

# REMEDIATION OF TCE PLUME SPEEDS SALE OF BROWNFIELD SITE

## CASE STUDY:

Low-Pressure Application of ZVI  
Achieves Regulatory Approval to Treat  
Former Manufacturing Site





## Overview

# ZVI Treats TCE Plume Allowing for Sale of Brownfield Site



REGENESIS' micron-scale ZVI is applied under low-pressure and does not require fracking. This allowed the ZVI treatment to gain regulatory approval.



In just one month following the application, monitoring shows successful reduction of the TCE plume.



Hargis + Associates and Gregg Drilling helped to implement an innovative drilling design which applied the remedial agent through ten points simultaneously at under 50 psi.

At a former manufacturing site in Fullerton, CA a trichloroethylene (TCE) plume contaminated the groundwater and prevented sale of the brownfield site. Past remediation included thermal, excavation and soil treatment. Despite these measures, the TCE plume remained. In order to complete the remediation and move forward with the sale, Hargis + Associates worked with REGENESIS® to develop an *in situ* chemical reduction (ISCR) design to address the plume. REGENESIS designed an injection plan using micron-scale Zero Valent Iron (ZVI) due to its proven ability to effectively reduce contaminant levels within a subsurface environment.

Working around existing buildings and infrastructure posed a number of challenges. Additionally, regulatory limits on pounds per square inch (psi) were enforced for all injections. REGENESIS, Hargis + Associates, and Gregg Drilling worked closely with the regulatory agency to ensure that the remediation and injection of the ZVI would be completed at a low pressure. After gaining regulatory approval, Gregg Drilling injected 50,000 gallons at less than 80 psi. Within a month, this low-pressure application yielded as much as 100% reductions in some zones.



## Background

# Uniquely Challenging Site Conditions



The site lithology consisted of low to medium permeability sands and silty sands.

This location was a former manufacturing site. TCE was used onsite and historic spills and leaks created a groundwater plume. Remediation of the plume was required in order to complete a real estate transaction.

The site lithology consisted of low to medium permeability sands and silty sands. In the deeper zones, the lithology became finer with less permeability. Previous consultants injected Zero Valent Iron using pressures as high as 200 psi. This method caused daylighting over 50 feet away. In order for Hargis + Associates to conduct additional ZVI injections, regulatory agencies required a lower pressure remedial application.





## Timeline

# Low-Pressure ZVI Application Effectively Remediate TCE Plume



- **2013-2016**

Previous remedial efforts take place including thermal and excavation



- **May-August 2018**

Large diameter auger excavation takes place



- **September 2018**

Hargis + Associates gain approval to inject ZVI under low pressure



- **September-October 2018**

ZVI injections take place



- **November 2018**

Post-injection monitoring begins and TCE was shown to be below required levels



- **November 2019**

Quarterly post-injection groundwater monitoring has shown that TCE concentrations in the source area have been reduced by 100% in some instances



## Treatment

# Unique ZVI Product Chemistry Provides A Perfect Low-Pressure Solution



Due to the regulatory concerns of daylighting, the injection rates had to remain at 80 psi. To satisfy the regulatory agency's limits on injection pressure, Hargis + Associates and REGENESIS completed a suitability study. REGENESIS' ZVI technology differs from others due to the small, micron-scale particle size of the ZVI. Additionally, the ZVI amendment uses transport polymers in the formulation, which allows it to be applied under low pressure.

## Treatment Process

**50,000** Gallons of ZVI

**37** Injection Points

50,000 gallons of ZVI were made in 150-gallon stainless steel mix tanks. The ZVI amendment was injected at a flow rate of 1-8 gallons per minute and at less than 80 psi. There were 37 injection points spaced 15 feet apart. The injections ranged from 10 to 80 feet below ground surface (bgs) and the remedial solution was injected into 10 points simultaneously. The low-pressure injection approach prevented fracturing or daylighting throughout the application.





