ECF-HANFORD-17-0069
Revision 0

Calculation of Groundwater Sample Limits of Detection and Limits of Quantitation for Total Organic Carbon and Total Organic Halides for Calendar Year 2016

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

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Appendix

Tables

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Terms

ACS	American Chemical Society
CM	critical mean
CY	calendar year
EPA	U.S. Environmental Protection Agency
GEL	GEL Laboratories
HISI	Hanford Information System Inventory
LOD	limit of detection
LOQ	limit of quantitation
RCRA	*Resource Conservation and Recovery Act of 1976*
TADN	TestAmerica Denver
TASL	TestAmerica St. Louis
TOC	total organic carbon
TOX	total organic halides

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1 Purpose

This document describes the calculation of calendar year (CY) 2016 limits of detection (LOD) and limits of quantitation (LOQ) for total organic carbon (TOC) and total organic halides (TOX) to support detection groundwater monitoring (i.e., indicator parameter evaluation) at the Hanford Site under the *Resource Conservation and Recovery Act of 1976* (RCRA).

2 Background

From the 1940s until the 1980s, the Hanford Site produced plutonium for national defense. During that time operations used many chemical constituents which potentially can migrate to groundwater from disposal sites. In the 1990s, the mission at Hanford changed to environmental cleanup, including remediation of known groundwater contamination under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* and groundwater monitoring under RCRA.

Under 40 CFR 265.92(b)(3), "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," "Sampling and Analysis," as referenced by WAC 173-303-400(3)(a), "Dangerous Waste Regulations," "Interim Status Facility Standards," interim-status groundwater monitoring requires measurement of pH, specific conductance, TOC, and TOX as indicators of groundwater impact from a facility. Monitoring for these parameters is also required by the Hanford permit for detection monitoring at certain final-status sites. Downgradient measurements of these indicator parameters are compared with upgradient measurements to determine potential facility impact to groundwater. 40 CFR 265.93(b) "Preparation, Evaluation, and Response," requires this comparison to be done with a *t*-test at a 0.01 level of significance. The threshold value of the downgradient well sample results that would statistically exceed the mean of the background data at the 0.01 level of significance is calculated from the upgradient well sample results and is referred to as the critical mean (CM). The calculation of the CM is beyond the scope of this document, but it is a function of the mean and variance of the upgradient measurements. Because the means of upgradient measurements of TOC and TOX can be near zero and the variances can be small, the calculated CM can be below the LOQ, the level sufficiently quantifiable by the analytical laboratory. Because the test criterion for detection monitoring must be quantifiable, the test criterion is the greater of the critical mean and the LOQ. Thus, the LOQ precludes basing regulatory decisions on measurements which are insufficiently precise (WHC-SA-1124-FP, *Statistical Approach on RCRA Groundwater Monitoring Projects at the Hanford Site*; PNNL-13080, *Hanford Site Groundwater Monitoring: Setting, Sources and Methods*).

Several methods exist for determining minimum quantifiable concentration levels. The U.S. Environmental Protection Agency (EPA) defines the LOQ as "the lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte," (EPA 821-B-04-005, *Revised Assessment of Detection and Quantitation Approaches*, p. 2-5). In 1994, the EPA defined the LOQ as 10 times the standard deviation used to calculate the detection limit (EPA 821-B-04-005, p. 2-5). The EPA defines the method detection limit as "The standard deviation among...replicate measurements...multiplied by the *t*-distribution for n-1 degrees of freedom (in the case of 7 replicates, the multiplier is 3.143, which is the value for 6 degrees of freedom [and a significance level of 0.02])" (EPA 821-B-04-005, p. 2-3). This is similar to the definition advanced by the American Chemical Society's (ACS) Committee on Environmental Improvement in the early 1980s. "The ACS LOD is defined as the lowest concentration level that can be determined to be statistically different from a blank. The recommended value for the LOD is three times the standard deviation of replicate measurements of a blank or low-level sample" (EPA 821-B-04-005, p. 2-10). This ACS definition of the LOD corresponds to the EPA's definition of the minimum level (EPA 821-B-04-005, p. 2-5).

The ACS also defined the LOQ as 10 times the standard deviation of blank or low-level sample results. The ACS definitions of the LOD and LOQ are the definitions used by the Soil & Groundwater Remediation Project.

Defining the LOQ as a concentration of 10 times the standard deviation of blank results seems high, but it can be shown statistically that this results in a 95% confidence level that the measured value would be within ±25% of the true value for an analytical result at the LOQ if the LOQ were determined from seven analytical blank results[1]. An accuracy of ±25% is generally deemed acceptable and is typical of quality control limits for spike recoveries at analytical laboratories.

3 Methodology

CY 2016 LODs and LOQs for TOC and TOX were calculated using results from field blank samples. The calculations used four moving quarters of analytical results (e.g., the calculations for the 4th quarter of 2016 used the blanks results for all of 2016). The calculations were performed separately for each analytical laboratory from which field blank data were available.

The basic method of calculating LODs and LOQs is as follows:

1. Every quarter, TOC/TOX field blank data were obtained from the analytical laboratories.
2. Replicates were averaged and the data were reviewed for consistency.
3. Normality of the data was assessed using the Shapiro-Wilk test as described in Section 3.1 (EPA 530/R-09-007, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance*, Section 10.5.1). This was done for information only (see Chapter 4).
4. Potential outliers were identified by visual inspection of the measurements. Only those values substantially off-trend were considered to be potential outliers, and these were evaluated using Dixon's test as described in Section 3.2 (EPA 530/R-09-007, Section 12.3) when 25 or fewer analyses were received from the laboratory for that quarter, or Rosner's test as described in Section 3.3 (EPA 530/R-09-007, Section 12.4) for more than 25 analyses. However, statistical outliers were removed from the calculation only if they were outside the range of historical results. In some instances, elevated results may have been caused by methylene chloride contamination of the deionized water used to prepare the field blanks. Where this was confirmed by the presence of methylene chloride in field blanks, these results were excluded from the LOD/LOQ calculations.
5. The current quarters' blank results (for either TOC or TOX) were merged with the previous three quarters of blank results and the pooled standard deviation (S_{pooled}) for a 1-year period was calculated as follows (IUPAC 2012, *Compendium of Chemical Terminology Gold Book*):

$$S_{pooled} = \sqrt{\frac{\sum_{i=1}^{4}(n_i - 1) * s_i^{\,2}}{\sum_{i=1}^{4}(n_i - 1)}} \qquad \text{Equation 1}$$

[1] A 95% confidence interval on the *t*-distribution with 6 (i.e., *n*-1) degrees of freedom ($t_{0.95,6}$) is ±2.447 standard deviations about the mean. At a concentration of 10 standard deviations of the blank results, ±2.447 standard deviations corresponds to a range of ~±25% of the concentration, and thus a 95% confidence level that the true value would lie within ~±25% of the measured value (assuming normality).

where n_i is the number of field blank results in the i^{th} quarter, and s_i^2 is the variance of the field blank results for the i^{th} quarter.

6. The LOD and LOQ were calculated (for either TOC or TOX) using the following equations, and were rounded to the nearest 10 µg/L for TOC and to the nearest 0.1 µg/L for TOX:

$$LOD = 3 \cdot S_{pooled} \quad \text{Equation 2}$$

$$LOQ = 10 \cdot S_{pooled} \quad \text{Equation 3}$$

3.1 Shapiro-Wilk Test for Normality

The procedure used for the Shapiro-Wilk test is documented in EPA 530/R-09-007, Section 10.5.1. As stated in that document, the "Shapiro-Wilk test is based on the premise that if a data set is normally distributed, the ordered values should be highly correlated with corresponding *quantiles* (z-scores) taken from a normal distribution." This test has the null hypothesis that the data are normally distributed. If the calculated test statistic exceeds the critical value, the null hypothesis is accepted. Otherwise, the null hypothesis is rejected and the alternative hypothesis that the data are not normally distributed is accepted.

The steps for performing this test are as follows:

1. Order the measurements from least to greatest.
2. Compute the following differences

$$\left(x_{(n-i+1)} - x_{(i)}\right) \quad \text{Equation 4}$$

for $i = 1$ to n, where n is the number of measurements and $x_{(i)}$ is the i-th measurement. In effect, this generates a sequence of differences where the first value is the last measurement minus the first measurement, the second value is the second-to-last measurement minus the second measurement, etc. Note that the second half of these values will be the same magnitude as the first half but of opposite sign. Thus, only the first half is used in the remainder of this test.

3. Determine k as the greatest integer less than or equal to $n/2$ (i.e., one-half the number of measurements [truncating the decimal]).
4. Obtain the Shapiro-Wilk coefficients from Table 10-2 in Appendix D of EPA 530/R-09-007. The coefficients are grouped by n, the number of measurements, and there will be k coefficients. The coefficients can be determined for up to 50 measurements, the limit of the Shapiro-Wilk test.
5. Compute the intermediate quantity, b, which is the sum of the products of the differences determined in step 2 and the coefficients obtained in step 4, in sequence:

$$b = \sum_{i=1}^{k} a_{(n-i+1)}\left(x_{(n-i+1)} - x_{(i)}\right) \quad \text{Equation 5}$$

where the values, a, are the coefficients obtained in step 4.

6. Calculate the standard deviation of the measurements.

7. Calculate the Shapiro-Wilk test statistic, *SW*:

$$SW = \left(\frac{b}{s\sqrt{n-1}} \right)^2 \quad \text{Equation 6}$$

8. Obtain the critical value from Table 10-3 in Appendix D of EPA 530/R-09-007. The critical values are given for three significance levels. In accordance with the guidance in EPA 530/R-09-007, use a level of significance of 0.10 for small data sets (i.e., $n < 10$), 0.05 for intermediate-sized data sets (i.e., $10 \leq n < 20$), and 0.01 for large data sets (i.e., $n \geq 20$).

9. If the test statistic computed in step 7 is greater than or equal to the critical value, accept normality. If the test statistic is less than the critical value, reject the null hypothesis of normality.

3.2 Dixon's Test for Outliers

With Dixon's test for outliers, the ratio of the difference between the suspected outlier and a nearby measurement to a measure of the range of the data is computed. If this test statistic exceeds a critical value, the suspected outlier is declared a statistical outlier. This test is most applicable to evaluating the most extreme measurement against the remaining measurements in a data set. It is used for relatively small data sets. When the number of measurements exceeds 25, Rosner's test is used (Section 3.3).

The steps for performing this test are as follows:

1. Arrange the measurements in increasing order, x_1 to x_n, where n is the number of measurements.

2. For a suspected low outlier (x_1), compute the test statistic, C, from

$$C = \begin{cases} (x_2 - x_1)/(x_n - x_1) \text{ for } 3 \leq n \leq 7 \\ (x_2 - x_1)/(x_{(n-1)} - x_1) \text{ for } 8 \leq n \leq 10 \\ (x_3 - x_1)/(x_{(n-1)} - x_1) \text{ for } 11 \leq n \leq 13 \\ (x_3 - x_1)/(x_{(n-2)} - x_1) \text{ for } 14 \leq n \leq 25 \end{cases} \quad \text{Equation 7}$$

   For a suspected high outlier (x_n), compute the test statistic, C, from

$$C = \begin{cases} (x_n - x_{(n-1)})/(x_n - x_1) \text{ for } 3 \leq n \leq 7 \\ (x_n - x_{(n-1)})/(x_n - x_2) \text{ for } 8 \leq n \leq 10 \\ (x_n - x_{(n-2)})/(x_n - x_2) \text{ for } 11 \leq n \leq 13 \\ (x_n - x_{(n-2)})/(x_n - x_3) \text{ for } 14 \leq n \leq 25 \end{cases} \quad \text{Equation 8}$$

3. Obtain the critical value from Table 12-1 in Appendix D of EPA 530/R-09-007 using a level of significance (α) of 0.05.

4. If the test statistic, C, exceeds the critical value, the suspected value is declared a statistical outlier.

3.3 Rosner's Test for Outliers

This test is used for data sets exceeding 25 measurements, or when testing multiple potential outliers. It tests for outliers in blocks of measurements rather than singly. The steps for performing this test are as follows:

1. Order the data set and determine the number of possible outliers, r_0, by inspection. The possible outliers could be either high or low values, or a combination of high and low values.
2. Compute the mean $\bar{x}^{(0)}$ and standard deviation, $s^{(0)}$, of all the measurements. Find the measurement furthest from the mean, $y^{(0)}$, and remove it from the dataset.
3. Compute the mean $\bar{x}^{(1)}$ and standard deviation, $s^{(1)}$, of all the remaining measurements. Find the measurement furthest from the new mean, $y^{(1)}$, and remove it from the dataset. Continue until all potential outliers are removed.
4. Test for r outliers (where $r \leq r_0$) by iteratively computing the test statistic, R, as:

$$R_{r-1} = \frac{\left| y^{(r-1)} - \bar{x}^{(r-1)} \right|}{s^{(r-1)}} \qquad \text{Equation 9}$$

Critical values are obtained from Table 12-2 in Appendix D of EPA 530/R-09-007 based on sample size and using a level of significance (α) of 0.05. Test for r_0 outliers initially. If the test statistic exceeds the first critical value, conclude there are r_0 outliers. If not, test for r_0-1 outliers by the same method using the next critical value from the table and continue until a block of outliers is identified or no outliers are identified.

Rosner's test was not used on any of the 2016 data sets, but is included here for completeness.

4 Assumptions and Inputs

Ninety-five percent confidence that a measured concentration lies within ±25% of the true concentration at the LOQ concentration level depends on the assumption that the field blank results are normally distributed. Dixon's and Rosner's tests for outliers also assume that the blank results are normally distributed. To evaluate each data set for normality, the Shapiro-Wilk test (Section 3.1) was applied to each of the quarterly TOC and TOX blanks results (from each laboratory). The test was performed only for those quarters in which eight or more blank sample results were available, in accordance with guidance in EPA 530/R-09-007.

It should be noted that the Shapiro-Wilk normality test is performed for information only. Quarterly blank results that are found to be not normally distributed are still used in the LOD and LOQ calculations. This is done for several reasons. First, the method of calculating the LOD as 3 times the standard deviation of the blanks results and the LOQ as 10 times the standard deviation of the blanks results is a simplified method that yields only an estimate of the "true" LOD and LOQ. Thus, there is already some uncertainty in these calculations even when the data are normally distributed. Second, LOD and LOQ values for a given laboratory fluctuate over time (hence the need to periodically recalculate the values), which further adds to the uncertainty of determining values applicable for a particular quarter. Thus, it is assumed that the additional uncertainty of using non-normal data sets in the calculations is small given the sources of uncertainty already present in the calculations. In addition, a better estimate of "true" LOD and LOQ values would entail the analysis of many blind standards near the estimated LOD and LOQ concentration levels. This is not a viable option because it would unacceptably increase analytical costs.

A total of 12 normality tests were performed on the blank results for CY 2016, and the results are shown in Table 1. Six of the 12 data sets were determined to be normally distributed. TOX data are left-censored at 0 µg/L, and this is a likely source of non-normality for the TOX data. As stated above, it is assumed that the effect of using non-normally distributed data to calculate the LOD and LOQ is small given the other sources of uncertainty in the calculations.

Table 1. Results of the Shapiro-Wilk Normality Test for CY 2016

Quarter/Analyte	Number of Samples	Level of Significance	Test Statistic	Critical Value	Result
GEL Laboratories Total Organic Carbon					
2016 1st Q TOC	28	0.01	0.756	0.896	Non-Normal
2016 2nd Q TOC	3	N/A	N/A	N/A	Not determined
2016 3rd Q TOC	5	N/A	N/A	N/A	Not determined
GEL Laboratories Total Organic Halides					
2016 1st Q TOX	28	0.01	0.817	0.896	Non-Normal
2016 2nd Q TOX	1	N/A	N/A	N/A	Not determined
2016 3rd Q TOX	5	N/A	N/A	N/A	Not determined
TestAmerica Denver Total Organic Carbon					
2016 4th Q TOC	13	0.05	0.879	0.866	Normal
TestAmerica Denver Total Organic Halides					
2016 4th Q TOX	12	0.05	0.782	0.859	Non-Normal
TestAmerica St. Louis Total Organic Carbon					
2016 1st Q TOC	12	0.05	0.942	0.859	Normal
2016 2nd Q TOC	12	0.05	0.880	0.859	Normal
2016 3rd Q TOC	17	0.05	0.849	0.892	Non-Normal
2016 4th Q TOC	12	0.05	0.911	0.859	Normal
TestAmerica St. Louis Total Organic Halides					
2016 1st Q TOX	12	0.05	0.857	0.859	Non-Normal
2016 2nd Q TOX	9	0.10	0.898	0.859	Normal
2016 3rd Q TOX	15[a]	0.05	0.968	0.881	Normal
2016 4th Q TOX	11[b]	0.05	0.828	0.850	Non-Normal

a. Excluding one outlier (sample number B35NC9).

b. Excluding one outlier (sample number B37449).

N/A = not applicable

Q = quarter

The spreadsheets used for the normality testing and calculation of the LODs and LOQs are shown in Appendix A. Two TOX blanks for TestAmerica St. Louis were not used in the calculations (third quarter sample B35NC9 and fourth quarter sample B37449); the results were biased high, and it was determined this was most likely due to contamination in the deionized water used to generate the field blanks. The values for those blanks also tested as statistical outliers by Dixon's outlier test. Table 2 lists the outlier sample numbers and their corresponding results.

