

CALCULATION OF CONCENTRATION SUMMARY STATISTICS FOR MONITORING WELLS OF THE 200-ZP-1 PERFORMANCE MONITORING PLAN (PMP) FOR THE CALENDAR YEAR 2019 (CY 2019)

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

**P.O. Box 1600
Richland, Washington 99352**

CALCULATION OF CONCENTRATION SUMMARY STATISTICS FOR MONITORING WELLS OF THE 200-ZP-1 PERFORMANCE MONITORING PLAN (PMP) FOR THE CALENDAR YEAR 2019 (CY 2019)

Date Published
September 2020

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company
P.O. Box 1600
Richland, Washington 99352

APPROVED

By Lynn M. Ayers at 1:47 pm, Sep 23, 2020

Release Approval

Date

TRADEMARK DISCLAIMER

Reference herein to any specific commercial product, process, or service by tradename, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof or its contractors or subcontractors.

This report has been reproduced from the best available copy.

Printed in the United States of America

ENVIRONMENTAL CALCULATION COVER PAGE

SECTION 1 - Completed by the Responsible Manager

Project: Soil and Groundwater Remediation Project	RELEASE / ISSUE
Date: 9/3/2020	DATE: Sep 23, 2020 
Calculation Title and Description: Calculation of Concentration Summary Statistics for Monitoring Wells of the 200-ZP-1 Performance Monitoring Plan (PMP) for the Calendar Year 2019 (CY 2019)	

Qualifications Summary

Preparer(s):

Name: Zdravka Karanovic

Degree, Major, Institution, Year: MS, Hydrogeology, Ohio State University, 2005
 BS, Hydrogeology, University of Belgrade, 1999

Professional Licenses:

Brief Narrative of Experience: Ms. Karanovic specializes in groundwater assessment, evaluation and modeling of hydrological and hydrogeological processes, as well as data evaluation and interpretation. She is proficient in map production, supervision of drilling, and installation and development of groundwater monitoring wells. She has also applied advanced research using fallout radionuclides in watersheds as tracers in sediment budget investigations. Her experience includes Microsoft Access and SQL Server database development, integration and management, obtaining and interpreting geochemical data, chemical fingerprinting, investigating the sources of contaminants for litigation, data visualization, statistical analysis, water -level mapping, and capture zone analysis.

Checker(s):

Name: Rachel Shannon

Degree, Major, Institution, Year: MS, Geology, Cornell University, 2007
 BA, Geology, University of Colorado - Boulder, 2002

Professional Licenses: Certified Professional Geologist, Virginia

Brief Narrative of Experience: Ms. Shannon's project experience includes groundwater hydrology, hydrocarbon resource evaluation, shallow geophysics, inorganic geochemistry, environmental site assessment, and modeling to support remedial design. She is adept in the development and maintenance of databases and the evaluation of spatial and time series data. She regularly works with ArcMap GIS, SQL, Visual Basic for Applications (VBA), Python, R-Statistical Language, and Matlab. She has been involved in the design, testing, and technical support of geologic modeling software, and has developed applications for geochemical modeling, data visualization, and statistical analysis.

ENVIRONMENTAL CALCULATION COVER PAGE (Continued)**Senior Reviewer(s):**

Name: Matthew Tonkin

Degree, Major, Institution, Year: PhD, Civil Engineering, University of Queensland, 2009
 MSc, Hydrogeology, University of Birmingham, 1994
 BSc, Applied Geology, University of Birmingham, 1993

Professional Licenses:

Brief Narrative of Experience: Dr. Tonkin has over 23 years' experience leading or advising on environmental and water resource projects. His PhD focused on model calibration and uncertainty analysis, and he has instructed on these and related topics. He has developed environmental software applications for public and private groups including the Hanford site, and has conducted remediation work under CERCLA, RCRA and other regulatory programs.

SECTION 2 - Completed by Preparer

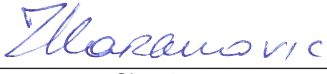
Calculation Number: ECF-200ZP1-20-0051

Revision Number: 0

Revision History

Revision No.	Description	Date	Affected Pages
0	Initial Issue		ALL

SECTION 3 - Completed by the Responsible Manager**Document Control:**Is the document intended to be controlled within the Document Management Control System (DMCS)? ☒ Yes ☐ NoDoes document contain scientific and technical information intended for public use? ☒ Yes ☐ NoDoes document contain controlled-use information? ☐ Yes ☒ No**SECTION 4 - Document Review and Approval****Preparer(s):**

Zdravka Karanovic Project Hydrogeologist  9/3/2020
 Print First and Last Name Position Signature Date

Checker(s):

Rachel Shannon Project Hydrogeologist  9/3/2020
 Print First and Last Name Position Signature Date

Senior Reviewer(s):

Matthew Tonkin Principal Hydrogeol.  9/3/2020
 Print First and Last Name Position Signature Date

Responsible Manager(s):

William Faught Manager Approved via attached Faught, William R 9/17/2020
 Print First and Last Name Position Signature Date

ENVIRONMENTAL CALCULATION COVER PAGE (Continued)**SECTION 5 - Applicable if Calculation is a Risk Assessment or Uses an Environmental Model****Prior to Initiating Modeling:**

Required training for modelers completed:

Integration Lead:

N / A

*Print First and Last Name**Signature**Date*

Safety Software Approved:

Integration Lead:

N / A

*Print First and Last Name**Signature**Date***Calculation Approved:**

Risk/Modeling Integration Manager:

N / A

*Print First and Last Name**Signature**Date*

From: [PRC SharePoint](#)
To: [Dodge, Bonnie J](#)
Cc: [Dodge, Bonnie J](#); [Lee, Art K](#)
Subject: Electronic Approval has completed for document: ECF-200ZP1-20-0051_R0_Combined.
Date: Wednesday, September 23, 2020 6:28:47 AM

Electronic Approval has completed for document: ECF-200ZP1-20-0051_R0_Combined.

Please include this email as the Electronic Approval page.

Electronic Approval for document: ECF-200ZP1-20-0051_R0_Combined has successfully COMPLETED.

Electronic Approval started by Dodge, Bonnie J on 9/17/2020 10:35 AM
Comment: Bill, Please approve for clearance and calc cover page. CACN: 302900

Approved by Faught, William R on 9/17/2020 10:38 AM

Comment:

Approved by Arola, Craig C on 9/17/2020 1:20 PM
Comment:

Approved by Lee, Art K on 9/17/2020 4:17 PM
Comment: Approved with no comments

Approved by Johanson, Julie A on 9/21/2020 8:29 AM
Comment:

Approved by Kaas, Jadie L on 9/22/2020 7:44 AM
Comment: Review complete with 1 typo comment

Approved by Zelen, Benjamin J on 9/23/2020 6:28 AM
Comment:

Contents

1	Purpose.....	1
2	Background.....	1
3	Methodology	1
3.1	Data Acquisition and Overview	1
3.2	Data Preparation.....	2
3.2.1	Review Qualifiers and Collection Purpose	2
3.2.2	Non-Detect Handling.....	2
3.2.3	Chromium Datasets.....	2
3.2.4	Contaminants of Concern (COCs)	2
3.2.5	Wells of Interest.....	2
3.3	Calculations.....	3
3.4	Visualization of Results.....	4
4	Assumptions and Inputs	5
5	Software Applications.....	5
5.1	Exempt Software	5
5.2	Approved Software.....	6
6	Calculations	6
7	Results and Conclusions	6
8	References	23

Figures

Figure 1.	Box-and-Whisker Plot	5
Figure 2.	Summary Statistics for Carbon Tetrachloride Boxplot.....	8
Figure 3.	Summary Statistics for Hexavalent Chromium and Filtered Total Chromium Boxplot.....	10
Figure 4.	Summary Statistics for Unfiltered Total Chromium Boxplot.....	12
Figure 5.	Summary Statistics for Iodine-129 Boxplot	14
Figure 6.	Summary Statistics for Nitrate Boxplot.....	16
Figure 7.	Summary Statistics for Technetium-99 Boxplot.....	18
Figure 8.	Summary Statistics for Trichloroethene Boxplot	20
Figure 9.	Summary Statistics for Tritium Boxplot.....	22

Tables

Table 1.	Excel Functions Used for Summary Statistics.....	3
----------	--	---

Table 2.	Summary Statistics for Carbon Tetrachloride.....	7
Table 3.	Summary Statistics for Hexavalent Chromium and Filtered Total Chromium	9
Table 4.	Summary Statistics for Unfiltered Total Chromium.....	11
Table 5.	Summary Statistics for Iodine-129	13
Table 6.	Summary Statistics for Nitrate.....	15
Table 7.	Summary Statistics for Technetium-99	17
Table 8.	Summary Statistics for Trichloroethene	19
Table 9.	Summary Statistics for Tritium.....	21

Terms

COC	contaminant of concern
ECF	environmental calculation file
HEIS	Hanford Environmental Information System
OU	operable unit
PMP	performance monitoring plan
TPA	Tri-Party Agreement
UCL	upper confidence limit

This page intentionally left blank.

1 Purpose

This report serves as the environmental calculation file (ECF) describing the input data and summary statistics calculations, with particular focus on determination of upper confidence limits (UCLs) on the mean values for constituents dissolved in groundwater as sampled from 200 West monitoring wells for the period 2011 through 2019.

2 Background

Summary statistic calculations were completed as one line of evidence to assist in assessing the performance of groundwater remedies located in the 200 West area of the Hanford Central Plateau. Use of the UCL statistics in particular is recommended for calculating groundwater plume exposure point concentrations in Superfund risk assessment guidance (OSWER 9285.6-10, *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*), where the UCL statistics are calculated using sample results obtained from monitoring wells. The advantage of such summary statistics is that they can provide a comprehensive evaluation of plume concentrations using a small number of metrics.

The calculations presented here were completed for the contaminants of concern (COC) for the 200-ZP-1 groundwater Operable Unit (OU) remedy as detailed in the record of decision (ROD) (EPA, et al., 2008, *Record of Decision, Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington*), emphasizing wells that are listed in the performance monitoring plan (PMP) (DOE/RL-2009-115, *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action*, with associated Tri-Party Agreement [TPA] change notice for that remedy [TPA-CN-0875]) and the sampling and analysis plan (SAP) (DOE/RL-2010-72, *Sampling and Analysis Plan for Remediation Wells in the 200-ZP-1 Operable Unit*, with associated TPA change notice for that remedy [TPA-CN-0876]).

3 Methodology

The sample data for the COCs was obtained for the monitoring period 1/1/2011 through 12/31/2019 for 200 West monitoring wells that are listed in the PMP (DOE/RL-2009-115). The procedure involves the following steps:

1. Data acquisition, overview, compilation and reduction.
2. Summary statistic calculations, including UCLs on the mean. The Student t-distribution was used to calculate UCLs for comparability with similar calculations performed for the adjacent groundwater OU 200-UP-1 (ECF-200UP1-18-0017, *Calculation of the 95th Percentile Upper Confidence Limit on Plume Monitoring Data for the 200-UP-1 Groundwater Operable Unit through Calendar Year 2017*).
3. Visualization of results using box-and-whisker plots for each COC.

3.1 Data Acquisition and Overview

The Hanford Environmental Information System (HEIS) was queried by William D. Webber on February 10, 2020, for all groundwater constituent concentration measurements collected between October 7, 1951, and December 31, 2019, and the table of the database snapshot was saved in HEIS as GW_REPORT_CY2019_GWSR. This dataset includes concentrations of chemical constituents and physical parameters in groundwater, measured across the Hanford site, in wells and aquifer tubes. These

data were downloaded by S.S. Papadopoulos & Associates, Inc. (SSP&A) on February 10, 2020, into a project-specific Microsoft Access® database.

3.2 Data Preparation

This section discusses the processing of data before performing calculations.

3.2.1 Review Qualifiers and Collection Purpose

Rejected samples (measurements flagged with qualifiers “R”) were removed from the dataset. Data flagged as characterization samples (“C”) in the COLLECTION_PURPOSE column are removed from the dataset.

3.2.2 Non-Detect Handling

For measurements flagged with the “U” qualifier (non-detects) or any combination including the “U” qualifier, the reported value represents (or is replaced by) the associated minimum detectable activity (MDA) for radionuclides, or the standard reporting limit (SRL) for all other COCs. If the SRL field is blank, the Standard Value Reported (STD_VALUE_RPD) is used.

3.2.3 Chromium Datasets

For chromium, two datasets are considered: (1) all hexavalent chromium and all filtered total chromium, and (2) only unfiltered total chromium.

3.2.4 Contaminants of Concern (COCs)

Calculations were performed for the 200-ZP-1 OU COCs measured during the period 1/1/2011 through 12/31/2019. The 200-ZP-1 COCs are:

1. Carbon tetrachloride
2. Hexavalent chromium (as represented by all hexavalent chromium and filtered total chromium)
3. Chromium (total) (as represented by unfiltered total chromium)
4. Iodine-129
5. Nitrate
6. Technetium-99
7. Trichloroethene
8. Tritium

3.2.5 Wells of Interest

Wells included in analysis are 200 West PMP wells listed below:

- | | | |
|--------------|---------------|-------------|
| • 299-W10-1 | • 299-W15-7 | • 299-W6-3 |
| • 299-W10-14 | • 299-W15-763 | • 299-W6-6 |
| • 299-W10-27 | • 299-W15-765 | • 299-W6-11 |
| • 299-W10-29 | • 299-W15-83 | • 299-W6-12 |
| • 299-W10-30 | • 299-W15-94 | • 299-W7-3 |
| • 299-W10-31 | • 299-W18-1 | • 699-30-66 |

® Microsoft and Access are registered trademarks of Microsoft Corporation in the U.S. and other countries.

- 299-W10-33
- 299-W11-13
- 299-W11-18
- 299-W11-33Q
- 299-W11-43
- 299-W11-45
- 299-W11-47
- 299-W11-48
- 299-W11-87
- 299-W11-88
- 299-W13-1
- 299-W13-2
- 299-W14-11
- 299-W14-13
- 299-W14-14
- 299-W14-71
- 299-W14-72
- 299-W15-11
- 299-W15-152
- 299-W15-17
- 299-W15-224
- 299-W15-30
- 299-W15-33
- 299-W15-37
- 299-W15-42
- 299-W15-46
- 299-W15-49
- 299-W15-50
- 299-W18-15
- 299-W18-16
- 299-W18-21
- 299-W18-22
- 299-W18-40
- 299-W19-105
- 299-W19-107
- 299-W19-18
- 299-W19-34A
- 299-W19-34B
- 299-W19-36
- 299-W19-4
- 299-W19-41
- 299-W19-47
- 299-W19-48
- 299-W19-49
- 299-W19-6
- 299-W21-2
- 299-W22-47
- 299-W22-72
- 299-W22-86
- 299-W22-87
- 299-W22-88
- 299-W23-19
- 299-W23-4
- 299-W26-13
- 299-W27-2
- 299-W5-2
- 699-32-62
- 699-32-72A
- 699-33-75
- 699-34-61
- 699-35-66A
- 699-35-78A
- 699-36-61A
- 699-36-66B
- 699-36-70A
- 699-36-70B
- 699-37-66
- 699-38-61
- 699-38-65
- 699-38-68A
- 699-38-70B
- 699-38-70C
- 699-40-62
- 699-40-65
- 699-43-69
- 699-44-64
- 699-45-69A
- 699-45-69C
- 699-47-60
- 699-48-71
- 699-50-74
- 699-51-63

3.3 Calculations

Annual summary statistic calculations, including UCLs on the mean, for the 200-ZP-1 COCs within 200 West monitoring wells listed in the 200-ZP-1 PMP were performed using built-in Microsoft Excel[®] functions. Specifically, the summary statistics were calculated in Excel using the Excel functions that are presented in Table 1.

Table 1. Excel Functions Used for Summary Statistics	
Summary Statistic	Excel Function
Sample size (n)	COUNT(cell range)
Average	AVERAGE(cell range)
Standard Deviation	STDEV(cell range)
Minimum value	MIN(cell range)

[®] Excel is a registered trademark of Microsoft Corporation in the U.S. and other countries.

