

Enhanced Reductive Dechlorination Results from Successful Pilot and Full-Scale HRC® Application

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SITE BACKGROUND

Subsurface assessment activities were performed at an existing dry cleaner site in Colorado to delineate the extent of chlorinated solvents in groundwater. Elevated levels of tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cDCE) were found at concentrations above the Colorado Groundwater Standards. The plume had originated beneath a building near the source and had migrated 280 feet downgradient. Observed groundwater concentrations of PCE and TCE had reached 6,000 parts per billion (ppb) and 3,000 ppb, respectively. In January 2006, a pilot test using Hydrogen Release Compound (HRC®) was performed near the source area to assess the potential for in-situ enhanced anaerobic bioremediation in the clay matrix. Significant reductions in PCE and TCE were observed shortly after the injection indicating biostimulation was occurring. A full-scale HRC injection was performed in the Fall of 2006.

PILOT SCALE DESIGN

In-Situ Enhanced Aerobic Bioremediation

A total of 300 pounds of Hydrogen Release Compound (HRC®) were injected around pilot test well MW-E, which is located inside the building and near the source area. Monitoring results one month after the application revealed significant reductions in PCE and TCE.

Pilot Application

- Soil Type: Clay
- Depth to Groundwater: 10 feet
- Treatment Thickness: 10 feet
- Application Rate: 4 lbs/ft
- Product: 300 lbs HRC

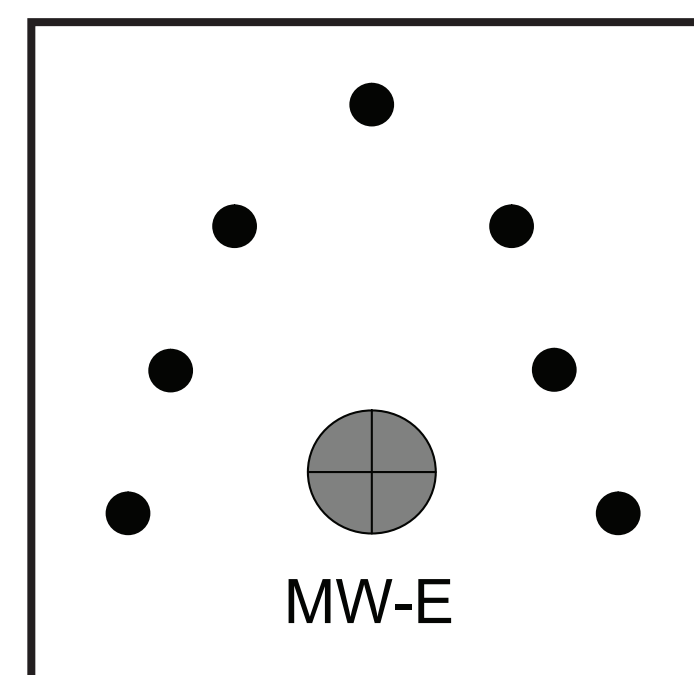


Figure 1. HRC Pilot Test Design

FULL-SCALE DESIGN

The success of the pilot test led to a full-scale application in the Fall of 2006. The application was designed using various amounts of HRC within five delineated PCE isopleths ranging from 6,000 µg/L to 100 µg/L. Injections inside the building, outside the building, and upgradient of the source area were completed between August 2006 and January 2007.

HRC Installation by Isopleths (Figure 1)

- Within 6,000 ppb Isopleth
720 lbs HRC using 5-foot center spacing
- Within 3,000 ppb Isopleth
1,140 lbs HRC using 7-foot center spacing
- Within 1,000 ppb Isopleth
2,400 lbs HRC using 7-foot center spacing
- Within 500 ppb Isopleth
660 lbs HRC using 7-foot center spacing
- Within 100 ppb Isopleth
960 lbs HRC using 7-foot by 20-foot spacing

Figure 2. October 2005 PCE Isopleth (baseline levels)

