A Department of Ecology Report

Lakewood Plaza Cleaners, May and September 2006 Groundwater Monitoring Results

Abstract

This progress report is one in a series describing results of long-term groundwater sampling at the former Lakewood Plaza Cleaners site south of Tacoma. Results of volatile organics in samples collected from seven monitoring wells and one municipal well in May 2006, and four monitoring wells and one municipal well in September 2006, are included.

- Monitoring wells MW-20B and MW-16A, as well as municipal well H1, continue to have tetrachloroethene (PCE) concentrations higher than the Model Toxic Control Act (MTCA) cleanup level of 5.0 ug/L. PCE concentrations in these wells during May and September were: MW-20B (216 and 518 ug/L), MW-16A (124 and 29 ug/L), and H1 (7.3 and 4.8 ug/L).

- PCE was also detected above the MTCA cleanup level in well LPMW-2 at a concentration of 9.9 ug/L. This well is located near the former septic system of Plaza Cleaners which was identified as the source of the contamination.

- Trichloroethene (TCE) was detected in MW-20B at concentrations of 4.2 and 5.6 ug/L, the latter of which exceeds the MTCA cleanup level for TCE of 5.0 ug/L.

- Cis-1,2-dichloroethene (cis-1,2-DCE) was detected in wells MW-20B (6.6 and 11 ug/L) and MW-16A (4.6 and an estimated 0.48 J ug/L). The federal maximum contaminant level for cis-1,2-DCE is 70 ug/L.

Most concentrations remain within the range of those reported in previous samplings conducted since 1991. However, PCE concentrations in wells MW-20B and MW-16A appear to be rising. PCE concentrations in well MW-16A during the May 2006 sampling had increased to the highest levels detected in the well since the initial sampling in 1985 (110 ug/L). PCE concentrations in municipal well H1 remain near the MTCA cleanup level.

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Background

In 1981 the U.S. Environmental Protection Agency (EPA) confirmed that the Lakewood Water District production wells H1 and H2 (Pierce County, Washington) were contaminated with tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE). The source of the contamination was identified as the Lakewood Plaza Cleaners (EPA, 1983).

In 1991 the Washington State Department of Ecology (Ecology) began semi-annual, long-term groundwater monitoring at the site. The objective of this sampling is to collect groundwater quality data for Ecology's Toxics Cleanup Program to evaluate the effectiveness of Lakewood water supply wells H1 and H2 to contain and remove groundwater contaminated by Plaza Cleaners.

In 1996 the monitoring program was evaluated. Based on data collected from 1986 to 1996, it was decided to decommission half of the remaining wells and reduce the monitoring program to wells in the immediate vicinity of Plaza Cleaners. The monitoring program was evaluated again in August 2002. The current monitoring program was determined to be sufficient to meet project objectives (Ecology, 2002).

In December 2004, three monitoring wells (LPMW-1, LPMW-2, and LPMW-3) were installed on property adjoining the former Plaza Cleaners site. Because PCE was detected during the installations, these wells were added to this monitoring program in May 2006.

Methods

Groundwater Sampling

In May 2006, groundwater samples were collected from monitoring wells MW-16A, MW-20A, MW-20B, MW-27, MW-33, LPMW-2, and LPMW-3, and municipal well H1 (Figure 1). Well LPMW-1 could not be sampled because it was dry. In September 2006, groundwater samples were collected from MW-16A, MW-20A, MW-20B, MW-27, and municipal well H1. None of the three new wells could be sampled in September because they were either dry (LPMW-1, LPMW-2) or had an insufficient amount of water for the selected sampling method (LPMW-3).

Wells MW-16A, MW-20A, MW-27, and MW-33 are screened in the Advance Outwash deposits, the primary water-supply aquifer for the area. Groundwater flow direction in the Advance Outwash is west-northwest when municipal wells H1 and H2 are not in use. When in use, the wells create a large cone of depression (EPA, 1985). Well MW-20B is screened in the Vashon Till, which forms an aquitard over most of the site. The new wells (LPMW-1, LPMW-2, and LPMW-3), which range from 28-32 feet in depth, are screened in the Steilacoom Gravel, which generally contains perched water above the impermeable Vashon Till and regional water table.