Table 1. Excel Functions Used for Summary Statistics

Summary Statistic	Excel Function
First quartile (Q1)	QUARTILE.INC(cell range, 1)
Median	QUARTILE.INC(cell range, 2)
Third quartile (Q3)	QUARTILE.INC(cell range, 3)
Maximum value	MAX(cell range)
Upper Confidence Level	CONFIDENCE.T(alpha, standard_dev, size)
UCL (Student-t)	Average + Upper Confidence Level

alpha = the significance level (= 1 – confidence level) (e.g., a significance level of 0.05 (1-0.95) equates to a confidence level of 95%)

standard_dev = standard deviation of the population

size = the population sample size

3.4 Visualization of Results

The distribution of each dataset is displayed using a standard box and whisker plot, constructed within Excel (Figure 1).

In a standard box and whisker plot, the lower limit of the box is defined by the lower quartile of the dataset and the upper limit of the box is defined by the upper quartile of the dataset, so that the box represents the interquartile range (IQR). The median of the dataset is displayed as a horizontal line within the limits of the box. The minimum and maximum values lie outside of the first and third quartiles (i.e., the box) and are represented by short horizontal lines that are connected to the box with vertical lines, which are called whiskers. Although Excel does offer the capability to prepare box and whisker plots directly from the data, in doing so it does deviate somewhat from these standard plotting rules, and for this reason the plots were prepared in Excel using stacked bar charts using the method detailed at the following URL: <https://support.office.com/en-us/article/create-a-box-plot-10204530-8cdf-40fe-a711-2eb9785e510f>, and summarized below:

The box plots were created by executing the following steps:

1. Calculate quartile values from the source data set.
2. Calculate quartile differences.
3. Create a stacked column chart type from the quartile ranges.
4. Convert the stacked column chart to the box plot style.

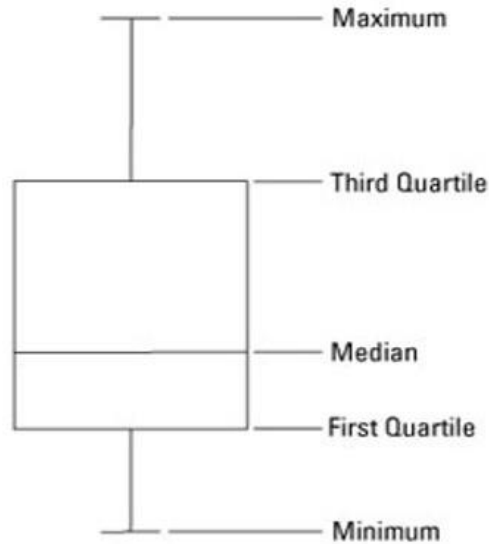


Figure 1. Box-and-Whisker Plot

4 Assumptions and Inputs

Input data to the calculations consisted of the well networks specified in the current version of the PMP (DOE/RL-2009-115 and associated TPA Change Notices) and the sample results obtained from HEIS as detailed in the foregoing sections. The list of wells that is included in the PMP may change over time: when this occurs, attention should be given to any changes in the results of statistical calculations that may result from the change in the list of wells used as input to the calculations.

The sample results used to calculate the UCLs were assumed to be normally distributed, an assumption necessary for Student's *t* distribution. This assumption of normality was not tested, but there is no real consequence if this assumption is violated for the limited purposes of this ECF, as the UCL statistic is only being used to track cleanup progress in general terms and will not be used for risk assessment purposes. Alternative methods and distributions should be considered for use if analyses such as presented herein will inform a risk assessment.

5 Software Applications

All calculations presented in this ECF were calculated using built-in Excel functions. Box-and-whisker plots are commonly used in the display of the results of statistical analyses. All software for this calculation was used in accordance with applicable Project internal controlled software management procedures.

5.1 Exempt Software

Microsoft Excel is site-licensed software used as “flat file” spreadsheets that are wholly incorporated into this calculation and verified during the technical review of this report and is therefore rated as exempt software. Spreadsheets were used to tabulate the groundwater data obtained from HEIS and calculate the statistics using the methodology described in Section 3.

5.2 Approved Software

No utility calculation software, as defined in Project internal controlled software management procedures, was used in these calculations.

6 Calculations

Calculations of the UCL95 values were performed in a spreadsheet which is archived as part of this ECF. The spreadsheet also contains the sample results obtained from HEIS. Two sets of calculations were made: in the first set of calculations, the summary statistics were calculated for ALL monitoring wells listed in the PMP that had sample results that year, regardless of whether each monitoring well had sample results for ALL years. In the second set of calculations, the summary statistics were calculated only for wells listed in the PMP that possess sample results for EVERY year.

The results of the calculations are provided in Section 7.

7 Results and Conclusions

The results of the calculations are presented in a series of tables and figures for each COC. The tables and figures produced as output from the calculations described in this ECF for the 200 West PMP wells are provided in this chapter. Tables 2 through 9 and Figures 2 through 9 illustrate the resulting summary statistics for each COC in 200 West PMP wells for each year from 2011 through 2019:

- Table 2: Summary Statistics for Carbon Tetrachloride
- Figure 2: Summary Statistics for Carbon Tetrachloride Boxplot
- Table 3: Summary Statistics for Hexavalent Chromium and Filtered Total Chromium
- Figure 3: Summary Statistics for Hexavalent Chromium and Filtered Total Chromium Boxplot
- Table 4: Summary Statistics for Unfiltered Total Chromium
- Figure 4: Summary Statistics for Unfiltered Total Chromium Boxplot
- Table 5: Summary Statistics for Iodine-129
- Figure 5: Summary Statistics for Iodine-129 Boxplot
- Table 6: Summary Statistics for Nitrate
- Figure 6: Summary Statistics for Nitrate Boxplot
- Table 7: Summary Statistics for Technetium-99
- Figure 7: Summary Statistics for Technetium-99 Boxplot
- Table 8: Summary Statistics for Trichloroethene
- Figure 8: Summary Statistics for Trichloroethene Boxplot
- Table 9: Summary Statistics for Tritium
- Figure 9: Summary Statistics for Tritium Boxplot

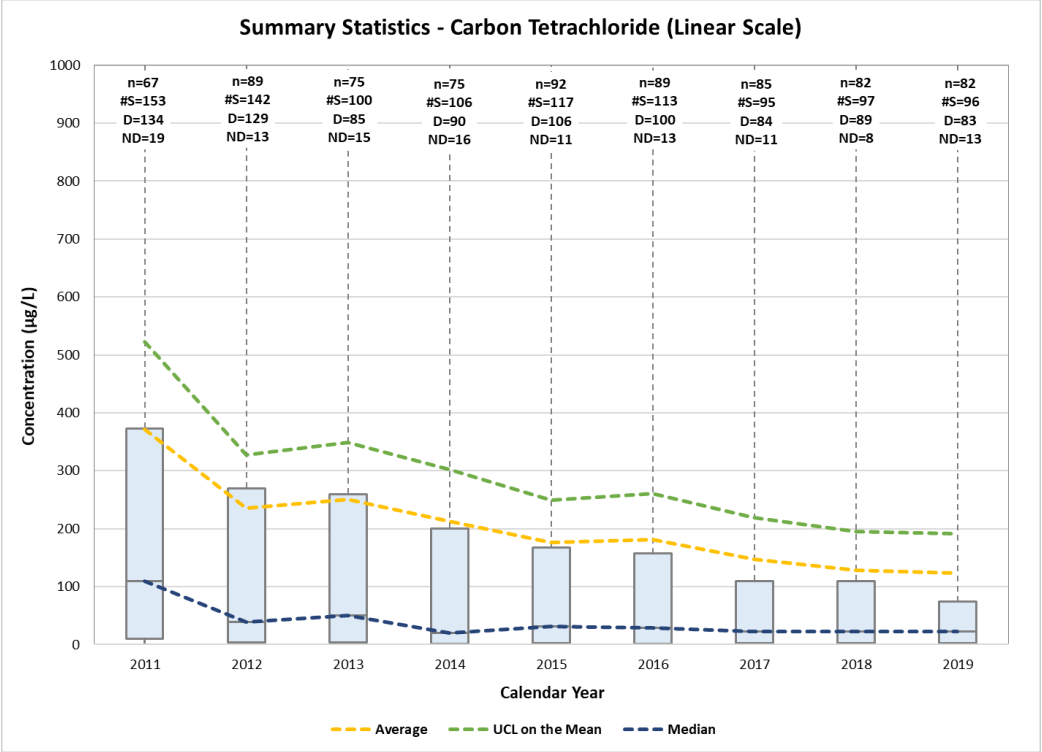
Table 2. Summary Statistics for Carbon Tetrachloride

All PMP Wells									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	67	89	75	75	92	89	85	82	82
Average	371.8	235.9	250.2	212.8	176.8	181.7	147.8	128.6	123.6
Standard Deviation	618.1	431.8	429.5	390.5	348.9	376.5	330.6	304.2	307.3
Minimum value	0.1	0.1	1.0	0.3	0.1	0.1	0.2	0.2	0.2
First quartile (Q1)	9.8	3.3	3.2	1.4	2.3	1.6	2.3	3.0	1.9
Median	110.0	39.0	50.0	20.0	31.3	29.4	23.0	22.6	22.2
Third quartile (Q3)	373.3	270.0	260.0	200.5	168.0	157.0	110.0	109.8	73.9
Maximum value	3250.0	2200.0	2100.0	2000.0	1980.0	2315.0	1960.0	1750.0	1830.0
Whisker- = (Q1-Min)	9.7	3.2	2.2	1.1	2.2	1.5	2.1	2.8	1.7
Whisker+ = (Max-Q3)	2876.7	1930.0	1840.0	1799.5	1812.0	2158.0	1850.0	1640.3	1756.1
Upper Confidence Level	150.8	91.0	98.8	89.8	72.3	79.3	71.3	66.9	67.5
UCL (Student-t)	522.6	326.9	349.0	302.7	249.1	261.0	219.1	195.5	191.1
Total Number of Samples (#S)	153	142	100	106	117	113	95	97	96
Number of detected values (D)	134	129	85	90	106	100	84	89	83
Number of non-detected values (ND)	19	13	15	16	11	13	11	8	13

PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	35	35	35	35	35	35	35	35	35
Average	314.1	333.1	289.9	299.1	280.5	290.8	230.3	186.7	193.7
Standard Deviation	527.0	536.4	447.4	476.6	480.2	526.5	445.5	392.8	417.3
Minimum value	0.1	0.2	1.0	0.5	0.1	0.3	0.2	0.2	0.2
First quartile (Q1)	3.2	4.0	3.2	2.9	2.6	3.5	4.0	4.7	3.4
Median	87.0	86.7	40.0	51.5	41.3	40.0	34.8	33.9	37.5
Third quartile (Q3)	315.0	445.0	445.0	420.0	344.0	226.5	173.5	130.5	132.5
Maximum value	2350.0	2200.0	1700.0	2000.0	1980.0	2315.0	1960.0	1750.0	1830.0
Whisker- = (Q1-Min)	3.1	3.8	2.2	2.3	2.5	3.2	3.9	4.5	3.2
Whisker+ = (Max-Q3)	2035.0	1755.0	1255.0	1580.0	1636.0	2088.5	1786.5	1619.5	1697.5
Upper Confidence Level	181.0	184.3	153.7	163.7	165.0	180.8	153.0	134.9	143.4
UCL (Student-t)	495.2	517.3	443.6	462.8	445.5	471.6	383.3	321.7	337.1
Total Number of Samples (#S)	79	64	50	53	50	54	43	44	46
Number of detected values (D)	62	57	45	45	48	54	41	43	43
Number of non-detected values (ND)	17	7	5	8	2	0	2	1	3

PMP = performance monitoring plan
UCL = upper confidence limit

All PMP Wells



PMP Wells with Data for All Years

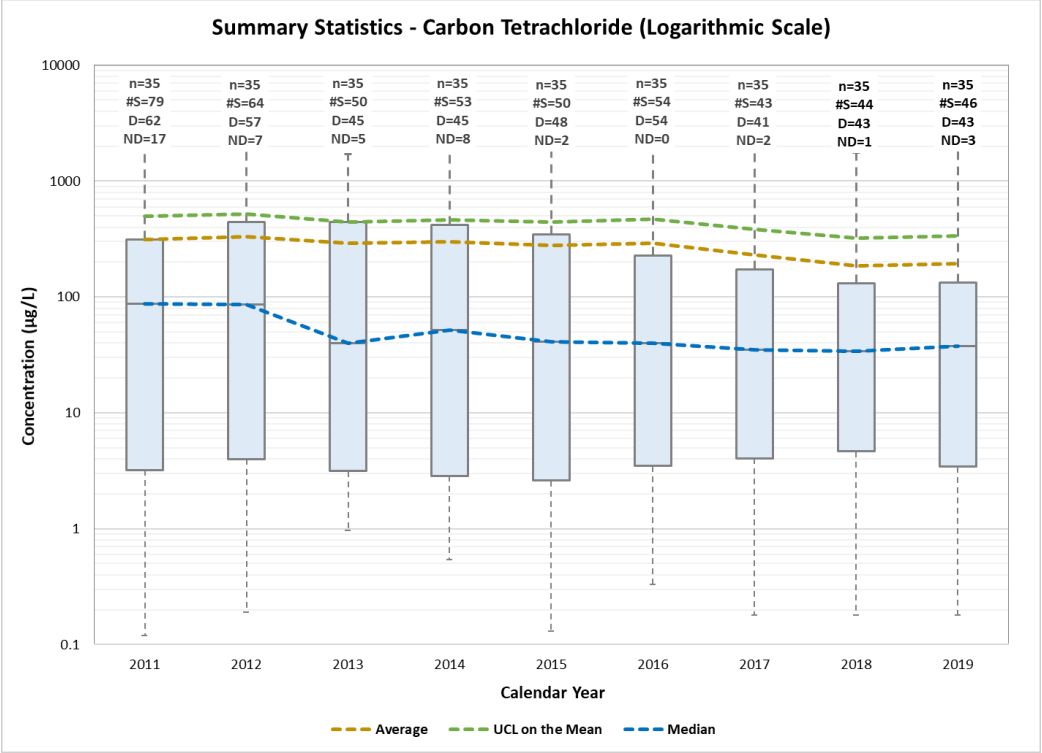
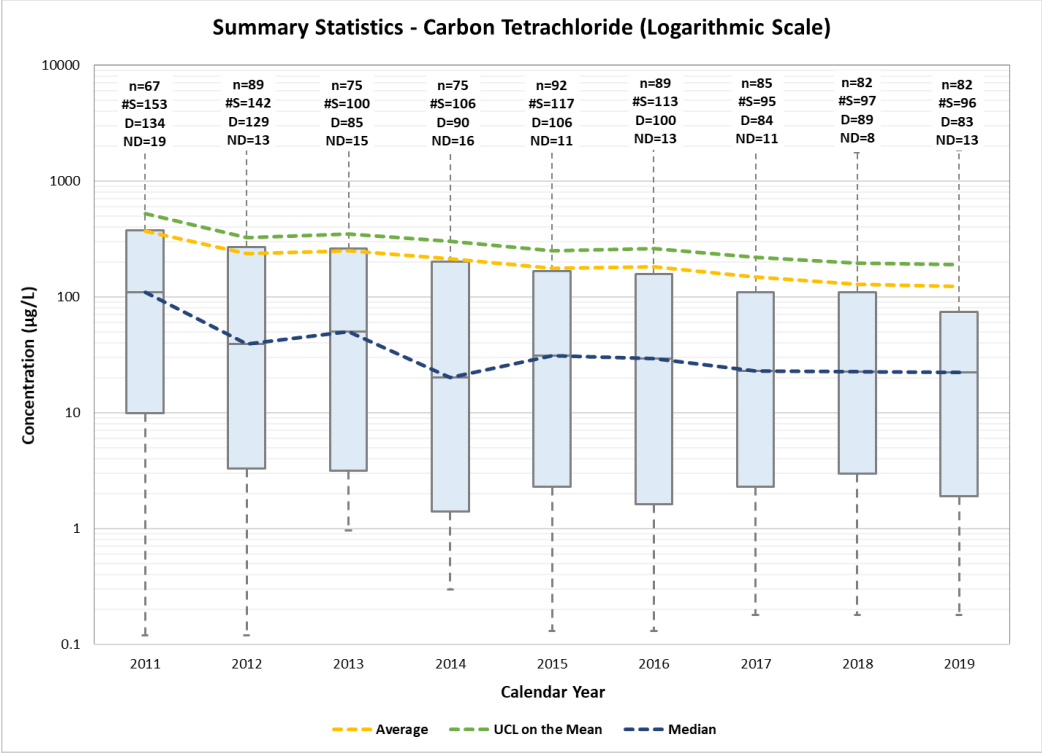
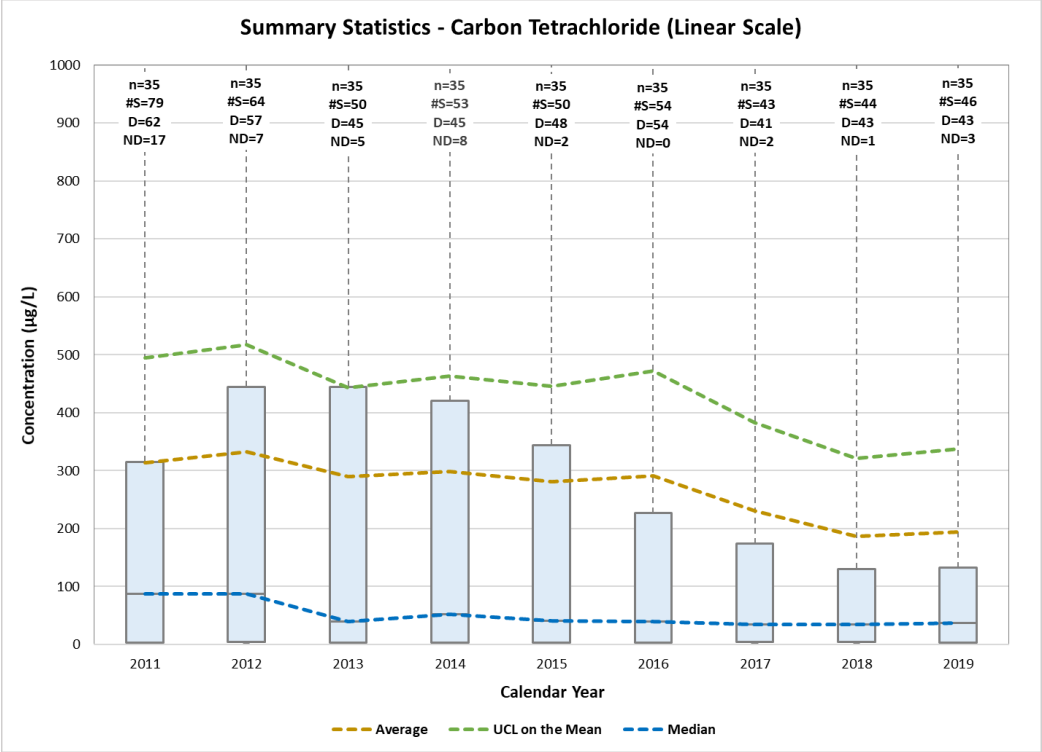


