



Shelton Laundry and Cleaners Groundwater Monitoring Results, November 2011 and June 2012: Data Summary Report

Abstract

Tetrachloroethene (PCE) contamination of shallow groundwater underlying Shelton Laundry and Cleaners was discovered in 1997. The source of contamination was assumed to be a 1993 solvent spill outside the dry cleaner's commercial building. Monitoring of four shallow wells in 1998 detected PCE in the local aquifer at concentrations as high as 280 ug/L in the well located nearest to the reported spill location (4W). The Washington State Model Toxic Control Act (MTCA) Method A cleanup level for PCE is 5 ug/L.

In 2002, the Washington State Department of Ecology (Ecology) began monitoring the groundwater quality at the site. From 2002 to 2005, PCE was consistently detected in well 4W over a concentration range of 10 to 25 ug/L. In an attempt to remediate the contamination, a hydrogen release compound (HRC[®]) was injected into the groundwater around well 4W in June 2005. Following the HRC injection, groundwater monitoring results indicated that the HRC was temporarily effective in reducing the contaminant concentrations. However, since August 2006, concentrations have gradually increased, returning to their pre-HRC injection concentrations.

This report describes the water quality results for groundwater samples collected in November 2011 and June 2012 from three of the shallow wells and two deep wells. PCE was detected in well 4W at estimated concentrations ranging from approximately 8 to 18 ug/L. Trichloroethene (TCE) and cis-1,2-dichloroethene (cis-DCE) were also detected in well 4W, at concentrations near or below the reporting limit of 1 ug/L. PCE, TCE, and cis-DCE were not detected in any of the other sampled wells.

Groundwater monitoring should continue in well 4W since PCE concentrations remain above the MTCA cleanup level of 5 ug/L.

Publication Information

This report is available on the Department of Ecology's website at <https://fortress.wa.gov/ecy/publications/SummaryPages/1303004.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 User Study ID, PMART001.

Ecology's Activity Tracker Code for this study is 04-064.

Water Resource Inventory Area (WRIA) and 8-digit Hydrologic Unit Code (HUC) numbers for the study area

Water Resource Inventory Areas (WRIAs): 14

Eight-digit Hydrologic Unit Code (HUC) number: 17110019

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Background

Shelton Laundry and Cleaners is an active laundromat located in downtown Shelton, Washington (Figure 1). In 1997, shallow groundwater beneath the site was found to be contaminated with tetrachloroethene (PCE) (Building Analytics, 1997). The source of the contamination is assumed to be a 1993 solvent spill in the alley behind the dry cleaner's commercial building.

Environmental investigations conducted at the site between 1997 and 2000 showed that PCE contamination was present in shallow groundwater in the southeastern portion of the site beneath the alley. Groundwater samples collected from shallow (approximately 15 feet deep) monitoring wells showed PCE contamination was primarily detected in well 4W (the well located nearest to the reported spill location). Between 1997 and 2000 PCE concentrations in this well decreased from 280 ug/L to 25 ug/L (GeoEngineers, 2000).

Ecology conducted a follow-up investigation in 2002 during which four deeper wells (approximately 45 to 60 feet deep) were installed to gain a better understanding of contaminant concentrations at greater depths. PCE was not detected in any of the deep wells. Between 2002 and 2005 PCE continued to be detected in well 4W at concentrations ranging from approximately 10 to 25 ug/L.

In June 2005 an effort was made to remediate the contamination. A Hydrogen Release Compound (HRC[®]) was injected into the ground to stimulate biodegradation processes in the soil and groundwater to degrade the chlorinated compounds. The HRC was injected below the water table at depths of 5 to 20 feet below ground surface (bgs) at 16 locations between wells 4W and 7W (Figure 1) (Balaraju, 2005).

Results from the first year of monitoring following the HRC injection suggest that enhanced degradation was occurring. PCE and trichloroethene (TCE) concentrations decreased while cis-1,2-dichloroethene (cis-DCE) concentrations increased (Figure 2). The contaminant concentrations in well 4W were at their lowest in August 2006, 15 months following the HRC injection. Since then concentrations have gradually increased to pre-injection levels. HRC typically has an effective longevity of about 12 to 18 months (Willett, 2004).

Ecology continues to monitor the site groundwater on a regular basis because PCE concentrations in well 4W continue to exceed Model Toxic Control Act (MTCA) Method A cleanup level of 5 ug/L.

The 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 User Study ID, PMART001.

Results

Ecology collected groundwater samples in November 2011 and June 2012 from three shallow and two deep monitoring wells. All wells were sampled in accordance with Ecology's SOP EAP078 (Marti, 2011).

