

CASE SUMMARY

This Superfund site is located in North Central Ohio. The remediation activity included Operable Unit #1, which consists of a 7 acre plume (Figure 1) located within the unconsolidated zone and includes residual source material under the retail shopping center, surface water, shallow groundwater contamination, and indoor air contamination. The site is primarily an open field surrounded by busy streets in the township, with mixed commercial and residential occupancy. Investigations in 1994 showed that volatile organic compounds (PCE, TCE, and VC) were contaminating the groundwater. Testing showed a former dry cleaning business was the likely source of ground water contamination.

SITE BACKGROUND

Geology: Unconsolidated glacial deposits and underlying bedrock. The treatment zone consists of interbedded silt, sand, clay, and gravel.

Hydrology: Hydraulic conductivities for the shallow water-bearing units is 7.37×10^{-3} with an average linear groundwater flow velocity of 1.05×10^3 cm/s (2.98 feet per day [ft/day]).

Extent of Contaminant: Approximately 2 ppm of Tetrachloroethylene (PCE) and 1 ppm Trichloroethylene (TCE)

Remediation Goal: MCLs for Groundwater (5 ppb) and PRGs for soil (480 ppb)

REMEDIATION APPROACH

The injection activity occurred over approximately four months using a three man crew with a 7000 series Geoprobe and a ChemGrout® high pressure injection system.

A total of 145,000 lbs of Ferox Plus was injected, with an average of 10 pts and 4,600 lbs of Ferox Plus injected per day.

PROJECT OBJECTIVES

The objective of this phase of the remediation project was to promote in situ reductive dechlorination to remove the cVOCs by injecting Ferox Plus carbon/ZVI formulation into the shallow groundwater.

For comparison, one fourth of the treatment area was treated with a similar EHC® ISCR reagent (PeroxyChem Inc.). Also, in ~10% of the injection points, bioaugmentation was performed 2 weeks after injection of the Ferox Plus to determine the effectiveness of the addition of dehalococcoides sp. microorganism to complete dechlorination of site contaminants to ethene.

The injection contract was based on a fixed unit price per pound of product injected per point with the product distributed to at least 5 feet horizontally in all directions in each injection interval. Also, it required that suitable mixing equipment be used to ensure that the product was well mixed and free of clumps.

Ferox Plus was chosen for its site-ready format and its superior distribution characteristics.

Remediation Approach, cont.

376 injection points (Figure 2) were injected with ~30 lbs/ft or ~400 pounds per point, starting at around the depth of shallow groundwater (~ 1 to 4 feet) throughout the targeted treatment interval (~14 ft. bgs.) The Ferox Plus was injected in 2 foot vertical intervals in a top-down fashion at a spacing based on a 5' radius of influence (ROI) (Figure 2). Angled injection was used to distribute the Ferox Plus up to 15 feet horizontally from the injection point. Over 100 conformational borings were completed to determine the ROI. The Ferox Plus injections were in compliance over 95% of the time.

In the comparison with EHC ISCR Reagent activities, it was found that in order to get the necessary distribution of iron to comply with the specifications, EHC had to be applied at the similar loading rate per linear foot, but at approximately a 2.5' ROI (Figure 2). 208 points (Figure 2) were injected with ~50 lbs/ft or ~125 pounds (dry product) per point, starting at around the depth of shallow groundwater.

RESULTS

After four months of injections, a quarterly sample event occurred. Table 1 shows a comparison of the average concentrations of PCE before the treatment compared to the values from the most recent quarterly sampling event. MW-3S, MW-5S, and MW-14S were all shallow monitoring wells in the Ferox Plus treatment area. MW-4S was within the EHC treatment area.

Over 98% removal of PCE and 93% of TCE was found in all wells within the treatment zone. As to be expected from these preliminary results, there were some increases and decreases of daughter products, cis-1,4 Dichloroethene (cis-DCE) and vinyl chloride, as the degradation process proceeds.

Both Ferox Plus and EHC ISCR Reagent gave similar results. However, because the Ferox Plus was ready to inject and required only 10 lbs/yd³ treated, versus 170 lbs/yd³, it is much more economical.

