



Lakewood Plaza Cleaners/Ponders Corner Groundwater Monitoring Results, October 2015: Data Summary Report

Abstract

This data summary report is one in a series describing results of long-term groundwater monitoring at the former Lakewood Plaza Cleaners/Ponders Corner site south of Tacoma. The Washington State Department of Ecology (Ecology) began collecting groundwater data at the site in the early 1990s as part of its responsibilities for operation and maintenance of the site remedial actions. Operation of the nearby Lakewood Water District municipal supply wells H1 and H2 with wellhead treatment systems continues to be the remedial option identified in the EPA Record of Decision. The monitoring goal is to evaluate the effectiveness of wells H1 and H2 to contain and remove groundwater contaminated by improper waste management practices at the former cleaners.

This report describes water quality results for groundwater samples collected in October 2015 from 4 project monitoring wells and Lakewood Water District municipal well H1.

Among the key findings:

- Tetrachloroethene (PCE) concentrations in monitoring wells MW-20B (340 ug/L) and MW-16A (44 ug/L) still do not meet the project cleanup level of 5 ug/L.
- Samples collected from municipal well H1 prior to treatment had a PCE concentration near the reporting limit of 1 ug/L.
- Trichloroethene was also detected in well MW-20B (5.4 ug/L) slightly above the cleanup level of 5 ug/L.

The use of municipal wells H1 and H2 to contain, remove, and treat contaminated groundwater associated with the Lakewood Plaza Cleaners/Ponders Corner site continues, since the cleanup goals have not been achieved. Based on recommendations of the last 5-year review, the Environmental Protection Agency (EPA) has begun the process of reevaluating the treatment remedy to determine if it is adequate to meet the cleanup goals. If the cleanup goals cannot be achieved through current actions, then EPA and Ecology will determine what additional actions are needed to achieve site cleanup.

Publication Information

This report is available on the Department of Ecology's website at <https://fortress.wa.gov/ecy/publications/SummaryPages/1603009.html>

Data and associated annual monitoring reports for this project are available at Ecology's Environmental Information Management (EIM) website www.ecy.wa.gov/eim/index.htm.
Search Study ID: LAKEWOOD.

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- HUC number: 17110019

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Background

In 1981, the U.S. Environmental Protection Agency (EPA) confirmed that Lakewood Water District production wells H1 and H2 were contaminated with volatile organic compounds: tetrachloroethene (PCE), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE). Lakewood is south of Tacoma in Pierce County, Washington. The source of the contamination was identified as the former Lakewood Plaza Cleaners, a nearby dry cleaning and laundry facility (EPA, 1983). The contamination resulted from the dumping of PCE into on-site septic tanks and the disposal of dry cleaning sludge on the ground surface. The Lakewood Plaza Cleaners site was added to the National Priorities List (NPL) in 1982 under the site name: Lakewood/Ponders Corner. The site is currently occupied by Rainier Lighting and Electric Supply.

EPA began remedial activities at the site in 1983. Remediation included the installation and operation of groundwater air-strippers at Lakewood Water District wells H1 and H2, which are located approximately 800 feet southwest of the contaminant source area (Figure 1). Contaminated soils and sludge were also removed from the source area and a small portion of the contaminated septic field soils were treated with vapor extraction. Soil remediation was completed in 1993. The soils unit of the site was removed from the NPL in 1996 (EPA, 1996). Treatment of the contaminated groundwater extracted by wells H1 and H2 continues, since groundwater cleanup levels for PCE of 5 ug/L have not been achieved.

Although the Washington State Department of Ecology's (Ecology) responsibilities for operation and maintenance of the remedial actions did not begin until 1997, Ecology began semi-annual groundwater compliance monitoring at the site in 1991. The objective of the sampling was to collect data on groundwater quality, to evaluate the effectiveness of Lakewood water supply wells H1 and H2 to contain, remove, and treat the groundwater contaminated by Plaza Cleaners.

Groundwater monitoring has been modified over the years to focus primarily on wells in the immediate vicinity of the former Plaza Cleaners. Currently there are eight monitoring wells and the two production wells (H1 and H2) in the monitoring program (Figure 1). Of the eight monitoring wells, one is screened in the Steilacoom Gravel unit (LPMW-2), one in the Vashon Till (MW-20B), and the remainder in the Advance Outwash deposits (MW-16A, MW-19A, MW-20A, MW-31, MW-32, MW-33).

The two shallow wells screened in the Steilacoom Gravel and Vashon Till units are located near the contaminant source area. The Steilacoom Gravel is composed of permeable Vashon recessional sand and gravel deposits. This unit typically ranges from about 0 to 30 feet below ground surface (bgs). The Steilacoom gravels, which are typically unsaturated, contain an area of perched groundwater in the immediate vicinity of the former Plaza Cleaners and near wells H1 and H2 (EPA, 1985a). The underlying Vashon Till consists of semi-confining silt and clay-rich layers that contain lenses of clean gravel. This unit, which is highly variable in thickness, typically ranges from about 30 to 75 feet bgs. At least one gravel lens is reported to be present beneath the former Plaza Cleaners site and appears to be large in its lateral extent. This

permeable interval appears to be hydraulically interconnected with the Steilacoom gravels (EPA, 1985b).

