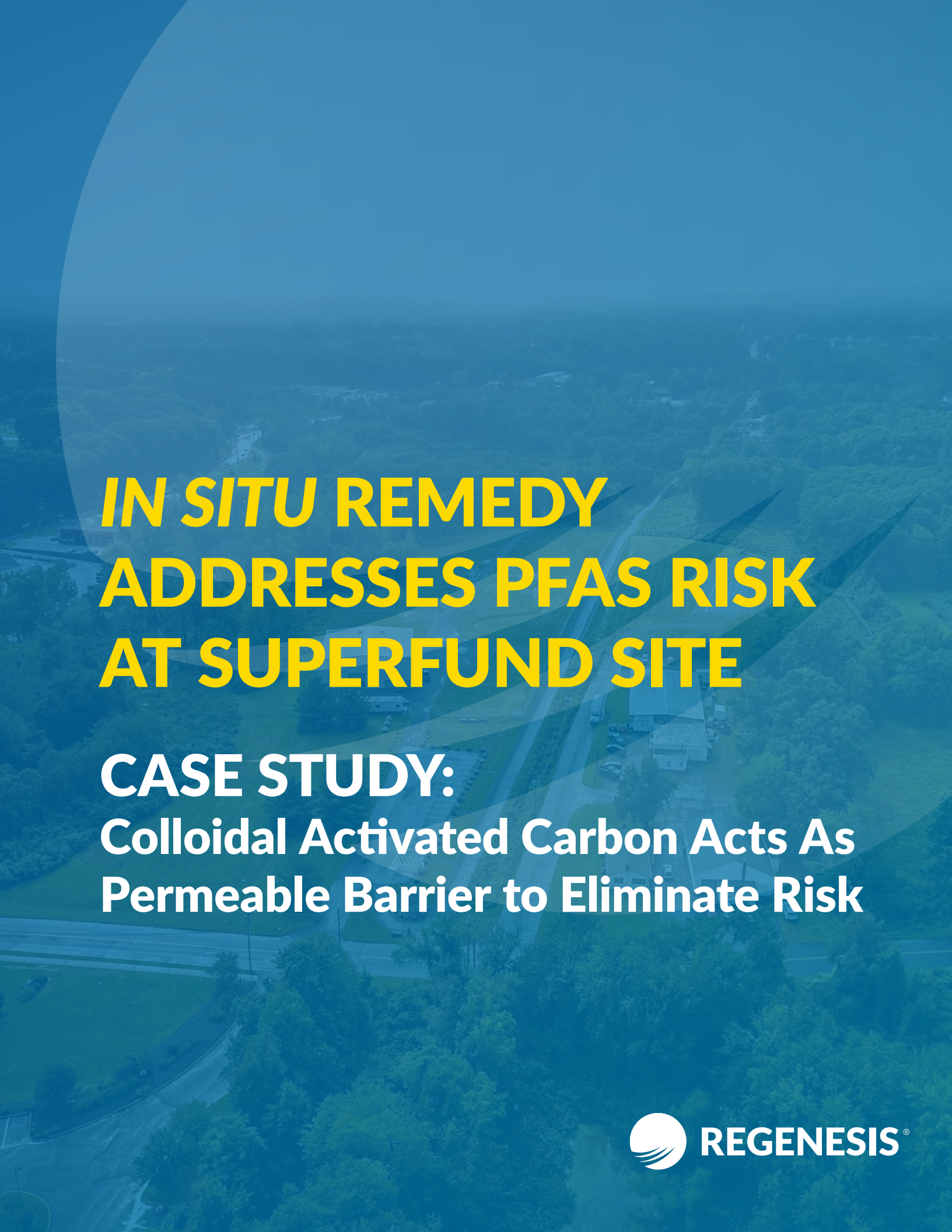




***IN SITU* REMEDY ADDRESSES PFAS RISK AT SUPERFUND SITE**

CASE STUDY:
Colloidal Activated Carbon Acts As
Permeable Barrier to Eliminate Risk



HIGHLIGHTS



Estimated savings of \$400,000 annually as a result of halting pump and treat operations



Innovative remedial approach incorporated natural attenuation with the use of PlumeStop® to work with existing sheet pile structure to limit the mobility of the plume and effectively treat contaminant concentrations



PlumeStop quickly reduced PFOS/PFOA levels and in combination with AquaZVI® eliminated VOC contaminant concentrations



