General Information

Site Name and Location:

Blacks Cleaners, Portland, Oregon, United States

Description: Historical activity that resulted in contamination.

The Blacks dry cleaner facility site is located in a densely developed commercial/residential area in southeast Portland, Oregon. The site is bounded by commercial properties to the south and residential properties to the north, west, and east. Various dry cleaners have operated at the site since the early 1950s. Historically, the dry cleaning operations at the site used Stoddard solvent (a petroleum-based solvent) until 1959 and perchloroethene (PCE) from 1959 to the present. The facility continues to operate as a dry cleaning establishment. Releases of dry cleaning solvents are apparently due to historical disposal of lint and filter media out the back door, releases to subsurface through concrete beneath the dry cleaning machine, releases from sanitary sewer lines, and leaks from 2 former underground storage tanks.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).

Contaminant	Conc in GW	Conc. in Soil
1,2,4-trimethylbenzene	0.180 mg/L	
1,3,5-trimethylbenzene	0.035 mg/L	
cis-1,2-Dichloroethene	39 mg/L	10.9 mg/kg
dichlorobenzenes	0.003 mg/L	
ethylbenzene	0.012 mg/L	
free-phase Stoddard's Solvent	@ MW-1	
Tetrachloroethene (PCE)	8.7 mg/L	1,100 mg/kg
Trichloroethene (TCE)	10.4 mg/L	91.6 mg/kg
Vinyl Chloride	0.35 mg/L	0.14 mg/kg
xylenes	0.05 mg/L	

Other Contaminants Present: Indicates what other contaminants were found on-site

Deepest Significant Groundwater Contamination: 20 ft below ground surface - vertical extent yet to be determined.

Plume Size: ~120 feet long, 60 feet wide, depth 20+

Site Hydrology:

Depth to Groundwater: varies seasonally from 6 to 12 feet.

Lithology and Subsurface Geology: The soil beneath the site consists of low permeability silty clay to a depth of approximately 3 m below ground surface (bgs), underlain by silty sand to a depth of approximately 6 m bgs. Coarse-grained gravels and sands underlie the silt unit. The regional productive aquifer in the project area is a coarse gravel unit of the Troutdale Formation at an estimated depth of 30 m bgs. Based on observed plume dimensions, a likely release history of up to 40 years, and taking into consideration retardation of PCE and breakdown products, it was estimated that groundwater flow velocities are in the range of 1.5 to 3 m/year. A full aquifer test was not completed at the site, though the sustainable pumping rate was measured from an injection well prior to initiating the pilot study (approximately 3 L/min).

Conductivity: Hydraulic conductivity estimates based on typical values for the encountered soil types are on the order of 10-4 cm/s.

Gradient: Groundwater flow in the shallow aquifer is to the west, with a gradient of approximately 0.08 m/m.

Media:

Media: DNAPL
Groundwater
Soil

Remediation Scenario:

Cleanup Goals: Cleanup goals for soil and groundwater will primarily be based on vapor intrusion into buildings. Preliminary remediation goals for groundwater approximately 1ppm for PCE, 100 ppb, for TCE and 20 ppb vinyl chloride.

Technologies:

Technologies Used: In Situ:
Bioremediation
Reductive Dechlorination (In Situ Bioremediation)
Ex Situ:
Removal

Other technologies used: In-situ bioremediation using electron donors (sodium lactate initially, emulsified soybean oil beginning in 2004) and bioaugmentation

Why the technology was selected: Removal action unable to achieve removal of source material beneath building. Dense development and access constraints limit use of SVE or other typical remedial approaches.

Date implemented: Full-scale in-situ bioremediation initated in summer 2002.

Final remediation design: Injection system modifications and adjustments to electron donor, bacterial amendments likely to change through time. Existing system includes three horizontal injection points beneath building footprint, horizontal injection system in former source area behind building, and several vertical injection wells between dry cleaner faciliity and adjacent apartment building.

Results and Next Steps:

Results to date: Although dissolved phase concentrations in groundwater were successfully treated using ClOut bioamendments in a pilot study conducted in a portion of the dissolved phase groundwater contaminant plume, concentrations of VOCs increase to pre-treatment levels due to advective transport of contaminants from the upgradient source areas.

Next Steps: Continue with enhanced in-situ bioremediation through 2005 and implement vapor mitigation for adjacent apartment building.

Costs:

Cost for Assessment: ~$100,000

Cost to Design and Implement: ~$30,000

Cost for Operation and Maintenance: Periodic injection of electron donor and/or bacterial treatment estimated at ~$35,000/year plus ~$20,000 year for on-going groundwater, soil gas and indoor air monitoring.

