Krazan & ASSOCIATES, INC.

GEOTECHNICAL ENGINEERING • ENVIRONMENTAL ENGINEERING
CONSTRUCTION TESTING & INSPECTION

January 14, 2002

Project No. 104-00011

Mr. Tom Sroufe
Wesbild Shopping Centers
2600 Southwest Barton Street, D-10
Seattle, Washington 98126

RE: In-Situ Remediation Performance Monitoring Report – Year 2001
Former Dry Cleaning Facility
Silverdale Plaza
Silverdale, Washington

Dear Mr. Sroufe:

This In-Situ Remediation Performance Monitoring Report has been prepared by Krazan & Associates, Inc. (Krazan) for the former dry cleaning facility on the referenced property. The report describes the operation and performance results of the first year of operation of the In-Situ Remediation System. The system was installed to address a release of perchloroethylene (PCE, also known as tetrachloroethylene) from the former dry cleaning facility. The property is located at 2912 NW Bucklin Hill Road, within the Silverdale Plaza complex in Silverdale, Washington (Figure 1). The work was conducted in general accordance with Krazan's June 12, 2001 proposal E01-020WAP.

Site Location

The site is located in the southwest quarter of Section 16, Township 25 North, Range 1 East, in Silverdale, Washington. The site is about 1000 feet north of the north end of Dyes Inlet (Puget Sound) at about elevation 25 feet.

Project Background

A remedial action was conducted between October 9 and November 14, 2000, to excavate and remove PCE-contaminated soil from the site. Soil sampling in the excavation indicated that the PCE extended beneath the former dry cleaning building at concentrations above the MTCA Method A cleanup level, which could not feasibly be removed by excavation. Two in-situ remediation methods were selected to remediate the residual PCE: installation of a Vapor Extraction/Air Sparging system beneath the building, and the use of a commercial Hydrogen Release Compound (HRC®) to enhance the degradation of the PCE. The remedial excavation and installation of the Vapor Extraction/Air Sparging System (installed in November 2000) and application of the HRC® are described in the Interim Closure Report (Krazan, 2001).

System Description

The Vapor Extraction/Air Sparging (VES) System was designed for the injection of ambient air and extraction of air containing the residual chlorinated solvents (PCE, with minor amounts of TCE) that exist beneath the building foundation. The total contaminant load beneath the building is estimated to be about 7.5 pounds of PCE at the start of the In-Situ Remediation operation. This estimate is based on the volume of soil contained within the boundaries of the VES piping system and the average soil PCE concentration obtained from sampling during the horizontal drilling. The system was designed as a dual-system utilizing vapor extraction, air sparging, and injection of a chemical treatment solution. For a complete system description, please refer to the "Vapor Extraction/Air Sparging System Installation" section on page 15 of the Interim Closure Report.

Operation Schedule

The manual operation of the Vapor Extraction System was initiated on January 5, 2001, followed by a period of testing and system modification. The effectiveness of the system was judged by periodic photoionization detector (PID) monitoring to determine the piping system with the highest levels of PCE. The system was then automated with periodic monitoring and sampling to evaluate the remediation process. Fully automated vapor extraction operation was initiated on March 5, 2001. The automatic system utilizes a series of electronic timers and electrical relays.

The Vapor Extraction System is typically operated in the following sequence. When the timer reaches its programmed set point, it turns on the system heater, which heats the air in the containment unit to 100° F. Approximately a set time, the timer turns on the system blower, which injects the heated air into the selected vent pipes. Heated air is typically injected into either the A or B level of pipes. After a time period of blowing heated air into selected areas (typically fifteen minutes), timers turn off the system heater and blower. The timer then turns on the system vacuum unit for a specified period and any volatile organic compounds released by the heated air are removed and vented. During 2001, heated air has been typically injected alternately into the A and B levels. Venting of air has been conducted from the A level of pipes. Air sparging is conducted with the system air compressor, which pumps fresh air at approximately 40 cubic feet per minute (CFM) and 10 pounds per square inch (PSI) into the C level of pipes.

The schedule of operation during 2001 is listed in Table 1. Changes were made during the year to vary the operation of the system. However, the primary goal was to extract air (and PCE) from the unsaturated zone of the A level.

System Monitoring

Operational parameters of the VES system were monitored to document a record of performance and contaminant removal. The following parameters were monitored.

- Air Flow: Air flow (velocity, flow rate, and air temperature) was measured at the inflow (in the case of the heater/blower unit) and outflow points (in the case of the vacuum unit). Flow measurements were made using either a Gray Wolf hot-wire or Extech pocket thermo anamometer air velocity sensor. Air temperature was also recorded. The discharge air flow measurements in cubic feet per minute are listed in Table 2.

