Environmental Solutions

EHC® Reagent
Case Study

EHC® Reagent for Treatment of PCE Plume at Former Dry Cleaner Site in Colorado

Project

Site:	Former Dry Cleaner, Boulder, CO
Lead Consultant:	Higgins and Associates, Inc.
Application:	EHC® Reagent Installed via Direct Injection in June 2009

Summary

EHC® Reagent was shown to effectively treat tetrachloroethylene (PCE) and its catabolites. The site is a former dry cleaning facility impacted with PCE from a historical solvent release. The source was previously excavated; however a down gradient plume showed maximum PCE concentrations of 1,400 ppb. A field scale injection of EHC took place in June 2009 with a goal to reduce the PCE mass in the distributed plume and treat any residual PCE potentially migrating from beneath the former drycleaner. A total of 1,700 lbs of EHC was injected into 18 points using direct push technologies. Subsequent field monitoring showed PCE below detection limits at all wells after 9 months, with the exception of one well at the toe of the plume (measured at 6.1 ppb). A 99.8% reduction of PCE was observed in the hot spot without the accumulation of recognized catabolites, such as DCE or VC. Upon request for site closure by the client, the CDPHE responded that "monitoring shall continue until at least two consecutive events demonstrate that inorganic parameters return to pre-treatment levels and that contaminant levels continue to remain low or non-detect".

Challenge

The groundwater at the Site was impacted by primarily PCE (max 1,400 ppb) and trichloroethene (TCE; max 21 ppb). There is limited indication of anaerobic catabolites (i.e., DCE and VC), however, cis 1,2-DCE was present at levels below the Colorado Basic Standards of Groundwater (70 ppb). The PCE plume distribution is shown in Figure 1. The aquifer consists of low permeability silty sand, in which hydraulic conductivity was measured to range from 0.0032 to 0.02 ft/day, and linear groundwater velocity was estimated to be approximately 1 ft/yr. The groundwater table is located about 10 ft below ground surface (bgs) and shale bedrock located about 14 ft bgs.

Solution

A total of 1,700 lbs of EHC was injected over two days into 18 injection points using a direct push technology (Figure 1). The EHC was supplied as a dry powder in 50-lb bags and mixed with water (Figure 2) on site into slurry containing about 29% solids. Four injection points with a higher application rate of 0.4% EHC to soil mass were conducted as close as possible to the former drycleaner and upgradient of MW-2. Fourteen injection points with an application rate of 0.1% EHC to soil mass were conducted downgradient of MW-2, roughly 10 to 12 ft apart along the plume centerline (Figure 1). EHC slurry was distributed from 10 to 14 ft bgs using three injection intervals at injection points nearest the source, and only one vertical injection at downgradient locations. The higher EHC application rate applied just outside of the dry cleaner building behaves as a permeable reactive barrier (PRB) to treat any residual PCE potentially migrating from beneath the former drycleaner. Injections took place over 1.5 days. A few direct push rods were left in the ground overnight to allow for injection pressures to drop slowly as EHC dissipated into the tight formation.

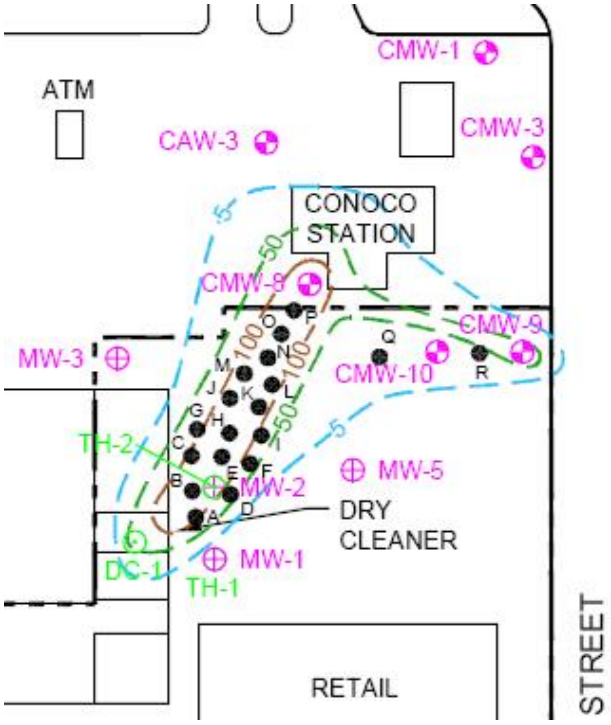


Figure 1. PCE plume (µg/L) and location of injection points (A to R).