Total Costs for Cleanup:

Lessons Learned:

Lessons Learned:

Contacts:

Principal Point of Contact:

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Site Specific References:

Site Specific References:

Images:

Images of Site:

Profile last updated on Jul 14, 2004

General Information

Site Name and Location: Carousel Cleaners, Oregon City, Oregon, United States

Description: Historical activity that resulted in contamination. Carousel Cleaners is an active retail dry cleaner located in Oregon City, Clackamas County, Oregon (NW ¼, Section 38, Township 2S, Range 2E). The site topography and surface gradient are relatively flat. Several residences and commercial businesses are located within the immediate vicinity of the site. The site is bounded by an apartment complex to the east, a vacant lot to the north, and a small business park to the south. In July 1999, soil and groundwater samples were collected at the site as part of a preliminary site investigation. PCE was detected in soil boring samples from 35 to 1,010,000 micrograms per kilogram (ug/kg). The location with 1,010,000 ug/kg of PCE is adjacent to the back door to the dry cleaning facility. 10-20PCE was also detected, at 0.7 ug/L, in a groundwater sample collected from the facility industrial supply well completed in the deep basalt aquifer. The supply well is on the south side of the property approximately 100 feet downgradient of the primary source area.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).

Contaminant	Conc in GW	Conc. in Soil
Tetrachloroethene (PCE)	up to 25,700 ug/L up	to 7,000 mg/kg

Other Contaminants Present: Indicates what other contaminants were found on-site

Deepest Significant Groundwater Contamination:	Periodic detections of PCE in supply well completed at depth of 150 feet below ground surface.
Plume Size:	Roughly 100 ft long by 50 ft wide
Site Hydrology:	
Depth to Groundwater:	Seasonally varies from 10 to 20 feet below ground surface.
Lithology and Subsurface Geology:	Silt to a depth of approximately 30 feet below ground surface. Beneath the silt unit is fractured basalt, which is currently used for on-site water supply for the laundramat and other industrial and irrigational uses in the general area.
Conductivity:	Not determined
Gradient:	0.002 ft/ft
Media:	
Media:	Groundwater Soil
Remediation Scenario:	
Cleanup Goals:	Final cleanup goals yet to be established. Likely cleanup goals for groundwater and soil will be based on vapor intrusion modeling, and protection of deep aquifer at the MCL of 5ppb for PCE.
Technologies:	
Technologies Used:	In Situ: Bioremediation
Other technologies used:	
Why the technology was selected:	Vendor funding of field scale demonstration project for the biological amendment products (BioRem H10).

Date implemented: Pilot Study initiated in spring 2001, and terminated in winter 2003 after 2 years of testing.

Final remediation design: Pilot Study: For the vadose zone treatment, trenches were cut along the perimeter, and in the center, of the 15 by 15-foot area to be treated located next to back door. The trenches were spaced so that no more than a 5-foot gap exists between any two trenches. The trenches were cut to a depth of 5-feet BGS, approximately 1-foot above the zone of greatest contamination. For the saturated zone, one new injection well and one existing monitoring well used for injection of biological amendments into the aquifer.

Results and Next Steps:

Results to date: BioRem H-10 has been demonstrated to degrade PCE without generation and accumulation of more toxic daughter products, namely TCE and vinyl chloride.

Next Steps: Completing focused FS to evaluate alternative treatment options for vadose zone soil. Will likely complete groundwater remediation using BioRem after vadose zone treatment completed.

Costs:

Cost for Assessment: Investigation phases $150,000

Cost to Design and Implement: 2-year pilot demonstration costs ~$75,000 for injection system, and monitoring. BioRem contributed H-10 bacteria product for study.

Cost for Operation and Maintenance: See above

Total Costs for Cleanup: 1. Site investigations need to be more comprehensive. Significant source material in vadose zone should have been addressed through alternative means than biological amendment flushing (e.g. SVE or removal)

Lessons Learned:

Lessons Learned:

Contacts:

Principal Point of Contact: Bruce A. Gilles, Project Manager
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Site Specific References:

Site Specific References:

Images:

Images of Site:

Profile last updated on Apr 14, 2005

General Information

Site Name and Location: Former 60 Minute Cleaners (College), Fort Myers, Florida, United States

Description: Historical activity that resulted in contamination. Drycleaning using PCE was performed at this site from 1968 until 1999. The site is located in a strip mall in a commercial-retail/residential setting. A gas station was formerly located adjacent to the strip mall and petroleum contaminants are comingled with the chlorinated solvent contamination. The contaminant source area is the soil beneath the facility floor slab near the former location of the drycleaning machine. Five water supply wells are located within one-half mile of the site. The nearest well is located approximately 500 ft from the site and produces from a zone 200-400 ft bgs.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).

