A Department of Ecology Report

# Lakewood Plaza Cleaners January and August 2001

# Groundwater Monitoring Sampling 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 two municipal wells and seven monitoring wells in January and August 2001 are included.

- Monitoring wells MW-20B and MW-16A, as well as municipal wells H1 and H2, continue to have tetrachloroethene (PERC) concentrations exceeding the Model Toxic Control Act (MTCA) cleanup standard of 5.0 ug/L. PERC concentrations in these wells during the past year of sampling were MW-20B (486 and 493 ug/L), MW-16A (25 and 31 ug/L), and H1 and H2 (6.8 and 11 ug/L).

- Trichloroethene (TCE) was detected in MW-20B in January at a concentration of 6.6 ug/L and in August at a concentration of 8.2 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 (12 and 18 ug/L) and MW-16A (0.7 and 1 ug/L).

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



Waterbody Numbers:

WA-225274471570GW

WA-12-1115, (Segment No. 05-12-GW)



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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, 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 in order 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 reduce the monitoring program to wells in the immediate vicinity of Plaza Cleaners.

As of August 2001, five years of monitoring have been completed since the last project review. The monitoring program should be evaluated by the project manager and staff to determine if project objectives are still being met. The next round of sampling is scheduled for January 2002.

# Methods

## Groundwater Sampling

In January 2001, groundwater samples were collected from one municipal well, H2, as well as four monitoring wells, MW-16A, MW-20A, MW-20B, and MW-27. In August 2001, groundwater samples were collected from one municipal well, H1, as well as seven monitoring wells, MW-16A, MW-20A, MW-20B, MW-19A, MW-27, MW-31, and MW-33 (Figure 1). All but one of the wells is screened in the Advanced Outwash deposits, which is the primary aquifer for the area. 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-20B, were purged and sampled using dedicated bladder pumps. Well MW-20B was purged and sampled with a decontaminated Teflon bailer. Municipal wells H1 and H2, which pump continuously, were sampled from taps nearest the well. Sampling procedures are discussed in detail in Appendix A.

