

AMMONIA REMOVAL ALTERNATIVE NO. 1

**SACRAMENTO COUNTY SANITATION DISTRICT
SACRAMENTO REGIONAL WASTEWATER TREATMENT PLANT
SACRAMENTO COUNTY**

**Proposed Waste Discharge Requirements Renewal and Time Schedule Order
(NPDES No. CA0077682)**

Regional Water Quality Control Board, Central Valley Region

Board Meeting – 9 December 2010

ITEM # 6

The proposed NPDES permit establishes the effluent limits for ammonia without the allowance of dilution. (See Section IV.C.3 of the Fact Sheet). As discussed in detail in Attachment J of the proposed NPDES permit, end-of-pipe effluent limits are proposed due to concerns with ammonia levels in the Delta that may be adversely affecting aquatic life beneficial uses and based on best practicable treatment or control of the discharge. The Central Valley Water Board staff recommendation would require construction of new nitrification facilities and ongoing increased use of chemicals and/or power to provide ammonia removal. The SRCSD estimated the cost for this alternative is \$800 million.

AMMONIA REMOVAL ALTERNATIVE NO. 1

AMMONIA LIMITATIONS BASED ON CHRONIC DILUTION CREDITS

For this alternative the water quality-based effluent limits for ammonia have been calculated considering a chronic dilution credit, which increases the proposed effluent limitations for ammonia (as N) to an average monthly effluent limitation (AMEL) and maximum daily effluent limitation (MDEL) of 11 mg/L and 13 mg/L, respectively. The Board may choose to exercise its discretion and grant chronic dilution credits for ammonia provided findings regarding the impacts of ammonia on the Sacramento-San Joaquin Delta are changed to find and support that a chronic mixing zone for ammonia complies with the state mixing zone Policy.

This alternative **MUST** be combined with Dilution alternatives that allow a chronic mixing zone.

This permit alternative results in the following changes to the NPDES Permit:

- NPDES Permit. Modify the final effluent limits for Ammonia in Table 6 of the Limitations and Discharge Specifications, as shown in underline/strikeout format below:***

Table 6. Effluent Limitations

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
<i>Conventional Pollutants</i>						
Ammonia Nitrogen, Total (as N)	mg/L	4.8 <u>11</u>	--	2.2 <u>13</u>	--	--
	lbs/day	2720 <u>16605</u>		3320 <u>19624</u>		

2. NPDES Permit. Add Ammonia and Nitrogen study to Section VI.C.3 of the Limitations and Discharge Specifications, as shown below:

c. Ammonia and Nitrogen Study. The Discharger shall submit a workplan and time schedule for Executive Officer approval for conducting studies of existing and threatened impacts of ammonia and nitrogen on aquatic ecosystems in the Sacramento River, Delta, Suisun Bay and other potentially impacted water bodies within 90 days from adoption of this Order. Studies should be conducted in coordination and conjunction with similar studies that may be required of other NPDES dischargers of ammonia containing ammonia and/or nitrogen into the waterways of concern. Proposed studies shall build upon existing research and be directed at clarifying and quantifying aquatic ecology impact issues as directed by the Executive Officer. The workplan shall be implemented upon approval by the Executive Officer.

<u>Task</u>	<u>Compliance Date</u>
i. Submit Workplan and Time Schedule	90 days from adoption of Permit
ii. Begin Study	To be determined in Task i.
iii. Complete Study	To be determined in Task i.
iv. Submit Study Report	To be determined in Task i.

3. NPDES Permit. Modify section IV.C.2.d.iii.(1) of the Fact Sheet (Attachment F) as shown in underline/strikeout format below:

(1) Shall not compromise the integrity of the entire waterbody - The TSD states that, "If the total area affected by elevated concentrations within all mixing zones combined is small compared to the total area of a waterbody (such as a river segment), then mixing zones are likely to have little effect on the integrity of the waterbody as a whole, provided that the mixing zone does not impinge on unique or critical habitats."¹ The Sacramento River is approximately 600 feet wide at the surface. The acute mixing zone is approximately 60 ft x 350 ft. The Sacramento River is a very large waterbody. ~~Except as noted for ammonia in subsection vi., below,~~ The acute mixing zone would not compromise the integrity of the entire waterbody.