- Vapor Concentration: The PCE concentration of the vented air was monitored at the discharge point using a PID and with a separate laboratory analysis of selected air samples. Both individual and combined flow configurations will be monitored. Air samples for laboratory analysis will be collected from the discharge pipe using a syringe to collect the air and transfer it into the sampling containers. The PID measurements are listed in Table 3. The analytical results for the collected air samples are listed in Table 4.

- VES Water Quality: Water samples will be collected from the saturated zones of the VES system periodically for laboratory analysis to determine the PCE/TCE concentration of the groundwater beneath the building. Any water removed from the system will be stored in drums pending laboratory analysis. The analytical results for the collected water samples are also listed in Table 4. During the course of the year, various breakdown components of the PCE were also detected in water samples. These components are listed in Table 5.

- Groundwater Quality: Monitoring wells installed as part of the remedial investigation, as well as two additional wells installed subsequent to the excavation, were sampled during the Quarterly Groundwater Monitoring Program in the perched aquifer. Water levels were also measured and groundwater samples collected for laboratory analysis of Halogenated Volatile Organics. The results of the Quarterly Monitoring (September and December, 2001) have been submitted under separate cover.

- Building Air Quality: Baseline air sampling was performed in the tenant spaces of the building for laboratory analysis to determine the PCE/TCE concentration in order to determine the system's impact. The results of the initial set of building monitoring are included in Table 4.

- Quality Assurance/Quality Control: Selected duplicate air and water samples were collected and analyzed by separate laboratories for Quality Control evaluation. These duplicates are noted in Tables 4 and 5.

System Performance Evaluation

An evaluation of the VES system performance was made for the 2001 calendar year and is listed in Table 6. This evaluation incorporated the system (vacuum extraction) running time, the PCE concentration of the extracted air, and the extraction rate of the vacuum system. The PCE extraction amount was calculated for each incremental period of time a different operational scenario was in place. The evaluation indicates that an estimated 4.0 pounds of PCE have been removed by the VES system. This compares with the original estimate of 7.5 pounds, indicating that slightly more than half of the PCE believed to occur beneath the building has been removed.

Limitations

The findings of this report were based upon the results of field and laboratory investigations, coupled with the interpretation of surface and subsurface conditions associated with our water samples. Therefore, the data are accurate only to the degree implied by review of the data obtained and by professional interpretation.

Laboratories certified by the State of Washington, Department of Ecology, did the analytical testing. The results of the chemical testing are accurate only to the degree of care of ensuring the testing accuracy and the representative nature of the samples obtained.

The findings presented herewith are based on professional interpretation using state of the art methods and equipment and a degree of conservatism deemed proper as of this report date. It is not warranted that such data cannot be superseded by future geotechnical, environmental, or technical developments.

We appreciate the opportunity to be of service. If you have any questions, please do not hesitate to contact our office at (360) 598-2126.

Respectfully submitted,
KRAZAN & ASSOCIATES, INC.

Donald K. Balmer
Senior Hydrogeologist

Shawn E. Williams
Senior Environmental Geologist

DKB/SEW

Cc: Mr. Ruben Poplawski, Barclays Realty and Management Company

Attachments

TABLE 1: 2001 IN-SITU OPERATION SCHEDULE

Date	A Row	B Row	C-Row	Notes
January 5 - February 5			None	Startup & manual testing of operation.
February 5 - March 5	Venting air – A1 – A4 4 2-hr. cycles /day	Venting air - B1 – B4	None	Alternating weekly operation of A and B zones.
March 5 – April 25	Venting air – A1 – A4 4 2-hr. cycles /day		None	
April 25 – June 5	Venting air – A1 & A2 4 2-hr. cycles /day	Inject air – B1 – B4	Sparging with compressor 1hr./day	Automated operation of A and B, Manual of C.
June 5 – June 22	None	None	None	Out-of-Service for Maintenance and Cleaning.
June 22 – September 18	Inject Hot Air – A1, A2 & A3 Vent A1, A2, & A3	None	None	Automated, 15 min./hr.
September 18 – October 16	Venting air – A1 – A3	Blower injecting air – B level	None	Automated, 15 min./hr. Blower 5 min./hr.
October 16 – November 15	Venting air – A1 – A3	Blower injecting air – B level	Sparging with Compressor – C-1 - 3	Automated, 15 min./hr. Blower 5 min./hr.
November 15 – December 13	Venting air – A1 – A4	None	None	

TABLE 2. SILVERDALE PLAZA VAPER EXTRACTION SYSTEM AIR FLOW MEASUREMENTS In CFM.

