

New York Brownfield Achieves Site Closure

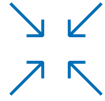
In Situ Remedy Replaces Pump-and-Treat and
Achieves TCE/PCE Cleanup Targets at Former
Metals Manufacturing Site



Highlights



Site Type:
Industrial



Project Driver:
Offsite plume migration



Contaminants:
Chlorinated solvents, mostly PCE and TCE, 500 µg/L maximum



Geology:
Fine sand and silt



Treatment:
Sorption-enhanced reductive dechlorination



Technologies:
PlumeStop, Hydrogen Release Compound, Bio-Dechlor INOCULUM Plus



A New Approach:
In situ remedy enables shutdown of mechanical treatment system.



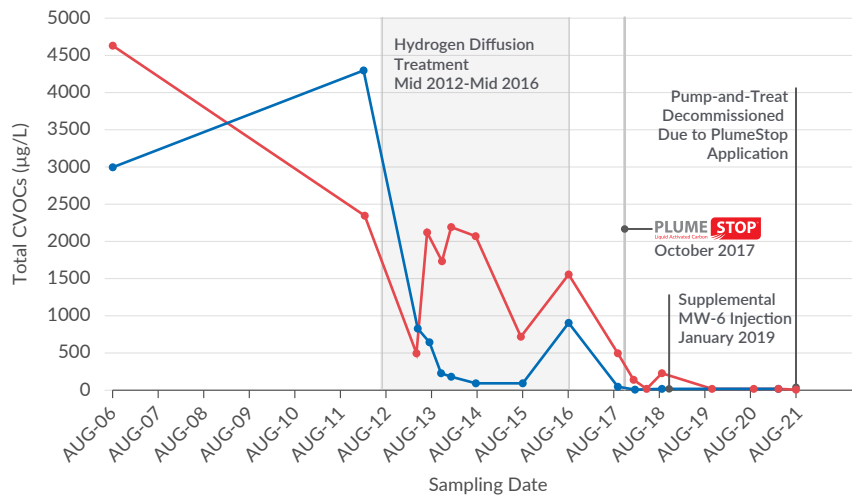
Site Closure Achieved
NYSDC approved discontinuing further monitoring in August 2021

Summary

A former metals manufacturing plant in New York State had previously used pump-and-treat and gas diffusion approaches to treat chlorinated solvents in groundwater. Keeping the system operational became problematic and costly. As a result, the remediation strategy was revised to an *in situ* approach and PlumeStop was injected along with electron donor and bioaugmentation amendments to facilitate sorption-enhanced reductive dechlorination. The *in situ* remedy enabled the mechanical treatment system to be shut down and achieved site closure by reducing chlorinated solvents from 500 micrograms per liter (µg/L) to below 1 µg/L for six consecutive quarters.

Results

- ***In Situ* approach replaces pump-and-treat system, achieves closure**
- **Concentrations reduced from 500 µg/L to below 1 µg/L for 6 consecutive quarters**





Background

Cleanup Targets Unmet with Pump-and-Treat System Leading to Remedial Strategy Change

The site was a former metals manufacturing facility in upstate New York that produced hardware and decorative metal products. Industrial metal processing, including stamping, cutting, degreasing, and electroplating operations occurred at the site for nearly a century. Chlorinated volatile organic compounds (CVOCs) from the plating operations, predominantly comprised of tetrachloroethene (PCE) and trichloroethene (TCE), impacted the shallow groundwater, forming a narrow contaminant plume migrating offsite.

In 2002, the site owner entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) to address these impacts and forge a path to site closure through NYSDEC's Voluntary Cleanup Program.

Interim remedial measures (IRM) were undertaken beginning in 2004. The IRM entailed installing building sub-slab-depressurization controls and a groundwater recovery and pre-treatment system, utilizing a low-profile air stripper. This pump-and-treat system recovered over 30 million gallons of CVOC-impacted groundwater near-continuously until 2018. The system was expanded and modified in 2012 to incorporate hydrogen gas infusion treatment and reinjection.

