A Department of Ecology Report

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Lakewood Plaza Cleaners, June and October 2007 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. The report includes results of volatile organics in samples collected from nine monitoring wells and one municipal well in June 2007, and four monitoring wells and one municipal well in October 2007.

- 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 µg/L. PCE concentrations in these wells during June and October were: MW-20B (204 and 491 µg/L), MW-16A (83 and 24 µg/L), and H1 (5.2 and 3.8 µg/L).

- PCE was also detected in well LPMW-2 at a concentration of 4.8 µg/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 4.4 and 7.5 µg/L, the latter of which exceeds the MTCA cleanup level for TCE of 5 µg/L.

- Cis-1,2-dichloroethene (cis-1,2-DCE) was detected in wells MW-20B (7.8 and 15 µg/L) and MW-16A (2.5 and an estimated 0.64 J µg/L). The federal maximum contaminant level for cis-1,2-DCE is 70 µg/L.

Most concentrations remain within the range of those reported in previous samplings conducted since 1991. However, PCE concentrations in well MW-16A appear to be steadily rising. Average PCE concentrations have increased from 8 µg/L in 1992 to 77 µg/L in 2006. The average PCE concentration in well MW-16A in 2007 was 54 µg/L. PCE concentrations in municipal well H1 remain near the MTCA cleanup level.

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

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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-dicloroethene (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. The Toxics Cleanup Program will use this data 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).

Three wells (LPMW-1, LPMW-2, and LPMW-3) were added to the monitoring program in May 2006. These wells are located on a property adjoining the former Plaza Cleaners property. PCE was detected in these wells during their installation in December 2004.

Methods

In June 2007, groundwater samples were collected from monitoring wells MW-16A, MW-19A, MW-20A, MW-20B, MW-27, MW-31, MW-33, LPMW-2, LPMW-3 and municipal well H1 (Figure 1). Well LPMW-1 was not sampled because it was dry.

In October 2007, groundwater samples were collected from wells MW-16A, MW-20A, MW-20B, MW-27, and municipal well H1. The three new wells were not sampled in October because the access gate to LPMW-1 and LPMW-3 was locked, and LPMW-2, located outside the gate, lacked enough water for the selected sampling method.

Wells MW-16A, MW-19A, MW-20A, MW-27, MW-31, and MW-33 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 water-supply wells H1 and H2 are not in use. When in use, these two 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 in depth from 28-32 feet, are screened in the Steilacoom Gravel, which generally contains perched water above the impermeable Vashon Till and regional water table.