The rest of the wells are screened in the highly permeable sands and gravels of the deeper Advance Outwash deposits, the primary water supply aquifer for the area. This unit is typically 75 to 110 feet bgs. Although regional groundwater flow in the Advance Outwash is generally to the west-northwest toward Gravelly Lake, the pumping of production wells H1 and H2 creates a capture zone influencing groundwater flow directions in the area. The horizontal hydraulic conductivities for this unit vary from 400 to 2000 feet per day. Linear flow velocities range from 2.7 ft/day to 100 ft/day (USACE, 2012).

Groundwater monitoring has been conducted at this site since 1985. In accordance with EPA policy and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA § 121(42 U.S.C. Section 9621) and the National Contingency Plan (NCP), five-year reviews are required on projects, as long as cleanup goals have not been achieved. Five 5-year reviews for the Lakewood Plaza Cleaners/Ponders Corner site have been completed by EPA, in consultation with Ecology, in 1992, 1997, 2002, 2007, and 2012. The latest 5-year review concluded that the current remedy is not performing as expected or providing long-term protectiveness towards attaining the groundwater cleanup goals. The review acknowledged that the continuing migration of contaminants from lower permeability soils is the likely cause for ongoing impacts to groundwater. This represents one of the major physical factors preventing the attainment of groundwater cleanup levels throughout the plume in a reasonable timeframe (USACE, 2012).

Because the cleanup goals have not been achieved at the Lakewood Plaza Cleaners/Ponders Corner site, remediation and monitoring of the groundwater is ongoing under a long-term response action. Based on recommendations of the 5-year review, EPA has begun the process of reevaluating the treatment remedy to determine if it is adequate to meet the cleanup goals.

Data collected by Ecology and the associated monitoring reports for this project are available at Ecology's Environmental Information Management (EIM) website www.ecy.wa.gov/eim/index.htm. Search Study ID: LAKEWOOD.

Methods and Results

In October 2015, Ecology collected groundwater samples from one shallow (MW-20B) and four deep (MW-16A, MW-20A, MW-33, H1) wells, to evaluate volatile organics in groundwater at the Lakewood Plaza Cleaners/Ponders Corner site. Shallow well LPMW-2 was scheduled to be sampled; however, the volume of water in the well was insufficient to collect a sample.

Ecology sampled all monitoring wells in accordance with Ecology's SOP EAP078 (Marti, 2014a). Monitoring wells MW-16A and MW-20A were purged and sampled, using dedicated bladder pumps. Wells MW-20B and MW-33 were purged and sampled with a stainless-steel submersible pump. Municipal well H1 was operating at the time of the October sampling. The

sample was collected from a tap prior to any treatment systems, in accordance with Ecology's SOP EAP077 (Marti, 2014b).

Groundwater samples were submitted for analysis of volatile organic compounds (VOCs). Analytical results for volatile organics of concern (PCE, TCE, cis-1,2-DCE and vinyl chloride) for the October 2015 sampling event are presented in Table 1 and Figure 1.

Quality control samples collected in the field consisted of a blind field duplicate collected from well MW-16A. The relative percent difference (RPD) for the October data ranged from 0% to 5%, which meets the data quality objective of 10% established for the project (Marti, 1991). The laboratory data quality control and quality assurance results indicate that the analytical performance was good and that the results are usable as qualified.

Table 1: Sample Results for Lakewood Plaza Cleaners/Ponders Corner, October 2015.

Field Measurements							Laboratory Analysis			
Well ID	Well Depth (feet) TOC	Ground Water Elevation (feet)	pH (Std. Units)	SC (uS/cm)	DO (mg/L)	ORP (mV)	PCE	TCE	Cis-1,2 DCE	Vinyl Chloride
							Project Cleanup Levels			
							5 ug/L	5 ug/L	70 ug/L	0.2 ug/L
Shallow Wells										
MW-20B	50.4	245.09	6.9	298	--	170	340	5.4	12	1 U
Deep Wells										
MW-16A	109	238.0	7.1	228	3.8	187	44	0.5 J	0.63 J	1 U
MW-16A (dup)	--	--	--	--	--	--	43	0.5 J	0.6 J	1 U
MW-20A	97.3	246.82	7.2	221	5.1	158	0.16 J	1 U	1 U	1 U
MW-33	99.3	241.82	6.9	209	4.6	155	1 U	0.15 J	1 U	1 U
H1	110	--	--	--	--	--	1.8	0.15 J	1 U	1 U

TOC: Top of Casing

SC: Specific Conductance

DO: Dissolved Oxygen

ORP: Oxidation Reduction Potential

Bold: Analyte was detected.

