Electroremediation of Radionuclide and TCE-Contaminated Groundwater Using Zero-Valent Iron

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Reactive media including zero-valent metals such as iron (Fe^0) absorbs, degrades, and precipitates radionuclides and chlorinated solvents as a contaminated plume flows through the treatment medium. Although the Fe^0 based reactive barrier has been demonstrated to be a cost-effective remedial method for trichloroethene (TCE) and reducible metal- and radionuclide-contaminated groundwater in the plumes, the current approach is limited by low process efficiency and uncertainty, effective life of the Fe^0 medium. The objective of this study is to develop and evaluate electrochemically enhanced dechlorination of TCE and immobilization of radionuclides in contaminated groundwater using Fe^0. A bench-scale flow-through Fe^0 reactor column with direct current (DC) was tested to increase the efficiency and effective life of the Fe^0 medium by providing an external supply of electrons to control the rate of iron oxidation and to enhance the rate of TCE dechlorination rate and radionuclide immobilization. The removal mechanism appears to be reductive coprecipitation of radionuclides by iron oxidation as well as reductive dechlorination by creating a reducible environment in the reactive iron barrier. Several factors influence the removal of radionuclides and TCE from groundwater using this reactor column including (1) electrode configuration, (2) applied voltage, (3) distance between cathode and anode, (4) material used as electrodes, and (5) influent concentration and water chemistry.