A Department of Ecology Report

Lakewood Plaza Cleaners
February and September 2003
Groundwater Monitoring Results

Abstract

This progress report is one in a series describing results of long-term groundwater sampling at Lakewood Plaza Cleaners in south Tacoma. Results of volatile organics of samples collected from one municipal well and seven monitoring wells in February and September 2003 are included.

- Monitoring wells MW-20B and MW-16A, as well as municipal well H1, continue to have tetrachloroethene (PCE) concentrations exceeding the Model Toxic Control Act (MTCA) cleanup standard of 5.0 ug/L. PCE concentrations in these wells during the past year of sampling were MW-20B (230 and 239 ug/L), MW-16A (59J and 26 ug/L), and H1 (1.3 and 6.4 ug/L).

- Trichloroethene (TCE) was detected in MW-20B in September at an estimated concentration of 5.4 ug/L, which exceeds the MTCA cleanup standard for TCE of 5.0 ug/L. TCE was not detected in MW-20B in February due to a high quantitation limit (100 ug/L).

- Cis-1,2-dichloroethene (cis-1,2-DCE) was detected in wells MW-20B (12 ug/L) and MW-16A (2.4 and 0.54J ug/L). The federal maximum contaminant level for cis-1,2-DCE is 70 ug/L.

Overall, concentrations are similar to those reported in previous sampling rounds.

December 2003
by Pam Marti

Publication No. 03-03-050
Waterbody No. WA-12-1115

Publication Information

This report is available on the Department of Ecology home page on the World Wide Web at http://www.ecy.wa.gov/biblio/0303050.html

For a printed copy of this report, contact the Department of Ecology Publications Distribution Office and refer to publication number 03-03-050.

E-mail: ecypub@ecy.wa.gov
Phone: (360) 407-7472
Address: PO Box 47600, Olympia WA 98504-7600

Author: Pamela B. Marti, Hydrogeologist
Washington State Department of Ecology
Environmental Assessment Program
Phone: (360) 407-6768
Address: PO Box 47600, Olympia WA 98504-7600

This report was prepared by a licensed hydrogeologist. A signed and stamped copy of the report is available upon request.

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, trichloroethene, and 1,2-dicloroethene. The source of the contamination was identified as the Lakewood Plaza Cleaners. 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 also to 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).

Methods

Groundwater Sampling

In February 2003, groundwater samples were collected from monitoring wells MW-16A, MW-20A, MW-20B, MW-27, and municipal well H1. In September 2003, groundwater samples were collected from monitoring wells MW-16A, MW-19A, MW-20A, MW-20B, MW-27, MW-31, and MW-33, as well as municipal well H1 (Figure 1). All but one of the wells are screened in the Advanced Outwash deposits, the primary water-supply aquifer for the area. Groundwater flow direction in the Advanced 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 (USEPA, 1985). Well MW-20B is screened in the Vashon Till, which forms an aquitard over most of the site.

Sampling methods were consistent with those previously used on this project. Static water levels were recorded prior to well purging. Wells were purged until pH, specific conductance, and temperature readings stabilized, and a minimum of three well volumes had been removed. All monitoring wells, except MW-20A and MW-20B, were purged and sampled using dedicated bladder pumps. Wells MW-20A and MW-20B was purged and sampled with decontaminated Teflon bailers. Municipal well H1, which pumps continuously, was sampled from a tap nearest to the well. Sampling procedures are discussed in detail in Appendix A.

