



Lakewood Plaza Cleaners June and November 2004 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 in samples collected from four monitoring wells and one municipal well in June and November 2004 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 June and November were MW-20B (344 and 241 ug/L), MW-16A (30 and 48 ug/L), and H1 (7.9 and 2.6 ug/L).
- Trichloroethene (TCE) also was detected in MW-20B at concentrations of 6.5 and 6.7 ug/L, which exceeds the MTCA cleanup standard for TCE of 5.0 ug/L.
- Cis-1,2-dichloroethene (cis-1,2-DCE) was detected in wells MW-20B (15 and 13 ug/L) and MW-16A (0.84 estimated and 1.4 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 samplings conducted since 1991. PCE concentrations continue to be elevated in monitoring wells MW-20B and MW-16A, as well as in municipal well H1.

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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. 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).

Methods

Groundwater Sampling

In June and November 2004, groundwater samples were collected from monitoring wells MW-16A, MW-20A, MW-20B, MW-27, and 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 (U.S. EPA, 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 measured using a 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-20A, and MW-27 were purged and sampled using dedicated bladder pumps. Well MW-20B was purged and sampled with decontaminated Teflon bailers. The bailers used to sample well MW-20B 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.

The monitoring wells were purged until pH, temperature, and specific conductance readings stabilized or three well volumes 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 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. 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 picked up 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).

