

SITE GOALS ACHIEVED WITHIN TWO MONTHS

CASE STUDY:

A Former Santa Barbara
Manufacturing Facility Treated Using
a Combined Remedy Approach

OVERVIEW

This case study reviews a contaminated manufacturing site in Santa Barbara, California. A former manufacturing operation had left PCE and TCE contaminant levels above regulatory limits with previous remediation approaches attempted without complete success. Applying a combined remedy approach, Haro Environmental chose to focus on incorporating a design to rapidly reduce contaminant concentrations for sustained treatment, and reduce the potential for further downgradient migration of the PCE and TCE contaminants. Working with REGENESIS technical services, the consultant, Elliot Haro, chose PlumeStop®, Hydrogen Release Compound® (HRC), and Bio-Dechlor Inoculum Plus® (BDI+) in his application to treat contaminant levels and meet regulatory guidelines for the site.



HIGHLIGHTS

- ➔ This site has been an active case since 2007. REGENESIS was able to eliminate the contaminant quickly and effectively using a combined remedy approach.
- ➔ After conducting a pre-field remediation test, the injection interval was reduced from 12 feet to 9 feet with a bottom-up approach, reducing the project costs by 30%.
- ➔ The combination of PlumeStop, HRC and BDI+ successfully eliminated the contaminants and created conditions for sustained treatment at the site.

BACKGROUND

A former manufacturing facility in Santa Barbara, California is located in a busy area of the city which was once used primarily for industrial and commercial manufacturing. Recently, this area has evolved into a popular urban district known as the “Funk Zone.” Due to its manufacturing history, this site has been an active PCE and TCE case with the Central Coast Regional Water Quality Control Board (CCRWQCB) for over 11 years.

Since the late 1990s, assessments and remedial activities have been performed at the site. Previous remediation attempts were made through limited excavation and ISCO injections using permanganate, but were unsuccessful at achieving levels for groundwater closure. The site required an aggressive approach to reach CCRWQCB cleanup goals. Environmental Consultant, Elliot Haro, chose PlumeStop colloidal activated carbon combined with HRC enhanced reductive dechlorination and BDI+ to eliminate the contaminants.

SITE TIMELINE

1950-1980s

Auto repair facility with spray booths and solvents - manufacturing operations began.

1930-1950

Residential homes occupied the area.

1980s-present

Boat storage, misc. storage, commercial, and retail

PROJECT TIMELINE

1993

Phase I report - Case opened

1995

Tank removal

2000

PCE discovered in soil and groundwater

2007

Soil gas surveys performed

2008

Additional soil gas investigations

2009

Confirmed soil gas issue above California Human Health Screening Levels

2011

Excavation of impacted soils at source area (former tanks)

2012

In situ Chemical Oxidation using Permanganate in the soils and shallow groundwater

2013

Soils only closure approved by Santa Barbara Department of Public Health

2013

Groundwater Issue continued with groundwater monitoring only

2014

Change of consultants to Haro Environmental



2015

 **REGENESIS®** REGENESIS engaged on project

2016

Application of Amendments PlumeStop, HRC and BDI+



Request for Closure August 2017

DESIGN EFFORTS

Prior to implementation of full-scale injection approach, a pre-field remediation test was implemented to confirm that the technology could properly treat the residual PCE and TCE groundwater. Continuous cores were collected to identify the transmissive zones and high mass zones. In addition, a clear water injection test was performed to demonstrate that *in situ* injections were capable of achieving sufficient lateral distribution for full-scale implementation. This pre-field remediation test led to a revised full-scale injection plan, which reduced the project cost by 30%.

The revised injection plan led to the application taking place over 16 field days, including some weekends. 24,900 gallons of PlumeStop, HRC and BDI were injected into 51 injection points.