Table 2. CY 2016 Outlier TOX Results for TestAmerica St. Louis

Quarter	Sample Number	Results (µg/L)	Average (µg/L)
2016 3rd Q TOX	B35NC9	12.68	19.98
		27.27	
2016 4th Q TOX	B37449	21.21	12.16
		3.11	

Q = quarter

5 Software Applications

A Microsoft® Excel® 2013 spreadsheet was used to perform the calculations described in Chapters 3 and 4, using functions available in that software. Microsoft Excel 2013 is registered in the Hanford Information System Inventory (HISI) as approved for use (HISI number 1915). The calculations were performed within the limitations of the software as approved.

6 Calculations

Spreadsheets for the quarterly calculation of the LODs and LOQs for CY 2016 are shown in Appendix A. The spreadsheets include the Shapiro-Wilk tests for normality and Dixon's test for outliers, as needed. Also included in Appendix A are charts of the field blank results.

7 Results

Table 3 lists the calculated LOD and LOQ values for TOC and TOX for each quarter of CY 2016.

Table 3. CY 2016 Total Organic Carbon and Total Organic Halides Limits of Detection and Limits of Quantitation

Analyte	Quarter	Limit of Detection (µg/L)*	Limit of Quantitation (µg/L)*
GEL Laboratories			
Total organic carbon	Jan-Mar 2016	120	390
	Apr-Jun 2016	120	410
	Jul-Sep 2016	140	460

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Table 3. CY 2016 Total Organic Carbon and Total Organic Halides Limits of Detection and Limits of Quantitation

Analyte	Quarter	Limit of Detection (µg/L)*	Limit of Quantitation (µg/L)*
Total organic halides	Jan-Mar 2016	3.3	10.9
	Apr-Jun 2016	3.4	11.3
	Jul-Sep 2016	3.8	12.8
TestAmerica Denver			
Total organic carbon	Oct-Dec 2016	190	640
Total organic halides	Oct-Dec 2016	6.0	20.0
TestAmerica St. Louis			
Total organic carbon	Jan-Mar 2016	340	1,130
	Apr-Jun 2016	370	1,240
	Jul-Sep 2016	440	1,460
	Oct-Dec 2016	410	1,350
Total organic halides	Jan-Mar 2016	6.6	22.1
	Apr-Jun 2016	6.8	22.5
	Jul-Sep 2016	7.7	25.7
	Oct-Dec 2016	7.5	24.8

* Total organic carbon limits of detection and limits of quantitation are rounded to the nearest 10 µg/L, and total organic halide limits of detection and limits of quantitation are rounded to the nearest 0.1 µg/L.

8 References

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WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*. Available at: http://apps.leg.wa.gov/wac/default.aspx?cite=173-303-400.

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Appendix A

Calculation Spreadsheets

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	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
5	Quarter ID	SAMP_NUM	SAMP_DATE_TIME	LAB_CODE	FIELD_QC_TYPE	METHOD_NAME	CON_LONG_NAME	Conc (ug/L)	Avg (ug/L)	ANAL_DATE_TIME	LAB_SAMP_ID	SDG_NUM	REPLICATE_NUM					
207	CY2016- Q2	B34MN8	42475.3055555556	TASL	FTB	9020_TOX	Total organic halides	2.13	=AVERAGE(I207:I208)	42499.9944444444	250366	SL2174	1					
208	CY2016- Q2	B34MN8	42475.3055555556					2.37					2		*Shapiro- Wilk Normality Test*			
209	CY2016- Q2	B34NB2	42461.2916666667	TASL	FTB	9020_TOX	Total organic halides	1.26	=AVERAGE(I209:I210)	42474	247972	SL2160	1		[redacted]	[redacted]	[redacted]	Coefficient
210	CY2016- Q2	B34NB2	42461.2916666667					2.16					2		1	0.105	=INDIRECT(ADDRESS(219+ P210,17))	Q210 0.5488
211	CY2016- Q2	B34NC9	42467.3229166667	TASL	FTB	9020_TOX	Total organic halides	0.22	=AVERAGE(I211:I212)	42496.0215277778	250363	SL2165	1		=P210+1	0.11	=INDIRECT(ADDRESS(219+ P211,17))	Q211 0.3244
212	CY2016- Q2	B34NC9	42467.3229166667					0					2		=P211+1	0.165	=INDIRECT(ADDRESS(219+ P212,17))	Q212 0.1976
213	CY2016- Q2	B34P31	42461.2916666667	TASL	FTB	9020_TOX	Total organic halides	5.73	=AVERAGE(I213:I214)	42485.6159722222	247983	SL2160	1		=P212+1	1.12	=INDIRECT(ADDRESS(219+ P213,17))	Q213 0.0947
214	CY2016- Q2	B34P31	42461.2916666667					5.7					2		=P213+1	1.71	=INDIRECT(ADDRESS(219+ P214,17))	Q214
215	CY2016- Q2	B34P33	42461.2916666667	TASL	FTB	9020_TOX	Total organic halides	2.26	=AVERAGE(I215:I216)	42473.9291666667	247972	SL2160	1		=P214+1	2.25	=INDIRECT(ADDRESS(219+ P215,17))	Q215
216	CY2016- Q2	B34P33	42461.2916666667					6.73					2		=P215+1	3.51	=INDIRECT(ADDRESS(219+ P216,17))	Q216
217	CY2016- Q2	B34P35	42461.2916666667	TASL	FTB	9020_TOX	Total organic halides	0.21	=AVERAGE(I217:I218)	42473.9840277778	247972	SL2160	1		=P216+1	4.495	=INDIRECT(ADDRESS(219+ P217,17))	Q217
218	CY2016- Q2	B34P35	42461.2916666667					0					2		=P217+1	5.715	=INDIRECT(ADDRESS(219+ P218,17))	Q218
219	CY2016- Q2	B34P43	42467.3229166667	TASL	FTB	9020_TOX	Total organic halides	0.57	=AVERAGE(I219:I220)	42495.9604166667	250363	SL2165	1					
220	CY2016- Q2	B34P43	42467.3229166667					6.45					2			k: =INT(P218/2)		
221	CY2016- Q2	B34P45	42467.3229166667	TASL	FTB	9020_TOX	Total organic halides	0.33	=AVERAGE(I221:I222)	42495.9868055556	250363	SL2165	1					
222	CY2016- Q2	B34P45	42467.3229166667					0					2			b: =SUMPRODUCT(R210:R213,S210:S213)		
223	CY2016- Q2	B34P47	42467.3229166667	TASL	FTB	9020_TOX	Total organic halides	1.54	=AVERAGE(I223:I224)	42495.9430555556	250363	SL2165	1			s: =STDEV(Q210:Q218)		
224	CY2016- Q2	B34P47	42467.3229166667					0.7					2					
225																SW: =(Q222/(Q223*SQRT(P218- 1)))^2		
226																		
227																Critical pt: 0.859		n = 9, α = 0.10
228																		
229															*SW > Critical pt, so normality accepted*			

Figure A-1. Example Spreadsheet with Formulas Displayed Showing the Shapiro-Wilk Normality Test - CY 2016 2nd Quarter TOX from TASL

	B	C	D	E	F	G	H	I	J	K	L	M	N
5	Quarter ID	SAMP_NU	SAMP_DATE_TI	LAB_CO	FIELD_QC_T	METHOD_NA	CON_LONG_NAME	Conc. (ug/L)	Avg. (ug/L)	ANAL_DATE_TI	LAB_SAMP_I	SDG_NU	REPLICATE_N
233	CY2016- Q3	B35NC9	42561.3125	TASL	FTB	9020_TOX	Total organic halides	12.68	=AVERAGE(I233:I234)	42576.9701388889	264096	SL2248	1
234	CY2016- Q3	B35NC9	42561.3125					27.27					2

	V	W
229	***Dixon's Outlier Test on Sample B35NC9***	
230		
231	Order	Value
232	1	0
233	=V232+1	0.8
234	=V233+1	1.125
235	=V234+1	2.065
236	=V235+1	2.08
237	=V236+1	2.625
238	=V237+1	3.895
239	=V238+1	4.07
240	=V239+1	4.255
241	=V240+1	4.305
242	=V241+1	4.73
243	=V242+1	4.835
244	=V243+1	5.67
245	=V244+1	7.35
246	=V245+1	8.295
247	=V246+1	19.975
248		
249	=ROUND((W247- W245)/(W247- W234),3)	Test Statistic (Eq. 12.6 in EPA 530/R- 09- 007)
250	0.507	Critical value (Appendix D, Table 12.1 of EPA 530/R- 09- 007, alpha = 0.05, n = 16)
251		
252	The test statistic exceeds the critical value, so the measurement is a statistical outlier.	
253	Additional data from an FXR blank taken the same day as B35NC9 indicates probable	
254	contamination of the blank DI water used to make the field blanks for that day.	

Figure A-2. Example Spreadsheet with Formulas Displayed Showing Dixon's Test for Outliers - CY 2016 3rd Quarter TOX from TASL

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
409	CY2016- Q1 B33T03		1/4/16 9:30	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/8/16 1:18	1535300	GEL388645	1		*Shapiro- Wilk Normality Test*			
410	CY2016- Q1 B33T03		1/4/16 9:30					0.000					2		Rank #	Ave (mg/L)	x(n- i+1) -	Coefficient
411	CY2016- Q1 B33T03		1/4/16 9:30					0.000					3		1	0	0.16075	0.4328
412	CY2016- Q1 B33T03		1/4/16 9:30					0.000					4		2	0	0.15675	0.2992
413	CY2016- Q1 B33TY9		1/18/16 8:00	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/22/16 10:53	1538440	GEL389586	1		3	0	0.11725	0.251
414	CY2016- Q1 B33TY9		1/18/16 8:00					0.000					2		4	0	0.108	0.2151
415	CY2016- Q1 B33TY9		1/18/16 8:00					0.000					3		5	0	0.0675	0.1857
416	CY2016- Q1 B33TY9		1/18/16 8:00					0.000					4		6	0	0.063	0.1601
417	CY2016- Q1 B33V10		1/18/16 8:40	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/22/16 19:01	1538632	GEL389587	1		7	0	0.06225	0.1372
418	CY2016- Q1 B33V10		1/18/16 8:40					0.000					2		8	0	0.0595	0.1162
419	CY2016- Q1 B33V10		1/18/16 8:40					0.000					3		9	0	0.056	0.0965
420	CY2016- Q1 B33V10		1/18/16 8:40					0.000					4		10	0	0.04275	0.0778
421	CY2016- Q1 B33V33		1/4/16 9:30	GEL	FTB	9060_TOC	Total organic carbon	0.084	0.021	1/7/16 20:19	1535300	GEL388645	1		11	0	0.0345	0.0598
422	CY2016- Q1 B33V33		1/4/16 9:30					0.000					2		12	0	0.02525	0.0424
423	CY2016- Q1 B33V33		1/4/16 9:30					0.000					3		13	0.0015	0.0195	0.0253
424	CY2016- Q1 B33V33		1/4/16 9:30					0.000					4		14	0.0025	0.015	0.0084
425	CY2016- Q1 B33V35		1/4/16 9:30	GEL	FTB	9060_TOC	Total organic carbon	0.005	0.002	1/7/16 18:23	1535300	GEL388645	1		15	0.0175	- 0.015	
426	CY2016- Q1 B33V35		1/4/16 9:30					0.000					2		16	0.021	- 0.0195	
427	CY2016- Q1 B33V35		1/4/16 9:30					0.001					3		17	0.02525	- 0.02525	
428	CY2016- Q1 B33V35		1/4/16 9:30					0.000					4		18	0.0345	- 0.0345	
429	CY2016- Q1 B33V37		1/4/16 9:30	GEL	FTB	9060_TOC	Total organic carbon	0.037	0.025	1/7/16 19:07	1535300	GEL388645	1		19	0.04275	- 0.04275	
430	CY2016- Q1 B33V37		1/4/16 9:30					0.035					2		20	0.056	- 0.056	
431	CY2016- Q1 B33V37		1/4/16 9:30					0.000					3		21	0.0595	- 0.0595	
432	CY2016- Q1 B33V37		1/4/16 9:30					0.029					4		22	0.06225	- 0.06225	
433	CY2016- Q1 B33VH4		1/18/16 8:00	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/22/16 9:25	1538440	GEL389586	1		23	0.063	- 0.063	
434	CY2016- Q1 B33VH4		1/18/16 8:00					0.000					2		24	0.0675	- 0.0675	
435	CY2016- Q1 B33VH4		1/18/16 8:00					0.000					3		25	0.108	- 0.108	
436	CY2016- Q1 B33VH4		1/18/16 8:00					0.000					4		26	0.11725	- 0.11725	
437	CY2016- Q1 B33VH6		1/18/16 8:00	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/22/16 8:41	1538440	GEL389586	1		27	0.15675	- 0.15675	
438	CY2016- Q1 B33VH6		1/18/16 8:00					0.000					2		28	0.16075	- 0.16075	
439	CY2016- Q1 B33VH6		1/18/16 8:00					0.000					3					
440	CY2016- Q1 B33VH6		1/18/16 8:00					0.000					4		k:	14		
441	CY2016- Q1 B33VH8		1/18/16 8:00	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/22/16 10:09	1538440	GEL389586	1					
442	CY2016- Q1 B33VH8		1/18/16 8:00					0.000					2		b:	0.2196914		
443	CY2016- Q1 B33VH8		1/18/16 8:00					0.000					3		s:	0.048641254		
444	CY2016- Q1 B33VH8		1/18/16 8:00					0.000					4					
445	CY2016- Q1 B33VJ3		1/18/16 8:40	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/22/16 18:16	1538632	GEL389587	1		SW:	0.75553194		
446	CY2016- Q1 B33VJ3		1/18/16 8:40					0.000					2					
447	CY2016- Q1 B33VJ3		1/18/16 8:40					0.000					3		Critical pt:	0.896	n = 28, α = 0.01	
448	CY2016- Q1 B33VJ3		1/18/16 8:40					0.000					4					
449	CY2016- Q1 B33VJ5		1/18/16 8:40	GEL	FTB	9060_TOC	Total organic carbon	0.010	0.003	1/22/16 16:48	1538632	GEL389587	1		*SW < Critical pt, so normality rejected*			
450	CY2016- Q1 B33VJ5		1/18/16 8:40					0.000					2					
451	CY2016- Q1 B33VJ5		1/18/16 8:40					0.000					3					
452	CY2016- Q1 B33VJ5		1/18/16 8:40					0.000					4					
453	CY2016- Q1 B33VJ7		1/18/16 8:40	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/22/16 17:31	1538632	GEL389587	1					
454	CY2016- Q1 B33VJ7		1/18/16 8:40					0.000					2					
455	CY2016- Q1 B33VJ7		1/18/16 8:40					0.000					3					
456	CY2016- Q1 B33VJ7		1/18/16 8:40					0.000					4					
457	CY2016- Q1 B346B3		1/19/16 7:30	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/27/16 16:18	1539008	GEL389695	1					

Figure A-3. Spreadsheet for TOC from GEL (1 of 3)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
458	CY2016- Q1	B346B3	1/19/16 7:30					0.000						2				
459	CY2016- Q1	B346B3	1/19/16 7:30					0.000						3				
460	CY2016- Q1	B346B3	1/19/16 7:30					0.000						4				
461	CY2016- Q1	B346B4	1/19/16 7:30	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/25/16 22:50	1539008	GEL389695		1				
462	CY2016- Q1	B346B4	1/19/16 7:30					0.000						2				
463	CY2016- Q1	B346B4	1/19/16 7:30					0.000						3				
464	CY2016- Q1	B346B4	1/19/16 7:30					0.000						4				
465	CY2016- Q1	B346B5	1/19/16 7:30	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/26/16 0:17	1539008	GEL389695		1				
466	CY2016- Q1	B346B5	1/19/16 7:30					0.000						2				
467	CY2016- Q1	B346B5	1/19/16 7:30					0.000						3				
468	CY2016- Q1	B346B5	1/19/16 7:30					0.000						4				
469	CY2016- Q1	B346B6	1/19/16 7:30	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	1/25/16 23:33	1539008	GEL389695		1				
470	CY2016- Q1	B346B6	1/19/16 7:30					0.000						2				
471	CY2016- Q1	B346B6	1/19/16 7:30					0.000						3				
472	CY2016- Q1	B346B6	1/19/16 7:30					0.000						4				
473	CY2016- Q1	B34B04	3/9/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.167	0.157	3/12/16 9:05	1551195	GEL392922		1				
474	CY2016- Q1	B34B04	3/9/16 7:00					0.157						2				
475	CY2016- Q1	B34B04	3/9/16 7:00					0.148						3				
476	CY2016- Q1	B34B04	3/9/16 7:00					0.155						4				
477	CY2016- Q1	B34B20	3/10/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.021	0.018	3/15/16 1:07	1551972	GEL393031		1				
478	CY2016- Q1	B34B20	3/10/16 7:00					0.021						2				
479	CY2016- Q1	B34B20	3/10/16 7:00					0.013						3				
480	CY2016- Q1	B34B20	3/10/16 7:00					0.015						4				
481	CY2016- Q1	B34BF2	3/2/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.064	0.060	3/5/16 6:21	1549273	GEL392442		1				
482	CY2016- Q1	B34BF2	3/2/16 7:00					0.059						2				
483	CY2016- Q1	B34BF2	3/2/16 7:00					0.056						3				
484	CY2016- Q1	B34BF2	3/2/16 7:00					0.059						4				
485	CY2016- Q1	B34BM8	3/9/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.128	0.117	3/12/16 10:03	1551195	GEL392922		1				
486	CY2016- Q1	B34BM8	3/9/16 7:00					0.114						2				
487	CY2016- Q1	B34BM8	3/9/16 7:00					0.111						3				
488	CY2016- Q1	B34BM8	3/9/16 7:00					0.116						4				
489	CY2016- Q1	B34BN0	3/9/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.161	0.161	3/12/16 10:42	1551195	GEL392922		1				
490	CY2016- Q1	B34BN0	3/9/16 7:00					0.160						2				
491	CY2016- Q1	B34BN0	3/9/16 7:00					0.164						3				
492	CY2016- Q1	B34BN0	3/9/16 7:00					0.158						4				
493	CY2016- Q1	B34BN2	3/9/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.120	0.108	3/12/16 7:05	1551195	GEL392922		1				
494	CY2016- Q1	B34BN2	3/9/16 7:00					0.107						2				
495	CY2016- Q1	B34BN2	3/9/16 7:00					0.105						3				
496	CY2016- Q1	B34BN2	3/9/16 7:00					0.100						4				
497	CY2016- Q1	B34BP9	3/10/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.039	0.035	3/15/16 1:45	1551972	GEL393031		1				
498	CY2016- Q1	B34BP9	3/10/16 7:00					0.034						2				
499	CY2016- Q1	B34BP9	3/10/16 7:00					0.034						3				
500	CY2016- Q1	B34BP9	3/10/16 7:00					0.031						4				
501	CY2016- Q1	B34BR1	3/10/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.074	0.056	3/14/16 23:50	1551972	GEL393031		1				
502	CY2016- Q1	B34BR1	3/10/16 7:00					0.057						2				
503	CY2016- Q1	B34BR1	3/10/16 7:00					0.051						3				
504	CY2016- Q1	B34BR1	3/10/16 7:00					0.042						4				
505	CY2016- Q1	B34BR3	3/10/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.046	0.043	3/15/16 0:29	1551972	GEL393031		1				
506	CY2016- Q1	B34BR3	3/10/16 7:00					0.044						2				

