

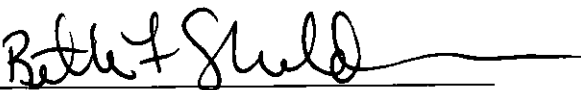
**Final Close-Out Report  
for  
Vancouver Water Station 1 Superfund Site  
WAD988519708  
Vancouver, Washington**

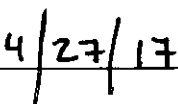
**April 2017**

**Prepared by:  
United States Environmental Protection Agency  
Region 10  
Seattle, Washington**

Approved by:

Date:

  
\_\_\_\_\_

  
\_\_\_\_\_

Beth Sheldrake, Acting Program Manager  
Remedial Cleanup Program  
U.S. EPA Region 10

**Final Close-Out Report  
Vancouver Water Station 1 Superfund Site  
WAD988519708  
Vancouver, Washington**

**I. INTRODUCTION**

This Final Close Out Report (FCOR) documents that the U.S. Environmental Protection Agency (EPA) has determined, in accordance with Close Out Procedures for National Priorities List Sites (OSWER Directive 9320.2-22, May 2011), that all appropriate response actions at the Vancouver Water Station 1 (WS1) Superfund Site (Site) have been successfully implemented by the EPA Region 10 with support from the City of Vancouver (City) which took the responsibility to operate and maintain the treatment system and to collect water samples to assure that the remedy was operating in accordance with the September 11, 1998 Record of Decision (ROD) issued for the Site.

**II. SUMMARY OF SITE CONDITIONS**

**Background**

The wellfield at WS1 has been owned by the City for over 60 years. WS1 lies within Waterworks Park located near the center of Vancouver, Washington, approximately 0.75 miles east of Interstate 5 and two miles north of the Columbia River (See Figure 1). The site is adjacent to commercial districts and residential areas. A summary of activities associated with the Superfund Site are listed in Table 1.

WS1 is a public water supply wellfield made up of ten production wells, five air-stripping towers and a holding reservoir used to provide storage capacity to accommodate daily fluctuations in water demand (See Figure 2). Water from WS1 is blended together with water from several other wellfields to provide drinking water to approximately 150,000 people in the Vancouver region. Approximately half of the total water system production is supplied by WS1.

The upper portion of the aquifer from which WS1 draws its water is approximately 200 feet below ground surface. It supplies water to several municipal wellfields and a number of private wells used mainly for irrigation. All new development within the city is required to connect to the public water supply system for all drinking water needs.

**Initial Investigation**

In March 1988, shortly after the federal Safe Drinking Water Act (SDWA) was amended to require suppliers of public drinking water to monitor for volatile organic compounds (VOCs), the City began monitoring VOCs in water supplied from all of its water stations. Results of this monitoring indicated a persistent presence of tetrachloroethylene (PCE) in the water at WS1 and Water Station 4 (WS4). In February 1989, in consultation with the Washington State Department of Health, the City notified the public of the presence of PCE in the groundwater at WS1 and WS4 as well as their actions to limit exposure through modifications in pumping rates at various

wells. As a result, PCE levels in the drinking water delivered to customers was consistently below the maximum contaminant level (MCL) established under the SDWA.

### **Historical Sources of Contamination**

In July 1989, the City initiated field investigations to determine if there was a source or sources of PCE or other VOCs near WS1. A soil-gas survey was conducted in the WS1 area, during which 19 soil-gas samples were collected and analyzed. In addition, groundwater samples were collected from five existing private wells located within a 1-mile radius of WS1. No pattern was found in the soil or groundwater data that might indicate the location of the potential source of PCE. Since the wellfield PCE concentrations were relatively low and suspected source areas were absent, no additional wells were installed at WS1 in an attempt to identify a PCE plume.

In August 1989, EPA Region 10 conducted another investigation to identify potential sources of PCE in the Vancouver area. Eight groundwater samples were collected from production wells at WS1 and Water Station 3 (located approximately 1 mile northwest of WS1) and from private wells within approximately a 1-mile radius of WS1. In addition, 194 soil-gas samples were collected throughout the city of Vancouver, 20 of which were collected in the vicinity of WS1.

In February and March of 1990, 100 additional soil-gas samples were collected from 40 locations north and east of WS1. In order to provide soil-gas depth profiles, multiple soil-gas samples were collected from each sampling location and analyzed in the field for VOCs.

Both the 1989 and 1990 phases of the investigation failed to identify a potential source of PCE entering WS1. PCE was detected in soil gas samples collected just north of WS1, although the concentrations were not high enough to indicate the area was responsible for the contaminated groundwater at WS1. Even though PCE concentrations at several production wells were above the MCL, similar results were not found at other monitored wells. Based on these results, EPA concluded that the likelihood of identifying a significant source was low and that further investigation into source identification were not warranted.

In 1993, the City installed five air stripping towers at WS1. All the water extracted from the WS1 production wells was routed through the air strippers prior to being distributed to customers. This treatment reduced PCE levels to below analytical detection limits.

### **Basis for Taking Action**

Water samples collected between 1988 and 1992 indicated the presence of PCE at concentrations up to 30 µg/L (6/28/93) in the groundwater used for the drinking water supplied from WS1. While the City managed the drinking water system such that the drinking water distributed to customers remained below the MCL of 5 µg/L, elevated concentrations of PCE continued to be present in the groundwater. Due to the persistent levels in groundwater, on June 23, 1993, EPA proposed WS1 for listing on the National Priorities List (NPL) (58 FR 34018). The NPL listing for the site (WAD988519708) was finalized on May 31, 1994 (59 FR 27989).

A baseline risk assessment completed by EPA quantified potential risks to future residents consuming untreated water ranged from 1E-06 to 6E-06 (1 to 6 excess cancers in 1,000,000 people). While this level of risk is within the National Contingency Plan (NCP) acceptable risk

range, EPA found it was necessary to take action at WS1 because the groundwater at several production wells had been shown to have persistent concentrations of PCE above the MCL. This decision was consistent with EPA guidance (*Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, 1991) and with the requirement in the NCP that MCLs be met in groundwater, not just at the tap.

### **Record of Decision**

EPA issued the ROD for Vancouver Water Station 1 on September 11, 1998.

### ***Contaminant of Concern***

The ROD identified tetrachloroethylene (PCE) as the only Contaminant of Concern (COC).

### ***Remedial Action Objectives***

The RAOs are:

*Protect human health by reducing concentrations of PCE and other VOCs in drinking water produced from WS1 to below the MCL specified in regulations promulgated under the federal Safe Drinking Water Act (SDWA) and in the state drinking water regulations.*

*Protect human health by reducing concentrations of PCE and other VOCs in groundwater at WS1 to below the Method A cleanup level specified in the Washington State Model Toxics Control Act (MTCA) regulations and below the federal and state drinking water standards (MCLs).*

A groundwater cleanup level of 5.0 µg/L was established for PCE at the time the ROD was issued based on the federal MCL and the state groundwater cleanup level. (both 5.0 µg/L for PCE)

### ***The Selected Remedy***

The selected remedy called for pumping WS1 at a rate consistent with customer demand, treatment of the water using air stripping, and distribution of the treated water to customers as drinking water. The selected remedy also included monitoring of the water extracted from each extraction well as well as the treated drinking water. The remedy did not include any source control actions.

