Abstract C-59, in: Bruce M. Sass (Conference Chair), *Remediation of Chlorinated and Recalcitrant Compounds—2006.* Proceedings of the Fifth International Conference on Remediation of Chlorinated and Recalcitrant Compounds (Monterey, CA; May 2006). ISBN 1-57477-157-4, published by Battelle Press, Columbus, OH, www.battelle.org/bookstore.

Plant Mulch to Treat TCE in Ground Water in a PRB

Hai Shen (NRC, R. S. Kerr Environmental Research Center, Ada, Oklahoma, USA)
John T. Wilson (U.S. EPA, R. S. Kerr Environmental Research Center, Ada, Oklahoma, USA)

In the past ten years, passive reactive barriers (PRBs) have found widespread application to treat chlorinated solvent contamination in ground water. The traditional PRB commonly uses granular zero-valent iron and/or iron alloys as filling materials for treatment of chlorinated solvents. In recent years, there has been a surge in the price of iron. The higher price for iron makes alterative matrix materials for the PRBs more attractive. One alternative for iron is shredded plant mulch. As the plant mulch decays under anaerobic conditions, it provides substrate to bacteria that biologically dechlorinate the contaminants. Because the PRB functions like an in situ bioreactor, the PRBs constructed with plant mulch are often called biowalls. The biowall is constructed by excavating a trench across the plume perpendicular to ground-water flow, and then backfilling the trench with a mixture of woody plant tissue (such as shredded tree mulch and cotton gin trash) and sand to hold the plant tissue in place below the water table. Because it is a passive treatment system, a biowall requires no continuous and intensive input of energy for operation. Because the plant mulch for the biowall can often be acquired for the cost of transportation to the site, the construction of a biowall is much less expensive than an iron PRB, and is generally much less expensive than conventional approaches such as pump and treat.

In May and June of 2005, the U.S. Air Force installed more than 1,000 meters of biowall along the southern perimeter of Altus Air Force Base in Oklahoma. The biowall was designed to intercept and treat TCE contamination in ground water leaving the base. To provide unequivocal data on the mass balance of contaminants moving across the biowall, we performed a laboratory column study to simulate the flow of ground water through the biowall and the aquifer material immediately down gradient of the biowall. Four columns simulating the biowall and two columns simulating the aquifer down gradient of the biowall were constructed. To simulate the biowall, columns 15 cm in diameter and 46 cm long was packed with the same materials that had been used to construct the biowall recently installed at Altus Air Force Base. The columns simulating the biowall were fed with ground water collected from the site that was spiked with TCE to a final concentration near 2 mg/L. Effluent from two of the columns simulating the biowall was fed to a second column that was 15 cm in diameter and 30 cm long. The second column was packed with subsurface materials from the aquifer.

Data are available for the first year of operation. The concentration of trichloroethylene was consistently reduced from 2 mg/L in the column influent to below 5 µg/L. No other potential byproducts, including vinyl chloride, were detected above their respective maximum contaminant levels (MCLs) permitted in the United States for drinking water. High concentrations of sulfide produced in the columns containing plant mulch were removed in the columns containing aquifer sediment. The results suggest that the plant mulch biowall may be an efficient and cost-effective method to control ground water contaminated by chlorinated solvents.