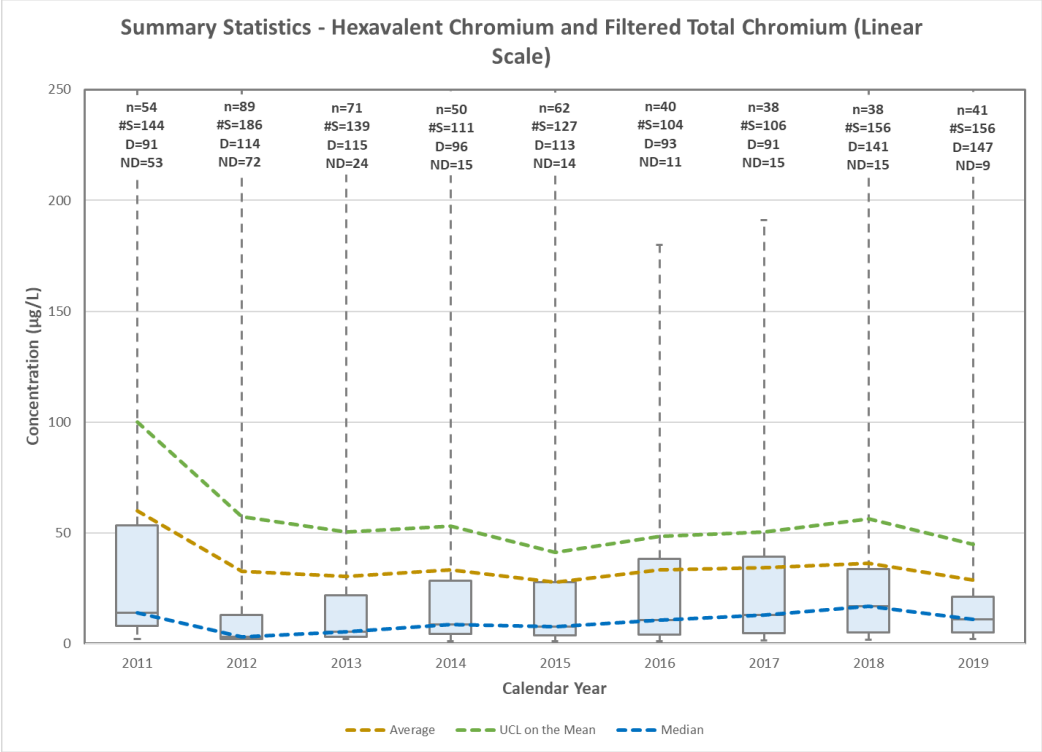
Figure 2. Summary Statistics for Carbon Tetrachloride Boxplot

Table 3. Summary Statistics for Hexavalent Chromium and Filtered Total Chromium

All PMP Wells										PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	54	89	71	50	62	40	38	38	41	Sample size (n)	25	25	25	25	25	25	25	25	25
Average	60.0	32.8	30.3	33.3	27.9	33.4	34.4	36.1	28.6	Average	103.2	94.7	64.8	49.6	43.3	35.5	35.0	39.2	34.6
Standard Deviation	146.9	116.3	85.6	69.2	52.2	47.2	48.8	61.8	51.7	Standard Deviation	206.6	207.8	137.2	92.6	73.5	54.5	54.8	71.8	62.3
Minimum value	2	2	2	1.01	1.25	1	1.5	1.7	2.15	Minimum value	2.235	2	2.4	1.0	1.3	1	1.5	1.7	3.0
First quartile (Q1)	8.0	2	3.15	4.475	3.8	4.0	4.6	4.9	5.04	First quartile (Q1)	5.725	3.5	5.2	5.5	3.8	3.694	4.0	4.4	5.2
Median	14	3.2	5.3	8.625	7.77	10.61	12.95	17.03	10.9	Median	16.15	16	17.5	11.2	7.6	8.6	7.6	14.0	11.6
Third quartile (Q3)	53.5	13.0	21.8	28.5	27.7	38.4	39.3	33.7	21.2	Third quartile (Q3)	107	96.5	95.9	40.5	37.5	30	34.3	33.8	32.6
Maximum value	1010.0	1042.7	680.3	430.5	297.8	180.0	191.2	336.8	299.8	Maximum value	1010	1042.7	680.3	430.5	297.8	180	191.2	336.8	299.8
Whisker- = (Q1-Min)	6.0	0.0	1.2	3.5	2.5	3.0	3.1	3.2	2.9	Whisker- = (Q1-Min)	3.5	1.5	2.8	4.5	2.6	2.7	2.5	2.8	2.2
Whisker+ = (Max-Q3)	956.5	1029.7	658.4	402.0	270.2	141.6	151.9	303.1	278.7	Whisker+ = (Max-Q3)	903.0	946.2	584.4	390.1	260.4	150.0	156.9	303.1	267.3
Upper Confidence Level	40.1	24.5	20.3	19.7	13.3	15.1	16.0	20.3	16.3	Upper Confidence Level	85.3	85.8	56.6	38.2	30.3	22.5	22.6	29.6	25.7
UCL (Student-t)	100.1	57.3	50.5	53.0	41.1	48.5	50.4	56.4	44.9	UCL (Student-t)	188.5	180.4	121.5	87.8	73.7	58.0	57.6	68.8	60.3
Total Number of Samples (#S)	144	186	139	111	127	104	106	156	156	Total Number of Samples (#S)	92	100	79	78	82	82	87	116	117
Number of detected values (D)	91	114	115	96	113	93	91	141	147	Number of detected values (D)	68	70	69	69	71	72	74	107	111
Number of non-detected values (ND)	53	72	24	15	14	11	15	15	9	Number of non-detected values (ND)	24	30	10	9	11	10	13	9	6

PMP = performance monitoring plan
UCL = upper confidence limit

All PMP Wells



PMP Wells with Data for All Years

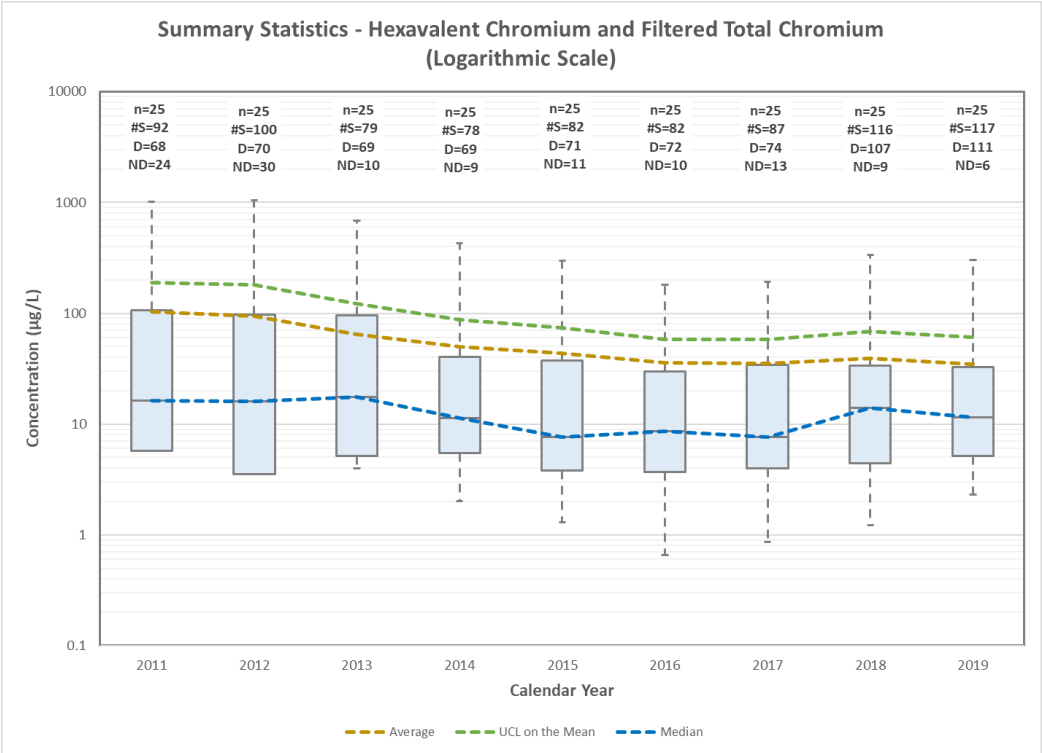
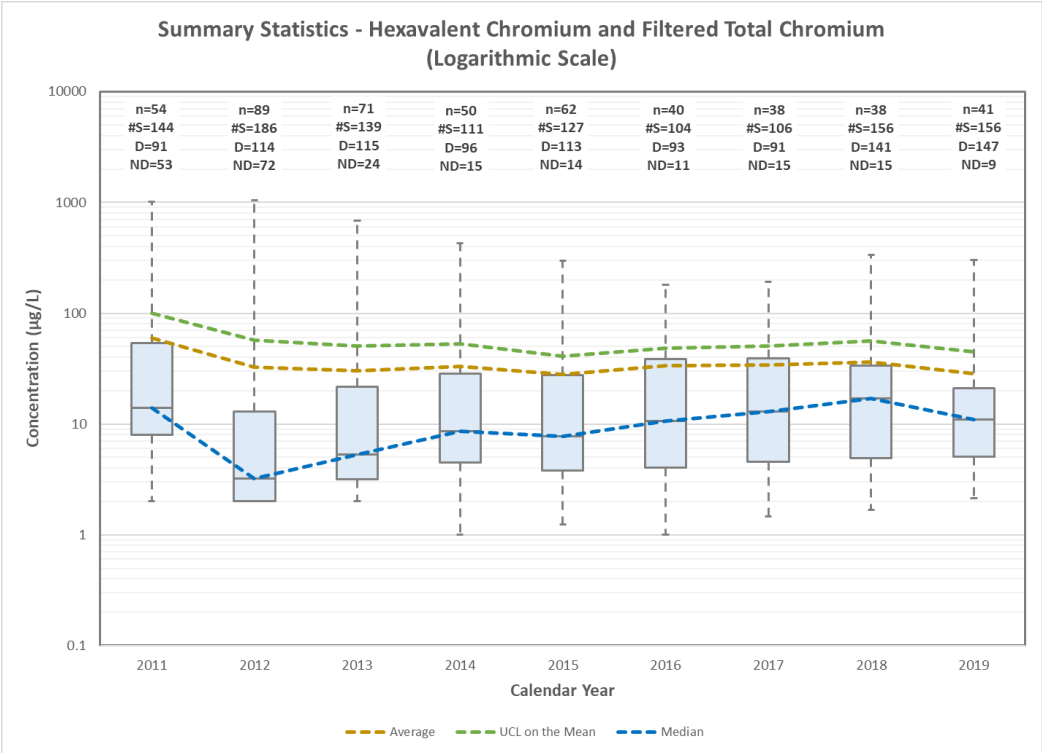
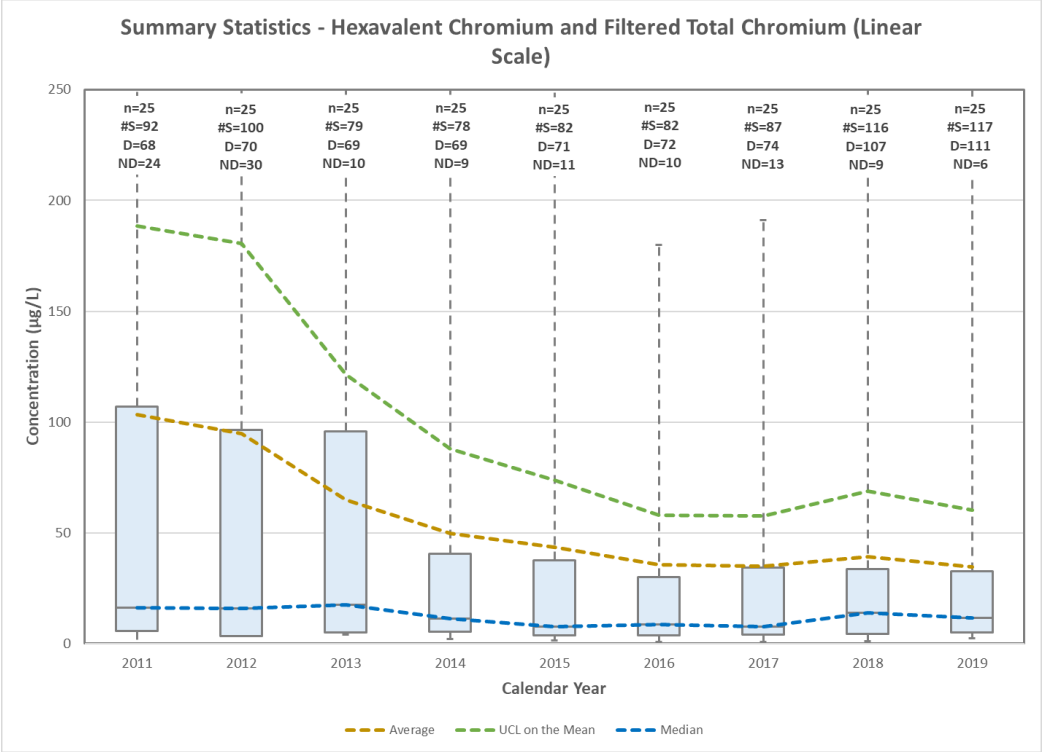


Figure 3. Summary Statistics for Hexavalent Chromium and Filtered Total Chromium Boxplot

