# Drycleaner Site Profiles

**Alpine Cleaners, --, OR**

**Site Description**

The former Alpine Drycleaners is located in a mixed commercial-residential zone. Investigations revealed the presence of volatile organic compound (VOC) contamination in the soil and groundwater. The exact set of circumstances leading to the release of perchloroethylene (PCE) to the catch basin is not known. A possible source of the contamination is the alleged disposal of PCE into the storm catch basin between 1987 and 1991. PCE appears to have entered the ground through subsurface breaks in the plastic storm drainpipe immediately adjacent to the drycleaner. This caused local contamination of the soil and introduced PCE and its breakdown products into the shallow groundwater.

**Site Hydrogeology**

**Depth to ground water:** 8-17 ft. bgs. (varies seasonally)

**Lithology/subsurface geology:** Predominantly clay and silt with widely separated intervals of fine-grained sand to maximum boring exploration depths (21.5-31.5 ft. bgs.).

**Conductivity:** Estimated to be 3-4 ft/day

**Gradient:** Approximately 0.027 ft/ft

**Groundwater Contamination**

**Contaminants present:** PCE, trichloroethylene (TCE), cis-1,2-dichloroethylene (cis-1,2-DCE), trans-1,2-dichloroethylene (trans-1,2-DCE)

**Highest contaminant concentrations:** 5,900 µg/L (PCE), 350 µg/L (TCE), 170 µg/L (cis-1,2-DCE), 11 µg/L (trans-1,2-DCE)

**Deepest significant ground-water contamination:**
At least 24-26 ft. bgs.

**Plume size:** About 225 ft. long and 120 ft. wide

**DNAPLs present:** Although no DNAPLs have been detected or observed at the site, extremely high concentrations of chlorinated compounds may indicate their presence. Groundwater sampling reveals PCE concentrations exceeding 1% saturation for pure-phase PCE.

**Soil Contamination**

**Contaminants Present:** PCE, TCE, cis-1,2-DCE

**Highest Contaminant Concentrations:** 12,400 µg/kg (PCE; 15 µg/kg (TCE); 33 µg/kg (cis-1,2-DCE)

## Description of Remediation Scenario

**Technologies Used:**
Air Sparging
Soil Vapor Extraction (SVE)

**Cleanup goals:** The Oregon Department of Environmental Quality (DEQ) seeks to remove the contaminant mass from the source area and protect or mitigate threats to human health or the environment. DEQ will establish groundwater cleanup levels as part of the site-specific risk assessment process.

**Remediation technology or technologies used:** Air Sparging (AS)/Soil Vapor Extraction (SVE)

**Why technology or technologies selected:** Innovative technologies like Hydrogen Release Compound (HRC) were not readily available when the remediation was first conducted at this site. The AS/SVE appeared to be a feasible, cost effective method to reduce concentration levels.

**Final Remediation Design:** The AS system consists of 6 sparging wells screened to a depth of 25-30 ft. bgs., a compressor, piping and associated controls and removes halogenated VOCs from saturated soils and groundwater. Contractors installed horizontal SVE piping installed along the storm drain east of the facility (4-7 ft. bgs) and a four-leg horizontal SVE installed in the trenching for the AS system piping (2-5 ft. bgs.). The SVE operates with a blower pulling a vacuum of 3-6 in. of water on an airflow of 4,500 ft/min. All remediation machinery is housed in an on-site concrete slab (6 ft. by 8 ft.) surrounded by a chain-link fence.

## Results

Groundwater monitoring and sampling events conducted by contractors indicate that the PCE groundwater plume has continued to spread, although at a slow rate. PCE concentrations exceed the Safe Drinking Water Act MCL in several wells. The contractor estimated that the remediation system removed approximately 388 lbs. of VOCs during 5 years of operation. The removal of VOCs leveled off after approximately 2 years of operation. A general decrease in groundwater VOC concentrations was observed with the initiation of AS/SVE operation. The most significant change in PCE concentration occurred in the first year: a decrease of PCE from 1200 µg/L to 542 µg/L. Concentrations of PCE breakdown products increased: TCE was sampled at 179 µg/L, cis-1,2-DCE was found at 314 µg/L, and trans-1,2-DCE was found at 22.8 µg/L. Rebounding PCE concentrations, though, were observed in other monitoring well locations.