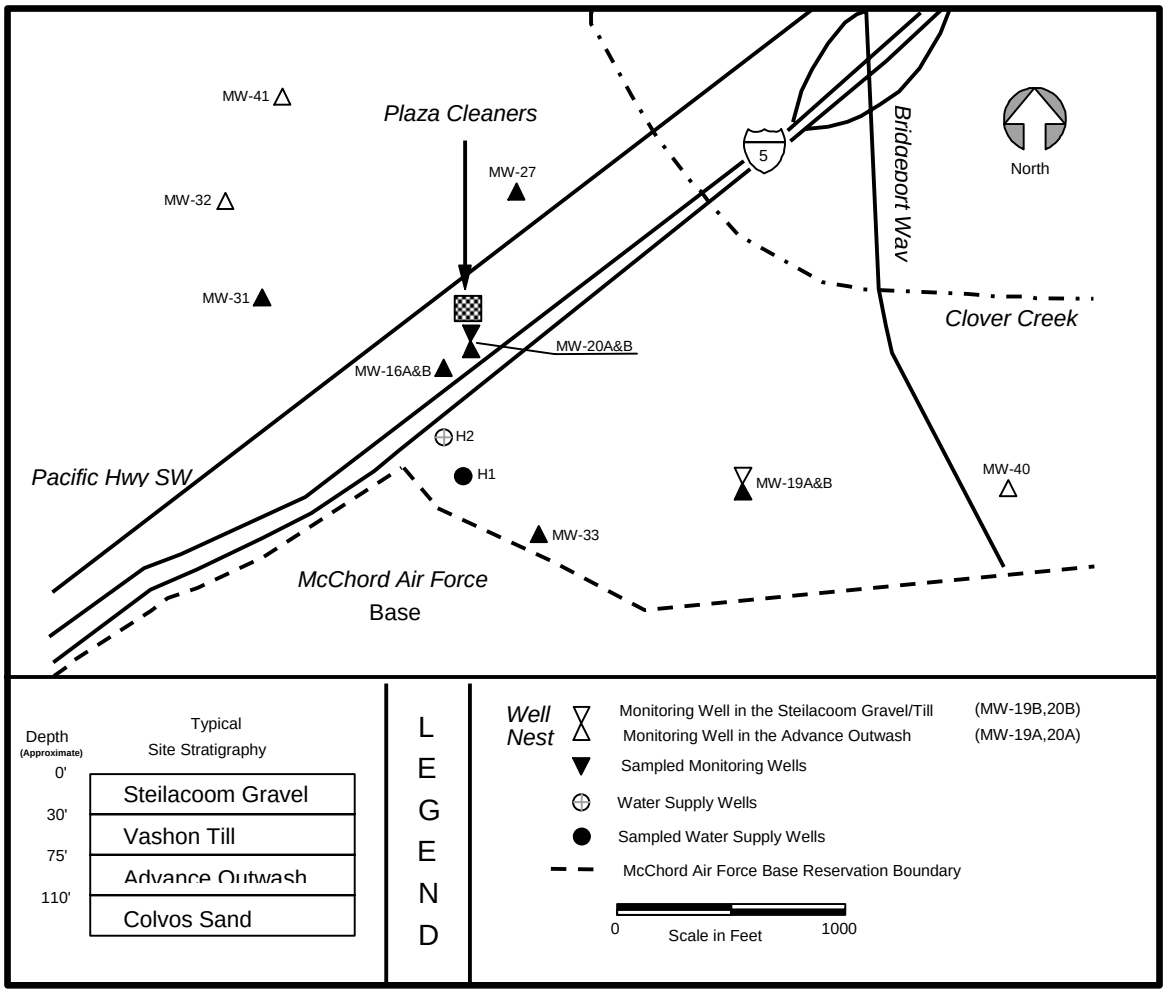


Figure 1: Well Location Map - Lakewood/Plaza Cleaners

Analysis

Analytes, analytical methods, and detection limits for both field and laboratory parameters are listed in Table 1. All groundwater samples were analyzed for volatile organics.

Table 1: Analytical Methods for February and September 2003 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 C
Specific Conductance	Beckman Conductivity Bridge	NA	10 umhos/cm
Laboratory			*Detection Limit*
Volatile Organics Analysis	SW-846 Method 8260	U.S. EPA, 1986	1-5 ug/L

In general, the quality of the data is acceptable. Quality control samples collected in the field consisted of blind field duplicates, which were obtained from well MW-16A. The numeric comparison of duplicate results is expressed as the relative percent difference (RPD). The RPD for PCE in February and September was 7% and 8%, respectively.

In addition to field quality control samples, duplicate matrix spikes and surrogate compound recoveries were performed in the laboratory. In February, duplicate matrix spikes could not be analyzed due to an instrument failure. Overall, matrix spikes and surrogate recoveries were within acceptable limits. Some analytes were outside of 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.

All field parameters were within expected ranges. The specific conductance in well MW-20B (460-505 umhos/cm), which is screened in a fine-grained till unit, was approximately two times greater than the other wells. Specific conductance readings are typically higher for water from fine-grained units.

