BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO	)	**R 02-19**
AMMONIA NITROGEN STANDARDS	)	**(Rulemaking – Water)**
35 Ill. Adm. Code	)	

NOTICE OF FILING

TO: Illinois Environmental Protection Agency
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See Attached Service List

PLEASE TAKE NOTICE today that I have filed with the Clerk of the Illinois Pollution Control Board **Testimony of James L. Daugherty, Michael Callahan and Robert J. Sheehan** a copy of which is herewith served upon you.

Respectfully submitted,

One of Attorneys for Petitioner

Dated: March 4, 2002

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PROPOSED AMENDMENTS TO	)	R02-19
AMMONIA NITROGEN STANDARDS	)	(Rulemaking – Water)
35 ILL. ADM. CODE 302.212, 302.213,	)	
AND 304.122	)	

TESTIMONY OF JAMES L. DAUGHERTY

Background:

My name is James Daugherty. I am employed as District Manager by the Thorn Creek Basin Sanitary District. The District serves 100,000 people in six communities located in southern Cook and northeastern Will Counties, Illinois. The District's wastewater treatment facility provides tertiary treatment and discharges to Thorn Creek, a tributary of the Little Calumet River.

The Thorn Creek plant has been producing a nitrified effluent since May of 1977 when a plant addition went online. I have been the certified operator of the facility since November 1976, holding an Illinois Environmental Protection Agency (Agency) Class I Wastewater Treatment Plant Operators License.

I have been employed by the TCB Sanitary District since 1973. My educational background includes both a bachelor's and master's degree in environmental engineering from the University of Illinois. I have authored many technical papers and presentations. Two of the papers are especially relevant here. I presented a paper titled "Fundamentals of Nitrification in Activated Sludge" at the 1986 Conference of the Illinois Association of Water Pollution Control Operators. In 1987, I authored a paper for the Illinois Association of Sanitary Districts on

"Development of Effluent Ammonia Limits for Plants Discharging to Low Flow Streams". I am a member of and have held offices in many professional organizations.

My professional involvement with ammonia toxicity and ammonia water quality standards coincides with the State of Illinois' efforts to limit ammonia discharges. In 1972, I was studying under Dr. John Pfeffer at the University of Illinois, while he was actively involved with the state in the development of the first ammonia water quality standards. My research was directed by Dr. Pfeffer and involved evaluating the environmental impacts of a new de-icing compound that consisted primarily of organic nitrogen compounds. My research evaluated the toxicity of that de-icing compound to the aquatic environment. The results demonstrated that the primary toxic component was the ammonia nitrogen present in the de-icing compound, as well as that produced during decomposition of the organic nitrogen compounds. My research included review of the literature on ammonia toxicity, the same literature being used at that time by the state to propose the first ammonia toxicity standard. When I started with the Thorn Creek Basin Sanitary District in 1973, the District was conducting pilot studies of two processes for nitrification. I was involved in the review of that pilot work and the recommendation to install activated sludge for nitrification. That process was designed, constructed and went online in 1977.

In addition to my experience operating a nitrification system for 25 years, I also have been involved in regulatory proceedings before the Board concerning ammonia for many years. I testified on behalf of the Illinois Association of Sanitary Districts in the proceeding R88-22, (commonly known as the Winter Ammonia Effluent Exception). My testimony documented the limits of biological treatment systems to achieve ammonia removals. The data I presented

demonstrated that a minimum winter effluent of 4.0 mg/L was consistent with the performance of nitrification technology.

I was also active before the Board concerning ammonia effluent and water quality standards in the Matter of R94-1, which was the prior rulemaking before the Board for the ammonia water quality standard. Again, I presented testimony and comments on behalf of the Illinois Association of Wastewater Agencies. On six different occasions I presented either testimony or comments before the Board. Part of those comments included suggested amendments to the Agency's proposal, which were eventually accepted by the Agency and adopted by the Board.

I welcome this opportunity to again provide information to the Board as it deliberates ammonia water quality standards. I am here today on behalf of, not only my own District, but also to represent the Illinois Association of Wastewater Agencies.