Table 4. Summary Statistics for Unfiltered Total Chromium

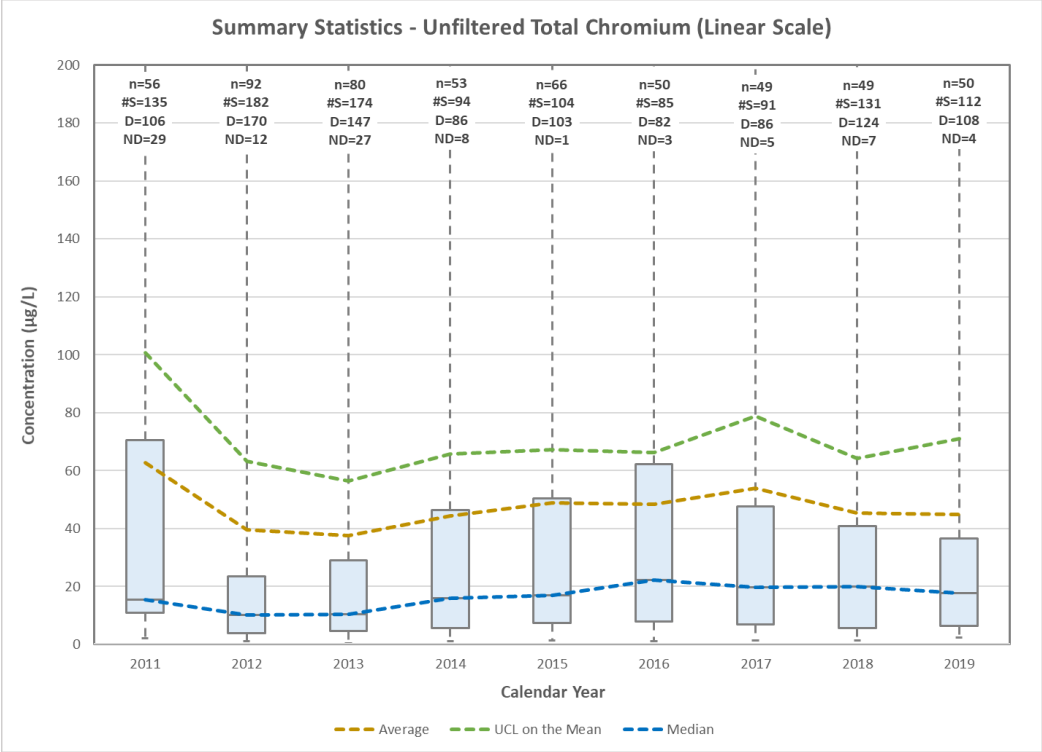
All PMP Wells									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	56	92	80	53	66	50	49	49	50
Average	62.8	39.6	37.7	44.2	48.8	48.3	54.0	45.3	44.9
Standard Deviation	141.7	113.7	84.1	78.3	75.2	63.0	86.7	65.5	92.3
Minimum value	2.2	1.1	0.3	1.0	1.5	1.1	1.3	1.3	2.3
First quartile (Q1)	10.9	4.0	4.5	5.6	7.3	8.0	7.0	5.7	6.3
Median	15.6	10.0	10.5	15.9	16.9	22.2	19.7	20.0	17.8
Third quartile (Q3)	70.6	23.6	29.0	46.5	50.3	62.3	47.7	40.8	36.6
Maximum value	996.4	1028.1	668	448.5	352	325	396	335.2	576
Whisker- = (Q1-Min)	8.7	2.9	4.2	4.6	5.8	6.9	5.6	4.4	4.0
Whisker+ = (Max-Q3)	925.8	1004.6	639.0	402.0	301.7	262.7	348.3	294.4	539.5
Upper Confidence Level	37.9	23.5	18.7	21.6	18.5	17.9	24.9	18.8	26.2
UCL (Student-t)	100.7	63.1	56.4	65.8	67.3	66.2	78.9	64.1	71.1
Total Number of Samples (#S)	135	182	174	94	104	85	91	131	112
Number of detected values (D)	106	170	147	86	103	82	86	124	108
Number of non-detected values (ND)	29	12	27	8	1	3	5	7	4

PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	35	35	35	35	35	35	35	35	35
Average	81.4	75.3	53.4	54.2	47.9	40.0	33.4	37.8	32.9
Standard Deviation	174.8	176.2	115.8	93.2	82.3	52.2	47.4	62.8	54.7
Minimum value	2.2	2.5	3.1	1.0	1.5	1.1	1.3	1.3	2.3
First quartile (Q1)	12.4	7.7	7.4	5.6	6.2	5.8	6.4	5.4	5.1
Median	16.5	14.4	14.4	15.9	15.8	13.1	14.6	17.0	13.8
Third quartile (Q3)	93.2	85.6	53.7	49.3	35.7	57.3	40.2	37.3	33.9
Maximum value	996.4	1028.1	668	448.5	352	166	187.2	335.2	284.6
Whisker- = (Q1-Min)	10.2	5.2	4.3	4.6	4.7	4.7	5.1	4.1	2.8
Whisker+ = (Max-Q3)	903.2	942.6	614.3	399.2	316.3	108.7	147.0	297.9	250.7
Upper Confidence Level	60.0	60.5	39.8	32.0	28.3	17.9	16.3	21.6	18.8
UCL (Student-t)	141.4	135.8	93.1	86.2	76.2	57.9	49.7	59.3	51.6
Total Number of Samples (#S)	91	106	85	69	71	68	72	97	88
Number of detected values (D)	70	97	76	62	70	66	67	92	85
Number of non-detected values (ND)	21	9	9	7	1	2	5	5	3

PMP = performance monitoring plan

UCL = upper confidence limit

All PMP Wells



PMP Wells with Data for All Years

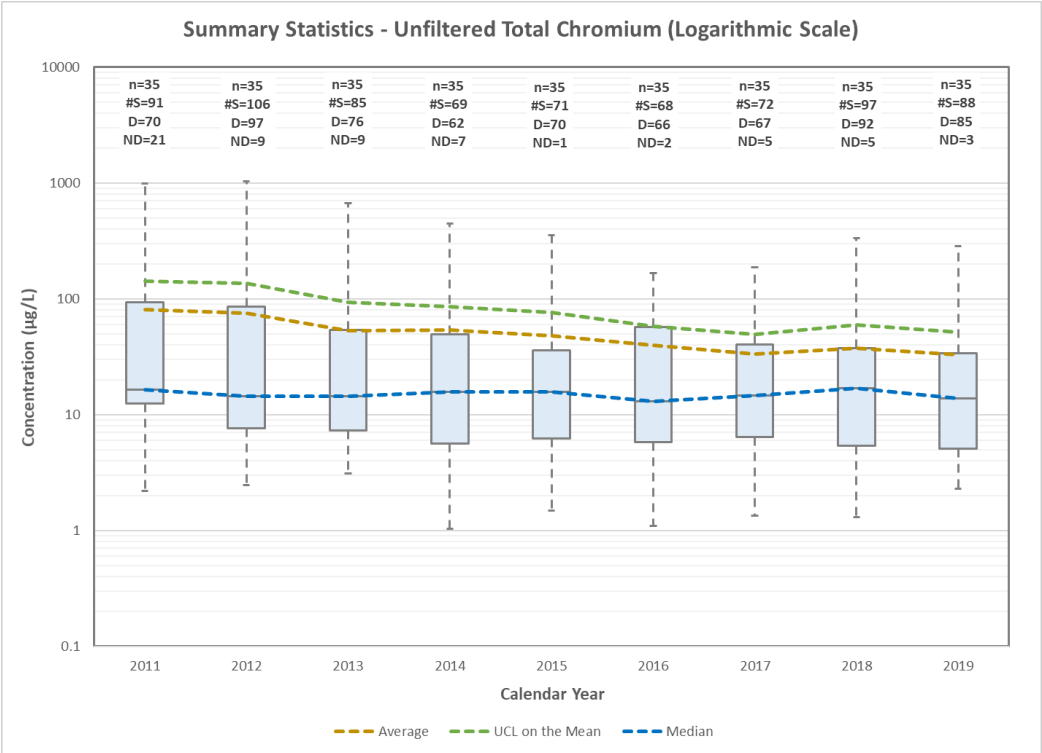
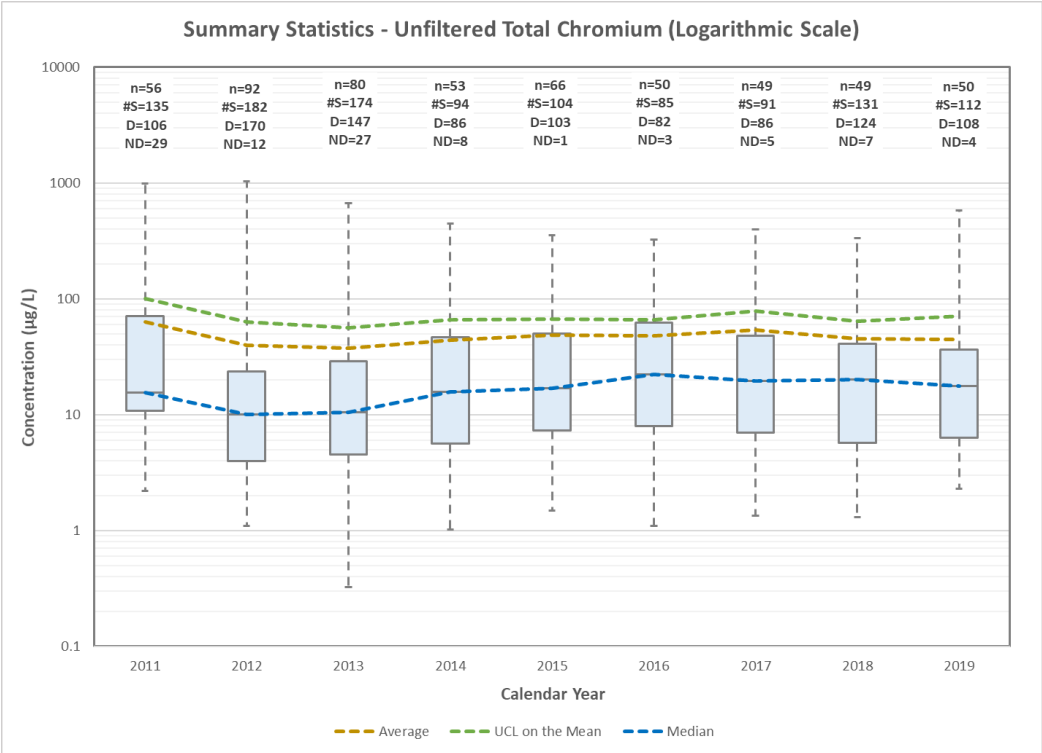
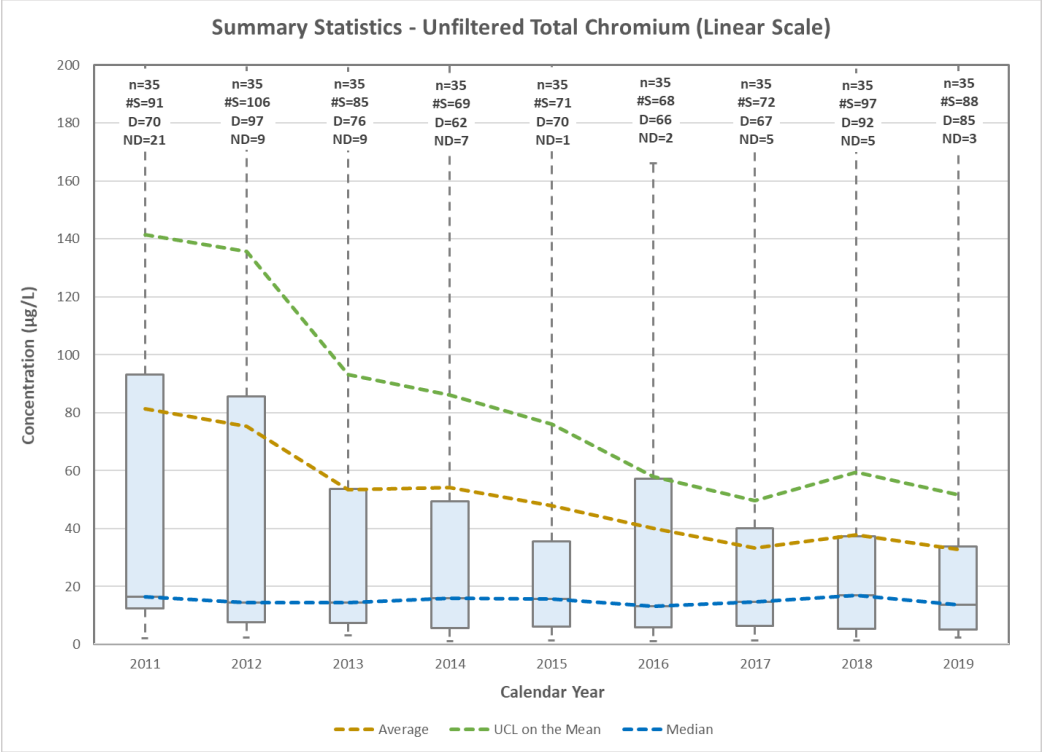


Figure 4. Summary Statistics for Unfiltered Total Chromium Boxplot

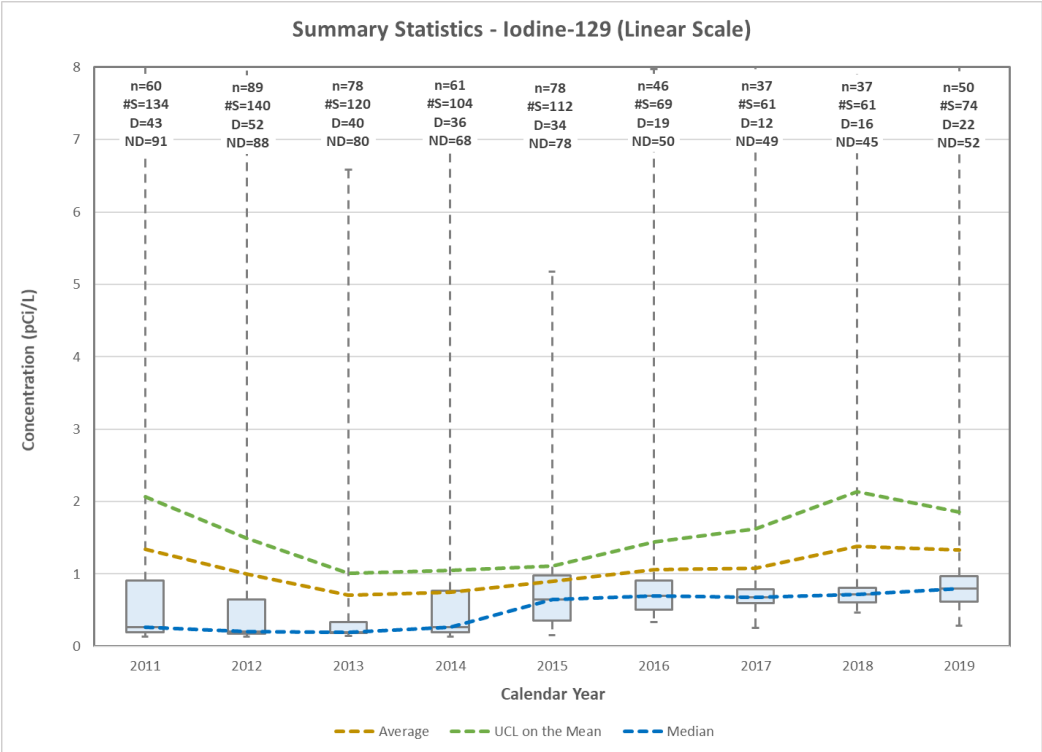
Table 5. Summary Statistics for Iodine-129

