Co-Treatment of TCE and Chromium in Groundwater with the use of EHC® Metals

Project

Site:	Manufacturing Facility, Washington, USA
COCs:	Chlorinated Ethenes and Hexavalent Chromium
Lead Consultant:	EA Engineering, Science, and Technology, Inc.

Summary

EHC® Metals has been shown to effectively treat ca. 6.1 ppb trichloroethene (TCE) and immobilize ca. 165 ppb hexavalent chromium (Cr(VI)*) from groundwater at a manufacturing facility in Washington. Following the injection of EHC Metals performed in September 2006, subsequent performance monitoring conducted in October 2006 and January, May, July and October 2007 showed TCE and all related daughter products below the detection limit of 0.05 ppb. Cr(VI) was reduced by >90% to 11 ppb one month following the injections and has remained below the detection limit of 5 ppb since the January 2007 sampling event.

Challenge

The site soil and groundwater is impacted with TCE and elevated levels of Cr (VI). An extraction system is currently in operation at the site, which has cleaned up portions of the downgradient end of the plume to below the treatment goals of 5 ppb for TCE and 80 ppb for Cr(VI). However, an isolated area experienced rebound when the extraction system was not operated and it appeared that the extraction system was not effective for treatment of the source of this rebound. A concentration of 6.1 ppb TCE and 165 ppb Cr(VI) was measured at the former extraction well MW 41 in April 2006 (**Figure 1**). The conditions were relatively oxic with a DO of 5 mg/L and ORP of 200 mV. The goal was to clean up this isolated hot-spot area to allow for the extraction system to be shut down completely at the downgradient end of the plume, which would result in significant cost and energy savings.

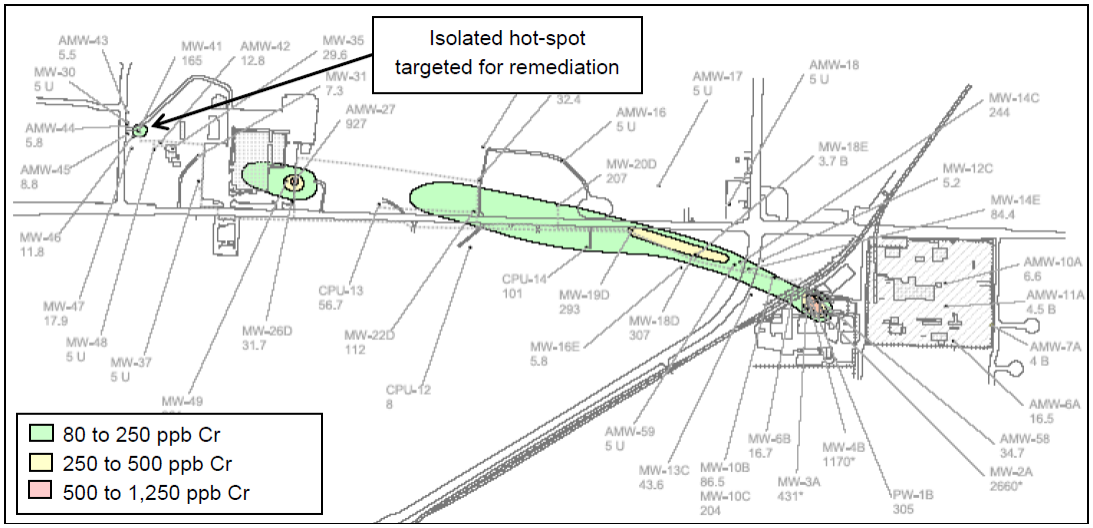

Figure 1: Concentration of Cr(VI) in groundwater measured in April 2006.

Solution

In September 2006, EHC Metals was injected into the suspected hot-spot area upgradient of extraction well MW-41. The targeted treatment area measured an estimated 60 ft wide x 100 ft long x 10 ft deep (from 75 to 85 ft bgs). A total of 9,600 lbs of EHC Metals was injected into the area, resulting in an average application rate of 0.15% to soil mass. The application rate applied was higher than the concentrations of TCE and Cr(VI) would suggest given the relatively oxic conditions at the site. The EHC Metals was injected as a slurry using direct injection. The injection points were spaced 10 to 15 ft apart, which resulted in a total of 32 injection points (**Figure 2**).

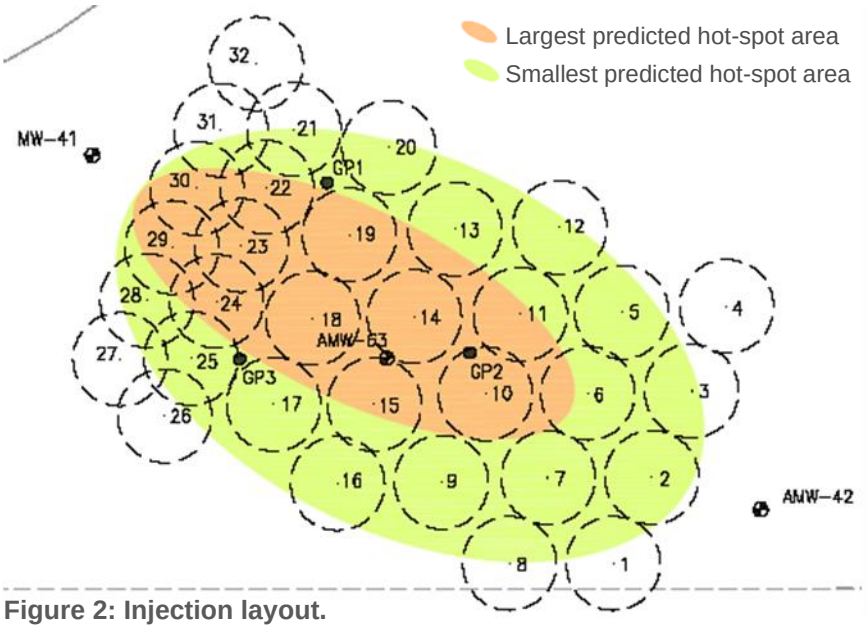

Figure 2: Injection layout.