Contaminant	Conc in GW	Conc. in Soil
1,1-Dichloroethane	8.6 : g/l	
1,1-Dichloroethene	1,050 : g/l	
Benzene	150 : g/l	
cis-1,2-Dichloroethene	2,321 : g/l	
ethylbenzene	2.5 : g/l	
Methyl tert butyl ether (MTBE)	29.5 : g/l	
Tetrachloroethene (PCE)	6,820 : g/l	1,800 : g/kg
toluene	6.9 : g/l	
trans-1,2-Dichloroethene	150 : g/l	
Trichloroethene (TCE)	2,040 : g/l	2.97 : g/kg
Vinyl Chloride	150 : g/l	
xylenes 4 : g/l		

Other Contaminants Present: Indicates what other contaminants were found on-site

Deepest Significant Groundwater Contamination: 44 ft bgs

Plume Size: 225 ft X 500 ft

Site Hydrology:

Depth to Groundwater: 4 ft bgs

Lithology and Subsurface Geology: Silty, fine-grained sand, surface-2.5 ft bgs; Limestone caprock, 2.5-11 ft bgs; Silty, fine-grained sand with shells and limestone stringers, 11-27 ft bgs; Sandy clay, 27-35 ft bgs; Clay, 35-44 ft bgs

Conductivity: shallow surficial aquifer: 16-43 ft/day; deeper surficial aquifer: 28-31 ft/day

Gradient: 0.001 ft/ft

Media:

Media: Groundwater
Soil

Remediation Scenario:

Cleanup Goals: Groundwater: PCE = 3 : g/l, TCE = 3 : g/l, cis 1,2-DCE = 70 : g/l, trans 1,2-DCE = 100 : g/l, 1,1-DCE = 7 : g/l, vinyl chloride = 1.0 : g/l Soil: PCE = 30 ug/kg; TCE = 30 ug/kg

Technologies:

Technologies Used:

Other technologies used:
In Situ:
Bioremediation
Monitored Natural Attenuation
Ex Situ:
Soil Vapor Extraction

Why the technology was selected: SVE is an effective technology for removal of VOCs from permeable unsaturated soils. In-situ biormediation via ethyl lactate injection/groundwater withdrawal and re-injection was chosen, because anaerobic conditions existed in the aquifer and reductive dechlorination was occurring. Ethyl lactate was chosen to stimulate biodegradation, because it is a relatively cheap carbon source. Groundwater withdrawal/injeciton was chosen to better distibute the ethyl lactate within the relatively heterogeneous aquifer. Natural attenation was chosen as the remedy for the distal portion of the contaminant plume. Since reductive dechlorination is occurring, treatment of high contaminant concentration in the source area coupled with natural attenuation of the low contaminant concentrations in the distal portion of the plume should remediate the plume.

Date implemented: March 13, 2004

Final remediation design: SVE - Three 20-ft horizontal SVE wells constructed of 2-inch diameter, schedule-40 PVC were installed (one on each of three sides of the former facility) in a 2-ft-deep trench. The system is powered by a 2-horsepower Rotron EN505 230 blower. Recovered vapors are routed to two 170-lb GAC units. The design flow rate is 90 scfm at 20 inches of water column vacuum. The design radius of influence for each SVE well is 20 ft. Groundwater remedial system: Twenty-two injection wells constructed of 4-inch diameter, schedule-40 PVC were installed outside the south and west walls of the facility (hydraullically upgradient). Fifteen shallow injection wells were screened 10-20 ft bgs with 0.10-inch slot. Seven deep injection wells were screened 30-40 ft bgs with 0.01-inch slot screen. Two recovery wells were installed outside the north (downgradient) side fo the facility. They were constructed of 5-inch diameter, schedule-40 PVC with 0.020-inch slot screen. One well was completed in the shallow portion of the aquifer (5-20 ft bgs) and one well was completed in the deeper portion of the aquufer (25-40 ft bgs). A 1/3-horsepower Grunfos 10E-5 submersible pump was installed in the shallow recovery well and a 1/2-horsepower Grunfos 16-E submersible pump was installed in the deeper monitor well. The design recovery well pumping rates were 8 and 7 gpm for the shallow and deep wells, respectively. Pumped water is treated in two 1000-lb liquid carbon vessels and then routed to a 300-gallon poly transfer tank where it is aerated to treat for vinyl chloride and then injected with a 1.5-horsepower Gould pump.

