



In-situ Remediation of an Operating Dry Cleaning Business using Combined Remedial Technologies Dual Phase Extraction and Electrical Resistive Heating

Contracting Summary

The Carson, California remediation was performed under a guaranteed fixed price remediation (GFPR) contract.

Project Summary

CES Group (CES) personnel performed an Electrical Resistance Heating (ERH) remediation of Tetrachloroethene (PCE) and trichloroethene (TCE) in soil and groundwater for Behullar Properties LLC. The guaranteed remediation contract was based upon reducing existing groundwater concentrations to MCL's and obtain a no further action letter from the Los Angeles Regional Water Quality control Board (LARWQCB). Groundwater concentrations were reduced by approximately 98% and the Site is currently submitted for regulatory closure.

Background

The soil and groundwater beneath an operating dry cleaning business and strip mall in Carson, California was impacted with tetrachloroethene (PCE), trichloroethene (TCE), dichloroethene (DCE), and vinyl chloride to a depth of 25 feet below ground surface (bgs). Initial soil concentrations at a depth of 16 feet bgs have maximum values of 860 µg/kg PCE and 1,700 µg/kg TCE. Initial groundwater concentrations in the hot spot area were 4,600 µg/L PCE and 18,000 µg/L TCE. CES personnel used Multi Phase Extraction (MPE) and Electrical Resistive Heating (ERH) combined to remediate both the soil and groundwater at the project site.

MPE was used to treat the down gradient dissolved phase groundwater plume and ERH was used to focus treatment in the source areas soil and groundwater. The Site is currently submitted for regulatory closure.

Site Characteristics & Design Parameters

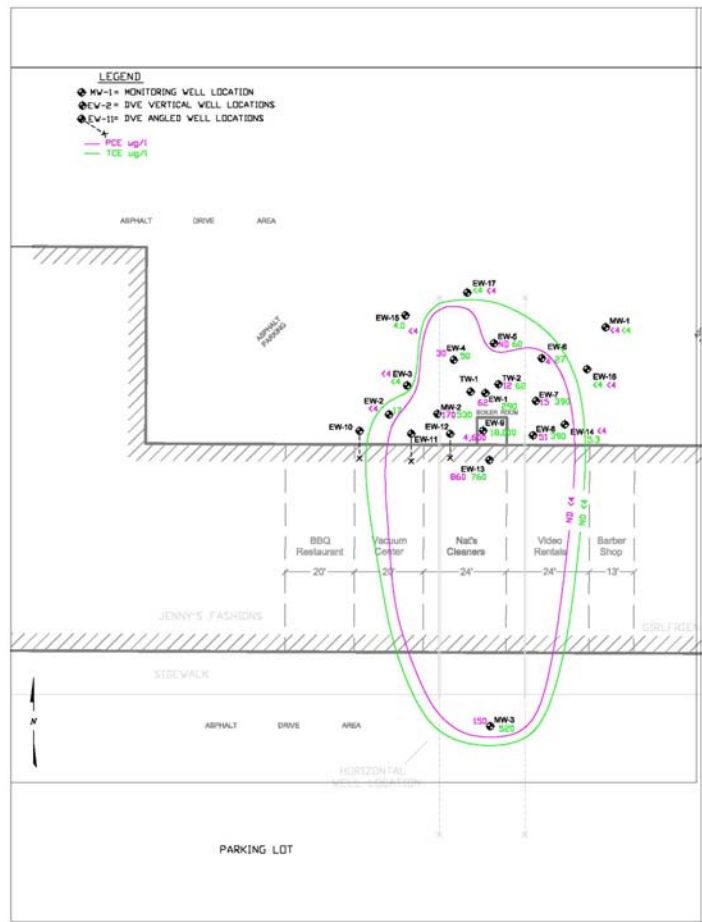
The remedial action objectives for the site is to reduce PCE and TCE concentrations to MCL's in groundwater and below the Los Angeles Regional Water Quality Control Board attenuation standards in soil. Clean up objectives were established as follows:

Depth (ft-bgs)	Soil Cleanup Goals			
	trans-1,2- DCE (ppb)	cis-1,2-DCE (ppb)	TCE (ppb)	PCE (ppb)
surface	106	63.6	53	53
5	76	45.6	38	38
11	40	24	20	20
16	10	6	5	5
21	10	6	5	5
Groundwater Clean-up Goals	10	6	5	5

Technology selection for the site began with an overall goal to complete remediation within 1.5 years. This goal was established by the property owner for sale of the property. Excavation was eliminated since it was not a viable alternative to address impacted soil and groundwater beneath the building. During evaluation of potential technologies a Soil Vapor Extraction and Dual Phase Extraction pilot test were conducted. Results of the pilot test showed that dual phase extraction was effective at dewatering the site and treating the more permeable saturated zones however, the lower permeability fine grained units resulted in low radius of influence and diffusion limited remediation.