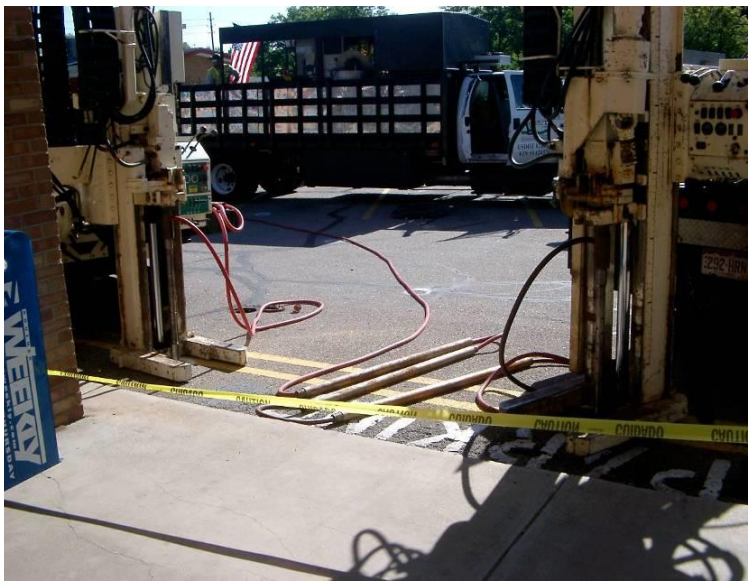
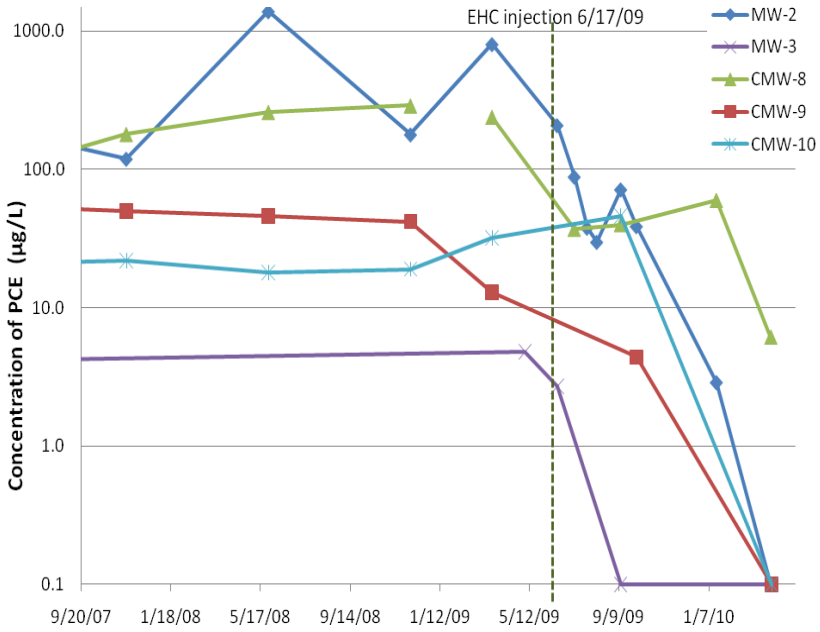


Figure 2. Direct injection outside of former dry cleaner.