Review Of Current Limits:

The Illinois Association of Wastewater Agencies (IAWA) supported the current ammonia nitrogen standards as they were being deliberated by the Board under R94-1. IAWA did support those standards as appropriate for adoption based on the fact that they represented the best peer reviewed understanding of ammonia toxicity available at the time and that the proposal contained floor effluent limits of 1.5 mg/L summer and 4.0 mg/L winter. R94-1 was supported even though the understanding of ammonia toxicity was incomplete. First, the proposed mechanism of ammonia toxicity did not fit all of the data. Secondly, the relative small amount of cold temperature chronic test data further limited the deviations of accurate limits. This position was stated repeatedly by IAWA before the Board. For example:

Daugherty, June 14, 1996, Page 4:

> The chronic toxicity database is seriously incomplete. The Agency was unable to find sufficient data to directly calculate a chronic standard for either the summer or winter period. Instead they were forced to use an acute/chronic ratio. The acute/chronic ratio was developed using data reflective of summer conditions; however, the ratio was also applied to the winter acute data to calculate the proposed winter chronic standard. The number one recommendation in IAWA's first comments and repeated in subsequent comments was that every effort should be made to produce additional chronic toxicity data so that more accurate chronic standards could be adopted in the future.

In spite of the data limitations, IAWA supported revision of the ammonia standards as presented in R94-1 as the previous standards were based on much older information.

IAWA no longer supports the current ammonia standards for two reasons: First, the regulations have not been implemented as expected when the proposal was presented to the Board. The effluent modified water (EMW) provision, the key to the effluent floor limits has not been implemented for reasons discussed below. Secondly, the "1999 Update of Ambient Water Quality Criteria for Ammonia" contains the most recent peer reviewed science and demonstrates that the assumed mechanism for ammonia toxicity in the current regulations is incorrect, as well as the limits themselves.

IAWA understands its key role before the Board in presenting information on treatment technology and current treatment practice. Our members are in a better position than anyone else to document treatment system performance and treatment system construction, operating and maintenance costs. We provided information on nitrification system performance to both the Agency and the Board in R94-1. Our information and the analysis of that information made it clear that compliance with the current ammonia water quality standards would produce effluent limits below the capabilities of best available treatment technology. Best available treatment technology for ammonia currently consists of biological nitrification. The Agency accepted our

analysis and agreed that reasonable treatability limits were 1.5 mg/L in the summer and 4.0 mg/L in the winter. Since compliance with the water quality standard contained in R94-1 would produce effluent limits below those values in low flow streams, the Agency developed the concept of effluent modified waters. The effluent modified water concept was based on the Agency's field experience, which showed repeatedly that there were no indications of ammonia toxicity in low flow streams downstream of facilities that were operating with permit limits of 1.5 mg/L in the summer and 4.0 mg/L in the winter. For example:

Testimony of Robert G. Mosher in R94-1, Page 17:

> "However, in its many years of conducting facility related stream surveys, the Agency is unaware of ammonia related toxicity problems causing a measurable impact in streams receiving effluents from nitrifying treatment plants meeting 1.5 and 4.0 limits."

IAWA understood the effluent modified water provision to be a widely available exception for stream segments below facilities that were discharging with permit limits of 1.5/4.0 mg/L. The Agency's testimony before the Board is consistent with that interpretation. IAWA repeatedly expressed that understanding in comments and testimony before the Board. Two examples are:

Daugherty, February 23, 1996, Page 2:

> In previous testimony, IAWA has raised a number of implementation issues, which will not be repeated here. The most important concept affirmed by the Agency's proposal, in IAWA's view, is the treatability level being defined at 1.5 mg/L ammonia nitrogen summer and 4.0 mg/L winter. The treatability levels are instituted in the Agency's proposal through an effluent modified waters designation (EMW).