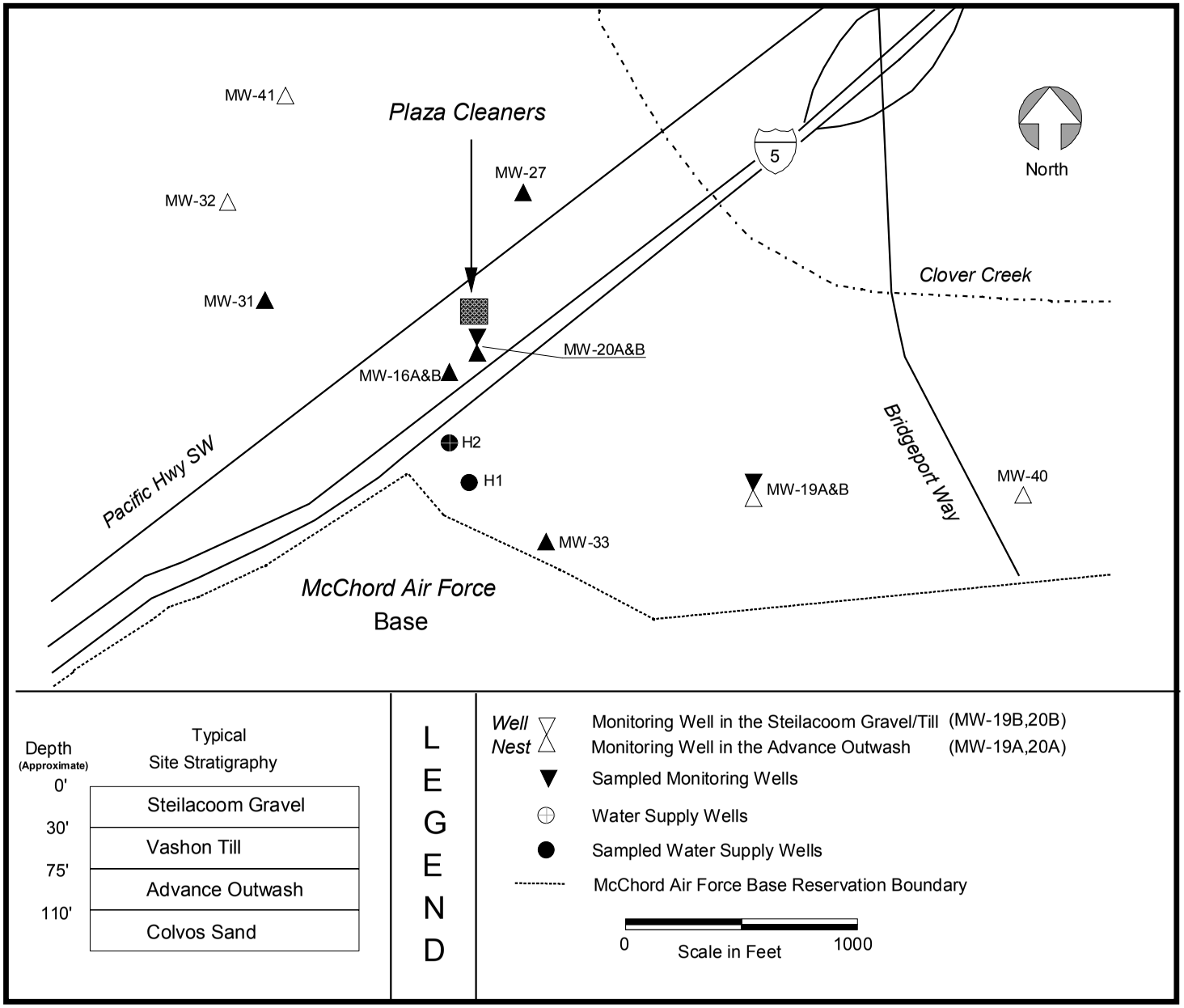


Figure 1: Well Location Map - Lakewood/Plaza Cleaners

# 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 January and August 2001 Samples**

| Analytes | Method | Reference | Detection Limit |
|---|---|---|---|
| **Field** | | | |
| Water Level | Solinst Well Probe | NA | 0.01 feet |
| pH | Orion 25A Field Meter | NA | 0.1 Std. Units |
| Temperature | Orion 25A Field Meter | NA | 0.1 C |
| Specific Conductance | Beckman Conductivity Bridge | NA | 10 umhos/cm |
| **Laboratory** | | | |
| VOAs | 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 duplicate samples, which were obtained from well MW-16A. The numeric comparison of duplicate results is expressed as the relative percent difference (RPD). The RPD for PERC in January and August was 7% and 11%, respectively. In addition to field quality control samples, duplicate matrix spikes and surrogate compound recoveries were performed in the laboratory. Matrix spikes and surrogate recoveries were within acceptable limits for all samples. Further discussion of quality assurance is presented in Appendix B. Laboratory reporting sheets 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. Well MW-20A had pH readings of 7.6 - 7.9 standard units, which is relatively high but consistent with previous measurements. High pH readings can be related to well construction. In the case of MW-20A, it is most likely caused by bentonite inadvertently being placed within the screened interval during well construction. The specific conductance in well MW-20B (460-540 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. The other wells are screened in an advanced outwash unit.

**Table 2: Summary of Field Parameters Results for January 31 and August 9, 2001**

| Monitoring Well | Total Depth (feet)[1] | Depth to Water (feet)[2] | pH (standard units) | Specific Conductance (umhos/cm) | Temperature (°C) | Purge Volume (gallons) |
|---|---|---|---|---|---|---|
| January | | | | | | |
| MW-16A | 109 | 40.93 | 7.2 | 220 | 11.6 | 133 |
| MW-20A | 97.3 | 32.92 | 7.6 | 229 | 12.0 | 32 |
| MW-20B | 50.4 | 33.88 | 6.9 | 540 | 12.4 | 11 |
| MW-27 | 96.4 | ++ | 6.7 | 190 | 11.9 | 30 |
| H2 | 110 | ++ | 5.8 | 168 | 10.7 | >1000 |
| August | | | | | | |
| MW-16A | 109 | 44.46 | 7.1 | 220 | 16.2 | 126 |
| MW-20A | 97.3 | 36.23 | 7.9 | 215 | 13.3 | 30 |
| MW-20B | 50.4 | 37.67 | 7.0 | 460 | 14.0 | 7 |
| MW-19A | 97.5 | 41.18 | 6.8 | 195 | 12.7 | 35 |
| MW-27 | 96.4 | ++ | 6.7 | 190 | 12.7 | 30 |
| MW-31 | 91.5 | ++ | 6.8 | 175 | 12.2 | 35 |
| MW-33 | 99.3 | ++ | 7.1 | 210 | 11.9 | 35 |
| H1 | 110 | ++ | --- | --- | --- | >1000 |

