

The subject site is in Spartanburg, South Carolina. The site has historically had soil and groundwater impacted by the use of the degreasing agents, tetrachloroethene (PCE) and trichloroethene (TCE). The in-situ injection program targeted these compounds and their anaerobic daughter products. A total of 38 injections were made in March 2007 over 2 days, twenty-two in the saturated zone and sixteen in the unsaturated zone. The injections were made at 10-12' below ground surface (bgs) and 14-16' bgs in the saturated zone and at 6.5-8' bgs and 8.5-10' bgs in the unsaturated zone. The geology of the site is saprolite with secondary porosity.

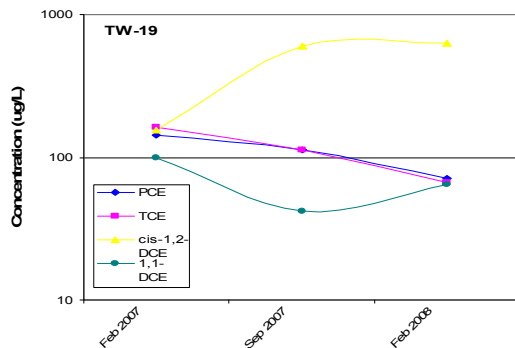
Remediation Plan

The injection program utilized direct-push technology to apply; vitamins (B₁₂, B₂), essential nutrients (o-PO₄⁺ and NH₄⁺), sodium sulfite, calcium propionate, yeast extract, zero-valent iron (ZVI), and hydrogen release compounds (HRC[®]-X and HRC[®]). The objectives of the program were to establish and maintain a stable dissolved hydrogen level, provide micro-nutrients, maintain pH, provide for optimal competitive conditions for the desired microbial consortia while minimizing the impact to the day-to-day operations of the facility (U.S. Patent 7,129,388). The stimulus of these indigenous bacteria in the subsurface, in conjunction with the ZVI component, is utilized to effect the rapid and measurable removal of the targeted compounds in the groundwater and saturated soils.

A second set of coincidental injections containing emulsified zero valent iron (EZVI), an emulsified, edible vegetable oil containing a water-ZVI miscule, were injected to partition CVOCs in the unsaturated soils to the hydrophobic oil. Together, the saturated and unsaturated programs utilized synergistic and enhancing technologies that chemically and biologically reduce the CVOCs.. The mechanism for injection employed both compressed inert gas feed and remedial liquid introduction (U.S. Patent 7,044,152). As a result of the injection process, the remedial liquids are introduced radially while minimizing the displacement of the preexisting pore volume laterally or vertically.

Results

The groundwater results from the four shallow monitoring wells within the source area show large reductions in the dissolved concentration of the contaminants: PCE and TCE. There is an increase in the appearance of daughter products such as cis-1,2-dichloroethene (cis-1,2-DCE). This increase in daughter products show that reductive dechlorination is occurring. Less than one year following the injections in February 2007, the four monitoring wells in the source area showed an average reduction of 50% in PCE and TCE concentrations. The results also show reducing conditions are still present in all of the wells, indicating that reduction is still occurring at the site. Analytical results from soil sampled six months after the injections showed that all concentrations of contaminants were below the USEPA industrial soil standards.



Source Area - Soil Results

	Baseline	210 days	350 days	Delta
PCE	71.5	5	5.9	-91.75%
TCE	44.3	5	7.4	-83.30%
c-DCE	118	2	68.7	-41.78%