

**SECTION A. Project Title: Internal Wireless Sensors for Dry Cask Storage – University of South Carolina****SECTION B. Project Description**

The University of South Carolina proposes to test the reliability of wireless, internal canister sensors used to monitor canister temperature and pressure. The sensors will be exposed to typical canister drying and long-term storage conditions to assess their performance. Radiation shielding will also be designed to protect the sensors from the radiation environment experienced during long-term dry storage. The effort will also develop the use of piezoelectric techniques for miniaturization of a plasma source for optical emission spectroscopy (OES) for use in monitoring canister gas composition during drying, closure, and long-term storage. Monitoring for water vapor provides useful data on effectiveness of the drying operation while in progress. Monitoring for Xe and Kr would be useful to provide indication of failed fuel during drying and during long-term storage. Following drying, radiolysis of any residual water (physisorbed or chemisorbed) in the canister will contribute to the buildup of hydrogen which presents issues for any future ability to retrieve fuel from the canister which is a requirement. This proposed work represents a combination of more fundamental engineering for sensor development and testing of more mature industry-led technologies that need confirmation of reliability and performance in typical canister drying operations and long-term storage environment. The major tasks associated with this effort include: 1) Finalize design of mock fuel assembly and hardware for configuration of Westinghouse Electric Corporation (WEC) sensors and instruments and the micro-sized OES; 2) Fabricate sensors, instruments, and special hardware; 3) Design shielding to increase reliability of WEC sensors exposed to canister radiation environment; 4) Test WEC sensors for performance and reliability through drying processes (forced helium dehydration (FHD) and vacuum); 5) Long-term storage tests and accelerated storage tests; 6) MicroOES initial benchtop demonstration and calibration; 7) MicroOES demonstrate operation in typical conditions through drying processes (FHD and vacuum) and dry canister storage; and 8) Evaluation of internal power source and wireless data transmission for microOES integration into dry cask storage system.

**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 sensors capable of measuring temperature, pressure, water, and gas composition located inside the canister that send signals through the canister wall to equipment located external to 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.