P.8 In-Situ Chelation and Removal of Subsurface Metals

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Abstract

Metals and radionuclides are a problem at many former nuclear weapons facilities. In-situ technologies are not well-developed for metal contamination currently, often necessitating excavation and groundwater pumping. Pump-and-treat processes are slow, even for organic contamination, due to sorption of the contaminants to soil particles.

We plan to develop a process for in-situ cleanup of metals and radionuclides in soils and groundwater. The process involves in-situ chelation of metals and radionuclides via recirculation of groundwater, destruction of chelating agent by passive chemical reduction in the well, or by reduction with the addition of ultrasonic energy, and reduction of metallic contaminants to metallic form for removal in small and potentially non-hazardous volumes from the subsurface.

The project length is three years, corresponding with three phases. Laboratory bench and full-scale pilot tests are proposed. In Phase I, Applied Research, laboratory column studies will be conducted to demonstrate the passive reduction of chelating agent and metal contaminants. If necessary, ultrasonic energy will be added to increase the efficiency of reductive decomposition of the chelating agent. Chemical byproducts will be positively identified using chromatographic and other techniques. In Phase II, bench pilot tests will be conducted to determine the efficiency of removal of nickel, cadmium, lead, strontium, mercury, arsenic, vanadium, and cesium, at different EDTA concentrations, dissolved oxygen levels, recirculation cycle lengths, with and without addition of ultrasonic energy, and identify chemical byproducts of the proposed process. Phase II will be conducted in cooperation with potential DOE end users. In Phase III, full scale laboratory pilot tests will be conducted to determine flow rates, hydraulics, process control parameters for different soil types, radius of influence, and the relationship between geological characteristics and process efficiency. Phase III will be conducted in cooperation with committed DOE end users. Environmental benefits and costs, clean up costs, and life cycle costs for cleanup of sites, with emphasis on sites identified by DOE end users, will be developed. Costs for simultaneous cleanup of organics in mixtures with metals and radionuclides will also be estimated. Plans for field subsequent demonstration will be developed.