Figure A-3. Spreadsheet for TOC from GEL (2 of 3)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
507	CY2016- Q1	B34BR3	3/10/16 7:00					0.041						3				
508	CY2016- Q1	B34BR3	3/10/16 7:00					0.040						4				
509	CY2016- Q1	B34BV9	3/2/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.066	0.062	3/5/16 7:37	1549273	GEL392442		1				
510	CY2016- Q1	B34BV9	3/2/16 7:00					0.065						2				
511	CY2016- Q1	B34BV9	3/2/16 7:00					0.062						3				
512	CY2016- Q1	B34BV9	3/2/16 7:00					0.056						4				
513	CY2016- Q1	B34BW1	3/2/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.077	0.068	3/5/16 5:43	1549273	GEL392442		1				
514	CY2016- Q1	B34BW1	3/2/16 7:00					0.062						2				
515	CY2016- Q1	B34BW1	3/2/16 7:00					0.065						3				
516	CY2016- Q1	B34BW1	3/2/16 7:00					0.066						4				
517	CY2016- Q1	B34BW3	3/2/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.069	0.063	3/5/16 6:59	1549273	GEL392442		1				
518	CY2016- Q1	B34BW3	3/2/16 7:00					0.059						2				
519	CY2016- Q1	B34BW3	3/2/16 7:00					0.066						3				
520	CY2016- Q1	B34BW3	3/2/16 7:00					0.058						4				
521																		
522	CY2016- Q2	B34X49	5/4/16 7:15	GEL	FTB	9060_TOC	Total organic carbon	0.022	0.006	5/6/16 22:07	1564957	GEL396712		1	Only 3 blanks results this quarter			
523	CY2016- Q2	B34X49	5/4/16 7:15					0.000						2	Normality assumed			
524	CY2016- Q2	B34X49	5/4/16 7:15					0.000						3				
525	CY2016- Q2	B34X49	5/4/16 7:15					0.000						4				
526	CY2016- Q2	B34X74	5/3/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.061	0.050	5/6/16 18:10	1564957	GEL396590		1				
527	CY2016- Q2	B34X74	5/3/16 7:00					0.039						2				
528	CY2016- Q2	B34X74	5/3/16 7:00					0.072						3				
529	CY2016- Q2	B34X74	5/3/16 7:00					0.026						4				
530	CY2016- Q2	B34XL7	5/20/16 7:00	GEL	FTB	9060_TOC	Total organic carbon	0.192	0.131	5/26/16 16:12	1569376	GEL397893		1				
531	CY2016- Q2	B34XL7	5/20/16 7:00					0.112						2				
532	CY2016- Q2	B34XL7	5/20/16 7:00					0.121						3				
533	CY2016- Q2	B34XL7	5/20/16 7:00					0.098						4				
534																		
535	CY2016- Q3	B36368	8/16/16 7:15	GEL	FTB	9060_TOC	Total organic carbon	0.131	0.130	8/19/16 22:07	1591337	GEL403970		1	Only 5 blanks results this quarter			
536	CY2016- Q3	B36368	8/16/16 7:15					0.130						2	Normality assumed			
537	CY2016- Q3	B36368	8/16/16 7:15					0.131						3				
538	CY2016- Q3	B36368	8/16/16 7:15					0.128						4				
539	CY2016- Q3	B368C7	9/12/16 8:50	GEL	FTB	9060_TOC	Total organic carbon	0.006	0.002	9/17/16 3:52	1597684	GEL405700		1				
540	CY2016- Q3	B368C7	9/12/16 8:50					0.000						2				
541	CY2016- Q3	B368C7	9/12/16 8:50					0.000						3				
542	CY2016- Q3	B368C7	9/12/16 8:50					0.000						4				
543	CY2016- Q3	B36980	9/12/16 8:50	GEL	FTB	9060_TOC	Total organic carbon	0.095	0.073	9/17/16 1:48	1597684	GEL405700		1				
544	CY2016- Q3	B36980	9/12/16 8:50					0.063						2				
545	CY2016- Q3	B36980	9/12/16 8:50					0.065						3				
546	CY2016- Q3	B36980	9/12/16 8:50					0.069						4				
547	CY2016- Q3	B36982	9/12/16 8:50	GEL	FTB	9060_TOC	Total organic carbon	0.000	0.000	9/17/16 2:29	1597684	GEL405700		1				
548	CY2016- Q3	B36982	9/12/16 8:50					0.000						2				
549	CY2016- Q3	B36982	9/12/16 8:50					0.000						3				
550	CY2016- Q3	B36982	9/12/16 8:50					0.000						4				
551	CY2016- Q3	B36984	9/12/16 8:50	GEL	FTB	9060_TOC	Total organic carbon	0.053	0.029	9/17/16 3:10	1597684	GEL405700		1				
552	CY2016- Q3	B36984	9/12/16 8:50					0.016						2				
553	CY2016- Q3	B36984	9/12/16 8:50					0.023						3				
554	CY2016- Q3	B36984	9/12/16 8:50					0.023						4				
555																		
556	CY2016- Q4	No data																

Figure A-3. Spreadsheet for TOC from GEL (3 of 3)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
169	CY2016- Q1	B33T03	1/4/16 9:30	GEL	FTB	9020_TOX	Total organic halides	1.28	1.61	1/8/16 22:32	1535184	GEL388645		1
170	CY2016- Q1	B33T03	1/4/16 9:30					1.94						2
171	CY2016- Q1	B33TY9	1/18/16 8:00	GEL	FTB	9020_TOX	Total organic halides	0.88	0.44	1/29/16 2:30	1538499	GEL389586		1
172	CY2016- Q1	B33TY9	1/18/16 8:00					0						2
173	CY2016- Q1	B33V10	1/18/16 8:40	GEL	FTB	9020_TOX	Total organic halides	0.02	0.01	1/29/16 22:37	1538500	GEL389587		1
174	CY2016- Q1	B33V10	1/18/16 8:40					0						2
175	CY2016- Q1	B33V33	1/4/16 9:30	GEL	FTB	9020_TOX	Total organic halides	0	0.05	1/7/16 23:01	1535183	GEL388645		1
176	CY2016- Q1	B33V33	1/4/16 9:30					0.1						2
177	CY2016- Q1	B33V35	1/4/16 9:30	GEL	FTB	9020_TOX	Total organic halides	0.58	0.44	1/7/16 21:16	1535183	GEL388645		1
178	CY2016- Q1	B33V35	1/4/16 9:30					0.3						2
179	CY2016- Q1	B33V37	1/4/16 9:30	GEL	FTB	9020_TOX	Total organic halides	0.4	0.2	1/7/16 22:19	1535183	GEL388645		1
180	CY2016- Q1	B33V37	1/4/16 9:30					0						2
181	CY2016- Q1	B33VH4	1/18/16 8:00	GEL	FTB	9020_TOX	Total organic halides	0	0	1/28/16 6:06	1538498	GEL389586		1
182	CY2016- Q1	B33VH4	1/18/16 8:00					0						2
183	CY2016- Q1	B33VH6	1/18/16 8:00	GEL	FTB	9020_TOX	Total organic halides	0	0	1/28/16 5:24	1538498	GEL389586		1
184	CY2016- Q1	B33VH6	1/18/16 8:00					0						2
185	CY2016- Q1	B33VH8	1/18/16 8:00	GEL	FTB	9020_TOX	Total organic halides	0.42	0.76	1/29/16 0:44	1538499	GEL389586		1
186	CY2016- Q1	B33VH8	1/18/16 8:00					1.1						2
187	CY2016- Q1	B33VJ3	1/18/16 8:40	GEL	FTB	9020_TOX	Total organic halides	0	1.02	1/29/16 20:21	1538500	GEL389587		1
188	CY2016- Q1	B33VJ3	1/18/16 8:40					2.04						2
189	CY2016- Q1	B33VJ5	1/18/16 8:40	GEL	FTB	9020_TOX	Total organic halides	0	0	1/29/16 17:53	1538500	GEL389587		1
190	CY2016- Q1	B33VJ5	1/18/16 8:40					0						2
191	CY2016- Q1	B33VJ7	1/18/16 8:40	GEL	FTB	9020_TOX	Total organic halides	0	0	1/29/16 19:40	1538500	GEL389587		1
192	CY2016- Q1	B33VJ7	1/18/16 8:40					0						2
193	CY2016- Q1	B346B3	1/19/16 7:30	GEL	FTB	9020_TOX	Total organic halides	1.48	0.78	2/3/16 6:03	1540938	GEL389695		1
194	CY2016- Q1	B346B3	1/19/16 7:30					0.08						2
195	CY2016- Q1	B346B4	1/19/16 7:30	GEL	FTB	9020_TOX	Total organic halides	3.58	1.84	2/3/16 3:36	1540938	GEL389695		1
196	CY2016- Q1	B346B4	1/19/16 7:30					0.1						2
197	CY2016- Q1	B346B5	1/19/16 7:30	GEL	FTB	9020_TOX	Total organic halides	0	0.92	2/3/16 5:22	1540938	GEL389695		1
198	CY2016- Q1	B346B5	1/19/16 7:30					1.84						2
199	CY2016- Q1	B346B6	1/19/16 7:30	GEL	FTB	9020_TOX	Total organic halides	0.1	0.21	2/3/16 4:18	1540938	GEL389695		1
200	CY2016- Q1	B346B6	1/19/16 7:30					0.32						2
201	CY2016- Q1	B34B04	3/9/16 7:00	GEL	FTB	9020_TOX	Total organic halides	4.46	3.9	3/22/16 21:27	1552146	GEL392922		1
202	CY2016- Q1	B34B04	3/9/16 7:00					3.34						2
203	CY2016- Q1	B34B20	3/10/16 7:00	GEL	FTB	9020_TOX	Total organic halides	0	0.24	4/1/16 21:48	1553987	GEL393031		1
204	CY2016- Q1	B34B20	3/10/16 7:00					0.48						2
205	CY2016- Q1	B34BF2	3/2/16 7:00	GEL	FTB	9020_TOX	Total organic halides	1.88	1.56	3/4/16 18:45	1549715	GEL392442		1
206	CY2016- Q1	B34BF2	3/2/16 7:00					1.24						2
207	CY2016- Q1	B34BM8	3/9/16 7:00	GEL	FTB	9020_TOX	Total organic halides	2.14	3.15	3/22/16 22:30	1552146	GEL392922		1
208	CY2016- Q1	B34BM8	3/9/16 7:00					4.16						2
209	CY2016- Q1	B34BN0	3/9/16 7:00	GEL	FTB	9020_TOX	Total organic halides	1.78	1.93	3/22/16 23:12	1552146	GEL392922		1
210	CY2016- Q1	B34BN0	3/9/16 7:00					2.08						2
211	CY2016- Q1	B34BN2	3/9/16 7:00	GEL	FTB	9020_TOX	Total organic halides	4.06	3.62	3/22/16 19:43	1552146	GEL392922		1
212	CY2016- Q1	B34BN2	3/9/16 7:00					3.18						2
213	CY2016- Q1	B34BP9	3/10/16 7:00	GEL	FTB	9020_TOX	Total organic halides	0	0	4/1/16 22:55	1553987	GEL393031		1
214	CY2016- Q1	B34BP9	3/10/16 7:00					0						2
215	CY2016- Q1	B34BR1	3/10/16 7:00	GEL	FTB	9020_TOX	Total organic halides	0	0	4/1/16 18:41	1553987	GEL393031		1
216	CY2016- Q1	B34BR1	3/10/16 7:00					0						2

Shapiro- Wilk Normality Test

Rank #	Ave (ug/L)	x(n- i+1) - x(i)	Coefficient
1	0	3.9	0.4328
2	0	3.62	0.2992
3	0	3.15	0.251
4	0	1.93	0.2151
5	0	1.84	0.1857
6	0	1.61	0.1601
7	0.01	1.55	0.1372
8	0.05	1.44	0.1162
9	0.2	1.2	0.0965
10	0.21	1	0.0778
11	0.24	0.78	0.0598
12	0.31	0.61	0.0424
13	0.44	0.34	0.0253
14	0.44	0.32	0.0084
15	0.76	- 0.32	
16	0.78	- 0.34	
17	0.92	- 0.61	
18	1.02	- 0.78	
19	1.21	- 1	
20	1.4	- 1.2	
21	1.49	- 1.44	
22	1.56	- 1.55	
23	1.61	- 1.61	
24	1.84	- 1.84	
25	1.93	- 1.93	
26	3.15	- 3.15	
27	3.62	- 3.62	
28	3.9	- 3.9	

k: 14

b: 5.233652

s: 1.114020497

SW: 0.81744691

Critical pt: 0.896 n = 28, α = 0.01

SW < Critical pt, so normality rejected

Figure A-4. Spreadsheet for TOX from GEL (1 of 2)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
217	CY2016- Q1	B34BR3	3/10/16 7:00	GEL	FTB	9020_TOX	Total organic halides	0.18	0.31	4/1/16 21:07	1553987	GEL393031	1					
218	CY2016- Q1	B34BR3	3/10/16 7:00					0.44					2					
219	CY2016- Q1	B34BV9	3/2/16 7:00	GEL	FTB	9020_TOX	Total organic halides	1.34	1.49	3/4/16 20:31	1549715	GEL392442	1					
220	CY2016- Q1	B34BV9	3/2/16 7:00					1.64					2					
221	CY2016- Q1	B34BW1	3/2/16 7:00	GEL	FTB	9020_TOX	Total organic halides	1.32	1.21	3/4/16 17:02	1549715	GEL392442	1					
222	CY2016- Q1	B34BW1	3/2/16 7:00					1.1					2					
223	CY2016- Q1	B34BW3	3/2/16 7:00	GEL	FTB	9020_TOX	Total organic halides	1.18	1.4	3/4/16 19:49	1549715	GEL392442	1					
224	CY2016- Q1	B34BW3	3/2/16 7:00					1.62					2					
225																		
226	CY2016- Q2	B34XL7	5/20/16 7:00	GEL	FTB	9020_TOX	Total organic halides	0.9	0.9	5/25/16 16:59	1569905	GEL397893	1					
227																		
228																		
229	CY2016- Q3	B368C7	9/12/16 8:50	GEL	FTB	9020_TOX	Total organic halides	2.14	1.83	9/22/16 18:41	1598320	GEL405700	1					
230	CY2016- Q3	B368C7	9/12/16 8:50					1.52					2					
231	CY2016- Q3	B36980	9/12/16 8:50	GEL	FTB	9020_TOX	Total organic halides	0.36	0.36	9/22/16 14:55	1598320	GEL405700	1					
232	CY2016- Q3	B36980	9/12/16 8:50										2					
233	CY2016- Q3	B36982	9/12/16 8:50	GEL	FTB	9020_TOX	Total organic halides	1.72	1.55	9/22/16 16:52	1598320	GEL405700	1					
234	CY2016- Q3	B36982	9/12/16 8:50					1.38					2					
235	CY2016- Q3	B36984	9/12/16 8:50	GEL	FTB	9020_TOX	Total organic halides	2.94	2.49	9/22/16 17:59	1598320	GEL405700	1					
236	CY2016- Q3	B36984	9/12/16 8:50					2.04					2					
237	CY2016- Q3	B36BL7	9/22/16 8:00	GEL	FTB	9020_TOX	Total organic halides	0.02	0.99	10/18/16 1:00	1606075	GEL406586	1					
238	CY2016- Q3	B36BL7	9/22/16 8:00					1.96					2					
239																		
240	CY2016- Q4	No data																