Date	A Row				B Row			
	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4
8/6/01	45.	85.	23.	14.				
8/6/01	100.							
8/6/01	99.							
8/6/01	53.*		53.*					
8/6/01			29.					
8/9/01	110.							
8/9/01	112.							
8/9/01	115.							
8/9/01	96.							
8/9/01	126.							
8/29/01	78.**							
8/29/01	97.***							
8/29/01	38.	80.	30.					
9/18/01	123.							
9/18/01	35.							
10/2/01	79.							
12/11/01	105.							
12/11/01	33.	90.	40.	38.				
12/11/01	103.							
12/13/01	103.							
12/13/01	33.	97.	32.	31.				

* Measurement includes A1 and A3.
** Blower unit not connected to A.
*** Blower unit connected to A.

TABLE 3. SILVERDALE PLAZA VAPER EXTRACTION SYSTEM PHOTOIONIZATION DETECTOR MEASUREMENTS, in ppm

Date	A Row				B Row			
	A-1	A-2	A-3	A-4	B-1	B-2	B-3	B-4
3/12/01	300.	200.	10.5	9.7	10.8	9.7	8.5	6.8
4/13/01	249.	103.	19.7	13.7	12.3	7.4	5.4	7.7
5/18/01	206.	85.	9.2	5.1	4.5	5.0	2.8	2.5
6/27/01	94.7	37.7	117	0.5				
6/29/01	85.	35.4	34.5	9.9				
7/9/01					1.2	1.1	1.2	2.0
7/31/01	300.	180.	500.	0.0				
8/2/01			380.					
8/6/01	171.	60.	236.	0.2				
8/6/01	123.							
8/17/01	27.4							
8/17/01	72.7	13.6	43.9					
8/29/01	7.2							
8/29/01	27.9	0.4	0.6					
9/18/01	33.0							
9/18/01	75.3							
10/2/01	8.5							
10/2/01	17.3	0.0	11.4					
12/11/01	29.0	16.5	8.1	0.6				
12/11/01	25							
12/13/01	0.0	10.8	13.4	0.0				

