CASE STUDY

TYPE: In Situ Bioremediation (Chlorinated Solvents)
COMPONENTS: ISD Equipment and Amendments

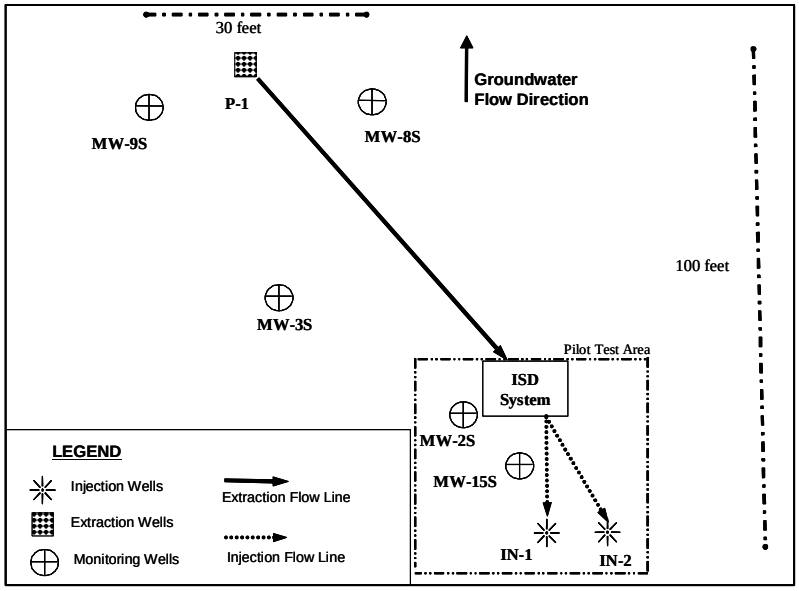
AGGRESSIVE CHLORINATED SOLVENT REMEDIATION USING AN AUTOMATED IN SITU DELIVERY (ISD™) SYSTEM
Former Dry Cleaning Facility, Lebanon, OR

Type of Project:	Pilot- and Full-scale demonstration
Contaminants Treated:	PCE, TCE, DCE, and VC
Concentration:	Maximum of 500 ppb total chlorinated solvents observed
Technology Applied:	Anaerobic Dechlorination
Geology:	Silty sand w/ large cobbles, confined on both sides by silt/clay
Treatment Interval:	7 to 24 ft bgs
Average % Reduction:	95-100% reduction of PCE, TCE, and DCE
Timeframe:	5 month pilot, then 8 month full-scale

DESCRIPTION

Our automated In Situ Delivery (ISD™) system was used at a former dry cleaning facility in Lebanon, OR to treat PCE- and TCE-contaminated soil and groundwater that was co-mingled with Stoddard solvent. ETEC worked with the environmental site consultant to conduct a pilot demonstration of our innovative ISD™ anaerobic bioremediation process at the site. The pilot study was successful in achieving complete dechlorination of PCE/TCE to ethene/ethane without bioaugmentation; therefore, a full-scale action was conducted.

The ISD™ system enhanced groundwater with a nutrient-amended carbohydrate solution (CarBstrate™) prior to distributing it into the subsurface via two upgradient injection wells. Shallow groundwater was already anoxic due to the presence of Stoddard solvent, which had promoted partial dechlorination of PCE (as indicated by the presence of TCE, DCE, and VC prior to initiating the pilot demonstration). CarBstrate™ was selected as the electron donor due to its high solubility and low cost, as well as the fact that it poses no risk to human health.



ETEC trained the consultant to operate the automated ISD™ system, and recommended the substrate feed rate based on the mass of chlorinated solvents, the mass of terminal electron acceptors, and the total groundwater extraction rate (~1 gpm). The ISD™ system automatically amended extracted groundwater and injected it on a 24-hour basis throughout the remediation timeframe. Existing monitoring wells at varying distances from the injection wells were used to measure the effectiveness of the remedial approach. Groundwater