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

# Analytical Results

Analytical results for volatile organics (VOAs) are summarized in Table 3.

In January, tetrachloroethene (PERC), trichloroethene (TCE), and cis-1,2-dichloroethene (cis-1,2-DCE) were detected in well MW-20B at concentrations of 493 ug/L, 6.6J ug/L, and 12 ug/L, respectively. PERC, TCE, and cis-1,2-DCE were also detected in MW-16A with concentrations of 31 ug/L, 0.44J ug/L, and 1 ug/L, respectively. Municipal well H2 had a PERC concentration of 11 ug/L.

In August, the PERC, TCE, and cis-1,2-DCE concentrations in well MW-20B were 486 ug/L, 8.2 ug/L, and 18 ug/L, respectively. PERC, TCE, and cis-1,2-DCE were detected in MW-16A with concentrations of 25 ug/L, 0.34J ug/L, and 0.71J ug/L, respectively. Municipal well H1 had a PERC concentration of 6.8 ug/L. Tetrahydrofuran was detected in well MW-20B with a concentration of 137 ug/L. This chemical is often associated with adhesives used in the installation of new plumbing. Tetrahydrofuran has a very high mobility in soil and is expected to biodegrade under aerobic conditions.

**Table 3: Summary of Analytical Results (ug/L) for January 31 and August 9, 2001**

| Monitoring Well | Tetrachloroethene | Trichloroethene | Cis-1,2-Dichloroethene |
|---|---|---|---|
| January | | | |
| MW-16A | 31 | 0.44 J | 1 |
| MW-20A | 0.21 J | 1 U | 1 U |
| MW-20B | 493 | 6.6 J | 12 |
| MW-27 | 1 U | 1 U | 1 U |
| H2 | 11 | 0.2 J | 1 U |
| August | | | |
| MW-16A | 25 | 0.34 J | 0.71 J |
| MW-19A | 1 U | 0.34 J | 1 U |
| MW-20A | 1 U | 2 U | 1 U |
| MW-20B | 486 | 8.2 | 18 |
| MW-27 | 1 U | 2 U | 1 U |
| MW-31 | 0.36 J | 2 U | 0.26 J |
| MW-33 | 1 U | 2 U | 1 U |
| H1 | 6.8 | 0.20 J | 1 U |

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

Benzene, toluene, ethylbenzene, and xylene (BTEX) were detected below the practical quantitation limits (1-2 ug/L) in a few of the wells during both sample rounds. BTEX compounds were detected in wells MW-16A and MW-20A in January, and in wells MW-19A and MW-20A in August. BTEX has been detected periodically in the past, always at concentrations below the quantitation limits. There is no consistent pattern or clear explanation as to the occurrence of these chemicals.

PERC and TCE were detected below the practical quantitation limit of 1 ug/L in some of the wells in both January and August as shown in Table 3.

Table 4 summarizes PERC, TCE, and cis-1, 2-DCE concentrations for sampling events from January 1991 through August 2001. Table 5 shows PERC and TCE concentrations that have exceeded the MTCA cleanup standard of 5.0 ug/L for the same period.

PERC 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 PERC concentrations.