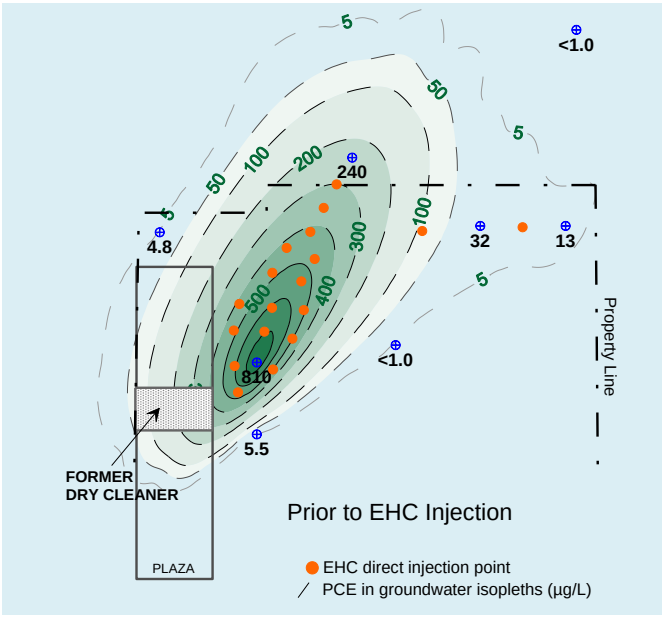
Result

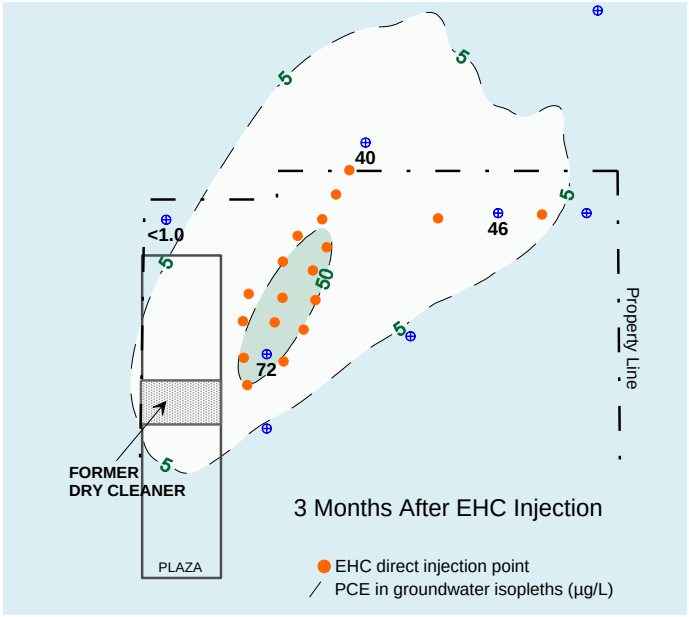
Colorado groundwater protection levels met in all wells after 9 months, with the exception of one downgradient well in which PCE was marginally above the standard (5ppb). Figure 3 shows the concentration of PCE in groundwater at all wells. 99.8% reduction of PCE was observed at MW-2 without the accumulation of catabolites (Figure 4). Trans 1,2 DCE and VC remained below detection levels at all wells.

Figure 3. Influence of EHC on PCE in groundwater

MW-2	PCE (µg/L)	TCE (µg/L)	Cis 1,2 DCE (µg/L)	Trans 1,2 DCE (µg/L)	VC (µg/L)
Colorado Standard	5	5	70	100	2
5/28/08	**1,400**	<1.0	<1.0	<1.0	<1.0
12/4/08	**180**	<1.0	<1.0	<1.0	<1.0
3/23/09	**810**	<1.0	<1.0	<1.0	<1.0
6/18/09	**210**	<1.0	<1.0	<1.0	<1.0
7/11/09	**89**	<1.0	<1.0	<1.0	<1.0
7/28/09	**38**	<1.0	<1.0	<1.0	<1.0
8/10/09	**30**	1.9	<1.0	<1.0	<1.0
9/11/09	**72**	**6.0**	<1.0	<1.0	<1.0
10/2/09	**39**	4.0	2.6	<1.0	<1.0
1/17/10	2.9	<1.0	30.1	<1.0	<1.0
3/31/10	0.1	<1.0	38.4	<1.0	<1.0

Figure 4. Influence of EHC on PCE and catabolites at MW-2





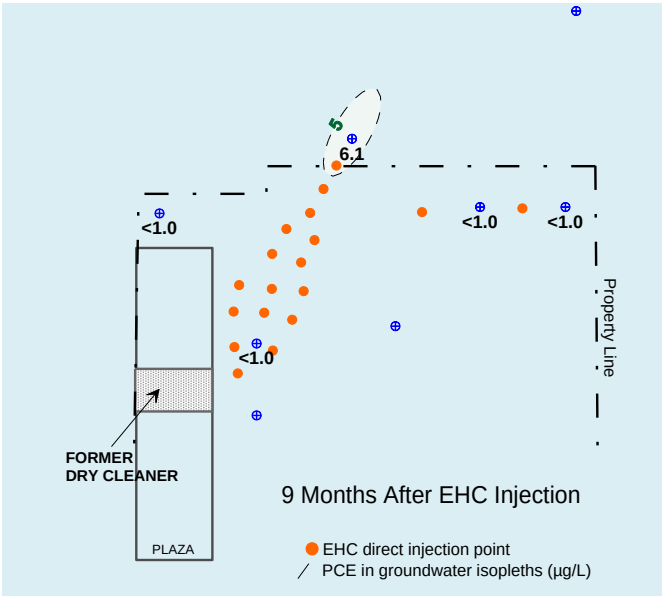


Figure 5. Impact of EHC on PCE plume (plume prior to treatment, 3months, and 9 months after EHC injection).