4. NPDES Permit. Modify section IV.C.2.d.iii.(4) of the Fact Sheet (Attachment F) as shown in underline/strikeout format below:

(4) Shall not adversely impact biologically sensitive or critical habitats, including, but not limited to, habitat of species listed under federal or State endangered species laws – The acute mixing zone will not cause acutely toxic conditions, allows adequate zones of passage, and, ~~except as noted for ammonia in subsection vi., below,~~ is sized

¹ TSD, pg. 33

appropriately to ensure that there will be no adverse impacts to biologically sensitive or critical habitats.

5. NPDES Permit. Modify section IV.C.2.d.iii.(5) of the Fact Sheet (Attachment F) as shown in underline/strikeout format below:

(5) Shall not produce undesirable or nuisance aquatic life; result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; cause nuisance – The current discharge has not been shown to produce undesirable or nuisance aquatic life, result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; or cause nuisance. This Order requires the discharge meets Title 22 (or equivalent) tertiary filtration and a reduction in ammonia, which will ensure continued compliance with these mixing zone requirements. ~~There is concern that the high ammonia concentrations in the discharge create undesirable or nuisance aquatic life (see subsection vi. for ammonia, below), therefore, an acute mixing zone for ammonia is not allowed.~~ With these requirements the acute mixing zone will not produce undesirable or nuisance aquatic life, result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; or cause nuisance.

6. NPDES Permit. Modify the first paragraph of section IV.C.2.d.iv. of the Fact Sheet (Attachment F) as shown in underline/strikeout format below:

iv. Evaluation of Available Dilution for Chronic Aquatic Life Criteria. The chronic aquatic life mixing zone is sized to protect the water body as a whole and is generally larger than the acute mixing zone. A mixing zone for chronic aquatic life criteria has been allowed in this Order for development of the WQBELs for ammonia and cyanide.

7. NPDES Permit. Modify section IV.C.2.d.iv.(1) of the Fact Sheet (Attachment F) as shown in underline/strikeout format below:

(1) Shall not compromise the integrity of the entire waterbody - The TSD states that, “*If the total area affected by elevated concentrations within all mixing zones combined is small compared to the total area of a waterbody (such as a river segment), then mixing zones are likely to have little effect on the integrity of the waterbody as a whole, provided that the mixing zone does not impinge on unique or critical habitats.*” The Sacramento River is approximately 600 feet wide at the surface. The chronic mixing zone is approximately 400 ft x 350 ft. The Sacramento River is a very large waterbody. ~~Except as noted for ammonia in subsection vi., below, t~~The chronic mixing zone would not compromise the integrity of the entire waterbody.

8. NPDES Permit. Modify section IV.C.2.d.iv.(4) of the Fact Sheet (Attachment F) as shown in underline/strikeout format below:

(4) Shall not adversely impact biologically sensitive or critical habitats, including, but not limited to, habitat of species listed under federal or State endangered species laws – The chronic mixing zone will not cause acutely toxic conditions, allows adequate zones of passage, and, ~~except as noted for ammonia in subsection vi., below,~~ is sized

appropriately to ensure that there will be no adverse impacts to biologically sensitive or critical habitats.

9. NPDES Permit. Modify section IV.C.2.d.iv.(5) of the Fact Sheet (Attachment F) as shown in underline/strikeout format below:

(5) Shall not produce undesirable or nuisance aquatic life; result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; cause nuisance – The current discharge has not been shown to produce undesirable or nuisance aquatic life, result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; or cause nuisance. This Order requires the discharge meets Title 22 (or equivalent) tertiary filtration and a reduction in ammonia, which will ensure continued compliance with these mixing zone requirements. ~~There is concern that the high ammonia concentrations in the discharge create undesirable or nuisance aquatic life (see subsection vi. for ammonia, below), therefore, a chronic mixing zone for ammonia is not allowed.~~ With these requirements the chronic mixing zone will not produce undesirable or nuisance aquatic life, result in floating debris, oil, or scum; produce objectionable color, odor, taste, or turbidity; cause objectionable bottom deposits; or cause nuisance.