The EHC Metals was delivered to the site as a dry powder in 50-lb bags. The EHC Metals powder was mixed with water on site into a slurry using a 55-USG drum with a paddle mixer at the bottom (**Figure 3**). The injections were performed using a truck-mounted PowerProbe (**Figure 4**). Using a vertical spacing of 2 ft, a total of 50 lbs was injected per injection layer (a total of 300 lbs over 6 layers per point). The injection work was performed by Boart Longyear over a period of 8 days.

Figure 3: Mixing Equipment.

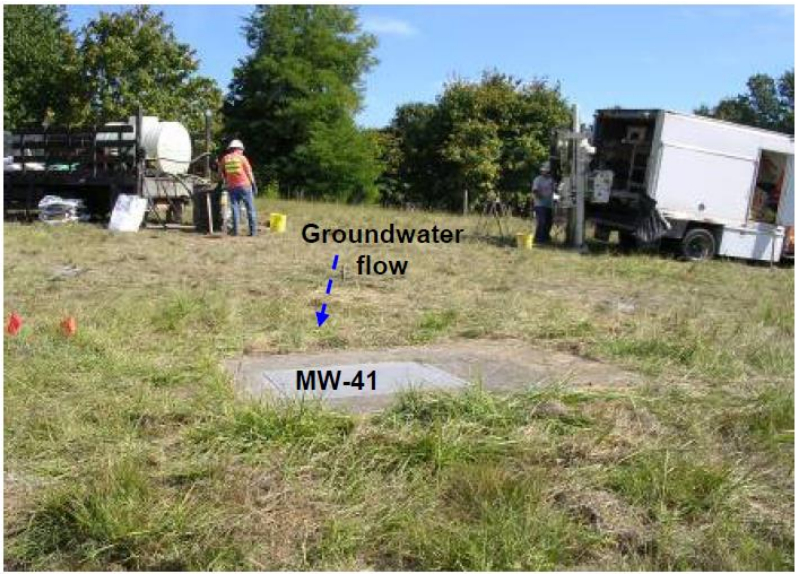

Figure 4: Injection of EHC Metals slurry using a truck-mounted PowerProbe.

Results

Subsequent performance monitoring conducted in October 2006 and January, May, July and October 2007 showed TCE below the detection limit at the former extraction well MW-41 (**Figure 5**). Cr(VI) was reduced by >90% to 11 ppb one month following the injections. Four months following the injections of EHC-M, Cr(IV) in groundwater had been reduced to below the detection limit of 5 ppb. Subsequent monitoring has shown that the chromium remained immobilized. An additional monitoring well, AMW-63, was installed in November 2006 at the center of the injection zone. TCE was non-detect and Cr was measured at 9.5 ppb at this new well in January 2007. TCE has remained below the detection limit of 0.05 ppb since July 2007, whereas total Cr was measured at 6.3 ppb in the latest monitoring event conducted in October 2007. All related daughter products from TCE degradation (cis-DCE, VC) has remained below the detection limit at both MW-41 and AMW-63.

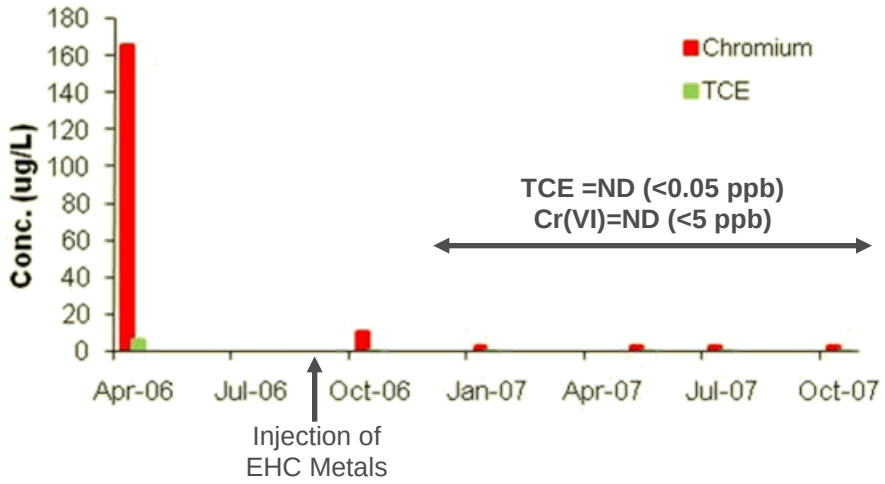

Figure 5: Influence of EHC Metals Injections on concentrations of TCE and Cr(VI) at MW-41.

***Note:** All data measures total dissolved Cr, however, it is used to represent Cr(VI). In comparison tests, all Cr detected in the dissolved phase at this site has been hexavalent; the trivalent forms have been found to precipitate out of solution.