Chesapeake Bay TMDL Loadings Errata Sheet 3
Correct Formula To Use and Example Calculations

INSTRUCTIONS:

The 2014 Industrial Stormwater General Permit (VAR05) requires permittees in the Chesapeake Bay watershed to calculate the facility specific loadings for total suspended solids (TSS), total nitrogen (TN) and total phosphorus (TP) (see permit Part I B 7 b (3) [Special Condition #7]).

TSS, TN, and TP samples are to be collected for the first four (4) permit monitoring periods (i.e., first two years of permit coverage) and reported on the Chesapeake Bay TMDL DMRs that were provided to your facility with the permit package.

STEP 1: Make sure that you are reporting the correct concentration values on the DMR for TSS, TN, and TP and that you are using the correct values in the facility-wide average concentration and loading calculations.

For TP and TSS:

- If the value is greater than or equal to the QL, then the value should be reported on the DMR.
- If the value is below the QL, then "< [lab QL]" should be reported on the DMR. For example, if TP is below the QL with a QL of 0.50 mg/L, then you would report "<0.50" as TP on the DMR. To calculate the facility-wide average concentration and the loading in this case, one half of the QL should be used; therefore, 0.25 mg/L would be used to calculate the facility-wide average concentration and the loading value.

For TN:

- TN is determined by adding the total kjeldahl nitrogen (TKN), nitrite-N (NO_2-N), and nitrate-N (NO_3-N) laboratory values. The lab may analyze nitrate-N+nitrite-N rather than analyzing them separately; in this case, the value for nitrate-N+nitrite-N will be added to the TKN value to calculate the concentration for TN.
- If all of the values are greater than or equal to the QL, then the TKN, nitrate-N, and nitrite-N values should be added together and the result reported as the TN on the DMR.
- If all of the nitrogen values are below the QL, then "< [the largest QL]" used for the respective species should be reported as the TN on the DMR. For example, if the TKN value is below the QL with a QL of 0.50 mg/L and the nitrate-N+nitrite-N value is below the QL with a QL of 0.20 mg/L, then you would report "< 0.50" as the TN on the DMR. To calculate the facility-wide average concentration and the loading in this case, one half of the largest QL should be used; therefore, 0.25 mg/L would be used to calculate the facility-wide average concentration and the loading value.
- If one of the values is greater than or equal to the QL and the others are below the QL, then the value greater than or equal to the QL should be reported as the TN on the DMR. For example, if the TKN value is 1.21 mg/L, nitrate-N is below the QL, and nitrite-N is below the QL, then you would report 1.21 mg/L as the TN on the DMR.
- If two of the values are greater than or equal to the QL and the other is below the QL, then the values greater than or equal to the QL should be added together and the result reported as TN on the DMR. For example, if TKN is 1.21 mg/L, nitrate-N is 2.55 mg/L, and nitrite-N is <QL, then you would report 3.76 mg/L as TN on the DMR.

NOTE: The lab may report the QL as the practical quantification level (PQL) on the laboratory certificate of analysis. The method detection level (MDL) is not the same as the QL and cannot be used as the QL.

STEP 2: Calculate the average concentration for TSS, TN, and TP

Once the correct values are reported on the DMRs, the facility-wide average concentration for each pollutant (i.e., average of all four lab results for each pollutant from all the outfalls at the facility) must

be calculated and used in the loading calculation. For values reported on the DMR as "<[lab QL]," please follow the instructions above to use one half of the reported QL in the facility-wide average concentration and loading calculations. See Examples #1 and #2 for more details.

STEP 3: Calculate the loading values for TSS, TN, and TP

The correct formula that should be used to calculate the loading values is:

$L = 0.226 \times R \times C$ *Equation (1)*

where:

L = the Pollutant of Concern (POC) loading value (lb/acre/year)

C = the facility-wide POC average concentration (mg/L)

*[**NOTE**: for facilities with more than one outfall, this should be a weighted average of the concentration values based on the area of each outfall - see the Example Calculation #2 below]*

0.226 = unit conversion factor

R = annual runoff (in/yr), calculated as: $R = P \times P_j \times R_v$

where:

P = annual rainfall (in/yr) [*use the Virginia annual average of 44.3 in/yr, or site specific annual rainfall for your area of the State, or another Board approved method*]

P_j = the fraction of annual events that produce runoff (usually 0.9)

R_v = the runoff coefficient, which can be expressed as: $R_v = 0.05 + (0.9 \times I_a)$

I_a = the impervious fraction [*the ratio of facility impervious area of industrial activity to the industrial activity area*]

or, $I_a = AREA_{IMPERVIOUS} / AREA_{INDUSTRIAL}$

*[**NOTE**: the impervious area of industrial activity and industrial activity area were provided in Question #10 of the Registration Statement*

Substituting in Equation (1):

$$\mathbf{L = 0.226 \times P \times P_j \times (0.05 + (0.9 \times I_a)) \times C} \qquad \textbf{\textit{Equation (2)}}$$

STEP 4: Compare the facility calculated loading values to the Chesapeake Bay TMDL loading values.

- If any of the facility calculated TP, TN, or TSS loading values are above the Chesapeake Bay TMDL Loading Values, the permittee would be required to submit a Chesapeake Bay TMDL Action Plan within 90 days from the end of the second year's monitoring period.
- If the facility calculated TP, TN, and TSS loading values are less than the Chesapeake Bay TMDL Loading Values, no action is required.

NOTE: You do not need to submit the loading values to DEQ; however, DEQ will check your calculations during site inspections.

If your facility has only one outfall, see Example Calculation #1.

If your facility has more than one outfall, see Example Calculation #2.

Example Calculation # 1 – For facilities with one stormwater outfall.

The facility has one (1) storm water outfall – Outfall 001. The impervious area of the industrial activity at the facility is 5 acres and the industrial activity area is 6.25 acres. The permittee has collected all four (4) grab samples for TP, TN, and TSS.

STEP 1: The facility has made sure that they reported the correct values on the DMRs as described in STEP 1 of the *Instructions*.

STEP 2: The lab results from the 4 grab samples are used to calculate the average concentration for each pollutant. The facility's lab results for the first four monitoring periods are as follows:

Parameter	Results from First 4 Monitoring Periods				
	1st Monitoring Period	2nd Monitoring Period	3rd Monitoring Period	4th Monitoring Period	**Average Concentration**
TSS	100	90	50	40	**70**
TN	1.3	3.2	2.5	1.0	**2.0**
TP	0.5	0.3	0.25	0.35	**0.35**

STEP 3: Calculate the loading (L) in lb/acre/year using *Equation (2)* from the Instructions and:

P = 44.3 in/yr,
P_j = 0.9,
I_a = 5 impervious acres/6.25 industrial activity acres = 0.80
C (TSS) = 70.0 mg/L
C (TN) = 2.0 mg/L
C (TP) = 0.35 mg/L

Calculations using Equation (2)

L (TP) = 0.226 x 44.3 x 0.9 x (0.05 + (0.9 x 0.8)) x 0.35 = **2.43**

L (TN) = 0.226 x 44.3 x 0.9 x (0.05 + (0.9 x 0.8)) x 2.0 = **13.88**

L (TSS) = 0.226 x 44.3 x 0.9 x (0.05 + (0.9 x 0.8)) x 70.0 = **485.7**

STEP 4: Compare the facility calculated loading values to the Chesapeake Bay TMDL loading values.

Calculated Loadings for the Facility	Chesapeake Bay TMDL Loading Values
2.43 lb/ac/yr TP	1.5 lb/ac/yr TP
13.88 lb/ac/yr TN	12.3 lb/ac/yr TN
485.7 lb/ac/yr TSS	440 lb/ac/yr TSS

In this example, the facility calculated TP, TN, and TSS loading values (L) are above the Chesapeake Bay TMDL Loading Values, so the permittee **is required** to submit a Chesapeake Bay TMDL Action Plan for all three pollutants within 90 days from the end of the second year's monitoring period. If the monitoring began on July 1, 2014, then the Chesapeake Bay TMDL Action Plan is due to DEQ on September 28, 2016.

See the permit Part I B 7 b (3) (c) for the TMDL Action Plan requirements, and Part I B 7 b (3) (d) for the Action Plan Annual Reports that are due June 30th of each year. Please note that the permittee is not required to submit the loading calculations to DEQ; however, these calculations will be reviewed during site inspections.