### ***Air Stripping***

EPA's selected remedy required continued operation of the City's air-stripping system at WS1. The City installed the air stripping system in 1993 and continues to operate and maintain the system. The treatment continues to reduce the PCE concentration in the drinking water to below detectable levels, thus eliminating the threat posed to human health from exposure to PCE in drinking water. Treatment is to be continued until the City, the Washington State Department of Ecology (Ecology), and EPA agree that the remedial action objectives have been met and the treatment can be terminated.

#### *Groundwater Cleanup*

No ongoing source of PCE in the groundwater at WS1 was identified. Therefore, the remedy focused on treatment of the groundwater extracted for drinking water purposes. Even though PCE sources were not specifically addressed, the concentration of PCE in groundwater in the production wells was expected to eventually decrease to a level below the MCL. As such, the ROD selected the continued use of this "pump-and-treat" system as the means of reducing the concentration of PCE in groundwater near WS1, eventually flushing out residual contaminants from the wellfield to a level that would attain remedial action objectives.

#### *Groundwater Monitoring*

The selected remedy included periodic monitoring of the groundwater to evaluate the effectiveness of, and the need for, continued operation of the treatment system. The monitoring plan required sampling at each production wellhead and at a point following treatment. Due to the nature of the remedy, no monitoring upgradient of the production wells was required. Decisions to continue and/or modify the monitoring program are to be made by EPA in conjunction with the State and the City of Vancouver.

#### *Institutional Controls*

No Institutional Controls were identified as part of the selected remedy as all domestic water in the area is supplied by the City and thus, being treated under the remedy.

#### **Remedy Implementation**

The air stripping system at WS1 has been effectively removing PCE from the City's water supply since 1993 and thus, was incorporated into EPA's 1998 remedy. Groundwater is pumped at a rate between 8 and 19 million gallons per day, treated by the air strippers and distributed to customers as drinking water. Periodic monitoring of the PCE levels in the groundwater and drinking water continues to be performed by the City. In addition, EPA monitored for PCE and other VOCs prior to each Five Year Review.

A Preliminary Close Out Report documenting the completion of construction activities was signed by EPA on September 25, 1998. The Site was identified as "Sitewide Ready for Anticipated Use" on September 28, 2012.

### **III. MONITORING RESULTS AND ATTAINMENT OF GROUNDWATER CLEANUP LEVELS**

The 1998 ROD requires treatment and groundwater monitoring until such time as the PCE concentrations at all monitoring locations is below the MCL of 5.0 µg/L. As there have been no changes to the federal or state drinking water standards for PCE or changes in the toxicity factors for PCE since the ROD was issued, this cleanup level remains protective of human health and the environment.

In January 2017 the City provided EPA with an Excel Spreadsheet containing the PCE data collected between 1988 and 2016. (COV, 2017). For the last several years the City sampled

twelve (12) production wells and the effluent (Reservoir) from the air stripping towers every other week. A subset of the recent data is presented in Table 2 and plotted in Figure 3.

In August 2014 the EPA published a "*Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Action at a Groundwater Monitoring Well*" (OSWER 9283.1-44, August 2014). This recommended approach focused on two phases of monitoring, the *remediation phase* and the *attainment monitoring phase*.

At this Site, the first phase began when the stripping towers were installed and began operating in 1993. The trend plots of data collected from each monitoring location between 2003 and 2012 were presented in the 2013 Five Year Review (see Figure 4 for an example). The data indicated that the PCE concentrations had been significantly below the MCL at all wells except for Well 1 where several spikes in PCE above the MCL were still being reported. Based on these data, EPA determined that, for purposes of assessing attainment, all wells had reached the attainment monitoring phase by the end of 2012.

EPA's 2014 groundwater approach recommended that a minimum of eight (8) data points be used to evaluate attainment at each monitoring location and that cleanup levels be attained at all wells prior to Site Completion. In order to assist with that assessment, a *Groundwater Statistics Tool* (EPA, 2014) was developed. The tool may be used to run a Mean test or a Trend test. This statistical tool will calculate the upper confidence limit (UCL) of the mean and account for uncertainty around the true mean. In general, the 95 percent confidence limit is used for the UCL determination (EPA, 2009).

Figure 3 presents the data collected since January 2013 from the twelve production wells and the reservoir (treated drinking water) at WS1. The data clearly indicate that PCE concentrations at 10 of the monitored locations (Well 2-5 and Well 8-13) have been below 2µg/L throughout the attainment monitoring period. EPA has determined that the cleanup goal of 5µg/L for PCE has been attained at each of these monitoring locations. An eleventh well, Well 7, spiked above the MCL of 5µg/L in early 2013 but dropped below the MCL in mid-2013 and remained below 3 µg/L for the rest of the period.

Production Well 1 experienced levels of PCE above the MCL in 2013 and 2015. As such, the EPA Groundwater Statistics Tool was used to evaluate attainment at this well (EPA, 2014). Since the tool limits input data to 20 data points, EPA used a subset of the data from across the period for the evaluation (see Table 2). EPA's analysis of the data (see Appendix) indicated the 95% UCL was 4.41 µg/L, below the MCL of 5 µg/L. In addition, the analysis indicated a downward trend, thus indicating future attainment is likely (see Figure 5). Thus, EPA determined that attainment of the cleanup level at Production Well 1 has been attained and confirmed through a statistical test (95% UCL).

In order to further assess the protectiveness of the remedy, EPA analyzed VOCs in groundwater samples collected in advance of each of the previous three Five-Year Reviews. PCE was the only analyte to exceed the MCL in any of the samples. Low levels of trichloroethylene (TCE) were detected in 3 of the 5 samples collected in 2003 and 1 of the 7 samples collected in 2008. No TCE was detected during the 2013 sample event. The highest TCE concentration reported was 1.0

µg/L, well below the MCL of 5.0 µg/L. Based on these sample results, EPA expects the MCL for all VOCs to be met in the drinking water and groundwater at WS1.

Due to the potential carcinogenicity of 1,4-dioxane and its association with PCE and other VOCs, in 2003 EPA analyzed samples for 1,4-dioxane (EPA, 2003). 1,4-dioxane was not detected in any of the samples and thus, not expected to be a concern at WS1.

EPA has found no significant changes at the Site that may affect protectiveness of the remedy selected in the 1998 ROD nor identified any other information that would call into question the protectiveness of that remedy. As such, EPA finds that the results of the groundwater sampling have demonstrated attainment of the groundwater cleanup levels and RAOs established for this Site and that the remedy has been successfully implemented. No further treatment or monitoring are required under CERCLA.