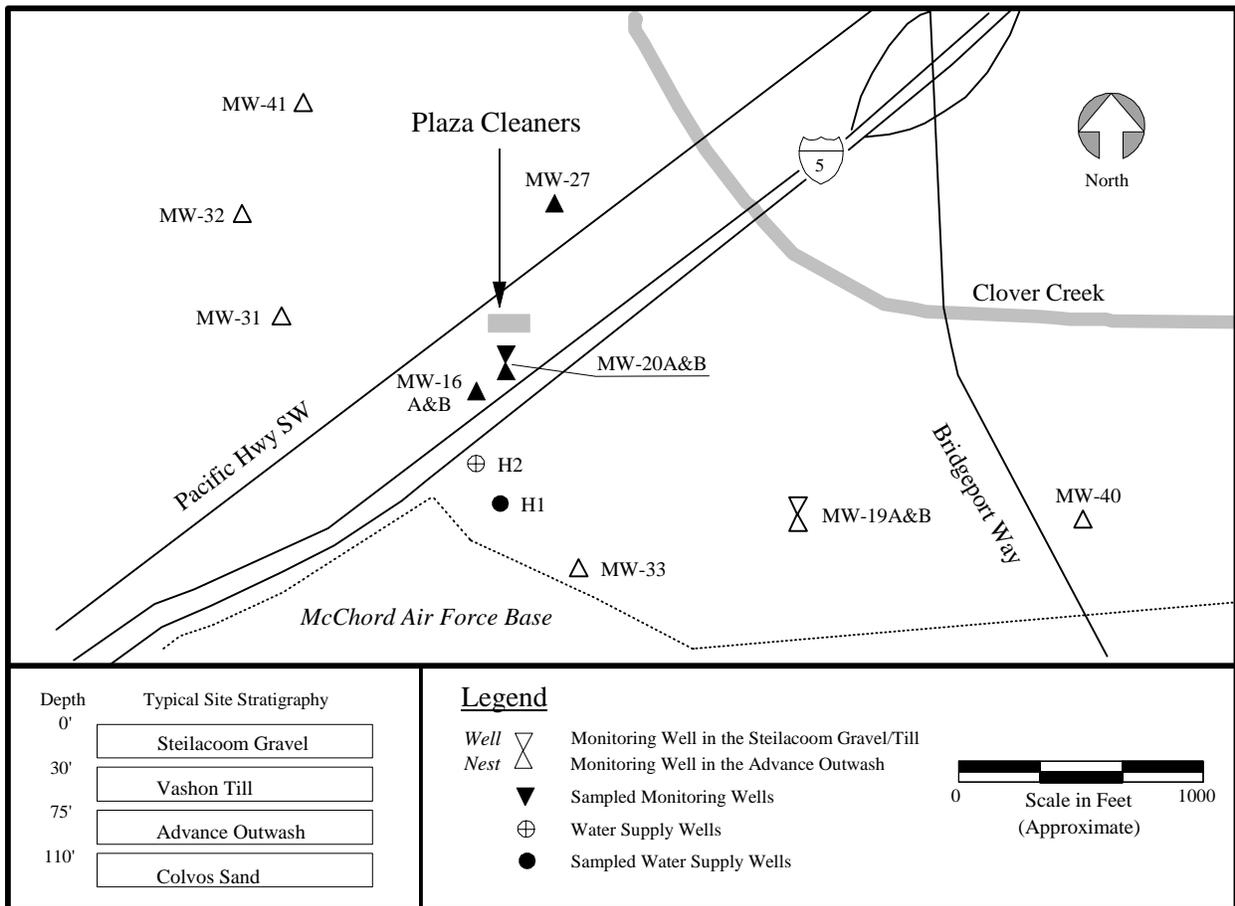


Figure 1: Lakewood Plaza Cleaners Sample Locations

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 June and November 2004 Samples

Analytes	Method	Reference	
<i>Field</i>			<i>Accuracy</i>
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
<i>Laboratory</i>			<i>Detection Limit</i>
Volatile Organics Analysis	SW-846 Method 8260	U.S. EPA, 1996	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 June and November was 6% and 0%, respectively.

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 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.

Table 2: Summary of Field Parameters Results for June 29 and November 18, 2004

Well	Total Depth (feet) ¹	Depth to Water (feet) ¹	pH (standard units)	Specific Conductance (umhos/cm)	Temperature (°C)	Purge Volume (gallons)
<i>June</i>						
MW-16A	109	43.29	8.0	221	13.2	94
MW-20A	97.3	34.58	8.4	221	13.1	28
MW-20B	50.4	35.76	7.8	419	13.6	7
MW-27	96.4	++	7.4	198	12.3	30
H1	110	++	--	--	--	>1000
<i>November</i>						
MW-16A	109	38.47	7.3	220	11.9	55
MW-20A	97.3	31.88	7.6	215	12.0	31
MW-20B	50.4	32.36	6.4	445	12.4	9
MW-27	96.4	++	6.7	200	11.7	30
H1	110	++	6.5	205	11.0	>1000

¹ Measured from top of PVC casing.

-- Not measured.

++ Dedicated pump obstructed water-level measurement.

All field parameters were within expected ranges. The specific conductance in well MW-20B (419-445 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.

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 June 29 and November 18, 2004

Well	Tetrachloroethene (PCE)	Trichloroethene (TCE)	Cis-1,2-Dichloroethene (cis-1,2-DCE)
<i>June</i>			
MW-16A	30	0.42 J	0.84 J
MW-20A	0.22 J	1 U	1 U
MW-20B	344	6.5 J	15
MW-27	1 U	1 U	1 U
H1	7.9	0.24 J	0.14 J
<i>November</i>			
MW-16A	48	1 U	1.4
MW-20A	0.27 J	1 U	1 U
MW-20B	241	6.7	13
MW-27	1 U	1 U	1 U
H1	2.6	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 344 ug/L, 6.5J ug/L, and 15 ug/L, respectively. PCE was also detected in monitoring well MW-16A and municipal well H1 with concentrations of 30 ug/L and 7.9 ug/L, respectively. TCE and cis-1,2-DCE were detected in wells MW-16A and H1 at concentrations below the practical quantitation limit of 1 ug/L.