Table 2: Summary of Field Parameters Results for February 25 and September 24, 2003

Monitoring Well	Total Depth (feet)[1]	Depth to Water (feet)[2]	pH (standard units)	Specific Conductance (umhos/cm)	Temperature (°C)	Purge Volume (gallons)
February						
MW-16A	109	32.60	7.2	229	13.1	149
MW-20A	97.3	27.73	8.4	210	12.8	27
MW-20B	50.4	26.60	6.9	505	12.3	12
MW-27	96.4	++	6.7	187	11.7	30
H1	110	++	5.8	165	10.5	>1000
September						
MW-16A	109	47.91	7.1	222	12.5	119
MW-19A	97.5	42.69	6.7	197	11.9	28
MW-20A	97.3	37.27	7.5	230	12.9	30
MW-20B	50.4	39.49	7.0	460	13.5	5
MW-27	96.4	++	6.3	190	12.3	30
MW-31	91.5	++	6.6	188	11.9	34
MW-33	99.3	++	6.5	215	11.7	30
H1	110	++	5.5	197	11.7	>1000

[1] Measured from top of PVC casing.
[2] Measured from top of PVC casing.
++ Dedicated pump obstructs water-level measurement.

Analytical Results

Analytical results for volatile organics of interest are summarized in Table 3.

In February, the tetrachloroethene (PCE) concentration in well MW-20B was 230 ug/L. Trichloroethene (TCE) and cis-1,2-dichloroethene (cis-1,2-DCE) were not detected in MW-20B in February due to a high quantitation limit (100 ug/L). TCE and cis-1,2-DCE are typically detected around 10 ug/L in well MW-20B. PCE, TCE, and cis-1,2-DCE were detected in MW-16A with estimated concentrations of 59J ug/L, 0.2J ug/L, and 2.4 ug/L, respectively. Municipal well H1 had a PCE concentration of 1.3 ug/L.

In September, the PCE, TCE, and cis-1,2-DCE concentrations in well MW-20B were 239 ug/L, 5.4 J ug/L, and 12 ug/L, respectively. PCE, TCE, and cis-1,2-DCE were also detected in MW-16A with concentrations of 26 ug/L, 0.29J ug/L, and 0.54J ug/L, respectively. Municipal well H1 had a PCE concentration of 6.4 ug/L. PCE, TCE, and cis-1,2-DCE were detected below the practical quantitation limit of 1 ug/L in some of the wells (Table 3).

Table 3: Results (ug/L) of Volatile Organics of Interest for February 25 and September 24, 2003

Monitoring Well	Tetrachloroethene	Trichloroethene	Cis-1,2-Dichloroethene
February			
MW-16A	**59 J**	**0.20 J**	**2.4**
MW-20A	1 U	1 U	1 U
MW-20B	**230**	100 U	100 U
MW-27	1 U	1 U	1 U
H1	**1.3**	1 U	1 U
September			
MW-16A	**26**	**0.29 J**	**0.54 J**
MW-19A	1 U	**0.37 NJ**	1 U
MW-20A	**0.10 J**	1 U	1 U
MW-20B	**239**	**5.4 J**	**12**
MW-27	1 U	1 U	1 U
MW-31	**0.48 J**	1 U	**0.14 NJ**
MW-33	1 U	1 U	1 U
H1	**6.4**	**0.20 NJ**	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.
NJ: There is evidence that the analyte is present. The associated numerical result is an estimate.

Benzene and toluene were detected below the practical quantitation limits (1-2 ug/L) in wells MW-16A and MW-20A in September. 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.

Table 4 summarizes PCE, TCE, and cis-1, 2-DCE concentrations for sampling events from January 1991 through September 2003. Table 5 shows average PCE and TCE concentrations that have exceeded the MTCA cleanup standard of 5.0 ug/L during the same period.

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.

Table 4: Summary of Sample Results (ug/L) from January 1991 to September 2003

Well	January 1991			May 1991			November 1991			May 1992			December 1992		
Number	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	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	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	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.
E = The concentration of the associated value exceeds the known calibration range.
-- = Not tested
= The analyte was positively identified.

Table 4 continued: Summary of Sample Results (ug/L) from January 1991 to September 2003

Well	January 1996			July 1996			January 1997			July 1997			February 1998		
Number	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	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	July 1998			January 1999			August 1999			January 2000			August 2000		
Number	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	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.
UJ = The analyte was not detected at or above the reported estimated result.
D = Analysis performed at secondary dilution.
E = The concentration of the associated value exceeds the known calibration range.
-- = Not tested
= The analyte was positively identified.