The groundwater pump-and-treat system significantly reduced CVOC concentrations in groundwater. However, after a few years, the reinjection wells became clogged and no longer accepted water. This required modification of the approach.

The *ex situ* pump-and-treat remedy maintained plume control. However, to continue this approach would have required well replacement. Additionally, these systems are well known to reach an asymptotic boundary condition above the low, part-per-billion cleanup targets for CVOCs and are prone to rebound once shut down. Such was the case at the site.

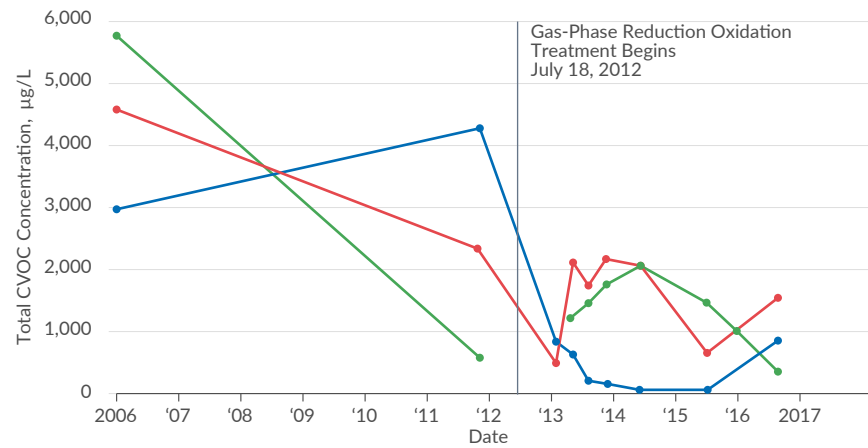
In response to these conditions, Roux (formerly Benchmark), a leading engineering and redevelopment consulting company, quickly adapted the remedial strategy, favoring an *in situ* approach to achieve the project objectives and facilitate site closure.

Figure 1

Pump-and-Treat Performance Over 10-Year Period

Chart showing Total CVOCs in Wells MW-5, MW-6, MW-9, over 10-year period from 2006 to 2016. Hydrogen diffusion treatment begins July 2012 and stops in 2016 due to well fouling.

- MW-5
- MW-6
- MW-9



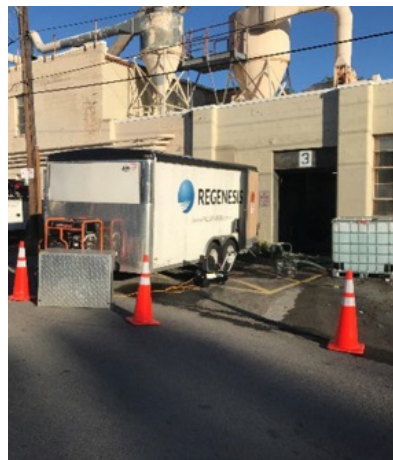


PlumeStop *In Situ* Remediation

By Adapting the Treatment Approach to Improve Performance, Substantial Cost and Energy Savings are Realized

After evaluating remedial alternatives, Roux (formerly Benchmark) proposed a new Corrective Action Plan (CAP), specifying the *in situ* application of PlumeStop® colloidal activated carbon, Hydrogen Release Compound® (HRC), a controlled-release electron donor, and Bio-Dechlor INOCULUM Plus® (BDI Plus), a bioaugmentation culture containing *Dehalococcoides sp.* and other beneficial microbes.

PlumeStop remediation treatments rely on natural groundwater advection to move the CVOCs through a treatment zone. The CVOCs are immediately sorbed onto an immense surface of activated carbon which coats the aquifer materials. They are subsequently biologically transformed to non-toxic end products via reductive dechlorination from the co-applied HRC and BDI Plus. Together this passive treatment process is referred to as sorption-enhanced reductive dechlorination.



