Soil Remediation Case Study: ZVI-Clay for Treatment of Tetrachloroethylene Source Zone

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Abstract. ZVI-Clay is an in situ soil remediation technology that involves admixing contaminated soils with reactive media (zero valent iron) and stabilizing agents (clay) using conventional soil mixing equipment. Through this process, source zone contaminants are degraded and hydraulic conductivity of the targeted zone is decreased. The net benefit is a dramatic reduction in future releases of contaminants from the treated interval. 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).

In February 2005, CSU collaborated with CH2M HILL to complete a ZVI-Clay field application at a former dry-cleaner site Camp Lejeune, North Carolina. Seven thousand cubic yards of soil, containing up to 2,700 mg/kg tetrachloroethylene (PCE), were treated. Raw materials used in the application include 200 tons of granular iron and 100 tons of bentonite clay. Progress was monitored via soil sampling conducted before and after the field application. Results indicate that, within one year of application, greater than 99% PCE removal was achieved through much of the treated interval. In addition, measured hydraulic conductivity values in the treated zone were reduced by 1-2 orders of magnitude.

Prior to the field application, CSU conducted a laboratory treatability study. The primary objectives of the study were to (1) verify the efficacy of ZVI-Clay in site soils, (2) evaluate reaction kinetics, and (3) compare treatment effectiveness using iron from various vendors. The objectives were met through completion of a batch study. The batch study was conducted in 20-mL vials, with conditions chosen to replicate field conditions after ZVI-Clay treatment. Vials were sacrificed periodically, and concentrations measured to determine reaction kinetics. In general, a PCE half-life of 30 days was predicted. In addition, the potential for downward migration was evaluated by conducting a mixed column study. No adverse downward migration was noted.

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