

## Identifying research gaps and tools for cost-effective implementation of the revised ammonia ambient water quality criteria

### Ammonia Criteria Implementation Stakeholders Meeting (WERF3C14)

#### The Central Issue

Freshwater mussels (Family: Unionidae) represent a widespread and threatened taxon in the United States. Toxicity due to chronic exposure to low levels of ammonia is one of the many factors leading to the inability of existing mussel beds to reproduce and to establish new beds. Recently, the U.S. Environmental Protection Agency (EPA) has used new chronic toxicity data for mussels to revise the ammonia ambient water quality criteria.

Implementation of the revised ammonia criteria is expected to be costly for many municipal (and likely for some industrial) wastewater dischargers. Because of this, EPA has developed tools to help the regulated and regulatory community understand flexibilities when implementing the new criteria; however, questions still remain that need to be addressed to assure appropriate implementation. Examples of these issues include: confirmation that some natural conditions preclude the presence of freshwater mussels; the applicability of multi-discharger variances; more appropriate water quality modeling with respect to temperature and pH conditions; and clarification on the use of mixing zones. Timely research can help fill these data and information gaps and is recommended to achieve desired ecological goals.



This *Lampsilis higginsii* (a federally endangered species) was collected in the Iowa River near Coralville, Iowa in 2013. This species was extirpated from the Iowa River until its host fish, walleye, infected with larval *L. higginsii* were released between 2001-2010. The reintroduction was successful, as several adult *L. higginsii* have been collected near Coralville in the past few years. Photo courtesy of Heidi Dunn.

#### Context and Background

In August 2013, EPA published ambient water quality criteria for ammonia reflecting the latest scientific knowledge on the levels of ammonia that cannot be exceeded in order to protect sensitive freshwater aquatic species. The new criteria are numerically lower (more stringent) than previous criteria (see chart below). The criteria levels are based largely on protection of unionid mussels, which are native to most freshwaters throughout the United States, and are considered an important taxonomic group in healthy aquatic communities.

A number of methods are authorized under the Clean Water Act for implementation of water quality standards, but some of these are not widely understood and may be under-utilized. With the publication of a *Mussel Survey Technical Support Document*, an *Implementation Flexibilities* document, and a *Revised Deletion Process*, EPA provided additional guidance with respect to flexibility in alternatives to comply with the new ammonia criteria. Both the regulators and the regulated community need to understand the new criteria, associated ramifications, and all options available to comply with the criteria before adoption in state water quality standards.

Comparison of Previous and Current Ammonia Criteria (at pH 7 and 20°C).

Criterion Duration	1999 Criteria	2013 Criteria
Acute (1-hr average)	24	17
Chronic (30-d rolling average)	4.5*	1.9*

\*Not to exceed 2.5 times CCC as a four-day average within the 30 days, more than once in three days on average.

Criteria frequency: Not to be exceeded more than once in three years on average.

In October 2014, the Water Environment Research Foundation (WERF) collaborated with the National Association of Clean Water Agencies (NACWA), the Association of Clean Water Administrators (ACWA), and the Water Environment Federation (WEF) to convene a meeting of selected stakeholders. This group of 32 experts represented municipal wastewater agencies, state agencies, federal agencies (EPA and United States Geological Survey), the scientific and academic communities, and consultants.

The objectives of the meeting were to:

- Identify data and information gaps regarding implementation of the revised criteria – what details pertaining to implementation flexibility are known and what needs more clarification.
- Identify what tools/projects are needed to provide information that will fill these gaps and clarify options in EPA's flexibility guidance. Based on a common set of principles, propose a framework for how to implement the criteria and provide clear guidance on a way to move forward on implementation of the criteria.

## Findings and Conclusions

A facilitated discussion identified issues and data gaps regarding implementation of the ammonia criteria. Key topics of discussion included interpretation of EPA regulations and guidance, factors affecting mussel presence and absence at discharge sites, state implementation of the criteria, and anticipated impacts on states and local communities.

The stakeholders identified the following as data gaps for further investigation:

- Decision trees for mussels present/absent determinations and related permitting decisions.
- The role of use attainability analysis and use of sub-categorization/tiered aquatic life uses.
- Use of water-effect ratios for applying the ammonia criteria.
- Better definition of mixing zone policies applicable to ammonia.
- Additional studies on the fate of ammonia in receiving waters.
- Potential use of in-stream studies to evaluate discharger impacts on viable mussel habitat.
- Better understanding of the consequences of pH, temperature, and upstream background concentration and parameter definitions/specifications.
- Better understanding of the scope of the problem: How many site-specific criteria are needed? Is it principally a small plant discharging to small stream and/or arid west problem?
- Assessment of water quality standards attainment options: adaptive/flexible implementation to make significant, step-wise improvements that may fall short of full attainment.