## Technology Used

### S-MicroZVI

**S-MicroZVI**  
Sulfidated Zero-Valent Iron

S-MicroZVI is an advanced zero-valent iron (ZVI) product proven to accomplish *In Situ* Chemical Reduction (ISCR) of contaminants within the subsurface environment. S-MicroZVI is delivered as a colloidal suspension, 40% ZVI by weight in glycerol with a particle size of less than 5 microns. S-MicroZVI is manufactured using a state-of-the-art sulfidation process resulting in a particle coating which increases activation toward specific contaminants and extends performance longevity. S-MicroZVI destroys contaminants abiotically and applied to stimulate ISCR-enhanced bioremediation.







GREGG

REMEDATION

CT2

S-Micro EMI

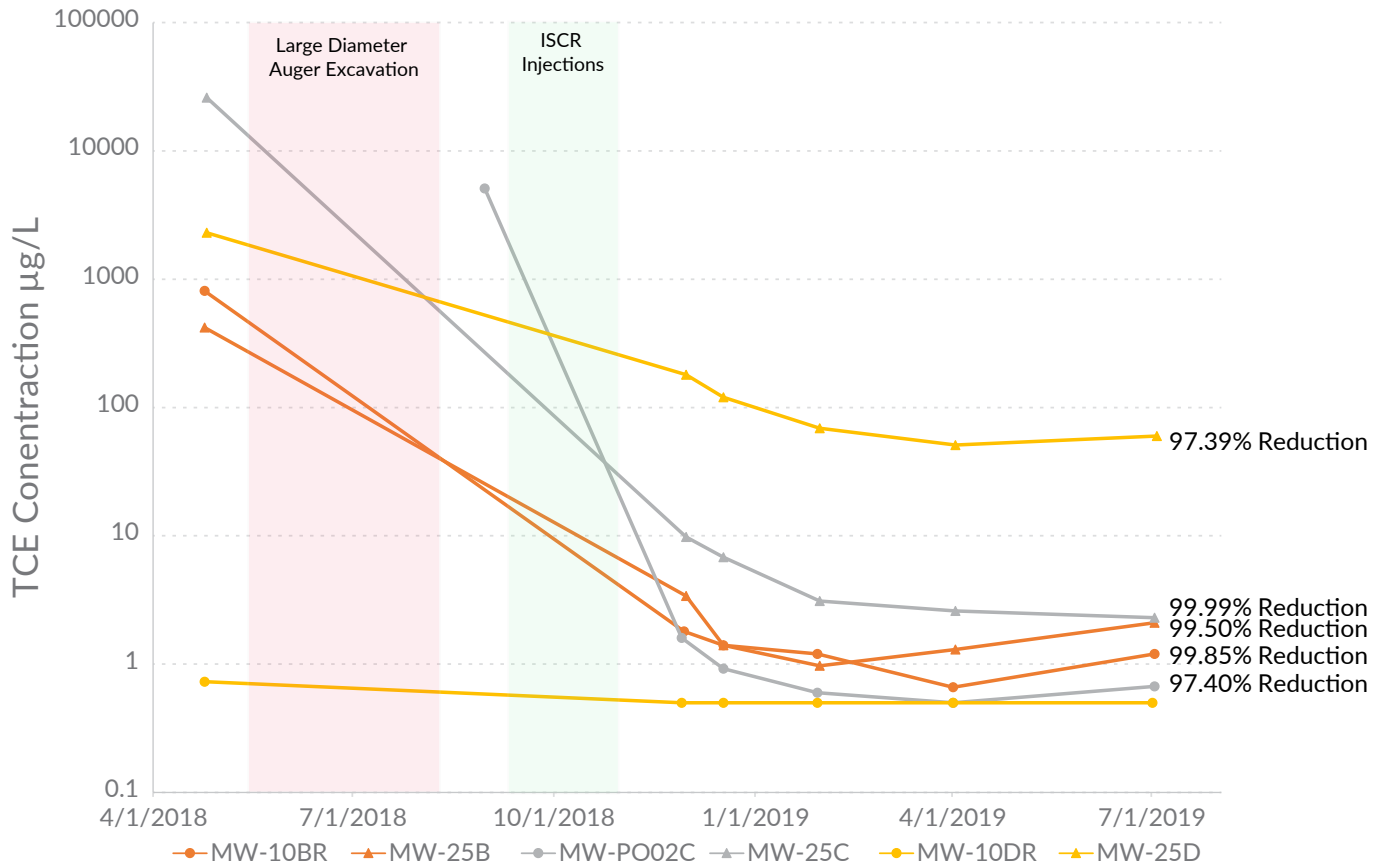
STERL

## Results

# Combined Remedy Allows the Property Owner to Move Closer to Sale of the Site



After the first month, monitoring results showed that the TCE plume was responding positively to the treatment. Due to the completion of this remediation, the real estate transaction could move forward and the site was sold. S-MicroZVI was an ideal remedy for this site because of its ability to be applied under low pressure, its reactivity, and its persistence. After a year of monitoring, there are strong and sustained reducing conditions which have maintained the dramatic contaminant reduction in several wells.





## About the Applicator

### Gregg Drilling



Gregg Drilling, LLC. (Gregg) offers a wide range of services for environmental, geotechnical and marine site investigation and remediation.

Since our inception, Gregg has been widely recognized as a leader and innovator in drilling, sampling, and subsurface investigation, providing clients in industry and government with the highest quality services. Throughout this time we have pursued one simple goal:

“To provide our clients with high-quality, innovative services performed in a timely and cost effective manner.”

Over the past 25 years, Gregg Drilling (Gregg) has earned the position of a leader within our industry by building a team of highly experienced personnel and management who reflect our mission and embody our commitment to providing the highest quality services. Everyone at Gregg has a vested interest in our success and is motivated to provide our clients with the most responsive and cost effective service.