10. NPDES Permit. Modify section IV.C.2.d.vi. of the Fact Sheet (Attachment F) as shown in underline/strikeout format below for ammonia:

Ammonia – ~~An acute or chronic mixing zone for ammonia does not meet the requirements of the SIP for the allowance of mixing zones. The SIP requires, in part, that mixing zones do not;~~

- ~~(1) compromise the integrity of the entire water body;~~
- ~~(2) adversely impact biologically sensitive or critical habitats, including, but not limited to, habitat of species listed under federal or State endangered species laws; and~~
- ~~(3) produce undesirable or nuisance aquatic life;~~

~~The allowance of acute or chronic mixing zones for ammonia do not meet these requirements, because ammonia discharges from the Facility have been shown to be negatively affecting the receiving water far downstream of the discharge within the Delta, not just the areas defined by the requested mixing zones. The allowance of the requested mixing zones for ammonia would compromise the integrity of the entire water body, adversely impact biologically sensitive or critical habitats, and produce undesirable or nuisance aquatic life.~~

~~Acute and chronic aquatic life dilution credits for ammonia have not been granted. This Order requires full nitrification for removal of ammonia. See Section IV.C.3 of the Fact Sheet for a detailed discussion. Table F-12, below, shows the WQBELs for ammonia calculated using SRCSD's dynamic model with the allowance of acute and chronic~~

aquatic life dilution, WQBELs calculated using SRCSD's dynamic model with the allowance of only chronic aquatic life dilution, end-of-pipe effluent limitations using a reasonable worst-case steady-state approach, and the Facility's performance. This information demonstrates the Facility cannot meet end-of-pipe effluent limits or limits with only chronic dilution allowed. Assimilative capacity is available for ammonia in the receiving water, and, as discussed above, the chronic aquatic life mixing zone meets the requirements of the SIP and Basin Plan and an acute aquatic life mixing zone has not been allowed in this Order. Therefore, the WQBELs for ammonia have been developed considering the allowance of chronic aquatic life dilution.

11. NPDES Permit. Add new Table F-12 in the Fact Sheet (Attachment F) as shown below and renumber remaining tables in the Fact Sheet and correct all references to Tables:

Table F-12. WQBELs for Ammonia

	Average Monthly Effluent Limitation	Maximum Daily Effluent Limitation
Dynamic Modeling (acute and chronic dilution)	41 mg/L	51 mg/L
Dynamic Modeling (chronic dilution only)	11 mg/L	13 mg/L
Steady-State Approach	1.8 mg/L	2.2 mg/L
Facility Performance ¹	45 mg/L	

12. NPDES Permit. Modify sections IV.C.3.d.ii.(c) and (d) of the Fact Sheet as shown in underline/strikeout format below:

~~(c) Dilution Considerations. As discussed in Section IV.C.2.d of the Fact Sheet, an allowance for chronic aquatic life dilution may be granted. However, based on the considerations below and discussed in more detail in Attachment K, no dilution has been allowed for ammonia. The Central Valley Water Board determines that the Discharger must fully nitrify and denitrify its wastewater to reduce ammonia and nitrogen for the following reasons:~~

~~(1) Recent studies suggest that ammonia at ambient concentrations in the Sacramento River, Delta and Suisun Bay may be acutely toxic to native *Pseudodiaptomus forbesi* (copepod).~~

~~(2) A consensus of scientific experts concluded the SRWTP is a major source of ammonia to the Delta².~~

² Sommer, T., CI Armor, R. Baxter, L. Brown, M. Chotkowski, S. Culberson, F. Feyrer, M. Gingras, B. Herbold, W. Kimmerer, A. Mueller-Solger, M. Nobriga, and K Souza. 2007. The Collapse of Pelagic Fishes in the Upper San Francisco Estuary. Fisheries 32(6):270-277.