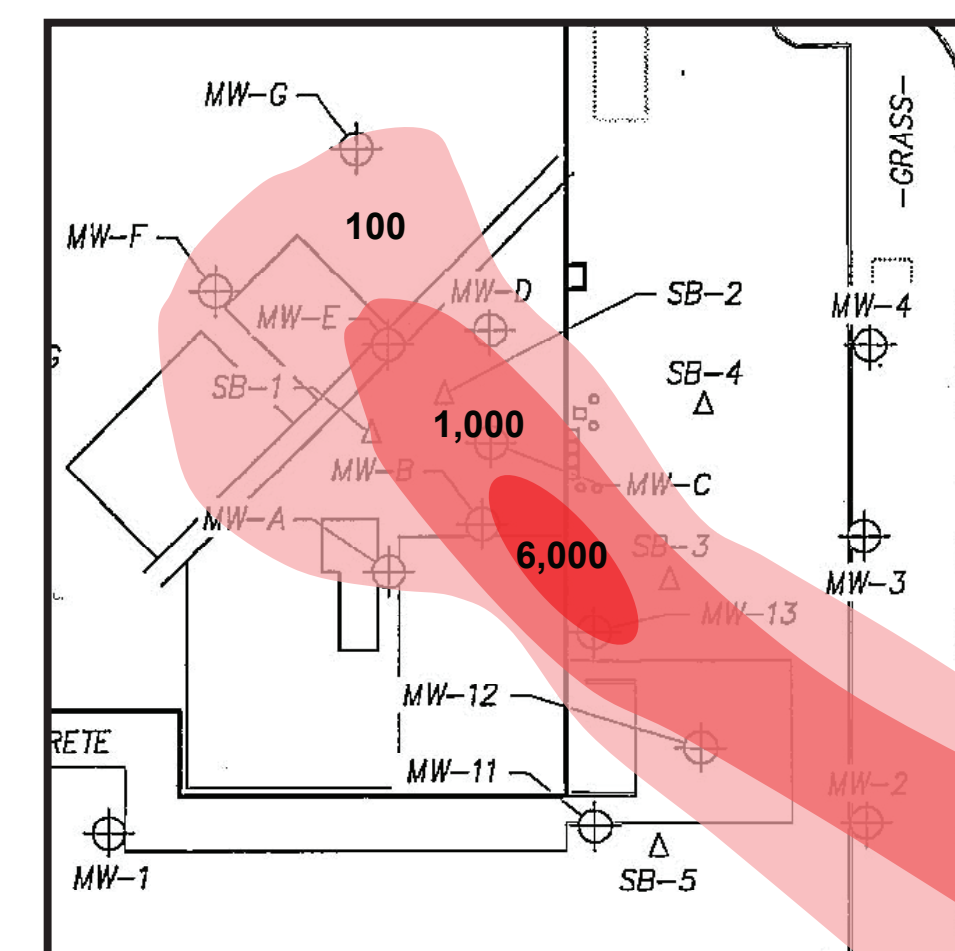
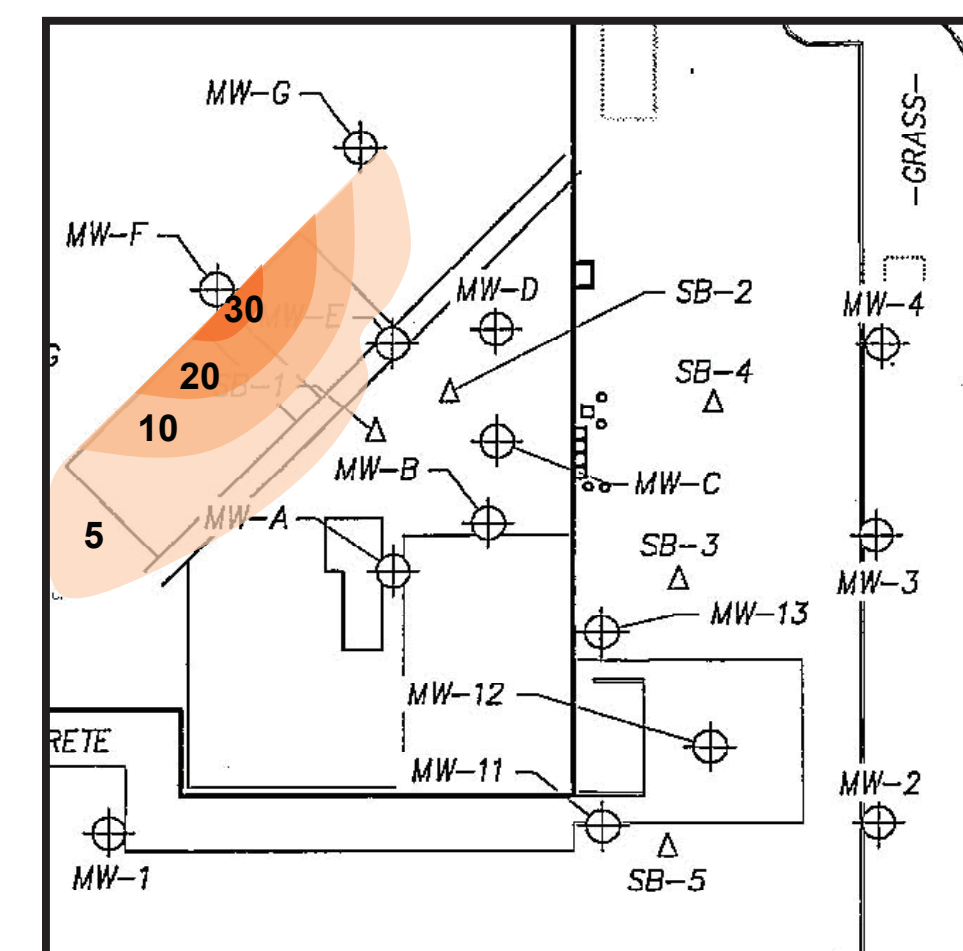


Figure 3. January 2008 PCE Isopleth (Post-HRC Full-Scale Application)



HYDROGEN RELEASE COMPOUND (HRC®)

HRC® is a patented, controlled-release, polylactate ester mixture specially formulated to slowly release lactic acid upon hydration. When placed into a contaminated aquifer, the lactic acid from HRC stimulates a multi-step process, resulting in hydrogen production. The newly available hydrogen stimulates a microbially-mediated process resulting in the degradation of chlorinated compounds.



