

Former One Stop Cleaners

Pump and Treat—Soil Vapor Extraction—In Situ Chemical Oxidation

Site Name: One Stop Cleaners

Site Location: Coral Springs, Florida

Technology Used:

- Pump and Treat
- Soil Vapor Extraction (SVE)
- In Situ Chemical Oxidation (ISCO) (Potassium Permanganate)

Regulatory Program: Florida Department of Environmental Protection—Drycleaning Solvent Cleanup Program ID: 069501160

Remediation Scale: Full

Project Duration: 1999 to present

Site Information: The former One Stop Cleaners operated a dry cleaning facility from 1978 to 1996. The business was located in a shopping mall that has since been converted to a charter school.

Contaminants: The contaminants of concern are tetrachloroethene (PCE) and its degradation products (Table 1). The highest detected level of PCE was 143 mg/L, which indicates the presence of a dense non-aqueous phase liquids (DNAPL). The release occurred near the former dry-cleaning machine and a floor drain. The contaminant plume was about 310 ft long, 200 ft wide and 60 ft deep.

Hydrogeology: The lithology at the site consists of:

- Fine- to medium-grained sand with up to 25% clay—surface to 8 ft below ground surface (bgs)
- Fine- to medium-grained sand—8 to 12 ft bgs
- Fossiliferous limestone—12 to 16 ft bgs
- Fine- to medium-grained sand with shells and minor clay—16 to 36 ft bgs
- Medium- to coarse-grained sand—36 to 50 ft bgs
- Silty fine-grained sand—50 to 52 ft bgs
- Weathered limestone with clay—52 to 57 ft bgs

- Limestone—57 to 100 ft bgs

The depth to groundwater at the site is between 5 and 7 ft bgs. The aquifer has a hydraulic conductivity of approximately 19 ft/day.

Table 1. Maximum Initial Contaminant Concentrations

Contaminant	Soil ¹	Ground-water ²	Water Solubility (µg/L) ³
Tetrachloroethene (PCE)	486,500	143,000	150,000
Trichloroethene (TCE)	1.3	22,360	1,100,000
1,1-Dichloroethene (1,1-DCE)	ND	16	400,000
<i>cis</i> -1,2-Dichloroethene (<i>cis</i> -1,2-DCE)	34.9	34,040	3,500,000 ⁴
<i>trans</i> -1,2-Dichloroethene (<i>trans</i> -1,2-DCE)	0.7	312	600,000
Vinyl Chloride (VC)	ND	3.1	2,763,000 ⁴

¹ Maximum Detected Concentration in µg/kg

² Maximum Detected Concentration in µg/L

³ J. Montgomery and L. Welkom. 1991. Groundwater Chemicals Desk Reference. Lewis Publishers, 640 pp

⁴ P. Howard (ed.). 1990. Handbook of Environmental Fate and Exposure Data For Organic Chemicals, Volume I & II Solvents. Lewis Publishers, 546 pp

Project Goals: Table 2 shows the remedial action goals set for the cleanup.

Table 2. Cleanup Goals

Contaminant	Groundwater (µg/L)	Soil (µg/kg)
PCE	3.0	30
TCE	3.0	30
<i>cis</i> -1,2-DCE	70	400
<i>trans</i> -1,2-DCE	100	n/a
1,1-DCE	7.0	n/a
VC	1.0	n/a

Cleanup Approach: Soil vapor extraction was selected for the thin vadose zone. Because of the shallow water table, horizontal wells were installed. Two 4-inch diameter, schedule 40 PVC SVE wells of 15 and 25 ft in length were installed at a depth of 2 ft beneath the building's floor slab. The location of the source area was determined by information obtained from direct-push vertical profiling of the subsurface below the building slab. Extracted vapors were treated in a 2,000 pound granular activated carbon vessel.

Pump and treat was selected for initial hydraulic containment of the contaminant plume. The groundwater pump and treat system initially used six wells and low-profile air strippers and came online in October 2001. An ISCO extraction/treatment/injection system added 14 more 4-inch-diameter wells. Depths of these wells ranged from 15 to 60 ft bgs with 10- to 50-ft-long well screens. Two additional injection wells were installed with screened intervals of 15 to 69 ft bgs and 15 to 80 ft bgs. Sampling from multi-port monitoring wells and low-flow sampling in the longer screened intervals provided information on the progress being made with the injection.

The injection of oxidant was done in two phases. During the first phase, which lasted approximately three months (February 28 to June 6, 2002), a total of 42,440 pounds of potassium permanganate (concentration of about 4800 to 7300 mg/L) was injected into the subsurface. Because of information from the monitoring well network, a 4-inch-diameter lateral injection well was installed to a depth of 50 ft bgs prior to the Phase II injection. The length of the well was 245 ft with 50 ft of screen. The second phase used three wells — the lateral injection well, one of the lateral vapor wells, and a recovery well. Over approximately one month (April to May 2003), 18,200 pounds of potassium permanganate were injected in the subsurface at concentrations ranging from about 6,100 to 7,800 mg/L. In addition, approximately 4,360 pounds of potassium permanganate was injected during the previous ISCO pilot study.

During the injection process, manganese dioxide fouling of the injection wells required redevelopment of the affected wells. Since the reaction products involved in the destruction of the contaminant include the formation of manganese dioxide, it can be anticipated that there may be clogging in highly contaminated wells at the site. Another operational problem that had to be dealt with was the high concentration of calcium carbonate and bicarbonate in the groundwater, which resulted in scaling in the air stripper, air stripper totalizer, and injection wells. The scaling has generally been addressed by periodic application of muriatic acid.

As of November 2011, the state reports remedial investigation costs of \$211,711, design and implementation costs of \$1,071,531, and operation and maintenance costs of \$971,877.

Project Results: From October 2001 through July 2005, the pump and treat system had processed 39.5 million gallons of water and recovered an estimated 217 pounds of VOCs. However, excessive calcium carbonate fouling resulted in the deactivation of the pump and treat system in July 2005. The system was removed in July 2011.

The estimated total mass recovered by the SVE system from October 2001 to April 2011 is 75.3 pounds. The calculated mass recovery rate, based on the analytical results, was 0.0104 pounds per day. The SVE system, which has been operating as a vapor mitigation system since the 2009 upgrade, is still operating and continues to recover small amounts of contaminants.

Contaminant concentrations in source area monitoring wells have dropped from total VOC concentrations of near 200,000 µg/L to less than 10 µg/L in most monitoring well samples. High PCE groundwater concentrations indicative of DNAPL remain present in a part of the source area, particularly at depths of 11 and 50 ft bgs. These high levels appear to be isolated laterally around the area directly underneath the former

dry-cleaning machine, as well as a nearby floor drain formerly located in the dry-cleaning facility. The concentration has fluctuated over time remaining significantly above the natural attenuation default concentrations. However, bioremediation has been naturally occurring at several intervals in the subsurface as evidenced by PCE daughter products, including vinyl chloride.

When funding becomes available, the Florida Department of Environmental Protection may also consider implementing measures such as bioremediation to contain the dissolved plume within the source area.

Sources:

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Shaw Environmental. 2011. Remedial Action Status Semi-Annual Report (Year 9, Quarters 3 and 4) December 2010 through May 2011: Former One Stop Cleaners, 61 pp.

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Shaw Environmental. 2012. Remedial Action Status Semi-Annual Report (Year 10, Quarter 4 And Year 11, Quarter 1) March 2012 Through August 2012 Former One Stop Cleaners d.b.a. Coral Springs Charter School
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FDEP Facility ID No. 069501160
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