



**Bureau of Land and Water Quality  
Division of Water Quality Management  
Compliance and Technical Assistance Unit  
Program Guidance Document**

**Calculating Monthly Average Mass Loadings for DMR Toxics Reporting**

**Question/Issue: This Guidance Document pertains to providing technical assistance to MEPDES dischargers on proper methods for calculating Toxic Pollutant Mass Loading Monthly Averages for DMR Reporting**

**Discussion:**

The Department has noted some confusion regarding the proper way for facilities to calculate and report Daily Maximum and Monthly Average mass loading results for toxic pollutants on the Discharge Monitoring Reports (DMR's). "Toxic Pollutants" or "Toxics" are chemicals listed in Chapter 584 - Surface Water Quality Criteria for Toxic Pollutants, Appendix A. They include all 111 Priority Pollutants (heavy metals and specific toxic organics) as well as Non Priority Pollutants, some of which are commonly found on MEPDES permits such as aluminum, ammonia, chloride, chlorine, iron, manganese, and nitrate. A complete list of compounds in Chapter 584, Appendix A can be found at: [www.maine.gov/sos/cec/rules/06/chaps06.htm](http://www.maine.gov/sos/cec/rules/06/chaps06.htm).

When it comes to calculating Monthly Average mass loadings for DMR reporting, the math is a little bit different for Toxics than for Conventional Pollutants like Biochemical Oxygen Demand (BOD) or Total Suspended Solids (TSS). This guidance document reviews the way to calculate the Monthly Average mass loadings for DMR Toxics reporting.

**Background:**

Toxics results are used by MeDEP to calculate chemical concentrations in receiving waters after treated effluent has fully mixed with the river or bay. These diluted concentrations are then compared to established water quality criteria to determine if there may be any short term (acute), longer term (chronic) or human health effects from toxic pollutants. In accordance with Chapter 530, DEP's Surface Water Toxics Control Program, "calculations must be based on the facility's flow on the day the sample was collected for acute criteria and the monthly average flow for the chronic and human health criteria".

This is different than when we calculate Monthly Average mass loadings for Conventional Pollutants. As an example, for BOD or TSS we calculate loadings for each day individually using the flow and concentration for that day. Then we just average the daily results at the end of the month to find the Monthly Average, which is reported on the DMR.



To calculate the Monthly Average mass loading for Toxics, we must first find the Monthly Average concentration, and then multiply that with the Monthly Average flow. This seems like a minor change and in most cases the difference is negligible. But depending on variability in flows throughout the month, it could make for significant differences in the results. Here are some examples to show the proper method to calculate Toxics Monthly mass loadings.

### **Daily Maximum Loading Calculation**

When performing calculations involving Toxics, it is important to note that Toxics results can be reported by the lab in either mg/L or  $\mu\text{g/L}$  (micrograms per liter). If they are reported in  $\mu\text{g/L}$  they will need to be converted to mg/L to correctly calculate the loading using the formula below. Since  $1 \mu\text{g} = 1/1000 \text{ mg}$ , this is done by simply dividing the results reported in  $\mu\text{g/L}$  by 1000 to get mg/L (or simply move the decimal three places to the left). Also, flow must be in MGD. To convert from GPD to MGD, divide by 1,000,000 (move decimal six places to the left).

For facilities required to monitor and report Toxics results once per month or less frequently (i.e. quarterly or annually), the daily mass loading is determined as follows:

- $\text{Concentration (mg/L) on Sample Date} * \text{Flow (MGD) on Sample Date} * 8.34 = \text{Pollutant Mass Loading (MGD)}$

The result is reported on the DMR as the Daily Maximum.

Example #1: Copper (Cu) concentration =  $8.87 \mu\text{g/L}$   
Flow for the day of sampling = 0.285 MGD  
Cu permit limit = 0.33 lb/day

First convert concentration to parts per million (mg/L):  
 $8.87 \mu\text{g/L} \div 1000 = 0.00887 \text{ mg/L}$

Calculate Mass Loading:

$$\text{Concentration (mg/L)} * \text{Flow (MGD)} * 8.34 = \text{Mass Loading (lb/day)}$$
$$0.00887 \text{ mg/L} * 0.28528 \text{ MGD} * 8.34 = 0.021 \text{ lb/day}$$

Compare to the permit limit of 0.33 lb/day:

$$0.021 \text{ lb/day} < 0.33 \text{ lb/day} \rightarrow \text{No Violation}$$

For facilities required to report Toxics two or more times per month, the calculations are performed the same way as the example above. Example #2 shows the Daily Maximum calculation for a facility required to test copper weekly:



Example #2	Week	Copper (Cu) Mass Loading (lb/day)
	1	0.07
	2	0.10
	3	0.12
	4	0.08

Compare the results:

$$0.12 > 0.10 > 0.08 > 0.07$$

0.12 lb/day is the Daily Maximum for the month and is reported on the DMR.