Shade: Values are greater than project cleanup levels.

U: Analyte was not detected at or above the reported value.

J: Analyte was positively identified. The associated numerical result is an estimate.

Monitoring wells MW-20B and MW-16A continue to have PCE concentrations that far exceed the cleanup level of 5 ug/L.

Samples collected from municipal wells H1 and H2 prior to treatment continue to have low concentrations of PCE (Tables 1 and 2).

Even though a sample could not be collected from well LPMW-2, PCE is also typically detected at low concentrations in this well (Table 2). This well is located near the former septic system of Plaza Cleaners, which was identified as a source of the contamination (Figure 1).

Vinyl chloride was not detected in any of the sampled wells. Although the reporting limit was 1 ug/L, the method detection limit for the October 2015 analysis was 0.04 ug/L. Vinyl chloride has not been detected in any of the samples collected by Ecology since we began sampling in 1991.

Long-term VOC data for wells monitored during the Lakewood Plaza Cleaners/Ponders Corner project is presented in Table 2. Figure 2 shows PCE concentration data for wells MW-16A and MW-20B for the same time period.

Discussion and Conclusions

Concentrations of PCE in groundwater have generally decreased from their 1980s levels with the implementation of remedial activities at the Lakewood Plaza Cleaners/Ponders Corner site. However, concentrations still do not meet the project groundwater cleanup goal of 5 ug/L. Since Ecology began sampling in 1991, groundwater PCE concentrations have varied over time. Concentrations in well MW-20B fluctuate seasonally but continue to be far above the cleanup level (Figure 2). PCE concentrations in well MW-16A also continue to exceed the cleanup level (Figure 2). Statistical trend analysis performed during the 2012 five-year review suggests that PCE concentrations in well MW-16A are actually increasing (USACE, 2012). The increasing trend in well MW-16A is attributed to the likely downward migration of contaminants from the Vashon Till to the Advance Outwash.

This supports the conceptual site model that contaminants migrate from the lower permeability till to the more permeable outwash. Once in the outwash, the contaminants move in the capture zone towards pumping wells H1 and H2. The latest 5-year review concludes that the continuing migration of contaminants from the Vashon Till represents one of the major physical factors preventing attainment of groundwater cleanup levels throughout the plume in a reasonable timeframe (USACE, 2012).

The use of municipal wells H1 and H2 to remove and treat contaminated groundwater associated with the Lakewood Plaza Cleaners/Ponders Corner site will need to continue, since the cleanup goals have not been achieved.

Recommendations

EPA has recommended, and Ecology is in agreement, that since the cleanup goals throughout the contaminant plume have not been achieved, the current remedial activities should be evaluated. The first three recommendations were made in the 2012 five-year review to evaluate the current remedial activities (USACE, 2012):

1. **Determine the capture zone in the Advance Outwash for wells H1 and H2 at the current pumping rates.** Wells H1 and H2 are currently operated on an alternate six-month rotation with seasonal flow variations. Weak hydraulic control of groundwater in the Advance Outwash and Vashon Till aquifers may result, since only one well operates at a time. Paired wells MW-20A and MW-20B appear to show vertical flow reversing seasonally, which may indicate a response to the changing pumping rates of production

wells H1 and H2 (USACE, 2012). Previous studies in the 1980s (EPA, 1985b) showed that drawdown occurs in shallow monitoring wells drilled in the Steilacoom Gravel when wells H1 and H2 are pumping. However, this may have occurred when both production wells were pumping.

Beginning in 2016, EPA will be evaluating the capture zone in the Advance Outwash based on the current pumping rates of wells H1 and H2. This information will be useful in reevaluating the treatment remedy.

2. **Update characterization of groundwater flow directions and extent of the contaminant plume in the Steilacoom Gravel and Vashon Till.** There is insufficient groundwater data to assess either of these issues, since there is only one well in each unit in the current monitoring program. All other wells in these units have either been decommissioned or lost over the course of the project.
 3. **Evaluate the restoration timeframe for the aquifer and alternatives to accelerate the restoration if necessary.** The estimated aquifer restoration timeframe has ranged from a minimum of 10 years to greater than 100 years (USACE), 2012). The shorter timeframe was apparently based on both production wells operating simultaneously and continuously. As of 2012, wells H1 and H2 have been used for 28 years to treat the contaminated groundwater. The variable pumping rates and continued leaching of PCE from the Vashon Till may be contributing to the increased length of time to achieve the cleanup goals. Additional treatment options for the source area (Steilacoom Gravel and Vashon Till) should be evaluated to determine if the restoration of the aquifer can be accelerated.
- Since Ecology began groundwater compliance monitoring in 1991, the monitoring program has been modified over the years to focus primarily on wells in the immediate vicinity of the former Plaza Cleaners. Currently there are eight monitoring wells and the two production wells in the monitoring program. It is recommended Ecology continue monitoring the primary wells (MW-16A, MW-20A, MW-20B, LPMW-2 and H1/H2) on an 18-month monitoring cycle to capture seasonal variation in the contaminant concentrations. Monitoring of the remaining wells on a 36-month (MW-33) and 5-year (MW-19A, MW-31, MW-32) cycle should continue to be sufficient to meet the project goals.

