

Anaerobic transformation of chlorinated aliphatic hydrocarbons in a sand aquifer based on spatial chemical distributions

Lewis Semprini, Peter K. Kitanidis, Don H. Kampbell, John T. Wilson

Department of Civil Engineering, Oregon State University, Corvallis

Abstract:

We estimated the distribution of chlorinated aliphatic hydrocarbons (CAHs) from groundwater samples collected along three transects in a sand aquifer. Trichloroethylene (TCE) leaked and contaminated the aquifer probably more than a decade before we collected the measurements. The data show significant concentrations of TCE, cis-1,2-dichloroethylene (c-DCE), vinyl chloride (VC), and ethene. We attributed DCE, VC, and ethene to the reductive dehalogenation of TCE. The CAH concentrations varied significantly with depth and correlate with sulfate and methane concentrations. Anoxic aquifer conditions exist with methane present at relatively high concentrations at depth. High concentrations of TCE correspond with the absence of methane or low methane concentrations, whereas products of TCE dehalogenation are associated with higher methane concentrations and low sulfate concentrations. Indications are that the dechlorination of TCE and DCE to VC and ethene is associated with sulfate reduction and active methanogenesis. TCE dechlorination to DCE is likely occurring under the less reducing conditions of sulfate reduction, with further reductions to VC and ethene occurring under methanogenic conditions. We estimated that about 20% of TCE has dechlorinated to ethene. The analysis of the data enhanced our knowledge of natural in situ transformation and transport processes of CAHs.

Keywords: 1831 Hydrology; Groundwater quality 1832 Groundwater transport

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