

SECTION A. Project Title: Non-destructive Evaluation of Dry Storage Canisters Using Acoustic Sensing – University of Southern California**SECTION B. Project Description**

The University of Southern California proposes to develop a robust non-destructive evaluation (NDE) technique based on acoustic sensing to detect impurity gases in a sealed (welded) dry storage canister (DSC) using only measurements collected on the external surface of the DSC. The method is based on time-of-flight analysis of acoustic signals propagating through the fill gas of a DSC, which is influenced by the composition, density, and temperature of the propagation medium. In this effort, USC will focus on the following: (1) Developing an active noise cancellation technique to eliminate the signal coupled into the canister wall by the transducers mounted on the same surface. The cancellation of this signal will enable a detection of the signal propagating through the fill gas with a low noise-to-signal ratio and allow for monitoring of the gas impurity. (2) Evaluate and calibrate the developed NDE approach under various spatial distributions of temperature within the DCS, different compositions and concentrations of the impurity gases, and potential obstructions from the different geometries of the upper tie structure of pressurized water reactor (PWR) and boiling water reactor (BWR) fuel assemblies. (3) Develop high fidelity computational models that represent the true physics of the wave propagation phenomenon to inform the development of the noise cancellation approach, as well as to study configurations that are beyond those that can be practically achieved in a lab environment. The following tasks are proposed: (1) Development of a noise cancellation technique; (2) Development of computational models; and (3) Experimental characterization and validation of the acoustic sensing technique.

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 computationally informed NDE technique for assessment of the gas composition in the cavity of a DSC.

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.