CleanOX® In Situ Chemical Oxidation of Groundwater (ER-200016)

Objectives of the Demonstration

Chlorinated solvent contamination of groundwater is a widespread problem at many military and civilian facilities. In Situ Chemical Oxidation (ISCO) has been rapidly adopted as a remediation technology for chlorinated volatile organic compounds in both soil and groundwater. The objective of this pilot demonstration was to determine the applicability and efficacy of the CleanOX® ISCO Process.

Technology Description

The CleanOX® ISCO Process is based on the Fenton's reaction, wherein hydrogen peroxide (H_2O_2) reacts with ferrous ions to produce hydroxyl radicals (OH·). The hydroxyl radical is a powerful oxidizer that can transform organic contaminants to carbon dioxide and water as final end products.

Demonstration Results

The demonstration occurred in a 2,500 ft^2 area of Solid Waste Management Unit (SWMU) 45, the location of a former dry cleaning facility at the Marine Corps Recruit Depot (MCRD), Parris Island, South Carolina. SWMU 45 was the site of a dry cleaning fluid release consisting primarily of tetrachloroethene (PCE). Groundwater PCE concentrations measured immediately before the demonstration exceeded 10 mg/L in some locations.

Four injection wells were installed in the impacted area, assuming an injection radius of influence of 15 ft. Six monitoring wells also were installed to aid performance tracking. Treatment consisted of gravity injecting an acidified ferrous sulfate solution (328 gal) over the first 2 days, followed by 8 days of gravity injecting peroxide (3,400 gal, 17.5% by wt.). The latter represented approximately one half of the quantity that was planned for injection based on stoichiometry and other considerations. Groundwater was monitored for routine parameters (temperature, conductivity, pH, oxidation reduction potential, dissolved oxygen) during chemical application and was sampled for chemical analysis 2 weeks and 6 weeks following treatment.

The analytical results did not confirm significant and permanent reduction in chlorinated aliphatic hydrocarbon concentrations in the application area. Potential reasons for the observed performance include incomplete site characterization, poor chemical distribution within the subsurface, and inadequate mass of injected oxidant.

Implementation Issues

ISCO treatment offers advantages over traditional containment (i.e., pump-and-treat) systems. It eliminates the need for groundwater withdrawal, treatment, and discharge, and can be implemented

to effectively target areas of highest contaminant concentrations, thereby accelerating site closure. Other benefits may include low costs, reliability, simplicity (as compared to in situ biological treatment), and rapid treatment. Like any in situ technology, site-specific constraints must be considered. (Project Completed - 2005)

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