- ~~(3) Recent studies provide evidence that ammonia from the SRWTP discharge is contributing to the inhibition nitrogen uptake by diatoms in Suisun Bay.~~
 - ~~(4) Ammonia along with the clam, *Corbula* and high turbidity are attributed to reducing diatom production and standing biomass in the Suisun Bay.~~
 - ~~(5) Downstream of the discharge point, ammonia may be a cause in the shift of the aquatic community from diatoms to smaller phytoplankton species that are less desirable as food species.~~
 - ~~(6) Regardless of whether ammonia is directly or indirectly contributing to the POD, ammonia is shown to affect adult *Pseudodiaptomus forbesi* reproduction at concentrations greater than or equal to 0.79 mg/L. And nauplii and juvenile *Pseudodiaptomus forbesi* are affected at ammonia concentrations greater to or equal 0.36 mg/L. These ammonia concentrations can be found downstream of the discharge. The beneficial use protection extends to all aquatic life and not limited to pelagic organisms.~~
 - ~~(7) USEPA expects to publish the 2009 Ammonia Criteria Update which includes more stringent ammonia criteria for freshwater mussels compared with criteria for salmonids in early 2011³. Freshwater mussels reside in the Upper Sacramento River above and likely below the SRWTP discharge.~~
 - ~~(8) The Discharger's effluent contains ammonia and BOD at levels that use all the assimilative capacity for oxygen demanding substances in the Sacramento-San Joaquin Delta. This results in no assimilative capacity for other cities and communities to discharge oxygen demanding constituents, which is needed for them to grow despite the fact that most of these cities and communities are already implementing Best Practical Treatment and Control (BPTC) at their own facilities and SRWTP is not.~~
 - ~~(9) The Discharger's effluent contains nitrosoamines at levels that are greater than 100 times the primary MCL. Nitrosamines are disinfection byproducts that are created when wastewater effluent contains ammonia and is then disinfected with chlorine, which is the case at the SRWTP.~~
 - ~~(10) The Discharger must fully comply with Resolution No. 68-16 that requires Best Practical Treatment and Control, which for this discharge includes nitrification and denitrification of their wastewater.~~
- (dc) WQBELs.** ~~The Central Valley Water Board calculates WQBELs in accordance with SIP procedures for non-CTR constituents, and ammonia is a non-CTR constituent. The SIP procedure assumes a 4-day averaging period for calculating the long-term average discharge condition (LTA). However, USEPA recommends modifying the procedure for calculating permit limits for ammonia using a 30-day averaging period for the calculation of the LTA corresponding to the 30-day CGC.~~

³ Personal Communication with Lisa Huff USEPA with Kathy Harder, August 2010.

~~Therefore, while the LTAs corresponding to the acute and 4-day chronic criteria were calculated according to SIP procedures, the LTA corresponding to the 30-day CCC was calculated assuming a 30-day averaging period. The lowest LTA representing the acute, 4-day CCC, and 30-day CCC is then selected for deriving the average monthly effluent limitation (AMEL) and the maximum daily effluent limitation (MDEL). The remainder of the WQBEL calculation for ammonia was performed according to the SIP procedures. As discussed in Section IV.C.3.d.vi of the Fact Sheet, chronic aquatic life dilution may be allowed for ammonia. Based on results of the Discharger's dynamic model for compliance with the NAWQC for ammonia at the edge of the chronic aquatic life mixing zone, a MDEL of 13 mg/L (as N), and an AMEL of 11 mg/L (as N) is calculated. This Order contains a final average monthly effluent limitation (AMEL) and maximum daily effluent limitation (MDEL) for ammonia of 4.8 11 mg/L and 2.2 13 mg/L, respectively, based on the NAWQC ammonia criteria for aquatic toxicity ~~with no dilution~~ considering a chronic aquatic life dilution credit.~~