Results and Next Steps:

Results to date: The SVE system operated at an average of 130 scfm at 15 inches of water column. The calcuated radius of influence for each well was over 20 ft. Approximately 20 pounds of VOCs (99% PCE) have been recovered.

To date there have been a total of five ethyl lactate injection events. A total of 110 gallons of ethyl lactate was injected during each event (55 gallons in the shallow injection well and 55 gallons in the deep injection well) in a 1-2% solution. During the first year of operation, 5,156,500 gallons of groundwater were recovered for an average overall system flow rate of 9.8 gpm.

Ethanol was detected in recovery wells within one week of the initial injection event. Within three weeks of the first injection event, ethanol was not being detected in recovery wells. There was a rapid decrease in PCE concentrations in system influent in the first quarter of system operation coupled with an increase of cis 1,2-DCE in groundwater influent concentrations. Cis 1,2-DCE concentrations in groundwater influent began decreasing late in the first quarter of system operation, and vinyl chloride concentrations increased substantially. Vinyl chloride concentrations began to decrease in the fourth quarter of system operation.

System Influent Concentrations (: g/l):
3/13/03--1080 PCE, 991 PCE, 318 cis DCE, 8 trans DCE, 22 vinyl chloride.

3/9/04--25 PCE, 20 TCE, 77 cis DCE, 2 trans DCE, 240 vinyl chloride.

Monitor well sampling (10 wells) results showed that PCE was only detected in one well, TCE in one well, cis DCE in three wells, trans 1,2-DCE in three wells and vinyl chloride in nine wells. During the fourth quarter sampling event, vinyl chloride concentrations had decreased in all monitor wells except one (where it went from non-detect to 4 : g/l).

Next Steps: The SVE system will be shut down for several months and then pulsed.

Consideration is being given to discontinuing groundwater recovery but continuing injections of ethyl lactate.

Costs:

Cost for Assessment: Site Assessment: $209,900

Cost to Design and Implement: Design: $32,300
Construction: $107,500

Cost for Operation and Maintenance: O&M - first year (includes ethyl lactate, injection, monitoring & reporting): $140,200

Total Costs for Cleanup:

Lessons Learned:

1. During site assessment, a solid stem auger was used to drill pilot holes in the the limestone caprock that allowed for direct push groundwater profiling of the deeper portion of the aquifer.

Lessons Learned:

2. Long delays occurred in obtaining various permits from local government agencies. Changes in the building codes caused addtional delays.

3. The orignal choice for an injectant was spirits-grade ethanol; however, ethyl lactate was chosen as the ehanced-dechlorination additive because of costs and time associated with the request for procurement of a small amount of ethanol.

Contacts:

Principal Point of Contact:

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Site Specific References:

Site Specific References:	Site Assessment Report, July 1999 Remedial Action Plan, December 2001 Remediation System Startup Report, Dec. 2003 Remediaiton System Status Reports 2003-2004

Images:

Images of Site:	

Profile last updated on Jun 01, 2004

General Information

Site Name and Location:	Village Green Shopping Center, Rockledge, Florida, United States
Description: Historical activity that resulted in contamination.	This is a designated state Brownsfield site. PCE drycleaning operations took place in a bay in this shopping center during the 1960s and 1970s. PCE was found in groundwater samples collected as part of a Phase II Environmental Site Assessment. The site is located in a mixed retail commercial/residential setting. The contaminant source area is located beneath the floor slab of the bay that formerly housed the drycleaning operation.

Contaminants:

Contaminants: Contaminants present and the highest amount detected in both soil and groundwater (please avoid giving ranges).	**Contaminant**	**Conc in GW**	**Conc. in Soil**
	cis-1,2-Dichloroethene	8,550 ug/L	
	Tetrachloroethene (PCE)	27,300 ug/L	564,000 ug/Kg
	Trichloroethene (TCE)	7,900 ug/L	5,007 ug/Kg
	Vinyl Chloride	780 ug/L	

Other Contaminants Present: Indicates what other contaminants were found on-site	45 ft BGS
Deepest Significant Groundwater Contamination:	330 ft x 140 ft

Plume Size:

Site Hydrology:

Depth to Groundwater: 4 ft BGS

Lithology and Subsurface Geology: Surface - 9 ft BGS: fine-grained sand; 9-12 ft BGS: silty fine-grained sand with organics (Foc of 1.1%); 12-45 ft BGS: fine-grained sand with shells; 45 ft BGS: silty sand with clay

