

SECTION A. Project Title: Redox Chemistry in Nuclear Materials Storage Matrices Under Ambient and Accelerated Aging Conditions– University of Washington**SECTION B. Project Description**

The University of Washington (UW) proposes to develop a non-destructive and extremely high-throughput method for characterizing the redox chemistry of deep geologic repositories (DGR)-relevant cements. The researchers will also apply this method to link redox chemistry to the causes and consequences of mineralogical transformations that occur from initial curing through cement aging and degradation either by natural or accelerated aging protocols likely to stimulate failure modes. The development of these methods will critically inform hypotheses for long-term mineral chemistry, structural integrity, and radionuclide fate and transport for DGR cementitious barriers. To this end, the researchers have identified five specific research objectives: 1) Develop a high-throughput instrument for determining metal oxidation state speciation in cements via x-ray emission spectroscopy (XES) in a laboratory setting; 2) Develop a new analytical procedure for redox characterization of DGR-relevant cements and its relationship to concrete mineralogy and changes thereof; 3) Evaluate accelerated aging modalities and their effect on redox chemistry in DGR-relevant cements; 4) Evaluate the interplay between steel inclusions and the naturally redox chemistry in DGR-relevant cements; and 5) Compile a test bank of DGR-relevant cements to support longitudinal study of their degradation in this and future research.

SECTION C. Environmental Aspects / Potential Sources of Impact

Cements and additives (metals and metal oxides, etc.) will be used to make the ‘doped’ concrete samples. Both project sites (UW and PNNL) are well equipped with chemical storage facilities. Both project sites have standard safety protocols for the development of experimental plans that include the determination of PPE requirements, of storage requirements, and of disposal requirements. Typical quantities are modest, with <50kg of concretes to be made over the lifetime of the award, using perhaps 500g of total chemical additives.

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 comprehensive understanding of how the redox chemistry of DGR-relevant cementitious materials evolve over time.

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.