13. NPDES Permit. Modify section IV.C.3.d.xx.(a) of the Fact Sheet as shown in underline/strikeout format below:

(b) RPA Results. Untreated domestic wastewater contains ammonia. Nitrification is a biological process that converts ammonia to nitrite and nitrite to nitrate. Denitrification is a process that converts nitrate to nitrite or nitric oxide and then to nitrous oxide or nitrogen gas, which is then released to the atmosphere. Nitrate and nitrite are known to cause adverse health effects in humans. Inadequate or incomplete denitrification may result in the discharge of nitrate and/or nitrite to the receiving stream. The conversion of ammonia to nitrites and the conversion of nitrites to nitrates present a reasonable potential for the discharge to cause or contribute to an in-stream excursion above the Primary MCLs for nitrite and nitrate.

Currently, the Discharger's effluent contains very low concentrations of nitrate, ranging from 0.016 to 1.4 mg/L with an average of 0.13 mg/L. However, this Order requires the Discharger ~~fully~~ nitrify its effluent to meet new ammonia effluent limitations, therefore, the ammonia will convert to nitrate and the nitrate concentrations will increase. Therefore, the discharge has reasonable potential to cause or contribute to an exceedance of the water quality objectives for nitrite and nitrate in the receiving water.

14. NPDES Permit. Modify section IV.C.4.a. of the Fact Sheet as shown in underline/strikeout format below:

(a) This Order includes WQBELs for copper, ammonia, cyanide, carbon tetrachloride, chlorodibromomethane, dichlorobromomethane, methylene chloride, tetrachloroethylene, pentachlorophenol, bis(2-ethylhexyl) phthalate, dibenzon(ah)anthracene, 1,2-diphenyl-hydrazine, N-nitrosodimethylamine, aluminum, nitrate, nitrite, manganese, MTBE,

mercury, temperature, settleable solids and chlorpyrifos. As discussed above in Section IV.C.2.d, the Discharger developed a dynamic mathematical model to evaluate near-field dilution and a mixing zone for compliance with chronic aquatic life criteria has been granted. The Discharger's dynamic model has been used to calculate the WQBELs for ammonia and cyanide. For the remaining constituents a steady-state approach has been used to calculate the WQBELs. The general steady-state methodology for calculating WQBELs based on the different criteria/objectives is described in subsections IV.C.4.b through e, below. See Attachment H for the WQBEL calculations. The methodology for calculating WQBELs using the dynamic model is discussed in subsection IV.C.4.f, below.

15. NPDES Permit. Modify the effluent limits for Nitrate in Table F-16 (Summary of Final Effluent Limitations) of the Fact Sheet as shown in underline/strikeout format below:

Parameter	Units	Effluent Limitations				
		Average Monthly	Average Weekly	Maximum Daily	Instantaneous Minimum	Instantaneous Maximum
Conventional Pollutants						
Ammonia Nitrogen, Total (as N)	mg/L	<u>4.8</u> 11	--	<u>2.2</u> 13	--	--
	lbs/day ¹	<u>2720</u> 16605		<u>3320</u> 19624		

16. NPDES Permit. Modify section IV.D.4 (8th paragraph) of the Fact Sheet, as shown in underline/strikeout format below:

As shown in Table F-18, the existing permitted discharge is degrading the receiving water. Therefore, the Discharger must use best practicable treatment or control (BPTC) of the discharge in accordance with State Water Board Resolution 68-16. The Sacramento River and Sacramento-San Joaquin Delta are high quality waters of exceptional recreation, economical, and ecological significance to the people of the State of California. As discussed below, the Central Valley Water Board finds that in order to maintain and enhance the water quality of the Sacramento River and Sacramento-San Joaquin Delta, the Discharger must implement BPTC. For the following reasons, BPTC for this facility includes implementation of nitrification nitrogen removal (ammonia and nitrate), ~~denitrification~~, and the equivalent of Title 22 filtration with ultraviolet light or chlorine disinfection treatment.