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Updated Ammonia Criteria and the Impact on Refinery Wastewaters

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Title: Revised USEPA Freshwater Ammonia Criteria – What’s the Scoop?
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USEPA Ammonia Criteria were first published in 1976; updated in 1985 and 1999; and then revised in 2013. The new criteria takes into account the latest scientific data related to ammonia toxicity to sensitive organisms such as mussels and snails. It addresses the potential for toxicity based on the presence or absence of the most sensitive species. Based on the interpretation and implementation of the revised criteria by states, adopted criteria can have a potential impact on industrial dischargers resulting in more stringent permit limits.

The newly adopted criteria will decrease the acute and chronic criteria from 24 and 4.5 mg/L to 17 and 1.9 mg/L, respectively assuming a pH 7 and at 20 °C. Comparisons of the previous (1999) and revised ammonia criteria (2013), and possible issues with implementation and impacts to industrial dischargers are discussed herein. Other considerations include wastewater treatment options to comply with lower permit limits.

EPA National Recommended Ambient Water Quality Criteria for Protection of Aquatic Life are used by States, Territories, and authorized Tribes, to update their water quality standards. The revised criteria remain pH and temperature dependent. Criteria were revised when toxicity data became available indicating aquatic species not originally considered may be more sensitive (i.e., unionid mussels, gill-breathing snail). The 1999 ammonia criteria were potentially no longer protective of 95% of aquatic species; therefore, USEPA issued Draft revised ammonia criteria in 2009; however, additional studies were needed.

How will the revised criteria affect my facility?

Facilities with Industrial/Municipal Discharge may see changes to their NPDES permit, such as lower effluent limit and increased monitoring requirements. Industrial discharges to a Publicly Owned Treatment Works (POTW) may have local limits applied (if not already) or reduced to accommodate new NPDES requirements for POTW.

New ammonia limits were issued by USEPA on August 22, 2013 (Table 1) States are required to review the water quality standards every three years. During the triennial review, States may choose to adopt the revised ammonia criteria or develop more stringent state-specific criteria. Once State criteria are adopted and effective, new criteria will be incorporated in to new/renewed NPDES Permits. Most NPDES Permit holders will likely see changes within next 1-2 Permit cycles.

Table 1
Ammonia Limits Issued by USEPA

Criterion^a	1999^b	2009 Draft^c	2013^{b,c}
Acute	24	19	17
Chronic	4.5	0.91	1.9

Notes:

- a. Criteria are as mg/L Total Ammonia-Nitrogen/L and assume pH 7.0, T 20°C
- b. Criteria based on Salmonids present
- c. Criteria based on mussels present

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States have flexibility in implementation of the revised criteria. Each state can determine whether they will allow for Site-Specific Criteria Implementation (i.e., demonstration that mussels are not present “at the site”, or Re-calculate the criteria accounting for species that are present likely resulting in higher criteria). Other compliance options include dilution allowances (i.e., mixing zones), variances, and compliance schedules.

What if I can’t meet the new permit limits?

There are some wastewater treatment options for reducing ammonia in effluent. Some of these options are:

- **Biological Nitrification:** In biological nitrification and denitrification process, ammonia is first aerobically converted to nitrite and then nitrate (nitrification) by bacteria. Then, nitrates are converted to nitrogen gas, which escapes (denitrification). Various biological process can be used to remove ammonia to include:
 - i. Conventional Activated Sludge (CAS)
 - ii. Extended Aeration
 - iii. Sequencing Membrane Reactors (SBRs)
 - iv. Membrane Bioreactors (MBR)
- **Breakpoint Chlorination:** Increasing in the mole ratio of chlorine to ammonia results in formation of some trichloramine and oxidation of part of the ammonia to NO₂ or NO₃. Further additions of chlorine produce free chlorine residuals. Chlorination of water to the extent that all the ammonia is converted to NO₂ or a higher oxidation state is referred to as breakpoint chlorination.
- **Air Stripping:** In the air-stripping (ammonia stripping) method, lime is added to water to increase its pH to about 10. This causes the ammonium ions, NH₄⁺, to change to dissolved ammonia gas, NH₃. The water is passed through a packed tower into which air is blown at high rates. The air strips the ammonia gas out of the water. Re-carbonation follows to remove the excess lime.

More to Think About

NPDES Permit holders should stay informed on your State’s triennial review process, the State’s priorities for revised water quality criteria, and their process for criteria adoption and implementation. Industrial Users should track POTW NPDES Permit cycle, and engage POTW to determine if change in local limits would be anticipated if new ammonia criteria are implemented.

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See below for examples of estimates timeframe of triennial review for select states. Consult with your state agency to confirm schedule.

State	Schedule
Oklahoma	In progress
California	In progress
Florida	In progress
Indiana	2016
Texas	2016
Indiana	2016
Arkansas	2016
Georgia	2016
West Virginia	2017
North Carolina	2017
Idaho	2017

Conclusion

USEPA has issued the revised freshwater ammonia water quality criteria in 2013. States will be adopting/revising state water quality criteria during triennial review process. NPDES Permit holders and industrial users may be affected as ammonia Permit limits may be lowered. However, if compliance with new ammonia limits is problematic, options are available.

References

- (1) USEPA, *Final Aquatic Life Ambient Water Quality Criteria For Ammonia—Freshwater 2013* (EPA 822-R-13-001)
- (2) USEPA, *Flexibilities for States Applying EPA’s Ammonia Criteria Recommendations* (EPA 800-F-13-001)