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Figures

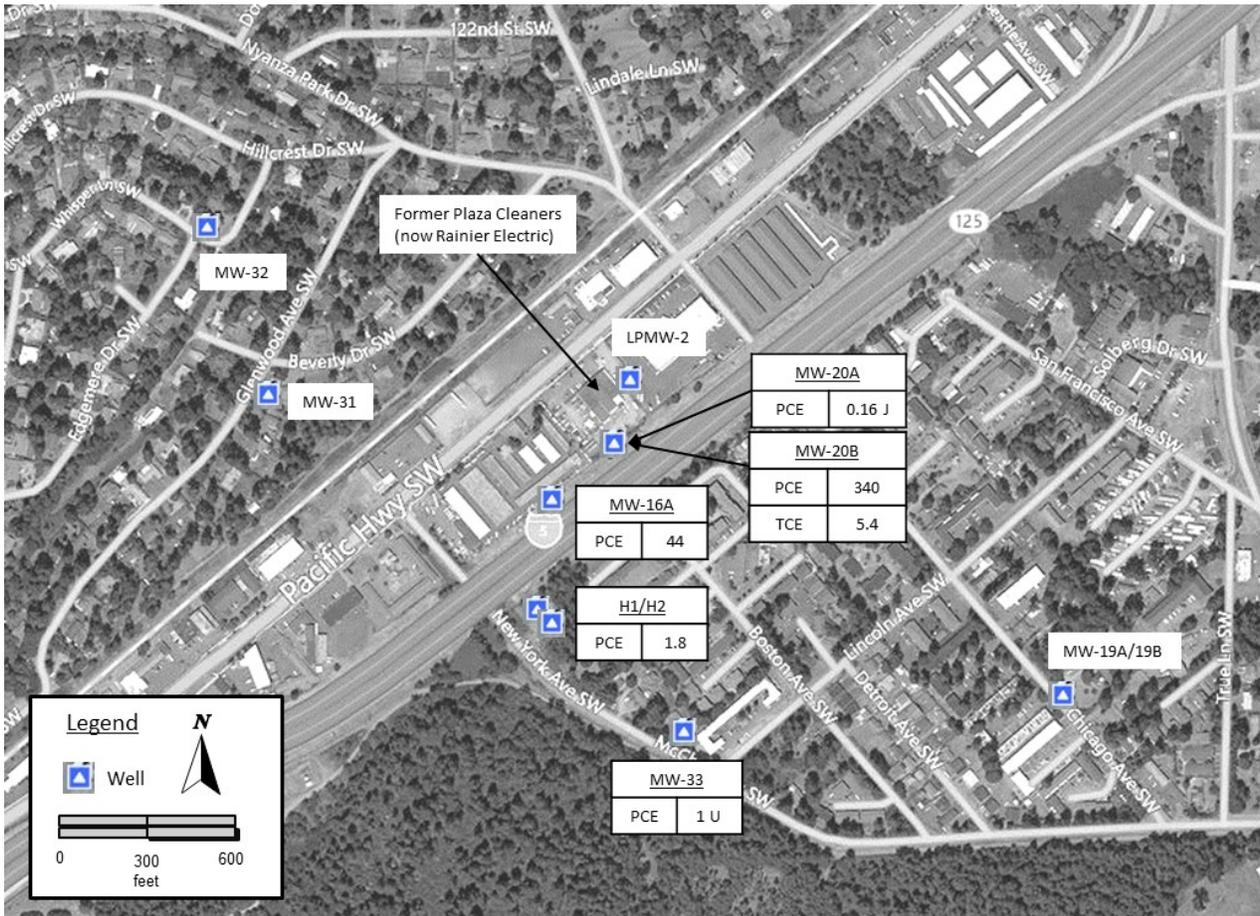


Figure 1. Lakewood Plaza Cleaners Sampling Locations and Results (ug/L), October 2015.

