

Name of Toolbox Element – Nutrient Bubbling Conditions in NPDES Permits

1. Introduction / Overview

The Revised February 2010 Spokane River and Lake Spokane Dissolved Oxygen Total Maximum Daily Load Water Quality Improvement Report (TMDL) established wasteload allocations (WLAs) for Washington dischargers, which are illustrated in Table 5 of the TMDL. The WLAs are for Ammonia (NH₃-N), Total Phosphorus (TP), and Carbonaceous Biochemical Oxygen Demand (CBOD₅). These WLAs were established for each discharger based on TMDL Model Scenario 1 inputs into the CE-QUAL-W2 model as described in the Spokane River Modeling Final Scenario Report (PSU, January 29, 2010).

The TMDL also provides for “Delta Elimination” and “Target Pursuit Actions” in recognition that the implementation of additional advanced treatment technologies alone at a point source may not be able to reduce permitted discharges to levels consistent with the wasteload allocations established in the TMDL.

Modeling has shown that the predicted impacts to dissolved oxygen levels in Lake Spokane vary by parameter. Equal mass discharges of ammonia, phosphorus, and CBOD₅ from the same discharge location in the Spokane River produce different predicted dissolved oxygen impacts in Lake Spokane. Phosphorus has the most pronounced impact to water quality in the lake, while ammonia has the least impact. Similarly, dissolved oxygen levels in Lake Spokane vary based on the physical location of a specific discharge relative to a fixed downstream location.

With respect to point source discharges, the cumulative impact of nutrient loadings at the end of the riverine section of the Spokane River is a key criterion for achieving the dissolved oxygen water quality standard in Lake Spokane. Since it is the cumulative impact in Lake Spokane that is important, the concept of “nutrient bubbling conditions” in NPDES Permits is a viable Target Pursuit Action.

A “Bubble limitation” is essentially a maximum allowable cumulative impact at the downstream compliance point on Lake Spokane, resulting from discharge of TP, NH₃-N, and CBOD₅ by all of the point source permittees involved in the DO TMDL. This Target Pursuit Action provides the ability to vary the parameter (TP, NH₃-N, and CBOD₅) and the concentration of that parameter in point source discharges at different locations on the river as long as the cumulative impact of the resulting discharges at the downstream compliance point in Lake Spokane is maintained or improved. The bubbling conditions provide a mechanism that recognizes variable point source performance and capability relative to cumulative impact from the combined discharges. The bubbling conditions are

calculated based on location on the river and internal point source pollutant equivalency.

2. Toolbox Concept

The toolbox concept for bubbling conditions in NPDES Permits is based on developing a combined equivalent nutrient discharge level for all participating permit holders taking into account location ratios and individual source pollutant equivalency factors for its nutrient discharges.

The bubbling condition in each permit utilizes a previously established pollutant equivalency factor for a point source’s nutrients and converts the source’s permit limitations for nutrients into a “nutrient equivalent” discharge limitation for bubbling purposes. In addition, the bubbling condition applies the source’s previously established location ratio (See Location Ratio Toolbox Element) to the nutrient equivalent and determines the source’s “nutrient equivalent impact” at the end of the riverine section of the river. The nutrient equivalent impacts for all participating permit holders are then combined. The sum of these combined equivalent impacts establishes the “bubble” or “bubble limitation”.

Compliance with the bubbling condition is demonstrated in the same manner except that the actual discharge levels for each source for the compliance period are used for determining if the bubble limitation has been exceeded. If the bubble limitation is exceeded for the compliance period, then only individual permit holders that exceeded their permit specific nutrient equivalent limitation are in non-compliance.

The following tables provide an example determination for establishing a bubble limitation and a corresponding compliance demonstration.

Permitted Impact Establishment Example					
		Permit Limit	Equivalency Factor	Location Ratio	Downstream Equivalents
	Parameter	(lbs/day)			(lbs/day)
Location A					
	Total Phosphorous	1.23	1.00	0.7	0.86
	Ammonia	24.29	0.10	0.7	1.70
	Carbonaceous BOD	1,283	0.05	0.7	44.91
	Total Equivalents				47.47
Location B					
	Total Phosphorous	3.21	1.00	0.65	2.09
	Ammonia	8.99	0.10	0.65	0.58
	Carbonaceous BOD	964	0.05	0.65	31.33
	Total Downstream Equivalents				34.00
Total					81.47

Compliance Demonstration Example					
		Actual	Equivalency Factor	Location Ratio	Downstream Equivalents
	Parameter	(lbs/day)			(lbs/day)
Location A					
	Total Phosphorous	1.20	1.00	0.7	0.84
	Ammonia	26.25	0.10	0.7	1.84
	Carbonaceous BOD	1,150	0.05	0.7	40.25
	Total Equivalents				42.39
Location B					
	Total Phosphorous	3.50	1.00	0.65	2.28
	Ammonia	7.25	0.10	0.65	0.47
	Carbonaceous BOD	990	0.05	0.65	32.18
	Total Downstream Equivalents				34.93
Total					77.32

In the example above, the total equivalents allowed are 81.47 lbs/day and the actual discharge for the period was 77.32 lbs/day. Thus for this example, compliance was demonstrated.

3. Data Collection, Sampling, and Research Needed

For the demonstrations that will be required to develop bubbling conditions, the determination of source pollutant equivalency and location ratios for the participating point sources is required via the CE QUAL W2 Model. No additional data collection, sampling efforts, or research are needed.

4. CE QUAL W2 Modeling Requirements for DO TMDL Equivalency (developed as part of step 2)

5. Permit Provisions (developed as part of step 3)