Phyto-Integrated™ Remediation System to Address CCl_4-Contaminated Groundwater in a Low-Permeability Aquifer

Edward Gatliff (ans@treemediation.com) (Applied Natural Sciences, Hamilton, OH, USA)
P. James Linton (Geosyntec, Clearwater, FL, USA)
R. Scott Rought (Amec Foster Wheeler, Traverse City, MI, USA)
Douglas J. Riddle (RELLC, Frederick, MD, USA)
Paul R. Thomas (Thomas Consultants Inc., Cincinnati, OH, USA)

Background/Objectives. In 2015 a *Phyto-Integrated*™ remediation system employing patented *TreeWell*® technology was installed to replace a recovery well system and capture and remediate a carbon tetrachloride (CCl_4) plume in a low-permeability aquifer on a site in eastern Illinois. The system was employed as a component to address the CCl_4 plume downgradient of a source area that is scheduled to be remediated via electrical resistive heating (ERH). Groundwater migrates through a low permeability glacial till approximately 25 feet deep and underlain by a denser till that functions as an aquitard. In general, the saturated thickness of the shallow aquifer within the till material ranges from 8 to 25 feet below ground surface (bgs). The upper portion of the saturated horizon consists primarily of tight silty clay while the basal portion consists of silty to sandy clay with some gravel and sand lenses. In general, these lenses occur 20 to 25 feet bgs and constitute most of the contaminant plume's migratory pathway.

Approach/Activities. In 2015 a pilot study area was established to evaluate requirements for a larger scale system for downgradient plume control. A site-specific engineered phytoremediation program using patented *TreeWell* system technology was designed and installed. The *TreeWell* units (*Units*) were purposely located to provide plume control/treatment and strategically placed immediately downgradient of the source area. After the pilot study installation successfully enabled the shutdown of the recovery well system, the system was expanded to its full design in 2016. In all cases, *Units* were constructed to exclude percolating rain water and uncontaminated groundwater from entering each *Unit* while targeting water removal from horizons of contaminated groundwater. Also in 2016, an ERH system was selected for the source area cleanup that is scheduled to commence in early 2018.
To monitor the hydraulic effects of the *TreeWell* system, pressure transducers and dataloggers were installed in piezometers located inside selected *Units* as well as in new and existing monitoring wells placed in and around the installations. To monitor the remedial effects, groundwater samples were collected from piezometers installed inside *Units* and/or monitoring wells during quarterly sampling events.

Results/Lessons Learned. Positive hydraulic and remedial effects have already been realized and will be discussed. In addition, site background, installation overview as well as more recent hydraulic and remedial data will be presented.