If one or more results are Non-Detect (ND), these are treated as zeros in the calculations. This is in accordance with DWQM's January 2011 Non-Detect Results Guidance Memo.

#### **Monthly Average Loading Calculation for Toxics\***

*\*Please note that these examples only apply to Monthly Average mass loading calculations for Toxics. They are not to be used for calculating Monthly Average loadings for Conventional Pollutants such as BOD or TSS.*

For Toxics DMR reporting, the Monthly Average pollutant mass loading calculations should be performed using the Monthly Average flow, Monthly Average pollutant concentration, and conversion factor (8.34 lb/gal), as follows:

$$\begin{array}{l} \text{Monthly Average Concentration} \\ \text{(mg/L)} \end{array} * \begin{array}{l} \text{Monthly Average Flow} \\ \text{(MGD)} \end{array} * 8.34 = \text{Monthly Average Loading}$$

For facilities required to sample once per month for Toxics, the calculation is only different from the Daily Maximum calculation in that the Monthly Average flow is used. In Example 3 below, the facility is required to monitor Aluminum 1/month with a Monthly Average limit of 5.8 lb/day.

Example #3: Aluminum concentration = 2954  $\mu\text{g/L}$   
Monthly Average flow = 0.777 MGD  
Aluminum limit from permit = 5.8 lb/day

Convert concentration to parts per million (mg/L):

$$2954 \mu\text{g/L} \div 1000 = 2.954 \text{ mg/L}$$

Calculate loading:

$$2.954 \text{ mg/L} * 0.777 \text{ MGD} * 8.34 = 19.1 \text{ lb/day Monthly Average}$$

Compare to limit:

$$19.1 \text{ lb/day} > 5.8 \text{ lb/day} \rightarrow \text{Violation}$$



For a facility required to perform analyses at a frequency of two or more times per month, the Monthly Average concentration must be determined first, and then multiplied by the Monthly Average flow (MGD) and 8.34 to find the Monthly Average loading.

Example #4	Week	Copper (Cu) Concentration ( $\mu\text{g/L}$ )
	1	9.1
	2	7.0
	3	24.9
	4	8.2

Monthly Average Flow = 1.3 MGD

First, calculate the Monthly Average concentration:

$$(9.1 \mu\text{g/L} + 7.0 \mu\text{g/L} + 24.9 \mu\text{g/L} + 8.2 \mu\text{g/L})/4 = 12.3 \mu\text{g/L}$$

Convert the concentration to parts per million (mg/L):

$$12.3 \mu\text{g/L} \div 1000 = 0.0123 \text{ mg/L}$$

Using the Monthly Average concentration found above, calculate loading:

$$0.0123 \text{ mg/L} * 1.3 \text{ MGD} * 8.34 = 0.13 \text{ lb/day}$$

Example 5 below shows how to handle results that are below the detection limit. Again, Non-Detects would be handled as zeros in accordance with the protocol established in the Department's January 2011 Non-Detect guidance document.

Example #5	Week	Lead (Pb) Concentration ( $\mu\text{g/L}$ )
	1	7.4
	2	< 3
	3	< 3
	4	4.8

Monthly Average Flow = 0.038 MGD

Calculate Monthly Average Pb Concentration:

$$(7.4 \mu\text{g/L} + 0 + 0 + 4.8 \mu\text{g/L})/4 = 3.05 \mu\text{g/L} \text{ (round up to } 3.1 \mu\text{g/L)}$$

Convert the concentration to parts per million (mg/L):

$$3.1 \mu\text{g/L} \div 1000 = 0.0031 \text{ mg/L}$$



Calculate loading:

$$0.038 \text{ MGD} * 0.0031 \text{ mg/L} * 8.34 = 0.00098 \text{ lb/day}$$

### **Conclusion**

It is important to be aware that the Monthly Average mass loading calculation for toxic pollutants (Toxics) is different than the method used for calculating Monthly Average loadings for Conventional Pollutants, as specified in DEP's Surface Water Toxics Control Program (Chapter 530). It is possible for facilities to set up a 49 Form to automatically calculate the loadings, but it is critical that the underlying formulas are correct.

If you have any questions or need help, contact your DEP Inspector, Bill Sheehan, (Bill.J.Sheehan@maine.gov) or Judy Bruenjes (Judy.K.Bruenjes@maine.gov).