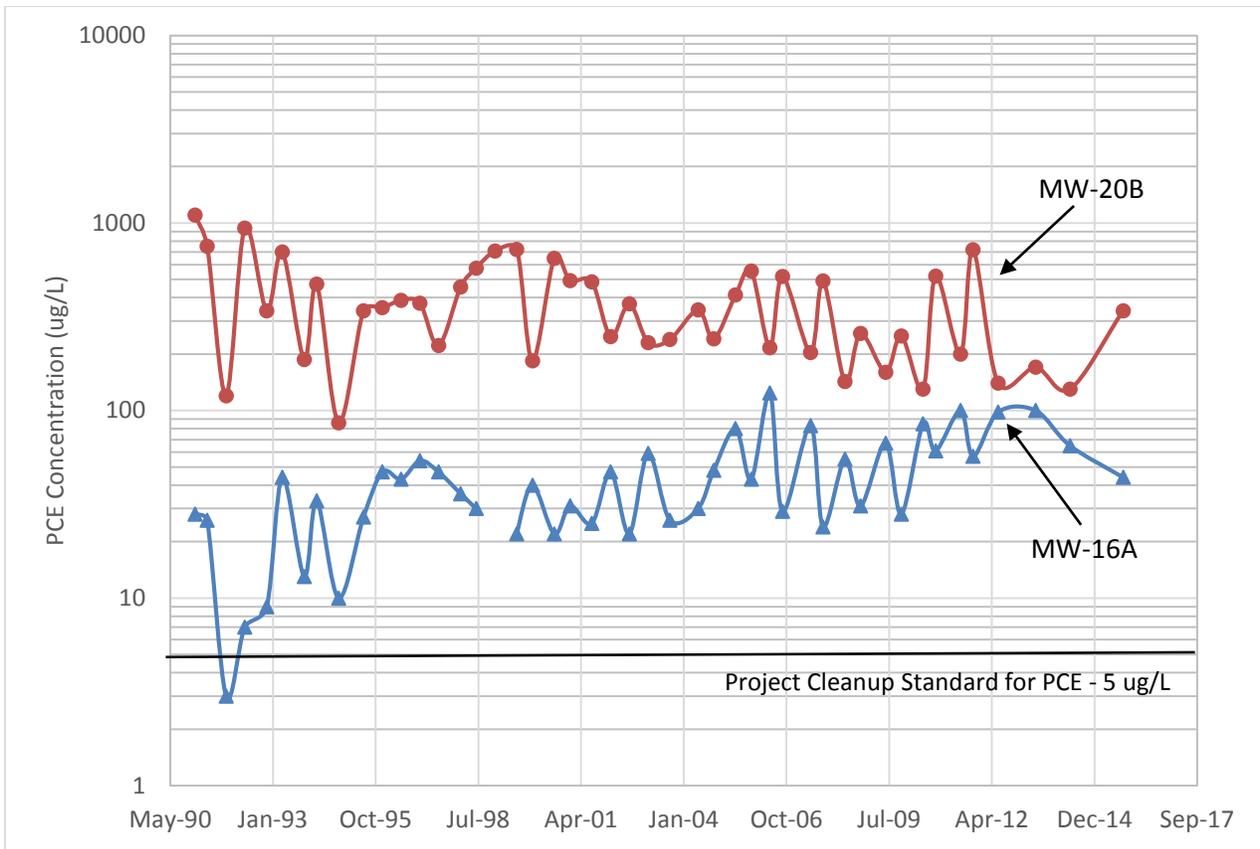


Figure 2. PCE Concentrations for Wells MW-16A and MW-20B, January 1991 to October 2015.

Tables

Table 2. Historical Sample Results (ug/L), January 1991 to October 2015.