The Gregg companies are directed and staffed by geotechnical and environmental professionals with experience in industry, consulting, and research. All our personnel are highly trained, certified, and experienced in site investigation technologies and applications. These exceptional qualifications enable Gregg personnel to solve complex problems and create a seamless working relationship between our staff and our clients.

### About The Project Manager

#### Todd Hanna



Mr. Hanna oversees Gregg's Remediation Services Division, he is involved in all aspects from sales to project management. Todd has worked in the Environmental Industry since 1993 and has been responsible for the engineering and design of over 25 mobile remediation systems, as well as specialized direct push injection tooling that has become the industry standard. Todd offers years of experience on hundreds of *in situ* Remediation projects across the U.S. Prior to working in the Environmental Industry, Todd served in the United States Marine Corps.

## The Environmental Firm

# Hargis + Associates



Hargis + Associates, Inc. (H+A) is an environmental consulting and engineering firm founded in 1979 with a commitment to providing high-quality, cost-effective services for their clients. They specialize in all aspects of environmental investigation, compliance, and remediation where they provide responsive, practical and innovative solutions for the treatment of soil, soil vapor, and groundwater contamination.

H+A's trustworthy reputation is built on technical excellence, responsiveness, and client commitment. They apply an integrated approach to all aspects of their projects, from initial assessment to remedial action strategies; with a mind toward the ultimate resolution of site issues. They consistently meet or exceed their client's expectations and enjoy very high client satisfaction ratings. In addition to their technical expertise, communication and responsive service are hallmarks of their reputation.

At H+A, clients are provided with their simple guarantee: to remain client-committed and solution-oriented. For over 40 years, the outcome has been practical and workable solutions, resulting in enduring client relationships.