Example Calculation # 2 – For facilities with more than one outfall.

The facility has three (3) storm water outfalls – Outfalls 001, 002, and 003. The impervious area of the industrial activity at the facility is 5 acres and the industrial activity area is 6.25 acres. For each outfall, the permittee has collected four (4) grab samples for TP, TN, and TSS.

STEP 1: The facility has made sure that they reported the correct values on the DMRs as described in STEP 1 of the *Instructions*.

STEP 2: The lab results from the 4 grab samples are used to calculate the average concentration for each pollutant. The facility's lab results for the first four monitoring periods are as follows:

Total Suspended Solids (TSS, mg/L) Lab Results					
Outfall No.	Monitoring Periods				**Average**
	1st	2nd	3rd	4th	
001	200	100	50	50	**100**
002	50	100	70	40	**65**
003	40	60	35	65	**50**
Total Nitrogen (TN, mg/L) Lab Results					
Outfall No.	Monitoring Periods				**Average**
	1st	2nd	3rd	4th	
001	3.3	1.7	2.8	1.8	**2.4**
002	1.5	2.5	2.2	1.8	**2.0**
003	1.0	1.8	2.0	0.8	**1.4**
Total Phosphorus (TP, mg/L) Lab Results					
Outfall No.	Monitoring Periods				**Average**
	1st	2nd	3rd	4th	
001	0.25	0.17	0.34	0.64	**0.35**
002	0.09	0.05	0.22	0.16	**0.13**
003	0.20	0.17	0.31	0.20	**0.22**

Calculate the facility wide average for each pollutant (i.e., weighted average) using the averages calculated in the tables above and the drainage areas for each outfall: Outfall 001 = 1.7 acres, Outfall 002 = 3.5 acres, Outfall 003 = 6.2 acres. The total drainage (i.e., the sum of the three outfalls) is 11.4 acres.

Facility-Wide Concentration Calculations (Weighted Average):

$$C\ (TP) = \frac{(0.35 \times 1.7) + (0.13 \times 3.5) + (0.22 \times 6.2)}{11.4} = \mathbf{0.212\ mg/L}$$

$$C\ (TN) = \frac{(2.4 \times 1.7) + (2.0 \times 3.5) + (1.4 \times 6.2)}{11.4} = \mathbf{1.73\ mg/L}$$

$$C\ (TSS) = \frac{(100 \times 1.7) + (65 \times 3.5) + (50 \times 6.2)}{11.4} = \mathbf{62.1\ mg/L}$$

STEP 3: Calculate the loading (L) in lb/acre/year using *Equation (2)* in the Instructions and:

P = 44.3 in/yr,
P_j = 0.9,
I_a = 5 impervious acres/6.25 industrial activity acres = 0.80
C (TP) = 0.212 mg/L
C (TN) = 1.73 mg/L
C (TSS) = 62.1 mg/L

Calculations using Equation (2)

L (TP) = 0.226 x 44.3 x 0.9 x (0.05 + (0.9 x 0.8)) x 0.212 = **1.47**

L (TN) = 0.226 x 44.3 x 0.9 x (0.05 + (0.9 x 0.8)) x 1.73 = **12.03**

L (TSS) = 0.226 x 44.3 x 0.9 x (0.05 + (0.9 x 0.8)) x 62.1 = **430.6**

STEP 4: Compare the facility calculated loading values to the Chesapeake Bay TMDL loading values.

Calculated Loadings for the Facility	Chesapeake Bay TMDL Loading Values
1.47 lb/ac/yr TP	1.5 lb/ac/yr TP
12.03 lb/ac/yr TN	12.3 lb/ac/yr TN
430.6 lb/ac/yr TSS	440 lb/ac/yr TSS

In this example, the facility calculated TP, TN, and TSS loading values (L) are below the Chesapeake Bay TMDL Loading Values, so the permittee would **NOT** be required to submit a Chesapeake Bay TMDL Action Plan for any of the pollutants. No further action is needed by the permittee. Please note that the permittee is not required to submit the loading calculations to DEQ; however, these calculations will be reviewed during site inspections.