



AGGRESSIVE CHLORINATED SOLVENT REMEDIATION USING THE 10-GPM IN SITU DELIVERY (ISD™) SYSTEM

Active Dry Cleaner Facility

Type of Project:

Full-scale demonstration Contaminants Treated: PCE, TCE, DCE, VC, TCA, DCA

Concentration: Maximum of 16,500 ppb total chlorinated solvents observed

Technology Applied: Anaerobic Dechlorination

Geology: Silty sand w/ some organic peat layers, lower confining clay unit

Treatment Interval: 10 to 25 ft. bgs.

Average % Reduction: >99% reduction of PCE, TCE, DCE, and VC in full-scale area

Timeframe: 24 months of active GW recirculation

DESCRIPTION: A 10-gpm In Situ Delivery (ISD™) system and our CarBstrate™ (a water soluble, nutrient amended carbohydrate substrate) was used at an active dry cleaner facility to treat PCE/TCE-contaminated soil and groundwater. This full-scale design was based on pump tests conducted at the site, which showed favorable extraction/injection rates. The source area dimensions are 300 feet wide by 125 feet long with a saturated thickness of 15 feet (total volume of 21,000 cubic yards). Saturated zone lithology consisted of silty sand with some organic peat layers.

The ISD™ system was fabricated and installed by ETEC. Over 6.0 million gallons of groundwater was recirculated in a 24 month time-frame and amended with 7,500 lbs. of CarBstrate™. Groundwater was extracted from 5 extraction wells (shown on the figure as squares), automatically amended with CarBstrate™ and distributed into the subsurface via 9 vertical injection wells (circles) and 3 horizontal injection wells (J, K and L).

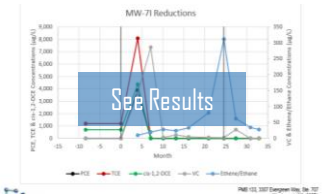
The system piping/conduit was installed with a directional drilling rig, which allowed the installation to occur without disruption to businesses and without trenching. On the figure the 2 hexagons and the dotted lines represent the horizontal drilling locations and piping/conduit runs. The horizontal injection wells were used to treat the vadose zone under the building (floor drain release). A specifically designed well screen was used for the horizontal injection wells that allow even distribution of amended groundwater across the 75 ft. screen intervals of each well.

ETEC trained the local consultant to operate the ISD™ system and provided the appropriate substrate feed rate based on the mass of chlorinated solvents, the mass of the terminal electron acceptors and the estimated groundwater extraction rate. Extraction wells were used as performance monitoring wells in addition to the monitoring wells to assess the effectiveness of the treatment. Groundwater samples were analyzed for VOCs, terminal electron acceptors (iron, manganese, nitrate and sulfate), methane/ethane/ethene, TOC, organic acids, chloride, and water quality parameters (pH, DO, ORP and conductivity) prior, during, and after the 24-month recirculation event.



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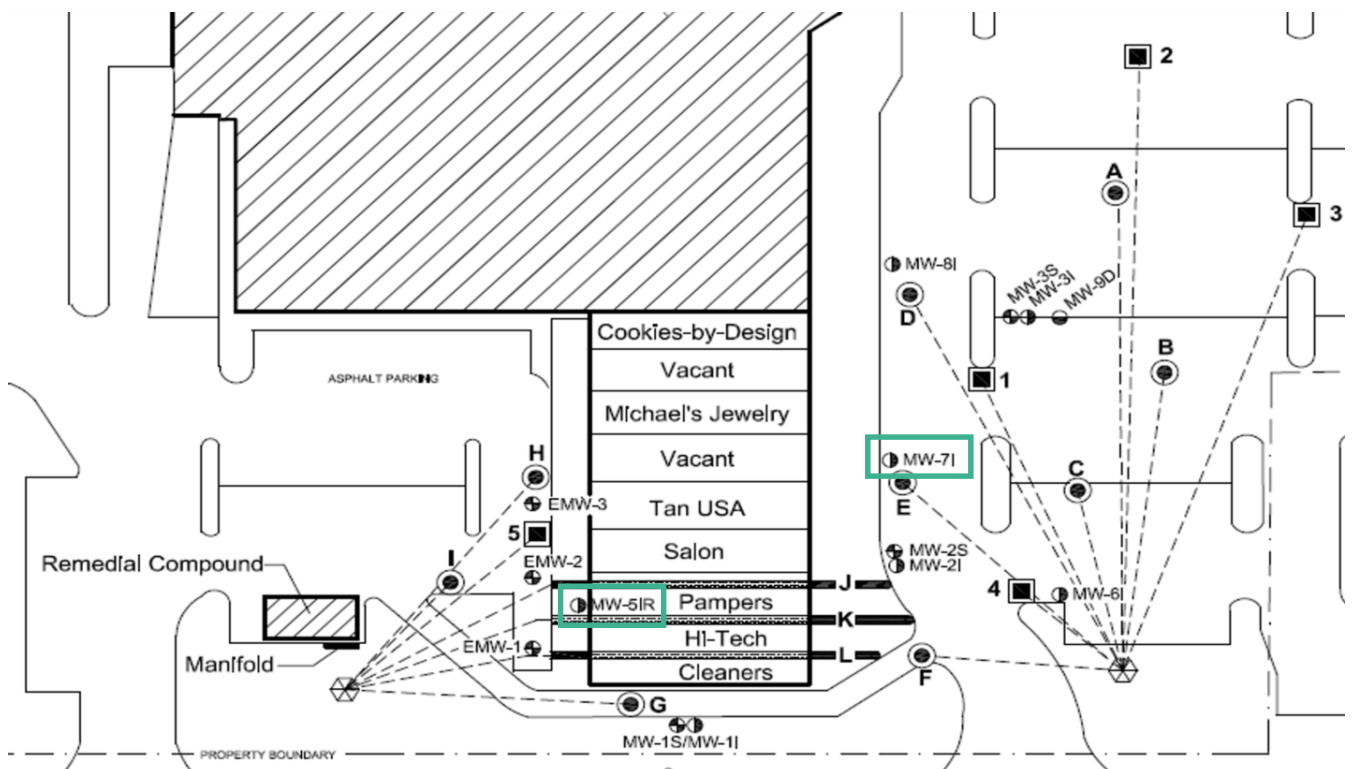
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SITE PLAN