Table 4: Summary of Sample Results (ug/L) from January 1991 to August 2001

| Well | January 1991 | | | May 1991 | | | November 1991 | | | May 1992 | | | December 1992 | | | May 1993 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 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** | **44** | 10 U | **2 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 | 10 U | 10 U | 10 U |
| MW-20B | **1100 D** | **18** | **33** | **752** | **16** | **30** | **120** | **2.6 J** | **6.7** | **940** | **13** | **32** | **340 J** | **14 J** | **20 J** | **700 D** | **12** | **21** |
| 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** | **1 J** | 10 U | 10 U |
| 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 | 10 U | 10 U | 10 U |
| 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** | 10 U | 10 U | 10 U |
| 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** | 10 U | 10 U | 10 U |
| 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 | 10 U | 10 U | 10 U |
| 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 | December 1993 | | | April 1994 | | | November 1994 | | | July 1995 | | | January 1996 | | | July 1996 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | PERC | TCE | cis-1,2-DCE |
| MW-16A | **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** | **47 E** | **0.8 J** | **1.5** | **43** | **0.7 J** | **1.9** |
| MW-20A | **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 | **0.2 J** | 1 U | 1 U | **0.4 J** | 1 U | 1 U |
| MW-20B | **187** | 50 U | **8.2 J** | **472** | **8.6 J** | **12.6** | **86** | 50 U | **3 J** | **340 D** | **8.4** | **17** | **353** | **7.2** | **15** | **387** | **7.6** | **15** |
| MW-21 | **1.6** | 1 U | **0.4 J** | **1.5** | **0.2 J** | **0.3** | **1.8** | **0.2 J** | **0.3 J** | -- | -- | -- | -- | -- | -- | Well Decommissioned | | |
| MW-27 | 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 | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U |
| MW-28A | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 U | 1 U | 1 U | 1 U | 1 U | 1 U | Well Decommissioned | | |
| MW-31 | **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** | **0.6 J** | 1 U | **0.7 J** | -- | -- | -- |
| MW-32 | **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** | **0.8 J** | 1 U | **0.6 J** | -- | -- | -- |
| MW-41 | 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 | 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 | -- | -- | -- | 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 | **8.4** | **0.2 J** | **0.2 J** | **0.14 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.
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 August 2001

| Well | January 1997 | | | July 1997 | | | February 1998 | | | July 1998 | | | January 1999 | | | August 1999 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | PERC | TCE | cis-1,2-DCE |
| MW-16A | **54** | **1.1** | **3.1** | **47** | **0.7 J** | **2.5** | **36** | **0.7 J** | **2 J** | **30** | 1 U | **1.5 J** | -- | -- | -- | **22** | **0.4 J** | **1.1** |
| MW-20A | **0.4 J** | 1 U | 1 U | **0.3 J** | 1 U | 2 U | **0.4 J** | 1 U | 1 U | **0.6 J** | 1 U | 1 U | 1 U | 2 U | 1 U | **0.8 J** | 2 U | 1 U |
| MW-20B | **373** | 100 U | **6.4 J** | **222** | **4** | **6.4** | **456** | **7 J** | **12** | **575 D** | **10** | **23** | **708** | **5.2** | **12** | **722** | **8.4 J** | **16 J** |
| MW-21 | | | | | | | | | | | | | | | | | | |
| MW-27 | 1 U | 1 U | 1 U | 1 U | 1 U | 2 U | 1 U | 1 U | 1 U | **0.05 J** | 1 U | 1 U | 1 U | 2 U | 1 U | 1 U | 2 U | 1 U |
| MW-28A | | | | | | | | | | | | | | | | | | |
| MW-31 | -- | -- | -- | **0.9 J** | 1 U | **0.9 J** | -- | -- | -- | -- | -- | -- | -- | -- | -- | **0.9 J** | 2 U | **0.4 J** |
| MW-32 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW-41 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| MW-19A | -- | -- | -- | 1 U | **0.3 J** | 2 U | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 U | **0.4 J** | 1 U |
| MW-33 | -- | -- | -- | 1 U | 1 U | 2 U | -- | -- | -- | 1 U | 1 U | 1 U | -- | -- | -- | 1 U | 2 U | 1 U |
| MW-40 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| H1/H2 | **18** | **0.4 J** | **0.4 J** | **8.8** | **0.3 J** | **0.6 J** | **11** | **0.4 J** | **0.3 J** | **10** | 1 U | **0.1 J** | **1.5** | 1 U | 1 U | **5.2** | **0.2 J** | 1 U |