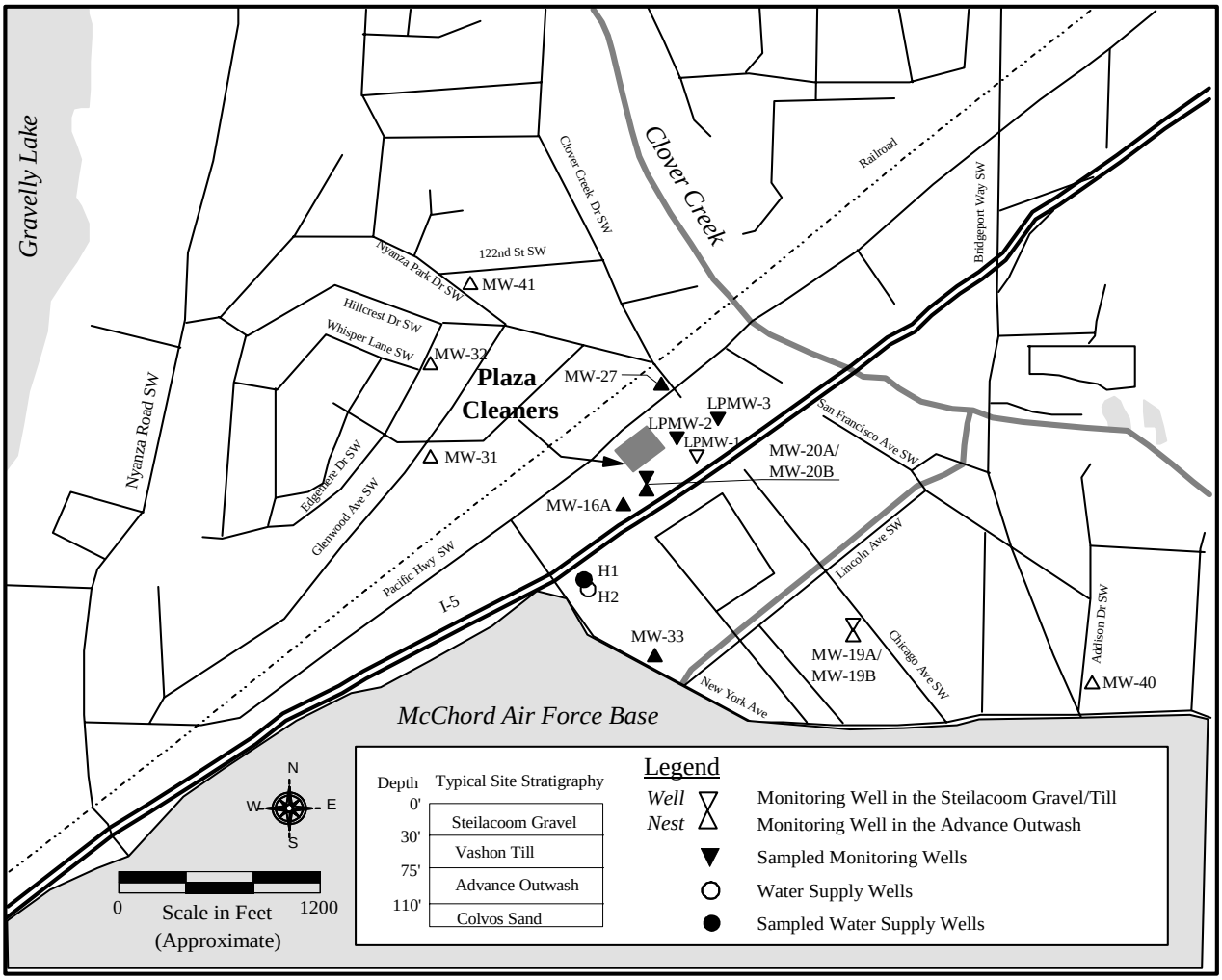

Figure 1: Sampling Locations at the former Lakewood Plaza Cleaners site

Static water levels were measured in all the wells using a calibrated Solinst water level meter prior to well purging and sampling. Measurements were recorded to 0.01 foot and are accurate to 0.03 foot. The probe was rinsed with deionized water between measurements.

In May, monitoring wells MW-16A, MW-20A, MW-27, and MW-33 were purged and sampled using dedicated bladder pumps. After sampling, the pump in MW-27 was removed so that the well could be refurbished. New wells LPMW-2 and LPMW-3 were purged and sampled with a stainless-steel submersible pump with dedicated tubing using low-flow sampling techniques. Well MW-20B, which does not have a dedicated pump, was purged and sampled with a decontaminated Teflon bailer.

In September, wells MW-16A and MW-20A were purged and sampled with the dedicated bladder pumps. Wells MW-20B and MW-27 were purged and sampled with the submersible pump.

The bailer used to sample well MW-20B in May was pre-cleaned with a Liquinox® wash and sequential rinses of hot tap water, 10% nitric acid, distilled/deionized water, and pesticide-grade acetone. After cleaning, the bailer was air-dried and wrapped in aluminum foil.

The submersible pump was decontaminated between wells by circulating laboratory grade detergent/water through the pump, followed by a clean water rinse with each cycle lasting five minutes.

The monitoring wells were purged until pH, temperature, and specific conductance readings stabilized or three well volumes of water had been removed. Purge water from the monitoring wells was collected and stored in 55-gallon drums. The purge water waste was transported and disposed of in accordance with Washington State regulations (Chapter 173-303 WAC). At the completion of purging, samples were collected from the monitoring wells directly from the dedicated pump discharge tubing into laboratory supplied containers. Municipal well H1, which pumps continuously, was sampled from a tap nearest the well.