Samples were submitted for analysis of volatile organic compounds (VOCs) to determine PCE concentrations in the vicinity of well 4W. Analytical results are summarized in Tables 1 and 2. PCE, TCE, and cis-DCE were the only volatile organics detected.

Blind field duplicates were collected from well 4W during both sample rounds. The relative percent difference (RPD) for the PCE and TCE duplicate results ranged from 21% to 109% as shown in Table 1.

Table 1. Relative Percent Difference (RPD) of Duplicate Sample Results (ug/L), November 2011 and June 2012.

Well Sample ID	Tetrachloroethene (PCE)		Trichloroethene (TCE)		Cis-1,2-Dichloroethene (cis-DCE)	
	11/11	6/12	11/11	6/12	11/11	6/12
4W	7.2	8.2	1.0 J	1.0	1 U	0.35 J
4W-A	8.9	28	1.2	2.9	1 U	0.85 J
RPD ¹ (%)	21%	109%	--	97%	--	--

MW-4A is the duplicate sample identification.

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

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

¹ RPD target $\pm 15\%$.

The PCE and TCE data from well 4W did not meet the data quality objectives of 15% established in the Quality Assurance Project Plan (Marti, 2002). However, because the concentrations are within the range of previous results detected in this well, the data is considered usable but has been "J" qualified as estimated. Average concentrations of the duplicate samples will be used in the remainder of this report. The laboratory data quality control and quality assurance results indicate that the overall analytical performance was good and that the results are usable as qualified.

As shown in Table 2, PCE and TCE were detected in well 4W during both sampling rounds. Estimated PCE concentrations in this well ranged from approximately 8 to 18 ug/L. Monitoring well 4W continues to have PCE concentrations that exceed the MTCA cleanup level of 5 ug/L. TCE and cis-DCE were also detected in well 4W at concentrations near or below the reporting limit of 1 ug/L.

Table 2: Summary of Analytical Results (ug/L), November 2011 and June 2012.

Well ID	Tetrachloroethene (PCE)		Trichloroethene (TCE)		Cis-1,2-Dichloroethene (cis-DCE)	
	5 ug/L		5 ug/L		70 ug/L	
MTCA Cleanup Level	11/11	6/12	11/11	6/12	11/11	6/12
Shallow						
1W	1 U	1 U	1 U	1 U	1 U	1 U
4W	8.1 J^a	18.1 J^a	1.0 J	1.95 J^a	1 U	0.35 J
7W	1 U	1 U	1 U	1 U	1 U	1 U
Deep						
MW-5	1 U	--	1 U	--	1 U	--
MW-6	1 U	--	1 U	--	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.

^a Average concentration of duplicate samples.

Bold - Analyte was detected.

--: Not sampled

PCE, TCE, and cis-DCE were not detected in shallow wells 1W and 7W. These contaminants have not been detected in well 1W since monitoring began in 1998. PCE was last detected in well 7W in February 2006 at a concentration of 0.53 ug/L.

Volatile organics have never been detected in the deep wells since the wells were installed in July 2002.

A summary of monitoring results since 2002 is presented in Table 3.

Conclusions

Shallow groundwater underlying the Shelton Laundry and Cleaners site continues to be contaminated in the area of well 4W. Estimated PCE concentrations ranged from approximately 8 to 18 ug/L during the 2011-2012 monitoring. PCE continues to be detected in this well above the MTCA cleanup level of 5 ug/L.

TCE and cis-DCE, associated with the breakdown of PCE, were also detected in well 4W but at concentrations near or below the reporting limit of 1 ug/L which is below their respective MTCA cleanup levels of 5 ug/L and 70 ug/L.

The remaining shallow and deep wells continue not to have detectable levels of contamination.

Although enhanced contaminant degradation appeared to be occurring following the 2005 HRC injection, concentrations have gradually increased the past six years, returning to their pre-HRC injection levels. The increase in PCE, TCE, and cis-DCE concentrations suggests the HRC is no longer effective in reducing contaminant concentrations.

Recommendations

Groundwater monitoring should continue in the three shallow wells (1W, 4W, and 7W) on an annual basis since PCE concentrations in monitoring well 4W continue to exceed the MTCA Method A cleanup level of 5 ug/L.

Because contaminants have never been detected in deep wells MW-5 and MW-6, a sample frequency of every other year should be sufficient.

The Shelton Laundry and Cleaners site needs a better-positioned downgradient well. The general groundwater flow direction across the site is southward. Flow direction from the source area consistently appears to be to the southeast. It is recommended that either a more appropriate downgradient well be installed or an existing well be located for use in the monitoring program in place of well 7W.