PlumeStop Injection Trailer and Mixing Setup



PlumeStop Injected at Multiple Points Simultaneously

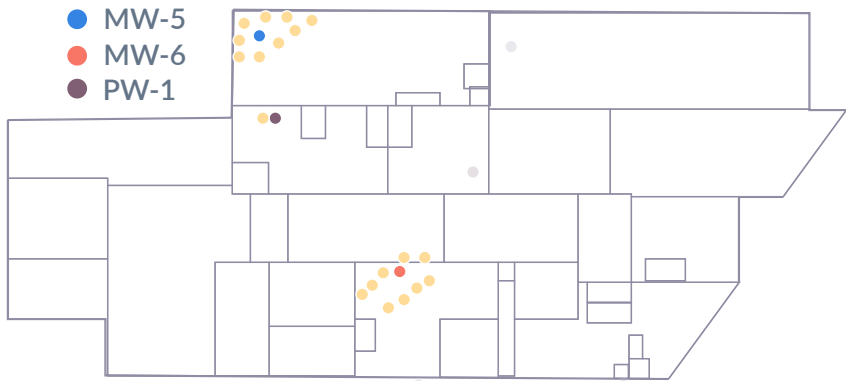
Timeline

- **C. 1900 - 1998**
Industrial manufacturing of metals, hardware, and decorative metals
- **2000-2002**
Phase I and Phase II investigations identify CVOCs in groundwater
- **2002**
Site owner enters into voluntary cleanup agreement with NYSDEC
- **2004**
Interim remedial measures installed - building sub-slab depressurization and groundwater pump-and-treat
- **2012**
Remediation expanded to include additional pumping well and hydrogen gas diffusion treatment system
- **2016**
Reinjection wells become clogged, Roux (formerly Benchmark) develops new corrective action plan specifying PlumeStop *in situ* remedy
- **2017**
PlumeStop, HRC, and BDI Plus injected, performance monitoring begins
- **2018**
Groundwater pump-and-treat system shut off
- **2019**
Limited supplemental application of PlumeStop at source area
- **2020**
Groundwater pump-and-treat system decommissioned
- **2021**
Site closure - NYSDEC approves discontinuing further monitoring following 6 consecutive clean sampling events below or near detection levels

Compared to *ex situ* pump-and-treat approaches, *in situ* PlumeStop treatments produce no greenhouse gas emissions or disposal waste, do not consume energy, generate no noise pollution, require minimal infrastructure (i.e., only the performance monitoring wells) and no post-installation operation. Due to these factors, the PlumeStop approach results in substantial project cost savings over the lifetime of the project.

In addition to its proven performance in fully remediating CVOCs at over 1,000 sites worldwide, these green and sustainability remediation (GSR) benefits were a factor in selecting the PlumeStop *in situ* remedy for the CAP, completed in 2016.

Following CAP approval, the PlumeStop, HRC, and BDI Plus injection was completed in 2017, with a limited supplemental injection completed in 2019. The pump-and-treat system was discontinued in 2018.



Site Plan Depicting PlumeStop Treatment Areas. PlumeStop was injected in two treatment zones with 9 points surrounding MW-5 and MW-6, as well as directly into PW-1.

