DOE-ID NEPA CX DETERMINATION

CX Posting No.: DOE-ID-13-023

SECTION A. Project Title: Development of a Nano-modified Concrete for Next Generation of Storage Systems – Vanderbilt University

SECTION B. Project Description

The goal of Vanderbilt University is to develop superior concrete for the long-term storage of used nuclear fuel by engineering concrete at the nanoscale through the incorporation of nano-sized and nano-structured particles based on enhanced reactivity. Tasks will include sample preparation, gamma irradiation at the ATR NSUF, exposure to thermal loadings and gradients, exposure to environmental weathering, and chemical and microstructural characterization.

SECTION C. Environmental Aspects / Potential Sources of Impact

Radioactive Material Use – Concrete samples will be exposed to gamma radiation at the ATR NSUF using a gamma irradiator. The irradiated samples (which are non-radioactive once removed from the irradiator) will then be subjected to further analysis. The tested specimens (non-radioactive) will be disposed as appropriate using standard procedures through the Vanderbilt Environmental Health and Safety.

Chemical Use/Storage – Storage and use of chemicals during the project performance will be done following procedures in place in accordance with Vanderbilt Environmental Health and Safety. Chemicals of concern include nanoparticles (Nano-SiO_2, nano-$CaCO_3$, nano-Fe_2O_3, nano-Al_2O_3, and nanoclay), cement, aggregates, high range water reducers, silica fume, sodium chloride, sodium sulfate, magnesium chloride, and phenolphthalein.

Chemical Waste Disposal – Disposal of all chemical wastes generated during the project will be done through the Vanderbilt Environmental Health and Safety. It is expected that up to 100 L of liquid wastes and up to 200 kg of solid wastes will be generated during the course of the project. Chemical wastes of concern include concrete specimens containing nanoparticles, leachate solutions from concrete specimens of sodium chloride, sodium sulfate, and magnesium chloride.

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: B3.15 Siting, construction, modification, operation, and decommissioning of facilities for indoor small-scale research and development projects and small-scale pilot projects using nanoscale materials in accordance with applicable requirements (such as engineering, worker safety, procedural, and administrative regulations) necessary to ensure the containment of any hazardous materials. Construction and modification would be within or contiguous to a previously disturbed or developed area (where active utilities and currently used roads are readily accessible).

Justification: The activity consists of evaluating nano-modified concrete performance for research purposes.

Is the project funded by the American Recovery and Reinvestment Act of 2009 (Recovery Act) ☐ Yes ☒ No

Approved by Jack Depperschmidt, DOE-ID NEPA Compliance Officer on 10/31/2013