All PMP Wells									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	60	89	78	61	78	46	37	37	50
Average	1.3	1.0	0.7	0.7	0.9	1.1	1.1	1.4	1.3
Standard Deviation	2.8	2.3	1.3	1.2	0.9	1.3	1.6	2.3	1.8
Minimum value	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.5	0.3
First quartile (Q1)	0.2	0.2	0.2	0.2	0.4	0.5	0.6	0.6	0.6
Median	0.3	0.2	0.2	0.3	0.6	0.7	0.7	0.7	0.8
Third quartile (Q3)	0.9	0.6	0.3	0.8	1.0	0.9	0.8	0.8	1.0
Maximum value	18.6	16	6.6	7.1	5.2	8.0	9.7	12.9	11.4
Whisker- = (Q1-Min)	0.1	0.0	0.0	0.1	0.2	0.2	0.3	0.1	0.3
Whisker+ = (Max-Q3)	17.7	15.4	6.2	6.3	4.2	7.1	8.9	12.1	10.5
Upper Confidence Level	0.7	0.5	0.3	0.3	0.2	0.4	0.5	0.8	0.5
UCL (Student-t)	2.1	1.5	1.0	1.0	1.1	1.4	1.6	2.1	1.9
Total Number of Samples (#S)	134	140	120	104	112	69	61	61	74
Number of detected values (D)	43	52	40	36	34	19	12	16	22
Number of non-detected values (ND)	91	88	80	68	78	50	49	45	52

PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	20	20	20	20	20	20	20	20	20
Average	2.1	2.3	1.0	1.0	1.1	1.3	1.4	1.8	1.7
Standard Deviation	4.4	4.4	1.9	1.8	1.4	1.8	2.2	3.0	2.7
Minimum value	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.5	0.5
First quartile (Q1)	0.2	0.2	0.2	0.2	0.4	0.5	0.6	0.6	0.6
Median	0.2	0.2	0.2	0.3	0.6	0.7	0.7	0.7	0.8
Third quartile (Q3)	1.6	1.8	0.7	0.6	0.9	1.1	0.8	1.3	0.9
Maximum value	18.6	16	6.3	7.1	5.2	8.0	9.7	12.9	11.4
Whisker- = (Q1-Min)	0.0	0.0	0.0	0.0	0.2	0.2	0.3	0.1	0.1
Whisker+ = (Max-Q3)	17.0	14.2	5.7	6.5	4.3	6.9	8.8	11.6	10.6
Upper Confidence Level	2.1	2.0	0.9	0.8	0.7	0.8	1.0	1.4	1.2
UCL (Student-t)	4.2	4.4	1.9	1.9	1.7	2.2	2.5	3.2	3.0
Total Number of Samples (#S)	47	40	40	46	45	39	41	39	40
Number of detected values (D)	18	15	13	17	17	12	11	12	12
Number of non-detected values (ND)	29	25	27	29	28	27	30	27	28

PMP = performance monitoring plan
UCL = upper confidence limit

All PMP Wells



PMP Wells with Data for All Years

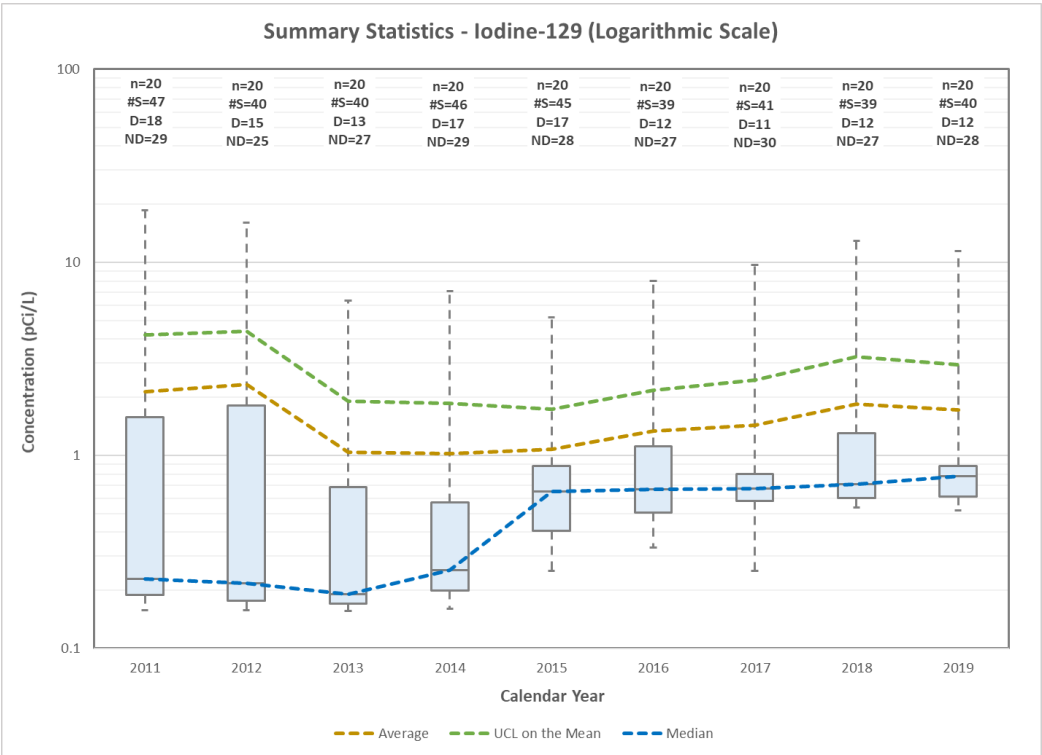
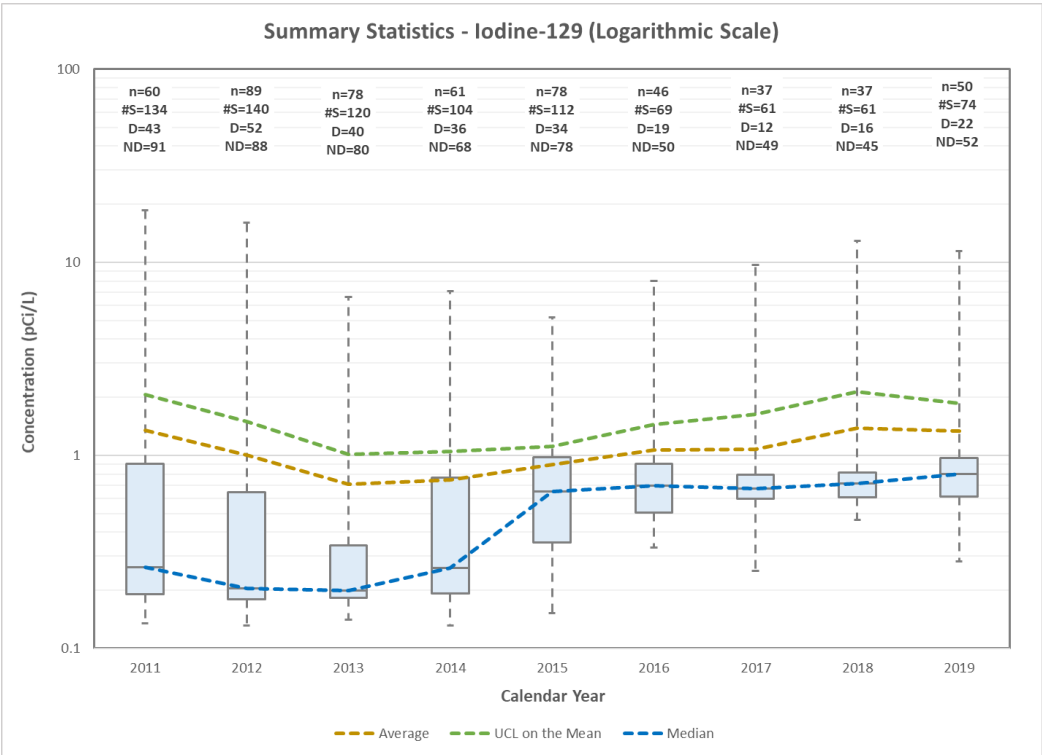
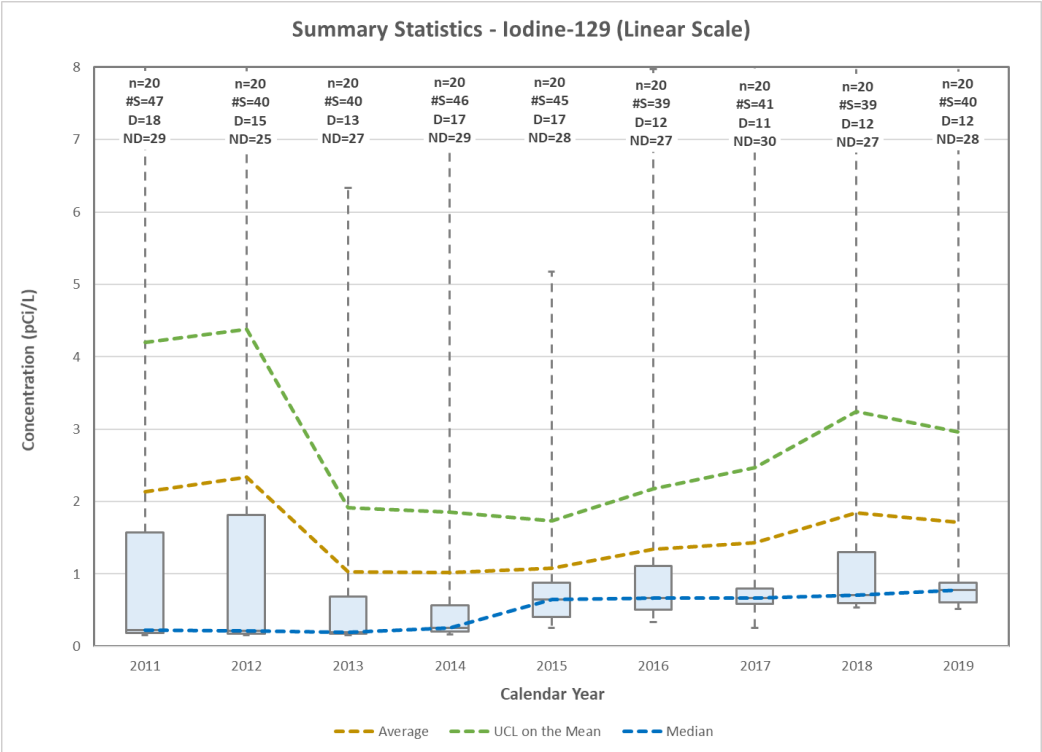


Figure 5. Summary Statistics for Iodine-129 Boxplot

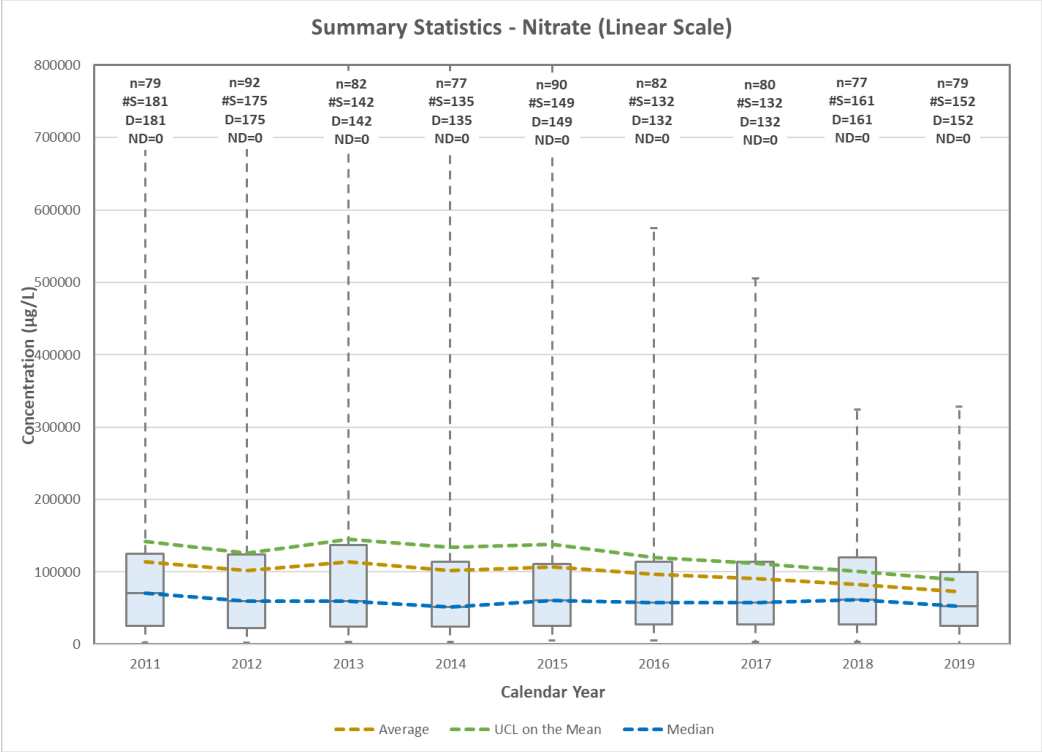
Table 6. Summary Statistics for Nitrate

All PMP Wells									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	79	92	82	77	90	82	80	77	79
Average	113604	101601.8	113949	101988	107207.1	96933.1	90736.4	83314.1	72951.7
Standard Deviation	127208.8	120773.3	144638.7	143444.3	149370.9	105451.5	95214.81	77274.49	69773.45
Minimum value	2736	2885	3605	3720	5676.667	5530	3100	3095	483
First quartile (Q1)	25437.5	22087.5	24468.75	24100	25358.33	27400	27212.5	27250	25290
Median	70400	59720	59300	51800	60850	57550	57750.0	62000	52200
Third quartile (Q3)	124750	124612.5	136825	114000	111250	114266.7	114087.5	120250	99625
Maximum value	690666.7	700666.7	846000	1010000	810000	575000	505000	324000	328000
Whisker- = (Q1-Min)	22701.5	19202.5	20863.8	20380.0	19681.7	21870.0	24112.5	24155.0	24807.0
Whisker+ = (Max-Q3)	565916.7	576054.2	709175.0	896000.0	698750.0	460733.3	390912.5	203750.0	228375.0
Upper Confidence Level	28493.2	25011.4	31780.6	32557.9	31285.1	23170.2	21189.0	17539.2	15628.4
UCL (Student-t)	142097.2	126613.2	145729.6	134545.8	138492.2	120103.3	111925.5	100853.3	88580.1
Total Number of Samples (#S)	181	175	142	135	149	132	132	161	152
Number of detected values (D)	181	175	142	135	149	132	132	161	152
Number of non-detected values (ND)	0	0	0	0	0	0	0	0	0

PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	41	41	41	41	41	41	41	41	41
Average	137256.2	133835.8	129836.3	107165.4	106951	92527.5	91106.6	88515.11	76927.8
Standard Deviation	149323.7	145500.8	143091	112439.1	138480.5	99677.51	93340.3	79552.7	64674.8
Minimum value	2736	2885	3605	4915	5676.667	5530	5795	5530	6200
First quartile (Q1)	27250	30100.0	29716.7	29000	27466.7	27400	26650	27250	27166.7
Median	83966.67	93860	65300	65100	51066.7	44300	53250	66400	53125
Third quartile (Q3)	187000	152166.7	162000	138000	112333.3	112066.7	117350	128000	130000
Maximum value	690666.7	700666.7	674666.7	447000	677500	429000	429500	284250	274000
Whisker- = (Q1-Min)	24514.0	27215.0	26111.7	24085.0	21790.0	21870.0	20855.0	21720.0	20966.7
Whisker+ = (Max-Q3)	503666.7	548500.0	512666.7	309000.0	565166.7	316933.3	312150.0	156250.0	144000.0
Upper Confidence Level	47132.4	45925.7	45165.1	35490.2	43709.8	31462.1	29461.8	25109.9	20413.9
UCL (Student-t)	184388.6	179761.5	175001.4	142655.6	150660.9	123989.6	120568.4	113625.0	97341.7
Total Number of Samples (#S)	106	103	87	86	90	85	86	111	105
Number of detected values (D)	106	103	87	86	90	85	86	111	105
Number of non-detected values (ND)	0	0	0	0	0	0	0	0	0