Table 1: Reduction in PCE after treatment with Ferox Plus

PCE	MW-3S	MW-4S*	MW-5S	MW-14S
BEFORE	214	857	1,060	27,500
AFTER	1.1	6	4.6	660
% REDUCTION	99%	99%	100%	98%
ORP	-120	-117	-146	-241

*EHC® ISCR Reagent treatment area

CONCLUSION

Ferox Plus carbon/ZVI amendment provided a very effective and cost-efficient solution to enhancing cVOC removal at this site. Its site-ready format eliminated any mixing or clumping problems. It distributed easily in the subsurface with greater ROI, ensuring its effectiveness on site.

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Figure 1: Copley Square 7 Acre Shallow PCE Plume

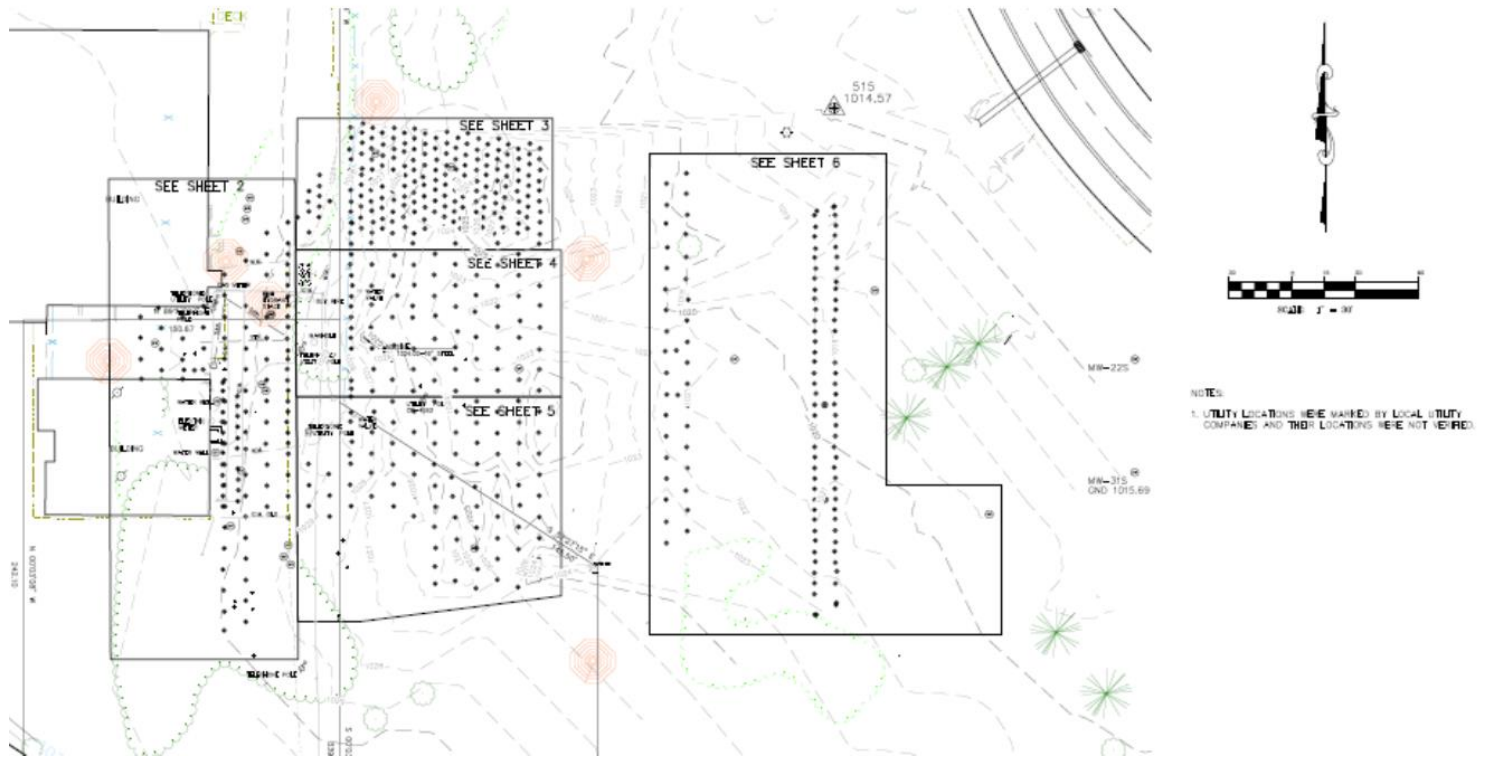


Figure 2: Copley Square Injection Point Layout