TABLE 4
SUMMARY OF REMEDIATION HALOGENATED VOLATILE ORGANIC ANALYSES

Sample No.	Date Sampled	Location	Media	Perchloro-ethylene	Trichloro-ethene
SPR-PH-A-001	1/12/01	Pizza Hut Interior	Air	<0.05 ppmv	<0.05 ppmv
SPR-MB-A-002	1/12/01	Mail Boxes Interior	Air	<0.05 ppmv	<0.05 ppmv
SPR-PH-A-003	1/12/01	Pizza Hut Interior	Air	<0.05 ppmv	<0.05 ppmv
SPR-MB-A-004	1/12/01	Mail Boxes Interior	Air	<0.05 ppmv	<0.05 ppmv
SPR-AL-A-005	1/23/01	A-Level (all)	Air	<0.05 ppmv	<0.05 ppmv
SPR-AL-A-006	1/23/01	A-Level (all)	Air	<0.05 ppmv	<0.05 ppmv
SPR-AL-A-007	2/5/01	A-Level (all)	Air	0.35 ppmv	<0.05 ppmv
SPR-AL-A-008*	2/5/01	A-Level (all)	Air	<0.05 ppmv	<0.05 ppmv
SPR-AL-A-009	3/27/01	A-Level (all)	Air	26.3 µg/l	1.8 µg/l
SPR-BL-A-010*	3/27/01	B-Level (all)	Air	<0.05 µg/l	0.21 µg/l
SPR-T1-SO-013	3/27/01	Tank 1	Soil	0.14 mg/kg	<0.05 mg/kg
SPR-T2-SO-014	3/27/01	Tank2	Soil	0.18 mg/kg	<0.05 mg/kg
SPR-AL-A-015	3/29/01	A-Level (all)	Air	3.8 µg/l	<0.05 µg/l
SPR-BL-A-016	3/29/01	B-Level (all)	Air	370. µg/l	4. µg/l
SPR-T1-W-016*	4/16/01	Tank 1	Water	5.6 µg/l	<1.0 µg/l
SPR-S1-GW-017	5/21/01	Vertical Pipe S-1	Water	42. µg/l	26. µg/l
SPR-W1-GW-018	5/21/01	Vertical Pipe W-1	Water	41. µg/l	130. µg/l
SPR-B4-GW-019**	6/7/01	B-4	Water	11. µg/l	<5.0 µg/l
SPR-A3-GW-020	6/27/01	A-3	Water	21,000. µg/l	63,000. µg/l
SPR-A4-GW-021*	6/27/01	A-4	Water	49,000. µg/l	4,100. µg/l
SPR-A1-A-022*	6/29/01	A-1	Air	0.07 ppmv	<0.05 ppmv
SPR-A2-A-023	6/29/01	A-2	Air	<0.05 ppmv	<0.05 ppmv
SPR-A3-A-024	6/29/01	A-3	Air	0.31 ppmv	<0.05 ppmv
SPR-A3-A-025	8/2/01	A-3	Air	1,400. µg/l	<5. µg/l
SPR-B4-GW-026	9/18/01	B-4	Water	17. µg/l	4. µg/l
SPR-C9-GW-027	10/2/01	C-9	Water	2. µg/l	<2. µg/l
SPR-C1-GW-028	10/2/01	C-1	Water	1,400. µg/l	560. µg/l***
SPR-S1-GW-029	10/2/01	Vertical Pipe S-1	Water	8. µg/l	<2. µg/l***
SPR-W1-GW-030	10/2/01	Vertical Pipe W-1	Water	60. µg/l	66. µg/l***
SPR-C9-GW-031	12/11/01	C-9	Water	<2. µg/l	<2. µg/l
SPR-C1-GW-032	12/11/01	C-1	Water	<40. µg/l	<40. µg/l***
SPR-A3-GW-033	12/11/01	A-3	Water	140. µg/l	5. µg/l***
SPR-A4-GW-034	12/11/01	A-4	Water	390. µg/l	4. µg/l***
SPR-A1-A-035	12/13/01	A-1	Air	0.11 ppmv	<0.01 ppmv
SPR-A2-A-036	12/13/01	A-2	Air	0.03 ppmv	<0.01 ppmv
SPR-A3-A-037	12/13/01	A-3	Air	0.18 ppmv	<0.01 ppmv
SPR-A3-A-037****	12/13/01	A-3	Air	8.4 µg/l	<0.2 µg/l
SPR-A4-A-038	12/13/01	A-4	Air	0.04 ppmv	<0.01 ppmv
SPR-S1-GW-039	12/20/01	Vertical Pipe S-1	Water	54. µg/l	3. µg/l***
SPR-W1-GW-040	12/20/01	Vertical Pipe W-1	Water	120. µg/l	82. µg/l***

* Laboratory Duplicate Sample Run
** Sample analyzed outside of Hold Time
**** QA analysis of duplicate sample.
*** Additional Parameters were detected.