#### **IV. SUMMARY OF FUTURE OPERATION AND MAINTENANCE REQUIRED**

No further operations or maintenance actions are required.

#### **V. DEMONSTRATION OF CLEANUP ACTIVITY QUALITY ASSURANCE AND QUALITY CONTROL**

The Preliminary Close Out Report documented completion of construction activities at the Site and concluded that the "City of Vancouver had constructed and is operating the remedy in accordance with plans and specifications". Furthermore, the report documented that the system had been operating successfully for several years and had "proven to be efficient and effective in removing VOCs including PCE from the drinking water". Water quality samples collected by the City of Vancouver have been collected consistent with the sampling plan adopted for SDWA compliance. Samples were analyzed at an accredited lab secured through a competitive process.

The EPA collected groundwater samples from monitoring wells, production wells and influent & effluent of the treatment system June 2003, April 2008 and April 2013 as part of the Five Year Review (EPA, 2003, 2008 & 2013). The objective of these sampling efforts was to determine the water quality or the concentration of PCE in the groundwater from selected monitoring wells, production wells, and influent & effluent. The samples were analyzed by the EPA Region 10 laboratory consistent with a Quality Assurance Project Plan. As part of each Five Year Review the EPA found that the data collected during the EPA sampling event compared reasonably well with the data collected by the City.

#### **VII. FIVE-YEAR REVIEW**

Three policy Five-Year Reviews have been completed at the Site, the last one in September 2013.

No issues or follow-up actions were identified as part of the 2013 Five Year Review. The protectiveness statement stated "The remedy at Vancouver WS1 is protective of human health and the environment because the treatment system is functioning as intended and human and ecological risks are under control. Long-term protectiveness of the remedial action will be verified by regular monitoring by the City of Vancouver."

The analysis conducted since the last FYR indicates that the remedy has been fully implemented and the RAOs and related cleanup levels have been attained. No hazardous substances, pollutants or contaminants remain above levels that could prevent unlimited use and unrestricted exposure. Therefore, no further Five-Year Reviews are required.

## **VIII. SITE COMPLETION CRITERIA**

The implemented remedy achieves the degree of cleanup or protection specified in the 1998 ROD for all pathways of exposure. All selected remedial action objectives and associated cleanup goals are consistent with agency policy and guidance. This Site meets all the site completion requirements as specified in OSWER Directive 9320.2-22, Close-Out Procedures for National Priorities List Sites. All remedial activities at the Vancouver Water Station 1 Superfund Site are complete and the Site poses no unacceptable risk to human health or the environment. Therefore, the EPA has determined that no further response action is necessary at the Vancouver Water Station 1 Superfund Site.



## References

City of Vancouver, 2017, *Ground Water Quality Database for PCE, Water Station 1 and 4*, City of Vancouver, Vancouver, Washington, January 2017

U.S. EPA, 1991, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*

U.S. EPA, 1998, *Record of Decision, Vancouver Water Station 1, Vancouver, Washington*.  
September 11, 1998.

U.S. EPA, 1999, *Vancouver Water Station #1, Preliminary Close Out Report*, September 25, 1988

U.S. EPA, 2003, *Trip Report – Groundwater Sampling at the City of Vancouver’s Water Station #1 & 4*, September 2003.

U.S. EPA, 2003, *Third Five Year Review Report for Vancouver Water Stations 1 and 4, City of Vancouver, Vancouver, Washington*, September 2003.

U.S. EPA, 2008, *Third Five Year Review Report for Vancouver Water Stations 1 and 4, City of Vancouver, Vancouver, Washington*, September 2008.

U.S. EPA, 2009, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance, EPA 530/R-09-007*, March 2009.

U.S. EPA, 2012, *Sitewide Ready for Anticipated Use*, September 28, 2012.

U.S. EPA, 2013, *Third Five Year Review Report for Vancouver Water Stations 1 and 4, City of Vancouver, Vancouver, Washington*, September 2013.

U.S. EPA, 2014, *Groundwater Statistics Tool User’s Guide*, OSWER 9283.1-46, July 2014.

U.S. EPA, 2014, *Recommended Approach for Evaluating Completion of Groundwater Restoration Remedial Action at a Groundwater Monitoring Well*, OSWER 9283.1-44, August 2014.

# Tables

Table 1- Chronology of Site Events at Vancouver Water Station 1

Table 2- City of Vancouver – Water Station #1 Groundwater PCE Concentrations ( $\mu\text{g/L}$ ) at the Production Wells and Reservoir 2012 to 2016

**Table 1 - Chronology of Site Events at Vancouver Water Station 1**

<b>Event</b>	<b>Date</b>
EPA monitoring detected PCE contamination in WS1 and WS4	March 1988
City of Vancouver notified public of PCE groundwater contamination at both WS1 and WS4	February 1989
EPA proposed MCL for PCE (5 µg/L)	May 1989
EPA initiated investigations for PCE sources near WS1	August 1989
EPA Issued final MCL for PCE (5 µg/L)	January 1991
City of Vancouver expanded monitoring at WS1 to include weekly PCE analysis	1991
EPA conducted a hydrogeologic assessment of the Vancouver area and installed 5 GW monitoring wells near WS1.	Fall 1992
City of Vancouver installed 5 air stripping towers at WS1	May 1993
Vancouver WS1 was proposed for the NPL	June 1993
EPA evaluated WS1 for potential removal actions	1993
WS1 Officially placed on the NPL	June 1994
WDOH/ATSDR Preliminary Public Health Assessment concludes that no apparent human health hazard exists from drinking water at WS1	Fall 1994
EPA postponed further investigations due to funding constraints	Fall 1994
EPA samples GW at all 5 monitoring wells at WS1	July 1997
EPA initiates WS1 RI/FS	November 1997
EPA released final RI/FS report	July 1998
EPA released the proposed plan	July 1998
WS1 ROD signed	September 1998
WS1 Preliminary Close Out Report signed	September 1998
Drinking water treated by air stripping	1993 – present
First Five Year Review completed	September 2003
Second Five Year Review completed	September 2008
Sitewide Ready for Anticipated Use signed	September 2012
Third Five Year Review completed	September 2013

**Table 2****City of Vancouver – Water Station #1 Groundwater PCE Concentrations( $\mu\text{g/L}$ ) at the Production Wells and Reservoir; 2012 to 2016**