PMP = performance monitoring plan
UCL = upper confidence limit

All PMP Wells



PMP Wells with Data for All Years

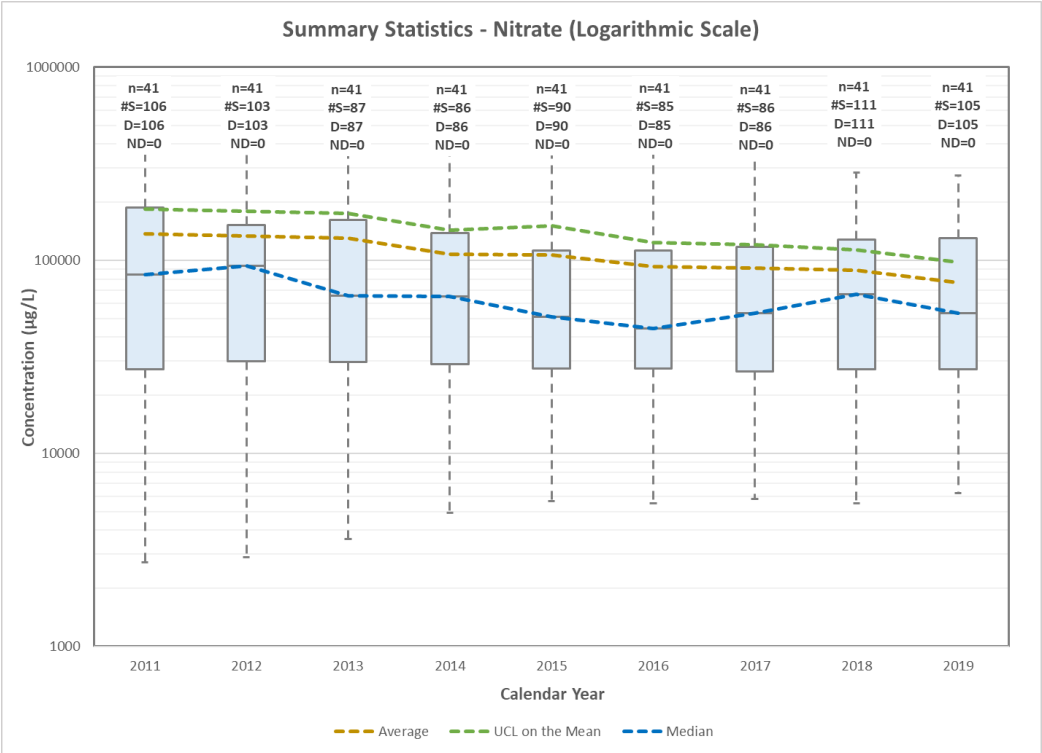
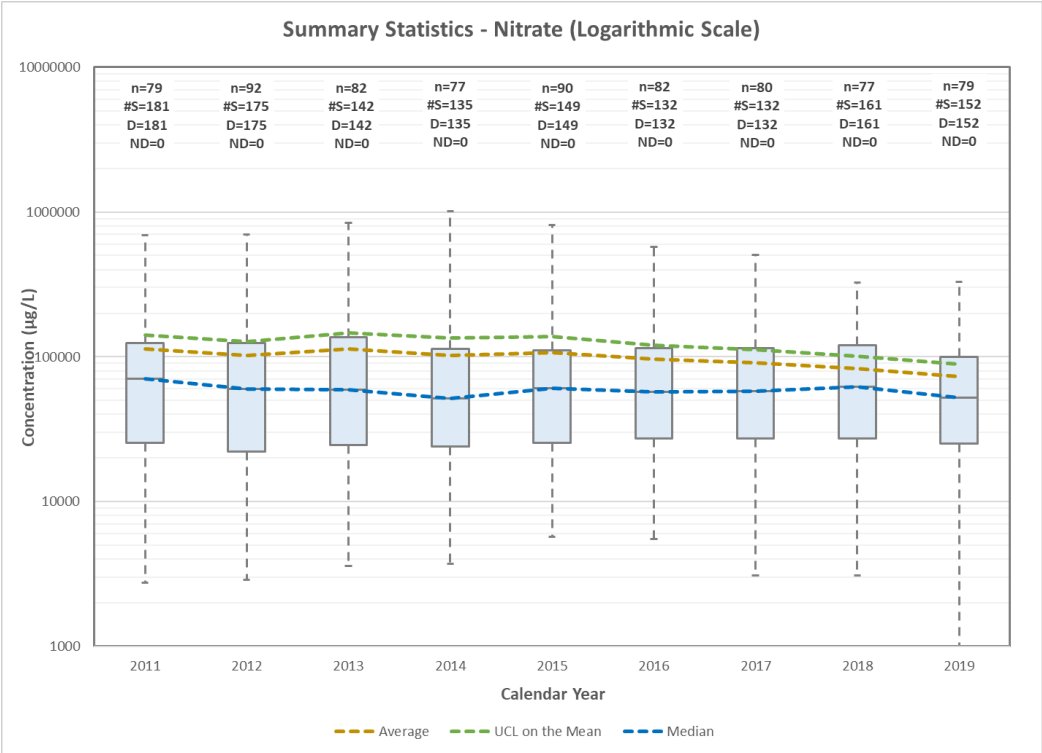
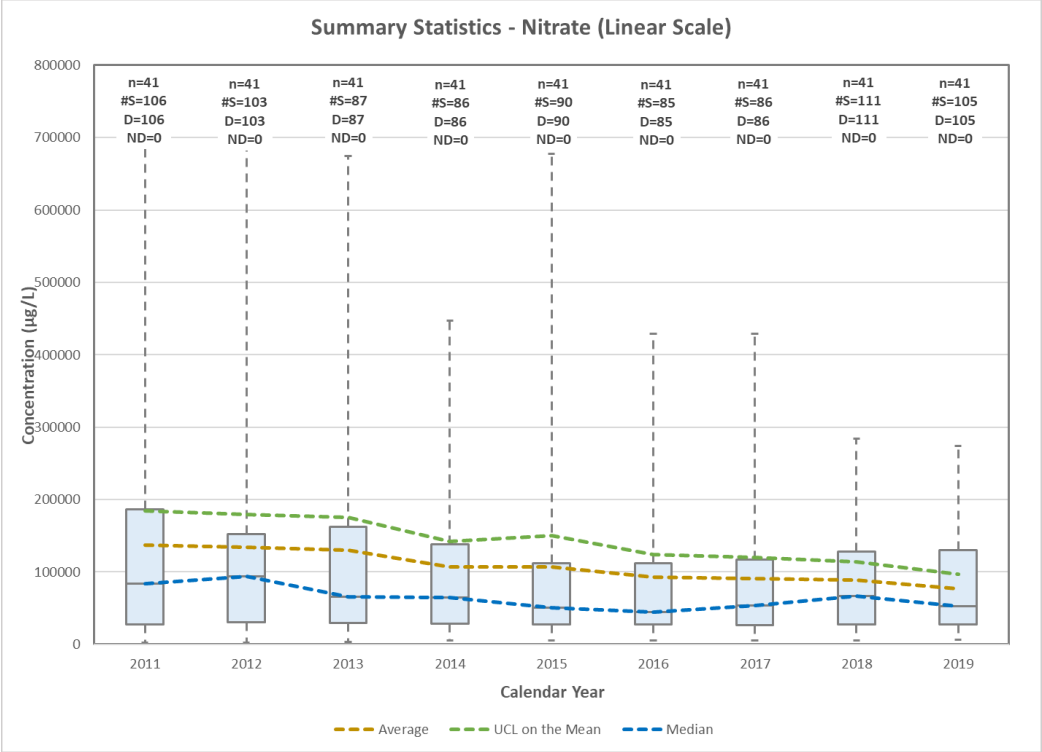


Figure 6. Summary Statistics for Nitrate Boxplot

Table 7. Summary Statistics for Technetium-99

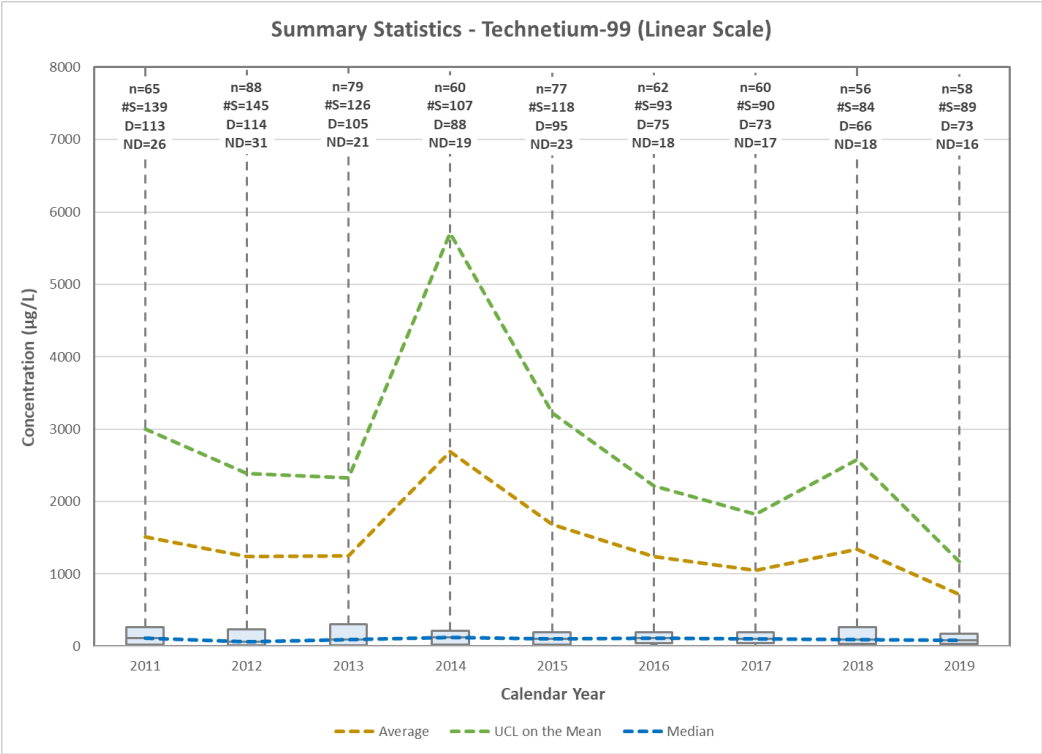
All PMP Wells									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	65	88	79	60	77	62	60	56	58
Average	1514.4	1238.8	1247.5	2687.7	1682.0	1238.2	1052.7	1342.2	716.7
Standard Deviation	5996.9	5432.3	4812.8	11690.1	6808.5	3860.6	2975.9	4606.3	1738.5
Minimum value	6.3	5.6	5.9	5.9	8.1	9.5	7.0	2.3	2.7
First quartile (Q1)	28.8	11.5	16.5	23.6	19.7	45.9	42.4	38.6	38.9
Median	118.5	67.4	98.0	120	103	110	103.7	91.0	82.2
Third quartile (Q3)	263.3	231.7	301.7	215.5	193.0	192.0	191.0	261.8	178.3
Maximum value	45000	45400	36000	86500	51400	22200	13700	30900	9480
Whisker- = (Q1-Min)	22.5	5.9	10.6	17.7	11.6	36.4	35.4	36.4	36.2
Whisker+ = (Max-Q3)	44736.7	45168.3	35698.3	86284.5	51207.0	22008.0	13509.0	30638.3	9301.8
Upper Confidence Level	1486.0	1151.0	1078.0	3019.9	1545.3	980.4	768.8	1233.6	457.1
UCL (Student-t)	3000.4	2389.8	2325.5	5707.6	3227.4	2218.6	1821.4	2575.7	1173.8
Total Number of Samples (#S)	139	145	126	107	118	93	90	84	89
Number of detected values (D)	113	114	105	88	95	75	73	66	73
Number of non-detected values (ND)	26	31	21	19	23	18	17	18	16

PMP = performance monitoring plan

UCL = upper confidence limit

PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	30	30	30	30	30	30	30	30	30
Average	2851.1	2867.4	2393.7	2385.6	2419.9	1676.4	1696.6	2215.6	1120.3
Standard Deviation	8629.4	8639.5	6785.8	5389.8	5637.7	3830.4	3780.0	6133.4	2271.0
Minimum value	6.4	6	6.7	7.5	9.1	9.8	7.1	12.6	4.0
First quartile (Q1)	72.4	57.5	65.5	55.8	58.9	46.9	52.8	38.3	52.4
Median	216.5	227.5	227.5	191.67	135.5	125.25	133.25	103.6	100.1
Third quartile (Q3)	664.13	586.25	682.5	474.56	237.25	343.75	401	583.25	703.13
Maximum value	45000	45400	36000	19000	19100	15300	13700	30900	9480
Whisker- = (Q1-Min)	66.0	51.5	58.9	48.2	49.8	37.1	45.7	25.7	48.4
Whisker+ = (Max-Q3)	44335.9	44813.8	35317.5	18525.4	18862.8	14956.3	13299.0	30316.8	8776.9
Upper Confidence Level	3222.3	3226.0	2533.9	2012.6	2105.2	1430.3	1411.5	2290.3	848.0
UCL (Student-t)	6073.4	6093.5	4927.5	4398.2	4525.1	3106.7	3108.0	4505.9	1968.3
Total Number of Samples (#S)	70	69	62	67	64	57	54	52	56
Number of detected values (D)	62	61	53	56	53	47	45	42	49
Number of non-detected values (ND)	8	8	9	11	11	10	9	10	7

