

DOE-ID NEPA CX DETERMINATION

SECTION A. Project Title: Effects of Radiolysis on Pertechnetate under Solvent Extraction Conditions, including Tri-Butyl Phosphate – City University of New York

SECTION B. Project Description

The City University of New York (CUNY) proposes to investigate effects of radiolysis on pertechnetate (TcO_4^-) speciation during tributyl phosphate (TBP) extractions from the molecular level to the macroscale. This work will address outstanding fundamental knowledge gaps regarding redox and extraction behavior of Tc in the HNO_3 /TBP/dodecane system. While studies have shown that Tc can change oxidation state upon irradiation, it is unclear if these changes are the result of the generation of TBP degradation products, changes in metal oxidation states due to radiolysis effects, or some combination of each. In this project CUNY will develop an understanding of the Tc oxidation state changes and the potential to bind to TBP (or phosphate degradation products) as a function of oxidation state. This will provide information on, and guidelines for, tailoring solvent extraction processes for efficient extraction of Tc. The specific research objectives are thus designed to evaluate the impact of 1) radiolysis, 2) degradation product formation 3) presence of other redox active metals like Cerium (Ce), Uranium (U) and Zirconium (Zr), and 4) oxidation states of Tc on the speciation of Tc and its distribution coefficients in solvent extraction processes. These objectives will be achieved through a combination of experimental and computational studies. The proposed work will be separated into four tasks: 1) solvent extractions with TcO_4^- and a TBP degradation simulant, 2) an irradiation “surrogate” that mimics radiolysis under reprocessing conditions, 3) gamma irradiation under reprocessing conditions using the ^{60}Co irradiator in the Brookhaven Accelerator Center for Energy Research (ACER) facility, and 4) computations that will provide an evaluation of stable Tc phosphate species. By comparing the simulant to the irradiated samples, the impact of radiolysis induced radicals will be assessed.

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 understand the interplay between radiolysis, TBP degradation product formation, and oxidation states of Tc on Tc extraction in PUREX processes.

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 08/31/2021.