the canister.

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.