Extension of the popular Rails to Trails route now runs through the property, as a result of successful remediation efforts

OVERVIEW

Due to past operations at the Solvents Recovery Service of New England (SRSNE), the soil and groundwater were contaminated with a wide variety of Volatile Organic Compounds (VOCs) and Polychlorinated Biphenyls (PCBs). The site was placed on the National Priorities List in 1983 and by 1991, all activities stopped as the site ceased operations. Since shutting down, the site has benefited from significant remediation efforts including thermal remediation, monitored natural attenuation, as well as the installation of a multi-layer cap to prevent human contact with residual contaminants. In 1995, de maximis, a leading environmental firm located in the Northeast, was hired to help manage the remediation project. Over the years, de maximis has engaged outside environmental consulting firms as part of the remedial efforts including Anchor QEA for hydrogeology, modeling, and characterization and GEI Consultants Inc. for monitoring and engineering expertise.



“The treatment has already resulted in a **significant decrease in PFAS levels...”**

In 2016, as part of ongoing monitoring and data collection, groundwater testing was expanded to include per- and polyfluoroalkyl substances (PFAS). While the previous remediation efforts had been successful in treating the VOCs, PFAS contamination was discovered and required treatment. REGENESIS® was chosen to use their colloidal activated carbon technology, PlumeStop, to treat the PFAS contamination. This cost-effective, *in situ* technology was applied to rapidly adsorb the PFAS contaminants in the upgradient water onto the micron-scale colloidal activated carbon. PlumeStop acts as a permeable barrier so that the PFAS contamination in the upgradient water is adsorbed and the water can flow downstream, without threatening the downgradient water quality. The treatment has already resulted in a significant decrease in PFAS levels and the pilot test will continue monitoring for a year. Once site goals are met, the potentially responsible party (PRP) group expects to save an estimated \$400,000 annually as a result of the pump and treat system being shut down, and if the contaminant levels remain below regulatory standards, can save the PRP group millions of dollars in the future.

BACKGROUND

SRSNE is a former solvent recovery facility located in Southington, Connecticut where spent solvents were recycled from industrial operations beginning in the 1950's and continuing until 1991. After the solvents were distilled and reused, the unusable solvent sludges were disposed of in two unlined lagoons from 1957 until 1967, when the lagoons were drained and covered with fill. After the lagoons closed, wastes were burned in an open pit on site or disposed of offsite. By the 1970s, the state ordered the end of incineration activities.

Due to site operations, the ground and groundwater were contaminated with a wide variety of VOCs and PCBs. The site was placed on the EPA Superfund list in September 1983, which spurred a decades-long attempt to remediate the site back to safe levels.



The site's long-term remedy included:

- ➔ Treating waste oils and solvents in an aquifer beneath the operations area by heating them in place.
- ➔ Consolidating and capping contaminated soil from impacted wetland and upland areas.
- ➔ Capturing and treating on-site contaminated groundwater exceeding federal or state drinking water standards.
- ➔ Monitoring natural degradation of the plume until groundwater cleanup levels are achieved.
- ➔ Monitoring natural degradation of the site-related chemicals in the bedrock.
- ➔ Putting in place restrictions on uses of the property and groundwater and monitoring groundwater.
- ➔ Maintaining the cap over the long term.

In 2016, as part of ongoing monitoring and data collection on the SRSNE site, environmental project management firm, de maximis arranged for additional groundwater sampling and expanded testing to include PFAS compounds, an emerging class of contaminants that have come under increased scrutiny. PFAS contamination was found to be present in the groundwater. de maximis tasked GEI Consultants, Inc. to further assess and address the PFAS in conjunction with ongoing and planned remedial activities. This led to the pilot-test injection of PlumeStop and AquaZVI with the goal of using this technology to reach the site goals in a timely and cost-effective manner.

PROJECT TIMELINE

1955-1991:

SRSNE distilled spent solvents at the facility.



1983:

EPA settled a lawsuit filed against the company in 1979 requiring SRSNE to capture and treat the contaminated groundwater.

1985:

The company installed the on-site groundwater pump-and-treat system and began operating it in 1986.



1991:

All activities stopped at the site in preparation for site shut-down.

1992:

EPA time-critical action identified PCB contamination.



1994:

EPA conducted an investigation into the sources, nature, and extent of contamination at the site.

1995:

Steel sheet pile barrier and updated pump & treat system installed.



1997:

EPA ordered site PRPs to expand the groundwater containment system to address bedrock contamination.