Contractors are conducting risk assessment to determine whether current concentrations pose an unacceptable risk. Contractors are conducting quarterly monitoring at the site. Contractors have noted that the AS compressor could be replaced and the AS/SVE treatment regime continued. Contractor also indicated that reductive dechlorination of the source area constituents could continue, and the AS curtain would contain promote biodegradation of PCE breakdown products. The results of the risk assessment, though, will ultimately dictate the next remediation steps.

**Costs**

**Site assessment:** Not available

**Design and implementation:** $28,135.00

**O&M:** (one year): $6167.00; Electricity for system operation (one year): $2500.00; Quarterly monitoring and sampling (for one year): $3234.00; Quarterly monitoring: lab analysis (one year): $7000.00

**Total costs:**

**Lessons Learned**

1. Vapor Extraction works well in general, but this site may not have been the best place for it. Contractor noted that given that entire AS/SVE system was installed downgradient of the source area, and that the site subsurface silts are moderately permeable at best, significant influence of SVE at the source area might not be expected. The AS system does not appear to have effectively removed mass from groundwater.
2. Contractor observed significant change in constituent ratios in the source area before and after operation of the downgradient AS/SVE. Contractor has concluded that reductive dechlorination has been occurring in a limited area near the source, that AS/SVE has had little influence over the source area, but did not aerate the areas downgradient of the source area.
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**Site Specific References**

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**Contacts**

Jim Anderson, R.G., C.E.G., Project Manager
OR DEQ, Voluntary Cleanup

Northwest Region
2020 SW Fourth Avenue, Suite 400
Portland, OR 97201-4987
800-452-4011 or 503-229-6825
anderson.jim@deq.state.or.us

Contractors:
Jack Sparo, Project Manager
AMEC Earth and Environmental, Inc. (formerly AGRA)
7477 S.W. Tech Center Drive
Portland, OR 97223
jspadaro@agraus.com

This profile last updated: November 26, 2001

# Drycleaner Site Profiles

**Dry Clean USA #11401, Boca Raton, FL**

**Site Description**

This is an active perchloroethylene (PCE) drycleaning facility that has been in operation since 1982. The nearest public supply well is approximately 1,500 ft southwest of the facility. Contaminant source areas include the soils beneath the facility floor slab near the drycleaning machine and the stormwater drain.

**Site Hydrogeology**

Depth to ground water: ~7 ft bgs

Lithology/subsurface geology:
Fine-grained sand & sandy clay, 0-4 ft bgs
Very fine to medium grained sands, 4-70 ft bgs
Soft, silty limestone, 70-75 ft bgs
Limestone interbedded with sand and silt

Conductivity: 21-245 ft/day

Gradient: 0.0002 ft/ft

**Groundwater Contamination**

Contaminants present: PCE, trichloroethylene (TCE), dichloroethylene (cis 1,2-DCE, trans 1,2-DCE, and 1,1-DCE)

Highest contaminant concentrations: 27,600 µg/L (PCE), 8,120 µg/L (TCE), 2,177 µg/L (cis 1,2-DCE), 103 µg/L (trans 1,2-DCE), 60 µg/L (1,1-DCE)

Deepest significant ground-water contamination: 18 µg/L (PCE), 2.2 µg/L (TCE) at 85 ft bgs

Plume size: 640 ft by 150 ft (1.6 acres - defined by MCLs)

DNAPLs present: A PCE concentration that is greater than 18% of solubility indicates that residual DNAPL is likely present in groundwater at the site.

**Soil Contamination**

Contaminants present: PCE

Highest contaminant concentrations:
In Soil -- 3,200 µg/kg (PCE)
In Sediment -- 86,000 µg/kg (storm drain)

**Description of Remediation Scenario**

Cleanup goals:
Groundwater (MCLs): PCE= 3.0 µg /L, TCE= 3.0 µg /L, cis 1,2-DCE= 70 µg/L, trans 1,2-DCE= 100 µg /L, vinyl chloride= 1.0 µg/L
Soils (Leachability-Based levels): PCE= 30 µg/kg

**Technologies Used:**
Air Sparging
Soil Vapor Extraction (SVE)

Any other technologies used: No

Why technology or technologies selected: These remedies were selected because the contaminants are VOCs; only limited residual DNAPL is indicated to be present; and these are relatively cost-effective remedial technologies.