Volatile organics samples were collected free of headspace in three 40-mL glass vials with Teflon-lined septa lids and preserved with 1:1 hydrochloric acid. After sample collection and proper labeling, all samples were stored in an ice-filled cooler. Samples were transported to Ecology's Operations Center in Lacey. Samples were kept in the walk-in cooler until taken by the courier to the Ecology/EPA Manchester Environmental Laboratory in Manchester, Washington. Chain-of-custody procedures were followed according to Manchester Laboratory protocol (Ecology, 2005).

Analysis

Table 1 lists analytes, analytical methods, and detection limits for both field and laboratory parameters. All groundwater samples were analyzed for volatile organics.

Table 1: Analytical Methods for May and September 2006 Samples

Analytes	*Method*	*Reference*	
Field			*Accuracy*
Water Level	Solinst Well Probe	NA	0.01 feet
pH	Orion 25A Field Meter	NA	0.1 standard units
Temperature	Orion 25A Field Meter	NA	0.1 Celsius degrees
Specific Conductance	Beckman Conductivity Bridge	NA	10 umhos/cm
Laboratory			*Reporting Limit*
Volatile Organics Analysis	SW-846 Method 8260	EPA, 1996	1-5 ug/L

The quality of the data is acceptable. Quality control samples collected in the field consisted of blind field duplicates obtained from well MW-16A. The numeric comparison of duplicate results is expressed as the relative percent difference (RPD). The RPD for PCE in May was 0% and in September was 7%.

In addition to field quality control samples, duplicate matrix spikes and surrogate compound recoveries were performed in the laboratory. Overall, matrix spikes and surrogate recoveries were within acceptable limits. Some analytes were outside the quality control limits and were qualified. It was determined that this did not affect the analytes of interest. Quality assurance case narratives and laboratory reporting sheets, with the complete list of volatile organics analyzed, are available upon request.

Results

Field Observations

Depth-to-water measurements and purge volume, as well as pH, specific conductance, and temperature readings, at the time of sampling are listed in Table 2.

Table 2: Summary of Field Parameters Results for May 22-23 and September 26, 2006

Well	Total Depth (feet)[1]	Depth to Water (feet)[1]	pH (standard units)	Specific Conductance (umhos/cm)	Temperature (°C)	Purge Volume (gallons)
May						
MW-16A	109	36.59	7.6	241	12.3	70
MW-20A	97.3	29.22	8.1	218	12.5	32
MW-20B	50.4	27.56	7.3	422	12.8	12
MW-27	96.4	++	6.5	193	11.9	33
MW-33	99.3	++	6.7	218	11.2	35
LPMW-2	29	22.62	6.3	217	14.0	3.5
LPMW-3	31.45	21.27	5.9	328	12.9	4.5
H1	110	++	6.1	190	11.8	>1000
September						
MW-16A	109	41.93	7.3	219	12.3	41
MW-20A	97.3	36.19	7.6	225	12.9	31
MW-20B	50.4	39.0	6.8	322	16.1	7
MW-27	96.4	34.20	6.7	191	13.6	19
H1	110	++	6.2	187	12.4	>1000

[1] Measured from top of PVC casing.
++ Dedicated pump obstructed water-level measurement.
-- Well dry.

All field parameters were within expected ranges. The specific conductance in wells MW-20B (322-422 umhos/cm) and LPMW-3 (328 umhos/cm) were greater than the other wells. Well MW-20B is screened in a fine-grained till unit. LPMW-3 is screened in a very dense, gravelly, sandy silt. Specific conductance readings are typically higher for water from fine-grained units.

Analytical Results

Analytical results for volatile organics of interest are summarized in Table 3 and presented in Figure 2.

Table 3: Results (ug/L) of Volatile Organics of Interest for May 22-23 and September 26, 2006

Well	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Cis-1,2-Dichloroethene (cis-1,2-DCE)
May			
MW-16A	**124**	**1.8**	**4.6**
MW-20A	1 U	1 U	1 U
MW-20B	**216**	**4.2**	**6.6**
MW-27	1 U	1 U	1 U
MW-33	1 U	1 U	1 U
LPMW-2	**9.9**	1 U	1 U
LPMW-3	1 U	1 U	1 U
H1	**7.3**	**0.22 J**	1 U
September			
MW-16A	**29**	**0.30 J**	**0.48 J**
MW-20A	1 U	1 U	1 U
MW-20B	**518**	**5.6**	**11**
MW-27	1 U	1 U	1 U
H1	**4.8**	1 U	1 U

Bold: Analyte detected.
U: Analyte was not detected at or above the reported value.
J: Analyte was positively identified. The associated numerical result is an estimate.