2005:

EPA selected final remedy for the site.



2014-2015:

In Situ thermal remediation of 55,000 cubic yards of the most contaminated soils removed 500,000 pounds of VOCs.

2016:

Ongoing monitoring and data collection was expanded to include PFAS compounds.



2017:

Multi-layer cap with solar panels was constructed.

2018:

Clean-up efforts focused on mitigating the risks of PFAS contaminants with a pilot study using PlumeStop and AquaZVI in a barrier trench application.

PLUME STOP
Liquid Activated Carbon

AquaZVI™



REMEDIATION HISTORY:

The first non-time-critical removal action (NCTRA 1) involved installing a groundwater pump and treatment system downgradient of the operations area to contain the VOC plume. This action consisted of constructing a sheet pile wall and 12 recovery wells to pump groundwater behind the wall. The goal was to treat the water with this on-site system and then discharge it to the nearby river with a permit. However, the impacted groundwater had already expanded beyond the wall. For hydraulic control, the site engineers installed the second non-time-critical removal action (NCTRA2) which consisted of a series of pumping wells further downgradient to capture the entire affected groundwater zone.

After thermal remediation reduced source-zone concentrations, the goal was to discontinue pumping the NCTRA 1 system and allow the groundwater to flow downgradient. However, because the sheet pile wall could not be removed, it was perforated at three control points so that the groundwater could flow through the wall instead of around it. Facilitating groundwater flow through the three small perforations required a creative groundwater hydraulic design and modeling. The team created a collection trench on the upgradient side and distribution trench on the downgradient side of the sheet pile wall with perforated pipes in the trenches and valves at the three perforations. This trench system also included 4 extensions which directed groundwater flow toward the NCTRA 2 system and allowed for various inputs and monitoring.



PILOT TEST:

The trench system design allowed for the cost-effective remedial amendment, PlumeStop, to be injected into the trench through which the water will flow as it moves toward the downgradient NTCRA 2 collection system. When it comes to addressing PFAS risk, PlumeStop functions by quickly sorbing the PFAS contaminants onto the colloidal activated carbon *in situ*, purifying groundwater as it passively migrates. This treatment permits the upgradient water to safely flow downgradient without endangering the downgradient water quality while effectively mitigating the risks of the PFAS and VOCs.

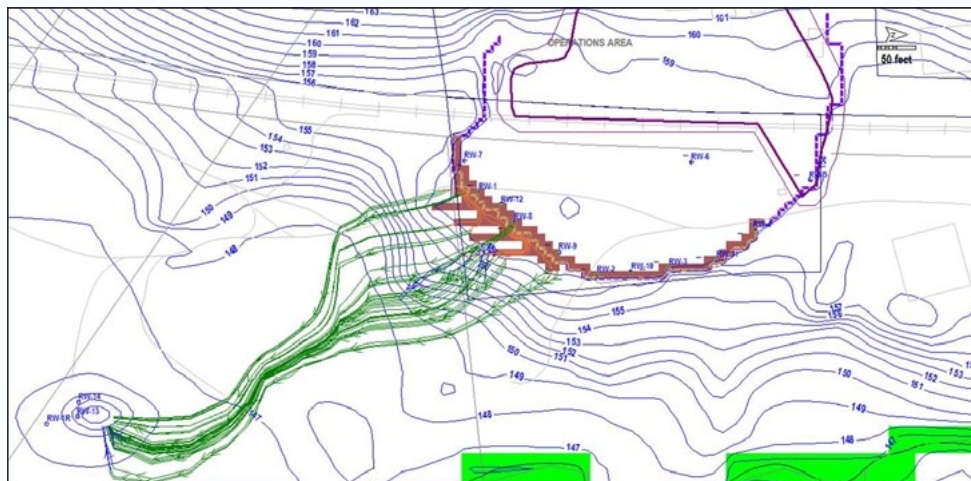


Figure illustrating predictive groundwater flow model output with sheet pile wall (purple), trench system (red) and groundwater flow lines (green)



RESULTS

After the initial application of PlumeStop, the PFAS concentrations have quickly decreased within the application area. Additionally, sampling shows that the water is not exceeding any of the EPA-determined triggers that are being tested downgradient. Continued improvements are expected over time as the impacted upgradient water flows through the PlumeStop application areas and toward the downgradient collection system. The pilot test will continue for 1-year post-injection with the goals of keeping the valves open, and operating the downgradient pumping system. The anticipated cost savings that this mode of operation will provide the client is approximately \$400,000 per year.