Date	MW-16A				MW-20A				MW-20B			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	28	1 J	2.4 J	1 U	1 U	1 U	1 U	1 U	1100	18	33	1 U
5/1991	26	0.6 J	2	1 U	0.4 J	1 U	1 U	1 U	752	16	30	1 U
11/1991	2.7 J	1 U	0.6 J	1 U	0.4 NJ	1 U	1 U	1 U	120	2.6 J	6.7	1 U
5/1992	7	1 U	1	1 U	0.5 J	1 U	1 U	1 U	940	13	32	1 U
12/1992	9 J	0.3 J	0.8 J	1 UJ	0.8 J	1 UJ	1 UJ	1 UJ	340 J	14 J	20 J	5 UJ
5/1993	44	10 U	2 J	10 U	10 U	10 U	10 U	10 U	700	12	21	10 U
12/1993	13	0.3 J	0.7 J	1 U	0.3 J	1 U	1 U	1 U	187	50 U	8.2 J	50 U
4/1994	33	0.6	1.4	1 U	0.4	0.2 U	0.2 U	1 U	472	8.6 J	12.6	50 U
11/1994	9.7	0.3 J	0.5 J	1 U	0.3 J	1 U	1 U	1 U	86	50 U	3 J	50 U
7/1995	27	0.5 J	0.8 J	1 U	0.4 J	1 U	1 U	1 U	340	8.4	17	1 U
1/1996	47 E	0.8 J	1.5	2 U	0.2 J	1 U	1 U	2 U	353	7.2	15	2 U
7/1996	43	0.7 J	1.9	1 U	0.4 J	1 U	1 U	1 U	387	7.6	15	1 U
1/1997	54	1.1	3.1	1 U	0.4 J	1 U	1 U	1 U	373	100 U	6.4 J	100 U
7/1997	47	0.7 J	2.5	1 U	0.3 J	1 U	2 U	1 U	222	4	6.4	1 U
2/1998	36	0.7 J	2 J	5 U	0.4 J	1 U	1 U	1 U	456	7 J	12	10 U
7/1998	30	1 U	1.5	1 U	0.6 J	1 U	1 U	1 U	575	10	23	1 U
1/1999	--	--	--	--	1 U	2 U	1 U	1 U	708	5.2	12	1 U
8/1999	22	0.4 J	1.1	1 U	0.8 J	2 U	1 U	1 U	722	8.4 J	16 J	1 U
1/2000	40	0.7 J	1.9	1 U	0.2 NJ	2 U	1 U	1 U	184	6	13	1 U
8/2000	22	0.3 J	0.7	1 U	0.1 J	2 U	1 U	1 U	648	200 U	100 U	100 U
1/2001	31	0.4 J	1	1 U	0.2 J	1 U	1 U	1 U	493	6.6 J	12	10 U
8/2001	25	0.3 J	0.7 J	1 U	1 U	2 U	1 U	1 U	486	8.2	18	100 U
2/2002	47	0.8 J	2.3	1 UJ	--	--	--	--	248	200 U	100 U	100 UJ
8/2002	22	0.3 J	0.8 J	1 U	--	--	--	--	371	8.5	16	1 U
2/2003	59 J	0.2 J	2.4	1 U	1 U	1 U	1 U	1 U	230	100 U	100 U	100 U
9/2003	26	0.3 J	0.5 J	5 U	0.1 J	1 U	1 U	5 U	239	5.4 J	12	50 U
6/2004	30	0.4 J	0.8 J	1 U	0.2 J	1 U	1 U	1 U	344	6.5 J	15	10 U
11/2004	48	1 U	1.4	5 U	0.3 J	1 U	1 U	5 U	241	6.7	13	5 U
6/2005	80	1.3	2.8	5 U	1 U	1 U	1 U	2 U	413	6.6	12	5 U
11/2005	43	0.7 J	1 J	2 U	1 U	1 U	1 U	2 U	555	6.4	11	2 U
5/2006	124	1.8	4.6	5 U	1 U	1 U	1 U	5 U	216	4.2	6.6	5 U
9/2006	29	0.3 J	0.5 J	2 U	1 U	1 U	1 U	2 U	518	5.6	11	2 U
6/2007	83	1.2	2.5	2 U	2 U	2 U	2 U	2 U	204	4.4	7.8	2 U
10/2007	24	1 U	0.6 J	2 U	2 U	1 U	1 U	2 U	491	7.5	15	2 U
5/2008	55	1.2	2.8	1 U	1 U	1 U	1 U	1 U	143	5.5	12	1 U
10/2008	31	0.5 J	0.6 J	1 U	1 U	1 U	1 U	1 U	258	4.5	9	1 U
6/2009	67	0.9 J	2.2	1 U	1 U	1 U	1 U	1 U	160	4.1	7.4	1 U
11/2009	28	0.5 J	0.8 J	1 U	0.6 J	1 U	1 U	1 U	250	4.7	9.6	1 U
6/2010	85	1.3	1.6	1 U	1 U	1 U	1 U	1 U	130	3.7	6.3	1 U

Date	MW-16A				MW-20A				MW-20B			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
10/2010	61	0.9 J	1.2	1 U	2 U	1 U	1 U	1 U	520	5.8	10	1 U
6/2011	100	1.4	1.6	1 UJ	1 U	1 U	1 U	1 UJ	200	3.5	5.6	1 UJ
10/2011	57	0.8 J	1	2 U	1 U	1 U	1 U	2 U	720	4.8	7.9	2 U
6/2012	98	1.3	2.4	1 U	1 U	1 U	1 U	1 U	140	3.3	5.7	1 U
6/2013	100	1.3	2.6	1 U	1 U	1 U	1 U	1 U	170	3.9	7	1 U
5/2014	65	1.1	1.3	1 U	1 U	1 U	1 U	1 U	130	2.1	3	1 U
10/2015	44	0.5 J	0.6 J	1 U	0.2 J	1 U	1 U	1 U	340	5.4	12	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.

NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.

E: The concentration of the associated value exceeds the known calibration range.

-- Not Sampled

Bold: The analyte was positively identified.

Shade: Values are greater than project cleanup levels.

Table 3. Summary of Sample Results (ug/L) from January 1991 to October 2015.