In May, PCE, TCE, and cis-1,2-DCE concentrations in well MW-20B were 216 ug/L, 4.2 ug/L, and 6.6 ug/L, respectively. PCE, TCE, and cis-1,2-DCE were also detected in monitoring well MW-16A at concentrations of 124 ug/L, 1.8 ug/L, and 4.6 ug/L, respectively. PCE was detected in municipal well H1 at a concentration of 7.3 ug/L. TCE was also detected near or below the practical quantitation limit of 1 ug/L in H1 in May as shown in Table 3. PCE was also detected in well LPMW-2 at a concentration of 9.9 ug/L. This well is located near the former septic system of Plaza Cleaners which was identified as the source of the contamination.

In September, PCE, TCE, and cis-1,2-DCE concentrations in well MW-20B were 518 ug/L, 5.6 ug/L, and 11 ug/L, respectively. PCE was detected in wells MW-16A and H1 at concentrations of 29 ug/L and 4.8 ug/L, respectively. TCE and cis-1,2-DCE were also detected in MW-16A at concentrations below the practical quantitation limit of 1 ug/L. Well LPMW-2 was not sampled in September due to the low water level.

Benzene and toluene were detected below the practical quantitation limit (1 ug/L) in wells MW-20A and LPMW-3 in May. These analytes have been detected periodically in the past, always at concentrations below the quantitation limits. There is no consistent pattern or clear explanation for the occurrence of these chemicals, although they are commonly elevated in urbanized areas.

Chloroform was tentatively identified in municipal well H1 at an estimated concentration of 0.34 ug/L during May. The chloroform is probably the result of chlorination during water treatment.