Date Implemented: October 2000

Final Remediation Design: An Intermediate Remedial Measure for source removal consisted of contaminated sediment removal from a storm drain.

Full-scale remediation design is as follows:

SVE Wells: 2 (installed as horizontal wells in trenches)
Design flow rate: 160 scfm
Actual avg. air flow rate: 215 scfm
Design vacuum: 84 inches of water column
Motor size: 7.5 hp
Radius of influence: 30 ft

Air Sparging Depth: 50 and 85 ft bgs
Radius of influence: 23-25 ft
Points: 11 shallow and 1 deep
Pressure: 53 psig
Flow rate: 43 scfm
Motor size: 10 hp

**Results**

Through September 2001, approximately 23.7 lbs of contaminants were removed from the subsurface. Total chlorinated ethylene concentrations in shallow- and intermediate-depth source area monitoring wells decreased by 2-3 orders of magnitude. Cis 1,2-DCE concentrations rose two orders of magnitude in the deep-source area monitoring well. Five wells still contain contaminant concentrations exceeding MCLs.

The air sparging system has not always been operational due to high rainfall events that significantly increased condensate production. This has significantly reduced the run-time of the system. The SVE blower had to be replaced and there has been excessive water uptake by the SVE system.

**Costs**

Site assessment: $122,000

Design and implementation:
$22,675 (Interim Remedial Measures, i.e., storm sewer cleanout)
$236,834.34

O&M: $200,453.03 (includes estimated costs for remainder of FY01)

Total costs (only completed sites):

**Lessons Learned**

1. Treatment system equipment may need to be enclosed in a building to mitigate excessive noise. Design phase activities should include a more extensive review of noise control options. (Complicating factors at this site included the County's refusal to allow the system to be enclosed in a trailer for cosmetic reasons.)
2. Local government agencies might require remedial equipment to be UL certified.
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**Site Specific References**

E & E Contamination Assessment Report-11/97
E & E Remedial Action Plan-5/99
E & E Operation and Maintenance Report-6/01

**Contacts**

Theresa Pepe, Site Project Manager
FDEP Division of Waste Management
2600 Blair Stone Road, MS 4520
Tallahassee, FL 32399-2400
850-488-0190
theresa.pepe@dep.state.fl.us

Contractor:
Chen H. Lin
Ecology and Environment, Inc.
1950 Commonwealth Lane

Tallahassee, FL 32303
850-574-1400
CLin@ene.com

This profile last updated: January 18, 2002

# Drycleaner Site Profiles

**Former American Uniform, Hutchinson, KS**

**Site Description**

The former American Uniform drycleaner facility operated in this commercial area from 1960-1974. The property is currently occupied by various commercial businesses in the original buildings. Testing of local public water supplies in 1982 revealed the presence of volatile organic compounds (VOCs) due to contamination from this drycleaning facility. The Kansas Department of Health and Environment (KDHE) conducted the site investigation and remediation under the authority of the Kansas Drycleaner Environmental Response Act (DERA).

**Site Hydrogeology**

Depth to ground water: 15 ft bgs at the source area; 25 ft bgs at leading edge of plume

Lithology/subsurface geology:
Silt and clay, from grade to 5 ft bgs
Potential interbedded clay/silt lenses at varying depths, 40-60 ft bgs
Fine grained, silty sand grading to medium- to coarse-grained sand, 5 ft bgs to 65-68 ft bgs.

Conductivity: 517 -771 ft/day (based on regional pump test data)

Gradient: 0.001 ft/ft

**Groundwater Contamination**

Contaminants present: PCE (perchloroethylene)

Highest contaminant concentrations: 80.4 µg/L (PCE)

Deepest significant ground-water contamination: 65 ft bgs (deepest sampling point)

Plume size: The PCE plume occurs in the upper, middle and lower depths of the alluvial, unconfined aquifer, and extends 2.7 miles downgradient. Vertical contamination extends from top of aquifer at 15 ft bgs to top of shale at 68 ft bgs.

