

In-situ Remediation of Chromium with Nanoiron Abstract

David Henderson, gitech environmental services, 92 Sharps Lane , Hamilton , NJ 08610, Tel: 609-213-3979, , Email drh@gitechllc.net

From 1905 to 1971, three major facilities in New Jersey were involved in the extraction of chromium from mineral chromite. In this period, over 2,000,000 tons of chromite ore processing residue (COPR) was produced. This waste product was used by the construction industry for various purposes such as grading material for roadways and as fill material in residential, industrial and commercial construction. The New Jersey Department of Environmental Protection (NJDEP) has classified over 150 sites in Hudson County as chromium-contaminated areas. These sites have chromium concentrations ranging from a few parts per million (mg/kg) to over 5 percent by weight.

The remediation of chromium-contaminated sites presents a technological and economic challenge; none of the currently available treatment methods have been effective and/or cost-effective. Recent research and development has demonstrated that hexavalent chromium can be rapidly reduced and immobilized at the surface of nanoscale zero-valent iron particles. Characterizations with High-Resolution X-ray Photoelectron Spectroscopy (HR-XPS) indicates that Cr(VI) is rapidly reduced to Cr(III), which is subsequently incorporated into the iron oxide shell of the nanoiron and forms an alloy-like Cr-Fe hydroxide which is stable and serves as a sink for Cr(VI). Due to the fast reaction kinetics and high chromium removal capacity, nanoiron is an effective reagent for in-situ immobilization of chromium contaminated soil and groundwater.

In the Fall of 2006, the NJDEP funded a comprehensive technology demonstration project in Jersey City in Hudson County to evaluate the in-situ remediation of chromium-contaminated soils and groundwater using zerovalent nanoiron. Tests were done in both the saturated zone as well as the vadoze zone. This paper presents the results of the comprehensive demonstration project and discusses the methodology for injecting the nanoiron to achieve optimum results.