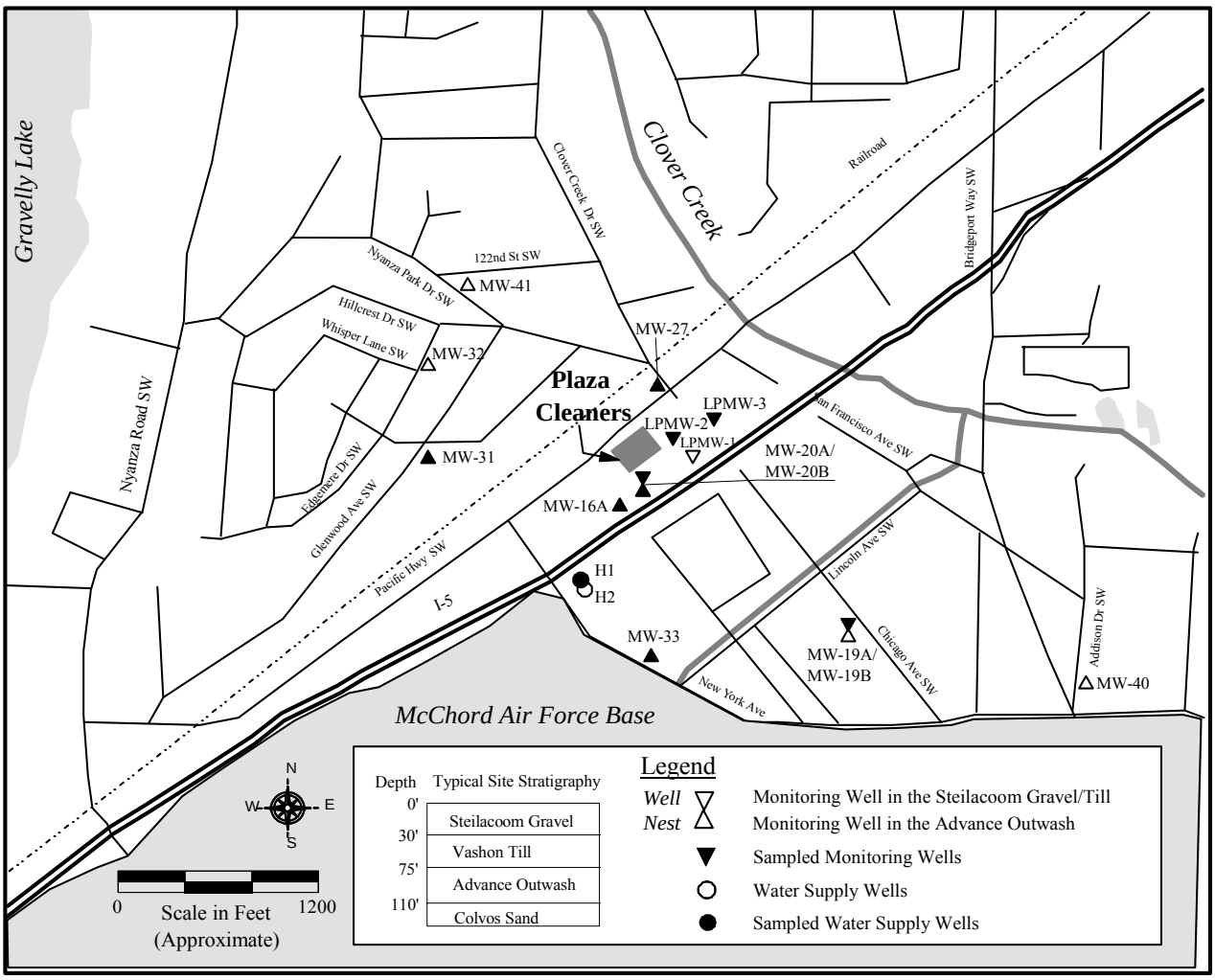

Figure 1. Lakewood Plaza Cleaners Sampling Locations.

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.

Monitoring wells MW-16A, MW-19A, MW-20A, MW-31, and MW-33 were purged and sampled using dedicated bladder pumps.

Wells MW-20B, MW-27, LPMW-2, and LPMW-3 were purged and sampled with a stainless-steel submersible pump with dedicated tubing using low-flow sampling techniques. 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 State of Washington regulations (Chapter 173-340-400 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 the 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. Upon 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, 2003).

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. Field and Laboratory Methods for June and October 2007 Samples.

Field Measurements	Instrument Type	Method	Accuracy
Water Level	Solinst Water Level Meter	Ecology SOP	±0.03 feet
pH	Orion 25A Field Meter	EPA 150.1	±0.1 std. units
Temperature	Orion 25A Field Meter	Ecology SOP	±0.1 ºC
Specific Conductance	YSI 3520 Conductivity Cell	EPA 120.1	±10 µmhos/cm
Laboratory Analytes	**Reference**	**Method**	**Reporting Limit**
Volatile Organic Analysis	EPA 1996	EPA SW-846 Method 8260B	1-5 µg/L

SOP = Standard operating procedure.

The quality of the data is acceptable. Quality control samples collected in the field consisted of blind field duplicates obtained from well MW-16A. Field duplicates were collected by splitting the pump discharge between two sets of sample bottles, which provides a measure of the overall sampling and analytical precision. Precision estimates are influenced not only by the random error introduced by collection and measurement procedures, but also by the natural variability of the concentrations in the media being sampled.

The numeric comparison of duplicate results is expressed as the relative percent difference (RPD). The RPD is calculated as the difference between sample results, divided by the mean and expressed as a percent. Table 2 shows the results of the duplicate samples and their relative percent difference (RPD). The RPD for the June data ranged from 4% to 9%, and the RPD for PCE in October was 22%.

Table 2. Relative Percent Difference (RPD) of Duplicate Sample Results (µg/L) from June and October 2007.