Table 4 continued: Summary of Sample Results (ug/L) from January 1991 to September 2003

Well	January 2001			August 2001			February 2002			August 2002		
Number	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE	PERC	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**
MW-20A	**0.2 J**	1 U	1 U	1 U	2 U	1 U	--	--	--	--	--	--
MW-20B	**493**	**6.6 J**	**12**	**486**	**8.2**	**18**	**248**	200 U	100 U	**371**	**8.5**	**16**
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
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

Well	February 2003			September 2003		
Number	PERC	TCE	cis-1,2-DCE	PERC	TCE	cis-1,2-DCE
MW-16A	**59 J**	**0.2 J**	**2.4**	**26**	**0.3 J**	**0.5 J**
MW-20A	1 U	1 U	1 U	**0.1 J**	1 U	1 U
MW-20B	**230**	100 U	100 U	**239**	**5.4 J**	**12**
MW-27	1 U	1 U	1 U	1 U	1 U	1 U
MW-31	--	--	--	**0.5 J**	1 U	**0.1 NJ**
MW-32	--	--	--	--	--	--
MW-41	--	--	--	--	--	--
MW-19A	--	--	--	1 U	**0.4 NJ**	1 U
MW-33	--	--	--	1 U	1 U	1 U
MW-40	--	--	--	--	--	--
H1/H2	**1.3**	1 U	1 U	**6.4**	**0.2 NJ**	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.
E = The concentration of the associated value exceeds the known calibration range.
-- = Not tested
= The analyte was positively identified.

Table 5: Average Annual PCE and TCE Concentrations that Exceeded MTCA Method A Cleanup Standards for Groundwater of 5 ug/L

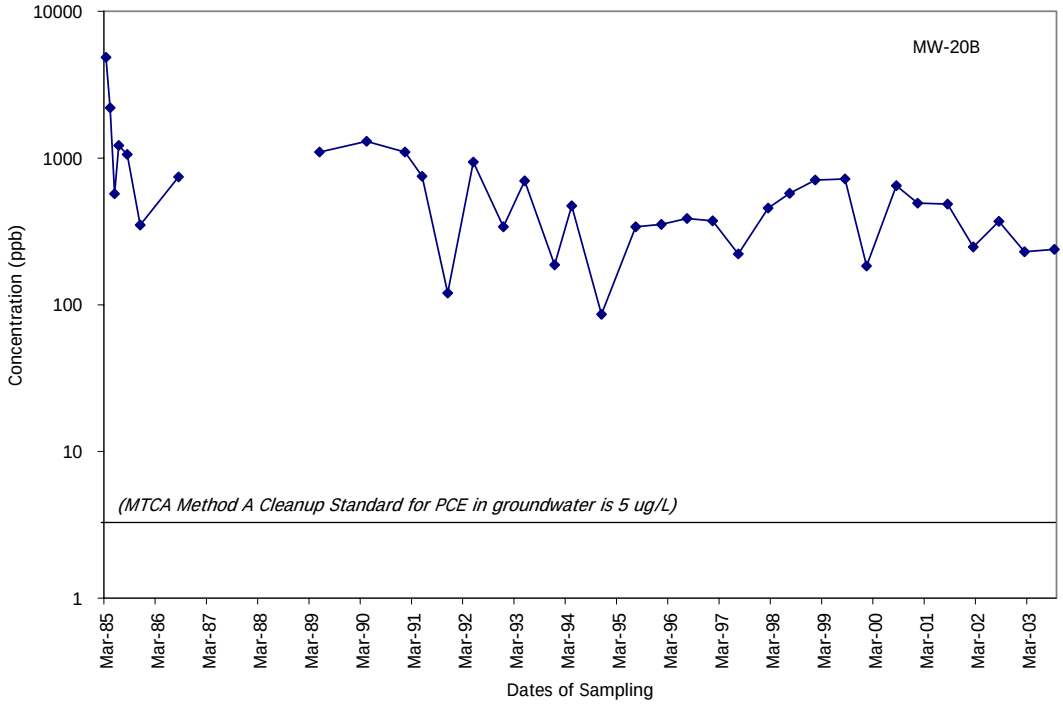
Year	MW-20B		MW-16A	H1/H2
	PCE	TCE	PCE	PCE
1991	657	12	19	---
1992	640	14	8	---
1993	443	12	28	---
1994	279	8.6	21	---
1995	340	8.4	27	9
1996	370	7	45	4
1997	297	4	50	13
1998	515	8	33	10
1999	715	7	22	3
2000	416	6	31	9
2001	489	7	28	9
2002	309	8.5	34	9
2003	234	5.4	42	6.4

-- = Not tested.