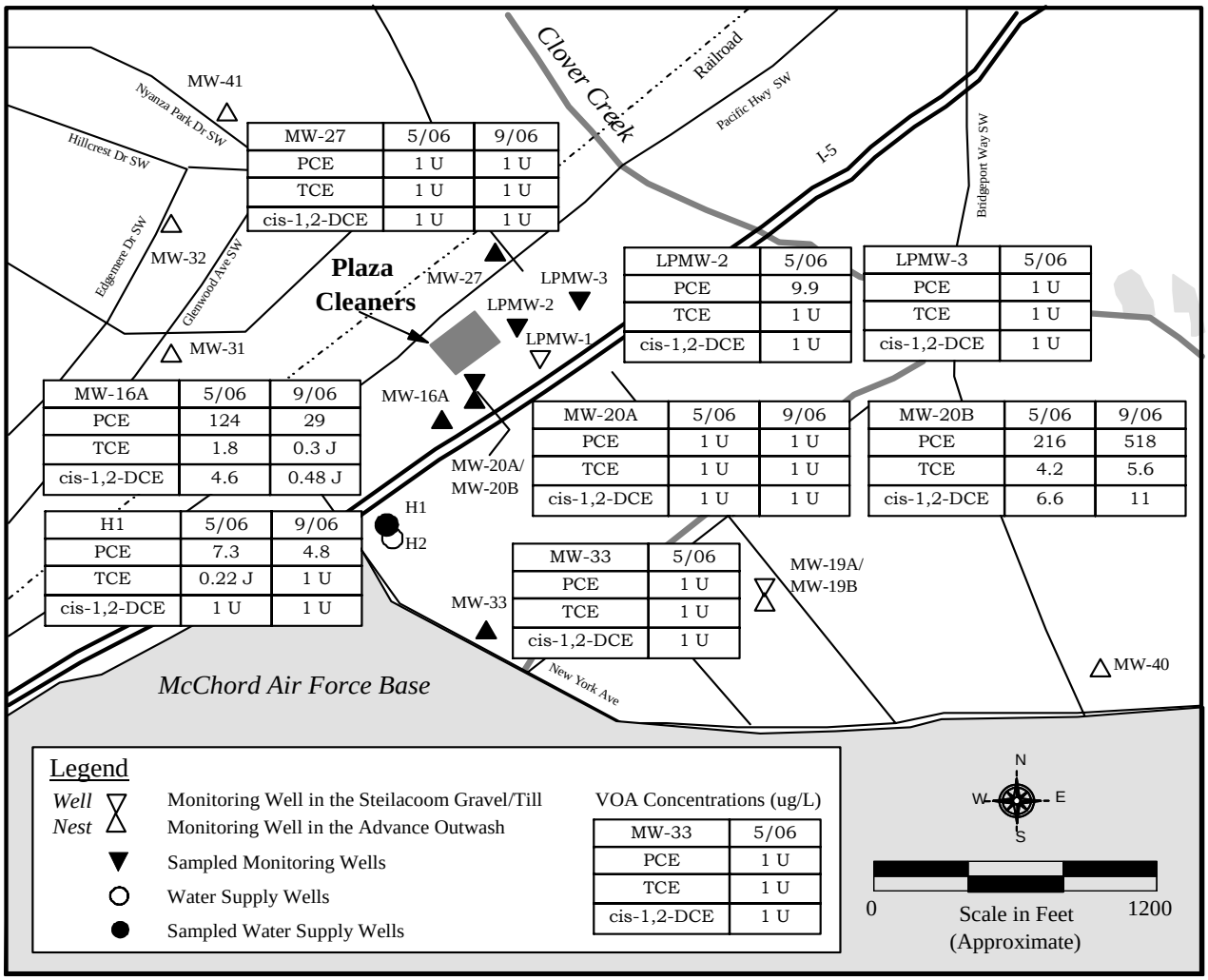

Figure 2: Lakewood Plaza Cleaners PCE, TCE and Cis-1,2-DCE Concentrations (ug/L), May and September 2006.

PCE, TCE, and cis-1, 2-DCE concentrations for sampling events from January 1991 through September 2006 are presented in the Appendix. Table 4 shows average PCE and TCE concentrations that have exceeded the MTCA cleanup level of 5.0 ug/L during the same period.

Table 4: Average Annual PCE and TCE Concentrations (ug/L) that Exceeded the MTCA Method A Cleanup Level for Groundwater of 5 ug/L

Year	MW-20B		MW-16A	H1/H2
	PCE	TCE	PCE	PCE
1991	657	12	19	---
1992	640	14	8	---
1993	443	12	28	---
1994	279	8.6	21	---
1995	340	8.4	27	9
1996	370	7	45	4
1997	297	4	50	13
1998	515	8	33	10
1999	715	7	22	3
2000	416	6	31	9
2001	489	7	28	9
2002	309	8.5	34	9
2003	234	5.4	42	6.4
2004	293	6.6	39	5.3
2005	484	6.5	62	10.2
2006	367	4.9	77	6.1

-- Not tested.

PCE concentrations continue to be elevated in wells MW-20B and MW-16A. Municipal wells H1 and H2, which were added to the monitoring program in 1995, also have elevated PCE concentrations.

Figure 3 shows PCE concentrations for MW-20B and MW-16A from 1991 to 2006. PCE concentrations in both wells have varied substantially.

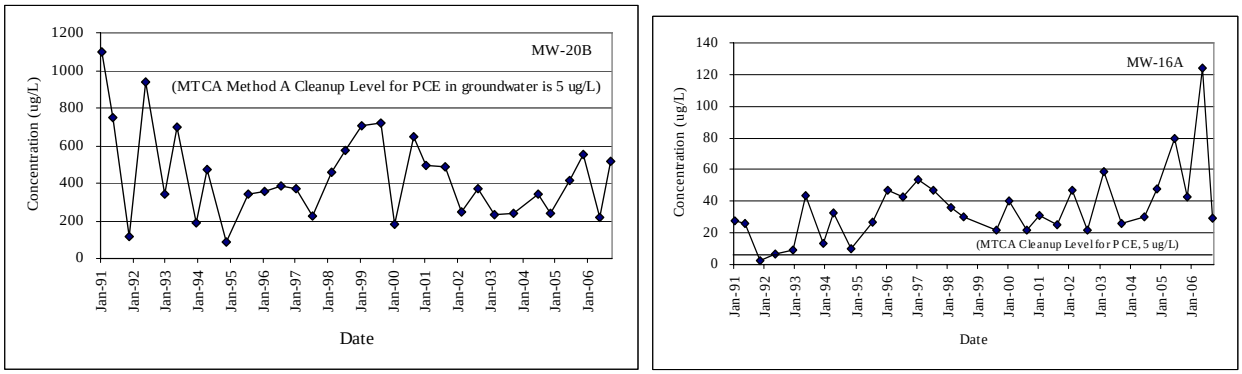

Figure 3: PCE Concentrations for Wells MW-20B and MW-16A from 1991 to 2006

PCE concentrations decreased initially in MW-20B from 4,800 ppb in March 1985 to 570 ppb in May 1985. The average PCE concentration for well MW-20B from May 1985 to April 1990 was 900 ppb. In 1991 Ecology began long-term groundwater monitoring of the site. Samples were collected in the spring and fall which corresponded to the high-water/low-water seasons. Concentrations fluctuated from a springtime high of 940 ug/L to a fall low of 86 ug/L. In 1995, the sampling routine was changed to a winter/summer schedule. Between July 1995 and July 1997, concentrations leveled off, ranging from 222 to 387 ug/L. Between February 1998 and August 2001, concentrations were slightly higher, ranging from 456 to 722 ug/L. During the 2002 to 2004 monitoring period, concentrations leveled off once again, ranging from 230 to 371 ug/L. In the fall of 2003 the sampling routine returned to the spring/fall schedule. Between November 2004 and November 2005 PCE concentrations in MW-20B more than doubled, increasing from 241 to 555 ug/L. Although concentrations decreased to 216 ug/L in May 2006, they then increased to 518 ug/L in September 2006.