Date	MW-27				H1/H2				LPMW-2			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
5/1991	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
11/1991	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
5/1992	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
12/1992	1 UJ	1 UJ	1 UJ	1 UJ	--	--	--	--	--	--	--	--
5/1993	10 U	10 U	10 U	10 U	--	--	--	--	--	--	--	--
12/1993	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
4/1994	0.2 U	0.2 U	0.2 U	1 U	--	--	--	--	--	--	--	--
11/1994	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--
7/1995	1 U	1 U	1 U	1 U	9	0.3 J	1 U	1 U	--	--	--	--
1/1996	1 U	1 U	1 U	2 U	8.4	0.2 J	0.2 J	2 U	--	--	--	--
7/1996	1 U	1 U	1 U	1 U	0.1 J	1 U	1 U	1 U	--	--	--	--
1/1997	1 U	1 U	1 U	1 U	18	0.4 J	0.4 J	1 U	--	--	--	--
7/1997	1 U	1 U	1 U	1 U	8.8	0.3 J	0.6 J	1 U	--	--	--	--
2/1998	1 U	1 U	1 U	1 U	11	0.4 J	0.3 J	1 U	--	--	--	--
7/1998	0.05 J	1 U	1 U	1 U	9.8	1 U	0.1 J	1 U	--	--	--	--
1/1999	1 U	2 U	1 U	1 U	1.5	1 U	1 U	1 U	--	--	--	--
8/1999	1 U	2 U	1 U	1 U	5.2	0.2 J	1 U	1 U	--	--	--	--
1/2000	1 U	2 U	1 U	1 U	10	2 U	1 U	1 U	--	--	--	--
8/2000	1 U	2 U	1 U	1 U	8.7	0.03 J	1 U	1 U	--	--	--	--
1/2001	1 U	1 U	1 U	1 U	11	0.2 J	1 U	1 U	--	--	--	--
8/2001	1 U	2 U	1 U	1 U	6.8	0.2 J	1 U	1 U	--	--	--	--
2/2002	1 U	2 U	1 U	1 UJ	12	0.2 J	0.2 J	1 UJ	--	--	--	--
8/2002	1 U	2 U	1 U	1 U	6.1	1 U	1 U	1 U	--	--	--	--
2/2003	1 U	1 U	1 U	1 U	1.3	1 U	1 U	1 U	--	--	--	--
9/2003	1 U	1 U	1 U	5 U	6.4	0.2 NJ	1 U	5 U	--	--	--	--
6/2004	1 U	1 U	1 U	1 U	7.9	0.2 J	0.1 J	1 U	--	--	--	--
11/2004	1 U	1 U	1 U	5 U	2.6	1 U	1 U	5 U	--	--	--	--
6/2005	1 U	1 U	1 U	2 U	14	0.3 J	1 U	2 U	--	--	--	--
11/2005	1 U	1 U	1 U	2 U	6.4	1 U	1 U	2 U	--	--	--	--
5/2006	1 U	1 U	1 U	5 U	7.3	0.2 J	1 U	5 U	9.9	1 U	1 U	5 U
9/2006	1 U	1 U	1 U	2 U	4.8	1 U	1 U	2 U	--	--	--	--
6/2007	2 U	2 U	2 U	2 U	5.2	2 U	2 U	2 U	4.8	1 U	1 U	2 U
10/2007	2 U	1 U	1 U	2 U	3.8	1 U	1 U	2 U	--	--	--	--
5/2008	1 U	1 U	1 U	1 U	9.6	1 U	1 U	1 U	2.5	1 U	1 U	1 U
10/2008	1 U	1 U	1 U	1 U	5.1	1 U	1 U	1 U	--	--	--	--
6/2009	1 U	1 U	1 U	1 U	6.8	1 U	1 U	1 U	4.1	1 U	1 U	1 U
11/2009	1 U	1 U	1 U	1 U	--	--	--	--	11	1 U	1 U	1 U
6/2010	1 U	1 U	1 U	1 U	4.3	1 U	1 U	1 U	4.4	1 U	1 U	1 U
10/2010	--	--	--	--	--	--	--	--	5	1 U	1 U	1 U

Date	MW-27				H1/H2				LPMW-2			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
6/2011	1 U	1 U	1 U	1 UJ	5.9	1 U	1 U	1 UJ	3.2	1 U	1 U	1 UJ
10/2011	1 U	1 U	1 U	2 U	1.4	1 U	1 U	2 U	--	--	--	--
6/2012					5.2	1 U	1 U	1 U	2.4	1 U	1 U	1 U
6/2013					4.9	1 U	1 U	1 U	2.2	1 U	1 U	1 U
5/2014					2.9	1 U	1 U	1 U	2.7	1 U	1 U	1 U
10/2015					1.8	0.2 J	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.

NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.

-- Not Sampled

Bold: The analyte was positively identified.

Shade: Values are greater than project cleanup levels.

Table 4. Summary of Sample Results (ug/L) for Annual/Bi-Annual Wells - January 1991 to October 2015.