Daugherty, June 14, 1996, Page 3:

> IAWA urges adoption of EMW as proposed by the Agency, amended by IAWA and approved by USEPA. IAWA has testified that EMW, as proposed and amended by IAWA, will result in technologically realistic limits for nitrifying facilities. The structure of EMW was worked out through repeated input from

IAWA, the Agency and USEPA. EMW has been designed to protect the aquatic environment, comply with the Clean Water Act and meet the needs of wastewater agencies.

Following the Board's adoption of R94-1 was the implementation of the EMW. The change of interpretation of EMW was forced on the Agency by USEPA after a threatened lawsuit if they approved the Board's standards. The implementation of the EMW provision was changed from a straightforward exception process to a process that now parallels what would be required to obtain an adjusted standard for a stream segment. The requirements for obtaining an effluent modified water determination are delineated in Section 355.301 of the Agency's implementation rule, which states as follows:

> The criteria for designation of an EMW include two specific provisions: the water body must have the potential to exceed the chronic standard due to a permitted discharge; and the elevated chronic ammonia nitrogen concentration will not adversely impact designated uses of the affected stretch of the water body. EMW status shall be designated in the receiving water body if:
>
> (a) aquatic life expected to exist in the receiving waters is known to be tolerant of the projected ammonia nitrogen concentrations resulting from the treatment plant effluent in conjunction with ambient conditions. Determination of the aquatic community expected to inhabit the receiving waters shall be consistent with stream morphology, particularly physical features and hydrologic regimes of the water body;
>
> (b) the receiving stream does not exceed the acute water quality standard of 35 Ill. Adm. Code 302.212(b); and
>
> (c) the discharger demonstrates a reasonable potential to exceed the chronic ammonia nitrogen standard pursuant to Subpart B of this Part.

Paragraph (a) of this provision is interpreted as requiring a very detailed analysis of the stream and its aquatic life. The discharger is expected to prove that the higher ammonia concentrations allowed by EMW status will not cause any impact on expected aquatic life. This analysis is basically the same as that used in establishing a water quality standard. Putting it another way, this language requires the discharger to prove that the existing water quality standard is incorrect.

This interpretation along with the 1999 USEPA ammonia guidance document, made it obvious to the wastewater community that it made more sense to revise the ammonia regulations statewide than to do it on a stream segment by stream segment basis using the EMW process. To my knowledge, no one has ever attempted to obtain an effluent modified water designation since the promulgation of Part 355 by the Agency.

Support For R02-19

During my many years of participation in the development of ammonia control regulations, I have always stated support for adoption of water quality standards. Ammonia is a known toxicant in the aquatic environment. I have also stressed the critical importance of using the best available science as the basis for standards. By best available science I mean the latest ammonia toxicological research that has been through peer review and public review and comment.

I have studied the "1999 Update of Ammonia Water Quality Criteria book for Ammonia" as published by the U.S. Environmental Protection Agency. I believe the proposal presented by the Illinois Association of Wastewater Agencies under this proceeding is an appropriate implementation of the criteria presented in that document. Our proposal is a straightforward application of best available science.

I would like to make several points relative to that document. First of all, the document presents ammonia criteria for both warm water and cold water species. I believe Illinois limits should be based solely on the warm water species. There are no indigenous salmonids in Illinois outside Lake Michigan. Secondly, it's important to understand that the chronic toxicity values contained in the proposal are 30-day average limits. To date, all chronic limits have been applied as a 4-day average limitation. IAWA's proposal is unique in that it proposes three levels of protection: acute, sub-chronic and chronic levels of protection. This approach allows the chronic

limit to be developed to more truly represent long-term exposure to ammonia toxicity impacts. A 30-day chronic limit also is more convenient when deriving monthly average NPDES Permit limits. With a 30-day chronic limit it is most appropriate that effluent limits be derived from stream flow, pH and temperature values representing long-term averages. The appropriate pH and temperature would be the 50th percentile values. The proposal is also innovative in that it contains sub-chronic limits as a more convenient tool for monitoring and enforcement of the stream standards.

