Source Zone Remediation via ZVI-Clay: Lessons Learned from the First Ten Laboratory Studies

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Abstract. ZVI-Clay is an *in situ* remediation technology developed for treatment of chlorinated solvent source zones. ZVI-Clay uses conventional soil mixing equipment to admix a grout consisting of water, reactive media (e.g., zero valent iron or "ZVI") and stabilizing agents (e.g., clay) with contaminated soil. Through this process, zones of high contaminant concentrations – including pools of DNAPL – are redistributed and brought into close contact with iron particles without bringing contaminated materials to the surface for treatment. Within the treated soil body, ZVI drives solvent degradation while the clay reduces the hydraulic conductivity. The overall benefit is a dramatic reduction in both the mass of chlorinated solvent in the ground and its migration from the treated area.

DuPont and the University of Waterloo pioneered this technology in the 1990s and early 2000s. In 2003, DuPont donated patents for the technology to Colorado State University (CSU). Since that time, CSU has conducted 10 bench-scale studies. These studies include site-specific pre-design studies and MS thesis research. In conducting these studies, the scope of our understanding of the ZVI-Clay treatment process has broadened considerably.

The first of these studies was an MS thesis that evaluated reactive transport processes. Site-specific pre-design studies have been conducted for 9 sites, 2 of which have gone on to full-scale field implementation. Contaminants have been evaluated including carbon tetrachloride, chloroform, methylene chloride, perchloroethylene (PCE), trichloroethene (TCE), 1,1,1-trichloroethane, 1,1,2,2-tetrachloroethane, and toxaphene. From these studies, a range of half-lives for these compounds under different treatment conditions has been generated. New ingredients have been evaluated for their ability to improve performance or better prepare the site for post-treatment use.

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