**These juvenile mussels were collected in a mussel survey in the Mississippi River. The presence of juveniles is indicative of a healthy reproducing mussel community. Photo courtesy of Heidi Dunn.**

- Determination of effective implementation timeframe that accounts for complexity of issues, including relationship to triennial review process.
- Development of a model multi-discharger variance for lagoons and other types of systems (e.g., small package plants) that cannot feasibly meet the criteria.
- Assessment of the applicability of stochastic or probabilistic analysis to derive permit limits.
- Holistic approaches for facilities required to meet both ammonia and nutrient limits – compatibility of treatment options and sequencing of implementation to cost effectively achieve compliance.
- Methodology for assessing the benefits of achieving ammonia limits.
- Public education to promote understanding of the importance of maintaining mussel populations as means of gaining support for funding projects.

## Management and Policy Implications

There was general agreement that the criteria can have major impacts on small communities and may present complexities for larger systems that are in the process of upgrades to meet new requirements for nutrient control. However, it was also agreed that implementation of EPA's new ammonia criteria provides a unique opportunity to:

- Introduce new permitting concepts and options to allow for more flexibility in meeting water quality standards.
- Re-evaluate and prioritize ways to meet Clean Water Act goals in light of competing priorities.
- Discuss return on investment and affordability for smaller communities.

A proceedings document was prepared to provide a complete summary of the stakeholders meeting and is available from WERF.

## Ammonia Criteria Implementation Stakeholders Meeting

Related WERF Research	
Project Title	Research Focus
<b>A Peer Review of the City of Lincoln, Nebraska Salt Creek Site-Specific Ammonia Water Quality Criteria (98WSM2P)</b>	Provides a summary of a portion of a larger-scale project titled Salt Creek Water Quality Studies performed by the City of Lincoln, Nebraska, from 1994 through 2000, to address proposed ammonia effluent limits for the city's two wastewater treatment plants (WWTPs). The project characterized Salt Creek by quantifying the existing biological community, evaluating existing water quality, physical and hydrologic conditions, and evaluating the impact of ammonia discharges from the WWTPs to the biological community compared to other stressors. The part of the project that is the primary focus of this report is the in situ toxicity study performed in Salt Creek that modeled typical laboratory tests that introduced a species of fish to known levels of ammonia to determine a dose-response relationship. The in situ toxicity study results would be the basis for developing a site-specific chronic ammonia water quality criterion for Segment LP2-20000 of Salt Creek. WERF provided peer review for this project, which resulted in credible research results that were used to develop alternative ammonia discharge limits for the city's WWTPs. Support was also provided by the Nebraska Department of Environmental Quality and the Region VII Environmental Protection Agency.
<b>Silver Biotic Ligand Model (BLM): Refinement of an Acute BLM for Silver: Phase II (99ECO12T)</b>	The BLM framework considers how site-specific water quality characteristics – pH, alkalinity, hardness, chloride, and dissolved organic matter – affect Ag speciation and the resulting bioavailability and toxicity to aquatic life. This research adds to our understanding of the bioavailability and toxicity of Ag to aquatic organisms, both fish and invertebrates and provides a more user-friendly version of the BLM, with implementations currently available for Ag, Al, Cd, Cu, Ni, Pb, and Zn.
<b>Technical Approaches for Setting Site-Specific Nutrient Criteria (99WSM3)</b>	Provides an efficient and economical approach for achieving site-specific water quality objectives and offers analysis of the relation between nutrients and desired water quality conditions. The results allow for direct inputs to localized management and decision making.
<b>Global Lessons for Watershed Management in the United States (00WSM5)</b>	Identifies the most promising watershed planning and management approaches from around the world and evaluates how they operate, their benefits and limitations; and assesses the degree to which these approaches could be successfully adapted to the U.S. context. Drawing on this international experience, the report informs policymakers and practitioners and promotes the implementation of integrated watershed management approaches most likely to succeed.
<b>Bioassessment: A Tool for Managing Aquatic Life Uses for Urban Streams (01WSM3)</b>	This tool defines a nationally applicable measure of urbanization and a process for developing urban-specific biological indicators. It also establishes empirically defined and realistic aquatic life use benchmarks for urban areas, and provides dischargers with a tool to address the relative aquatic life use condition of receiving waters in urban areas.
<b>Factors for Success in Developing Use Attainability Analyses (04WEM1)</b>	Identifies highlights, and analyzes the major challenges faced in the UAA process and reports on the common lessons learned from how these challenges were addressed. The user's guide to UAAs informs stakeholders of critical factors in UAAs and related information needs. The findings and recommendations can help users make well-informed, well-supported, and well-documented decisions throughout the UAA process.
<b>Collaborative Water Quality Solutions: Exploring Use Attainability Analyses – WERF/NACWA cooperative effort (04WEM7)</b>	Explores collaborative water quality solutions and features a handbook intended to be a practical UAA roadmap for stakeholders trying to determine whether a UAA is the right tool. The roadmap is based on past experience and case studies. References additional technical guidance documents.

## Participating Organizations



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