All PMP Wells



PMP Wells with Data for All Years

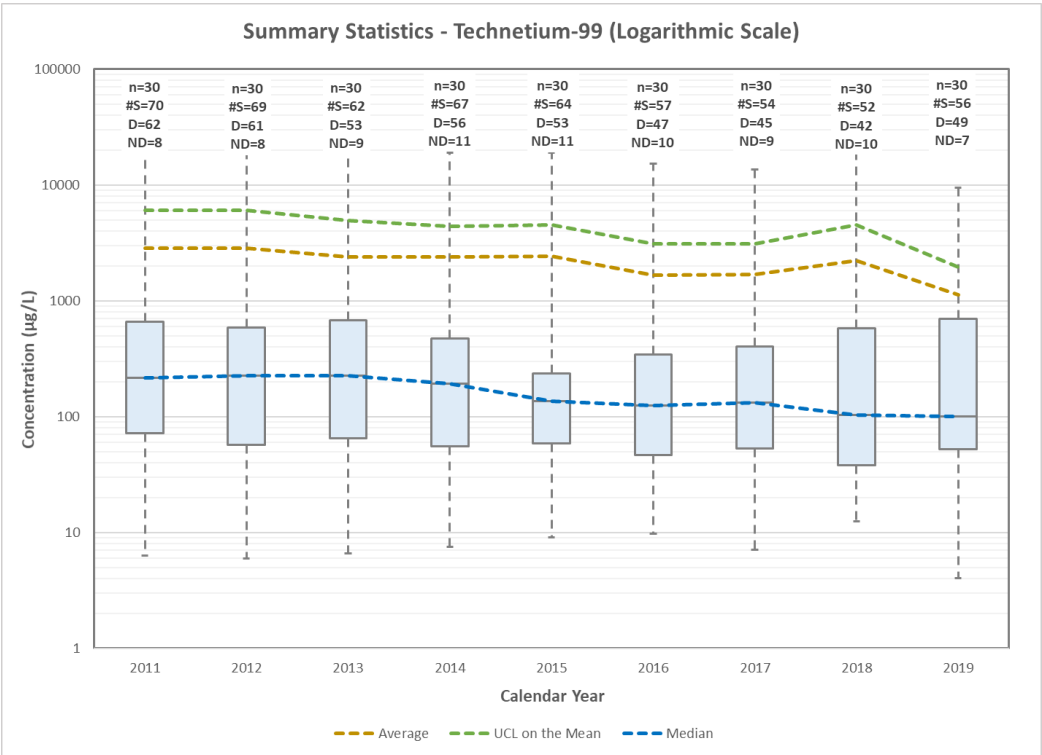
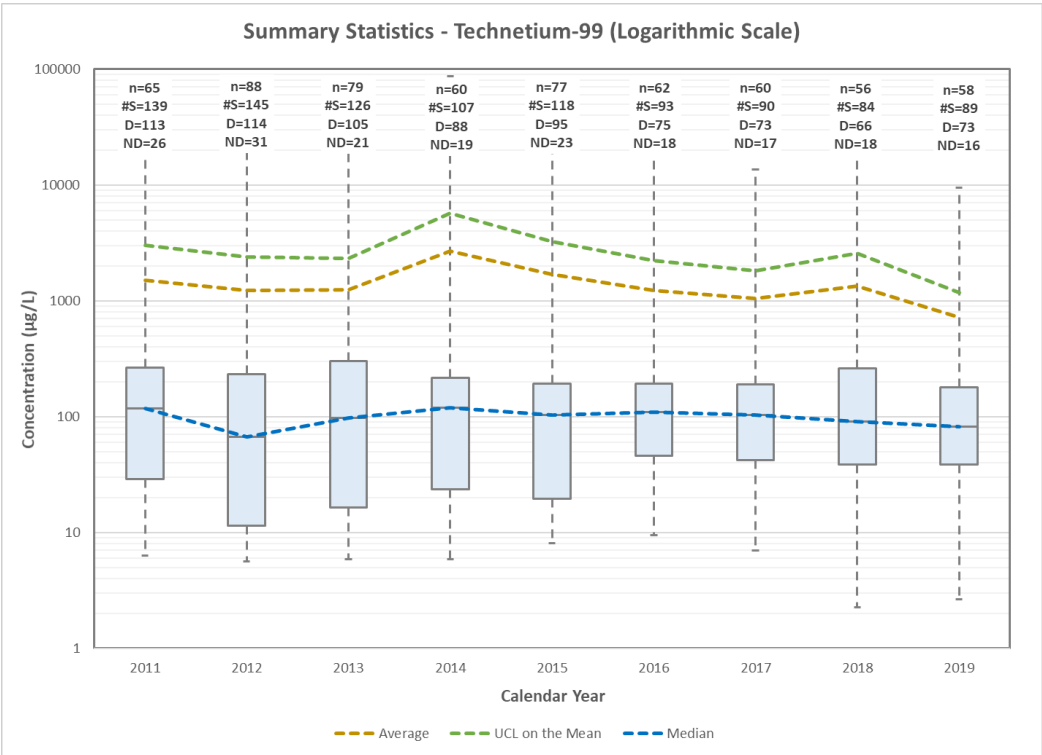
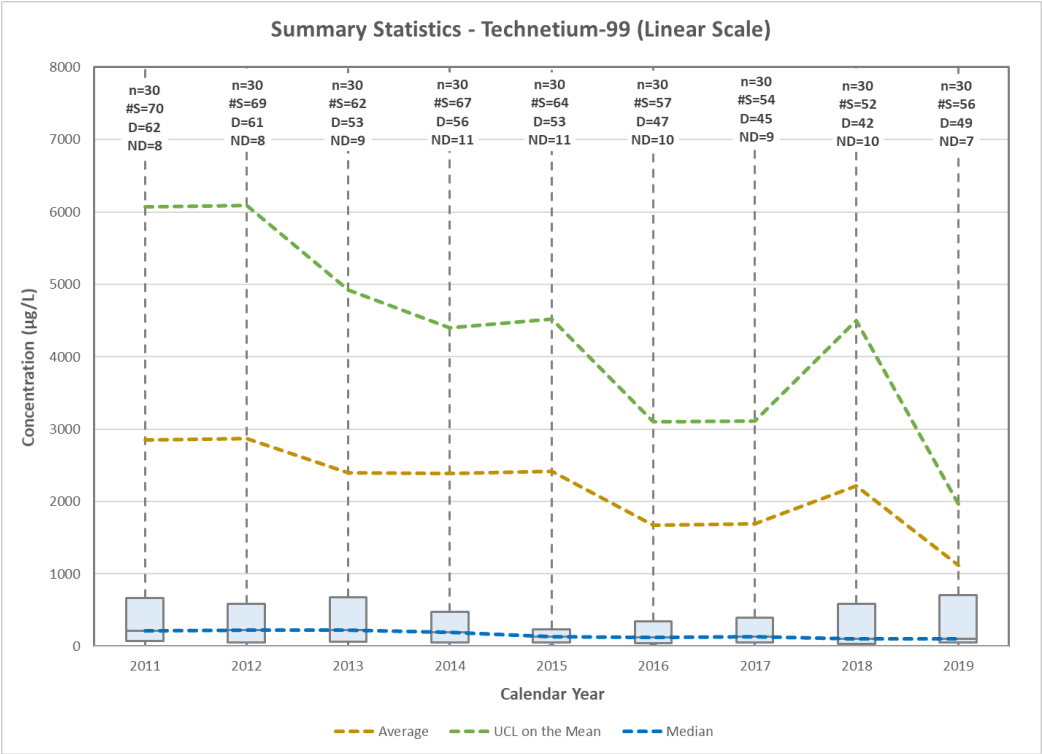


Figure 7. Summary Statistics for Technetium-99 Boxplot

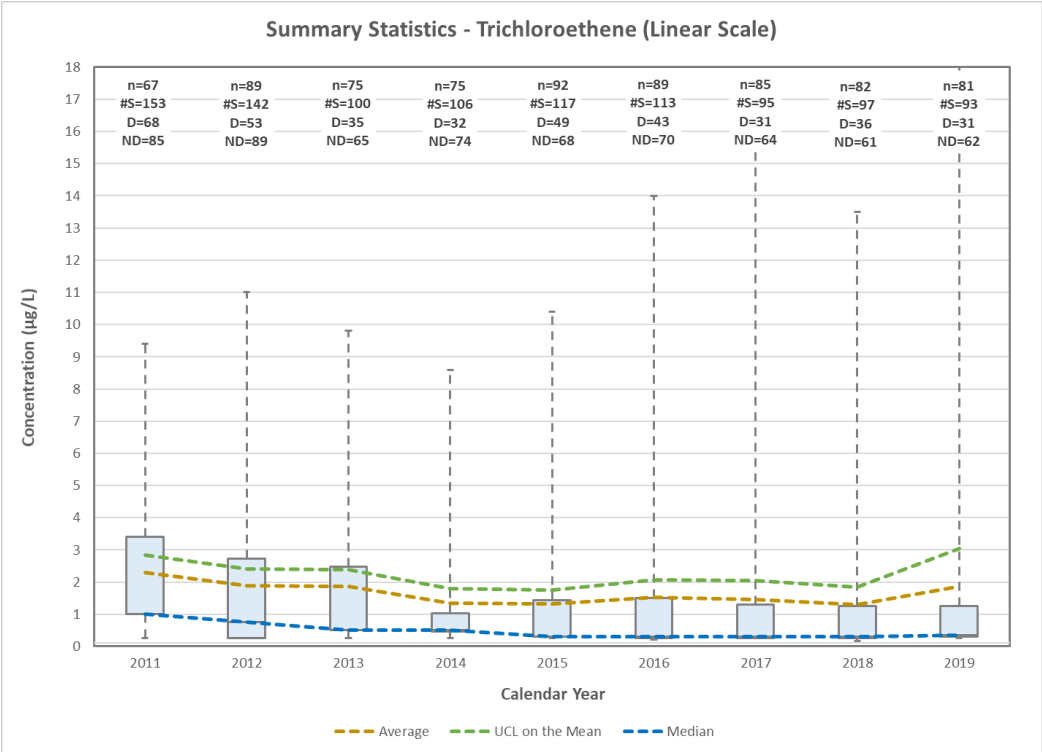
Table 8. Summary Statistics for Trichloroethene

All PMP Wells									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	67	89	75	75	92	89	85	82	81
Average	2.3	1.9	1.9	1.3	1.3	1.5	1.5	1.3	1.9
Standard Deviation	2.1	2.5	2.3	1.9	2.0	2.6	2.7	2.4	5.3
Minimum value	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.3
First quartile (Q1)	1	0.3	0.5	0.5	0.3	0.3	0.3	0.3	0.3
Median	1	0.8	0.5	0.5	0.3	0.3	0.3	0.3	0.3
Third quartile (Q3)	3.4	2.73	2.5	1.03	1.4	1.5	1.3	1.3	1.3
Maximum value	9.4	11	9.8	8.6	10.4	14	16	13.5	45.3
Whisker- = (Q1-Min)	0.8	0.0	0.3	0.2	0.1	0.0	0.0	0.1	0.1
Whisker+ = (Max-Q3)	6	8.3	7.3	7.6	9.0	12.5	14.7	12.3	44.0
Upper Confidence Level	0.5	0.5	0.5	0.4	0.4	0.5	0.6	0.5	1.2
UCL (Student-t)	2.8	2.4	2.4	1.8	1.7	2.1	2.0	1.8	3.0
Total Number of Samples (#S)	153	142	100	106	117	113	95	97	93
Number of detected values (D)	68	53	35	32	49	43	31	36	31
Number of non-detected values (ND)	85	89	65	74	68	70	64	61	62

PMP = performance monitoring plan
UCL = upper confidence limit

PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	35	35	35	35	35	35	35	35	35
Average	2.5	2.8	2.0	1.7	1.7	2.0	1.8	1.6	1.6
Standard Deviation	2.3	2.9	2.5	2.4	2.5	3.0	2.9	3.0	2.4
Minimum value	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.2	0.3
First quartile (Q1)	1	0.7	0.5	0.4	0.3	0.3	0.3	0.3	0.3
Median	1	1	0.8	0.5	0.3	0.3	0.3	0.3	0.5
Third quartile (Q3)	3.8	5	2.1	1.8	2.0	3.3	2.0	1.4	1.4
Maximum value	8.8	11	9.8	8.6	10.4	12.9	12.5	13.5	10.8
Whisker- = (Q1-Min)	0.8	0.4	0.3	0.1	0.1	0.1	0.0	0.1	0.1
Whisker+ = (Max-Q3)	5.0	6.0	7.8	6.8	8.4	9.6	10.5	12.1	9.4
Upper Confidence Level	0.8	1.0	0.9	0.8	0.9	1.0	1.0	1.0	0.8
UCL (Student-t)	3.3	3.7	2.9	2.5	2.6	3.0	2.8	2.7	2.4
Total Number of Samples (#S)	79	64	50	53	50	54	43	44	44
Number of detected values (D)	23	17	17	15	17	18	12	14	12
Number of non-detected values (ND)	56	47	33	38	33	36	31	30	32

All PMP Wells



PMP Wells with Data for All Years

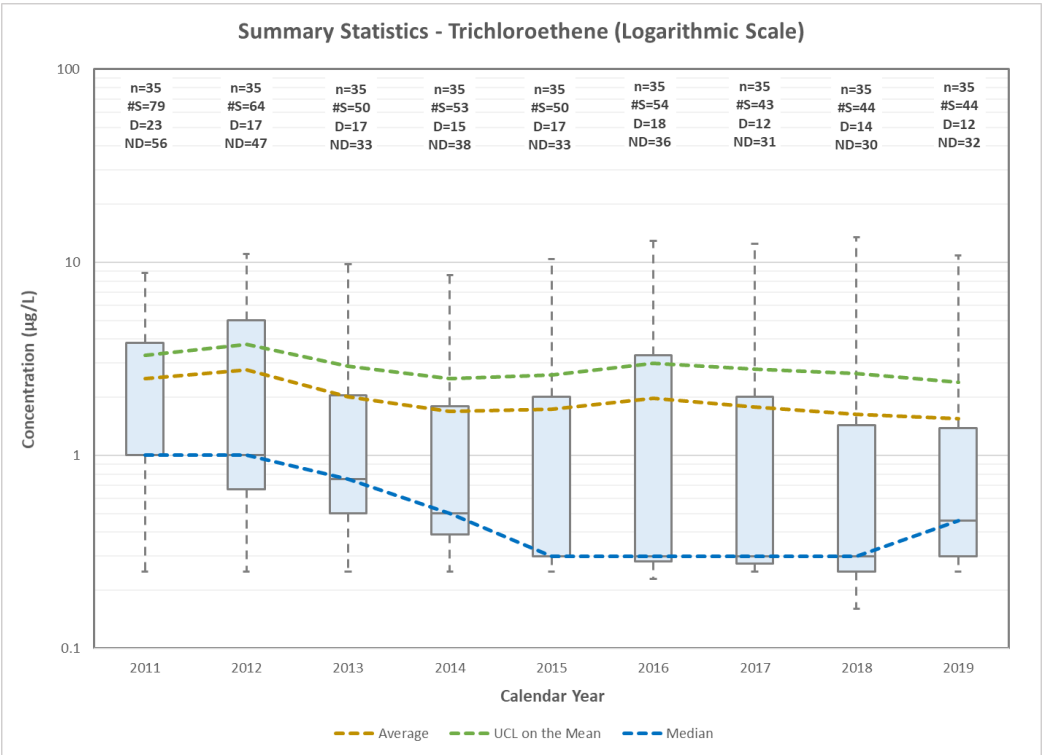
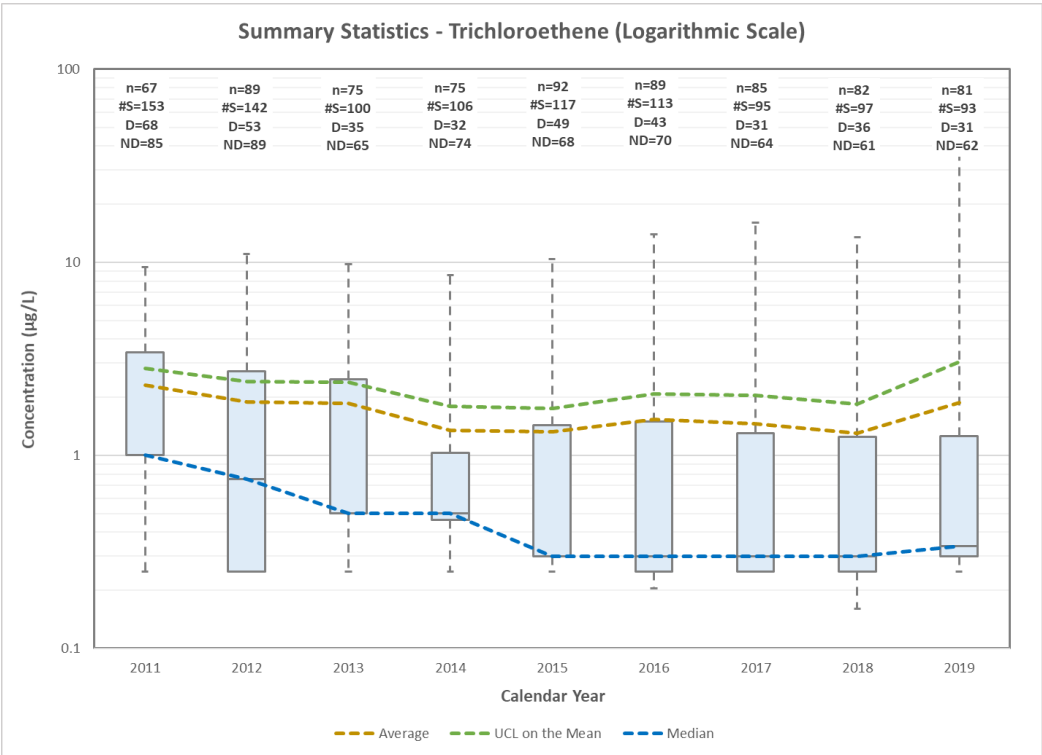
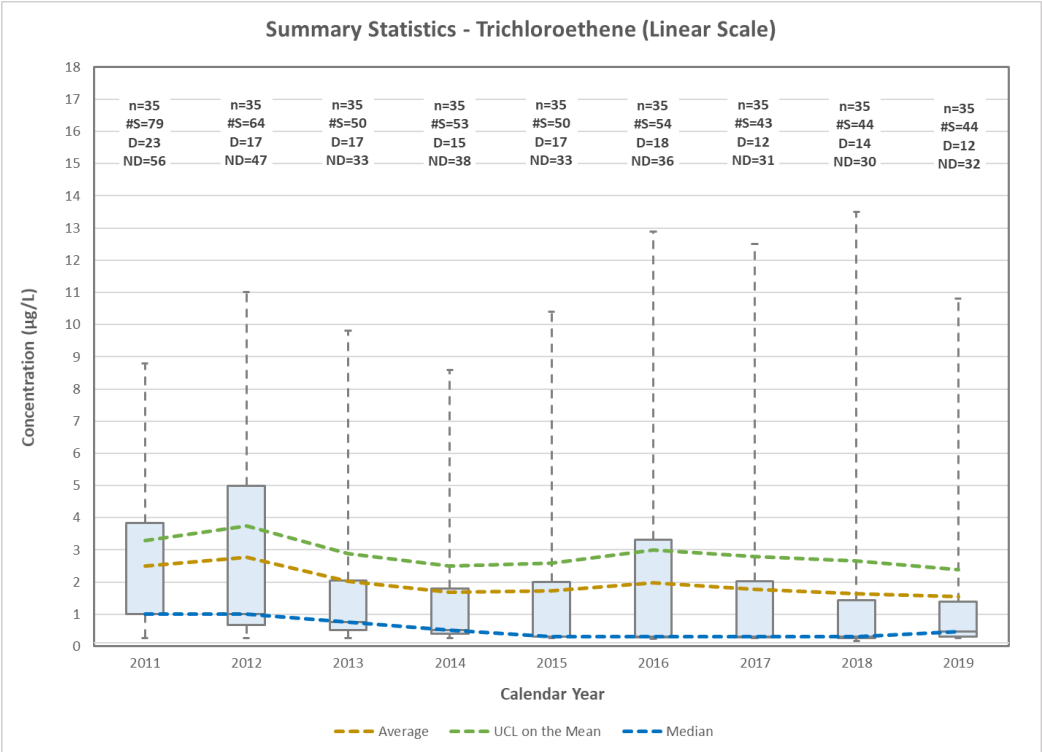