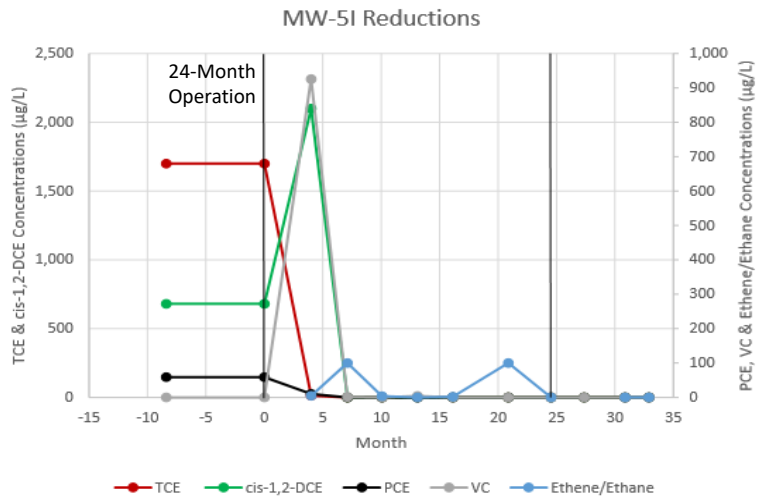
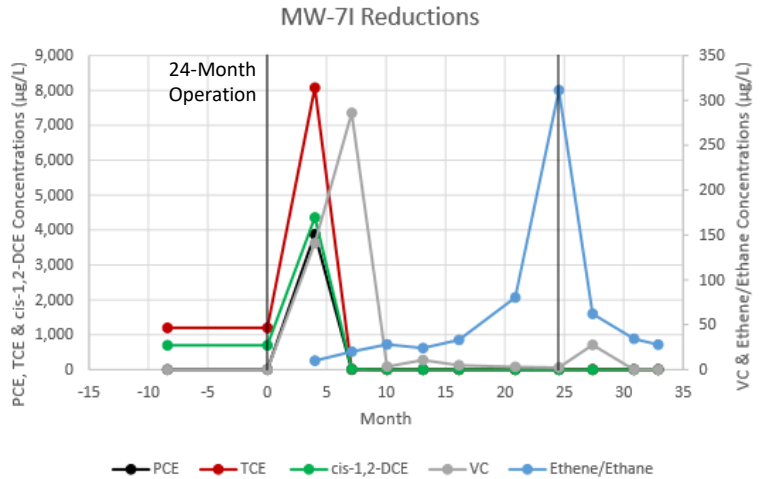


Results and observations from the full-scale implementation include the following:

- ✓ MW-7I contained total cVOC concentrations as high as 16.5 mg/L, with rapid transformation after 6 months. Ethene/ethane concentrations confirm complete dichlorination without inoculation.
- ✓ MW-5I was the release area out the back door of the facility.
- ✓ The upgradient locations show rapid and complete dechlorination within 6 months with no rebound, and all cVOCs below 1 µg/L.
- ✓ All monitoring locations (MWs and EWs) showed a >99% decrease in total cVOC concentrations 24 months after recirculation and substrate addition began.

The results demonstrate that aggressive short-term groundwater recirculation can achieve effective electron donor delivery that promotes complete PCE/TCE dechlorination within months, and the generated biomass will continue to sustain dechlorination for months/years. Sustained dechlorination occurred for months after the recirculation event due to utilization of soluble fermentation byproducts & degradation of generated biomass.

EFFECTIVE RESULTS



ISD™ 10 GPM In Situ Delivery System