Figure 2 shows PCE concentrations for MW-20B and MW-16A between 1985 and 2003. Since 1984, PCE concentrations in both wells have varied substantially.

- PCE concentrations decreased initially in MW-20B from March 1985 (4800 ppb) to May 1985 (570 ppb). Between May 1985 and November 1994, concentrations have ranged from 86 to 1200 ppb. In 1995 the sample schedule was changed from spring/fall, which corresponded to the high-water/low-water seasons, to a winter/summer schedule. Between July 1995 and July 1997 concentrations leveled off, ranging from 222 to 387 ppb. Since February 1998, overall PCE concentrations have been slightly higher, ranging from 184 to 722 ppb.

- Over the monitoring period, PCE concentrations in MW-16A have varied. Since 1999, PCE concentrations in this well have ranged from 22 to 59 ppb.



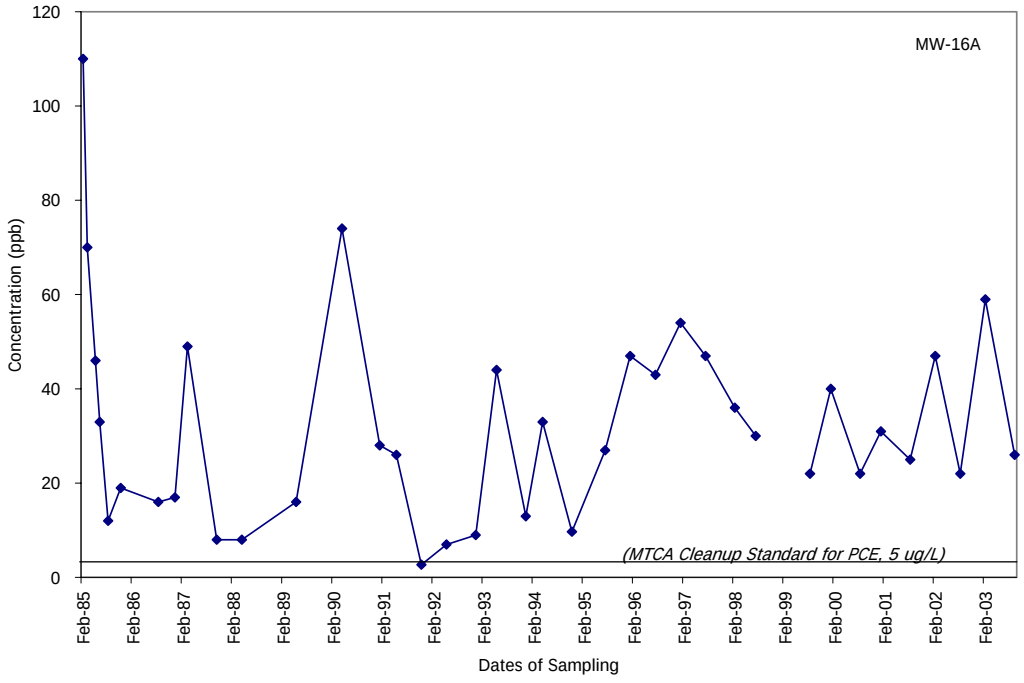


Figure 2: PCE Concentrations for Wells MW-20B and MW-16A from 1985 to 2003

Conclusions

Monitoring was conducted in February and September 2003 at one municipal well and seven monitoring wells to evaluate volatile organics in groundwater at the 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 standard of 5.0 ug/L.

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

Overall, concentrations are similar to those reported in previous sampling conducted since 1991. A five-year review of the project was completed in August 2002. The current monitoring program was determined to be sufficient to meet project objectives.

Citations

Ecology, 2002. Five Year Review Report. Third Five-Year Review Report for Lakewood/Ponders Corner Superfund Site, Tacoma, WA – September 2002. Washington State Department of Ecology, Toxics Cleanup Program.

Ecology, 2003. Manchester Environmental Laboratory - Laboratory Users Manual. 7th edition. Washington State Department of Ecology, Manchester, WA.

U.S. EPA, 1985. Final Draft Remedial Investigation Report – Ponder's Corner, Washington. U.S. Environmental Protection Agency. EPA 112-0L22, 1985.

U.S. EPA, 1986. Test Methods for Evaluating Solid Waste, SW-846. Office of Emergency Response, U.S. Environmental Protection Agency, Washington, DC.