Figure 4. Hydrogen Release Compound (HRC®)

RESULTS

As a result of the pilot application, an increase in TCE and cDCE was observed in pilot test well MW-E as PCE was reduced from an initial 3,200 ppb to 1,067 ppb. The full-scale application resulted in a decline in parent products PCE and TCE by more than 96% and an accompanied increase in cDCE (Figure 5) indicating reductive dechlorination was occurring.

A similar pattern of reductive dechlorination was observed across the plume as indicated in Tables 1 and 2. Both PCE and TCE were reduced to non-detect levels while an increase in cDCE occurred as a result of the breakdown process of chlorinated solvents. Monitoring is on-going and a request for No Further Action has been submitted to the regulatory agency.

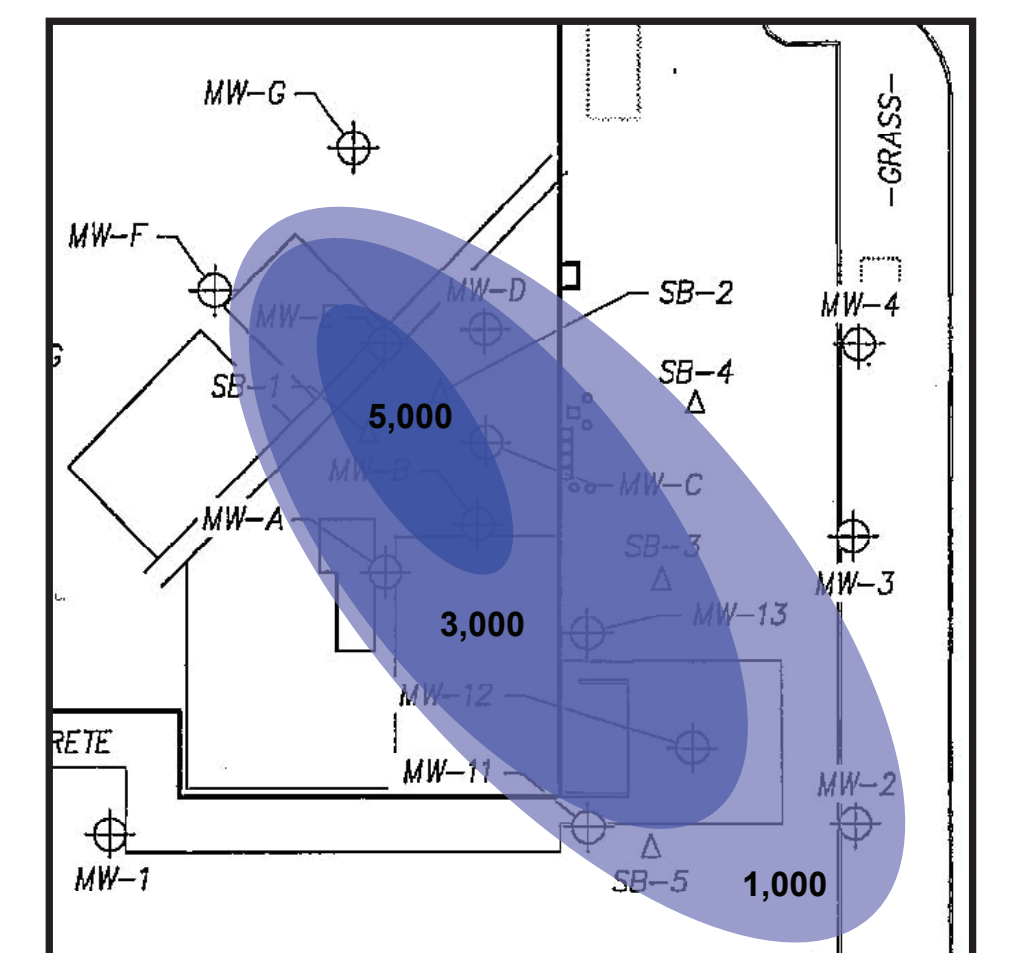


Figure 5. January 2008 cDCE Isopleth

Table 1. Concentrations in MW-B (Source Area) (ppb)				
	PCE	TCE	cDCE	VC
Pre-HRC Pilot Application	6174	3107	401	<0.5
Post-HRC Full-Scale Application	<0.5	<0.5	7281	<0.5

Table 2. Concentrations in MW-2 (Downgradient Plume) (ppb)				
	PCE	TCE	cDCE	VC
Pre-HRC Pilot Application	1138	499	131	<0.5
Post-HRC Full-Scale Application	<0.5	<0.5	2519	<0.5