Date	Well #1	Well #2	Well #3	Well #4	Well #5	Well #7	Well #8	Well #9	Well #10	Well #11	Well #12	Well #13	Reservoir
1/2012	4.5	0.4	0.6	1.0	0.9	2.6	0.5	0.4	1.0	0.9	0.6	0.4	0.4
4/2012	2.5	0.4	1.0	0.9	0.6	1.0	NA	0.4	0.6	0.6	0.4	0.8	0.4
8/2012	3.9	0.4	0.4	0.6	0.9	2.4	0.5	0.4	0.4	0.8	0.4	0.5	0.4
12/2012	4.1	0.4	0.4	0.8	0.7	1.5	1.1	0.4	1.2	0.4	0.7	0.7	0.4
1/2013	6.9	0.4	0.8	1.1	0.8	3.1	1.8	0.4	1.4	0.6	1.0	0.9	0.4
5/2013	4.4	0.4	0.5	1.1	1.0	5.4	0.7	0.4	0.4	0.7	0.8	0.6	0.4
7/2013	8.8	0.4	NA	0.7	0.9	2.4	0.6	0.4	0.4	0.5	0.6	0.4	0.4
10/2013	4.4	0.4	0.4	0.4	0.4	1.6	0.4	0.5	0.4	0.5	0.9	0.6	0.4
1/2014	4.9	0.4	0.4	0.8	0.8	2.1	0.5	0.4	0.4	0.7	0.8	0.4	0.4
4/2014	2.9	0.4	0.4	0.8	0.9	0.8	0.5	0.4	0.4	0.8	0.4	0.7	0.4
7/2014	3.4	0.4	0.5	0.4	0.4	1.0	0.5	0.4	0.4	0.4	0.4	0.6	0.4
10/2014	3	0.4	NA	0.4	0.6	0.9	0.6	0.4	0.4	0.9	0.4	0.4	0.4
1/2015	1	0.4	0.8	0.9	1.2	NA	0.8	0.4	0.4	1.3	0.7	0.6	0.4
4/2015	3	0.4	0.4	0.4	0.8	0.8	0.8	0.4	0.4	1.0	0.4	NA	0.4
7/2015	5.8	0.4	0.7	0.8	1.0	1.8	1.1	0.4	0.4	1.3	0.6	NA	0.4
9/2015	1	0.4	1.1	0.9	0.9	0.9	1.1	0.4	0.4	1.2	0.4	NA	0.4
12/2015	1.7	0.4	0.4	0.6	0.9	0.7	0.4	0.4	0.4	1.0	0.4	NA	0.4
2/2016	1.9	0.4	0.4	0.9	0.9	0.4	0.4	0.4	0.4	0.9	0.4	NA	0.4
5/2016	3.4	0.4	0.6	1.0	1.1	0.7	1.0	0.4	0.4	NA	0.4	NA	0.4
9/2016	1.2	0.4	0.4	0.4	0.9	0.7	0.8	0.4	0.4	1.0	NA	0.6	0.4
12/2016	2.3	0.4	0.4	0.5	0.9	0.7	0.9	0.4	0.4	1.3	0.4	0.5	0.4

All groundwater concentrations are  $\mu\text{g/L}$

The Reporting limit for PCE is  $0.4 \mu\text{g/L}$

NA- Not available for sampling

This data was provided to EPA-Region 10 by the City of Vancouver

Reservoir is the water quality concentration of PCE for all of the Production wells after treatment or the effluent water sample.

# Figures

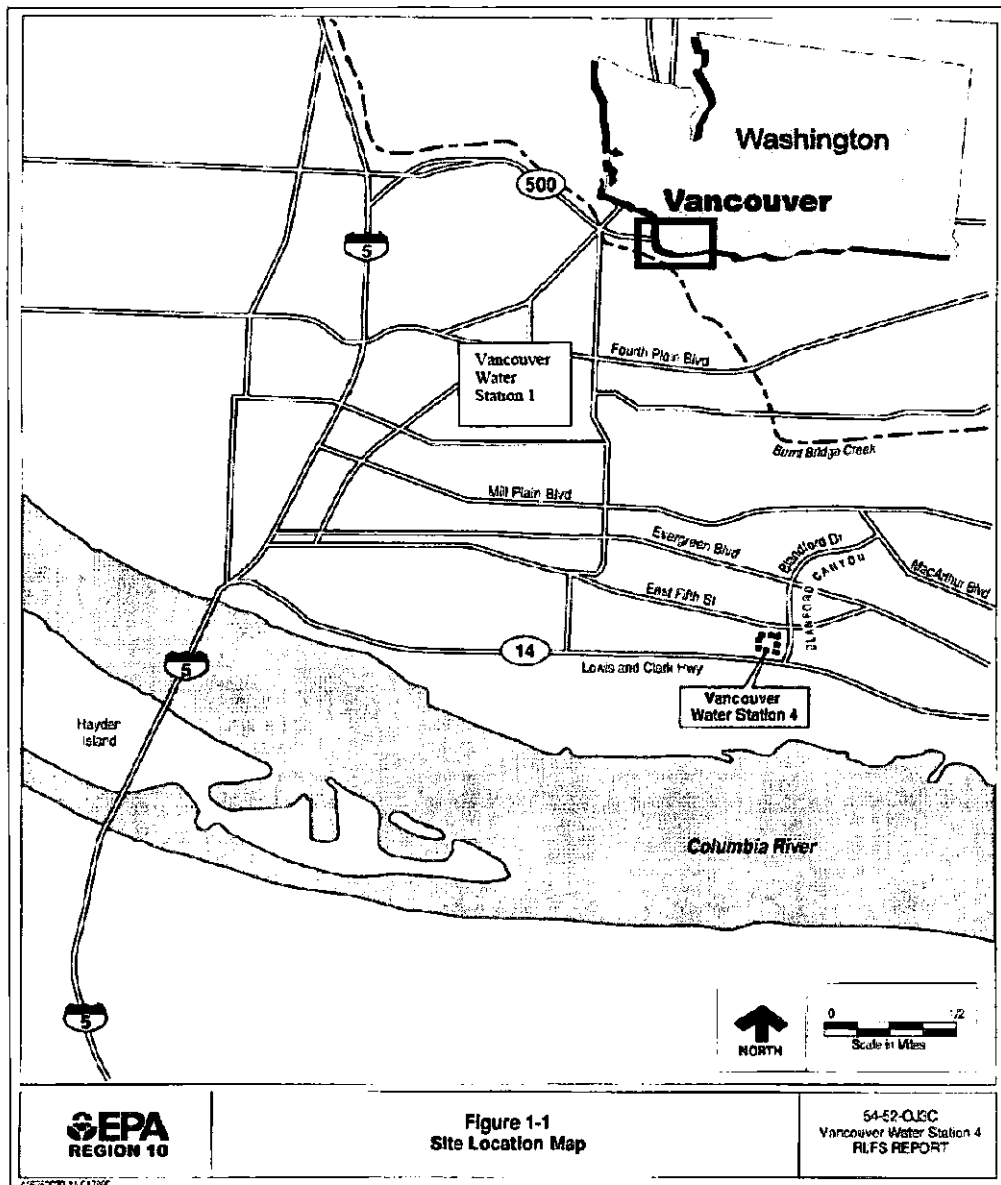
Figure 1 - Site Location Map

Figure 2 - Production Well Locations for Water Station 1

Figure 3 - Recent Water Station #1 Well Data and Attainment Phase Monitoring

Figure 4 – Trend Plot, PCE Concentration vs Time for Well 1 Remediation Phase Monitoring; 2003 to 2012