Well	PCE		TCE		cis-1,2-DCE	
	6/07	10/07	6/07	10/07	6/07	10/07
MW-16A	83	24	1.2	1 U	2.5	0.64 J
MW-16B	80	30	1.1	1 U	2.4	0.70 J
RPD (%)	4%	22%	9%	--	4%	--

A review of the data quality control and quality assurance from laboratory case narratives indicates that analytical performance was good. The reviews include descriptions of analytical methods, holding times, instrument calibration checks, blank results, surrogate recoveries, and laboratory control samples. No major problems were reported that compromised the usefulness or validity of the sample results; therefore, all results are usable as qualified. Quality assurance case narratives and laboratory reporting sheets are available upon request.

Results

Field

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 3.

Table 3. Summary of Field Parameters Results for June 13-14 and October 4, 2007.

Well	Total Depth (feet)[1]	Depth to Water (feet)[1]	pH (standard units)	Specific Conductance (µmhos/cm)	Temperature (°C)	Purge Volume (gallons)
June						
MW-16A	109	35.95	7.1	251	13.5	54
MW-19A	97.5	++	7.0	207	11.9	30
MW-20A	97.3	30.54	7.7	225	12.7	23
MW-20B	50.4	29.64	6.5	423	13.8	7
MW-27	96.4	28.95	6.7	186	13.7	15
MW-31	93	++	6.9	189	12.0	28
MW-33	99.3	++	7.2	220	11.5	27
LPMW-2	29	23.99	6.2	184	14.2	3
LPMW-3	31.45	23.03	6.6	281	17.9	2.5
H1	110	++	6.6	184	12.5	>1000
October						
MW-16A	109	40.61	7.1	212	12.4	66
MW-20A	97.3	35.02	7.6	224	12.5	16
MW-20B	50.4	36.9	6.4	407	13.8	6
MW-27	96.4	33.31	6.7	188	14.0	18
H1	110	++	--	177	11.9	>1000

[1] Measured from top of PVC casing.
++ Dedicated pump obstructed water-level measurement.
-- Not measured.

All field parameters were within expected ranges. The specific conductance in wells MW-20B (407-423 µmhos/cm) and LPMW-3 (281 µmhos/cm) was 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

Analytical results for volatile organics of interest are summarized in Table 4 and presented in Figure 2.

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 at study ID LAKEWOOD.

Table 4. Results (µg/L) of Volatile Organics of Interest for June 13-14 and October 4, 2007.

Well	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Cis-1,2-Dichloroethene (cis-1,2-DCE)
June			
MW-16A	**83**	**1.2**	**2.5**
MW-19A	2 U	**1.2 J**	2 U
MW-20A	2 U	2 U	2 U
MW-20B	**204**	**4.4**	**7.8**
MW-27	2 U	2 U	2 U
MW-31	**1.6 J**	2 U	2 U
MW-33	2 U	2 U	2 U
LPMW-2	**4.8**	1 U	1 U
LPMW-3	2 U	1 U	1 U
H1	**5.2**	2 U	2 U
October			
MW-16A	**24**	1 U	**0.64 J**
MW-20A	2 U	1 U	1 U
MW-20B	**491**	**7.5**	**15**
MW-27	2 U	1 U	1 U
H1	**3.8**	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 June, PCE, TCE, and cis-1,2-DCE concentrations in well MW-20B were 204 µg/L, 4.4 µg/L, and 7.8 µg/L, respectively. PCE, TCE, and cis-1,2-DCE were also detected in monitoring well MW-16A at concentrations of 83 µg/L, 1.2 µg/L and 2.5 µg/L, respectively. PCE was detected in municipal well H1 at a concentration of 5.2 µg/L. PCE was also detected in well LPMW-2 at a concentration of 4.8 µg/L. This well is located near the former septic system of Plaza Cleaners which was identified as the source of the contamination.

In October, PCE, TCE, and cis-1,2-DCE concentrations in well MW-20B were 491 µg/L, 7.5 µg/L, and 15 µg/L, respectively. PCE was also detected in wells MW-16A and H1 at concentrations of 24 µg/L and 3.8 µg/L, respectively. MW-16A also contained cis-1,2-DCE at a concentration below the practical quantitation limit of 1 µg/L.

