



## Project Highlights

- **ERDENHANCED™ Pilot Study**  
76.8% reduction in total cVOCs over an 8-month period.
- PCE initially decreased 74.5%. The additive enhanced solubilization of residual source mass represented by a 275% increase in PCE; followed by a 76.6% reduction from peak PCE concentrations.
- **ERDENHANCED™** additive enhances the natural co-solvent effect, increasing contaminant bioavailability to eliminate rebound out-front.
- **ERDENHANCED™** enhances cVOC biotransformation; realizing increases in daughter products:
  - 176% TCE
  - 452% cis-1,2-DCE, and
  - 191% VC by month 6
- **ERDENHANCED™** enhances reductive dechlorination of parent and daughter cVOCs realizing the following reductions from peak:
  - 81.8% TCE
  - 91.0% cis-1,2-DCE
  - 78.8% VC
- Proven Cost-Effective Strategy for **Sustainable** destruction of residual source mass contaminants



## TerraStryke® ERDENHANCED™

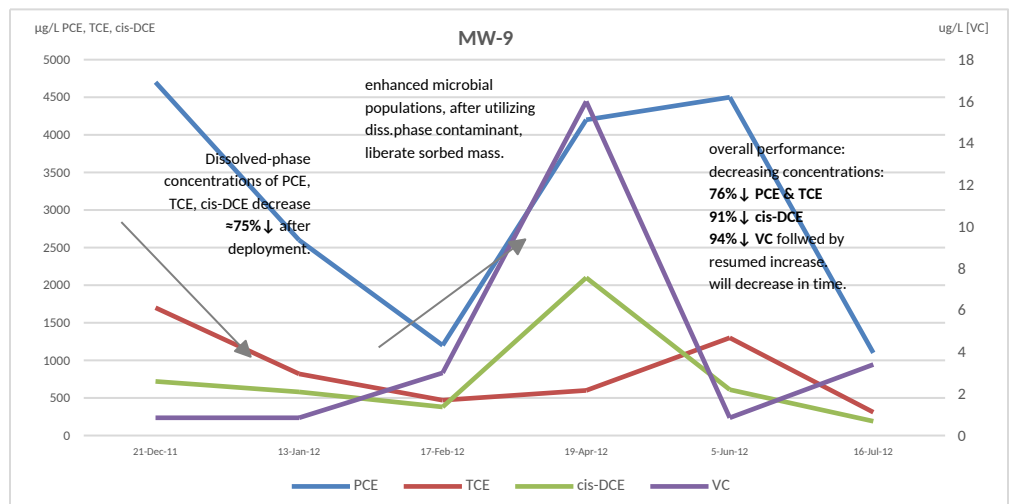
### In-Situ Passive Pilot Study - Chlorinated DNAPL Source Zone

#### Former Dry Cleaner; Stoney Creek, Ontario Canada

**Background:** Former operating dry cleaner with past use including use and storage of chlorinated volatile organic compounds (cVOCs). Specifically, Tetrachloroethylene (PCE) was used at the Site. Site characterization activities documented cVOC impacts to subsurface soils and groundwater. Previous remedial efforts proved ineffective and costly. **TerraStryke** proved biostimulation is a low-cost, low-impact solution to organically meet redevelopment objectives.

**Method:** 2011 City of Hamilton Ontario sponsored Pilot Study performed at Site to evaluate additive efficacy under actual Site biogeochemical conditions. Passive Release Sock (PRS) deployment units used to passively amend a 1-2 meter AOI about MW-9A over 7-month evaluation period which included 5 PRS replacement events. Baseline and performance groundwater monitoring, sampling and analytical testing completed concurrent with each replacement event. **ERDENHANCED™** efficacy was determined by comparing performance data to baseline data.

**Results:** 7-month evaluation produced the following results:



Specifically, in terms of total cVOC reductions; *after* a 275% increase in PCE due to additive enhanced microbial solubilization:

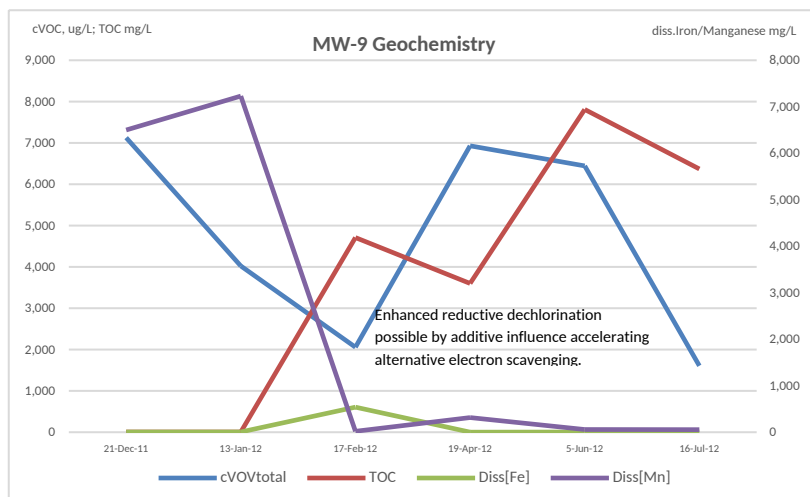
Immediately post deployment PCE, TCE, cis-DCE *decreased  $\approx 75\%$*   $\downarrow$  VC generated ( $\approx 191\%$   $\uparrow$ ) as parent and daughter cVOCs are bio-transformed; then,

Additive enhanced microbial populations liberated sorbed contaminant mass; seen as, Increases in all cVOC diss.phase concentrations. Then, at peak bioavailability:

**PCE and TCE decrease  $>76\%$**   $\downarrow$  in 2-months,

**cis-DCE decreased  $>91\%$**   $\downarrow$

**VC decreased  $>94\%$**   $\downarrow$



- TOC increased three Orders of Magnitude
- **77.5% reduction in total cVOCs**
- **99.1% decrease in dissolved iron**
- **99.2% decrease in dissolved manganese**
- Chloride increased three Orders of Magnitude

Consultant of record did not sample or analyze groundwater for either DO or ORP.

Ethene was recorded at Month-6 of the evaluation confirming complete biotransformation by additive enhanced indigenous microbial population.

Nitrates were not detected above laboratory reporting limits throughout the evaluation.

**TerraStryke®** biostimulation additive **ERDENHANCED™** enhances site biogeochemistry to facilitate the development of biofilm and the generation of volatile fatty acids (VFAs). These forces combine to assist the liberation of residual source mass contaminants; making them more bioavailable, effectively expediting the destruction of Site contaminants.

**TerraStryke® ERDENHANCED™** also expedites scavenging of alternative electron acceptors (TEAs) such as oxygen, nitrate, iron/manganese, and sulfate which typically limit cVOC dehalorespiration.

As with any in-situ project it is imperative that a vigorous groundwater monitoring and analytical testing program is performed to include, at a minimum, the parameters presented in the adjoining table.

**TerraStryke®** biostimulation additives facilitate the natural liberation and destruction of residual source mass, eliminating rebound upfront, to expedite the attainment of Site compliance.

**TerraStryke®** biostimulants are designed to be unbelievably soluble making them amendable to multiple types of deployment technologies, including direct gravity feed.

Parameter	Methodology	Container & Preservative	Notes
Methane	EPA Method 3C GC Screen	Glass 40-ml VOA	HCl Preserved
Nitrate, Nitrites	EPA Method 6010b	Plastic 250 ml	48-hr Holding Time
Sulfate	EPA Method 375.4	Plastic 250 ml	No Preservative
Chloride <sup>1</sup>	Not Applicable for TPHenhanced	Plastic 250 ml	No Preservative
Dissolved Manganese & Iron	ICP EPA Method 6010b	Plastic 500 ml	None, Lab Filtered
Total Organic Carbon (TOC)	TOC SM-5310B	Glass	H <sub>2</sub> SO <sub>4</sub> Preserved
pH	Field Monitored	NA	No Purge
Conductivity	Field Monitored	NA	No Purge
Dissolved Oxygen (DO)	Field Monitored	NA	No Purge
Oxidation-Reduction Potential (ORP)	Field Monitored	NA	No Purge

Required Testing Parameters for Each Sampling Event

**TerraStryke®** amendments are easy to handle, require less water, less pore space displacement, less site time, and less overall remedial costs; **TerraStryke®** amendments **maximize project margins while minimizing project impacts**.

**What does this mean to you?** Expedited site compliance without site encumbrances, costs, or annoyances. Our strategies sequester Greenhouse gasses during and beyond project completion. **TerraStryke®** Products LLC biostimulation additives are proven to maximize the performance of your remediation dollar. Our strategies biostimulation strategies don't 'trap-and-linger' contaminants; rather, we enhance the **destruction** of Site contaminants by indigenous microbes to realize Site compliance, with **less cost, less impacts, maximum performance**.