Results

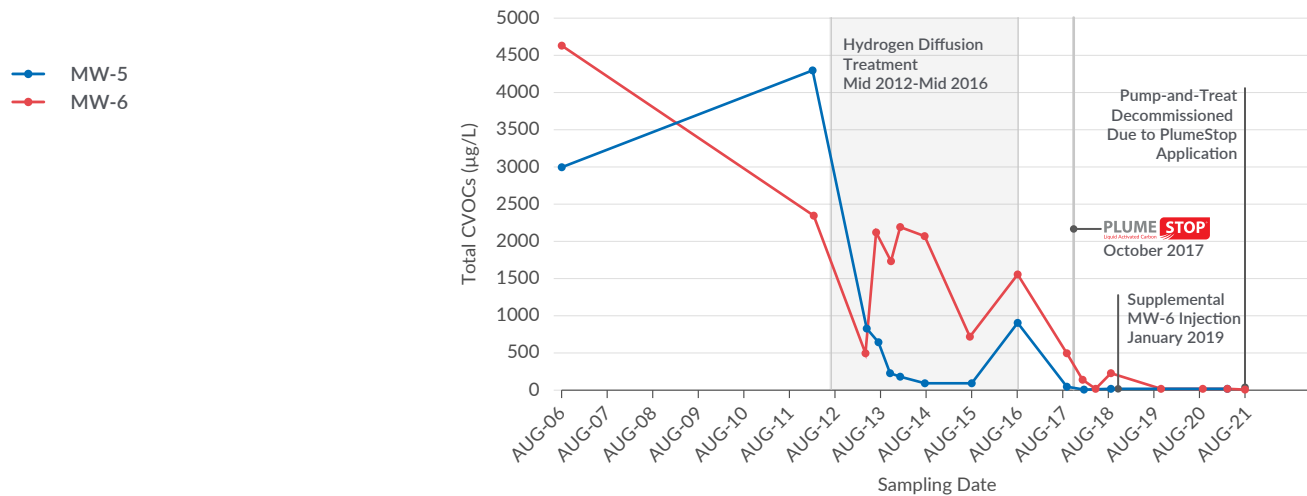
Following Six Consecutive Monitoring Events Meeting Regulatory Requirements, Site Achieves Closure

Performance monitoring was initiated soon after the PlumeStop injection and continued through June 2021. Following the application, CVOC concentrations were reduced from as high as 500 micrograms per liter ($\mu\text{g/L}$) at baseline to below one $\mu\text{g/L}$ in the source area and downgradient performance monitoring wells for six consecutive sampling events.

✔ Based on these results, the pump-and-treat system was decommissioned in 2020, and the NYSDEC granted the site closure in August 2021.