DNAPLs present: No

**Soil Contamination**

Contaminants present: PCE

Highest contaminant concentrations: 239 µg/kg (PCE)

**Description of Remediation Scenario**

Cleanup goals: Reduce PCE groundwater contamination to below EPA Maximum Contaminant Level (MCL) of 5 µg/L. Reduce PCE soil contamination in accordance with KDHE Risk-Based Standards of 200 µg/kg.

**Technologies Used:**

Air Sparging
Soil Vapor Extraction (SVE)

Why technology or technologies selected: O&M cost, effectiveness of the technology, and expected duration of cleanup. KDHE selected the SVE system in order to reduce the PCE soil impacts, which would facilitate natural attenuation of the groundwater.

Final Remediation Design: At the source area, contractor installed nine SVE wells and four monitoring wells at or near the site, associated above and sub-grade piping, and remediation equipment. The remediation equipment was placed within an 8-by-12-foot enclosure. The SVE remediation system consists of two regenerative blowers, a 5-horsepower (HP) Rotron Model DR6D89 and a 10-HP Rotron Model DR823BB72, which together have a maximum combined design capacity of approximately 265 ft3/min (cfm) at 60 in of water vacuum. Each blower is powered by a 230-volt (V), 3-phase motor. The SVE wells range in depths from 12.5-15 ft bgs, and each one contains a 5-foot screened section at the bottom. The contractor also installed 15 drip legs along the pipe runs to allow condensate water to drain away from the SVE piping. Piping installation cost was high due to trenching in concrete parking lots.

A downgradient aquifer air sparging treatment fence used standard C-Sparger® technology, except without the ozone injection. The C-Sparger® treatment fence used six sparge wells spaced 65 ft.

**Results**

The SVE system achieved cleanup goals to remediate the source area vadose zone and enhance natural attenuation of the groundwater. Sampling events conducted from May-October 2000 revealed significant reduction in groundwater solvent concentrations. Overall PCE concentrations decreased, but samples showed rebounding PCE concentrations during the 6-month period. December 2001 levels of PCE were 19 µg/L or less. The SVE system had removed 221 lbs of PCE since May 1999.

**Costs**

Site assessment: $21,263

Design and implementation: $212,433

O&M: $30,790 (2+ years)

Total costs (only completed sites):

**Lessons Learned**

1. SVE system removed available vapors very quickly, but clay soils prevented significant capture zone in some SVE wells.
2. Improper installation of a SVE line allowed blockage of air flow, even though drip legs were designed to prevent fluid build up.
3. C-Sparger® well spacing was over-optimistic and was not able to adequately treat the groundwater to below EPA MCLs.
4. Incorporating the ozone injection vs. air only probably would have enhanced the reduction of contaminant.
5. C-Sparger® equipment had significant maintenance problems and was not able to operate an extended period of time. Therefore, utility savings were negated by extra O&M costs. KV Associates has repaired the equipment, and KDHE is awaiting completion of a unrelated construction project before re-installing the system.
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**Site Specific References**

Not Provided

**Contacts**

Bob Jurgens
KDHE, Bureau of Environmental Remediation
Curtis Bldg., 1000 SW Jackson, Suite 410
Topeka, KS 66612-1367
785-291-3250
email address: bjurgens@kdhe.state.ks.us

Contractors:
Alan Rittgers, Project Manager
Burns and McDonnell
9400 Ward Parkway
Kansas City, MO 64114
816-822-3893
email:arittge@burnsmcd.com

Todd Anderson, P.G., Project Geologist
BE&K/Terranext
13202 West 98th Street
Lenexa, KS 66215
913-894-4000
email: tanderson@bektnxt.com

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# Drycleaner Site Profiles

**One Hour Dry Cleaners, Coral Springs, FL**

**Site Description**

One Hour is a former perchloroethylene (PCE) drycleaning facility that operated from 1985-2000. It occupies space in a strip mall located in a mixed commercial/residential setting. A drainage canal is located approximately 130 ft north of the site. Public water supply wells are located approximately 1,800 ft from the facility. The contaminant source area is beneath the building floor slab near the former location of the drycleaning machine and outside the service door of the facility.