TABLE 5. SUMMARY OF REMEDIATION HALOGENATED VOLATILE ORGANIC ANALYSES

Location	Date Sampled	Media	Perchloro-ethylene	Trichloro-ethene	Cis-1,2-Dichloro-ethene	Trans-1,2-Dichloro-ethene	1,1-Dichloro-ethene	Vinyl Chloride
Pizza Hut	1/12/01	Air	<0.05 ppmv	<0.05 ppmv	NA	NA	NA	NA
Mail Boxes	1/12/01	Air	<0.05 ppmv	<0.05 ppmv	NA	NA	NA	NA
Pizza Hut	1/12/01	Air	<0.05 ppmv	<0.05 ppmv	NA	NA	NA	NA
Mail Boxes	1/12/01	Air	<0.05 ppmv	<0.05 ppmv	NA	NA	NA	NA
A-Level	1/23/01	Air	<0.05 ppmv	<0.05 ppmv	NA	NA	NA	NA
A-Level	1/23/01	Air	<0.05 ppmv	<0.05 ppmv	NA	NA	NA	NA
A-Level	2/5/01	Air	0.35 ppmv	<0.05 ppmv	<0.05 ppmv	<0.05 ppmv	<0.05 ppmv	<0.05 ppmv
A-Level	2/5/01	Air	<0.05 ppmv	<0.05 ppmv	<0.05 ppmv	<0.05 ppmv	<0.05 ppmv	<0.05 ppmv
A-Level	3/27/01	Air	26.3 µg/l	1.8 µg/l	NA	NA	NA	NA
B-Level	3/27/01	Air	<0.05 µg/l	0.21 µg/l	NA	NA	NA	NA
Tank 1	3/27/01	Soil	0.14 mg/kg	<.05 mg/kg	NA	NA	NA	NA
Tank 2	3/27/01	Soil	0.18 mg/kg	<.05 mg/kg	NA	NA	NA	NA
A-Level	3/29/01	Air	3.8 µg/l	<0.05 µg/l	<0.05 µg/l	<0.05 µg/l	<0.05 µg/l	<0.05 µg/l
B-Level	3/29/01	Air	370. µg/l	4. µg/l	<4. µg/l	<4. µg/l	<4. µg/l	<4. µg/l
Tank 1	4/16/01	Water	5.6 µg/l	<1.0 µg/l	<1.0 µg/l	<1.0 µg/l	<1.0 µg/l	<1.0 µg/l
S-1	5/21/01	Water	42. µg/l	26. µg/l				
W-1	5/21/01	Water	41. µg/l	130. µg/l				
B-4	6/7/01	Water	11. µg/l	<5.0 µg/l				
A-3	6/27/01	Water	21,000. µg/l	63,000. µg/l				
A-4	6/27/01	Water	49,000. µg/l	4,100. µg/l				
A-1	6/29/01	Air	0.07 ppmv	<0.05 ppmv				
A-2	6/29/01	Air	<0.05 ppmv	<0.05 ppmv				
A-3	6/29/01	Air	0.31 ppmv	<0.05 ppmv				
A-3	8/2/01	Air	1,400. µg/l	<5. µg/l				
B-4	9/18/01	Water	17. µg/l	4. µg/l				
C-9	10/2/01	Water	2. µg/l	<2. µg/l	<2. µg/l	<2. µg/l	<2. µg/l	<2. µg/l
C-1	10/2/01	Water	1,400. µg/l	560. µg/l	4,200. µg/l	<100. µg/l	<100. µg/l	740. µg/l
S-1	10/2/01	Water	8. µg/l	<2. µg/l	110. µg/l	<2. µg/l	<2. µg/l	<2. µg/l
W-1	10/2/01	Water	60. µg/l	66. µg/l	3,800. µg/l	100. µg/l	5. µg/l	3,200. µg/l
C-9	12/11/01	Water	<2. µg/l	<2. µg/l	<2. µg/l	<2. µg/l	<2. µg/l	<2. µg/l
C-1	12/11/01	Water	<40. µg/l	<40. µg/l	9,700. µg/l	<40. µg/l	<40. µg/l	130. µg/l
A-3	12/11/01	Water	140. µg/l	5. µg/l	8. µg/l	<2. µg/l	<2. µg/l	<2. µg/l
A-4	12/11/01	Water	390. µg/l	4. µg/l	9. µg/l	<2. µg/l	<2. µg/l	<2. µg/l
A-1	12/13/01	Air	0.11 ppmv	<0.01 ppmv	NA	NA	NA	NA
A-2	12/13/01	Air	0.03 ppmv	<0.01 ppmv	NA	NA	NA	NA
A-3	12/13/01	Air	0.18 ppmv	<0.01 ppmv	NA	NA	NA	NA
A-3***	12/13/01	Air	8.4 µg/l	<0.2 µg/l	<0.2 µg/l	<0.2 µg/l	<0.2 µg/l	<0.2 µg/l
A-4	12/13/01	Air	0.04 ppmv	<0.01 ppmv	NA	NA	NA	NA
S-1	12/20/01	Water	54. µg/l	3. µg/l	50. µg/l	<2. µg/l	<2. µg/l	<2. µg/l
W-1	12/20/01	Water	120. µg/l	82. µg/l	1,700. µg/l	34. µg/l	2. µg/l	740. µg/l

* Laboratory Duplicate Sample Run
** Sample analyzed outside of Hold Time
*** QA analysis of duplicate sample.
NA= Not Analyzed

TABLE 6: 2001 IN SITU PERFORMANCE EVALUATION

Date	A Row	Air Flow, cfm/Time	PCE, µg/l	PCE Removed, lbs.
January 5 - February 5	System testing			
February 5 - March 5	Venting air – A1 – A4	100. 4,800. Min.	2.4	0.07
March 5 – April 25	Venting air – A1 – A4 4 cycles /day	100. 24,480. Min.	15.0	2.29
April 25 – June 5	Venting air – A1 & A2 4 cycles /day	100. 19,680. Min.	5.0	0.62
June 5 – June 22	None			
June 22 – September 18	Inject Hot Air – A1, A2 & A3 Vent A1, A2, & A3	88. 5,490. Min.	25.0	0.75
September 18 – October 16	Venting air – A1 – A3	100. 5,040. Min.	5.0	0.16
October 16 – November 15	Venting air – A1 – A3	100. 5,400. Min.	2.0	0.07
November 15 – December 13	Venting air – A1 – A4	100. 3,780. Min.	2.2	0.05
				Total: 4.01 pounds