Use of Direct-Push Injections and a Biobarrier for Remediating Chlorinated Solvents during Residential Redevelopment

Carl Elder, Ph.D., P.E. (celder@geosyntec.com) (Geosyntec Consultants, Acton, MA, USA)
Mary deFlaun (Geosyntec Consultants, Ewing, NJ, USA)
Joseph Hochreiter (Senior Environmental Consulting, LLC, Yardley, PA, USA)

Background/Objectives. Materials historically stored at a former warehouse property in northern New Jersey impacted groundwater at this site with tetrachloroethene (PCE) and trichloroethene (TCE). By 2015, PCE and TCE groundwater plumes had migrated from a source near the center of the approximately 10-acre property onto the adjacent downgradient parcel. The property was sold in the summer of 2014 to a developer who had plans to immediately demolish the warehouses, raise the elevation of the property by approximately 17 feet (on average), and then construct apartment buildings and retail space. The property transaction obligated our client, the former owner, to implement a groundwater remedy by the spring of 2015 so that remediation would not impede the construction of new buildings. This abstract describes the expedited design and implementation of a source-area bioremediation treatment and downgradient biological reactive barrier (biobarrier), and the challenges encountered installing these remedies during one of the coldest and snowiest winter on record in the northeast and coincident site demolition and regrading.

Approach/Activities. In October 2014, Geosyntec was awarded the project to design, permit and implement source-area and downgradient groundwater remedies for overburden, on or before 31 March 2015 (i.e., within 5 months of project award). Geosyntec selected bioremediation using emulsified vegetable oil (EVO) and bioaugmentation with KB-1®, and implemented using direct-push technology, as the source area treatment. The source treatment also incorporated a cap to manage recharge during the two-year period of site development. The source remedy design intentionally excluded infrastructure since 17 to 20 feet of fill would be placed over the area and then apartments. Treatment of the downgradient plume was accomplished by installing a 200-foot long biobarrier constructed from gravel mixed with zero-valent iron (ZVI) and augmented with EVO and KB-1®. The biobarrier was constructed beneath the existing and future driveway to the property. ZVI was added into the gravel biobarrer to supplement biological processes by providing pH control, greater groundwater reduction capacity and some abiotic PCE/TCE treatment. The biobarrier has limited impact to the developed site; the only apparent component of the biobarrier is a manhole which contains connections to subsurface wells and piping necessary for future additions of EVO.

Results/Lessons Learned. Bioremediation, implemented with different approaches and combined with ZVI and capping, provided a robust and flexible remedy for this site that was compatible with site demolition that was occurring concurrent with remedy implementation and complementary to future site development and use. The combined remedies were designed in three weeks and permitted within six weeks of project award. All remedy components were implemented within five months of project award. Along with working on a site amidst building demolition and a continuous stream of trucks importing fill, construction of the biobarrier occurred in January and February 2015 which posed significant challenges since this was one of the coldest and snowiest winter in the history of the northeast. Nevertheless, schedules were met and groundwater data collected subsequent to site development proving that both remedies are providing excellent groundwater treatment.