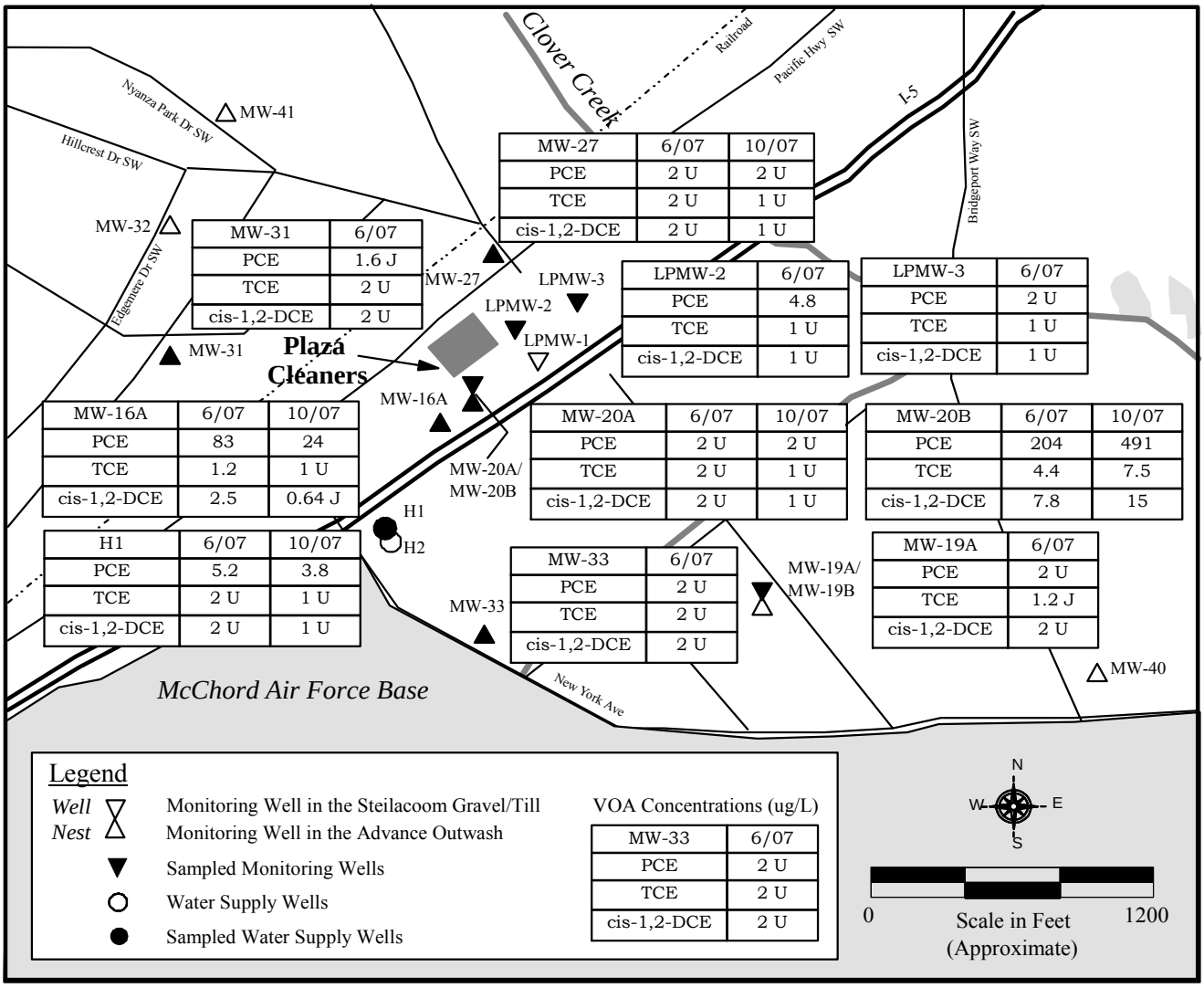

Figure 2. Lakewood Plaza Cleaners PCE, TCE, and Cis-1,2-DCE Concentrations (µg/L), June and October 2007.