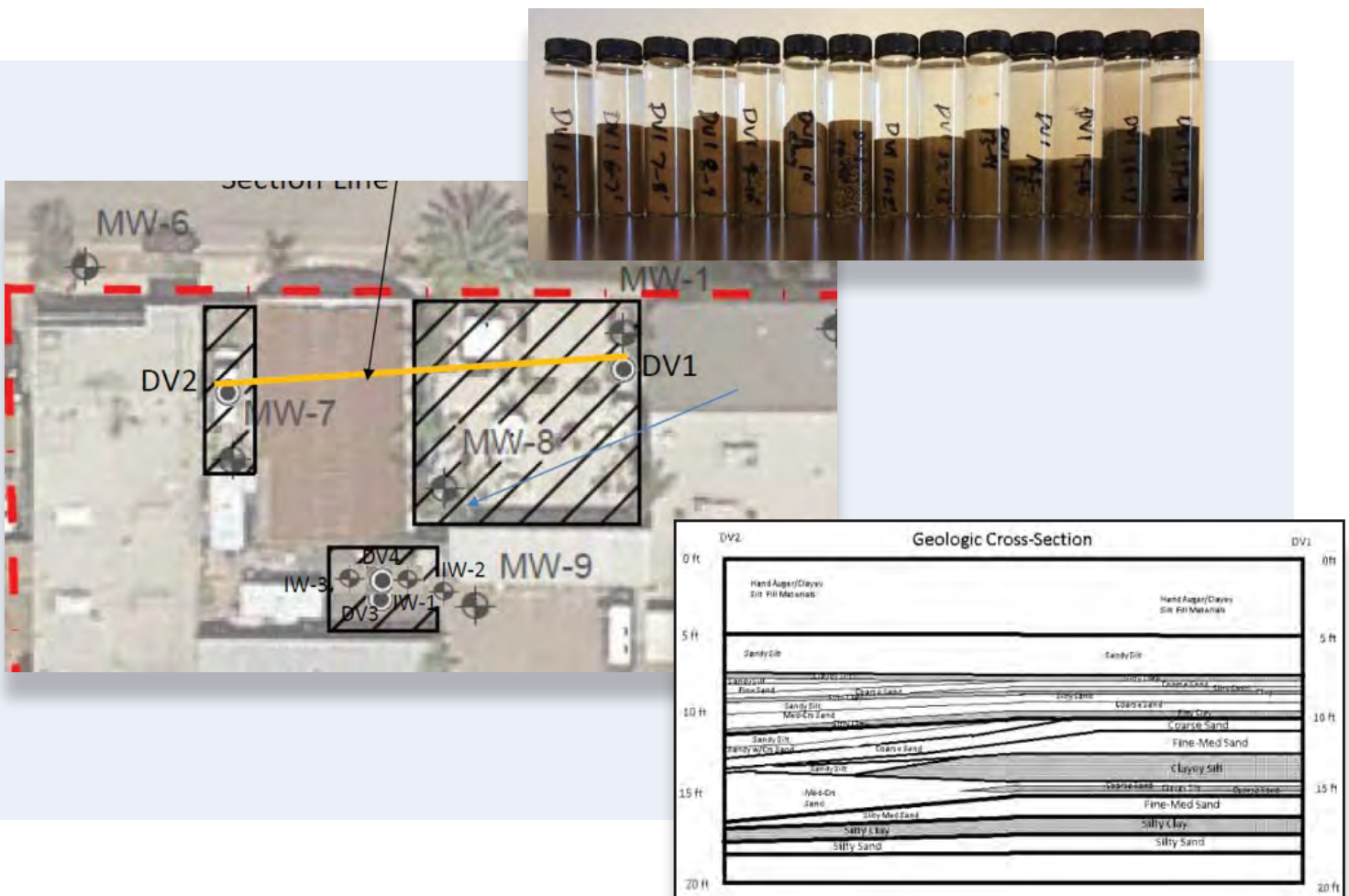
16 field days



24,900 Gallons



51 Injection Points



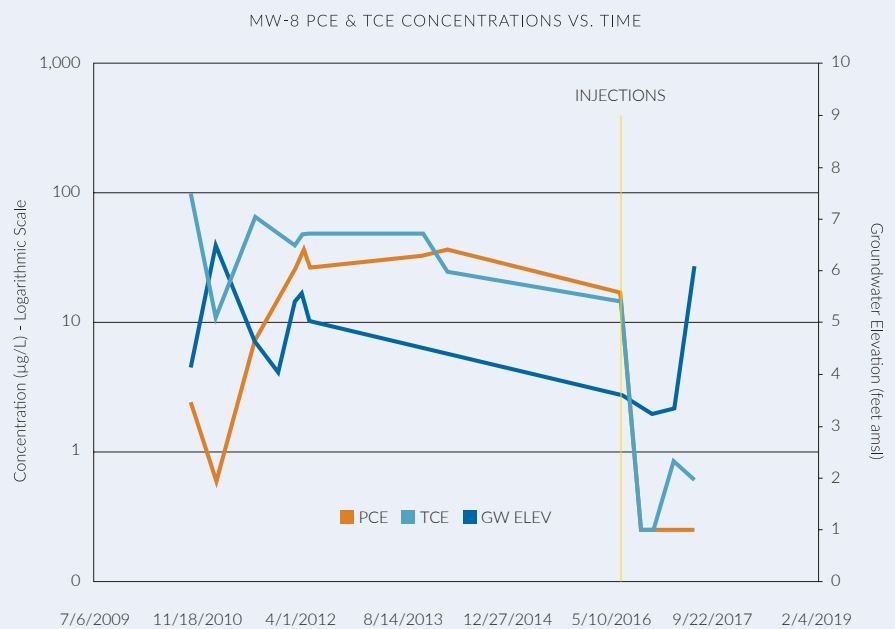
APPLICATION PLAN

COMMERCIAL/INDUSTRIAL PROPERTY

Well	PlumeStop Lbs.	PlumeStop Volume (as applied) Gals.	Area Ft ²	Application Points
MW7	2,400	4,800	700	11
MW8	8,800	16,300	2,800	28
MW9	2,000	3,800	600	12
Total	13,200	24,900	4,100	51

RESULTS

When REGENESIS began work on this site, the PCE concentrations were 53 µg/L and the TCE concentrations were 45 µg/L. After treatment of the 4,100 square foot area, PCE and TCE concentrations were reduced to clean-up goals set by the CCRWQCB. Site closure has been requested and development is scheduled for early 2019. The total project time from injection to closure is estimated to be 15 months. The cost savings on this project for pre-field injection work is 30%, as the target treatment zone was reduced from 12 ft. to nine feet.



APPLICATION DETAILS

- ➔ 16 FIELD DAYS
- ➔ 24,900 GALLONS OF PLUMESTOP, HRC AND BDI+
- ➔ 51 PLUMESTOP/BDI+ POINTS SPACED 7-10' BASED ON ACCESS
- ➔ 31 HRC POINTS SPACED 7-10' BASED ON ACCESS
- ➔ TOTAL TREATMENT ZONE: 6-15' BGS (REDUCED DUE TO RESULTS FROM DESIGN VERIFICATION TESTING)



ABOUT THE ENVIRONMENTAL CONSULTANT

ELLIOT R. HARO, PRINCIPAL SCIENTIST

As Principal Scientist at Haro Environmental, Mr. Haro's responsibilities include project procurement, budgeting, and project implementation. His project management experience includes proposal and cost estimate preparation for site assessments and remediation projects, design of soil and groundwater remediation systems, in-house staff and subcontractor coordination, technical report preparation, and permit acquisition. Mr. Haro has managed and performed numerous Phase I and Phase II Environmental Site Assessments (ESAs) as well as site investigation and remediation