



Highlights

ERDENHANCED™ cVOC REMEDIATION VIA BIOSTIMULATION

safe, sustainable, effective

- Faster Kinetics
- Expedited Solubilization
- Increased Bioavailability
- Greater Longevity
- Complete Biotransformation

ERDENHANCED™ Superior Kinetics

complete biotransformation... faster

ERDENHANCED™ Sustainable

longterm reducing conditions

ERDENHANCED™ Biostimulates

native microbial populations

ERDENHANCED™ Cost-effective

lowering overall remediation costs

Call **TerraStryke®** NOW to realize safe, sustainable, and effective cVOC destruction!!

TerraStryke® ERDENHANCED®

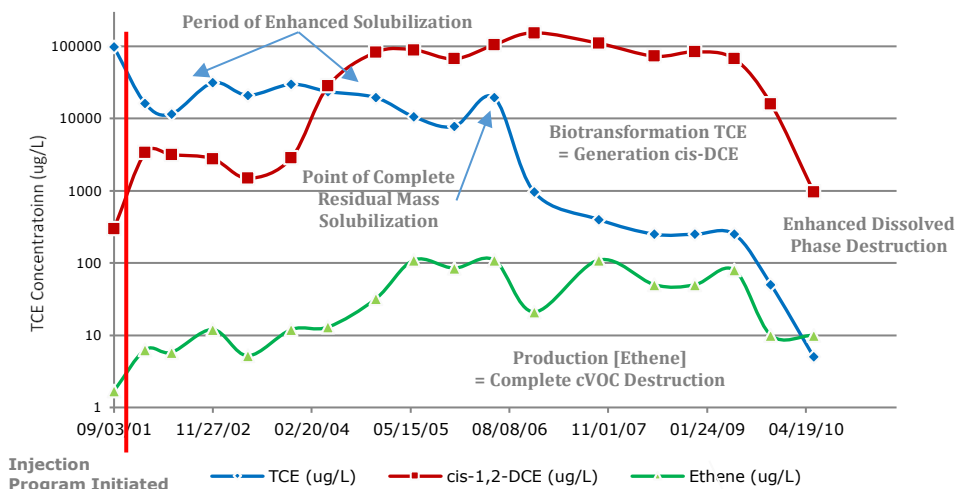
DNAPL Source Zone Green Remediation

Optics Manufacturing Facility, Lebanon, New Hampshire

BACKGROUND: Optical manufacturer desired *sustainable* low-impact groundwater solution. ERDENHANCED™ (2,600 pounds) deployed in 2001 via direct-push technology (26 nodes) into two, silty-clay, laterally continuous, hydraulically conductive source zones; baseline concentration of Trichloroethylene (TCE) ≈97,400 micrograms per liter (µg/L), roughly 9% solubility of TCE, indicating significant residual source mass in saturated soils as non-aqueous phase liquid (NAPL).

RESULTS: Post 6-months deployment, TCE decreased 86% followed by 4-5 years of enhanced solubilization of residual Parent Perchloroethylene (PCE) DNAPL into dissolved phase, recorded as asymptotic TCE. Concurrent with the period of expedited solubilization was increased cis-1,2-Dichloroethene (cis-1,2-DCE) and Ethene generation, indicating *complete* biotransformation and >99.9% reduction in PCE by 2010; additionally,

- CIS-1,2-DCE INCREASED THROUGH FIRST 6-YEARS OF PROGRAM.
- ETHENE INCREASED CONCURRENT WITH CIS-1,2-DCE BIOTRANSFORMATION.
- VINYL CHLORIDE WAS BELOW LABORATORY DETECTION LIMITS DURING ENTIRE PROGRAM.
- >99.99% REDUCTION IN PARENT-PARENTDAUGHTER MOLAR RATIO AT YEAR 7.
 - TCE DECREASED 99.99% TO <1 µg/L IN 2014.
- NO ADDITIONAL DEPLOYMENTS WITH **No** OBSERVED REBOUND IN 2014.