Figure A-4. Spreadsheet for TOX from GEL (2 of 2)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
8	CY2016- Q1	No data												
9														
10	CY2016- Q2	No data												
11														
12	CY2016- Q3	No data												
13														
14	CY2016- Q4	B36NT6	10/5/16 8:50	TADN	FTB	9060_TOC	Total organic carbon	0.1067	0.087115	10/14/16	348498- 9	DN0027	1	
15	CY2016- Q4	B36NT6	10/5/16 8:50					0.08972					2	
16	CY2016- Q4	B36NT6	10/5/16 8:50					0.0842					3	
17	CY2016- Q4	B36NT6	10/5/16 8:50					0.06784					4	
18	CY2016- Q4	B36P49	10/16/16 7:15	TADN	FTB	9060_TOC	Total organic carbon	0.1536	0.156325	10/28/16	350145- 12	DN0034	1	
19	CY2016- Q4	B36P49	10/16/16 7:15					0.1537					2	
20	CY2016- Q4	B36P49	10/16/16 7:15					0.1508					3	
21	CY2016- Q4	B36P49	10/16/16 7:15					0.1672					4	
22	CY2016- Q4	B36PL1	10/5/16 8:50	TADN	FTB	9060_TOC	Total organic carbon	0.01579	0.0316825	10/14/16	348498- 13	DN0027	1	
23	CY2016- Q4	B36PL1	10/5/16 8:50					0.03688					2	
24	CY2016- Q4	B36PL1	10/5/16 8:50					0.03902					3	
25	CY2016- Q4	B36PL1	10/5/16 8:50					0.03504					4	
26	CY2016- Q4	B36PL3	10/5/16 8:50	TADN	FTB	9060_TOC	Total organic carbon	- 0.01119	0.016565	10/14/16	348498- 16	DN0027	1	
27	CY2016- Q4	B36PL3	10/5/16 8:50					0.0255					2	
28	CY2016- Q4	B36PL3	10/5/16 8:50					0.02612					3	
29	CY2016- Q4	B36PL3	10/5/16 8:50					0.02583					4	
30	CY2016- Q4	B36PL5	10/5/16 8:50	TADN	FTB	9060_TOC	Total organic carbon	- 0.05972	- 0.0333075	10/14/16	348498- 12	DN0027	1	
31	CY2016- Q4	B36PL5	10/5/16 8:50					- 0.03027					2	
32	CY2016- Q4	B36PL5	10/5/16 8:50					- 0.01573					3	
33	CY2016- Q4	B36PL5	10/5/16 8:50					- 0.02751					4	
34	CY2016- Q4	B36PN5	10/16/16 7:15	TADN	FTB	9060_TOC	Total organic carbon	0.02954	0.0067525	10/28/16	350157- 10	DN0034	1	
35	CY2016- Q4	B36PN5	10/16/16 7:15					- 0.00716					2	
36	CY2016- Q4	B36PN5	10/16/16 7:15					0.00136					3	
37	CY2016- Q4	B36PN5	10/16/16 7:15					0.00327					4	
38	CY2016- Q4	B36PN7	10/16/16 7:15	TADN	FTB	9060_TOC	Total organic carbon	0.1187	0.11485	10/28/16	350157- 6	DN0034	1	
39	CY2016- Q4	B36PN7	10/16/16 7:15					0.1095					2	
40	CY2016- Q4	B36PN7	10/16/16 7:15					0.1176					3	
41	CY2016- Q4	B36PN7	10/16/16 7:15					0.1136					4	
42	CY2016- Q4	B36PN9	10/16/16 7:15	TADN	FTB	9060_TOC	Total organic carbon	0.05386	0.0736775	10/28/16	350157- 7	DN0034	1	
43	CY2016- Q4	B36PN9	10/16/16 7:15					0.08396					2	
44	CY2016- Q4	B36PN9	10/16/16 7:15					0.08559					3	
45	CY2016- Q4	B36PN9	10/16/16 7:15					0.0713					4	
46	CY2016- Q4	B373F2	11/6/16 7:10	TADN	FTB	9060_TOC	Total organic carbon	0.1414	0.14845	11/21/16	352639- 15	DN0048	1	
47	CY2016- Q4	B373F2	11/6/16 7:10					0.1613					2	
48	CY2016- Q4	B373F2	11/6/16 7:10					0.1468					3	
49	CY2016- Q4	B373F2	11/6/16 7:10					0.1443					4	
50	CY2016- Q4	B373Y4	11/4/16 7:10	TADN	FTB	9060_TOC	Total organic carbon	- 0.0028	- 0.0064375	11/18/16	353546- 19	DN0046	1	
51	CY2016- Q4	B373Y4	11/4/16 7:10					- 0.0065					2	
52	CY2016- Q4	B373Y4	11/4/16 7:10					- 0.01207					3	
53	CY2016- Q4	B373Y4	11/4/16 7:10					- 0.00438					4	
54	CY2016- Q4	B37441	11/4/16 7:10	TADN	FTB	9060_TOC	Total organic carbon	- 0.00418	- 0.00398	11/18/16	353684- 6	DN0046	1	

Shapiro- Wilk Normality Test

Rank #	Ave (mg/L)	x(n- i+1) - x(i)	Coefficient
1	- 0.0333075	0.1896325	0.5359
2	- 0.0064375	0.1548875	0.3325
3	- 0.0052075	0.1200575	0.2412
4	- 0.00398	0.091095	0.1707
5	- 0.00167	0.0753475	0.1099
6	0.0067525	0.02493	0.0539
7	0.016565	0	0
8	0.0316825	- 0.02493	
9	0.0736775	- 0.0753475	
10	0.087115	- 0.091095	
11	0.11485	- 0.1200575	
12	0.14845	- 0.1548875	
13	0.156325	- 0.1896325	

k: 6

b: 0.207256353

s: 0.063832352

SW: 0.878522251

Critical pt: 0.866 n = 13, α = 0.05

SW > Critical pt, so normality accepted

Figure A-5. Spreadsheet for TOC from TADN (1 of 2)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
55	CY2016- Q4	B37441	11/4/16 7:10					0.00014						2				
56	CY2016- Q4	B37441	11/4/16 7:10					- 0.00599						3				
57	CY2016- Q4	B37441	11/4/16 7:10					- 0.00589						4				
58	CY2016- Q4	B37443	11/4/16 7:10	TADN	FTB	9060_TOC	Total organic carbon	- 0.00946	- 0.00167	11/18/16	353546- 20	DN0046		1				
59	CY2016- Q4	B37443	11/4/16 7:10					- 0.00711						2				
60	CY2016- Q4	B37443	11/4/16 7:10					0.00667						3				
61	CY2016- Q4	B37443	11/4/16 7:10					0.00322						4				
62	CY2016- Q4	B37445	11/4/16 7:10	TADN	FTB	9060_TOC	Total organic carbon	- 0.00602	- 0.0052075	11/18/16	353546- 16	DN0046		1				
63	CY2016- Q4	B37445	11/4/16 7:10					0.00493						2				
64	CY2016- Q4	B37445	11/4/16 7:10					- 0.01076						3				
65	CY2016- Q4	B37445	11/4/16 7:10					- 0.00898						4				

Figure A-5. Spreadsheet for TOC from TADN (2 of 2)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
8	CY2016- Q1	No data												
9														
10	CY2016- Q2	No data												
11														
12	CY2016- Q3	No data												
13														
14	CY2016- Q4	B36NT6	10/5/16 8:50	TADN	FTB	9020_TOX	Total organic halides	4.534	3.4005	10/26/16 5:51	348498- 9	DN0027	1	
15	CY2016- Q4	B36NT6	10/5/16 8:50					2.267					2	
16	CY2016- Q4	B36P49	10/16/16 7:15	TADN	FTB	9020_TOX	Total organic halides	2.36	1.18	11/2/16 6:36	350145- 12	DN0034	1	
17	CY2016- Q4	B36P49	10/16/16 7:15					0					2	
18	CY2016- Q4	B36PL1	10/5/16 8:50	TADN	FTB	9020_TOX	Total organic halides	1.524	1.8105	10/26/16 5:51	348498- 13	DN0027	1	
19	CY2016- Q4	B36PL1	10/5/16 8:50					2.097					2	
20	CY2016- Q4	B36PL3	10/5/16 8:50	TADN	FTB	9020_TOX	Total organic halides	0.874	0.437	10/26/16 5:51	348498- 16	DN0027	1	
21	CY2016- Q4	B36PL3	10/5/16 8:50					0					2	
22	CY2016- Q4	B36PL5	10/5/16 8:50	TADN	FTB	9020_TOX	Total organic halides	2.947	2.7655	10/26/16 5:51	348498- 12	DN0027	1	
23	CY2016- Q4	B36PL5	10/5/16 8:50					2.584					2	
24	CY2016- Q4	B36PN5	10/16/16 7:15	TADN	FTB	9020_TOX	Total organic halides	0.85	1.135	11/3/16 15:32	350157- 10	DN0034	1	
25	CY2016- Q4	B36PN5	10/16/16 7:15					1.42					2	
26	CY2016-	B36PN	10/16/16 7:15	TADN	FTB	9020_TOX	Total organic halides	10.47	6.88	11/3/16 15:32	350157- 6	DN0034	1	
27	Q4	7	10/16/16 7:15					3.29					2	
28	CY2016- Q4	B36PN9	10/16/16 7:15	TADN	FTB	9020_TOX	Total organic halides	1.52	1.175	11/3/16 15:32	350157- 7	DN0034	1	
29	CY2016- Q4	B36PN9	10/16/16 7:15					0.83					2	
30	CY2016- Q4	B373Y4	11/4/16 7:10	TADN	FTB	9020_TOX	Total organic halides	0	0	11/28/16 10:49	353546- 19	DN0046	1	
31	CY2016- Q4	B373Y4	11/4/16 7:10					0					2	
32	CY2016- Q4	B37441	11/4/16 7:10	TADN	FTB	9020_TOX	Total organic halides	0.02	0.01	11/29/16 9:22	353684- 6	DN0046	1	
33	CY2016- Q4	B37441	11/4/16 7:10					0					2	
34	CY2016- Q4	B37443	11/4/16 7:10	TADN	FTB	9020_TOX	Total organic halides	0	0	11/28/16 10:49	353546- 20	DN0046	1	
35	CY2016- Q4	B37443	11/4/16 7:10					0					2	
36	CY2016- Q4	B37445	11/4/16 7:10	TADN	FTB	9020_TOX	Total organic halides	0.33	0.205	11/28/16 10:49	353546- 16	DN0046	1	
37	CY2016- Q4	B37445	11/4/16 7:10					0.08					2	
38														

Shapiro- Wilk Normality Test

Rank #	Ave (ug/L)	x(n- i+1) -	Coefficient
1	0	6.88	0.5475
2	0	2.4005	0.3325
3	0.01	2.7555	0.2347
4	0.205	1.6055	0.1586
5	0.437	0.743	0.0922
6	1.135	0.04	0.0303
7	1.175	- 0.04	
8	1.18	- 0.743	
9	1.8105	- 1.6055	
10	2.7655	- 2.7555	
11	3.4005	- 3.4005	
12	6.88	- 6.88	

k: 6

b: 5.868531

s: 2.000896645

SW: 0.782018107

Critical pt: 0.859 $n = 12$, $\alpha = 0.05$

SW < Critical pt, so normality rejected

Figure A-6. Spreadsheet for TOX from TADN (1 of 2)

	U	V	W	X	Y	Z	AA
33	***Dixon's Outlier Test on Sample B36PN7***						
34	Order	Value					
35	1	0					
36	2	0					
37	3	0.01					
38	4	0.205					
39	5	0.437					
40	6	1.135					
41	7	1.175					
42	8	1.18					
43	9	1.8105					
44	10	2.7655					
45	11	3.4005					
46	12	6.88					
47							
48	0.598	Test Statistic (Eq. 12.6 in EPA 530/R- 09- 007)					
49	0.546	Critical value (Appendix D, Table 12.1 of EPA 530/R- 09- 007, $\alpha = 0.05$, n = 12)					
50							
51	The test statistic exceeds the critical value, so the measurement is a statistical outlier.						
52	However, no additional information is available that indicates the value should be excluded						
53	from the calculations, therefore the value will be retained.						

Figure A-6. Spreadsheet for TOX from TADN (2 of 2)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
476	CY2016- Q1	B33T73	1/7/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.3095	- 0.252225	1/19/16	233344	SL2091		1	*Shapiro- Wilk Normality Test*			
477	CY2016- Q1	B33T73	1/7/16 7:30					- 0.2252						2	Rank #	Ave (mg/L)	x(n- i+1) -	Coefficient
478	CY2016- Q1	B33T73	1/7/16 7:30					- 0.2225						3	1	- 0.37845	0.326355	0.5475
479	CY2016- Q1	B33T73	1/7/16 7:30					- 0.2517						4	2	- 0.370325	0.2708825	0.3325
480	CY2016- Q1	B33TJ7	1/15/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.2123	- 0.174	1/26/16	234634	SL2102		1	3	- 0.3446	0.173425	0.2347
481	CY2016- Q1	B33TJ7	1/15/16 7:40					- 0.1789						2	4	- 0.318325	0.144325	0.1586
482	CY2016- Q1	B33TJ7	1/15/16 7:40					- 0.1428						3	5	- 0.252225	0.056775	0.0922
483	CY2016- Q1	B33TJ7	1/15/16 7:40					- 0.162						4	6	- 0.208225	0.011625	0.0303
484	CY2016- Q1	B33V69	1/7/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.2418	- 0.171175	1/19/16	233344	SL2091		1	7	- 0.1966	- 0.011625	
485	CY2016- Q1	B33V69	1/7/16 7:30					- 0.145						2	8	- 0.19545	- 0.056775	
486	CY2016- Q1	B33V69	1/7/16 7:30					- 0.1352						3	9	- 0.174	- 0.144325	
487	CY2016- Q1	B33V69	1/7/16 7:30					- 0.1627						4	10	- 0.171175	- 0.173425	
488	CY2016- Q1	B33V71	1/7/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.03667	- 0.0994425	1/19/16	233344	SL2091		1	11	- 0.0994425	- 0.2708825	
489	CY2016- Q1	B33V71	1/7/16 7:30					- 0.1175						2	12	- 0.052095	- 0.326355	
490	CY2016- Q1	B33V71	1/7/16 7:30					- 0.1284						3				
491	CY2016- Q1	B33V71	1/7/16 7:30					- 0.1152						4	k:	6		
492	CY2016- Q1	B33V73	1/7/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	0.0283	- 0.052095	1/19/16	233344	SL2091		1				
493	CY2016- Q1	B33V73	1/7/16 7:30					- 0.1299						2	b:	0.337927479		
494	CY2016- Q1	B33V73	1/7/16 7:30					- 0.02475						3	s:	0.104981426		
495	CY2016- Q1	B33V73	1/7/16 7:30					- 0.08203						4				
496	CY2016- Q1	B33VD9	1/15/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.243	- 0.19545	1/26/16	234634	SL2102		1	SW:	0.941953346		
497	CY2016- Q1	B33VD9	1/15/16 7:40					- 0.1784						2				
498	CY2016- Q1	B33VD9	1/15/16 7:40					- 0.1848						3	Critical pt:	0.859	n = 12, α = 0.05	
499	CY2016- Q1	B33VD9	1/15/16 7:40					- 0.1756						4				
500	CY2016- Q1	B33VF1	1/15/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.2514	- 0.1966	1/26/16	234634	SL2102		1	***SW > Critical pt, so normality accepted***			
501	CY2016- Q1	B33VF1	1/15/16 7:40					- 0.2175						2				
502	CY2016- Q1	B33VF1	1/15/16 7:40					- 0.1062						3				
503	CY2016- Q1	B33VF1	1/15/16 7:40					- 0.2113						4				
504	CY2016- Q1	B33VF3	1/15/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.2456	- 0.208225	1/26/16	234634	SL2102		1				
505	CY2016- Q1	B33VF3	1/15/16 7:40					- 0.2177						2				
506	CY2016- Q1	B33VF3	1/15/16 7:40					- 0.202						3				
507	CY2016- Q1	B33VF3	1/15/16 7:40					- 0.1676						4				
508	CY2016- Q1	B34B37	3/10/16 7:15	TASL	FTB	9060_TOC	Total organic carbon	- 0.3975	- 0.37845	3/18/16	241338	SL2135		1				
509	CY2016- Q1	B34B37	3/10/16 7:15					- 0.3538						2				
510	CY2016- Q1	B34B37	3/10/16 7:15					- 0.3642						3				
511	CY2016- Q1	B34B37	3/10/16 7:15					- 0.3983						4				
512	CY2016- Q1	B34BV0	3/10/16 7:15	TASL	FTB	9060_TOC	Total organic carbon	- 0.3485	- 0.3446	3/18/16	241338	SL2135		1				
513	CY2016- Q1	B34BV0	3/10/16 7:15					- 0.3616						2				
514	CY2016- Q1	B34BV0	3/10/16 7:15					- 0.346						3				
515	CY2016- Q1	B34BV0	3/10/16 7:15					- 0.3223						4				
516	CY2016- Q1	B34BV2	3/10/16 7:15	TASL	FTB	9060_TOC	Total organic carbon	- 0.4425	- 0.370325	3/18/16	241338	SL2135		1				
517	CY2016- Q1	B34BV2	3/10/16 7:15					- 0.3633						2				
518	CY2016- Q1	B34BV2	3/10/16 7:15					- 0.3432						3				
519	CY2016- Q1	B34BV2	3/10/16 7:15					- 0.3323						4				
520	CY2016- Q1	B34BV4	3/10/16 7:15	TASL	FTB	9060_TOC	Total organic carbon	- 0.3523	- 0.318325	3/18/16	241338	SL2135		1				
521	CY2016- Q1	B34BV4	3/10/16 7:15					- 0.3078						2				
522	CY2016- Q1	B34BV4	3/10/16 7:15					- 0.33						3				