In November, the PCE, TCE, and cis-1,2-DCE concentrations in well MW-20B were 241 ug/L, 6.7 ug/L, and 13 ug/L, respectively. PCE and cis-1,2-DCE were detected in MW-16A with concentrations of 48 ug/L and 1.4 ug/L, respectively. Municipal well H1 had a PCE concentration of 2.6 ug/L.

Toluene was detected below the practical quantitation limit (1 ug/L) in wells MW-16A and H1 in June. 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 estimated concentrations of 0.2 ug/L during both rounds of monitoring.

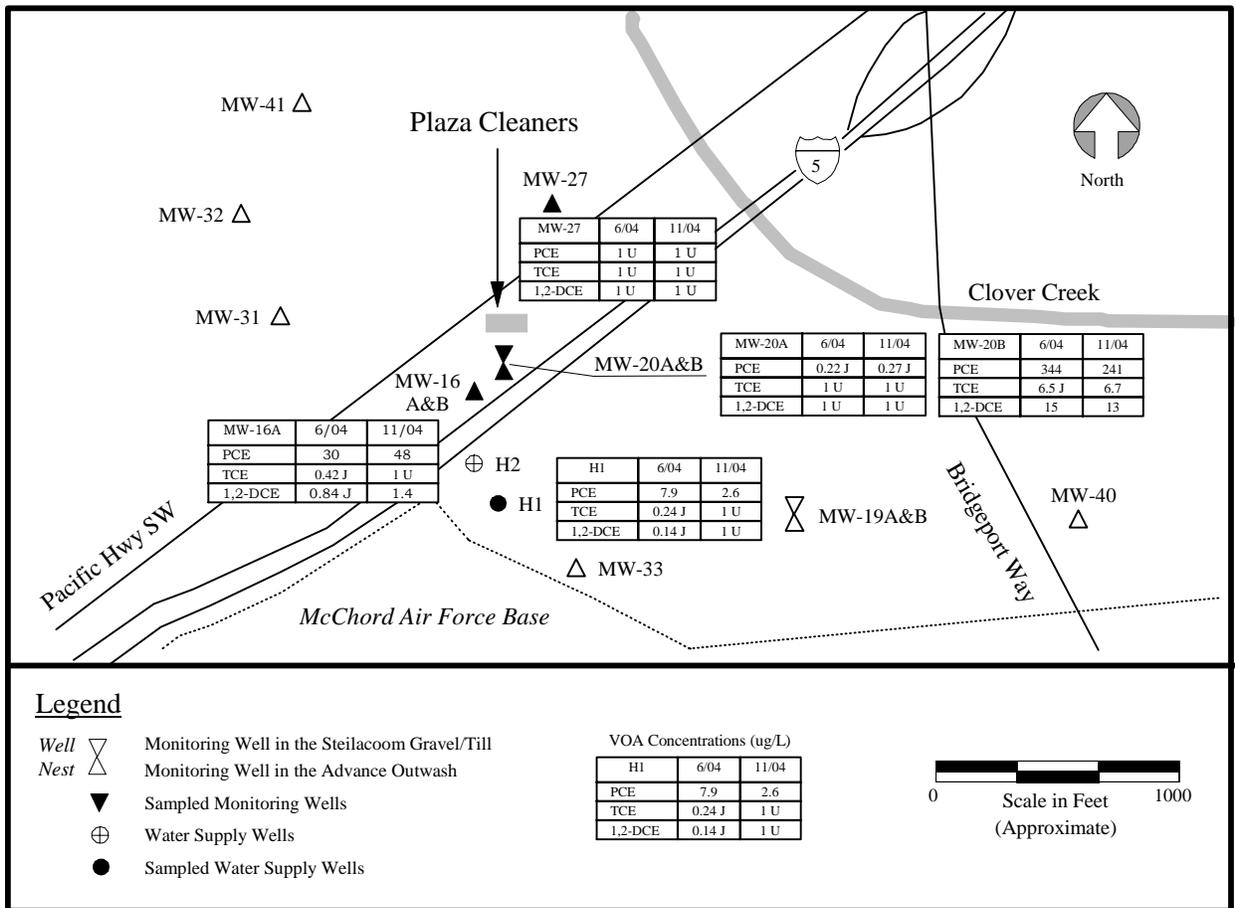


Figure 2: Lakewood Plaza Cleaners PCE, TCE and Cis-1,2-DCE Concentrations (ug/L)