The plan for long term success at this project is based on allowing the valves to remain open, and allow the trench system to serve as a long-term permeable reactive barrier. The current results from the PlumeStop/AquaZVI treatment have led the team to anticipate that it will be possible to permanently turn off the 12 pumping wells and reduce the onsite treatment needed because the groundwater pumped downgradient is clean enough to transfer to the sanitary sewage system.

While a large portion of the cleanup work and construction has been completed, the PlumeStop/AquaZVI remediation treatment will continue to be monitored for ongoing contaminant attenuation and will continue until cleanup levels are met. As an additional benefit to the community, the remediation efforts have allowed for the development of an extension to the Rails-to-Trails Greenway bike path. This runs through the capped area of the site signaling there is no risk of exposure to contaminants.

The EPA Acting Regional Administrator, Deb Szaro considers this, “Cleanup and redevelopment a win-win.”

ABOUT THE ENVIRONMENTAL CONSULTANTS



ABOUT DE MAXIMIS

de maximis has been the leader in providing Environmental Project Management solely to industry for the past 30 years. de maximis provides Project Coordination and Management services to multi-party groups and single party clients involved in environmental projects throughout the United States and in the Caribbean. Our staff of professional Project Managers has a unique blend of experience in industry, regulatory agencies, remedial contracting and engineering/environmental consulting.



ABOUT GEI

GEI Consultants, Inc. is a consulting engineering and environmental firm that delivers value by providing professional services to improve our world's built environments. With more than 800 staff and 38 offices nationwide, GEI is a leader in providing multi-disciplined engineering and technical services to a range of private and public sector clients domestically and abroad. As an employee-owned firm, we foster personal relationships with our clients and cultivate our staff in a partnership model which is underpinned by continuous learning and sharing of knowledge. We retain proven recognized industry experts and attract the best young minds in the industry to deliver to our clients a refreshing blend of technical expertise, collaborative spirit and innovation that is rare in our profession.



ABOUT ANCHOR QEA

Anchor QEA is an internationally recognized environmental and engineering consulting firm with industry-leading expertise in contaminated sediment management, habitat restoration, and coastal development. Formed in 1997 to solve challenging cleanup and restoration projects in the aquatic environment, Anchor QEA employs more than 370 technical staff at over 20 locations throughout the United States. Most of our projects also involve upland groundwater characterization and remediation, and our technical staff includes national experts who participate on ITRC and ASTM committees developing guidance in these areas. Through collaboration and innovation, we solve some of the most challenging problems in the environmental arena. We ranked 24th in ENR's Top All-Environmental Firms 2018 list in the U.S.

TECHNOLOGY

PLUME STOP[®]

Liquid Activated Carbon

PlumeStop is an *in situ* technology that rapidly reduces dissolved-phase plumes. PlumeStop behaves as a colloidal matrix binding to the aquifer matrix, rapidly removing contaminants from groundwater, and expediting permanent contaminant biodegradation. The benefit to PlumeStop's dispersive properties is its ability to sorb contaminants, quickly removing them from the mobile phase while providing a high surface area matrix which proves favorable for microbial colonization and growth.

Key Benefits:

- *In Situ* remediation technology that rapidly reduces dissolved-phase plumes in days/weeks
- Distributes widely under low injection pressures
- Colloidal biomatrix completely biodegrades contaminants in-place
- Achieves stringent groundwater clean-up standards
- Stops contaminant migration and protects sensitive receptors
- Provides a long-term means of addressing matrix back-diffusion
- Eliminates excessive time and end-point uncertainty associated with groundwater remediation

