Bioremediation and Sustainable Environmental Technologies—2017. Fourth International Symposium on Bioremediation and Sustainable Environmental Technologies (Miami, FL; May 2017). ©2017 Battelle Memorial Institute, Columbus, OH, www.battelle.org/biosymp. A. Barton and S. Rosansky (Chairs)

Enhanced Bioremediation of a DNAPL Source Area Using Lactate and Ethanol

Donald Miller (Golder Associates Inc., Jacksonville, FL, USA)

Background/Objectives. The Florida Petroleum Reprocessors (FPR) Superfund site is located in Davie, Broward County, Florida. Petroleum constituents and chlorinated solvents were released to the surficial aquifer underneath the site while the facility was being used as a waste oil recycling facility from 1978 to 1991. The surficial aquifer is part of the Biscayne aquifer system and consists of strata of sand, shell, limestone and sandstone. EPA listed the site on the National Priority List in 1998. Golder's initial involvement at the site was the performance of a conventional source removal of the upper 15 feet of largely impacted with petroleum constituents. DNAPL consisting mostly of trichloroethene (TCE) was found at depths of 40 and 50 feet. In-situ chemical oxidation (ISCO) using Fenton's reagent was first employed to treat the DNAPL zone. Even though ISCO was initially effective at DNAPL treatment, significant concentration rebound indicated the continued presence of DNAPL and lead to enhanced reductive dechlorination as the final polishing step.

Approach/Activities. There was no problem switching from an oxidative technology to a reducing technology as the site has naturally reducing conditions. Source zone wells that were saturated with oxygen from the ISCO injections turned anaerobic within six months. Biodegradation was not naturally causing significant mass destruction as natural organic carbon in the aquifer was low. Injections of potassium lactate and ethanol were conducted. Groundwater samples were analyzed for VOCs, TOC, sulfate, alkalinity, and methane, ethane, and ethene. Results of the source zone wells showed rapid decline of TCE, followed by initial creation and then subsequent decline of cis-1,2-dichloroethene, followed by creation and decline of vinyl chloride, and finally creation and decline of ethene.

Results/Lessons Learned. Due to circumstances beyond control of the responsible parties (PRPs), the project was conducted in a series of starts and stops and significant intervals of non-activity. Eventually, injections of the organic carbon substrate lead to the creation of robust biodegradation and eventual DNAPL destruction. Understanding of subsurface NAPL architecture, injection frequency, the potential for bio-augmentations, were significant learning opportunities during project execution. EPA documented removal action completion on October 29, 2015.