field activities including air, soil, groundwater, and surface water sampling, groundwater monitoring well installations, and remediation system operations and maintenance. He has prepared various environmental reports including site assessment reports, feasibility studies, remedial/corrective action plans, remedial work plans and health-based risk evaluations. Mr. Haro is familiar with the regulatory process and has consulted with both local and regional agencies on Client's behalf for work plan approvals and modifications. Mr. Haro's technical expertise includes evaluation, design and implementation of innovative *in situ* groundwater treatment technologies including enhanced bioremediation and *in situ* chemical oxidation.

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PLUME STOP

Liquid Activated Carbon

PlumeStop rapidly removes contaminants from groundwater and stimulates their permanent degradation.

KEY BENEFITS:

- Rapid reduction of dissolved-phase plumes.
- Distribution of widely under low injection pressures.
- Achievement of stringent groundwater clean-up standards.
- Providing a long-term means of addressing matrix back diffusion, so contaminants do not return.
- Elimination of excessive time and end-point uncertainty associated with groundwater remediation

BIO-DECHLOR INOCULUM PLUS

BDI

Bio-Dechlor INOCULUM Plus (BDI-Plus) is an enriched, natural microbial consortium containing species of *Dehalococcoides sp.* (DHC) which are capable of completely dechlorinating contaminants during *in situ* anaerobic bioremediation processes.

KEY BENEFITS:

- Rapid and effective treatment of undesirable anaerobic dechlorination intermediates such as dichloroethene (DCE) and vinyl chloride (VC).
- Highly compatible with a range of electron donors such as 3-D Microemulsion and HRC.
- Easy to apply and handle.