Figure A-7. Spreadsheet for TOC from TASL (1 of 5)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
523	CY2016- Q1	B34BV4	3/10/16 7:15					- 0.2832						4				
524																		
525	CY2016- Q2	B34MN8	4/15/16 7:20	TASL	FTB	9060_TOC	Total organic carbon	- 0.5973	- 0.572675	4/27/16	248164	SL2174		1	*Shapiro- Wilk Normality Test*			
526	CY2016- Q2	B34MN8	4/15/16 7:20					- 0.5674						2	Rank #	Ave (mg/L)	x(n- i+1) - x(i)	Coefficient
527	CY2016- Q2	B34MN8	4/15/16 7:20					- 0.5333						3	1	- 0.621025	0.5419325	0.5475
528	CY2016- Q2	B34MN8	4/15/16 7:20					- 0.5927						4	2	- 0.613525	0.339475	0.3325
529	CY2016- Q2	B34NB2	4/1/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.666	- 0.613525	4/11/16	245551	SL2160		1	3	- 0.586025	0.225475	0.2347
530	CY2016- Q2	B34NB2	4/1/16 7:00					- 0.6274						2	4	- 0.58355	0.2219	0.1586
531	CY2016- Q2	B34NB2	4/1/16 7:00					- 0.5945						3	5	- 0.572675	0.204975	0.0922
532	CY2016- Q2	B34NB2	4/1/16 7:00					- 0.5662						4	6	- 0.3887	0.0096	0.0303
533	CY2016- Q2	B34NC9	4/7/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.4162	- 0.3887	4/20/16	247119	SL2165		1	7	- 0.3791	- 0.0096	
534	CY2016- Q2	B34NC9	4/7/16 7:45					- 0.3851						2	8	- 0.3677	- 0.204975	
535	CY2016- Q2	B34NC9	4/7/16 7:45					- 0.3627						3	9	- 0.36165	- 0.2219	
536	CY2016- Q2	B34NC9	4/7/16 7:45					- 0.3908						4	10	- 0.36055	- 0.225475	
537	CY2016- Q2	B34P31	4/1/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.5795	- 0.58355	4/11/16	245551	SL2160		1	11	- 0.27405	- 0.339475	
538	CY2016- Q2	B34P31	4/1/16 7:00					- 0.6025						2	12	- 0.0790925	- 0.5419325	
539	CY2016- Q2	B34P31	4/1/16 7:00					- 0.5801						3				
540	CY2016- Q2	B34P31	4/1/16 7:00					- 0.5721						4	k:	6		
541	CY2016- Q2	B34P33	4/1/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.6415	- 0.586025	4/11/16	245551	SL2160		1				
542	CY2016- Q2	B34P33	4/1/16 7:00					- 0.5852						2	b:	0.516885379		
543	CY2016- Q2	B34P33	4/1/16 7:00					- 0.5512						3	s:	0.16610926		
544	CY2016- Q2	B34P33	4/1/16 7:00					- 0.5662						4				
545	CY2016- Q2	B34P35	4/1/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.6594	- 0.621025	4/11/16	245551	SL2160		1	SW:	0.880254229		
546	CY2016- Q2	B34P35	4/1/16 7:00					- 0.6088						2				
547	CY2016- Q2	B34P35	4/1/16 7:00					- 0.611						3	Critical pt:	0.859	n = 12, α = 0.05	
548	CY2016- Q2	B34P35	4/1/16 7:00					- 0.6049						4				
549	CY2016- Q2	B34P43	4/7/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.3992	- 0.3791	4/20/16	247119	SL2165		1	*SW > Critical pt, so normality accepted*			
550	CY2016- Q2	B34P43	4/7/16 7:45					- 0.3904						2				
551	CY2016- Q2	B34P43	4/7/16 7:45					- 0.3628						3				
552	CY2016- Q2	B34P43	4/7/16 7:45					- 0.364						4				
553	CY2016- Q2	B34P45	4/7/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.3756	- 0.36165	4/20/16	247119	SL2165		1				
554	CY2016- Q2	B34P45	4/7/16 7:45					- 0.3645						2				
555	CY2016- Q2	B34P45	4/7/16 7:45					- 0.3685						3				
556	CY2016- Q2	B34P45	4/7/16 7:45					- 0.338						4				
557	CY2016- Q2	B34P47	4/7/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.4126	- 0.3677	4/20/16	247119	SL2165		1				
558	CY2016- Q2	B34P47	4/7/16 7:45					- 0.3906						2				
559	CY2016- Q2	B34P47	4/7/16 7:45					- 0.3703						3				
560	CY2016- Q2	B34P47	4/7/16 7:45					- 0.2973						4				
561	CY2016- Q2	B34TW6	4/11/16 8:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.2892	- 0.27405	4/19/16	247119	SL2166		1				
562	CY2016- Q2	B34TW6	4/11/16 8:00					- 0.2868						2				
563	CY2016- Q2	B34TW6	4/11/16 8:00					- 0.2263						3				
564	CY2016- Q2	B34TW6	4/11/16 8:00					- 0.2939						4				
565	CY2016- Q2	B35JT0	5/31/16 11:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.1027	- 0.0790925	6/10/16	255921	SL2210		1				
566	CY2016- Q2	B35JT0	5/31/16 11:30					- 0.06871						2				
567	CY2016- Q2	B35JT0	5/31/16 11:30					- 0.07468						3				
568	CY2016- Q2	B35JT0	5/31/16 11:30					- 0.07028						4				
569	CY2016- Q2	B35K26	6/28/16 9:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.3587	- 0.36055	7/5/16	259381	SL2230		1				

Figure A-7. Spreadsheet for TOC from TASL (2 of 5)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
570	CY2016- Q2	B35K26	6/28/16 9:45					- 0.362						2
571	CY2016- Q2	B35K26	6/28/16 9:45					- 0.3572						3
572	CY2016- Q2	B35K26	6/28/16 9:45					- 0.3643						4
573														
574	CY2016- Q3	B35NB9	7/8/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.2431	- 0.242125	7/14/16	260603	SL2246		1
575	CY2016- Q3	B35NB9	7/8/16 7:00					- 0.2414						2
576	CY2016- Q3	B35NB9	7/8/16 7:00					- 0.2482						3
577	CY2016- Q3	B35NB9	7/8/16 7:00					- 0.2358						4
578	CY2016- Q3	B35NC9	7/10/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.3098	- 0.293225	7/14/16	260603	SL2248		1
579	CY2016- Q3	B35NC9	7/10/16 7:30					- 0.291						2
580	CY2016- Q3	B35NC9	7/10/16 7:30					- 0.2801						3
581	CY2016- Q3	B35NC9	7/10/16 7:30					- 0.292						4
582	CY2016- Q3	B35NJ4	7/14/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.1179	- 0.126775	7/19/16	261135	SL2252		1
583	CY2016- Q3	B35NJ4	7/14/16 7:40					- 0.1253						2
584	CY2016- Q3	B35NJ4	7/14/16 7:40					- 0.1287						3
585	CY2016- Q3	B35NJ4	7/14/16 7:40					- 0.1352						4
586	CY2016- Q3	B35P75	7/8/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.2163	- 0.20075	7/14/16	260603	SL2246		1
587	CY2016- Q3	B35P75	7/8/16 7:00					- 0.1985						2
588	CY2016- Q3	B35P75	7/8/16 7:00					- 0.1835						3
589	CY2016- Q3	B35P75	7/8/16 7:00					- 0.2047						4
590	CY2016- Q3	B35P77	7/8/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.2522	- 0.255075	7/15/16	260603	SL2246		1
591	CY2016- Q3	B35P77	7/8/16 7:00					- 0.2592						2
592	CY2016- Q3	B35P77	7/8/16 7:00					- 0.2518						3
593	CY2016- Q3	B35P77	7/8/16 7:00					- 0.2571						4
594	CY2016- Q3	B35P79	7/8/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.2594	- 0.26115	7/14/16	260603	SL2246		1
595	CY2016- Q3	B35P79	7/8/16 7:00					- 0.2645						2
596	CY2016- Q3	B35P79	7/8/16 7:00					- 0.2607						3
597	CY2016- Q3	B35P79	7/8/16 7:00					- 0.26						4
598	CY2016- Q3	B35P93	7/10/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.2762	- 0.267175	7/14/16	260603	SL2248		1
599	CY2016- Q3	B35P93	7/10/16 7:30					- 0.2619						2
600	CY2016- Q3	B35P93	7/10/16 7:30					- 0.2592						3
601	CY2016- Q3	B35P93	7/10/16 7:30					- 0.2714						4
602	CY2016- Q3	B35P95	7/10/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.2442	- 0.223725	7/14/16	260603	SL2248		1
603	CY2016- Q3	B35P95	7/10/16 7:30					- 0.2137						2
604	CY2016- Q3	B35P95	7/10/16 7:30					- 0.2162						3
605	CY2016- Q3	B35P95	7/10/16 7:30					- 0.2208						4
606	CY2016- Q3	B35P97	7/10/16 7:30	TASL	FTB	9060_TOC	Total organic carbon	- 0.294	- 0.264925	7/14/16	260603	SL2248		1
607	CY2016- Q3	B35P97	7/10/16 7:30					- 0.2609						2
608	CY2016- Q3	B35P97	7/10/16 7:30					- 0.2641						3
609	CY2016- Q3	B35P97	7/10/16 7:30					- 0.2407						4
610	CY2016- Q3	B35PD9	7/14/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.1	- 0.0987225	7/19/16	261135	SL2252		1
611	CY2016- Q3	B35PD9	7/14/16 7:40					- 0.1016						2
612	CY2016- Q3	B35PD9	7/14/16 7:40					- 0.09572						3
613	CY2016- Q3	B35PD9	7/14/16 7:40					- 0.09757						4
614	CY2016- Q3	B35PF1	7/14/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.1626	- 0.126995	7/19/16	261135	SL2252		1
615	CY2016- Q3	B35PF1	7/14/16 7:40					- 0.1287						2
616	CY2016- Q3	B35PF1	7/14/16 7:40					- 0.1222						3

Shapiro- Wilk Normality Test

Rank #	Ave (mg/L)	x(n- i+1) -	Coefficient
1	- 0.589025	0.4903025	0.4968
2	- 0.5757	0.450425	0.3273
3	- 0.559725	0.43295	0.254
4	- 0.53315	0.406155	0.1988
5	- 0.3177	0.11695	0.1524
6	- 0.293225	0.0695	0.1109
7	- 0.267175	0.02505	0.0725
8	- 0.264925	0.00985	0.0359
9	- 0.26115	0	0
10	- 0.255075	- 0.00985	
11	- 0.242125	- 0.02505	
12	- 0.223725	-	
13	- 0.20075	- 0.11695	
14	- 0.126995	- 0.406155	
15	- 0.126775	- 0.43295	
16	- 0.125275	- 0.450425	
17	- 0.0987225	- 0.4903025	

k: 8

b: 0.609419769

s: 0.165352844

SW: 0.848964935

Critical pt: 0.892 n = 17, α = 0.05

SW < Critical pt, so normality rejected

Figure A-7. Spreadsheet for TOC from TASL (3 of 5)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
617	CY2016- Q3	B35PF1	7/14/16 7:40					- 0.09448						4
618	CY2016- Q3	B35PF3	7/14/16 7:40	TASL	FTB	9060_TOC	Total organic carbon	- 0.1536	- 0.125275	7/19/16	261135	SL2252		1
619	CY2016- Q3	B35PF3	7/14/16 7:40					- 0.1148						2
620	CY2016- Q3	B35PF3	7/14/16 7:40					- 0.1185						3
621	CY2016- Q3	B35PF3	7/14/16 7:40					- 0.1142						4
622	CY2016- Q3	B36330	8/16/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.3439	- 0.3177	8/27/16	267254	SL2272		1
623	CY2016- Q3	B36330	8/16/16 7:00					- 0.2997						2
624	CY2016- Q3	B36330	8/16/16 7:00					- 0.3152						3
625	CY2016- Q3	B36330	8/16/16 7:00					- 0.312						4
626	CY2016- Q3	B368B5	9/9/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.5194	- 0.53315	9/23/16	271262	SL2291		1
627	CY2016- Q3	B368B5	9/9/16 7:00					- 0.5342						2
628	CY2016- Q3	B368B5	9/9/16 7:00					- 0.5281						3
629	CY2016- Q3	B368B5	9/9/16 7:00					- 0.5509						4
630	CY2016- Q3	B36971	9/9/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.5913	- 0.5757	9/23/16	271262	SL2291		1
631	CY2016- Q3	B36971	9/9/16 7:00					- 0.5676						2
632	CY2016- Q3	B36971	9/9/16 7:00					- 0.5872						3
633	CY2016- Q3	B36971	9/9/16 7:00					- 0.5567						4
634	CY2016- Q3	B36973	9/9/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.6055	- 0.589025	9/23/16	271262	SL2291		1
635	CY2016- Q3	B36973	9/9/16 7:00					- 0.5791						2
636	CY2016- Q3	B36973	9/9/16 7:00					- 0.5827						3
637	CY2016- Q3	B36973	9/9/16 7:00					- 0.5888						4
638	CY2016- Q3	B36975	9/9/16 7:00	TASL	FTB	9060_TOC	Total organic carbon	- 0.564	- 0.559725	9/23/16	271262	SL2291		1
639	CY2016- Q3	B36975	9/9/16 7:00					- 0.5554						2
640	CY2016- Q3	B36975	9/9/16 7:00					- 0.5628						3
641	CY2016- Q3	B36975	9/9/16 7:00					- 0.5567						4
642														
643	CY2016- Q4	B36NM9	10/5/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.3016	- 0.276375	10/12/16	273704- 8	SL2323		1
644	CY2016- Q4	B36NM9	10/5/16 7:45					- 0.2513						2
645	CY2016- Q4	B36NM9	10/5/16 7:45					- 0.2558						3
646	CY2016- Q4	B36NM9	10/5/16 7:45					- 0.2968						4
647	CY2016- Q4	B36NX1	10/6/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.2789	- 0.266375	10/12/16	273704- 23	SL2326		1
648	CY2016- Q4	B36NX1	10/6/16 7:45					- 0.2666						2
649	CY2016- Q4	B36NX1	10/6/16 7:45					- 0.2606						3
650	CY2016- Q4	B36NX1	10/6/16 7:45					- 0.2594						4
651	CY2016- Q4	B36PH4	10/5/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.2708	- 0.276325	10/12/16	275089- 16	SL2323		1
652	CY2016- Q4	B36PH4	10/5/16 7:45					- 0.2944						2
653	CY2016- Q4	B36PH4	10/5/16 7:45					- 0.2669						3
654	CY2016- Q4	B36PH4	10/5/16 7:45					- 0.2732						4
655	CY2016- Q4	B36PH6	10/5/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.1949	- 0.19685	10/11/16	275089- 12	SL2323		1
656	CY2016- Q4	B36PH6	10/5/16 7:45					- 0.1865						2
657	CY2016- Q4	B36PH6	10/5/16 7:45					- 0.1847						3
658	CY2016- Q4	B36PH6	10/5/16 7:45					- 0.2213						4
659	CY2016- Q4	B36PH8	10/5/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.1799	- 0.166175	10/12/16	275089- 13	SL2323		1
660	CY2016- Q4	B36PH8	10/5/16 7:45					- 0.1586						2
661	CY2016- Q4	B36PH8	10/5/16 7:45					- 0.1829						3
662	CY2016- Q4	B36PH8	10/5/16 7:45					- 0.1433						4
663	CY2016- Q4	B36PM9	10/6/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.2947	- 0.303925	10/12/16	275944- 18	SL2326		1

	P	Q	R	S
	Shapiro- Wilk Normality Test			
	Rank #	Ave (mg/L)	s(n- i+1) - x(i)	Coefficient
	1	- 0.3424	0.176225	0.5475
	2	- 0.34015	0.1433	0.3325
	3	- 0.32785	0.065325	0.2347
	4	- 0.31035	0.0475	0.1586
	5	- 0.303925	0.03755	0.0922
	6	- 0.276375	5E- 05	0.0303
	7	- 0.276325	- 5E- 05	
	8	- 0.266375	- 0.03755	
	9	- 0.26285	- 0.0475	
	10	- 0.262525	- 0.065325	
	11	- 0.19685	- 0.1433	
	12	- 0.166175	- 0.176225	
	k:	6		
	b:	0.17045934		
	s:	0.053861891		
	SW:	0.910512119		