Figure 5 - Trend Plot, PCE concentration vs Time for Well 1 Attainment Monitoring; 2013 to 2016



**EPA**  
REGION 10

Figure 1-1  
Site Location Map

54-E2-016C  
Vancouver Water Station 4  
RIFS REPORT

Figure 1 - Site Location Map

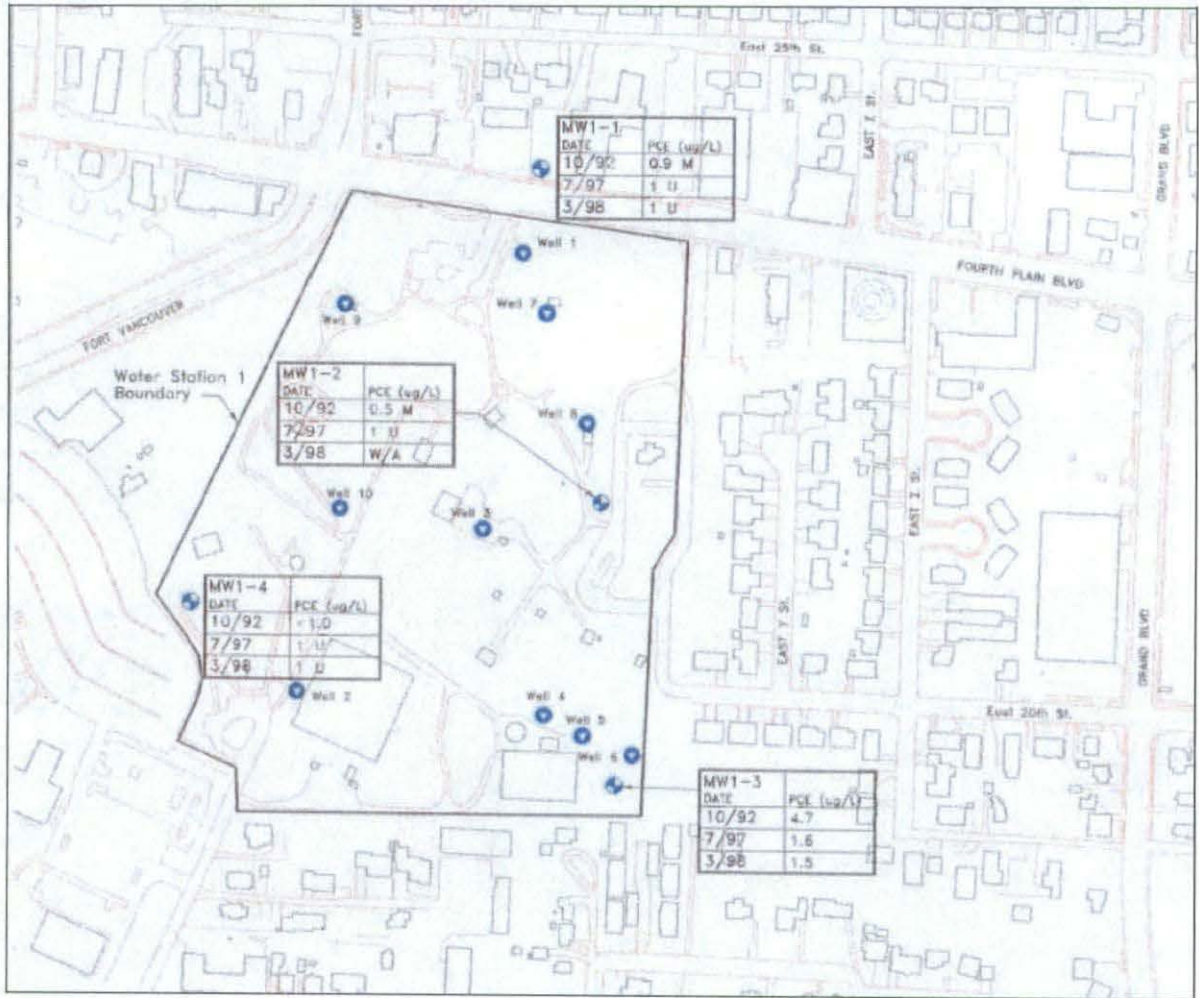
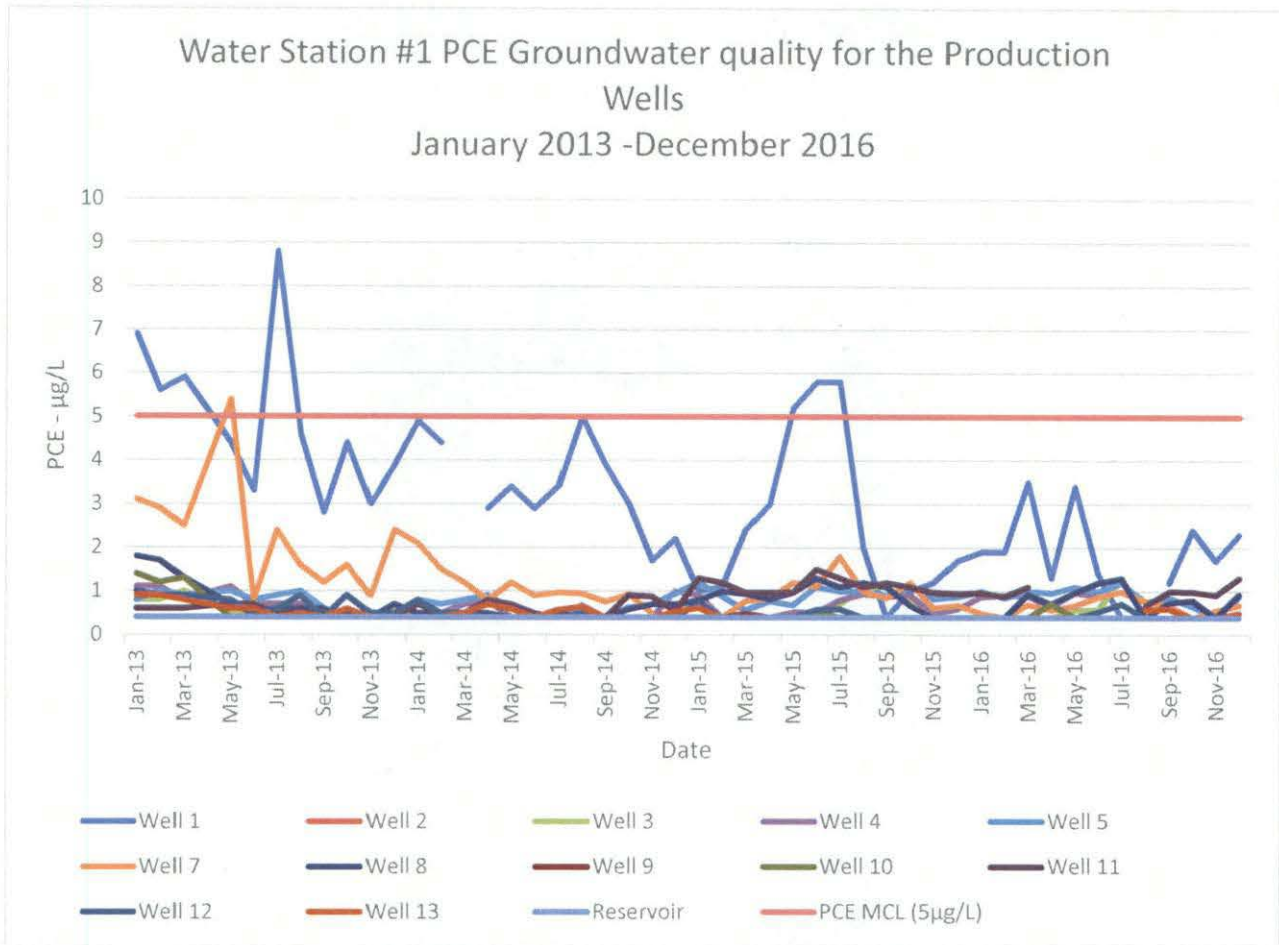