| Well | January 2000 | | | August 2000 | | | January 2001 | | | August 2001 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | **40** | **0.7 J** | **1.9** | **22** | **0.3 J** | **0.7** | **31** | **0.4 J** | **1** | **25** | **0.3 J** | **0.7 J** |
| MW-20A | **0.2 J** | 2 U | 1 U | **0.1 J** | 2 U | 1 U | **0.2 J** | 1 U | 1 U | 1 U | 2 U | 1 U |
| MW-20B | **184** | **6** | **13** | **648** | 200 U | 100 U | **493** | **6.6 J** | **12** | **486** | **8.2** | **18** |
| MW-27 | 1 U | 2 U | 1 U | 1 U | 2 U | 1 U | 1 U | 1 U | 1 U | 1 U | 2 U | 1 U |
| MW-31 | -- | -- | -- | -- | -- | -- | -- | -- | -- | **0.4 J** | 2 U | **0.3 J** |
| MW-32 | -- | -- | -- | **0.8 J** | 2 U | 1 U | -- | -- | -- | -- | -- | -- |
| MW-41 | -- | -- | -- | 1 U | 2 U | 1 U | -- | -- | -- | -- | -- | -- |
| MW-19A | -- | -- | -- | -- | -- | -- | -- | -- | -- | 1 U | **0.3 J** | 1 U |
| MW-33 | -- | -- | -- | 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 | 1 U | **8.7** | **0.03 J** | 1 U | **11** | **0.2 J** | 1 U | **6.8** | **0.2 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 5: Summary of PERC and TCE Concentrations that Exceeded MTCA Method A Cleanup Standard of 5 ug/L**

| | *1991* | *1992* | *1993* | *1994* | *1995* | *1996* | *1997* | *1998* | *1999* | *2000* | *2001* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *MW-20B* | | | | | | | | | | | |
| Tetrachloroethene | 120-1100 | 340J-940 | 187-700 | 86-472 | 340 | 353-387 | 222-373 | 456-575 | 708-722 | 184-648 | 486-493 |
| Trichloroethene | 2.6J-18 | 13-14J | 12 | 8.6J | 8.4 | 7.2-7.6 | 4 | 7J-10 | 5.2-8.4J | 6 | 6.6-8.2 |
| *MW-16A* | | | | | | | | | | | |
| Tetrachloroethene | 2.7J-28 | 7-9J | 13-44 | 9.7-33 | 27 | 43-47 | 47-54 | 30-36 | 22 | 22-40 | 25-31 |
| *H1/H2* | | | | | | | | | | | |
| Tetrachloroethene | --- | --- | --- | --- | 9 | 0.14J-8.4 | 8.8-18 | 10-11 | 1.5-5.2 | 8.7-10 | 6.8-11 |

*(Model Toxic Control Act Method A cleanup standard for PERC and TCE in groundwater is 5 ug/L)*

J = Analyte was positively identified. The associated numerical result is an estimate.
-- = Not tested.

Figure 2 shows PERC concentrations for MW-20B and MW-16A between 1985 and 2001. Since 1984, PERC concentrations in both wells have varied substantially.

- PERC 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 of 1998, overall PERC concentrations have been slightly higher ranging from 184 to 722 ppb.

- Over the monitoring period, PERC concentrations in MW-16A have varied. Since 1991, PERC concentrations in this well have ranged from 3 to 55 ppb.