Figure A-7. Spreadsheet for TOC from TASL (4 of 5)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
664	CY2016- Q4	B36PM9	10/6/16 7:45					- 0.3124						2				
665	CY2016- Q4	B36PM9	10/6/16 7:45					- 0.3253						3	Critical pt:	0.859	n = 12, α = 0.05	
666	CY2016- Q4	B36PM9	10/6/16 7:45					- 0.2833						4				
667	CY2016- Q4	B36PN1	10/6/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.3577	- 0.3424	10/12/16	275811- 31	SL2326		1	*SW > Critical pt, so normality accepted*			
668	CY2016- Q4	B36PN1	10/6/16 7:45					- 0.3331						2				
669	CY2016- Q4	B36PN1	10/6/16 7:45					- 0.3508						3				
670	CY2016- Q4	B36PN1	10/6/16 7:45					- 0.328						4				
671	CY2016- Q4	B36PN3	10/6/16 7:45	TASL	FTB	9060_TOC	Total organic carbon	- 0.3319	- 0.32785	10/12/16	275811- 32	SL2326		1				
672	CY2016- Q4	B36PN3	10/6/16 7:45					- 0.3397						2				
673	CY2016- Q4	B36PN3	10/6/16 7:45					- 0.3181						3				
674	CY2016- Q4	B36PN3	10/6/16 7:45					- 0.3217						4				
675	CY2016- Q4	B37407	11/2/16 7:50	TASL	FTB	9060_TOC	Total organic carbon	- 0.2541	- 0.262525	11/4/16	279439- 11	SL2349		1				
676	CY2016- Q4	B37407	11/2/16 7:50					- 0.2512						2				
677	CY2016- Q4	B37407	11/2/16 7:50					- 0.2739						3				
678	CY2016- Q4	B37407	11/2/16 7:50					- 0.2709						4				
679	CY2016- Q4	B37447	11/2/16 7:50	TASL	FTB	9060_TOC	Total organic carbon	- 0.3244	- 0.34015	11/4/16	279823- 23	SL2349		1				
680	CY2016- Q4	B37447	11/2/16 7:50					- 0.3519						2				
681	CY2016- Q4	B37447	11/2/16 7:50					- 0.3632						3				
682	CY2016- Q4	B37447	11/2/16 7:50					- 0.3211						4				
683	CY2016- Q4	B37449	11/2/16 7:50	TASL	FTB	9060_TOC	Total organic carbon	- 0.2379	- 0.31035	11/4/16	279823- 19	SL2349		1				
684	CY2016- Q4	B37449	11/2/16 7:50					- 0.3256						2				
685	CY2016- Q4	B37449	11/2/16 7:50					- 0.3341						3				
686	CY2016- Q4	B37449	11/2/16 7:50					- 0.3438						4				
687	CY2016- Q4	B37451	11/2/16 7:50	TASL	FTB	9060_TOC	Total organic carbon	- 0.2476	- 0.26285	11/4/16	279823- 20	SL2349		1				
688	CY2016- Q4	B37451	11/2/16 7:50					- 0.3101						2				
689	CY2016- Q4	B37451	11/2/16 7:50					- 0.2033						3				
690	CY2016- Q4	B37451	11/2/16 7:50					- 0.2904						4				

Figure A-7. Spreadsheet for TOC from TASL (5 of 5)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
182	CY2016- Q1	B33T73	1/7/16 7:30	TASL	FTB	9020_TOX	Total organic halides	7.93	9.105	1/21/16 15:50	234073	SL2091		1	*Shapiro- Wilk Normality Test*			
183	CY2016- Q1	B33T73	1/7/16 7:30					10.28						2	Rank #	Ave (ug/L)	x(n- i+1) - x(i)	Coefficient
184	CY2016- Q1	B33TJ7	1/15/16 7:40	TASL	FTB	9020_TOX	Total organic halides	4.93	5.16	2/3/16 15:53	236485	SL2102		1	1	0	9.105	0.5475
185	CY2016- Q1	B33TJ7	1/15/16 7:40					5.39						2	2	0	7.02	0.3325
186	CY2016- Q1	B33V69	1/7/16 7:30	TASL	FTB	9020_TOX	Total organic halides	3.21	1.605	1/15/16 2:17	232604	SL2091		1	3	0	6.21	0.2347
187	CY2016- Q1	B33V69	1/7/16 7:30					0						2	4	0.37	5.73	0.1586
188	CY2016- Q1	B33V71	1/7/16 7:30	TASL	FTB	9020_TOX	Total organic halides	6.03	6.1	1/21/16 14:06	234073	SL2091		1	5	0.38	4.78	0.0922
189	CY2016- Q1	B33V71	1/7/16 7:30					6.17						2	6	1.605	0.99	0.0303
190	CY2016- Q1	B33V73	1/7/16 7:30	TASL	FTB	9020_TOX	Total organic halides	2.4	2.595	1/15/16 1:47	232604	SL2091		1	7	2.595	- 0.99	
191	CY2016- Q1	B33V73	1/7/16 7:30					2.79						2	8	5.16	- 4.78	
192	CY2016- Q1	B33VD9	1/15/16 7:40	TASL	FTB	9020_TOX	Total organic halides	0	0	2/3/16 17:04	236485	SL2102		1	9	6.1	- 5.73	
193	CY2016- Q1	B33VD9	1/15/16 7:40					0						2	10	6.21	- 6.21	
194	CY2016- Q1	B33VF1	1/15/16 7:40	TASL	FTB	9020_TOX	Total organic halides	4.43	6.21	2/3/16 15:21	236485	SL2102		1	11	7.02	- 7.02	
195	CY2016- Q1	B33VF1	1/15/16 7:40					7.99						2	12	9.105	- 9.105	
196	CY2016- Q1	B33VF3	1/15/16 7:40	TASL	FTB	9020_TOX	Total organic halides	0	0	2/3/16 16:42	236485	SL2102		1				
197	CY2016- Q1	B33VF3	1/15/16 7:40					0						2	k:	6		
198	CY2016- Q1	B34B37	3/10/16 7:15	TASL	FTB	9020_TOX	Total organic halides	6.07	7.02	3/23/16 20:35	243325	SL2135		1				
199	CY2016- Q1	B34B37	3/10/16 7:15					7.97						2	b:	10.1561155		
200	CY2016- Q1	B34BV0	3/10/16 7:15	TASL	FTB	9020_TOX	Total organic halides	0.41	0.37	3/23/16 19:42	243325	SL2135		1	s:	3.307879339		
201	CY2016- Q1	B34BV0	3/10/16 7:15					0.33						2				
202	CY2016- Q1	B34BV2	3/10/16 7:15	TASL	FTB	9020_TOX	Total organic halides	0	0	3/23/16 21:30	243325	SL2135		1	SW:	0.856965342		
203	CY2016- Q1	B34BV2	3/10/16 7:15					0						2				
204	CY2016- Q1	B34BV4	3/10/16 7:15	TASL	FTB	9020_TOX	Total organic halides	0.76	0.38	3/23/16 21:01	243325	SL2135		1	Critical pt:	0.859	n = 12, α = 0.05	
205	CY2016- Q1	B34BV4	3/10/16 7:15					0						2				
206															*SW < Critical pt, so normality rejected*			
207	CY2016- Q2	B34MN8	4/15/16 7:20	TASL	FTB	9020_TOX	Total organic halides	2.13	2.25	5/9/16 23:52	250366	SL2174		1				
208	CY2016- Q2	B34MN8	4/15/16 7:20					2.37						2	*Shapiro- Wilk Normality Test*			
209	CY2016- Q2	B34NB2	4/1/16 7:00	TASL	FTB	9020_TOX	Total organic halides	1.26	1.71	4/14/16 0:00	247972	SL2160		1	Rank #	Ave (ug/L)	x(n- i+1) - x(i)	Coefficient
210	CY2016- Q2	B34NB2	4/1/16 7:00					2.16						2	1	0.105	5.61	0.5888
211	CY2016- Q2	B34NC9	4/7/16 7:45	TASL	FTB	9020_TOX	Total organic halides	0.22	0.11	5/6/16 0:31	250363	SL2165		1	2	0.11	4.385	0.3244
212	CY2016- Q2	B34NC9	4/7/16 7:45					0						2	3	0.165	3.345	0.1976
213	CY2016- Q2	B34P31	4/1/16 7:00	TASL	FTB	9020_TOX	Total organic halides	5.73	5.715	4/25/16 14:47	247983	SL2160		1	4	1.12	1.13	0.0947
214	CY2016- Q2	B34P31	4/1/16 7:00					5.7						2	5	1.71	0	
215	CY2016- Q2	B34P33	4/1/16 7:00	TASL	FTB	9020_TOX	Total organic halides	2.26	4.495	4/13/16 22:18	247972	SL2160		1	6	2.25	- 1.13	
216	CY2016- Q2	B34P33	4/1/16 7:00					6.73						2	7	3.51	- 3.345	
217	CY2016- Q2	B34P35	4/1/16 7:00	TASL	FTB	9020_TOX	Total organic halides	0.21	0.105	4/13/16 23:37	247972	SL2160		1	8	4.495	- 4.385	
218	CY2016- Q2	B34P35	4/1/16 7:00					0						2	9	5.715	- 5.61	
219	CY2016- Q2	B34P43	4/7/16 7:45	TASL	FTB	9020_TOX	Total organic halides	0.57	3.51	5/5/16 23:03	250363	SL2165		1				
220	CY2016- Q2	B34P43	4/7/16 7:45					6.45						2	k:	4		
221	CY2016- Q2	B34P45	4/7/16 7:45	TASL	FTB	9020_TOX	Total organic halides	0.33	0.165	5/5/16 23:41	250363	SL2165		1				
222	CY2016- Q2	B34P45	4/7/16 7:45					0						2	b:	5.493645		
223	CY2016- Q2	B34P47	4/7/16 7:45	TASL	FTB	9020_TOX	Total organic halides	1.54	1.12	5/5/16 22:38	250363	SL2165		1	s:	2.049481303		
224	CY2016- Q2	B34P47	4/7/16 7:45					0.7						2				
225															SW:	0.898138421		
226																		
227															Critical pt:	0.859	n = 9, α = 0.10	
228																		

Figure A-8. Spreadsheet for TOX from TASL (1 of 5)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O
229														
230														
231	CY2016-	Q3	B35NB9	7/8/16 7:00	TASL	FTB	9020_TOX	Total organic halides	4.93	5.67	7/21/16 15:16	261880	SL2246	1
232	CY2016-	Q3	B35NB9	7/8/16 7:00					6.41					2
233	CY2016-	Q3		7/10/16 7:30	TASL	FTB	9020_TOX	Total organic halides	12.68	19.975	7/25/16 23:17	264096	SL2248	1
234	B35NC9	CY2016-		7/10/16 7:30					27.27					2
235	CY2016-	Q3	B35NJ4	7/14/16 7:40	TASL	FTB	9020_TOX	Total organic halides	1.34	1.125	8/4/16 19:31	264530	SL2252	1
236	CY2016-	Q3	B35NJ4	7/14/16 7:40					0.91					2
237	CY2016-	Q3	B35P75	7/8/16 7:00	TASL	FTB	9020_TOX	Total organic halides	10.41	8.295	7/21/16 17:56	261880	SL2246	1
238	CY2016-	Q3	B35P75	7/8/16 7:00					6.18					2
239	CY2016-	Q3	B35P77	7/8/16 7:00	TASL	FTB	9020_TOX	Total organic halides	10.02	7.35	7/21/16 18:24	261880	SL2246	1
240	CY2016-	Q3	B35P77	7/8/16 7:00					4.68					2
241	CY2016-	Q3	B35P79	7/8/16 7:00	TASL	FTB	9020_TOX	Total organic halides	6.12	4.835	7/21/16 17:30	261880	SL2246	1
242	CY2016-	Q3	B35P79	7/8/16 7:00					3.55					2
243	CY2016-	Q3	B35P93	7/10/16 7:30	TASL	FTB	9020_TOX	Total organic halides	4.48	4.255	7/25/16 22:43	264096	SL2248	1
244	CY2016-	Q3	B35P93	7/10/16 7:30					4.03					2
245	CY2016-	Q3	B35P95	7/10/16 7:30	TASL	FTB	9020_TOX	Total organic halides	0	2.625	7/25/16 23:47	264096	SL2248	1
246	CY2016-	Q3	B35P95	7/10/16 7:30					5.25					2
247	CY2016-	Q3	B35P97	7/10/16 7:30	TASL	FTB	9020_TOX	Total organic halides	0	0	7/26/16 0:20	264096	SL2248	1
248	CY2016-	Q3	B35P97	7/10/16 7:30					0					2
249	CY2016-	Q3	B35PD9	7/14/16 7:40	TASL	FTB	9020_TOX	Total organic halides	1.6	0.8	8/4/16 17:52	264530	SL2252	1
250	CY2016-	Q3	B35PD9	7/14/16 7:40					0					2
251	CY2016-	Q3	B35PF1	7/14/16 7:40	TASL	FTB	9020_TOX	Total organic halides	2.85	4.07	8/4/16 19:54	264530	SL2252	1
252	CY2016-	Q3	B35PF1	7/14/16 7:40					5.29					2
253	CY2016-	Q3	B35PF3	7/14/16 7:40	TASL	FTB	9020_TOX	Total organic halides	1.2	4.73	8/4/16 20:43	264530	SL2252	1
254	CY2016-	Q3	B35PF3	7/14/16 7:40					8.26					2
255	CY2016-	Q3	B368B5	9/9/16 7:00	TASL	FTB	9020_TOX	Total organic halides	4.44	3.895	10/6/16 18:26	273808	SL2291	1
256	CY2016-	Q3	B368B5	9/9/16 7:00					3.35					2
257	CY2016-	Q3	B36971	9/9/16 7:00	TASL	FTB	9020_TOX	Total organic halides	5.23	4.305	10/6/16 20:37	273808	SL2291	1
258	CY2016-	Q3	B36971	9/9/16 7:00					3.38					2
259	CY2016-	Q3	B36973	9/9/16 7:00	TASL	FTB	9020_TOX	Total organic halides	2.52	2.065	10/6/16 21:55	273808	SL2291	1
260	CY2016-	Q3	B36973	9/9/16 7:00					1.61					2
261	CY2016-	Q3	B36975	9/9/16 7:00	TASL	FTB	9020_TOX	Total organic halides	2.83	2.08	10/6/16 20:12	273808	SL2291	1
262	CY2016-	Q3	B36975	9/9/16 7:00					1.33					2
263														
264	CY2016-	Q4	B36NM9	10/5/16 7:45	TASL	FTB	9020_TOX	Total organic halides	2.69	1.525	10/17/16 21:51	273704- 8	SL2323	1
265	CY2016-	Q4	B36NM9	10/5/16 7:45					0.36					2
266	CY2016-	Q4	B36NX1	10/6/16 7:45	TASL	FTB	9020_TOX	Total organic halides	0.15	0.19	10/22/16 12:08	273704- 23	SL2326	1
267	CY2016-	Q4	B36NX1	10/6/16 7:45					0.23					2
268	CY2016-	Q4	B36PH4	10/5/16 7:45	TASL	FTB	9020_TOX	Total organic halides	2.76	1.495	10/17/16 20:27	275089- 16	SL2323	1
269	CY2016-	Q4	B36PH4	10/5/16 7:45					0.23					2
270	CY2016-	Q4	B36PH6	10/5/16 7:45	TASL	FTB	9020_TOX	Total organic halides	1.1	1.78	10/17/16 19:16	275089- 12	SL2323	1
271	CY2016-	Q4	B36PH6	10/5/16 7:45					2.46					2
272	CY2016-	Q4	B36PH8	10/5/16 7:45	TASL	FTB	9020_TOX	Total organic halides	3.9	2.96	10/17/16 19:45	275089- 13	SL2323	1
273	CY2016-	Q4	B36PH8	10/5/16 7:45					2.02					2
274	CY2016-	Q4	B36PM9	10/6/16 7:45	TASL	FTB	9020_TOX	Total organic halides	0.26	0.135	10/24/16 21:42	275944- 18	SL2326	1
275	CY2016-	Q4	B36PM9	10/6/16 7:45					0.01					2

	P	Q	R	S
	SW > Critical pt, so normality accepted			
	Shapiro- Wilk Normality Test (omitting B35NC9)			
	Rank #	Ave (ug/L)	x(n- i+1) - x(i)	Coefficient
	1	0	8.295	0.515
	2	0.8	6.55	0.3306
	3	1.125	4.545	0.2495
	4	2.065	2.77	0.1878
	5	2.08	2.65	0.1353
	6	2.625	1.68	0.088
	7	3.895	0.36	0.0433
	8	4.07	0	0
	9	4.255	- 0.36	
	10	4.305	- 1.68	
	11	4.73	- 2.65	
	12	4.835	- 2.77	
	13	5.67	- 4.545	
	14	7.35	- 6.55	
	15	8.295	- 8.295	
	k:	7		
	b:	8.6135115		
	s:	2.340259448		
	SW:	0.967619085		
	Critical pt:	0.881 n = 15, α = 0.05		
	SW > Critical pt, so normality accepted			
	Shapiro- Wilk Normality Test without Sample B37449			
	Rank #	Ave (ug/L)	x(n- i+1) - x(i)	Coefficient
	1	0	6.37	0.5601
	2	0.135	2.885	0.3315
	3	0.19	2.77	0.226
	4	0.64	1.14	0.1429
	5	0.81	0.715	0.0695
	6	1.495	0	0
	7	1.525	- 0.715	
	8	1.78	- 1.14	
	9	2.96	- 2.77	
	10	3.02	- 2.885	

Figure A-8. Spreadsheet for TOX from TASL (2 of 5)

	V	W	X	Y	Z	AA	AB
230	***Dixon's Outlier Test on Sample B35NC9***						
231	Order	Value					
232	1	0					
233	2	0.8					
234	3	1.125					
235	4	2.065					
236	5	2.08					
237	6	2.625					
238	7	3.895					
239	8	4.07					
240	9	4.255					
241	10	4.305					
242	11	4.73					
243	12	4.835					
244	13	5.67					
245	14	7.35					
246	15	8.295					
247	16	19.975					
248							
249	0.67	Test Statistic (Eq. 12.6 in EPA 530/R- 09- 007)					
250	0.507	Critical value (Appendix D, Table 12.1 of EPA 530/R- 09- 007, alpha = 0.05, n = 16)					
251							
252	The test statistic exceeds the critical value, so the measurement is a statistical outlier.						
253	Additional data from an FXR blank taken the same day as B35NC9 indicates probable						
254	contamination of the blank DI water used to make the field blanks for that day.						