Figure 2

Trend in Chlorinated VOC Concentrations

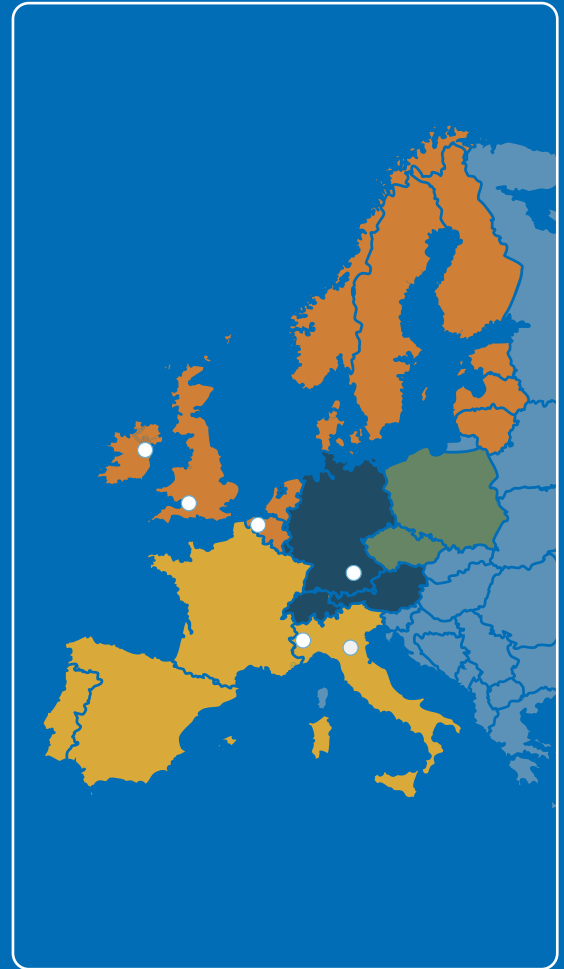
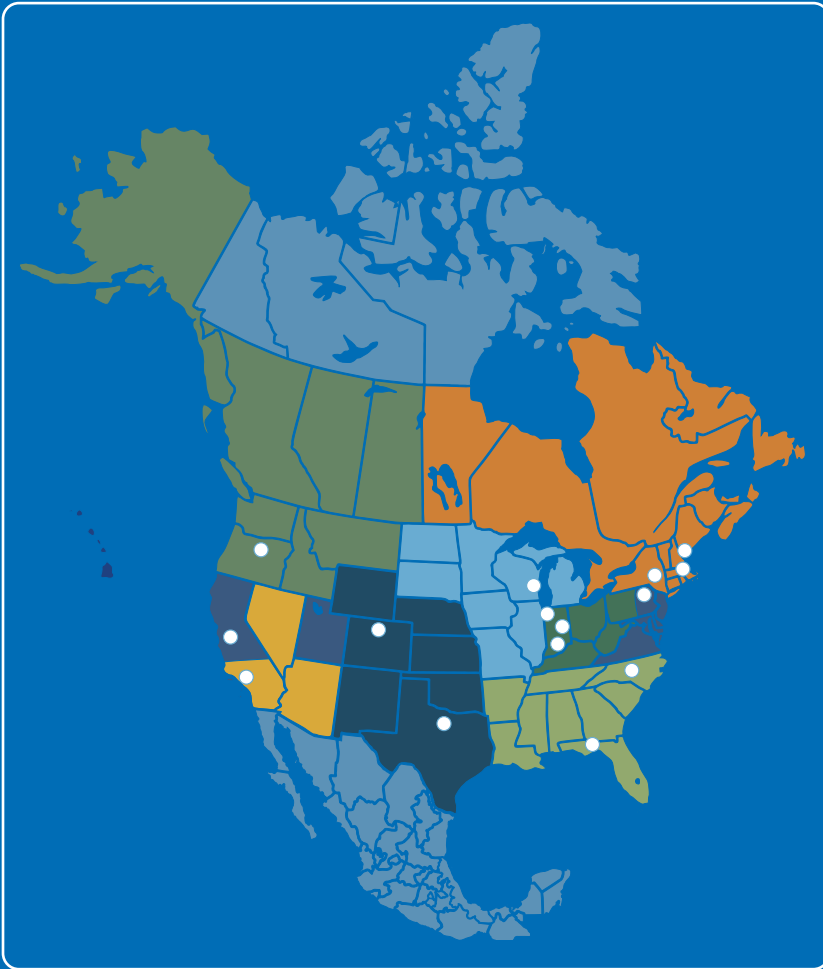


“By not having to operate and maintain the pump-and-treat system, substantial energy and cost savings were realized in this period.”

Switching to a PlumeStop *in situ* approach in 2017, combined with the system shutdown in 2018, saved an additional six million gallons of groundwater recovery (approximate) through August 2021, when the site closure was obtained. By not having to operate and maintain the pump-and-treat system, substantial energy and cost savings were realized in this period. However, the real cost savings were certainly much greater as the PlumeStop treatment reduced the CVOC concentrations below drinking water maximum contaminant levels much more efficiently than is possible with pump-and-treat.

✔ Roux’s agile site management, making the switch from an *ex situ* to a PlumeStop *in situ* approach, saved time and money for their client.

We're Ready to Help You Find the Right Solution for Your Site



Global Headquarters

1011 Calle Sombra
San Clemente, CA 92673 USA

Ph: (949) 366-8000
Fax: (949) 366-8090

Europe

Bath, United Kingdom
Ph: +44 (0) 1225 61 81 61

Dublin, Ireland
Ph: +353 (0) 9059 663

Torino, Italia
Ph: +39 338 8717925

Ieper, België
Ph: +32 (0) 57 35 97 28



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