PCE concentrations also initially decreased in MW-16A, dropping from 110 ppb in March 1985 to 12 ppb in August 1985. The average PCE concentration of well MW-16A from March 1985 to April 1990 was 37 ppb. From 1991 to 2004, PCE concentrations in this well have ranged from 2.7 to 59 ug/L. However, the last two spring sample rounds demonstrate rising PCE levels: the June 2005 sampling showed concentrations of 80 ug/L, and the May 2006 concentrations were 124 ug/L.

All field measurements and analytical results data are available in electronic format from Ecology's EIM data management system: www.ecy.wa.gov/eim/index.htm. Search user study ID, LAKEWOOD.

Conclusions

Monitoring was conducted in May 2006 at seven monitoring wells and one municipal well, and in September 2006 at four monitoring wells and one municipal well, to evaluate volatile organics in groundwater at the former Lakewood Plaza Cleaners site.

- Monitoring wells MW-20B and MW-16A, as well as municipal well H1, continue to have PCE concentrations exceeding the MTCA cleanup level of 5 ug/L.

- Monitoring well MW-20B continues to have TCE concentrations exceeding the MTCA cleanup level of 5.0 ug/L.

- New well LPMW-2 has PCE concentrations exceeding the MTCA cleanup level of 5.0 ug/L. This well is located near the former septic system of Plaza Cleaners which was identified as the source of the contamination.

Although most concentrations are within the range of those reported in previous samplings conducted since 1991, PCE concentrations in wells MW-20B and MW-16A appear to be rising. Concentrations in MW-20B more than doubled from November 2004 to November 2005, and continued to remain high (518 ppb) in the September 2006 sampling. The May 2006 PCE concentrations in well MW-16A (124 ug/L) were the highest detected in this well since the initial sampling in 1985 (110 ug/L).

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Appendix. Summary of Sample Results (ug/L) from January 1991 to September 2006

Well	January 1991			May 1991			November 1991			May 1992			December 1992		
Number	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE
MW-16A	**28**	**1 J**	**2.4 J**	**26**	**0.6 J**	**2**	**2.7 J**	1 U	**0.6 J**	**7**	1 U	**1**	**9 J**	**0.3 J**	**0.8 J**
MW-20A	1 U	1 U	1 U	**0.4 J**	1 U	1 U	**0.4 J**	1 U	1 U	**0.5 J**	1 U	1 U	**0.8 J**	1 UJ	1 UJ
MW-20B	**1100 D**	**18**	**33**	**752**	**16**	**30**	**120**	**2.6 J**	**6.7**	**940**	**13**	**32**	**340 J**	**14 J**	**20 J**
MW-21	**2.1 J**	1 U	**1 J**	**2**	1 U	**0.7 J**	**2.2 J**	1 U	**1.0 J**	**2**	1 U	**0.6 J**	**2**	**0.2 J**	**0.3 J**
MW-27	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ
MW-28A	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-31	**1 J**	1 U	**1.9 J**	**0.6 J**	1 U	**2**	**0.9 J**	1 U	**2.2 J**	**0.8 J**	1 U	**1**	**0.5 J**	1 UJ	**0.9 J**
MW-32	**1 J**	1 U	**1.1 J**	**1**	1 U	**2**	**0.6 J**	1 U	**0.6 J**	**0.7 J**	1 U	**1**	**0.7 J**	1 UJ	**0.5 J**
MW-41	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 UJ	1 UJ
MW-19A	--	--	--	--	--	--	1 U	**0.5 J**	1 U	--	--	--	1 UJ	1 UJ	1 UJ
MW-33	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-40	1 U	1 U	1 U	--	--	--	1 U	1 U	1 U	--	--	--	1 UJ	1 UJ	1 UJ
H1/H2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Well	May 1993			December 1993			April 1994			November 1994			July 1995		
Number	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE
MW-16A	**44**	10 U	**2 J**	**13**	**0.3 J**	**0.7 J**	**33**	**0.6**	**1.4**	**9.7**	**0.3 J**	**0.5 J**	**27**	**0.5 J**	**0.8 J**
MW-20A	10 U	10 U	10 U	**0.3 J**	1 U	1 U	**0.4**	0.2 U	0.2 U	**0.3 J**	1 U	1 U	**0.4 J**	1 U	1 U
MW-20B	**700 D**	**12**	**21**	**187**	50 U	**8.2 J**	**472**	**8.6 J**	**12.6**	**86**	50 U	**3 J**	**340 D**	**8.4**	**17**
MW-21	**1 J**	10 U	10 U	**1.6**	1 U	**0.4 J**	**1.5**	**0.2 J**	**0.3**	**1.8**	**0.2 J**	**0.3 J**	--	--	--
MW-27	10 U	10 U	10 U	1 U	1 U	1 U	0.2 U	0.2 U	0.2 U	1 U	1 U	1 U	1 U	1 U	1 U
MW-28A	--	--	--	--	--	--	--	--	--	--	--	--	1 U	1 U	1 U
MW-31	10 U	10 U	10 U	**0.8 J**	1 U	**1.2 J**	**0.7**	0.2 U	**1.0**	**0.8 J**	1 U	**1**	**0.6 J**	1 U	**0.5 J**
MW-32	10 U	10 U	10 U	**0.7 J**	1 U	**0.6 J**	**0.7**	0.2 U	**0.6**	**0.6 J**	1 U	**0.5 J**	**0.7 J**	1 U	**0.5 J**
MW-41	10 U	10 U	10 U	1 U	1 U	1 U	0.2 U	0.2 U	0.2 U	1 U	1 U	1 U	1 U	1 U	1 U
MW-19A	--	--	--	1 U	**0.4**	1 U	0.2 U	**0.5**	0.2 U	--	--	--	1 U	**0.4 J**	1 U
MW-33	--	--	--	--	--	--	--	--	--	--	--	--	1 U	1 U	1 U
MW-40	--	--	--	1 U	1 U	1 U	0.2 U	0.2 U	0.2 U	--	--	--	1 U	1 U	1 U
H1/H2	--	--	--	--	--	--	--	--	--	--	--	--	**9**	**0.3 J**	1 U

