

Large-Scale Superfund Site Completed Ahead of Schedule

PlumeStop Application Displaces Pump & Treat System and Eliminates Risk to Community's Drinking Water

REGENES



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REGENESIS Remediation Services (RRS) completed a large-scale PlumeStop application to eliminate the risk of exposure to chlorinated solvents at a large Federally operated Superfund site. While meeting the site's high-level security clearance to perform the work, the RRS team expertly managed the complex application at this heterogenous site, incorporating multiple treatment zones and amendment formulations. In the end, 224,800 lbs of PlumeStop[®] colloidal activated carbon were safely injected into the defined treatment zones. The PlumeStop treatment effectively eliminates chlorinated solvents in groundwater, preventing plume migration and protecting nearby community drinking water wells.





Background

Following Years of Pump & Treat, A New Remedy is Needed

A large, secure government facility in the Mid-Atlantic region was designated a Superfund site under the Federal Safe Drinking Water Act (SDWA) after chlorinated solvents and other volatile materials were spilled in a high-security area, formerly used as a salvage yard. These chlorinated volatile organic compounds (CVOCs) leached into the groundwater, creating a large plume in the sandy aquifer threatening to reach the surrounding community's water supply. For years, a groundwater pump & treat (P&T) system was used to halt plume migration. Although the P&T system reduced contaminant concentrations over time, the approach was inefficient and costly to operate and maintain.



TRC, a leading global environmental consulting firm working with the responsible party, completed environmental investigations detailing the chlorinated solvent impacts and the extent of the contaminant plumes. TRC's role on this project was to specify and recommend a remedial approach to treat the contaminants and prevent the groundwater plume's migration offsite more efficiently.

amentum >

Amentum, a leading American governmental and commercial services contractor, is the responsible party's contractor. Amentum has worked with the client at this site for years, providing oversight and management of their contracting partners. The project's sensitive nature required an enhanced awareness of health, safety, and security issues and seamless coordination between RRS, Amentum, and their client.



"What's really challenging about this site is that the contaminants are widespread, and we have very low targets."

> — Maureen Dooley Vice President Industrial Sector REGENESIS

Remedy Selection

Pilot Test Shows PlumeStop to be Far More Effective than Alternatives

TRC specified a series of field-scale pilot studies to test the efficacy of *in situ* remediation approaches to achieve the remedial objectives, which included reducing concentrations in the plume, preventing plume migration, and ultimately, attaining a no further action (NFA) status for the site. The pilot test program included two *in situ* chemical oxidation (ISCO) technologies: Perozone and metal-activated sodium persulfate (MASP).

In a third pilot study area, a sorption-enhanced natural attenuation approach was tested using PlumeStop to reduce chlorinated solvent concentrations below the stringent action levels. Specifically, PCE and 1,1-DCE needed to be reduced and maintained below five parts per billion. By binding contaminants to the aquifer matrix for decades, the remedy would effectively eliminate the contaminants from groundwater and allow natural biodegradation of the contaminants on PlumeStop's vast sorption surface, approximated to be 100 acres per pound.

The pilot test results showed PlumeStop to be far more effective at eliminating the chlorinated solvents from groundwater compared to the ISCO approaches. These results led the project team to select PlumeStop for the full-scale remediation at the site.





Remedial Design

Heterogenous Conditions Drive Design Complexity

"Where these injections are happening, the subsurface soils are complicated. They're pretty heterogenous, with a lot of clay content, more so than the rest of the site. The various soil types are definitely a consideration for the injection media and design.

> – Chelsea Headley Project Geologist Amentum

Following the selection of PlumeStop for site cleanup, the team collaborated with REGENESIS to prepare an application design. The design specified a direct push approach for PlumeStop injection. Ten different treatment zones, forming a complex array of grids and permeable reactive barriers, were used to achieve the optimal spatial distribution of PlumeStop across the identified mass flux zones. The vertical injection intervals were varied across the treatment zones to sufficiently cover these mass flux zones, ranging from 5 feet to 50 feet in thickness.

Several challenges were addressed to enable the PlumeStop remedy to be successful at this site. These challenges included a widespread and diffuse contaminant plume, low cleanup goals, and heterogenous soil conditions. Moreover, the predominant soil type at several treatment zone locations was clay—notorious for restricting and complicating many *in situ* injections. PlumeStop's unique colloidal activated carbon form allows it to easily migrate through soil pores, even the relatively tiny soil pores in clays.