Elevated PCE concentrations (88-269 ug/Kg) were detected in shallow soil samples (4-8 feet) near well 4W in June 2005. PCE concentrations decreased to approximately 1 ug/Kg in deeper soils (12-16 feet) from the same borings. Since groundwater concentrations continue to exceed MTCA Method A cleanup levels in well 4W after the HRC injection treatment, evaluation of additional soil remediation is recommended.

References

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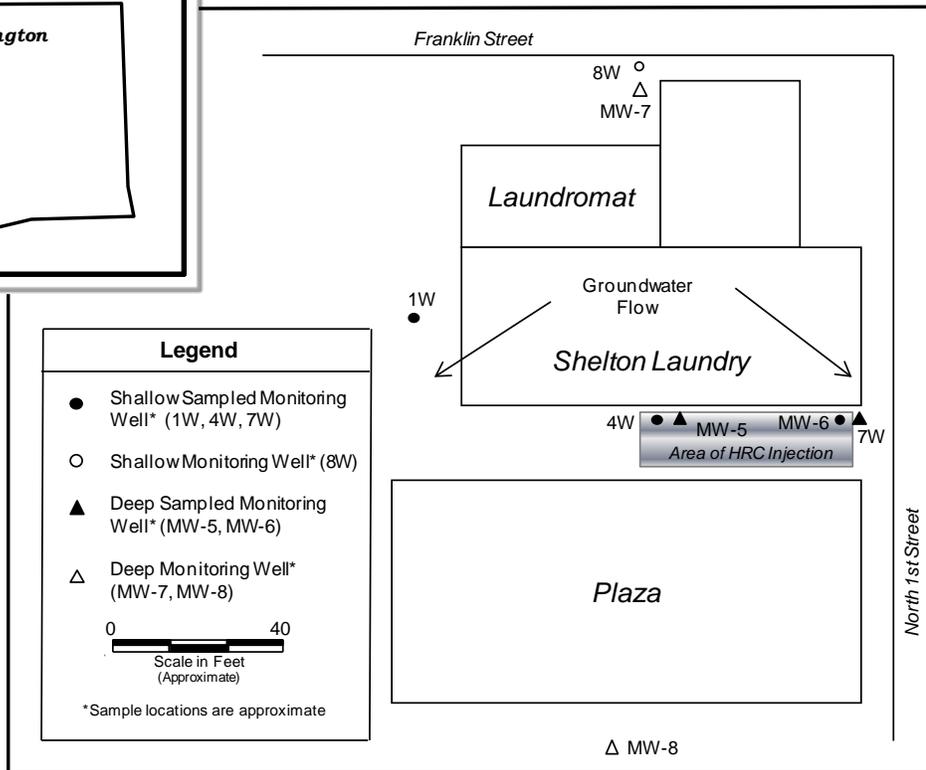
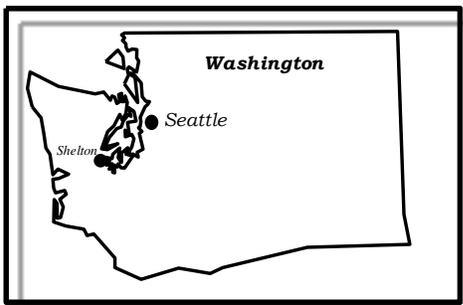
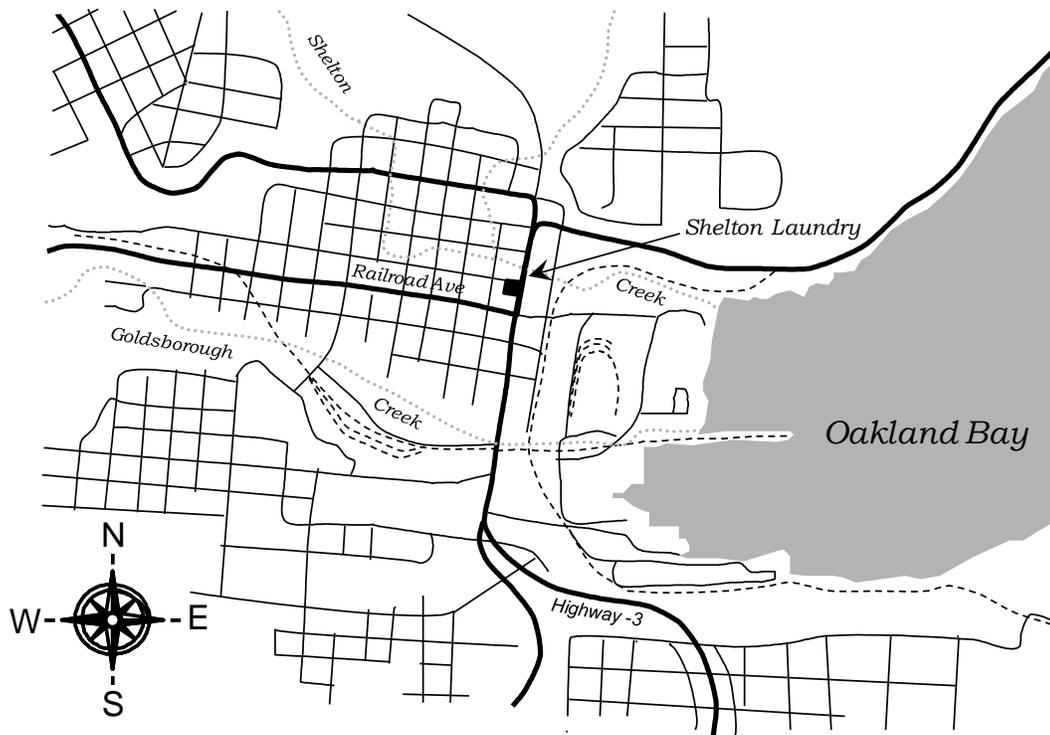
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Legend