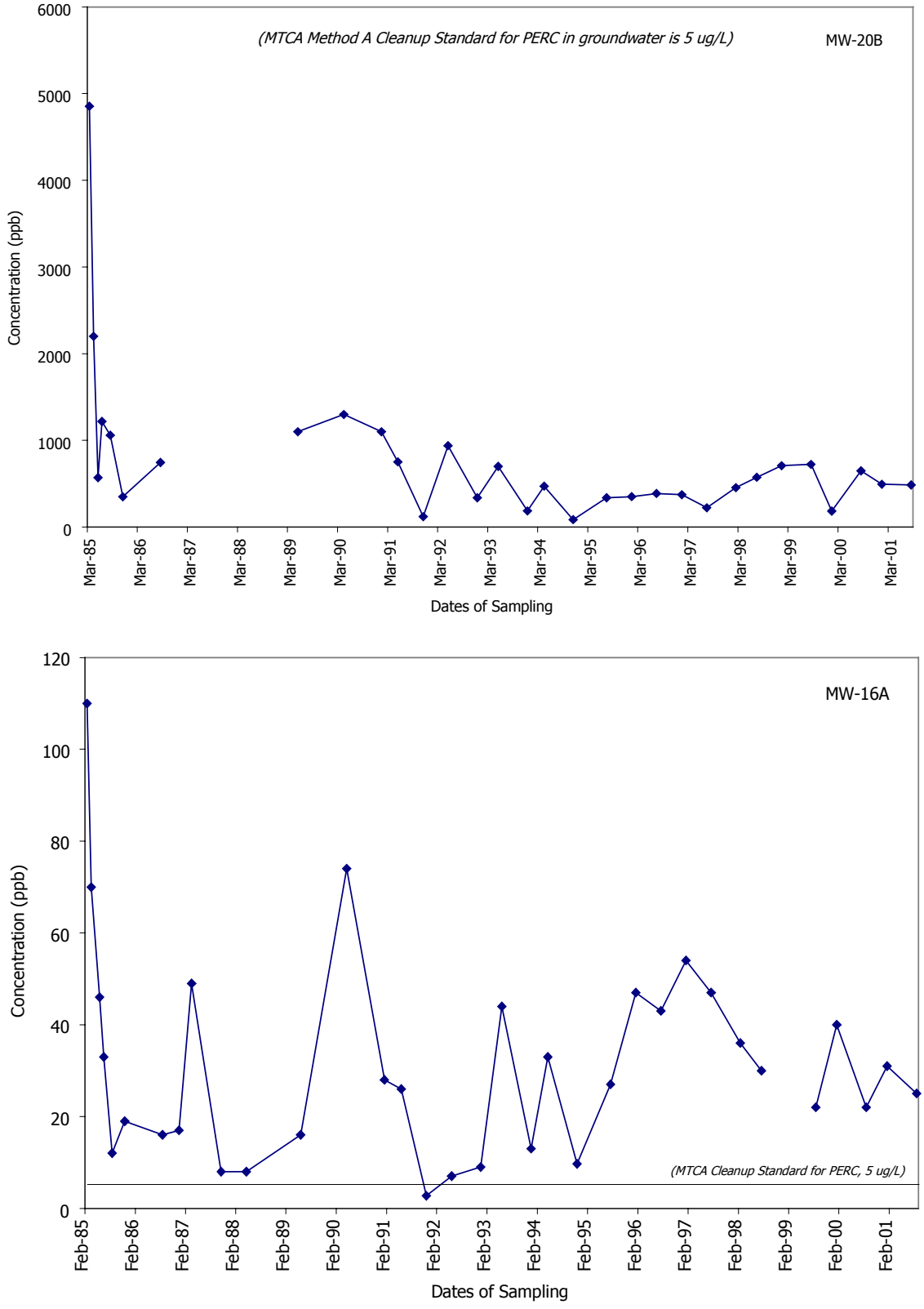


Figure 2

PERC Concentrations for Wells MW-20B and MW-16A from 1985 to 2001

## Conclusions

Monitoring was conducted in January and August 2001 at two municipal wells 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 wells H1 and H2, continue to have PERC concentrations exceeding the MTCA cleanup standard of 5.0 ug/L.

- TCE continues to exceed the MTCA cleanup standard of 5.0 ug/L in MW-20B.

- Tetrahydrofuran was detected in well MW-20B with a concentration of 137 ug/L. Well MW-20B should continue to be monitored to determine if tetrahydrofuran continues to be detected in groundwater.

Overall, concentrations are similar to those reported in previous sampling conducted since 1991. As of August 2001, five years of monitoring have been completed since the last project review. The monitoring program should be evaluated by the project manager and staff before the next round of sampling, which is scheduled for January 2002, to determine if project objectives are still being met.