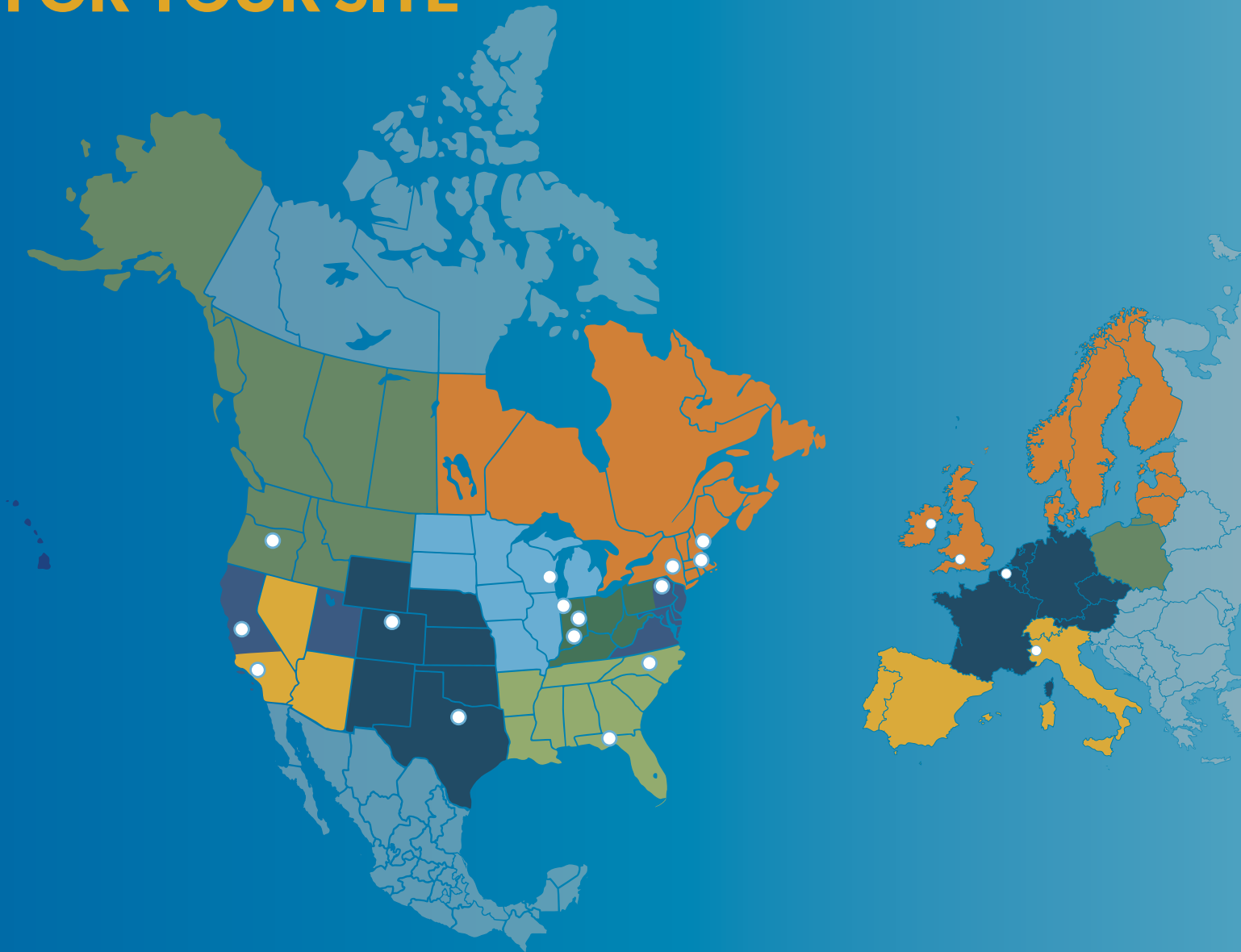
AquaZVI[™]

AquaZVI is composed of colloidal, sulfidated zero-valent iron (ZVI) particles suspended in an aqueous medium with environmentally-acceptable, proprietary dispersants. The passivation technique of sulfidation, completed through proprietary processing methods, provides unparalleled reactivity with chlorinated hydrocarbons like PCE and TCE, and increases its stability and longevity *in situ* by minimizing undesirable side-reactions. In addition to superior reactivity, AquaZVI is designed for easy handling that is unmatched by any ZVI material on the market. Shipped as an aqueous suspension, AquaZVI requires no powder feeders, no thickening with guar, and pneumatic or hydraulic fracturing is not mandatory. When diluted with water in the field, the resulting suspension is easy to mix and inject using direct push or injections wells.

Key Benefits:

- Micron-scale, zero-valent iron suspended in a colloidal solution allows for easy handling and application on-site.
- Micron-size particles flow through soil pores dispersing outward without the need for fracturing or mechanical mixing in the subsurface.
- Outperforms commodity iron 30-40 times.
- Creates an anoxic and highly reducing environment, providing ideal conditions for sequential enhanced anaerobic biodegradation to destroy chlorinated contaminants.

WE'RE READY TO HELP YOU FIND THE RIGHT SOLUTION FOR YOUR SITE



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