

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

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## BACKGROUND/OBJECTIVES

#### Site History

- 1989 USEPA identifies 15 Solid Waste Management Units (SWMUs) 1998 - Schneider Electric retains 3 SWMUs including the Burn Pit
- (SWMU 14)
- 2004 Burn Pit excavated to top of partially weathered rock (PWR) approximately 8 feet below ground surface (bgs) backfilled with gravel · 2007 - Construction of infiltration gallery in excavated burn pit
- 2007 Phase I In-situ Chemical Oxidation (ISCO) Gravity injection of permanganate and persulfate through infiltration gallery 2008 – Phase II ISCO – Pressure injection (permanganate only) into all three levels – above PWR, PWR, and saprolite between PWR and
- fractured bedrock at 25 to 30 feet bgs

8/2015-3/2016 - Aerobic Bioremediation/Volatilization Plot Test

### Remedial objectives were not met

#### Recent History

· Recent attempts at ISCO have proven relatively ineffective due to site stratigraphy. The South Carolina Department of Health and Environmental Control (SCDHEC) were requiring a mechanical pump-and-treat system in order to satisfy the need for an active remediation methodology. Following the completion of a Corrective Measures Study of the former burn pit area, phytoremediation was selected as the remedial approach over pump-and-treat to address plume migration and residual source area contamination. SCDHEC's Bureau of Land and Waste Management was initially reluctant based on poor past experience with traditional phytoremediation. After presenting details of our engineered phytoremediation system and previous positive experience with elevated levels of chlorobenzene in groundwater, the phytoremediation approach was enthusiastically accepted in late 2016

- 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 partially weathered metamorphic rock (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 has made previous in-situ remediation efforts
- Previous source area remedial efforts included excavation in-situ chemical oxidation and aerobic bioremediation/volatilization. Treatment of contaminants in the deeper, more complex, PWR proved insufficient to meet cleanup criteria. Following a site feasibility evaluation, a PHYTO-INTEGRATED™ remediation system employing patented *TreeWell*\* technology was installed to control plume migration and remediate areas of chlorinated solvent-affected groundwater and soil within the vicinity of the former industrial waste burn pit.

The TreeWell Units (Units) were designed to target contaminated 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 datalogers 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).

#### Objectives

 Remediation of groundwater and soil media via this engineered phytoremediation system. Reduction of chlorobenzene contaminant mass in the immediate area of the former burn pit. Reduction of contaminant concentrations in the downgradient portion of the groundwater plume



Note that by Year 4, spring recharge uptick continues to lessen as source reserves are almost depleted

# SITE CONDITIONS - NORTH CENTRAL SOUTH CAROLINA



## **IMPLEMENTATION – FEB/MAR 2017**

Feasibility

Study

Test Boring of Partially

Weathered Rock



Installation





• 0.4 gpm = \$0.0 • 0.5 gpm = \$0.067/ga

> Finished Installation

**RESULTS TO DATE** 

Nested wells to monitor

concentrations at depth

## Chlorobenzene (µg/L)



Transducers in Monitoring Wells & in-TW piezometers & Weather station to help with hydraulic calculations