Conductivity: Shallow surficial aquifer (5-15 ft BGS): 5 ft./day; lower surficial aquifer (35-45 ft/day: 8 ft/day

Gradient: 0.001 - 0.005 ft/day

Media:

Media: DNAPL
Groundwater
Soil

Remediation Scenario:

Cleanup Goals: Groundwater: PCE = 3.0 ug/L; TCE = 3.0 ug/L; cis 1,2-DCE = 70 ug/L Soil (leachability): PCE = 30 ug/Kg; TCE = 30 ug/Kg

Technologies:

Technologies Used:
In Situ:
- Bioremediation
- Monitored Natural Attenuation
- Multi Phase Extraction
- Reductive Dechlorination (In Situ Bioremediation)

Ex Situ:
- Air Stripping
- Bioremediation
- Carbon Adsorption

Other technologies used:

Why the technology was selected: The contaminant source area was located beneath the building and excavation was not an option. The predominant portion of the contaminant mass resided in an organic-rich silty sand in the shallow portion of the aquifer. Ethyl lactate is a relatively cheap carbon source. The remedial goals were to reduce the sorbed contaminant mass, reduce the dissolved VOC flux and enable monitored natural

attenuation. PCE daughter products were present, indicating that reductive dechlorination was occurring in the aquifer.

Date implemented: Ethyl lactate flushing occurred from November 12, 2002 to February 13, 2003.

Final remediation design: In the contamiant source area, 12 co-solvent flushing points were installed and screened from 6-8 ft BGS. Seven extraction wells (screened 12-16 ft BGS) were installed. In the dissolved phase portion of the plume 4 shallow injection wells were installed (screened 5-15 ft BLS) and five deep injection wells (screened 35-45 ft BGS) were installed. The plan was to inject a 100% ethyl lactate solution in the shallow soure zone (organic-rich sand). The co-solvent flush system consisted of a 25 hp PreVac MPE system, two 21,000 gallon frac tanks, a 24-inch diameter by 25 ft. air stripper with an AF-12 5 hp blower and an off-gas carbon tretment unit (600 lb. GAC). The MPE system operated at a vacuum of 18 to 21 inches of mercury (extraction from 7 source area wells) and corresponding air flow rate of approximately 100 cfm. The system was operated in batches: frac tank filled, cycled through air stripper and discharged to second frac tank for confirmatory sampling. Treated effluent (containing residual ethyl lactate) was pumped into injection wells or a percolation area.

Results and Next Steps:

Results to date: A total of 880 gallons of ethyl lactate was pumped into 12 injection points above the organic-rich shallow sand (source area). Fluids were extracted from 7 recovery wells screened below the source area and the extracted fluids were pumped to 20,000 gallon frac tanks and circulated through the air stripper. There was a focused injection of 200 gallons of ethyl lactate. A total of 131,000 gallons of groundwater was extracted/treated/injected and or percolated. The site is currently in natural attenuation monitoring with seimi-annual dilute ethyl lactate dosing.

A spike of PCE was detected in the influent as a result of the initial injection event and a smaller PCE spike was detected following the focused injection event.

Confirmatory soil sampling revealed that maximum PCE contaminant concentrations in soil decreased from 564,000 ug/kg to 2,300 ug/kg.

An initial increase in PCE daughter products was observed in groundwater. One year after injection, dissolved PCE concentrations in groundwater in the source area had decreased by 68%. PCE daugher product concentrations have have

shown a continuing decreasing trend after the initial increase in concentrations.

In the downgradient portion of the plume, there has been a > 99% decrease in PCE concentrations in groundwater samples collected from the wells that previously had the highest contaminant concentrations. Concentrations of PCE daugher products in groundwater have shown strong declines after initial increases in concentrations.

Next Steps: Continued semi-annual monitoring and semi-annual dilute ethyl lactate dosing. Consideration is being given to bioaugmentation of the source area with KB-1(TM).

Costs:

Cost for Assessment: No cost data were available.

Cost to Design and Implement:

Cost for Operation and Maintenance:

Total Costs for Cleanup:

Lessons Learned:

Lessons Learned: 1.This appears to be an effective remedy for solubilizing sorbed contaminant mass.

2. The remedial system provides an effective dual purpose application - source removal and enhanced biormediation.

3. Implementation costs are similar to excavation and/or chemical oxidation.

4. Follow-up monitoring/dosing costs are low compared to operating a mechanical system.

5. Technology is flexible and can be followed by bioaugmentation.

Contacts:

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Site Specific References:

Site Specific References:

Images:

Images of Site:

Profile last updated on Sept 19, 2004