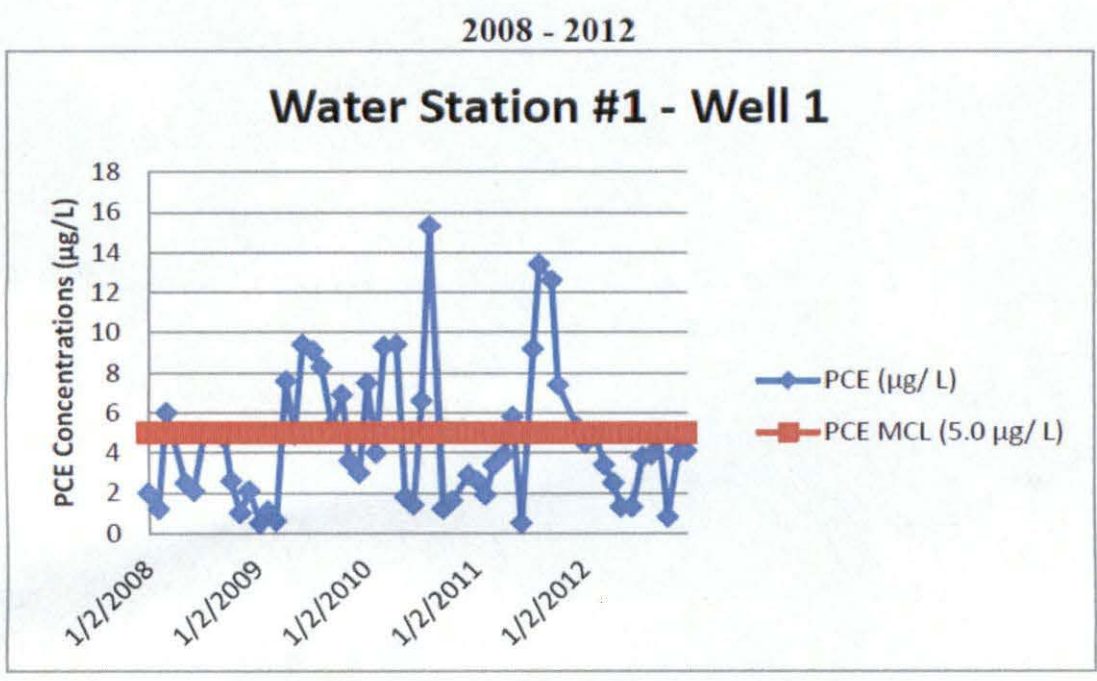
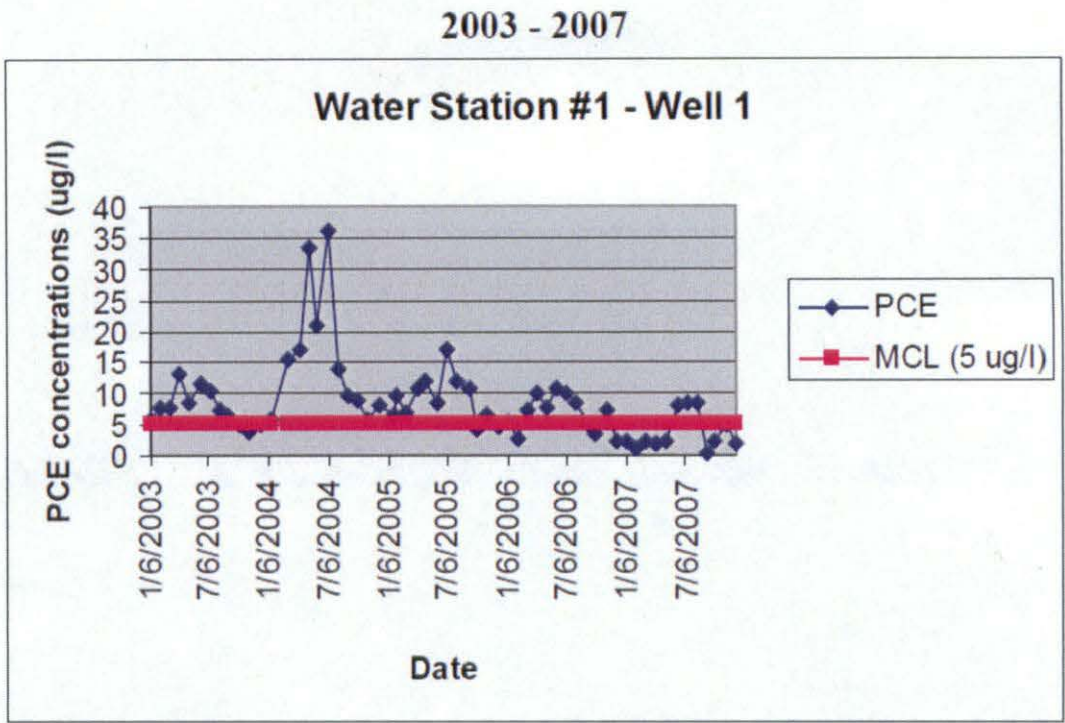
Figure 2 - Production Well Locations for Water Station 1