- Shallow Sampled Monitoring Well* (1W, 4W, 7W)
- Shallow Monitoring Well* (8W)
- ▲ Deep Sampled Monitoring Well* (MW-5, MW-6)
- △ Deep Monitoring Well* (MW-7, MW-8)

0 ——— 40
Scale in Feet
(Approximate)

*Sample locations are approximate

Figure 1: Shelton Laundry and Cleaners Location and Site Detail.

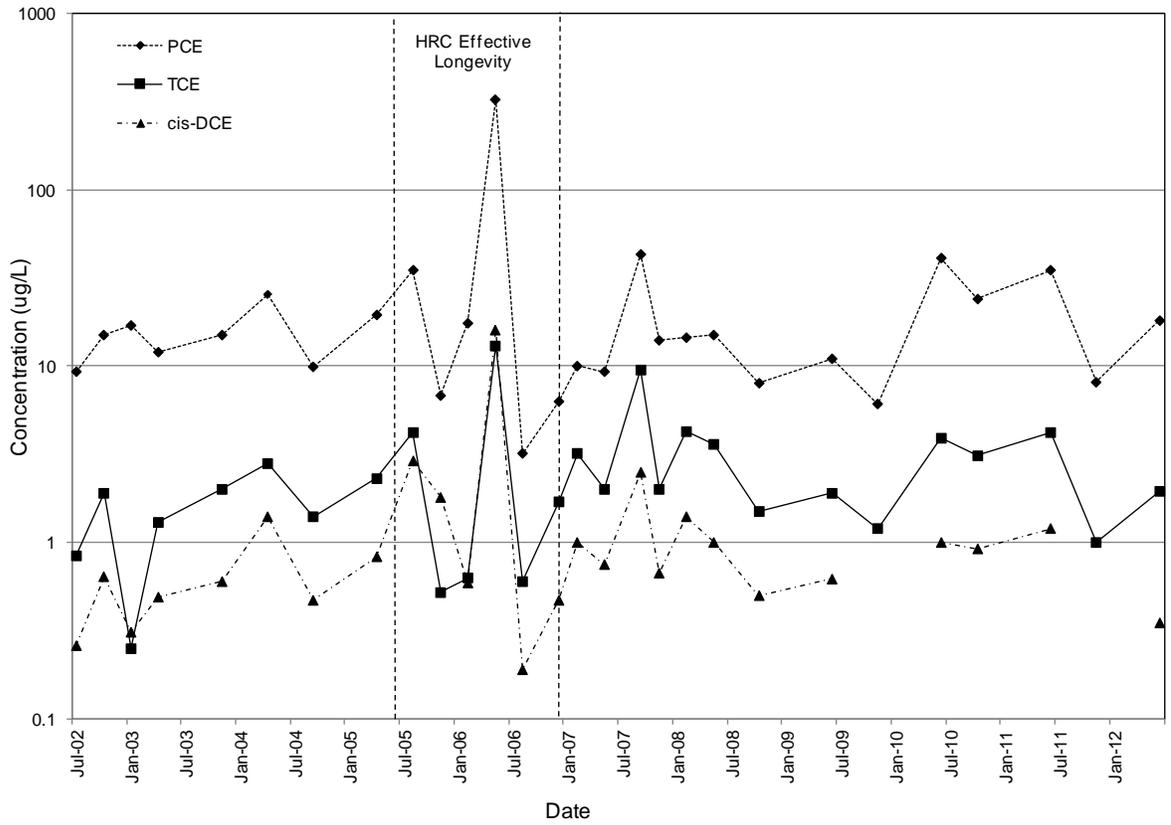


Figure 2: PCE, TCE, and cis-DCE Concentrations (ug/L – log scale) in well 4W, July 2002 through June 2012.

