

Soil Chemical Processes and Properties Impacting Chromium Cycling in Highly Contaminated Sediments

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Hexavalent chromium [Cr(VI)] is one of the most pervasive contaminants at EPA Superfund Sites, with almost 2/3rds containing chromium. However, Cr exhibits vastly different behaviors depending on its redox state. Trivalent chromium [Cr(III)] is fairly nontoxic and insoluble, while Cr(VI) is readily soluble and highly carcinogenic. Despite the significance of Cr(VI) in the environment, there is currently an incomplete understanding of its behavior under certain environmental conditions. To further investigate this sediment cores with highly elevated concentrations of Cr(VI) were obtained from the E.C. Electroplating Superfund Site, Garfield, NJ. Sediment samples were then characterized using both aqueous and in-situ techniques. Cr stability and sorption mechanisms were determined in a stirred-flow chamber utilizing competing electrolyte solutions of various molarities. The effluent was speciated for Cr(III), Cr(VI) and co-released metals via Inductively coupled plasma mass spectrometry (ICP-MS) to quantify Cr release levels over the course of the reaction. At several time points the stirred-flow reaction was quenched, to conduct surface analysis on the soil. Sorbed Cr was speciated using synchrotron-based X-ray absorption fine structure spectroscopy (XAFS). Identifying labile and recalcitrant Cr in the soil matrix is crucial to understanding the cycling of Cr in the subsurface. This knowledge is essential in designing effective Cr treatment strategies, such as bioremediation or pump and treat to minimize the long term risk of environmental contamination