**Site Hydrogeology**

Depth to ground water: 7-8 ft. bgs

Lithology/subsurface geology:
Silty, fine to medium-grained sands with shells, surface: 14 ft bgs;
Medium to coarse-grained sand with shells: 14-18 ft bgs;
Very fine to fine-grained sand: 18-50 ft bgs

Conductivity: 14 ft/day

Gradient: 0.0003 ft/ft

**Groundwater Contamination**

Contaminants present: PCE, trichloroethylene (TCE), dichloroethylene (cis 1,2-DCE, trans 1,2-DCE, and 1,1-DCE)

Highest contaminant concentrations: 1,252 µg/L (PCE), 24,300 µg/L (TCE), 25,100 µg/L (cis 1,2-DCE), 1,425 µg/L (trans 1,2-DCE), 98.6 µg/L (1,1-DCE)

Deepest significant ground-water contamination: PCE-0.74 µg/L, cis 1,2-DCE-8.8 µg/L at 50 ft bgs

Plume size: 140 ft by 200 ft (defined to MCLs)

DNAPLs present: No presumptive evidence of DNAPLs

**Soil Contamination**

Contaminants present: PCE

Highest contaminant concentrations: 10.8 µg/kg (PCE)

**Description of Remediation Scenario**

Cleanup goals: Groundwater (MCL's): PCE = 3.0 µg/L, TCE = 3.0 µg/L, cis-1,2-DCE = 70 µg/L, trans-1,2-DCE = 100 µg/L, 1,1-DCE = 7.0 µg/L.
Soils (leachability-based /CTLs): PCE = 30 µg/kg

**Technologies Used:**
Air Sparging
Soil Vapor Extraction (SVE)

Any other technologies used: No

Why technology or technologies selected: : The contaminants are volatile organic compounds in concentrations that do not indicate the presence of DNAPL and these technologies are relatively low-cost remedies. The groundwater contaminant plume will be remediated to Natural Attenuation Default Source Concentrations (NADSCs) (e.g. 300 µg/L for PCE). Monitored natural attenuation will be used for the plume below NADSCs.

Date Implemented: August 2000

Final Remediation Design: The full-scale remediation design is as follows:
SVE Wells: 2
Design flow rate: 122 scfm
Actual avg. air flow rate: 186 scfm
Design vacuum: 123 inches of water column
Motor size: 7.5 hp
Radius of influence: 50 ft

Air Sparging Points: 4
Depth: 40 ft bgs
Radius of influence: 30 ft
Pressure: 26.7 psig
Flow rate: 14.4 scfm
Motor size: 5 hp

**Results**

Through August of 2001, approximately 3.74 lbs of contaminants had been removed from the subsurface. Contaminant concentrations in source area monitoring wells were reduced two orders of orders of magnitude. Cis 1,2-DCE concentrations remain above MCLs in the vicinity of four monitoring wells, but are below Natural Attenuation Default Concentrations (NADCs).

The air sparging system has had some down-time due to air compressor maintenance requirements.

At present, the system continues to operate. Overall, the contaminant concentrations in the groundwater have been reduced significantly since the system startup. If concentrations remain below NADCs during the next reporting period, the system may be turned off to allow for natural attenuation.

**Costs**

Site assessment: $103,366.10

Design and implementation: $201,503.69

O&M: $167,376.82 (includes estimated costs for remainder of FY01)

Total costs (only completed sites):

**Lessons Learned**

1. Air compressor problems have been resolved by consulting with the manufacturer.
2. Local government agencies may require remediation equipment to be UL certified.
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**Site Specific References**

E & E Contamination Assessment Report-11/97
E & E Remedial Action Plan-5/99
E & E Operation and Maintenance Report-6/01

**Contacts**

Theresa Pepe, Project Manager
FDEP, Division of Waste Management, Bureau of Waste Cleanup, Hazardous Waste Cleanup Section
2600 Blair Stone Road, MS 4520
Tallahassee, FL 32399-2400
850-488-0190
theresa.pepe@dep.state.fl.us

Contractor:
Chen H. Lin
Ecology and Environment, Inc.
1950 Commonwealth Lane
Tallahassee, FL 32303
850-574-1400
CLin@ene.com

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