

TerraStryke® **TPHENHANCED™**

**Product Highlights**

**TPHENHANCED™** is a cost-effective residual source mass remediation strategy

**TPHENHANCED™** Enhances biodegradation of petroleum contaminants by native microbials *anaerobically*

**TPHENHANCED™** provides a metabolic analog to Oxygen (O<sub>2</sub>)

**TPHENHANCED™** represents a **Green** strategy that minimizes the impact of remediation.

**TPHENHANCED™** *cost-effectively* eliminates aboveground energy consuming, emissions generating equipment.

**TPHENHANCED™** leverages existing Site conditions to realize low-cost, low-risk contaminant destruction.

**TPHENHANCED™** is ideal for remote site locations with limited access and energy availability.



TerraStryke® **TPHENHANCED™** Residual Source Mass Remediation  
**Fire Training Center: Petroleum Hydrocarbons, Naphthalene, BTEX  
Former Chanute Air Force Base, Illinois USA**

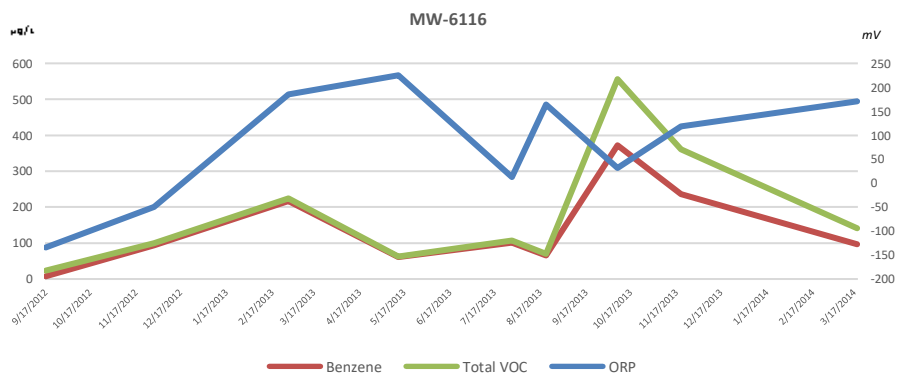
TerraStryke® Remediation Products LLC (TerraStryke®) develop and distribute biostimulation additives proven to cost-effectively enhance the destruction of dissolved phase, sorbed and/or residual source mass contaminants by native microbial populations.

TerraStryke® **TPHENHANCED™** enriches site geochemistry and native heterotrophic microbials to provide cost-effective contaminant degradation with minimal support equipment and site impact.

This case study summarizes product efficacy under full-scale application. The Site, a fire training ground, is located within a former US Air Force (USAF) facility. Smear zone soils and groundwater are adversely impacted by Volatile Organic Compound (VOC) and Petroleum Hydrocarbon (PHC) contaminants.

**RESULTS:** 12-months after **TPHENHANCED™** deployment, native microbials enhanced the solubilization of residual source mass contaminants. A greater-than 23-fold increase in dissolved phase total VOC concentrations was observed (from 23.3 µg/L to 556 µg/L at MW-6116). Five months later, total VOCs realized ≈ 75% reduction in bioavailable contaminants and >95% additive assimilation. Specifically, VOC concentrations within **TPHENHANCED™** amended groundwater realized:

- A near 30-fold increase in benzene, followed by >**71.8%** reduction
- A secondary 6-fold increase in benzene, followed by >**74.2%** reduction
- A near 10-fold increase in total VOCs followed by >**71.9%** reduction
- A secondary 9-fold increase in total VOCs followed by >**74.7%** reduction



**TPHENHANCED™** nourishes native microbials, enhancing the production of biosurfactants, increasing contaminant bioavailability, and long-term achievement of site remediation goals.

**TPHENHANCED™** process is a cost-effective long-term source mass remediation strategy eliminating typical above ground, energy-consuming, emissions-generating equipment.

Ideal for fixed, remote, and legacy site locations, **TPHENHANCED™** provides a low-cost low-impact process to address soil and/or groundwater environmental management concerns.



TerraStryke® Remediation Products LLC

P.O. Box 254  
Andover, NH 03216

[www.TerraStryke.com](http://www.TerraStryke.com)

**BACKGROUND:** Prior to treatment, soils adjacent to the proposed treatment zones had been excavated to remove smear zone soils contaminated with residual (sorbed and stringer) contaminant source mass. Excavated soils were reportedly removed to immediately below the soil/water interface. Three distinct treatment areas resulted; each with an assumed 10-foot thick groundwater impact zone, and surface areas ranging from 3,000 square feet (s.f.) to 17,400 s.f. The treatment areas had within them one groundwater monitoring well each, for the two smaller areas, and three monitoring wells within the larger area. Monitoring well MW-6116, located within the larger treatment area, is generally downgradient from the majority of the treated areas.

#### **OPERATIONS:**

Additive deployment was performed using Direct Push Technology (DPT) with site costs approximating \$10-\$15 per ton. Soils within the treatment zones had not been excavated, and it was later discovered that TOC within the smear zone was 4-8 times that reported as baseline. This increase in source mass contaminants increased additive load demand and, extended compliance timelines; however, without complete residual source mass contaminant removal, compliance goals will be forfeited over time. The **TPHENHANCED™** process proved a cost-effective strategy to passive-aggressively enhance contaminant solubilization, bioavailability, and degradation.

TerraStryke® **TPHENHANCED™** provide native microbials an analog to Oxygen (O<sub>2</sub>), allowing for the cost-effective passive-aggressive destruction of VOC/PHC contaminants, with less-cost and less-impact. The **TPHENHANCED™** process eliminates costly, long-term above-ground, energy-consuming and emissions-generating support equipment. **TPHENHANCED™** is proven effective in terms of cost and performance, allowing the realization of long-term compliance goals by working with Mother Nature, not against.

**To determine if our additive is appropriate for an environmental management concern at your site please consider our low-cost, low-risk pilot evaluation process described below**

#### **PRODUCT EVALUATION PROCESS:**

TerraStryke® has established a low-cost, low-risk Pilot Study program to determine additive efficacy under actual site biogeochemical conditions, eliminating the costly 'jar effect' and providing potential end-users a representative, yet conservative, 'Go-No-Go' evaluation. The Pilot Study confirms amendment efficacy and facilitates more accurate additive loading requirements. TerraStryke® on-site evaluation provides insight into full-scale remedial expectations allowing all Stakeholders a level of assurance with full-scale implementation, while avoiding costly mistakes.

#### **DEPLOYMENT PROCEDURES**

TerraStryke® evaluations are performed *in-situ*, under actual site biogeochemical conditions, using Passive Release Sock (PRS) deployment units. Additive filled PRS units fit within 2-inch diameter groundwater monitoring well(s) and remain suspended/undisturbed in the test well screened interval for a prescribed period of time. Ideally the test well is proximate to source zone contaminants. At scheduled intervals, PRS units are replaced and performance groundwater monitoring and sampling is performed. Average evaluations require up to 4-5 deployment/replacement events.

#### **LENGTH OF EVALUATION**

TerraStryke® evaluations at petroleum hydrocarbon sites require up to 6-9 weeks to complete; whereas, chlorinated volatile organic compound (cVOC) sites require 6-9 months for completion. A minimum 50% Performance Goal is established for the evaluation to be considered a success and justify future discussions regarding full-scale additive deployment strategies. Upon the completion of each evaluation, TerraStryke® provides a Technical Memorandum discussing pertinent results relative to established Performance Goal(s), estimated costs, and remediation time-lines. Please note, PRS deployment units are for efficacy evaluation only and are not designed for use under full-scale treatment operations.