PCE, TCE, and cis-1, 2-DCE concentrations for sampling events from January 1991 through November 2004 are presented in the Appendix. Table 4 shows average PCE and TCE concentrations that have exceeded the MTCA cleanup standard of 5.0 ug/L during the same period.

Table 4: Average Annual PCE and TCE Concentrations (ug/L) 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
2004	293	6.6	39	5.3

-- = 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 between 1985 and 2004. Since 1985, PCE concentrations in both wells have varied substantially.

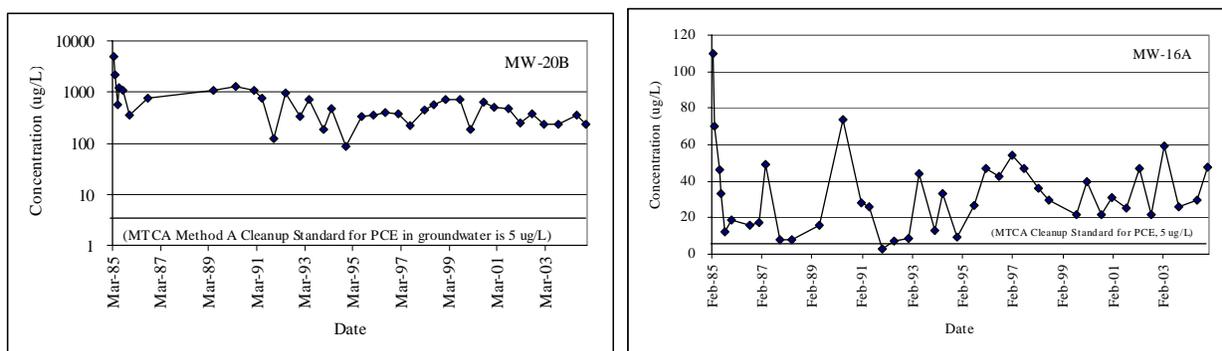


Figure 3: PCE Concentrations for Wells MW-20B and MW-16A from 1985 to 2004

PCE concentrations decreased initially in MW-20B from March 1985 (4,800 ppb) to May 1985 (570 ppb). Between May 1985 and November 1994, concentrations have ranged from 86 to 1,200 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. Between February 1998 and August 2001, concentrations were slightly higher, ranging from 456 to 722 ppb. Since February 2002 concentrations have leveled off once again, ranging from 230 to 371 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.

Conclusions

Monitoring was conducted in June and November 2004 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 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 samplings 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.

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Appendix. Summary of Sample Results (ug/L) from January 1991 to November 2004

Well Number	January 1991			May 1991			November 1991			May 1992			December 1992		
	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 Number	May 1993			December 1993			April 1994			November 1994			July 1995		
	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.
- 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 November 2004

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.
- 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.

Appendix (cont.). Summary of Sample Results (ug/L) from January 1991 to September 2004

Well Number	January 2001			August 2001			February 2002			August 2002		
	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
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 Number	February 2003			September 2003			June 2004			November 2004		
	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	59 J	0.2 J	2.4	26	0.3 J	0.5 J	30	0.4 J	0.8 J	48	1 U	1.4
MW-20A	1 U	1 U	1 U	0.1 J	1 U	1 U	0.2 J	1 U	1 U	0.3 J	1 U	1 U
MW-20B	230	100 U	100 U	239	5.4 J	12	344	6.5 J	15	241	6.7	13
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
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	7.9	0.24 J	0.1 J	2.6	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.