Figure A-8. Spreadsheet for TOX from TASL (3 of 5)

	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
276	CY2016-	B36PN1	10/6/16 7:45	TASL	FTB	9020_TOX	Total organic halides	3.67	3.02	10/22/16 4:26	275811- 31	SL2326	1		11	6.37	- 6.37	
277	CY2016-	B36PN1	10/6/16 7:45					2.37					2					
278	CY2016-	B36PN3	10/6/16 7:45	TASL	FTB	9020_TOX	Total organic halides	0	0.81	10/22/16 11:43	275811- 32	SL2326	1		k:	5		
279	CY2016-	B36PN3	10/6/16 7:45					1.62					2					
280	CY2016-	B37407	11/2/16 7:50	TASL	FTB	9020_TOX	Total organic halides	0.52	0.64	11/16/16 20:33	279439- 11	SL2349	1		b:	5.362833		
281	CY2016-	B37407	11/2/16 7:50					0.76					2		s:	1.864091541		
282	CY2016-	B37447	11/2/16 7:50	TASL	FTB	9020_TOX	Total organic halides	0	0	11/17/16 0:39	279823- 23	SL2349	1					
283	CY2016-	B37447	11/2/16 7:50					0					2		SW:	0.827664018		
284	CY2016- Q4	B37449	11/2/16 7:50	TASL	FTB	9020_TOX	Total organic halides	21.21	12.16	11/16/16 21:52	279823- 19	SL2349	1					
285	CY2016- Q4	B37449	11/2/16 7:50					3.11					2		Critical pt:	0.85 n = 11, α = 0.05		
286	CY2016-	B37451	11/2/16 7:50	TASL	FTB	9020_TOX	Total organic halides	0	6.37	11/16/16 22:59	279823- 20	SL2349	1		*SW < Critical pt, so normality rejected*			
287	CY2016-	B37451	11/2/16 7:50					12.74					2					

Figure A-8. Spreadsheet for TOX from TASL (4 of 5)

	V	W	X	Y	Z	AA	AB
264	***Dixon's Outlier Test on Sample B37449***						
265	Order	Value					
266	1	0					
267	2	0.135					
268	3	0.19					
269	4	0.64					
270	5	0.81					
271	6	1.495					
272	7	1.525					
273	8	1.78					
274	9	2.96					
275	10	3.02					
276	11	6.37					
277	12	12.16					
278							
279	0.76	Test Statistic (Eq. 12.6 in EPA 530/R- 09- 007)					
280	0.546	Critical value (Appendix D, Table 12.1 of EPA 530/R- 09- 007, $\alpha = 0.05$, n					
281							
282	The test statistic exceeds the critical value, so the measurement is a statistical outlier.						
283	The outlier is from a poorly reproducible measurement on the sample. Furthermore,						
284	two of the other TOX field blanks taken on the same day show no evidence of VOC chloride						
285	contamination. Other FXR field blanks taken the same day have trace methylene chloride						
286	contamination (1.4 and 7 ppb), so the outlier is not likely due to VOC chloride contamination						
287	of the blank. The outlier is also outside historical values for TOX from TASL. Therefore,						
288	outlier is rejected.						

Figure A-8. Spreadsheet for TOX from TASL (5 of 5)

	U	V	W	X	Y	Z	AA	AB
5	**Quarter ID**	**# of Meas (n)**	**df (n - 1)**	**Variance (s^2)**	**(n - 1) * s^2**	**Pooled St Dev**	**LOD (ug/L)**	**LOQ (ug/L)**
9	CY2015-Q1	=COUNT(J153:J224)	=V9-1	=VAR(J153:J224)	=W9*X9	=SQRT(SUM(Y6:Y9)/SUM(W6:W9))	=ROUND(3*Z9*1000,-1)	=ROUND(10*Z9*1000,-1)
10	CY2015-Q2	=COUNT(J226:J265)	=V10-1	=VAR(J226:J265)	=W10*X10	=SQRT(SUM(Y7:Y10)/SUM(W7:W10))	=ROUND(3*Z10*1000,-1)	=ROUND(10*Z10*1000,-1)
11	CY2015-Q3	=COUNT(J267:J334)	=V11-1	=VAR(J267:J334)	=W11*X11	=SQRT(SUM(Y8:Y11)/SUM(W8:W11))	=ROUND(3*Z11*1000,-1)	=ROUND(10*Z11*1000,-1)
12	CY2015-Q4	=COUNT(J336:J407)	=V12-1	=VAR(J336:J407)	=W12*X12	=SQRT(SUM(Y9:Y12)/SUM(W9:W12))	=ROUND(3*Z12*1000,-1)	=ROUND(10*Z12*1000,-1)
13	CY2016-Q1	=COUNT(J409:J520)	=V13-1	=VAR(J409:J520)	=W13*X13	=SQRT(SUM(Y10:Y13)/SUM(W10:W13))	=ROUND(3*Z13*1000,-1)	=ROUND(10*Z13*1000,-1)
14	CY2016-Q2	=COUNT(J522:J533)	=V14-1	=VAR(J522:J533)	=W14*X14	=SQRT(SUM(Y11:Y14)/SUM(W11:W14))	=ROUND(3*Z14*1000,-1)	=ROUND(10*Z14*1000,-1)
15	CY2016-Q3	=COUNT(J535:J554)	=V15-1	=VAR(J535:J554)	=W15*X15	=SQRT(SUM(Y12:Y15)/SUM(W12:W15))	=ROUND(3*Z15*1000,-1)	=ROUND(10*Z15*1000,-1)
16	CY2016-Q4	No data						

Figure A-9. Example LOD/LOQ Spreadsheet (TOC for GEL) with Formulas Displayed

	U	V	W	X	Y	Z	AA	AB
5	**Quarter ID**	**# of Meas**	**df (n -**	**Variance**	**(n - 1) * s^2**	**Pooled St Dev**	**LOD**	**LOQ**
9	CY2015- Q1	18	17	0.006611318	0.112392406	0.135711335	410	1360
10	CY2015- Q2	10	9	0.000933469	0.008401225	0.127625827	380	1280
11	CY2015- Q3	17	16	0.00075353	0.012056485	0.117534476	350	1180
12	CY2015- Q4	18	17	0.001159412	0.01971	0.050850415	150	510
13	CY2016- Q1	28	27	0.002365972	0.063881232	0.038832405	120	390
14	CY2016- Q2	3	2	0.004037521	0.008075042	0.040901684	120	410
15	CY2016- Q3	5	4	0.003044175	0.0121767	0.045572574	140	460
16	CY2016- Q4	No data						

Figure A-10. GEL LOD/LOQ Spreadsheet for TOC

	U	V	W	X	Y	Z	AA	AB
5	**Quarter ID**	**# of Meas (n)**	**df (n -**	**Variance**	**(n - 1) * s^2**	**Pooled St Dev**	**LOD**	**LOQ**
9	CY2015- Q1	17	16	3.127136029	50.03417647	1.223506893	3.7	12.2
10	CY2015- Q2	8	7	0.624926786	4.3744875	1.166755368	3.5	11.7
11	CY2015- Q3	16	15	0.128531667	1.927975	1.052434221	3.2	10.5
12	CY2015- Q4	11	10	3.060441818	30.60441818	1.345835066	4.0	13.5
13	CY2016- Q1	28	27	1.241041667	33.508125	1.092462664	3.3	10.9
14	CY2016- Q2	1	0	N/A	N/A	1.126947188	3.4	11.3
15	CY2016- Q3	5	4	0.65888	2.63552	1.275931636	3.8	12.8
16	CY2016- Q4	No data						

Figure A-11. GEL LOD/LOQ Spreadsheet for TOX

	U	V	W	X	Y	Z	AA	AB
5	**Quarter ID**	**# of Meas (n)**	**df (n - 1)**	**Variance**	**(n - 1) * s^2**	**Pooled St Dev**	**LOD**	**LOQ**
7	CY2016- Q1	No data						
8	CY2016- Q2	No data						
9	CY2016- Q3	No data						
10	CY2016- Q4	13	12	0.004074569	0.04889483	0.063832352	190	640

Figure A-12. TADN LOD/LOQ Spreadsheet for TOC

	U	V	W	X	Y	Z	AA	AB
5	**Quarter ID**	**# of Meas (n)**	**df (n - 1)**	**Variance**	**(n - 1) * s^2**	**Pooled St Dev**	**LOD**	**LOQ**
7	CY2016- Q1	No data						
8	CY2016- Q2	No data						
9	CY2016- Q3	No data						
10	CY2016- Q4	12	11	4.003587384	44.03946123	2.000896645	6.0	20.0

Figure A-13. TADN LOD/LOQ Spreadsheet for TOX

	U	V	W	X	Y	Z	AA	AB
5	Quarter ID	# of Meas (n)	df (n - 1)	Variance	(n - 1) * s^2	Pooled St Dev	LOD	LOQ
26	CY2015- Q1	6	5	0.006548837	0.032744183	0.170001233	510	1700
27	CY2015- Q2	10	9	0.017561352	0.158052166	0.112345693	340	1120
28	CY2015- Q3	17	16	0.009483384	0.151734142	0.114862058	340	1150
29	CY2015- Q4	10	9	0.015943773	0.143493956	0.111634069	330	1120
30	CY2016- Q1	12	11	0.0110211	0.121232099	0.112990891	340	1130
31	CY2016- Q2	12	11	0.027592286	0.30351515	0.123768431	370	1240
32	CY2016- Q3	17	16	0.027341563	0.43746501	0.146280568	440	1460
33	CY2016- Q4	12	11	0.002901103	0.031912136	0.135083073	410	1350

Figure A-14. TASL LOD/LOQ Spreadsheet for TOC

	U	V	W	X	Y	Z	AA	AB
5	Quarter ID	# of Meas (n)	df (n - 1)	Variance	(n - 1) * s^2	Pooled St Dev	LOD	LOQ
26	CY2015- Q1	4	3	3.62925625	10.88776875	1.52501049	4.6	15.3
27	CY2015- Q2	8	7	3.237010268	22.65907188	1.655300661	5.0	16.6
28	CY2015- Q3	12	11	0.486726515	5.353991667	1.252353709	3.8	12.5
29	CY2015- Q4	4	3	2.641439583	7.92431875	1.396799184	4.2	14.0
30	CY2016- Q1	12	11	10.94206572	120.3627229	2.21006296	6.6	22.1
31	CY2016- Q2	9	8	4.200373611	33.60298889	2.25122204	6.8	22.5
32	CY2016- Q3	15	14	5.476814286	76.6754	2.574260576	7.7	25.7
33	CY2016- Q4	11	10	3.474837273	34.74837273	2.484320526	7.5	24.8