Table 2: PCE, TCE, and DCE Groundwater Results (ug/L), July 2002 through June 2012.

Well ID	Ecology															
	7/17/02	10/3/02	1/22/03	4/3/03	11/5/03	4/1/04	9/23/04	4/20/05	8/19/05	11/3/05	2/1/06	5/3/06	8/22/06	12/1/06	2/15/07	5/14/07
1W																
PCE	1 U	1 U	1 U	1 U	--	--	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
TCE	1 U	2 U	1 U	1 U	--	--	--	--	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4W																
PCE	9.3	15	17	12	15	26^a	9.9	20^a	35^a	6.8	18^a	324	3.2 J	6.3	10	9.3
TCE	0.84 J	1.9 J	0.25 J	1.3	2	2.8^a	1.4	2.3	4.2^a	0.52 J	0.63 J	13	0.60 J	1.7	3.2	2
DCE	0.26 J	0.64 J	0.31 J	0.49 J	0.60 J	1.4	0.47 J	0.83 J	2.9^a	1.8	0.59 J	16	0.19 J	0.47 J	1	0.75 J
7W																
PCE	1 U	0.19 J	1 U	1 U	1 U	1.7	0.47 J	0.15 J	0.38 J	1 U	0.53 J	1 U	1 U	1 U	1 U	1 U
TCE	1 U	2 U	1 U	1 U	1 U	1 U	0.26 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
DCE	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	1 U
8W																
PCE	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--	--	--	--	--
TCE	1 U	2 U	1 U	1 U	--	--	--	--	--	--	--	--	--	--	--	--
MW-5																
PCE	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
TCE	1 U	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	1 U	1 U
MW-6																
PCE	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U
TCE	1 U	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	1 U	1 U
MW-7																
PCE	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--	--	--	--	--
TCE	1 U	2 U	1 U	1 U	--	--	--	--	--	--	--	--	--	--	--	--
MW-8																
PCE	1 U	1 U	1 U	1 U	--	--	--	--	--	--	--	--	--	--	--	--
TCE	1 U	2 U	1 U	1 U	--	--	--	--	--	--	--	--	--	--	--	--

Bold = Analyte was detected.

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

UJ - Analyte was not detected at or above the reported estimated result.

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

^a Average concentration of duplicate samples.

Table 2 (continued): PCE, TCE, and DCE Groundwater Results (ug/L), July 2002 through June 2012.

Well ID	Ecology															
	9/7/07	11/30/07	2/19/08	5/14/08	10/20/09	6/12/09	11/20/09	6/10/10	10/15/10	6/10/11	11/8/11	6/12/12				
1W																
PCE	2 U	2 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U				
TCE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U				
4W																
PCE	43	14	15 J^a	15 J	8	11	6.1 J^a	41 J^a	24	35 J	8.1 J^a	18.1 J^a				
TCE	9.5	2	4.3 J^a	3.6	1.5	1.9	1.2	3.9 J^a	3.1	4.2 J	1.0 J	1.95 J^a				
DCE	2.5	0.67 J	1.4 J	1	0.5 J	0.62 J	1 U	1	0.92 J	1.2	1 U	0.35 J				
7W																
PCE	2 U	2 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	1 U				
TCE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U				
8W																
PCE	--	--	--	--	--	--	--	--	--	--	--	--				
TCE	--	--	--	--	--	--	--	--	--	--	--	--				
MW-5																
PCE	2 U	2 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	--				
TCE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--				
MW-6																
PCE	2 U	2 U	1 U	2 U	1 U	1 U	1 U	1 U	1 U	2 U	1 U	--				
TCE	2 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	--				
MW-7																
PCE	--	--	--	--	--	--	--	--	--	--	--	--				
TCE	--	--	--	--	--	--	--	--	--	--	--	--				
MW-8																
PCE	--	--	--	--	--	--	--	--	--	--	--	--				
TCE	--	--	--	--	--	--	--	--	--	--	--	--				

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

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

^a Average concentration of duplicate samples.