Table 5 shows average PCE and TCE concentrations that have exceeded the MTCA cleanup level of 5 µg/L during the sample period. All PCE, TCE, and cis-1,2-DCE concentrations from January 1991 through October 2007 are presented in the Appendix.

Table 5. Average Annual PCE and TCE Concentrations (µg/L) that Exceeded the MTCA Method A Cleanup Level for Groundwater of 5 µg/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[a]	8.4[a]	27[a]	9[a]
1996	370	7	45	4
1997	297	4	50	13
1998	515	8	33	10
1999	715	7	22[a]	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
2007	348	6	54	4.5

--: Not tested.
a: Single annual result.

Figures 3 and 4 show the average annual PCE concentrations for MW-20B and MW-16A from 1985 to 2007. PCE concentrations in both wells have varied substantially.

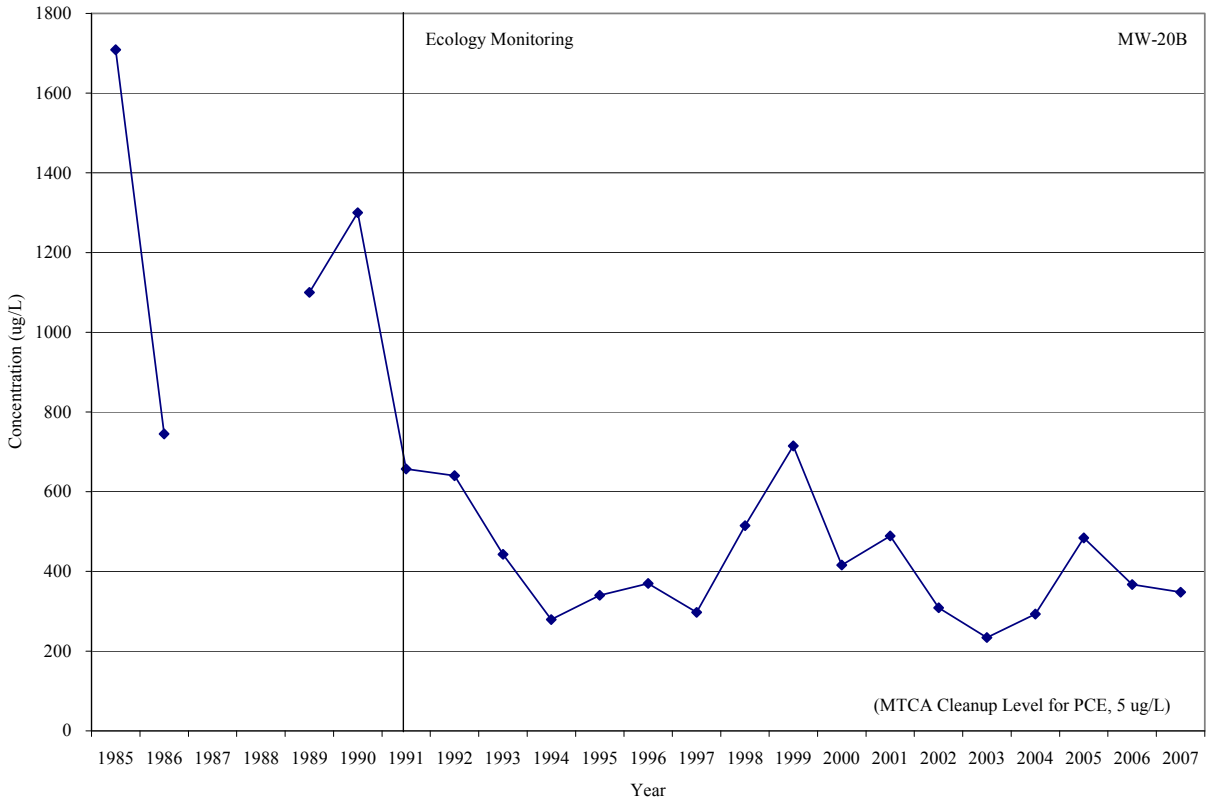

Figure 3. Average Annual PCE Concentrations for Well MW-20B from 1985 to 2007.