Therefore to enhance the remediation time frame for the entire site ERH was selected for application in the low permeability source area with MPE to be applied in the more permeable down gradient dissolved phase plume. MPE wells were installed using both vertical and horizontal drilling technologies to address the dissolved phase hydrocarbon plume. MPE operations commenced approximately one year prior to initiating SPH and continued to operate in some areas as vapor recovery wells during ERH.

Five Vertical and two horizontal MPE wells were installed in the dissolved phase plume and in the source area. Wells were constructed of schedule 40 PVC and completed to depths of 28 feet below grade. Prior to the start of the ERH remediation, MPE was used as the remedial alternative for dissolved phase hydrocarbons and also operated in the source area. Mass removal rates during MPE remediation were approximately 0.08 pounds of VOC's per day. After one year of MPE operations a total of 58 pounds of VOC's were removed from the subsurface as vapor.



ERH electrodes were installed below grade inside the operating dry cleaning business and above grade outside the business in the adjacent parking lot. A total of 11 electrodes (co-located vapor recovery) and vapor recovery wells (3 located inside and 9 located outside) were used to heat the subsurface and remove the contaminants. Electrodes were installed at a depth of 8 to 28 feet bgs with a protective outer sleeve extending to the surface.

In addition to the multi-purpose electrodes (vapor recovery wells), two existing horizontal wells located at a depth of 10 feet bgs beneath the operating business were also used for vapor recovery. A low vacuum vapor recovery system was also installed to remove potential migrant steam and vapors from beneath the existing concrete building slab at the site.