References

CH2M HILL, 1990a. Sampling and Analysis Plan Remedial Action - Lakewood.

------, 1990b. Technical Memorandum from Lisa Dally Wilson to Ann Williamson RE: Groundwater Sampling at Lakewood (April 1990). Project No. SEA69018RA.FQ.

Marti, P., 1991. Lakewood/Plaza Cleaners Monitoring Round I - January 1991. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 91-e34.

------, 1991. Lakewood/Plaza Cleaners Monitoring Round II - May 1991. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 91-e35.

------, 1992. Lakewood/Plaza Cleaners Monitoring Round III - November 1991. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 92-e43.

------, 1992. Lakewood/Plaza Cleaners Monitoring Round IV - May 1992. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 92-e44.

------, 1993. Lakewood/Plaza Cleaners Monitoring Round V - December 1992. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 93-e38.

------, 1993. Lakewood/Plaza Cleaners Monitoring Round VI - May 1993. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 93-e39.

------, 1994. Lakewood/Plaza Cleaners Monitoring Round VII - December 1993. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 94-131.

------, 1994. Lakewood/Plaza Cleaners Monitoring Round VIII - April 1994. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 94-198.

------, 1995. Lakewood/Plaza Cleaners Monitoring Round IX - November 1994. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 95-340.

------, 1995. Lakewood/Plaza Cleaners Monitoring - July 11, 12 & 14, 1995. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 95-359.

------, 1996. Lakewood/Plaza Cleaners Monitoring - January 17-18, 1996. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 96-317.

------, 1997. Lakewood/Plaza Cleaners Monitoring - July 31, 1996. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 97-312.

------, 1997. Lakewood/Plaza Cleaners Monitoring - January 9, 1997. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 97-324a.

------, 1997. Lakewood/Plaza Cleaners Monitoring - July 23-24, 1997. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 97-339.

------, 1998. Lakewood/Plaza Cleaners Monitoring - February 2, 1998. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 98-325.

------, 1999. Lakewood/Plaza Cleaners Monitoring - July 15, 1998. Environmental Investigations and Laboratory Services, Washington State Department of Ecology, Olympia, WA. Publication No. 99-312.

------, 1999. Lakewood/Plaza Cleaners Long-term Monitoring – January and August, 1999. Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA. Publication No. 99-344.

------, 2000. Lakewood/Plaza Cleaners, January and August 2000 Groundwater Monitoring Sampling Results. Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA. Publication No. 00-03-046. http://www.ecy.wa.gov/biblio/0003046.html

------, 2001. Lakewood/Plaza Cleaners, January and August 2001 Groundwater Monitoring Sampling Results. Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA. Publication No. 01-03-032. http://www.ecy.wa.gov/biblio/0103032.html

------, 2003. Lakewood Plaza Cleaners, February and August 2002 Groundwater Monitoring Sampling Results. Environmental Assessment Program, Washington State Department of Ecology, Olympia, WA. Publication No. 03-03-007. http://www.ecy.wa.gov/biblio/0303007.html

Appendix A. Groundwater Sampling Procedures

On February 25, samples were collected from municipal well H1 and monitoring wells MW-16A, MW-20A, MW-20B, and MW-27. On September 24, samples were collected from municipal well H1 and seven monitoring wells: MW-16A, MW-19A, MW-20A, MW-20B, MW-27, MW-31, and MW-33 (Figure 1).

Prior to sample collection, static water level measurements were obtained using an electronic water level probe. The probe was rinsed with deionized water after each use. All monitoring wells were purged a minimum of three well volumes and until pH, temperature, and specific conductance readings stabilized. Purge water was discharged to storm drains or to the ground near each well. Monitoring wells MW-16A, MW-19A, MW-27, MW-31, and MW-33 were purged and sampled using dedicated bladder pumps. In February, well MW-20A was purged and sampled with a decontaminated teflon bailer, and in September with a dedicated bladder pump. Well MW-20B was purged and sampled with a decontaminated teflon bailer during both sample rounds. Municipal well H1, which pumps continuously, was sampled from a tap nearest the well. Samples collected for volatile organics were free of headspace and preserved with two drops of 1:1 hydrochloric acid.

The bailers were 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 bailers were air-dried and wrapped in aluminum foil.

Chain-of-custody procedures were followed in accordance with Manchester Laboratory protocol (Ecology, 2003). Manchester Laboratory analyzed all samples.