Memo to File

From: Jenny Wu, U.S. EPA Region 10, Office of Water and Watersheds
Re: Ammonia toxicity evaluations of revised, Pre-Public Draft Klamath TMDL allocations
Date: October 31, 2017

On December 21, 2010, Oregon DEQ finalized the Upper Klamath and Lost River Subbasins TMDL ("Klamath TMDL") for dissolved oxygen (DO), pH, ammonia toxicity, and algae, and submitted it to the EPA for approval. EPA approved these TMDLs on May 30, 2012. Oregon DEQ shared a pre-public draft, revised Klamath TMDL with EPA in December 2016. In the process of reviewing this draft, the EPA realized that new water quality standards for ammonia had been approved on August 4, 2015. The EPA must consider all applicable water quality standards when acting on revised TMDLs with significant changes. Therefore, it was necessary to assess whether the allocations in the pre-public draft, revised TMDL would meet the new ammonia water quality standards.

In January 2017, the EPA completed its assessment and found that the ammonia allocations in the pre-draft, revised TMDL would satisfy the new ammonia water quality standards criteria. To evaluate whether the allocations in the revised TMDL would meet the new criteria, the EPA obtained the nutrient allocations in the 2010 TMDL to the new acute and chronic criteria for ammonia. The nutrient allocations in both the 2010 and revised TMDL are the same and were both based on meeting pH at the most sensitive location at the South Suburban WWTP Outfall. This was because in both TMDLs, ammonia concentrations to meet pH standards were more stringent than ammonia concentrations needed to meet ammonia toxicity requirements. That is, the pH standard, not the ammonia toxicity standard, was the driver for lower ammonia allocations in the TMDL. The nutrient allocations are a sum of allocations of ammonia and phosphorus. Therefore, if the nutrient allocations meet the new ammonia criteria, the ammonia allocations, which are a subset of the total nutrient allocations, would also meet the new ammonia criteria. Therefore, though the ammonia toxicity standard changed between the 2010 TMDL and revised TMDL, the nutrient allocations were the same.

The EPA obtained files from Dan Sobota at Oregon DEQ on January 12, 2017 on the TMDL WLAs for NH3-N as nitrogen, pH values, and temperature in the 2010 TMDL. The EPA then calculated the new acute criteria at OAR 340-041-0033, Table 30(a) for salmonid species present, and the new chronic criteria at Table 30(c).

$$Acute\ Criterion = MIN\left(\left(\frac{0.275}{1+10^{7.204-pH}}+\frac{39.0}{1+10^{pH-7.204}}\right),\left(0.7249\times\left(\frac{0.0114}{1+10^{7.204-pH}}+\frac{1.6181}{1+10^{pH-7.204}}\right)\times\left(23.12\times 10^{0.036\times(20-T)}\right)\right)\right)$$

$$Chronic\ Criterion = 0.8876\times\left(\frac{0.0278}{1+10^{7.688-pH}}+\frac{1.1994}{1+10^{pH-7.688}}\right)\times\left(2.126\times 10^{0.028\times(20-MAX(T,7))}\right)$$

Figure 1. Acute and Chronic Criterion Equations for Ammonia Toxicity, OAR 340-041-0033, Tables 30(a), 30(c)

The ammonia toxicity criteria that the 2010 TMDL used was dependent on temperature and pH, so Oregon DEQ measured or calculated temperature and pH, which was paired with the

allocations. The EPA used the same paired temperature and pH data to calculate new ammonia criteria. The EPA selected Table 30(a) where salmonid species were present for a more stringent criteria compared to Table 30(b) where salmonid species were not present as a conservative assumption.

The EPA's calculations are in Tab "2015 NH3 Tox South Suburban" in the XL Spreadsheet, "Klamath ammonia toxicity eval 1.12.16 v2." Column I contains the TMDL allocations. Column J is the calculated acute ammonia criteria using the equation from Table 30(a) and measured or calculated temperature and pH values from Columns B and D. Column K is the calculated acute ammonia criteria using the equation from Table 30(c) and measured or calculated temperature and pH values from Columns B and D. Column L assesses whether the TMDL allocation is lower than the calculated acute chronic ammonia toxicity criteria. Column M assesses whether the TMDL allocation is lower than the calculated acute chronic ammonia toxicity criteria.

The EPA found that nutrient allocations in the pre-public draft, revised TMDL were well under the 2015 chronic and acute ammonia criteria and would therefore meet ammonia toxicity standards. A second assessment should be completed to make sure that the allocations submitted in the final draft are the same as those evaluated in the pre-public draft.