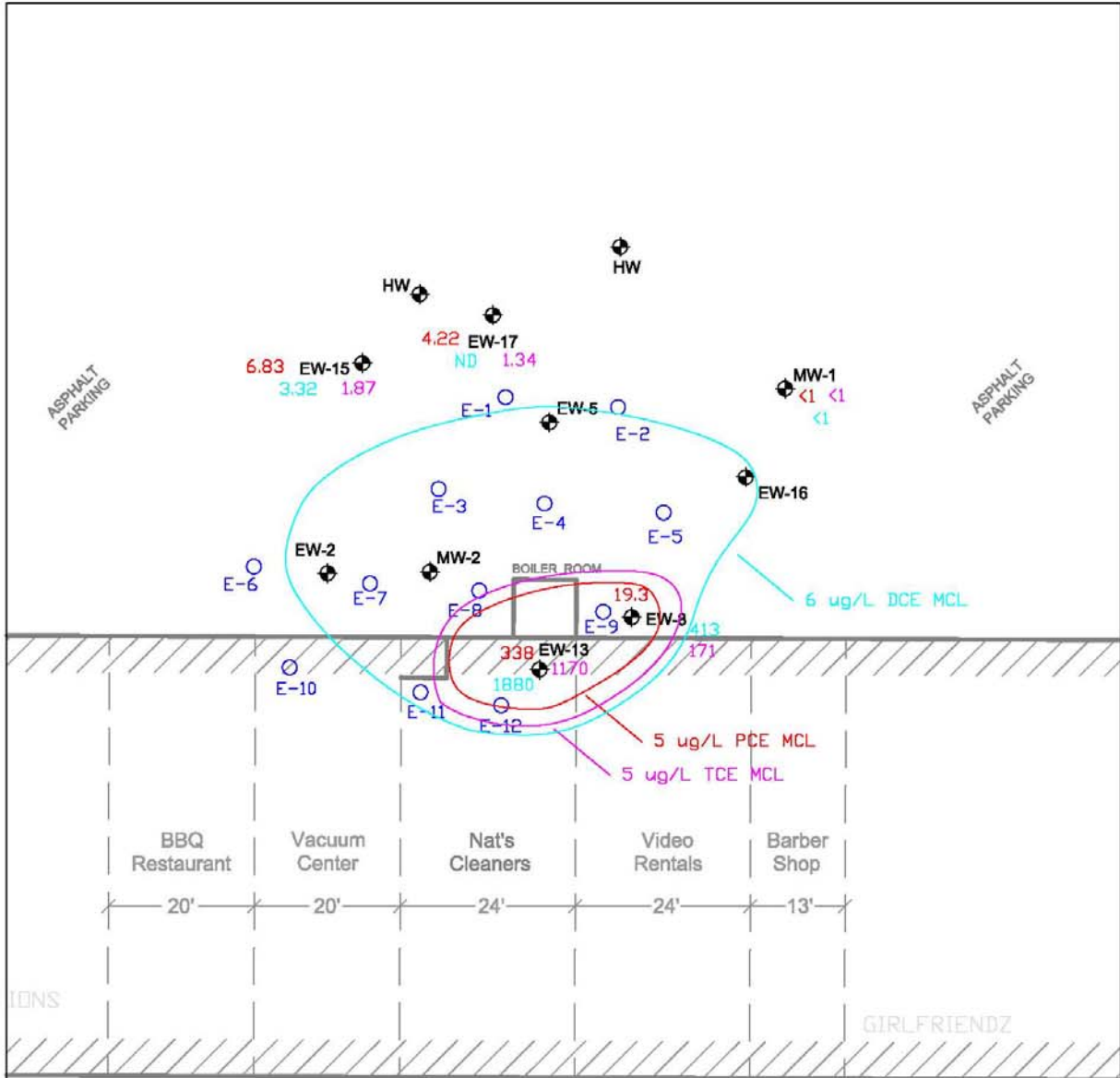


The extraction system consists of a 30-hp extraction blower and 150-gallon water/vapor separator. The extracted groundwater and vapor will be treated using 1,000 lbs of vapor-phase carbon and 1,000 pounds of liquid-phase carbon. Treated groundwater was discharged to the storm drain using a National Pollution Discharge Elimination System (NPDES) permit and treated vapors were discharged to the atmosphere using a South Coast Air Quality Management District (SCAQMD) permit. The project was completed under the oversight of the Los Angeles Regional Water Quality Control Board (RWQCB) and is the first commercial remediation using Six Phase Heating in California. The combined remedy was installed and operated in an operating shopping center with residents within 100 feet of the remedial system.

Project Results

Within 27 days from the start of Electrical Resistance Heating operations mass removal rates of VOC's increased by 725% (0.66 lbs/day) when compared to DVE alone. The dramatic increase in mass removal was detected when average subsurface temperatures reached approximately 52 deg. C. With only an additional week (34 days total) of SPH operation VOC mass removal rates climbed to more than 5 lbs/day or 6,150 % greater than DVE alone. After only 48 days of SPH operation more than 100 lbs of VOC have been removed from the site. This is 75% more mass removed than after a year of DVE.

After only sixty-five days of ERH operation soil and groundwater contaminant concentrations levels were reduced to below MCLs, approximately 177 pounds of VOC's were removed and the project was submitted for no further action with one year of rebound monitoring.



NOTES:	MARCH 2007 SAMPLING RESULTS		
	641 E. UNIVERSITY DR. CARSON, CA		
	DRAWN BY: JL	CHECKED BY:	PROJECT NO: 2707
	APPROVED BY:	DATE: 8/15/07	SCALE: AS SHOWN
			FIGURE 3

Project Summary

<i>Project Manager (Superintendent Name)</i>	<i>Skye Green</i>
<i>Site Geology and Hydrology</i>	<i>Clay, silty sand, silt</i>
<i>Treatment Area Size, Volume, and Depth</i>	<i>82 ft x 135 ft x 30 ft bgs - 12,300 cubic yards</i>
<i>Beginning Highest Contaminant Concentrations</i>	<i>18,000 µg/L TCE, 37,000 µg/L DCE, 4,600 µg/L PCE</i>
<i>Final Average Contaminant Concentrations</i>	<i>149 µg/L TCE, 5.7 µg/L PCE</i>
<i>Remedial Goal(s)</i>	<i>Obtain No further Action</i>
<i>Actual Cleanup Achieved</i>	<i>99% reduction in TCE groundwater concentrations and 99.8% for PCE</i>
<i>Period of Performance</i>	<i>146 days of operations</i>
<i>Contract Terms</i>	<i>Guaranteed Fixed Price Remediation (GFPR)</i>
<i>Project Name</i>	<i>Carson Plaza</i>
<i>Site Owner</i>	<i>Bhullar Properties LLC, Mr. Sunny Bhullar (408) 230-8999</i>
<i>Bid Price / Final Completion price</i>	<i>\$425,000 (confidential)</i>