TerraStryke® **Products LLC**
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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_2)

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

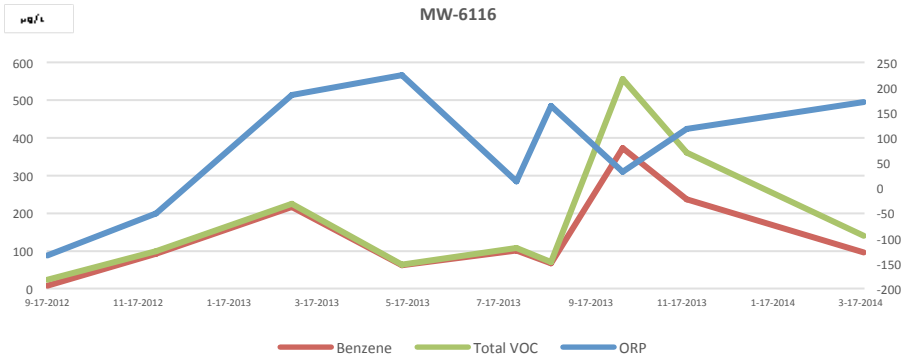
Fire Training Center: Petroleum Hydrocarbons, Naphthalene, BTEX Former Chanute Air Force Base, Illinois USA

TerraStryke® Remediation Products LLC (*TerraStryke*®) develop and distribute biostimulation additives proven to cost-effectively maximize the destruction of dissolved phase, sorbed and/or residual source mass contaminants by native microbial consortiums, harnessing 4-billion years of Mother Nature's experience, allowing microbial communities to work in collectively, increasing the bulk fraction of degraders; i.e. greater microbial performance.

SITE: Former fire training ground located within US Air Force (USAF) facility. Past use resulted in Volatile Organic Compound (VOC) and Petroleum Hydrocarbon (PHC) impacted smear zone and groundwater.

RESULTS: 12-months after **TPHENHANCED™** deployment additive enhanced microbial populations expedited the solubilization of residual source mass contaminants; realizing a greater-than 23-fold increase in dissolved-phase concentrations VOCs at MW-6116 (23.3 µg/L to 556 µg/L). Five months after reaching peak bioavailability, total VOCs decreased ≈75% and ≈95% additive was apparently assimilated. Specifically, VOC concentrations within **TPHENHANCED™** amended groundwater realized:

- 30-fold increase [Benzene], followed by **>71.8%** reduction; solubilization, destruction.
- A secondary 6-fold increase in benzene, followed by an additional **>74.2%** reduction
- A near 10-fold increase in [total VOCs] followed by **>71.9%** reduction; and similarly,
- A secondary 9-fold increase in total VOCs followed by an additional **>74.7%** reduction



Continued reductions were observed, and had the program continued, like similar sites >95% reductions in amended areas would be realized. **TPHENHANCED™** components allow native microbials to enhance the production of natural biosurfactants to help ensure

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attainment of your long-term remediation goals. Our products 'get-the-rebound' out up front, increasing performance while decreasing overall remediation costs and impacts.

TPHENHANCED™: a cost-effective strategy for long-term destruction of dissolved-phased and residual source mass contaminants; sustainably eliminating above ground energy-consuming and emissions-generating equipment, allowing maximum performance with minimal impact.

SITE HISTORY: Prior to **TPH**ENHANCED™ application, assumed source zone soils were excavated to immediately below the groundwater/soil interface to remove saturated smear zone (sorbed and stringer) contaminant source mass. Biostimulation deployments were performed adjacent to the excavated zones, in areas assumed free of residual mass. A total of three amended zones were established; each with an assumed 10-foot thick groundwater impact zone, and [BTEX] ranging from 7.0 to 11.0 mg/L. Two amended zones were roughly 3,000 square feet (s.f.), the third approximating 17,400 s.f.. Each of the smaller amending zones had one monitoring well, three monitoring wells are located within the larger. The most downgradient from all 3 amended zones was MW-6116, located within the larger treatment area, generally downgradient from the two smaller areas.

OPERATIONS:

Additive deployment was performed using Direct Push Technology (DPT). Due to the additives ability to enhance microbial expedition of residual mass solubilization, it was realized that saturated soils within the amended zones had [BTEX] and [TOC] within the smear zone 4-8x times that reported as baseline, from which loading was established. This increase in source mass contaminants increased additive load demand and extended projected timelines; which forced the time-based contract to cease further biostimulation and revert to a costly hog-and-haul project. **TPH**ENHANCED™ proved a cost-effective strategy to realize long-term compliance goals while minimizing site impact by maximizing microbial abilities to enhance contaminant solubilization, bioavailability, and degradation.

TerraStryke® **TPH**ENHANCED™ provide native microbials an analog to Oxygen (O_2), enhancing respiration, under anaerobic conditions. The **TPH**ENHANCED™ process eliminates costly, long-term above-ground, energy-consuming and emissions-generating support equipment. **TPH**ENHANCED™ is proven effective in terms of cost and performance, allowing for 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 allow potential clients the opportunity to evaluate additive efficacy under actual site biogeochemical conditions, providing potential end-users a representative 'Go-No-Go' evaluation process. The study confirms amendment efficacy and facilitates a more accurate loading estimate. *TerraStryke*® on-site evaluations provide insight into full-scale remedial expectations allowing Stakeholders a level of assurance prior to full-scale implementation.

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), remain suspended/undisturbed for approximately 2-3 weeks. Ideally, test wells are best located proximate to source zone contaminants and, groundwater monitoring and sampling for analytical testing is performed concurrent with each prescribed PRS replacement event.

Typical evaluations require 5-6 replacement events. Upon the completion of each evaluation *TerraStryke*® provides a Technical Memorandum discussing pertinent results relative to established Performance Goal(s), estimated costs, and/or remediation timelines. Please note: PRS deployment units are designed to determine additive efficacy *only*, amending a very limited area of an impact zone located within the casing volume of a test well, and as such, are not designed for use under full-scale treatment operations.

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Contact us today. Let us help you bring the ground back to life, maximizing your remediation dollar, realizing long-term objectives.