TerraStryke® ERDENHANCED™ is a Patented Carbon based biostimulation additive formulated with macro-micro nutrients to nourish **native bacteria** and enhance treatment zone geochemistry; realizing long-term reducing conditions supportive of safe, sustainable and cost-effective **complete biotransformation** after a *single* full-scale deployment event. ERDENHANCED™ expedites residual mass solubilization (additive enhanced **co-solvent** effect), increases contaminant bioavailability to eliminating rebound up-front and realize compliance objectives with less-risk, less-cost, less impact.

"Make Something Good Happen Today"

ERDENHANCED™ Patented Carbon-based biostimulation additive formulated with proprietary macro-micro nutrient blend designed to enhance native microbial populations and realize sustainable reducing conditions and complete chlorinated volatile organic contaminant (cVOC) destruction. The additive is proven effective against chlorinated alkanes and alkenes.

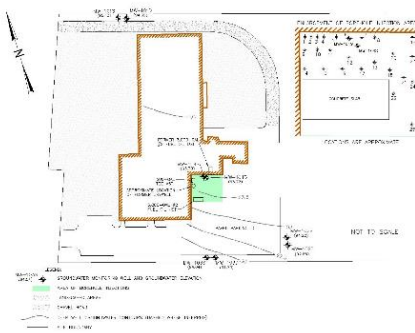
ERDENHANCED™ proven cost-effective remediation strategy for dissolved phase **and** residual source mass contaminants. Additive components expedite the attainment of reducing conditions, introducing and maximizing the recirculation of beneficial Carbon by leveraging and enhancing site biogeochemical conditions. Microbial utilization of additive components generates Volatile-Fatty-Acids (VFAs) which produce a 'co-solvent' effect, expediting residual DNAPL solubilization while maximizing contaminant bioavailability to ensure the realization of long-term compliance.

Project Summary: Source zone contamination was generated via poor site housekeeping of spent Trichloroethylene (TCE). To accomplish Site objectives, approximately 2,600 pounds of **ERDENHANCED™** was injected in 2001. **NO** additional additive was required as of 2014, 13-years post single full-scale deployment event in 2001. Subslab and subsurface injections into saturated soils via direct push technology (DPT). 25-injection nodes using ≤ 100 pounds additive/ ≤ 80 gallons water/node.

Shallow subsurface conditions include approx. 35-ft of silty clay with two impacted sand/silt lenses; one at approx. 18-25ft below ground surface (bgs), and a second at approx. 30-33ft bgs. Both lenses are laterally continuous and hydraulically conductive. The sand lenses were the targeted remediation zones. Baseline source area groundwater concentrations of parent TCE $\approx 100,000$ $\mu\text{g/L}$; total concentrations daughter products cis/trans-1,2-dichloroethene (cis-DCE), 1,1-DCE, and VC ≈ 400 $\mu\text{g/L}$. On a molar basis, baseline parent (PCE/TCE) product contaminants represented $\approx 99.6\%$ of total signature indicating little to no biotic activity. 6-yrs after a single deployment event of $< \$12,500$ additive, TCE concentrations decreased $> 99.99\%$, with similar daughter reductions, and compliance achieved.

TerraStryke® **ERDENHANCED™** attained project objectives after a single deployment event with minimal Site impacts. Non-compliant source area [cVOC] were reduced to $< 1,000$ $\mu\text{g/L}$ within 5-years; allowing seamless transition to enhanced monitored natural attenuation (MNA). Additive proved capable of biostimulating native microbial populations, expediting residual mass solubilization, realizing sustainable reducing conditions, and enhancing dissolved phase cVOC destruction.

ERDENHANCED™ leverages Mother Natures' momentum to realize safe, sustainable and cost-effective Site compliance.



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Please visit www.terrastryke.com for additional information