PCE concentrations decreased initially in MW-20B from 4850 µg/L in March 1985 to 570 µg/L in May 1985. The average PCE concentration for 1985 was 1700 µg/L. Well MW-20B was sampled annually in 1986, 1989, and 1990 and had a PCE concentration range of 745 to 1300 µg/L.

In 1991, Ecology began long-term groundwater monitoring of the site.

From 1991 to 1994, samples were collected in the spring and fall which corresponded to the high-water/low-water seasons. PCE concentrations decreased from a 1991 average of 657 µg/L to 279 µg/L in 1994.

In 1995, the sampling routine changed to a winter/summer schedule. Seasonal fluctuations in concentrations which occurred from 1991 to 1994 leveled off with the change in the sample schedule. In 1995 average PCE concentrations were 340 µg/L. Average concentrations then increased to a high of 715 µg/L in 1999, before decreasing to a low of 234 µg/L in 2003.

In the fall of 2003, sampling returned to the spring/fall schedule, which led to a corresponding

return to seasonal variations in concentrations. Average annual PCE concentrations have since ranged from 234 µg/L in 2003, increasing to 484 µg/L in 2005, and then decreasing to 348 µg/L in 2007.

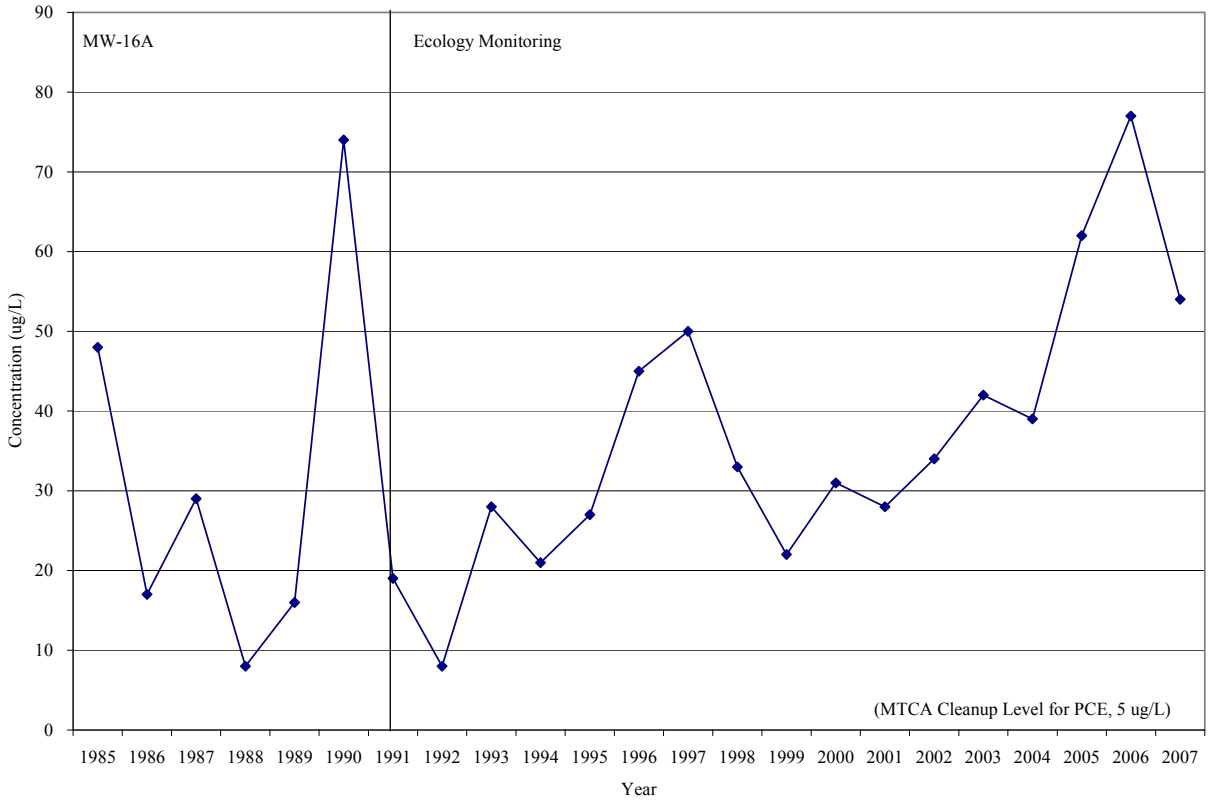

Figure 4. Average Annual PCE Concentrations for Well MW-16A from 1985 to 2007

PCE concentrations also initially decreased in well MW-16A, dropping from 110 µg/L in March 1985 to 12 µg/L in August 1985, with an average annual PCE concentration of 48 µg/L. From 1986 to 1990, PCE concentrations of individual samples ranged from 8 µg/L, increasing to 74 µg/L in 1990. Since Ecology began monitoring in 1991, average annual PCE concentrations have ranged from 8 µg/L in 1992, increasing to 50 µg/L in 1997, and decreasing to 22 µg/L in 1999. Since 1999, average annual concentrations have been steadily increasing to 77 µg/L in 2006. Average PCE concentrations in 2007 were 54 µg/L.

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 PCE concentrations above the MTCA cleanup level.

Conclusions

Monitoring was conducted in June 2007 at nine monitoring wells and one municipal well and in October 2007 at four monitoring wells and one municipal well, 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 level of 5 µg/L.

- Monitoring well MW-20B continues to have TCE concentrations exceeding the MTCA cleanup level of 5 µg/L.

- PCE concentrations in well LPMW-2 have been above or near the cleanup level of 5 µg/L. This well is located near the former septic system of Plaza Cleaners which was identified as the source of the contamination.