**Figure 3 - Recent Water Station #1 Well Data and Attainment Phase Monitoring**

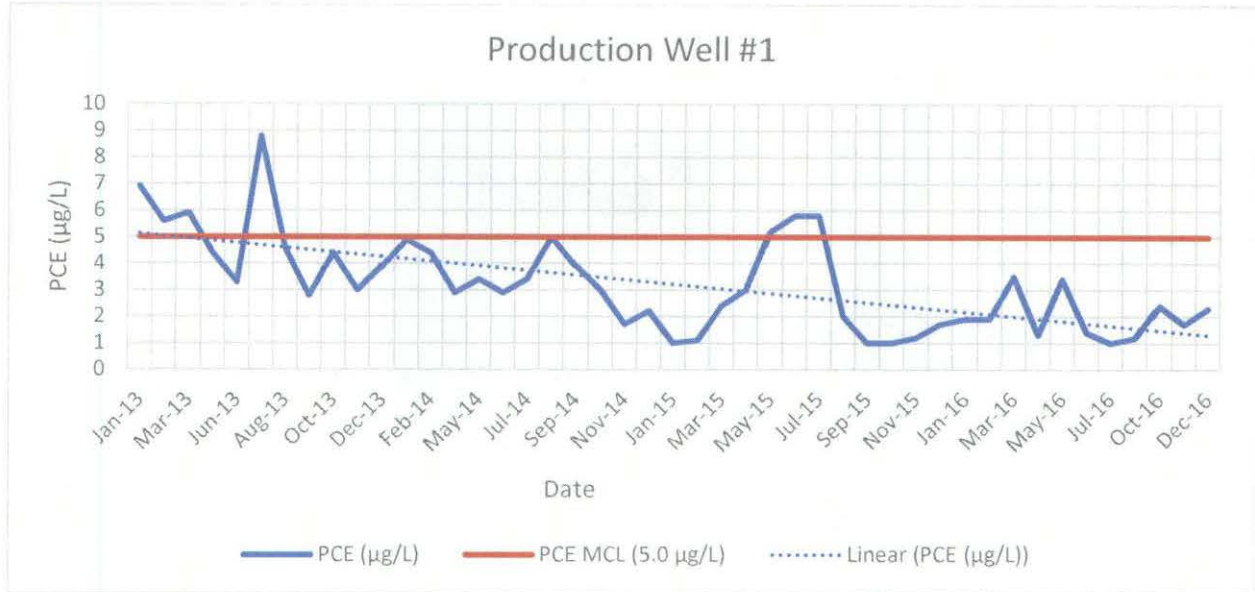




**Figure 4 – Trend Plot, PCE  
Concentration vs Time for Well 1  
Remediation Phase Monitoring; 2003  
to 2012**



**Figure 5 - Trend Plot, PCE  
 Concentration vs Time for Well 1  
 Attainment Monitoring; 2013 to 2016**



# Appendix

## Groundwater Statistic Tool

### Data Input Worksheet

#### Groundwater Statistics Tool

Data input worksheet

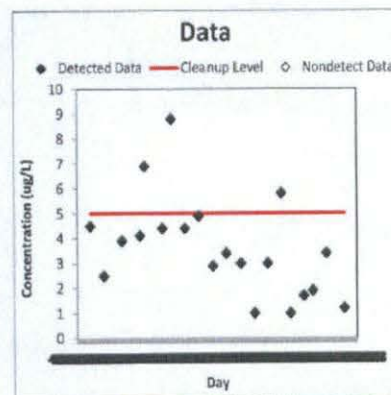
Site Name	V Water Station #1
Operating Unit (OU)	
Type of Evaluation	Attainment
Date of Evaluation	March 15 2017
Person performing analysis	Bernie Zavala

Chemical of Concern	PCE
Well Name/Number	Production Well 1
Date Units	Date
Concentration Units	ug/L

Confidence Level Desired	95%
Cleanup Level	5
Source of cleanup level (e.g. MCL or risk-based concentration)	MCL
Risk of False Outlier Rejection	10%
Random Seed (may be left blank)	
Significant figures to use	3

Number of data points:	20
Number of detected results:	20
Number of nondetect results:	0
Detection frequency:	1

Date (Date)	PCE Concentration (ug/L)	Data Qualifier	Detected? (Yes or No)
1/1/2012	4.5		Yes
4/1/2012	2.5		Yes
8/1/2012	3.9		Yes
12/1/2012	4.1		Yes
1/1/2013	6.9		Yes
5/1/2013	4.4		Yes
7/1/2013	8.8		Yes
10/1/2013	4.4		Yes
1/1/2014	4.9		Yes
4/1/2014	2.9		Yes
7/1/2014	3.4		Yes
10/1/2014	3		Yes
1/1/2015	1		Yes
4/1/2015	3		Yes
7/1/2015	5.8		Yes
9/1/2015	1		Yes
12/1/2015	1.7		Yes
2/1/2016	1.9		Yes
5/1/2016	3.4		Yes
9/1/2016	1.2		Yes



Axis Values			
Time		Concentration	
Min	Max	Min	Max
Auto	Auto	Auto	Auto

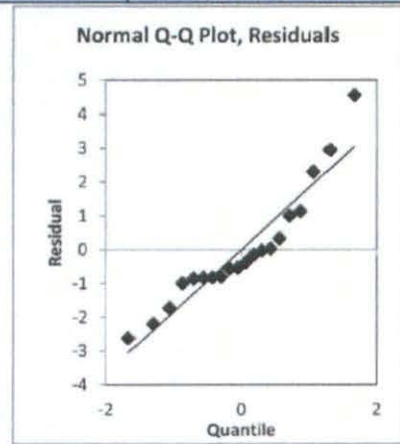
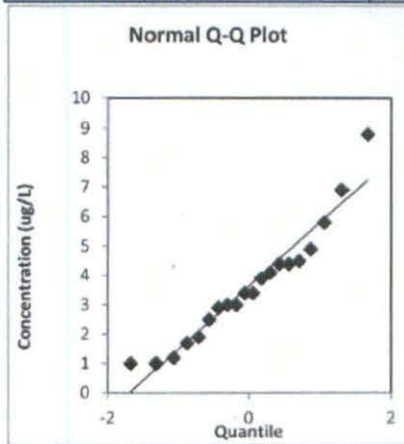
**Reset Concentration Axis**

Data Review		Recommendations
Are all necessary data fields entered, and in proper format?	Yes	None
Are at least 4 data points present for statistical analysis?	Yes	None
Are detection limits for nondetects ≤ maximum detected value?	Yes	None
Are all data within chart axis limits?	Yes	None

# Groundwater Statistics Tool

## Normality Testing Worksheet

Normality Test Results			
Parameter	All Data	Minus Outliers	Residuals
Number of data points	20	20	20
Shapiro-Wilk alpha value	1%	N/A	1%
Slope	2.154867122	N/A	1.825016342
Intercept	3.635	N/A	-7.3469E-16
Correlation, R	0.965697809	N/A	0.944878936
Exact Test Value	0.937653102	N/A	0.909553925
Critical Value	0.868	N/A	0.868
Conclude sample distribution:	Appears normal	N/A	Appears normal