U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
UJ = The analyte was not detected at or above the reported estimated result.
D = Analysis performed at secondary dilution.
-- = Not tested
Bold = The analyte was positively identified.

Appendix (cont.). Summary of Sample Results (ug/L) from January 1991 to September 2006

Well Number	January 1996			July 1996			January 1997			July 1997			February 1998		
	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE
MW-16A	**47 E**	**0.8 J**	**1.5**	**43**	**0.7 J**	**1.9**	**54**	**1.1**	**3.1**	**47**	**0.7 J**	**2.5**	**36**	**0.7 J**	**2 J**
MW-20A	**0.2 J**	1 U	1 U	**0.4 J**	1 U	1 U	**0.4 J**	1 U	1 U	**0.3 J**	1 U	2 U	**0.4 J**	1 U	1 U
MW-20B	**353**	**7.2**	**15**	**387**	**7.6**	**15**	**373**	100 U	**6.4 J**	**222**	**4**	**6.4**	**456**	**7 J**	**12**
MW-21	--	--	--	Well Decommissioned											
MW-27	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U
MW-28A	1 U	1 U	1 U	Well Decommissioned											
MW-31	**0.6 J**	1 U	**0.7 J**	--	--	--	--	--	--	**0.9 J**	1 U	**0.9 J**	--	--	--
MW-32	**0.8 J**	1 U	**0.6 J**	--	--	--	--	--	--	--	--	--	--	--	--
MW-41	1 U	1 U	1 U	--	--	--	--	--	--	--	--	--	--	--	--
MW-19A	--	--	--	--	--	--	--	--	--	1 U	**0.3 J**	2 U	--	--	--
MW-33	--	--	--	1 U	1 U	1 U	--	--	--	1 U	1 U	2 U	--	--	--
MW-40	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
H1/H2	**8.4**	**0.2 J**	**0.2 J**	**0.14 J**	1 U	1 U	**18**	**0.4 J**	**0.4 J**	**8.8**	**0.3 J**	**0.6 J**	**11**	**0.4 J**	**0.3 J**

Well Number	July 1998			January 1999			August 1999			January 2000			August 2000		
	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE
MW-16A	**30**	1 U	**1.5 J**	--	--	--	**22**	**0.4 J**	**1.1**	**40**	**0.7 J**	**1.9**	**22**	**0.3 J**	**0.7**
MW-20A	**0.6 J**	1 U	1 U	1 U	2 U	1 U	**0.8 J**	2 U	1 U	**0.2 J**	2 U	1 U	**0.1 J**	2 U	1 U
MW-20B	**575 D**	**10**	**23**	**708**	**5.2**	**12**	**722**	**8.4 J**	**16 J**	**184**	**6**	**13**	**648**	200 U	100 U
MW-27	**0.05 J**	1 U	1 U	1 U	2 U	1 U	1 U	2 U	1 U	1 U	2 U	1 U	1 U	2 U	1 U
MW-31	--	--	--	--	--	--	**0.9 J**	2 U	**0.4 J**	--	--	--	--	--	--
MW-32	--	--	--	--	--	--	--	--	--	--	--	--	**0.8 J**	2 U	1 U
MW-41	--	--	--	--	--	--	--	--	--	--	--	--	1 U	2 U	1 U
MW-19A	--	--	--	--	--	--	1 U	**0.4 J**	1 U	--	--	--	--	--	--
MW-33	1 U	1 U	1 U	--	--	--	1 U	2 U	1 U	--	--	--	1 U	2 U	1 U
MW-40	--	--	--	--	--	--	--	--	--	--	--	--	1 U	2 U	1 U
H1/H2	**10**	1 U	**0.1 J**	**1.5**	1 U	1 U	**5.2**	**0.2 J**	1 U	**10**	1 U	1 U	**8.7**	**0.03 J**	1 U

U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
D = Analysis performed at secondary dilution.
E = The concentration of the associated value exceeds the known calibration range.
-- = Not tested
Bold = The analyte was positively identified.