Injection Points

Central Treatment Area



Injection Point Legend

Central Treatment Area

Symbol	Color	Function	Quantity	Injection Depths (ft. bgs.)
•	Light Blue	Downgradient Barrier	6	13.5 to 39.5
•	Medium Blue	Downgradient Barrier	8	29.5 to 34.5
•	Purple	Downgradient Barrier	12	13.5 to 34.5
•	Light Green	Downgradient Barrier	6	13.5 to 29.5
•	Pink	Downgradient Barrier	19	34.5 to 39.5
•	Red	Main Grid	155	Varies as noted
•	Dark Green	Internal Barrier	40	Varies as noted



Injection Points

Northwest Treatment Area



Injection Point Legend

Northwest Treatment Area

Symbol	Color	Function	Quantity	Injection Depths (ft. bgs.)
•	Light Blue	Main Grid	163	14 to 29
•	Light Green	Bridge Grid	31	14 to 39
•	Dark Green	Barrier/Pilot	78	Varies as noted



Careful Monitoring of Injections Allows for Optimization of Remedial Application

"We've made significant changes throughout the project. Our observations have allowed us to fine-tune the theoretical design that we've now implemented in the field."

– Will Clogan, Project Manager II REGENESIS Remediation Services

With decades of injection experience, RRS scientists use real-world field observations of product distribution to optimize the remedial application in the field. Remedial optimization is critical, especially at sites with heterogenous soils, where the available porosity in a treatment zone - a primary control for an amendment's lateral distribution - can't be easily modeled on the desktop. With PlumeStop, our experts may modify injection point spacing or amendment concentrations to ensure no gaps in coverage throughout the treatment zone. Our team is highly trained in remedial optimization best practices, and our commitment to remedial performance is unmatched in the industry.

Application

Success was Dependent on a High Degree of Quality Control and Detailed Planning and Tracking

RRS conducted the PlumeStop application over a six month period. Due to the complexity of the design, the application required detailed planning and meticulous tracking to ensure proper PlumeStop dosing at each treatment area.

RRS controlled the injection flow rates to maintain low injection pressures throughout the application. In doing so, RRS ensured the amendment's placement as intended, minimizing the potential for PlumeStop 'short circuiting' to the surface.

"This is a more complicated design. We have a lot of different concentrations, a lot of different depths, and they're all intermixed."

– Josh Grasser, Senior Project Supervisor REGENESIS Remediation Services

RRS validated PlumeStop distribution in the subsurface by installing 15 temporary piezometers, collecting 25 soil cores, and observing the treatment area monitoring wells. The results of the distribution testing confirmed adequate PlumeStop coverage at most of the treatment areas. However, based on testing and field results, RRS implemented significant design changes, including an 87,000 gallon increase in the remedial solution across isolated areas on the site, where the original design's recommended concentration needed to be adjusted to achieve appropriate distribution of the remedial solution.





Cumulative PlumeStop Application Details

All Treatment Areas

Areal Extent of Treatment	31,000 square feet (approximate)
Injection Points	506
Total PlumeStop Quantity Applied	224,800 pounds
Total PlumeStop Volume Applied	663,000 gallons

Application Information

Central Treatment Area

Symbol	Color	PlumeStop Quantity Applied (lbs)	PlumeStop Volume Applied (gals)
•	Light Blue	46,960	233,000
•	Medium Blue	49,300	79,000
•	Purple	2,860	7,000
•	Light Green	730	2,000
•	Pink	4,630	11,000
•	Red	1,760	4,000
•	Dark Green	1,740	4,000
Subtotal		107,980	340,000

Application Information

Northwest Treatment Area

Symbol	Color	PlumeStop Quantity Applied (lbs)	PlumeStop Volume Applied (gals)
•	Light Blue	24,100	130,000
•	Light Green	9,160	40,000
•	Dark Green	83,540	143,000
Subtotal		116,800	313,000



Results

224,800 Pounds of PlumeStop Safely Applied Effectively Protects Community's Drinking Water

Upon completion, RRS had safely applied 224,800 pounds of PlumeStop into ten treatment areas, encompassing almost one acre of contaminated aquifer area. Maintaining strict quality control throughout, RRS observed the aquifer's responses during injection to optimize the remedial design. RRS' efficient project management allowed the team to complete the application significantly ahead of schedule.

The installed PlumeStop treatment effectively eliminates chlorinated solvents in groundwater, preventing plume migration and removing the potential exposure risk to nearby community drinking water wells. This approach achieves these results sustainably, eliminating the massive carbon footprint created by outdated P&T approaches.







About REGENESIS

At REGENESIS we value innovation, technology, expertise and people which together form the unique framework we operate in as an organization. We see innovation and technology as inseparably linked with one being born out of the other.

Inherently, innovation imparts new and better ways of thinking and doing. For us this means delivering expert environmental solutions in the form of the most advanced and effective technologies and services available today.

We value expertise, both our customers' and our own. We find that when our experienced staff collaborates directly with customers on complex problems there is a high potential for success including savings in time, resources and cost. At REGENESIS we are driven by a strong sense of responsibility to the people charged with managing the complex environmental problems we encounter and to the people involved in developing and implementing our technology-based solutions. We are committed to investing in lasting relationships by taking time to understand the people we work with and their circumstances. We believe this is a key factor in achieving successful project outcomes.

We believe that by acting under this set of values, we can work with our customers to achieve a cleaner, healthier, and more prosperous world.

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





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