PHYTO-INTEGRATED™ Remediation System to Address Chlorobenzene-Contaminated Groundwater in a Complex Saprolitic Aquifer

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Background/Objectives. In 2017, a *Phyto-Integrated*™ remediation system employing patented *TreeWell*® technology was installed to remediate areas of chlorinated solvent-affected groundwater and soil within the vicinity of a former industrial waste burn pit. Previous source area remedial efforts included excavation, in-situ chemical oxidation and aerobic bioremediation/volatilization activities but treatment of contaminants in the deeper, more complex, partially weathered rock (PWR) proved insufficient to meet cleanup criteria. Site soils typically consist of saprolitic silty sands to approximately 10 feet below ground surface (bgs). These unconsolidated materials are underlain by a 0.5 to 2.0-foot thick layer of PWR, which is underlain by an additional 20 feet of unconsolidated saprolitic soil. Saturated conditions are encountered at approximately 25-40 feet bgs into increasingly competent bedrock. The PWR at 10 feet bgs complicated previous in situ remediation efforts. Groundwater remediation via this engineered phytoremediation system is designed to decrease chlorobenzene concentrations in the downgradient portion of the groundwater plume within the PWR and provide additional remediation of residual source area contaminants.

Approach/Activities. Following the completion of a Corrective Measures Study and despite initial reluctance based on their mixed past experience with phytoremediation applications, the *TreeWell* system approach was enthusiastically accepted in late 2016 by the South Carolina Department of Health and Environmental Control (SCDHEC) Bureau of Land and Waste Management. Following an evaluation, the engineered phytoremediation system was designed and in early 2017, 19 *TreeWell* units (*Units*) were installed at the site. The *Units* were designed to target contaminated groundwater at a depth ranging from approximately 25-40 feet bgs and, in the burn pit area, residual contamination in unsaturated soils from 5 to 25 feet bgs. To monitor the hydraulic effects of the *TreeWell* system, pressure transducer dataloggers were installed in piezometers located inside selected *Units* as well as in existing monitoring wells placed in and around the installation. To monitor the remedial effects, groundwater samples were collected from piezometers installed inside *Units* and/or monitoring wells during subsequent sampling events. In addition, submersible conductivity sensors were also installed in selected *Unit* piezometers in the source area to monitor changes in groundwater conductivity as proxy for remedial effects (i.e. increased chloride concentrations).

Results/Lessons Learned. Aspects on the design and installation will be presented and discussed. Results from other, longer-term sites, demonstrating the remedial and hydraulic effects on chlorinated solvent plumes will be presented and discussed as well as results of the hydraulic and remedial effects collected to date at this site.