### About The Consultant

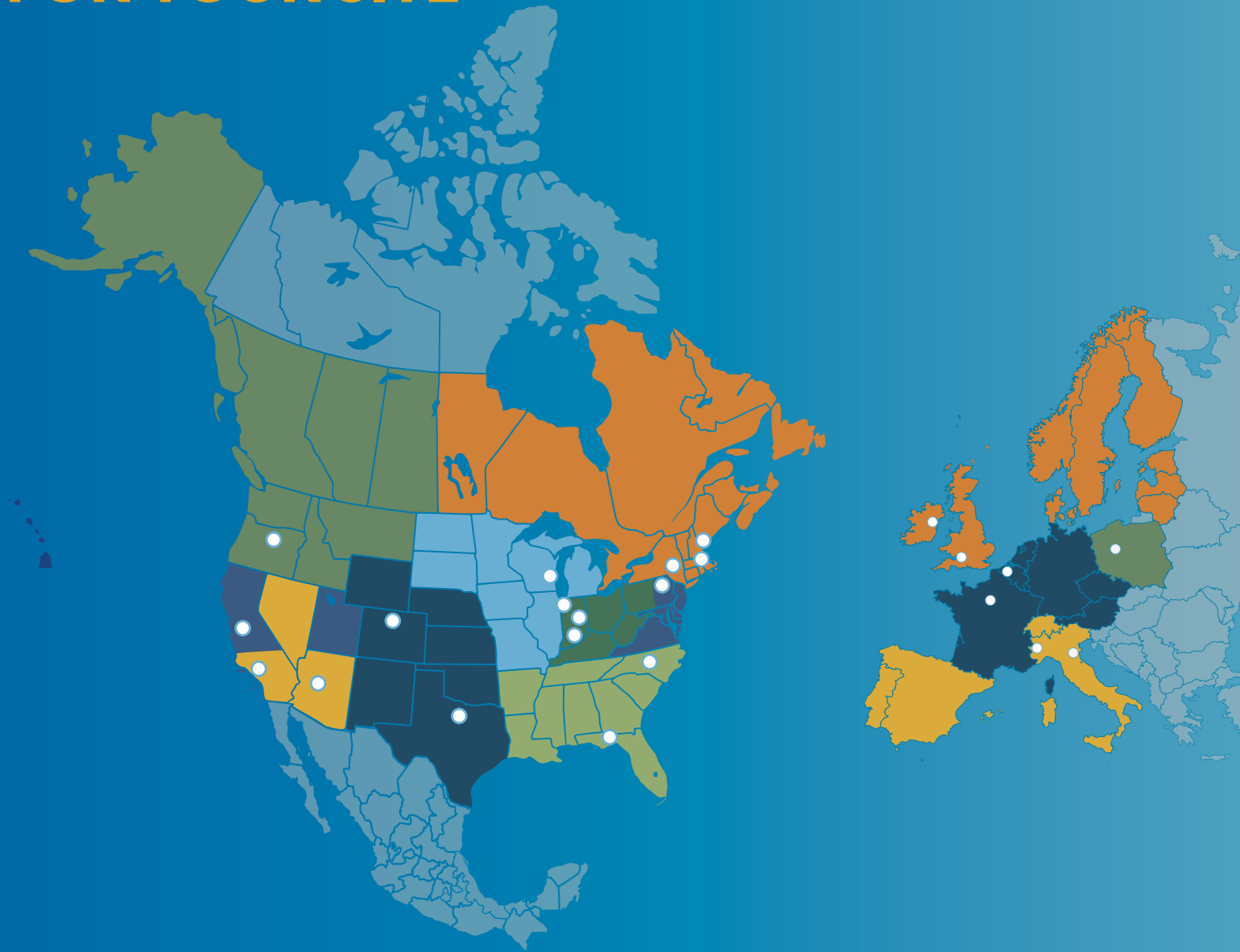
## Tyler Evans



Mr. Evans has professional experience in hydrogeology since 2009. Mr. Evans worked at the US Geological Survey for 5 years, working throughout California providing groundwater sampling services. Since 2014, Mr. Evans has provided environmental consulting services for groundwater contamination projects regulated under Resource Conservation and Recovery Act (RCRA), California Environmental Protection Agency (EPA) Department of Toxic Substance Control (DTSC). Tyler's expertise include investigation and assessment of soil and groundwater contamination; enhanced *in situ* bioremediation; *in situ* chemical reduction injection remediation; report preparation; soil and water quality monitoring and data evaluation; monitor well construction and development; and preparation of data submittals.



# 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 731 447  
Dublin, Ireland  
Ph: +353 (0) 1 9059 663

Torino, Italia  
Ph: +39 (0) 11 19781549  
Ieper, België  
Ph: +32 (0) 57 35 97 28



[www.REGENESIS.com](http://www.REGENESIS.com)

©2020 All rights reserved. S-MicroZVI is a registered trademark of REGENESIS Bioremediation Products. All other trademarks are the property of their respective owners.

