Field Investigations of Lactate-Stimulated Bioreduction of Cr(VI) to Cr(III) at Hanford 100H

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DOE faces challenging problems in cleaning up 18 major facilities, including those with sites contaminated with hexavalent chromium [Cr(VI)] associated with the production of weapons-grade nuclear materials, plating and boiler operations, and equipment repair and fabrication. Cr(VI), which is a strong carcinogen, is highly mobile, whereas trivalent Cr(III) is less hazardous and practically immobile under reduced conditions. Cr(VI), which is widely distributed at one of the most contaminated DOE sites, Hanford, is migrating to the Columbia River. One of the most promising new remediation technologies for chromium-contaminated groundwater is in situ bioreduction. The proposed field project is a direct extension of a NABIR project that received 3 years of support and demonstrated the biogeochemical transport effects of carbon on stimulation of bioreduction of chromium in soil cores, and supports the SCFA Technical Targets, "Metals and radionuclide source zone stabilization and treatment," and "Biogeochemical processes that determine contaminant fate."

The overall objective of the proposed project is to carry out field investigations to demonstrate the feasibility of a cost-effective, in situ remediation technology, using lactate-stimulated bioreduction of dissolved Cr(VI) to form an insoluble mineral precipitation of Cr(III) at the Hanford 100H area. Specific goals will include: (1) design of a field test to develop criteria for full-scale deployment of in situ Cr(VI) bioreduction via lactate stimulation for use at DOE sites; (2) providing of field testing and monitoring (including geophysical methods) of the effects of lactate biostimulation on microbial community activity, redox gradients, transport limitations, and other reducing agents, and comparison of the field results with those of our previous NABIR laboratory work; (3) assessment of the kinetic rates and conditions that may cause reoxidation of Cr(III) to Cr(VI) after biostimulation is terminated; (4) assessment of the use of bioremediation in conjunction with other alternative remediation technologies, such as a pump-and-treat approach, for the Hanford 100H area. The results of this project will be used to develop a conceptual model of chromium bioreduction in groundwater on a field scale and to provide recommendations for field deployment of lactate-stimulated bioremediation.