Concentrations of PCE have decreased from their original levels, but continue to remain elevated. Average PCE concentrations in wells MW-20B and MW-16A have decreased since their 1985 concentrations of 4850 µg/L and 110 µg/L, respectively. Since Ecology began sampling in 1991, average PCE concentrations in well MW-20B have ranged from a high of 715 µg/L in 1999 to a low of 234 µg/L in 2003. Although PCE concentrations have been slightly higher during the last four years of monitoring, concentrations are still within the range of those reported in previous samplings. The average PCE concentration for well MW-20B in 2007 was 348 µg/L.

PCE concentrations in well MW-16A appear to be steadily increasing. Average PCE concentrations in 1992 were 8 µg/L, increasing to 77 µg/L in 2006. The average PCE concentrations in 2007 were 54 µg/L.

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Appendix. Summary of Results

Table A-1. Summary of Sample Results (ug/L) from January 1991 to October 2007.

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

Table A-1 (cont.). Summary of Sample Results (ug/L) from January 1991 to October 2007.

Well	January 1996			July 1996			January 1997			July 1997			February 1998		
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	**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	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

Table A-1 (cont.). Summary of Sample Results (ug/L) from January 1991 to October 2007.

Well	January 2001			August 2001			February 2002			August 2002			February 2003		
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	**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	September 2003			June 2004			November 2004			June 2005			November 2005		
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	**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

Table A-1 (cont.). Summary of Sample Results (ug/L) from January 1991 to October 2007.

Well	May 2006			September 2006			June 2007			October 2007		
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
MW-16A	**124**	**1.8**	**4.6**	**29**	**0.3 J**	**0.48 J**	**83**	**1.2**	**2.5**	**24**	1 U	**0.64 J**
MW-20A	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	2 U	2 U	1 U	1 U
MW-20B	**216**	**4.2**	**6.6**	**518**	**5.6**	**11**	**204**	**4.4**	**7.8**	**491**	**7.5**	**15**
MW-27	1 U	1 U	1 U	1 U	1 U	1 U	2 U	2 U	2 U	2 U	1 U	1 U
MW-31	--	--	--	--	--	--	**1.6 J**	2 U	2 U	--	--	--
MW-32	--	--	--	--	--	--	--	--	--	--	--	--
MW-41	--	--	--	--	--	--	--	--	--	--	--	--
MW-19A	--	--	--	--	--	--	2 U	**1.2 J**	2 U	--	--	--
MW-33	1 U	1 U	1 U	--	--	--	2 U	2 U	2 U	--	--	--
MW-40	--	--	--	--	--	--	--	--	--	--	--	--
H1/H2	**7.3**	**0.22 J**	1 U	**4.8**	1 U	1 U	**5.2**	2 U	2 U	**3.8**	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.
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
Bold = The analyte was positively identified.