Figure 8. Summary Statistics for Trichloroethene Boxplot

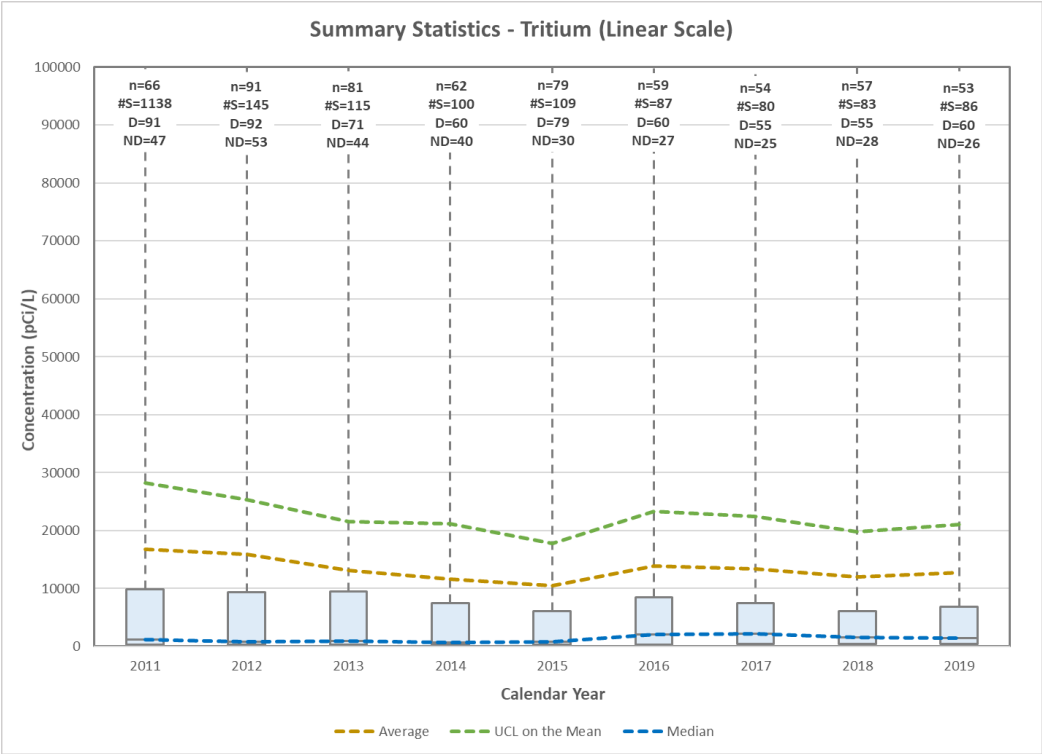
Table 9. Summary Statistics for Tritium

All PMP Wells									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	66	91	81	62	79	59	54	57	53
Average	16766.8	15893.6	13093.5	11601.2	10438.2	13908.8	13404.8	12045.4	12744.6
Standard Deviation	46436.5	45511.8	38492.9	37876.4	32930.7	35987.9	33090.4	29048.9	29915.7
Minimum value	27.2	114.6	23.95	22.7	76.2	84.9	129.0	101	195.4
First quartile (Q1)	310	324.1667	320	291.375	318	345	419.75	365	366
Median	1223.333	810	940	725.5833	814	2056.667	2130	1500	1440
Third quartile (Q3)	9837.5	9350	9500	7430	6065	8505	7492.5	6085	6850
Maximum value	331666.7	350000	310000	280000	264000	250000	218000	187000	193000
Whisker- = (Q1-Min)	282.8	209.5	296.1	268.7	241.8	260.1	290.8	264.0	170.6
Whisker+ = (Max-Q3)	321829.2	340650.0	300500.0	272570.0	257935.0	241495.0	210507.5	180915.0	186150.0
Upper Confidence Level	11415.5	9478.3	8511.5	9618.8	7376.1	9378.5	9031.9	7707.7	8245.8
UCL (Student-t)	28182.3	25371.9	21604.9	21220.0	17814.2	23287.3	22436.7	19753.1	20990.4
Total Number of Samples (#S)	138	145	115	100	109	87	80	83	86
Number of detected values (D)	91	92	71	60	79	60	55	55	60
Number of non-detected values (ND)	47	53	44	40	30	27	25	28	26

PMP Wells with Data for All Years									
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019
Sample size (n)	26	26	26	26	26	26	26	26	26
Average	28531.1	19397.2	9647.0	5862.0	6029.3	6206.4	6136.2	7602.8	6074.5
Standard Deviation	69190.0	42702.7	17543.0	10761.5	12586.6	12411.3	13279.9	18295.3	14793.0
Minimum value	27.2	114.6	24.0	22.7	76.2	164.7	251.4	270.5	195.4
First quartile (Q1)	290	376.6667	327.5	303.5	556.3	318.375	473.25	387	345
Median	1223.333	1440	1357.5	1204.5	1177.5	925.8	1625	1192.5	1162.5
Third quartile (Q3)	16125	12583.33	10500	7110.0	5547.5	4880	3818.917	3855	2841.25
Maximum value	331666.7	200000	63000	43300	54000	50550	57100	84250	59166.7
Whisker- = (Q1-Min)	262.8	262.0	303.6	280.8	480.0	153.7	221.9	116.5	149.6
Whisker+ = (Max-Q3)	315541.7	187416.7	52500.0	36190.0	48452.5	45670.0	53281.1	80395.0	56325.4
Upper Confidence Level	27946.4	17248.0	7085.8	4346.6	5083.8	5013.0	5363.8	7389.6	5975.0
UCL (Student-t)	56477.5	36645.2	16732.8	10208.6	11113.1	11219.4	11500.0	14992.4	12049.6
Total Number of Samples (#S)	52	53	45	45	46	49	47	45	53
Number of detected values (D)	36	37	27	29	33	33	31	27	34
Number of non-detected values (ND)	16	16	18	16	13	16	16	18	19

PMP = performance monitoring plan
UCL = upper confidence limit

All PMP Wells



PMP Wells with Data for All Years

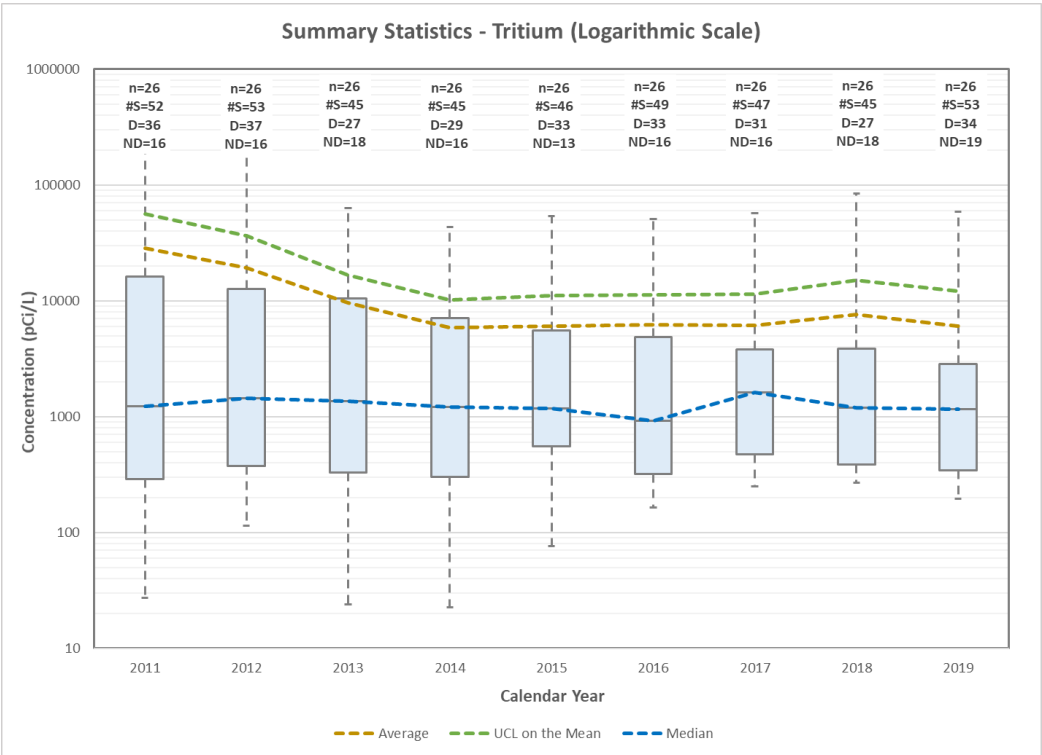
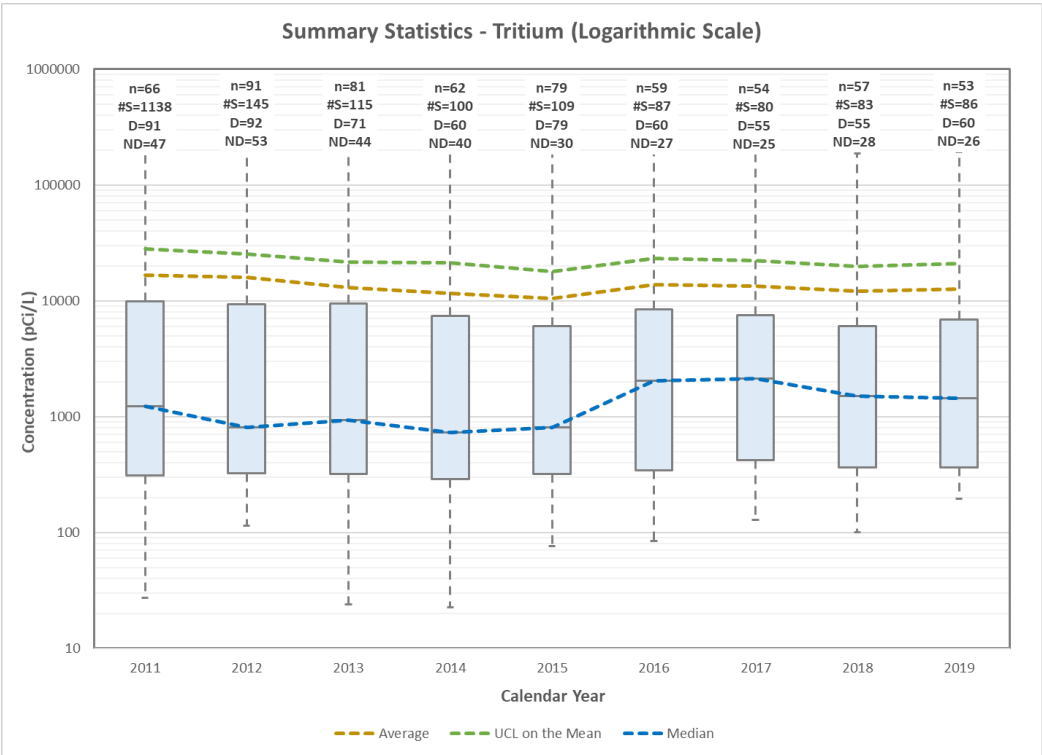
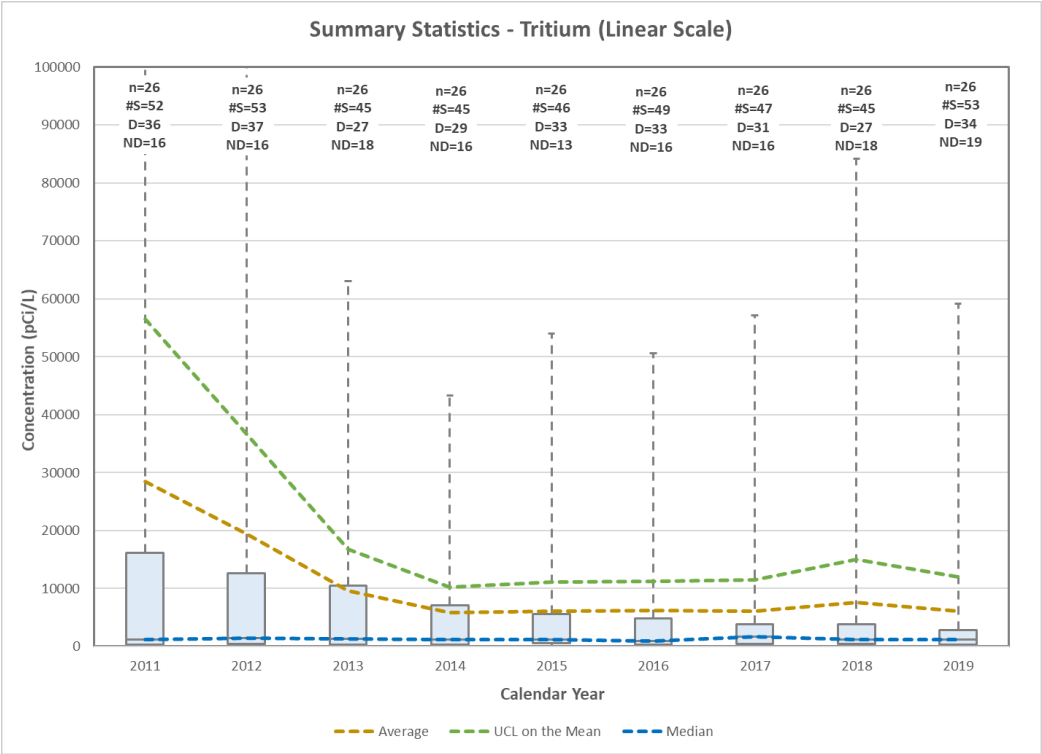


Figure 9. Summary Statistics for Tritium Boxplot

8 References

DOE/RL-2009-115, 2016, *Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action*. Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <https://pdw.hanford.gov/document/0074328H>.

Modified by:

TPA-CN-0875, 2019, *Tri-Party Agreement Change Notice: DOE/RL-2009-115, Performance Monitoring Plan for the 200-ZP-1 Groundwater Operable Unit Remedial Action, Revision 2*, U.S. Department of Energy, Richland Operations Office, and U.S. Environmental Protection Agency, Richland, Washington. Available at: <https://pdw.hanford.gov/document/AR-03254>.

DOE/RL-2010-72, 2014, *Sampling and Analysis Plan for Remediation Wells in the 200-ZP-1 Operable Unit*, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: <https://pdw.hanford.gov/document/1411040778>.

Modified by:

TPA-CN-0876, 2019, *Tri-Party Agreement Change Notice: DOE/RL-2010-72, Sampling and Analysis Plan for Remediation Wells in the 200-ZP-1 Operable Unit, Revision 2*, U.S. Department of Energy, Richland Operations Office, and U.S. Environmental Protection Agency, Richland, Washington. Available at: <https://pdw.hanford.gov/document/AR-03284>.

ECF-200UP1-18-0017, 2018, *Calculation of the 95th Percentile Upper Confidence Limit on Plume Monitoring Data for the 200-UP-1 Groundwater Operable Unit through Calendar Year 2017*, Rev. 0, CH2M HILL Plateau Remediation Company, Richland, Washington. Available at: <https://pdw.hanford.gov/document/0064872H>.

EPA, Ecology, and DOE, 2008, *Record of Decision, Hanford 200 Area 200-ZP-1 Superfund Site, Benton County, Washington*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: <http://pdw.hanford.gov/document/00098825>.

OSWER 9285.6-10, 2002, *Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C. Available at: <https://www.epa.gov/sites/production/files/2016-03/documents/upper-conf-limits.pdf>.

This page intentionally left blank.