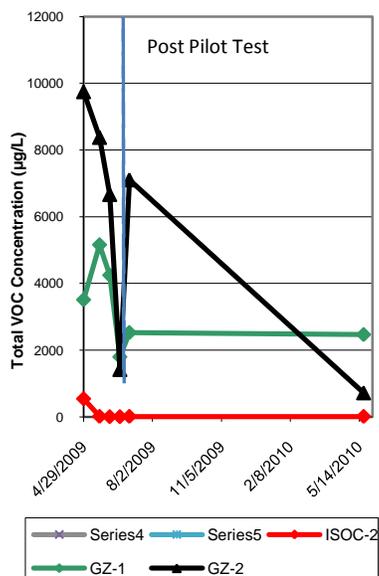


## Project Highlights

- **TPHENHANCED™** demonstrated ability to remediate recalcitrant petroleum compounds in saturated soils/groundwater.
- **TPHENHANCED™** demonstrated 100% reduction in [BTEX] in test well with minimal rebound 10 months later.
- **TPHENHANCED™** is a Green and sustainable option, proven to minimize environmental impact and save Client costs.
- **TPHENHANCED™** provides expedited site compliance, reduced monitoring costs, reduced long-term liabilities, and increased property values.
- **TPHENHANCED™** represents a cost-effective, passive-aggressive process that works with Mother Nature, not against.

Figure 1 - Total VOCs vs. Time



## Residual Petroleum Remediation Home Heating Oil Fuel Distribution Facility Peterborough, New Hampshire

Plant Products Co. Ltd. (PPCL) manufactures and distributes BioStryke® remedial products, innovative green products designed to biostimulates existing site conditions to expedite site compliance while minimizing environmental and cost impacts. BioStryke® **TPHENHANCED™** leverages existing *anaerobic* conditions and is proven to destroy dissolved, sorbed, and residual source mass contaminants in groundwater and saturated soils; without the use of above-ground energy consuming, and emissions generating equipment. BioStryke® remedial products cost-effectively expedite site compliance with less environmental impact, working with Mother Nature, not against Her.

The site location consisted of a former gasoline service station in New Hampshire where an unauthorized release of gasoline from an underground storage tank (UST) system resulted in the adverse impact to soil and groundwater. In 2003, groundwater fuel hydrocarbon concentrations exceeded regulatory standards and due to local zoning limitations, an In-Situ Oxygen Curtain™ (iSOC™) program was implemented; however, the system proved ineffective and was abandoned.

Consequently, a **TPHENHANCED™** Pilot Study was performed under New Hampshire Department of Environmental Services (NHDES) overview. The study consisted of a 7-week evaluation period designed to quantify the ability of **TPHENHANCED™** to significantly increase the rate of biodegradation and passive-aggressively destroy petroleum-related recalcitrant hydrocarbons in saturated zone soil and groundwater. During the **TPHENHANCED™** Pilot Study, total volatile organic compound (VOC) concentrations decreased from 542.5 micrograms per liter (µg/L) to non-detectable – a **100-percent reduction**. Furthermore, ≈ 1-year later, total [VOC] remained minimal and in compliance in the test area with **no** presence of amendment. In summary, the results indicate the introduction of **TPHENHANCED™** resulted in the 100% reduction in gross [VOC] concentrations over the 7-week duration of the Pilot Study.

**TPHENHANCED™** is sustainable, typically requiring a single injection/deployment event to demonstrate cost-effective in-situ green remediation: transforming petroleum constituents to harmless byproducts, minimizing environmental impacts, minimizing excavation and off-site disposal costs, and eliminating the long-term use of power-consuming and carbon dioxide-emitting engines. By leveraging the momentum nature provides, **TPHENHANCED™** saves time, effort, and costs by avoiding the expenses and technical limitations associated with delivering oxygen to the subsurface. Rather, by leveraging the anaerobic, **TPHENHANCED™** enhances existing site conditions allowing native microflora to expedite the biological degradation of source mass contaminants.

Prior to the implementation of the Pilot Study, baseline groundwater monitoring and sampling was performed in April 2009, immediately followed by the deployment of **TPHENHANCED™** using a Passive Release Sock (PRS) deployment unit. The PRS is designed to fit into an existing 2-inch groundwater monitoring well. For the purpose of the evaluation, the PRS containing **TPHENHANCED™** was deployed in monitoring well identified as ISOC-2. Monitoring wells are also located downgradient to the test well (ISOC-2) and are identified as GZ-1 and GZ-2.

In May 2009, post-deployment performance monitoring was performed with groundwater samples collected from ISOC-2 and additional samples collected from downgradient performance wells GZ-1 and GZ-2. Specifically, four rounds of post-deployment performance monitoring and sampling were performed to include wells ISOC-2, GZ-1 and GZ-2. The dates of implementation were: May 21, 2009; June 4, 2009; June 18, 2009; and, July 1, 2009.

During the June 18, 2009 sampling round, the PRS deployed in well ISOC-2 was removed. Therefore, the July 1, 2009 monitoring period represents groundwater conditions *after* a minimum 2-week stabilization period during which no **TPHENHANCED™** was introduced to the groundwater. Figure 1 on the previous page depicts total BTEX concentrations during the **TPHENHANCED™** Pilot Study period. The red line depicted ISOC-2 represents a decrease in [BTEX] concentrations over time in response to **TPHENHANCED™** PRS deployment.

Results of groundwater performance monitoring, and analytical testing, indicate the introduction of **TPHENHANCED™** resulted in the 100% reduction in gross [VOC] concentrations in the AOI of ISOC-2 over the 7-week duration of the Pilot Study. Furthermore, results trend lines for GZ-1 (located ≈5 feet downgradient of ISOC-2) initially reflect a spiked increase in [BTEX] in response to PRS deployment, after which, decreasing concentrations were observed with time. Additionally, trend lines GZ-2 well (located ≈10 feet downgradient of ISOC-2) reflects a steady decrease in [BTEX] over time, also in response to PRS deployment. The initial increase observed in GZ-1 is anticipated as **TPHENHANCED™** creates a significant concentration gradient between dissolved solute and sorbed/residual source mass contaminants; resulting in increased rates of contaminant flux, subsequently increasing bioavailability, contaminant destruction, and the elimination of rebound.

Groundwater samples collected approximately 2 weeks after the PRS was removed (June 2009) indicated a slight rebound in total BTEX in the two downgradient wells (GZ-1 and GZ-2); however, samples collected 10 months later (May 2010); prior to the performance of a NHDES approved expanded pilot study, clearly indicate the additive program enhanced the biodegradation and destruction of dissolved phase, sorbed phase, and residual source mass petroleum hydrocarbons, minimizing the BTEX rebound proximate to ISOC-2, as shown on Figure 1.