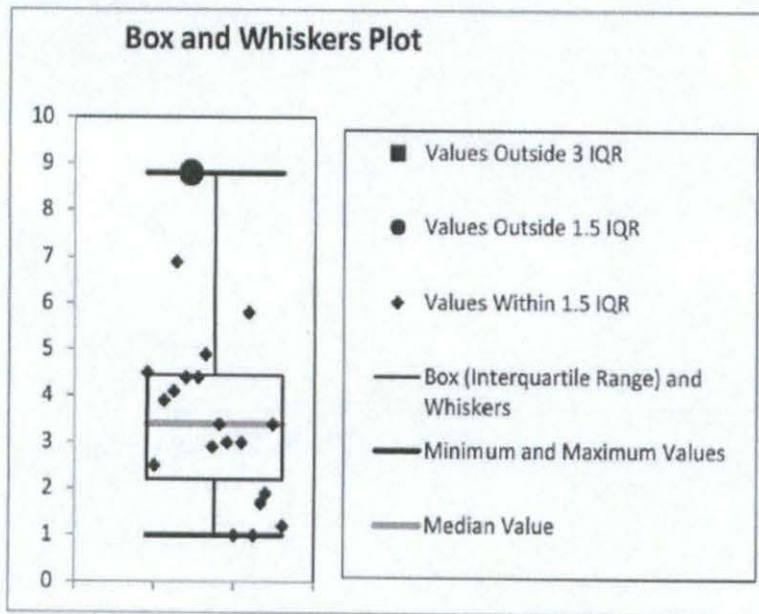


Previous Step: Outliers Screen
Next Step: Trend Screen
Skip Step: UCL Screen

# Groundwater Statistics Tool

## Outlier testing worksheet

Dixon's Outlier Test Results		
Number of data points	20	
Risk of false rejection	10%	
Critical value	0.401	
<b>Outlier type</b>	<b>Low</b>	<b>High</b>
Test statistic	0.0417	0.3947
Potential Outlier?	No	No
Validity of Dixon's Test	Valid	

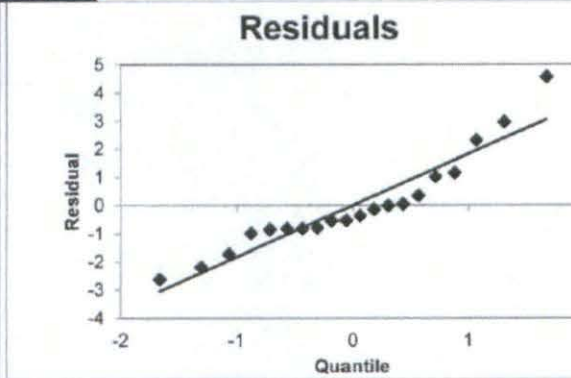


## Groundwater Statistics Tool

Trend test results for datasets with normally distributed residuals (with our without transformation)

i	t ( Date)	C (ug/L)	C Predicted	Fit residual	Upper Confidence Band
1	1/1/2012	4.5	5.29	-0.79	7.08
2	4/1/2012	2.5	5.11	-2.61	6.77
3	8/1/2012	3.9	4.88	-0.98	6.36
4	12/1/2012	4.1	4.65	-0.55	5.96
5	1/1/2013	6.9	4.59	2.31	5.86
6	6/1/2013	4.4	4.36	0.04	5.49
7	7/1/2013	8.8	4.24	4.56	5.31
8	10/1/2013	4.4	4.06	0.34	5.05
9	1/1/2014	4.9	3.89	1.01	4.82
10	4/1/2014	2.9	3.71	-0.81	4.62
11	7/1/2014	3.4	3.54	-0.14	4.45
12	10/1/2014	3	3.38	-0.38	4.3
13	1/1/2015	1	3.19	-2.19	4.18
14	4/1/2015	3	3.01	-0.01	4.09
15	7/1/2015	5.8	2.84	2.96	4.01
16	9/1/2015	1	2.72	-1.72	3.97
17	12/1/2015	1.7	2.55	-0.85	3.91
18	2/1/2016	1.9	2.43	-0.53	3.87
19	5/1/2016	3.4	2.28	1.14	3.83
20	9/1/2016	1.2	2.02	-0.82	3.78

Ordinary Least Squares	
Slope	-0.001917983
Intercept	83.75221559
Correlation, R <sup>2</sup>	0.2508
Test Result	Decreasing
Test Statistic	-2.454
Critical Value	1.734
When is the concentration predicted to exceed the cleanup level?	Not applicable - slope is not statistically increasing



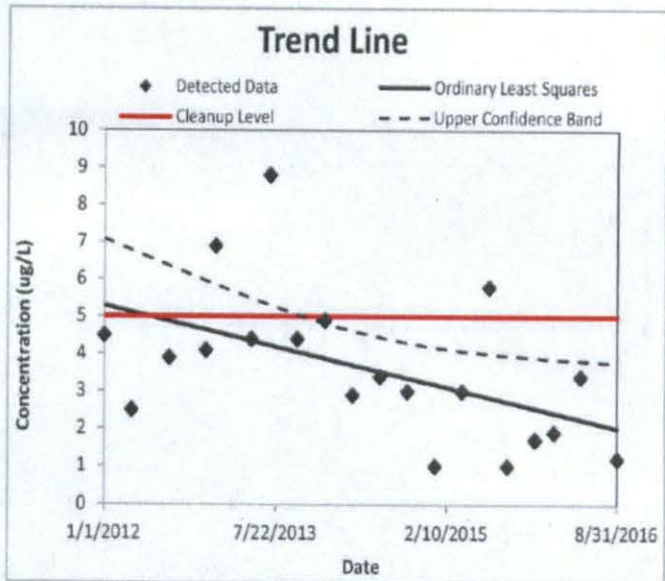
# Groundwater Statistics Tool

UCL calculations and summary statistics for data sets that are normally distributed

Site Name	V Water Station #1
Operating Unit (OU)	0
Type of Evaluation	Attainment
Date of Evaluation	March 15 2017
Person performing analysis	Bernie Zavala

Chemical of Concern	PCE
Well Name/Number	Production Well 1
Date Units	Date
Concentration Units	ug/L

Confidence Level	95%
Number of results	20
Number < cleanup level	17
Are any potential outliers present?	No
Mean of concentration	3.64
Standard deviation of concentration	1.99
t-value for UCL calculation	1.729



95% Upper Confidence Limit (UCL)	4.41
Method for calculating UCL	Student's t UCL
Value of 95% Upper Confidence Band value at final sampling event	3.78
Trend calculation method	Ordinary Least Squares
Cleanup level	5
Source of cleanup level	MCL
Is the trend decreasing or statistically insignificant?	Yes

When is the concentration predicted to exceed the MCL?	Not applicable - slope is not statistically increasing
Message: None.	