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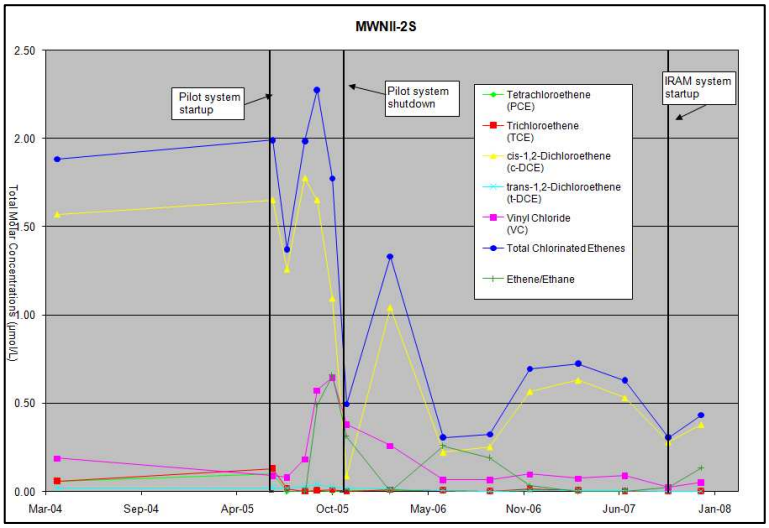
samples were collected prior, during, and after the demonstration and analyzed for VOCs, terminal electron acceptors (iron, manganese, nitrate, and sulfate), methane/ethane/ethene, TOC, chloride, and water quality parameters (pH, DO, ORP, and conductivity).

RESULTS & DISCUSSION

During the entire operation period, the ISD unit amended and re-circulated over 750,000 gallons of groundwater through the project site. It should be noted that, although the original treatment area was approx. 40 ft. x 40 ft., complete dechlorination was stimulated well beyond this zone. Results and observations included the following:

- Dissolved-phase chlorinated solvent concentrations increased immediately after re-circulation was initiated, likely the result of increased dissolution.
- A rapid decrease in the parent compounds (PCE and TCE) to below detection limits was observed in all site monitoring wells, and no significant rebound has occurred to date.
- cis-DCE concentrations in pilot study monitoring wells increased (up to 1.1 ppm) after the parent compounds were transformed, but showed rapid subsequent decreases to less than 10 ppb
- VC concentrations also increased, but rapidly decreased after cis-DCE transformation

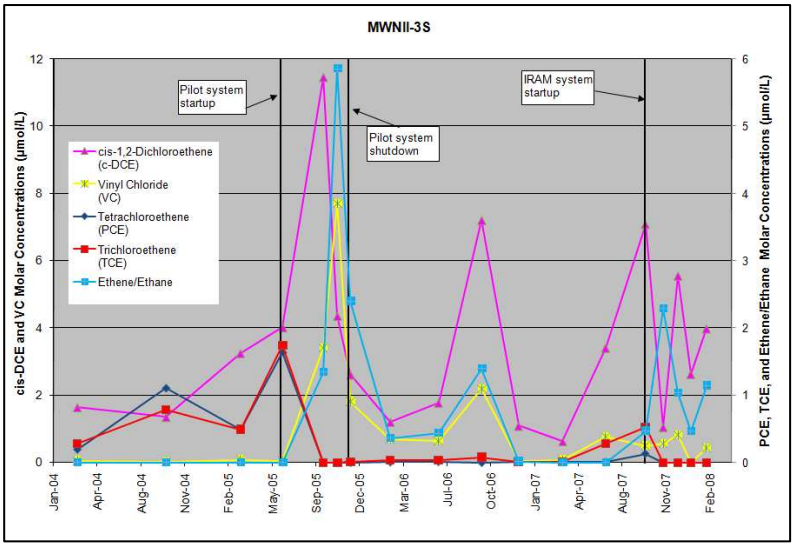


Aggressive delivery of an electron donor via GW recirculation resulted in complete dechlorination of PCE/TCE within just a few months.

Rapid transformation was achieved within the pilot area (MW-15S & MW-2S) and beyond (MW-3S and MW-8S). Complete data set available upon request.

This treatment was achieved using:

- ***Existing infrastructure***
- ***Indigenous microbes (no bioaugmentation)***
- ***A meager 1.1 gpm extraction rate from one extraction well,***
- ***Injection into two inexpensive pre-packed injection wells, and 1 retrofitted monitoring well***
- ***Minimal O&M***



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