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# Appendix A. Groundwater Sampling

On January 31, samples were collected from municipal well H2 and monitoring wells MW-16A, MW-20A, MW-20B, and MW-27. On August 9, 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. All monitoring wells, except MW-20B, were purged and sampled using dedicated bladder pumps. Well MW-20B was purged and sampled with a decontaminated teflon bailer. Municipal wells H1 and H2, which pump continuously, were sampled from taps nearest the wells. Samples collected for volatile organics were free of headspace and preserved with two drops of 1:1 hydrochloric acid.

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

Chain-of-custody procedures were followed in accordance with Manchester Laboratory protocol (Ecology, 2000). Manchester Laboratory analyzed all samples.

# Appendix B. Quality Assurance

## Manchester Environmental Laboratory

7411 Beach Dr E, Port Orchard Washington 98366

## CASE NARRATIVE

September 27, 2001

Subject: Lakewood Plaza Cleaners
Samples: 01058020 - 25
Case No. 116101
Officer: Pam Marti
By: Greg Perez
Organics Analysis Unit

## VOLATILE ORGANIC ANALYSIS

**SUMMARY:**

In addition to matrix spikes performed on sample 01058022, a control sample spiked with an analyte mix different in origin than the matrix spike/calibration solution was analyzed.

**ANALYTICAL METHODS:**

Volatile organic compounds were analyzed using Manchester modification of the EPA Method 8260 purge-trap procedure with capillary GC/MS analysis. Normal QA/QC procedures were performed on the samples.

**BLANKS:**

Low levels of acetone were detected in the laboratory blanks. If the concentrations of the compounds in the sample are greater than or equal to five times the concentrations of the compounds in the associated method blank, they are considered native to the sample.

**SURROGATES:**

Surrogate recoveries were within acceptable limits for the water samples.

**HOLDING TIMES:**

The water samples were analyzed within the recommended 14 day holding time.

**QUALITY CONTROL:**

Matrix spike recoveries and control sample recoveries were within acceptable limits for the water samples. The duplicate analyses also were within acceptable limits.

**DATA QUALIFIER CODES:**

| | | |
|---|---|---|
| U | - | The analyte was not detected at or above the reported value. |
| J | - | The analyte was positively identified. The associated numerical value is an estimate. |
| UJ | - | The analyte was not detected at or above the reported estimated result. |
| REJ | - | The data are unusable for all purposes. |
| NAF | - | Not analyzed for. |
| N | - | For organic analytes there is evidence the analyte is present in this sample. |
| NJ | - | There is evidence that the analyte is present. The associated numerical result is an estimate. |
| E | - | This qualifier is used when the concentration of the associated value exceeds the known calibration range. |
| **bold** | - | The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.) |

# Manchester Environmental Laboratory

7411 Beach Dr E, Port Orchard Washington 98366

## CASE NARRATIVE

September 4, 2001

Subject: Lakewood / Plaza Cleaners – 32 Project
Samples: 01328020-28
Project No. 184301
Officer: Pam Marti
By: Bob Carrell
Organics Analysis Unit

### VOLATILE ORGANIC ANALYSIS

**ANALYTICAL METHODS:**

Volatile organic compounds were analyzed using EPA Method 8260 purge-trap procedure with capillary GC/MS analysis. Normal QA/QC procedures were performed on the sample.

**BLANKS:**

No significant amounts of target compounds were detected in the laboratory blanks thus demonstrating that the system was free of contamination.

**SURROGATES:**

Surrogate recoveries were within acceptable limits for all samples.

**HOLDING TIMES:**

The samples were analyzed within the recommended holding time.

**COMMENTS:**

The data are useable as qualified.

**DATA QUALIFIER CODES:**

U - The analyte was not detected at or above the reported value.

| | | |
|---|---|---|
| J | - | The analyte was positively identified. The associated numerical value is an estimate. |
| UJ | - | The analyte was not detected at or above the reported estimated result. |
| REJ | - | The data are unusable for all purposes. |
| NAF | - | Not analyzed for. |
| N | - | For organic analytes there is evidence the analyte is present in this sample. |
| NJ | - | There is evidence that the analyte is present. The associated numerical result is an estimate. |
| E | - | This qualifier is used when the concentration of the associated value exceeds the known calibration range. |
| **bold** | - | The analyte was present in the sample. (Visual Aid to locate detected compound on report sheet.) |