Appendix (cont.). Summary of Sample Results (ug/L) from January 1991 to September 2006

Well Number	January 2001			August 2001			February 2002			August 2002			February 2003		
	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE
MW-16A	**31**	**0.4 J**	**1**	**25**	**0.3 J**	**0.7 J**	**47**	**0.8 J**	**2.3**	**22**	**0.3 J**	**0.8 J**	**59 J**	**0.2 J**	**2.4**
MW-20A	**0.2 J**	1 U	1 U	1 U	2 U	1 U	--	--	--	--	--	--	1 U	1 U	1 U
MW-20B	**493**	**6.6 J**	**12**	**486**	**8.2**	**18**	**248**	200 U	100 U	**371**	**8.5**	**16**	**230**	100 U	100 U
MW-27	1 U	1 U	1 U	1 U	2 U	1 U	1 U	2 U	1 U	1 U	2 U	1 U	1 U	1 U	1 U
MW-31	--	--	--	**0.4 J**	2 U	**0.3 J**	--	--	--	--	--	--	--	--	--
MW-32	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-41	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MW-19A	--	--	--	1 U	**0.3 J**	1 U	--	--	--	--	--	--	--	--	--
MW-33	--	--	--	1 U	2 U	1 U	--	--	--	1 U	1 U	1 U	--	--	--
MW-40	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
H1/H2	**11**	**0.2 J**	1 U	**6.8**	**0.2 J**	1 U	**12**	**0.2 J**	**0.2 J**	**6.1**	1 U	1 U	**1.3**	1 U	1 U

Well Number	September 2003			June 2004			November 2004			June 2005			November 2005		
	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE
MW-16A	**26**	**0.3 J**	**0.5 J**	**30**	**0.4 J**	**0.8 J**	**48**	1 U	**1.4**	**80.3**	**1.3**	**2.8**	**43**	**0.69 J**	**1.0 J**
MW-20A	**0.1 J**	1 U	1 U	**0.2 J**	1 U	1 U	**0.3 J**	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MW-20B	**239**	**5.4 J**	**12**	**344**	**6.5 J**	**15**	**241**	**6.7**	**13**	**413**	**6.6**	**12**	**555**	**6.4**	**11**
MW-27	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
MW-31	**0.5 J**	1 U	**0.1 NJ**	--	--	--	--	--	--	**0.53 J**	1 U	1 U	--	--	--
MW-32	--	--	--	--	--	--	--	--	--	**1.4**	1 U	1 U	--	--	--
MW-41	--	--	--	--	--	--	--	--	--	1 U	1 U	1 U	--	--	--
MW-19A	1 U	**0.4 NJ**	1 U	--	--	--	--	--	--	1 U	**0.57 J**	1 U	--	--	--
MW-33	1 U	1 U	1 U	--	--	--	--	--	--	1 U	1 U	1 U	--	--	--
MW-40	--	--	--	--	--	--	--	--	--	1 U	1 U	1 U	--	--	--
H1/H2	**6.4**	**0.2 NJ**	1 U	**7.9**	**0.24 J**	**0.1 J**	**2.6**	1 U	1 U	**14**	**0.31 J**	1 U	**6.4**	1 U	1 U

U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
-- = Not tested
Bold = The analyte was positively identified.

Appendix (cont.). Summary of Sample Results (ug/L) from January 1991 to September 2006

Well Number	May 2006			September 2006		
	PCE	TCE	cis-1,2-DCE	PCE	TCE	cis-1,2-DCE
MW-16A	**124**	**1.8**	**4.6**	**29**	**0.3 J**	**0.48 J**
MW-20A	1 U	1 U	1 U	1 U	1 U	1 U
MW-20B	**216**	**4.2**	**6.6**	**518**	**5.6**	**11**
MW-27	1 U	1 U	1 U	1 U	1 U	1 U
MW-31	--	--	--	--	--	--
MW-32	--	--	--	--	--	--
MW-41	--	--	--	--	--	--
MW-19A	--	--	--	--	--	--
MW-33	1 U	1 U	1 U	--	--	--
MW-40	--	--	--	--	--	--
H1/H2	**7.3**	**0.22 J**	1 U	**4.8**	1 U	1 U

U = The analyte was not detected at or above the reported result.
J = The analyte was positively identified. The associated numerical result is an estimate.
-- = Not tested
Bold = The analyte was positively identified.