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LIBRO DE RESÚMENES

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P213. In situ redox manipulation (ISRM) for treatment of trichloroethylene and hexavalent chromium in groundwater from a site located Sao Paulo State, Brazil

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The studied area was previously occupied by an industry whose developed activities promoted groundwater contamination with TCE and hexavalent chromium, reaching concentration levels above environmental agency preliminary remediation goals. Detailed site investigation showed groundwater concentrations up to 4 g L^{-1} of Cr(VI) and 1 mg L^{-1} of TCE. In order to treat around 14,000 m^3 of groundwater impacted by Cr(VI) and 10,000 m^3 of an aquifer contaminated by TCE, ISRM was applied. These redox sensitive contaminants were removed from the creation of an Fe(II) reactive zone by injecting the referred metal in two different valence states at two stages - the first one as mZVI (microscale zero valent iron), combined with a biopolymer, and the second one, as divalent iron, in the soluble form.
Bench tests carried out with the most contaminated groundwater samples collected from the studied area indicated over 99% of contaminants mass removal with ZVI after 20 days without pH adjustment. Additional bench test was performed focusing on a delineated hot spot with dissolved plume of Cr(VI); at this stage, divalent iron solution was employed, allowing to achieve results below laboratory quantitation limit in the groundwater sample from hot spot zone used in the test . After completion of bench tests, large-scale pilot study was implemented in order to evaluate the effectiveness of remedial approaches. Fifty tons of microscale ZVI dispersed in a biopolymer and around four ton of divalent iron were consumed aiming to treat the aquifer impacted by TCE and its natural degradation products as well as CrVI.
Iron injection resulted in the destruction of approximately 800 kg of Cr(VI) and 0.3kg of TCE in the target site, confirming the efficiency of the in situ redox manipulation for treating groundwater impacted simultaneously by TCE and Cr(VI). The use of ZVI in microscale instead of nanoscale was preferred once it is easier to handle in the field, with a lower corrosion rate and at a reduced cost. The selection of the biopolymer is also crucial; the viscosity of its mixture with mZVI has to be adequate to maintain the particles suspended during transport to porous media and also allow the application of an injection pressure close to the critical pressure of the aquifer. After TCE and its natural products oxidation, application of DivIRed (Divalent Iron Reduction) in the site showed to be efficient to reduce Cr(VI) to the less toxic and insoluble Cr(III) form.

Keywords: ISRM, hexavalent chromium, trichloroethylene, reduced iron.