HRC

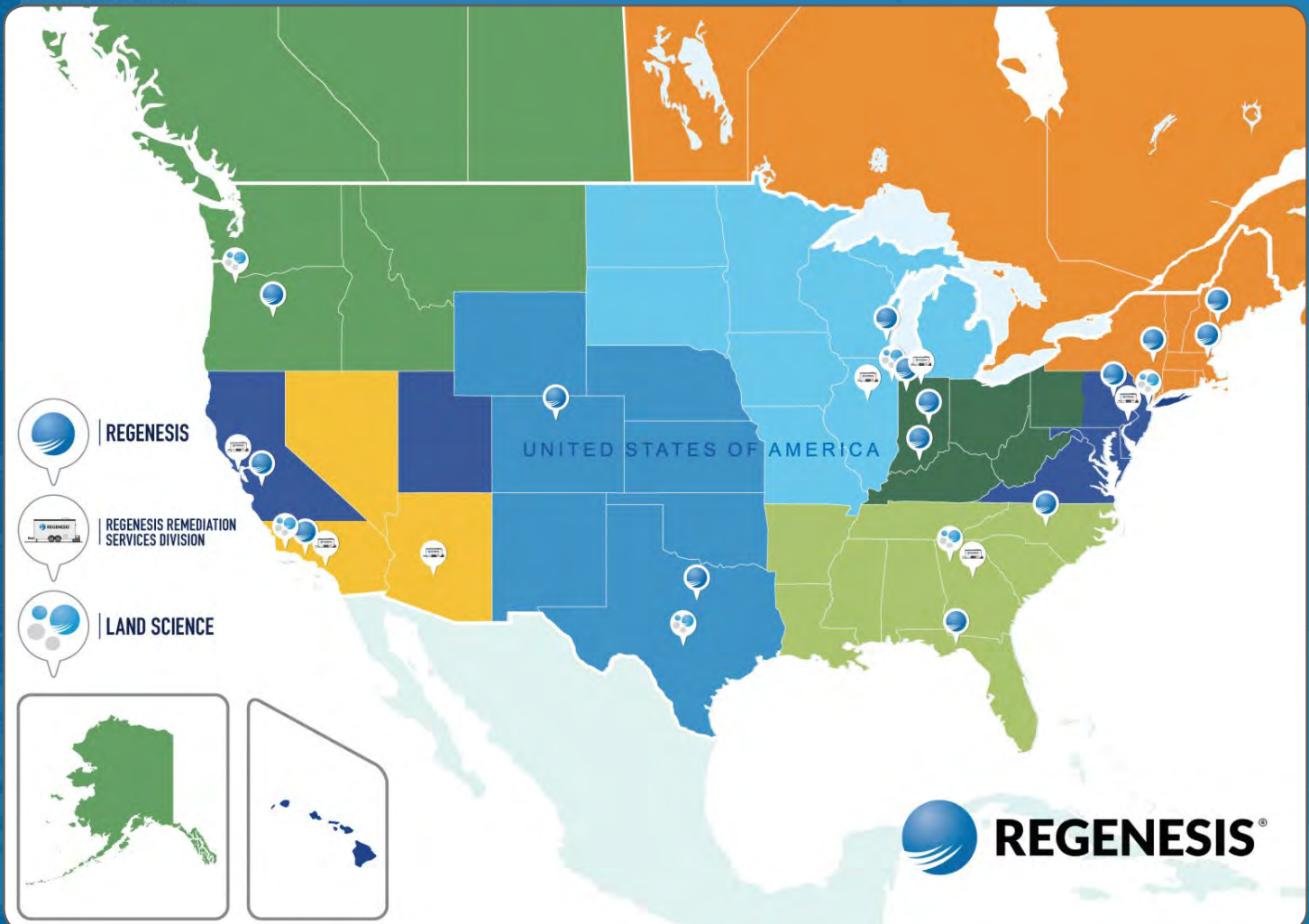
HYDROGEN RELEASE COMPOUND

HRC is an engineered, hydrogen release compound designed specifically for enhanced, *in situ* anaerobic bioremediation of chlorinated compounds in groundwater or highly saturated soils. Upon contact with groundwater, this viscous, poly-lactate ester material becomes hydrated and subject to microbial breakdown producing a controlled-release of hydrogen for periods of up to 18-24 months on a single application. HRC enables enhanced anaerobic biodegradation by adding hydrogen (an electron donor) to groundwater and/or soil to increase the number and vitality of indigenous microorganisms able to perform the naturally occurring process of enhanced reductive dechlorination.

KEY BENEFITS:

- Provides controlled-release lactic acid to promote reducing conditions and optimize the anaerobic enhanced reductive dechlorination process
- Highly viscous to stay in-place where injected for highly targeted treatment
- A viable, long-term source of staged-release hydrogen, on the order of 2-5 years from a single application
- Clean, low-cost, non-disruptive application (permanent wells, direct-push, excavations, etc.)
- No on-going operations and maintenance needed
- Faster and often lower cost than drawn out natural attenuation approaches

REGENESIS IS READY TO ASSIST YOU IN DETERMINING THE RIGHT SOLUTION FOR YOUR SITE



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