

PRETREATMENT CORNER

Local Limits Based on Total Nitrogen and Total Phosphorus Cap Loads

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Total Nitrogen (TN) and Total Phosphorus (TP) annual cap loads are being imposed in NPDES permits of municipal wastewater treatment facilities discharging more than 0.40 MGD to the Susquehanna River Basin in Pennsylvania, per the Chesapeake Bay Tributary Strategy. Most NPDES permittees in Pennsylvania have never had a TN permit limit, though they may have an Ammonia Nitrogen (NH₃-N) limit. The annual TP cap load, if evaluated on a daily limit, may be more stringent than some TP concentration-based permit limits currently contained in NPDES permits. In addition, future TMDLs for certain impaired receiving streams may result in even more stringent NH₃-N and TP limits.

The first thing to decide is whether it is prudent to impose a TN limit on an SIU. The SIU would be required to conduct TKN and NO₃+NO₂-N testing instead of the typical NH₃-N testing. One alternative is to develop a correlation between the NH₃-N and the TN concentrations measured in the raw influent to the wastewater treatment plant. By establishing such a correlation, perhaps a Local Limit only needs to be established for NH₃-N.

Table 1 shows influent and effluent concentrations and loadings of a hypothetical wastewater treatment plant that has a design flow of 1.60 MGD and a current discharge flow of 1.00 MGD. Therefore, if the average influent NH₃-N concentration is 20.0 mg/L and the average TN concentration is 35.0, a NH₃-N/TKN ratio of 1:1.75 can be established.

Parameter	Influent		Effluent	
	mg/L	Lbs/Day	mg/L	Lbs/Day
BOD	250	2,085	5.0	41.7
NH ₃ -N	20	167	2.0	16.7
TN	35	292	5.2	43.4
TP	6.0	50.0	0.60	5.00
TSS	275	2,294	10.0	83.4

It is one thing to develop Local Limits based on an NPDES permit limits, which are typically daily or monthly limits in concentration. But have you thought of how you will calculate Local Limits based on annual loadings? One approach is to use the TN concentration (6.0 mg/L) and TP concentration (1.0 mg/L) DEP uses to calculate the annual cap loads, bearing in mind that the annual cap loads are based on the design flow of the wastewater treatment plant. On the other hand, Local Limit determinations use current discharge flows. The resulting concentrations may be treated like permit limits.

Using the above NH₃-N/TKN ratio, an NH₃-N concentration of 3.4 mg/L will be used. Interestingly, the current NPDES permit limit for NH₃-N is 5.0 mg/L. Therefore, the more stringent concentration will be used for the headworks analysis. A permit limit of 2.0 mg/L was previously established for TP. However, the cap load equivalent of 1.0 mg/L TP will be used on Table 2. The maximum allowable headworks loadings for TN and TP based on pass through are then determined as shown on Table 2.

Table 2. NPDES AHLs			
POTW Actual Flow: 1.000 MGD			
Parameter	NPDES Permit Limit, mg/L	Percent POTW Removal	NPDES AHL, Lbs/Day
BOD	25.0	98.0	10,425
NH ₃ -N	3.4	90.0	284
TN	6.0	85.0	334
TP	1.0	90.0	83.4
TSS	30.0	96.0	6,255
NPDES AHL, Lbs/Day = (NPDES Limit, mg/L × POTW Flow, MGD × 8.34) ÷ [1 - (% POTW Removal ÷ 100)]			

While the above loadings based on NPDES limits appear to be valid, don't forget to compare the calculated loadings against the actual design capacities of the wastewater treatment plant. Table 3 shows a comparison of the design capacities versus the calculated loadings from Table 2. In addition, it may be wise to determine the influent loading based on the effluent annual cap load. The influent "cap" loads are essentially the same as using a TN of 6.0 mg/L and a TP of 1.0 mg/L in Table 2 if the same percent removal efficiencies are employed. In this scenario, the existing flow is used.

Table 3. Pass Through AHLs			
Parameter	NPDES AHL, Lbs/Day	Cap Load/ Design Capacity Lbs/Day	Pass Through AHL, Lbs/Day
BOD	10,425	4,000	4,000
NH ₃ -N	284	286	284
TN	334	334	334
TP	83.4	83.4	83.4
TSS	6,255	4,670	4,670

No matter which method is used to calculate the nutrient Local Limits, the decision of whether to impose the limits on all of the SIUs is site specific. Will the SIUs be able to meet the TN and TP Local Limits and at what cost to the SIUs? Will the imposition of TN and TP limits reduce the load to the wastewater treatment plant and thus reduce the capital costs a wastewater treatment plant must invest for a plant upgrade to meet the TN and TP cap loads? Since the Phase I dischargers under the CBTS are already in the midst of feasibility studies and designs, and may already have their financing in place, what are the benefits of reducing the nutrient loadings from the industrial dischargers? It does potentially create available loadings for new development, including new industrial dischargers.

Those municipal wastewater treatment facilities that are not located in the Susquehanna River Basin may be similarly impacted if their discharge is subject to a TMDL. Also, DEP continues to talk of statewide nutrient criteria. Only time will tell.