Date	MW-19A				MW-31				MW-33			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	--	--	--	--	1 J	1 U	1.9 J	1 U	--	--	--	--
5/1991	--	--	--	--	0.6 J	1 U	2	1 U	--	--	--	--
11/1991	1 U	0.5 NJ	1 U	1 U	0.9 NJ	1 U	2.2 J	1 U	--	--	--	--
5/1992	--	--	--	--	0.8 J	1 U	1	1 U	--	--	--	--
12/1992	1 UJ	1 UJ	1 UJ	1 UJ	0.5 J	1 UJ	0.9 J	1 UJ	--	--	--	--
5/1993	--	--	--	--	10 U	10 U	10 U	10 U	--	--	--	--
12/1993	1 U	0.4 J	1 U	1 U	0.8 J	1 U	1.2 J	1 U	--	--	--	--
4/1994	0.2 U	0.5	0.2 U	1 U	0.7	0.2 U	1	1 U	--	--	--	--
11/1994	--	--	--	--	0.8 J	1 U	1	1 U	--	--	--	--
7/1995	1 U	0.4 J	1 U	1 U	0.6 J	1 U	0.5 J	1 U	1 U	1 U	1 U	1 U
1/1996	--	--	--	--	0.6 J	1 U	0.7 J	2 U	--	--	--	--
7/1996	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
7/1997	1 U	0.3 J	2 U	1 U	0.9 J	1 U	0.9 J	1 U	1 U	1 U	2 U	1 U
7/1998	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
8/1999	1 U	0.4 J	1 U	1 U	0.9 J	2 U	0.4 J	1 U	1 U	2 U	1 U	1 U
8/2000	--	--	--	--	--	--	--	--	1 U	2 U	1 U	1 U
8/2001	1 U	0.3 J	1 U	1 U	0.4 J	2 U	0.3 J	1 U	1 U	2 U	1 U	1 U
8/2002	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
9/2003	1 U	0.4 NJ	1 U	5 U	0.5 J	1 U	0.1 NJ	5 U	1 U	1 U	1 U	5 U
6/2004	--	--	--	--	--	--	--	--	--	--	--	--
6/2005	1 U	0.6 J	1 U	2 U	0.5 J	1 U	1 U	2 U	1 U	1 U	1 U	2 U
5/2006	--	--	--	--	--	--	--	--	1 U	1 U	1 U	5 U
6/2007	2 U	1.2 J	2 U	2 U	1.6 J	2 U	2 U	2 U	2 U	2 U	2 U	2 U
5/2008	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
6/2009	1 U	1 U	1 U	1 U	--	--	--	--	1 U	1 U	1 U	1 U
6/2010	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
6/2011	--	--	--	--	--	--	--	--	--	--	--	--
10/2011	1 U	0.4 J	1 U	2 U	0.7 J	1 U	1 U	2 U	1 U	1 U	1 U	2 U
6/2013	--	--	--	--	--	--	--	--	1 U	1 U	1 U	1 U
10/2015	--	--	--	--	--	--	--	--	1 U	0.2 J	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.

NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.

-- Not Sampled

Bold: The analyte was positively identified.

Table 5. Summary of Sample Results (ug/L) for 5-Year Wells - January 1991 to October 2015.

Date	MW-32				MW-40				MW-41			
	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC	PCE	TCE	Cis-DCE	VC
1/1991	1 J	1 U	1.1 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
5/1991	1	1 U	2	1 U	--	--	--	--	1 U	1 U	1 U	1 U
11/1991	0.6 NJ	1 U	0.6 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
5/1992	0.7 J	1 U	1	1 U	--	--	--	--	1 U	1 U	1 U	1 U
12/1992	0.7 J	1 UJ	0.5 J	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
5/1993	10 U	10 U	10 U	10 U	--	--	--	--	10 U	10 U	10 U	10 U
12/1993	0.7 J	1 U	0.6 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4/1994	0.7	0.2 U	0.6	1 U	0.2 U	0.2 U	0.2 U	1 U	0.2 U	0.2 U	0.2 U	1 U
11/1994	0.6 J	1 U	0.5 J	1 U	--	--	--	--	--	--	--	--
7/1995	0.7 J	1 U	0.5 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1/1996	0.8 J	1 U	0.6 J	2 U	--	--	--	--	1 U	1 U	1 U	2 U
7/1996	--	--	--	--	--	--	--	--	--	--	--	--
8/2000	0.8 J	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U
6/2005	1.4	1 U	1 U	2 U	1 U	1 U	1 U	2 U	1 U	1 U	1 U	2 U
6/2010	1.8	1 U	1 U	1 U	--	--	--	--	1 U	1 U	1 U	1 U
10/2011	--	--	--	--	1 U	1 U	1 U	2 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.

NJ: The analyte that has been tentatively identified. The associated numerical result is an estimate.

-- Not Sampled

Bold: The analyte was positively identified.