Figure A-15. TASL LOD/LOQ Spreadsheet for TOX

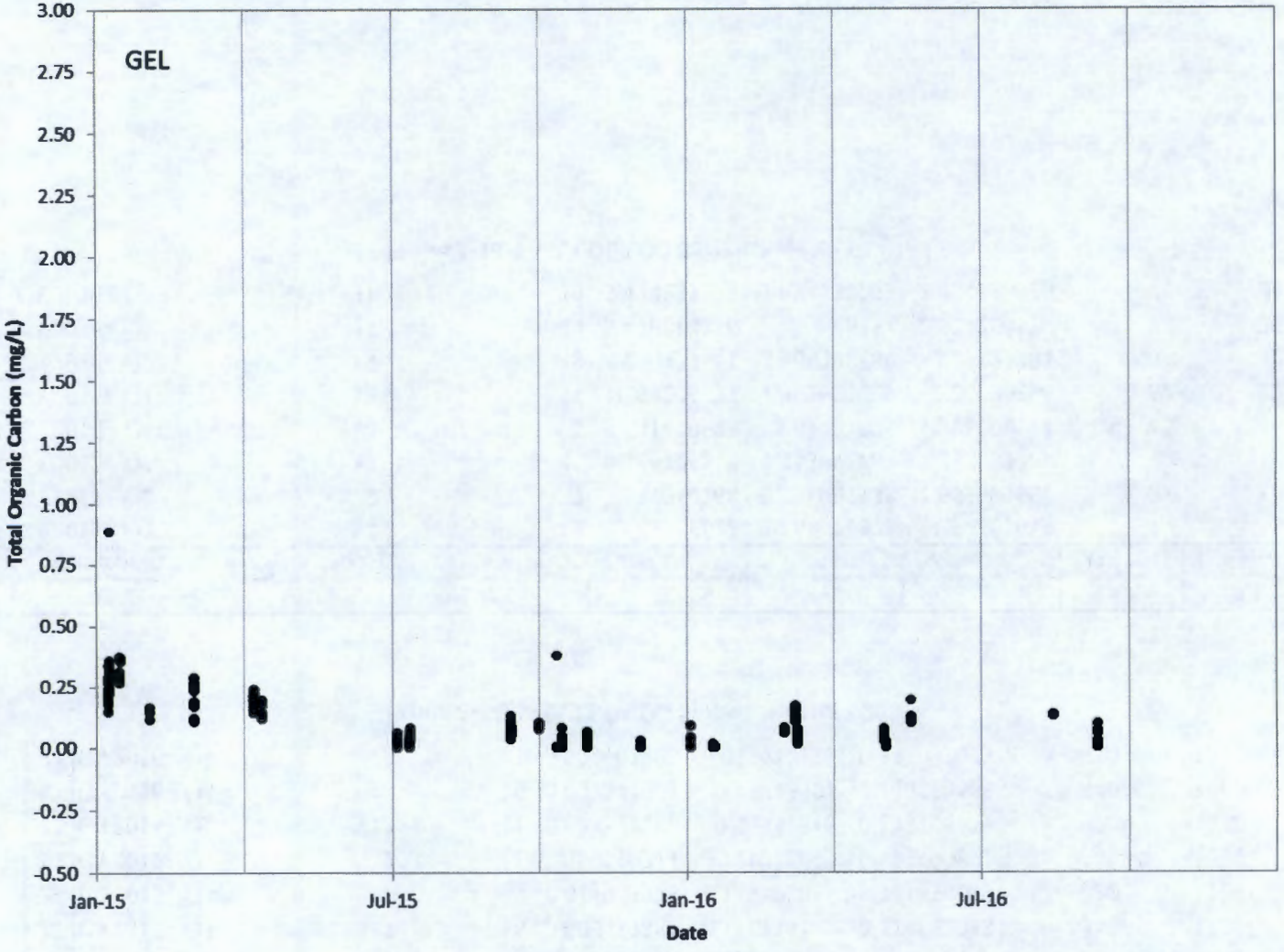

Figure A-16. Chart of TOC Blank Results from GEL: 2015 and 2016

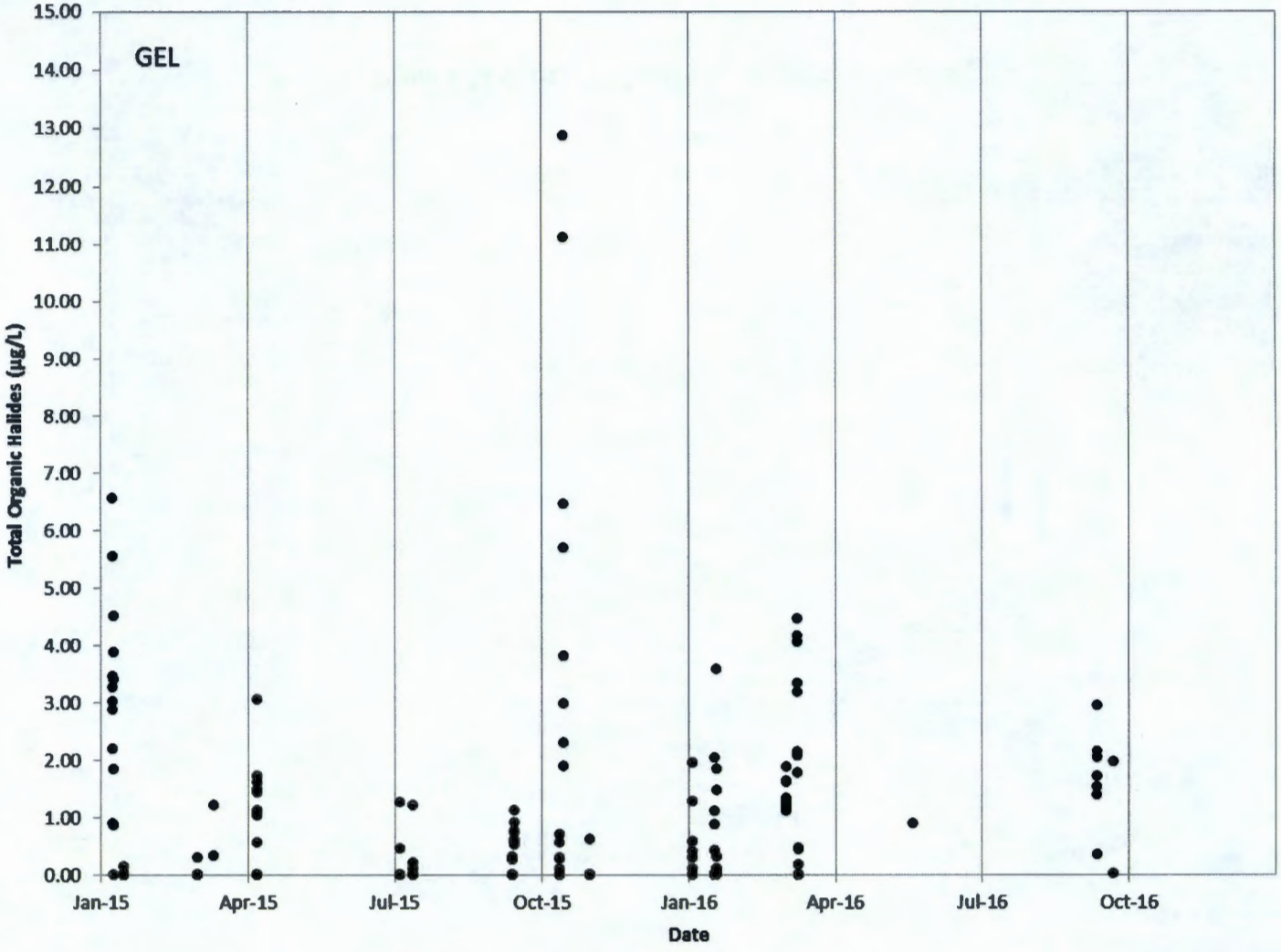

Figure A-17. Chart of TOX Blank Results from GEL: 2015 and 2016

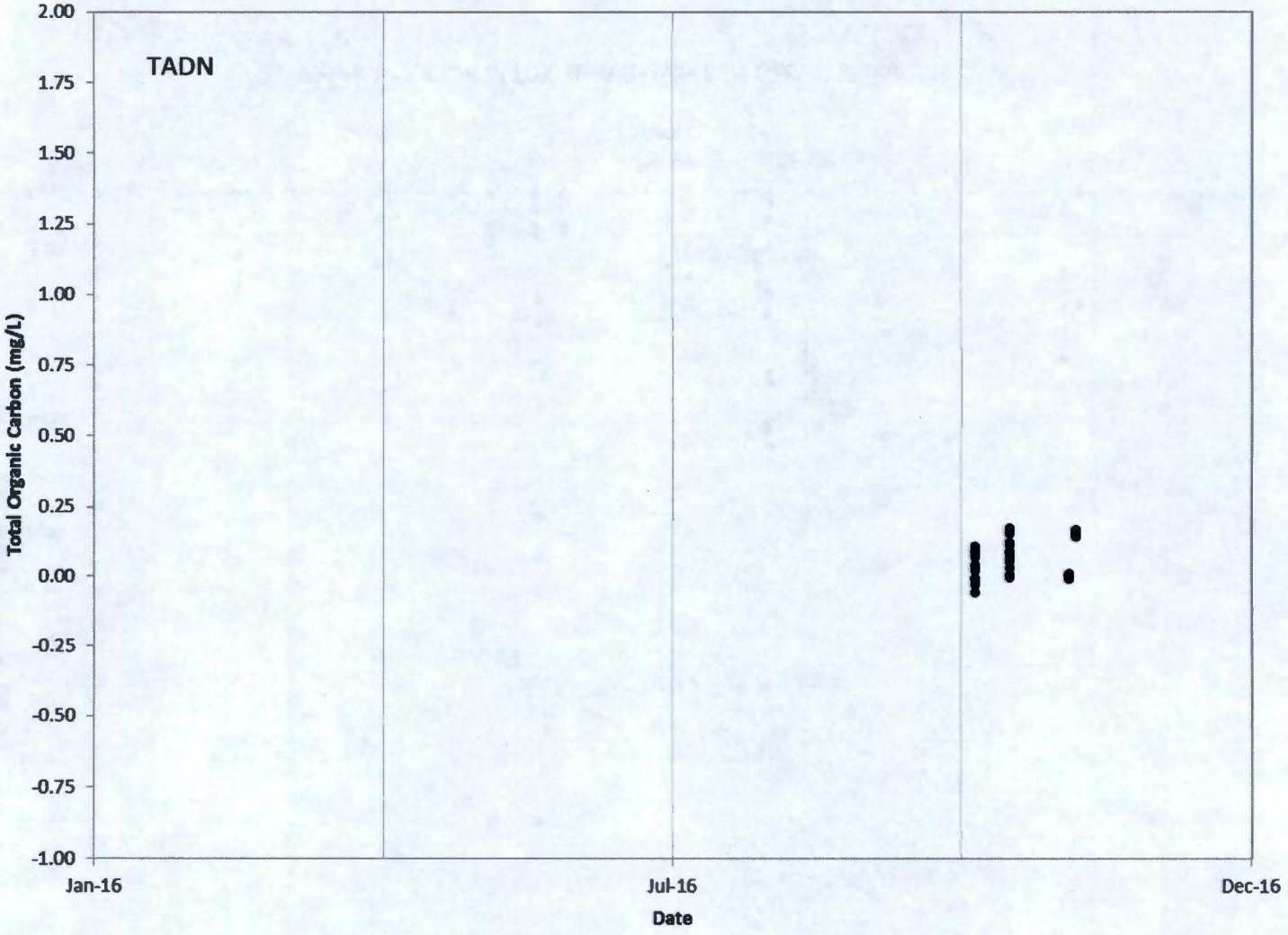

Figure A-18. Chart of TOC Blank Results from TADN: 2016

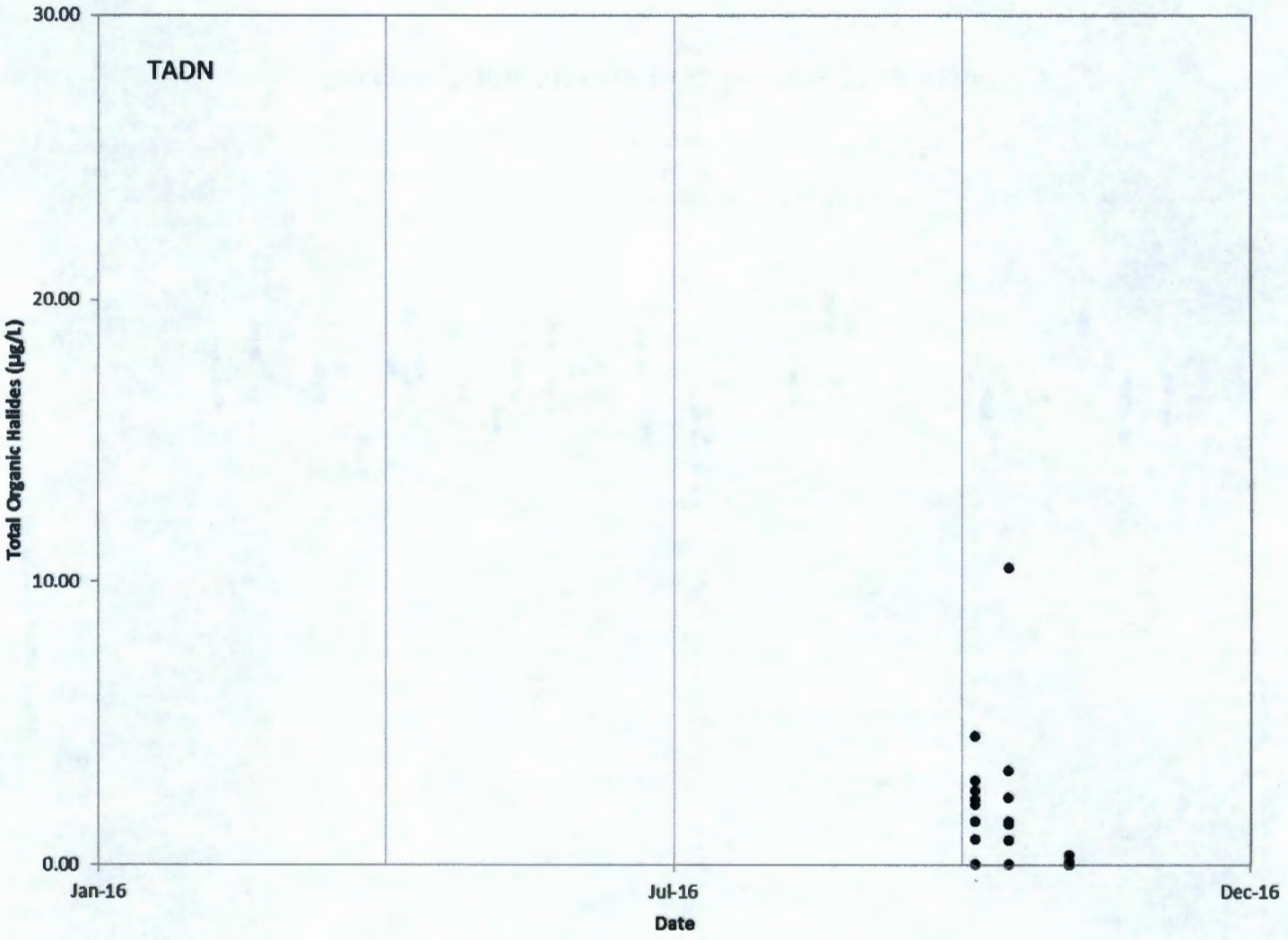

Figure A-19. Chart of TOX Blank Results from TADN: 2016

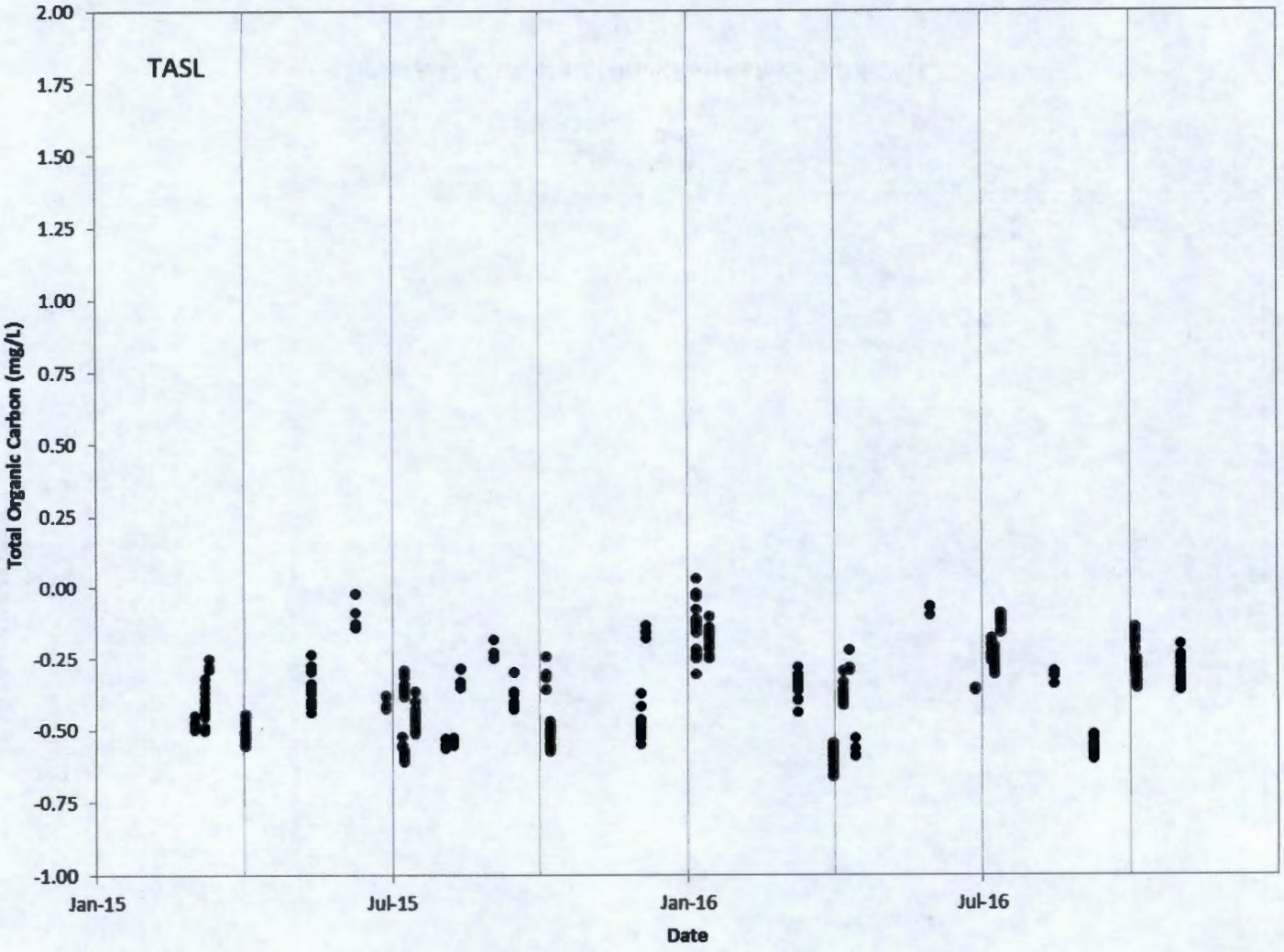

Figure A-20. Chart of TOC Blank Results from TASL: 2015 and 2016

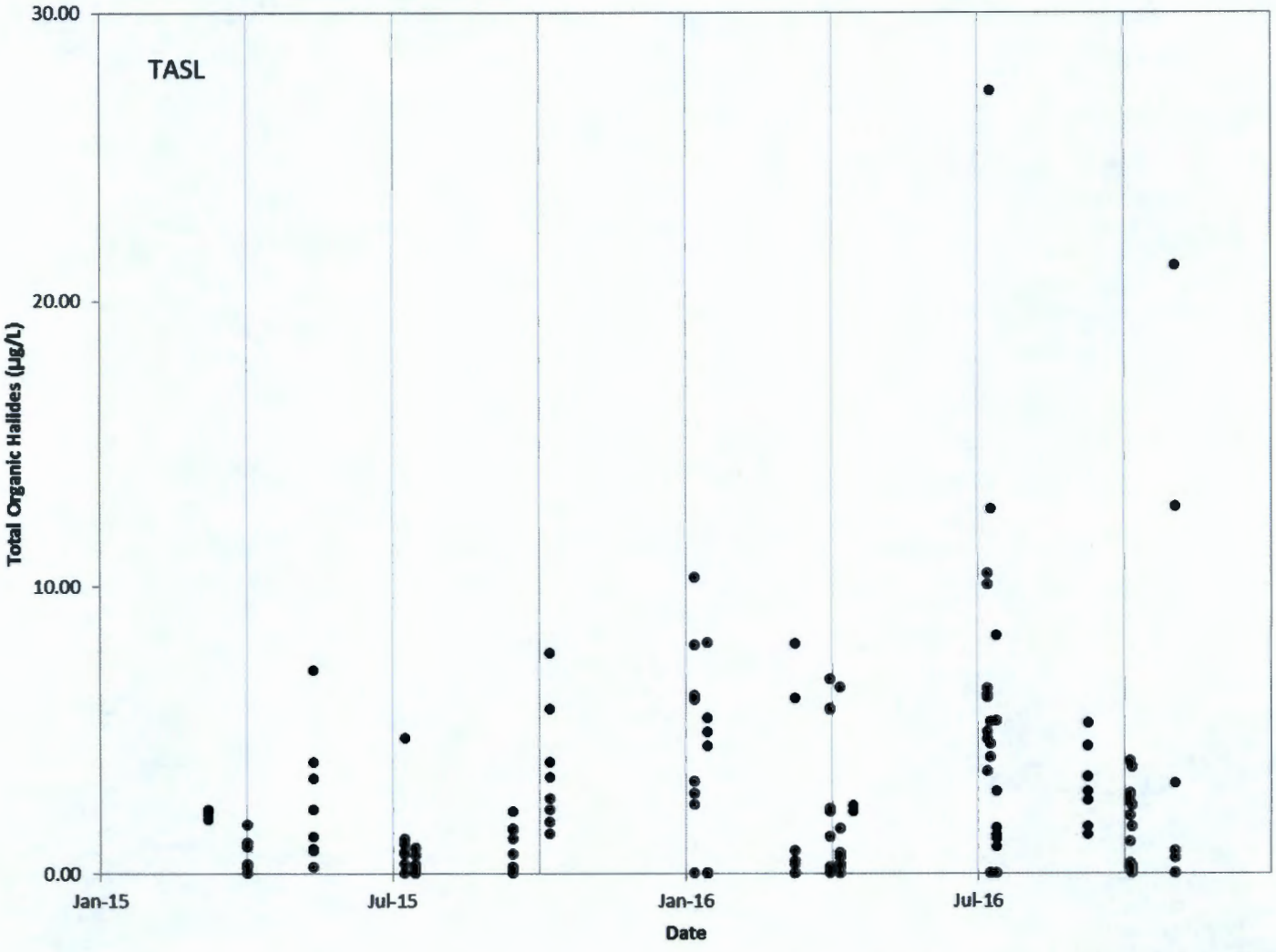

Figure A-21. Chart of TOX Blank Results from TASL: 2015 and 2016