The proposed standard is unique in its recognition of the increased sensitivity of early life stages to ammonia. The proposed winter standard allow higher concentrations of ammonia since early life stages are absent. In past regulations, March has been included in the winter period. While it is true that almost no early life stages are present during March in most of the state, IAWA agreed to move March from the winter period to the summer period to eliminate the need for site-specific evaluation of the possible presence of early life stages in March.

I believe the "1999 Update of Ambient Water Quality Criteria for Ammonia" represents a significant step forward in the understanding of ammonia aquatic toxicity. IAWA's proposal is a straightforward application of the criteria document. It is free of the exceptions, exemptions and special provisions that plagued previous ammonia standards. Based on my knowledge of Illinois streams, the proposed standard will result in effluent limits that are within capabilities of current nitrification technologies in most cases. If there are cases where effluent limits are unachievable, those dischargers would still have recourse to a site-specific ammonia standard proceeding.

I urge the Board to adopt IAWA's proposed ammonia standard. I am grateful to the Board for this public forum to provide for the open discussion of new standards. Thank you for considering my comments.

CH02/22175126.1

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	)	

WRITTEN TESTIMONY OF MICHAEL CALLAHAN
ON BEHALF OF THE ILLINOIS ASSOCIATION OF WASTEWATER AGENCIES

Introduction

My name is Michael Callahan. I am here on behalf of the Illinois Association of Wastewater Agencies (IAWA) to petition the Illinois Pollution Control Board (Board) to adopt the 1999 United States Environmental Protection Agency's (USEPA) 1999 Update of Ambient Water Quality Criteria for Ammonia (1999 USEPA guidance) (IAWA Exhibit 9 in this proceeding) published in final form in the Federal Register on December 22, 1999 (Vol. 64, No. 245) as the basis for the ammonia nitrogen water quality standard for Illinois.

I am keenly aware of the uniqueness of the current position of IAWA before the Board advocating such a rulemaking. Ordinarily this type of advocacy before the Board would be undertaken by the Illinois Environmental Protection Agency (Agency). However, the Agency was unable to develop this petition in a timely manner due to the severe time demands placed upon its personnel by the many other issues simultaneously being considered in the area of water pollution control within Illinois. The IAWA has asked the Agency for advisement on the tenets of this issue as well as approval of the petition presented to the Board today. The Agency has been very helpful in this regard, and we understand the Agency will offer supportive testimony later in this proceeding. The IAWA has elected to undertake the time commitment and cost of

approximately $70,000 to prepare the petition for rulemaking before the Board because of the importance the IAWA places upon a protective and economically justifiable ammonia nitrogen water quality standard for the State.

The importance to IAWA of the adoption of this USEPA criteria as the Illinois standard is multi-faceted. Later in this testimony I will elaborate upon these various facets as well as explain the recent history of the ammonia nitrogen water quality standard rulemaking in Illinois which has created our current situation. Further, I will share with the Board the steps in the IAWA development of the proposed standard as well as justifications for key determinations made in that development.

The IAWA is petitioning the Board to modify Sections 302.212, 302.213 and 304.122. of Title 35, Subtitle C of the Illinois Administrative Code. Also included with this action are minor modifications to Section 355, but not submitted to the Board for approval. Section 355 addresses the Agency's implementation procedures for this matter. The Agency prefers, and the IAWA currently agrees, that this implementation procedure should remain within the jurisdiction of the Agency. However, the IAWA strongly emphasizes that the modifications to and ultimate content of Section 355 as currently proposed are of absolute essential importance to the successful resolution of a protective and equitable ammonia water quality standard for Illinois. Should the Board approve this petition absent a successful modification of Section 355, the IAWA may return to the Board for action on this implementation procedure. This, however, is not the desired intent of IAWA at this time. My later testimony will illustrate this importance of this position and elaborate upon the matter.

Following my testimony will be testimony of Dr. Robert Sheehan, Professor of Fisheries and Zoology, Southern Illinois University; Dr. David Zenz, consulting engineer with Consoer

Townsend Envirodyne Engineers, Inc., formerly with the Research and Development Department of the Metropolitan Water Reclamation District of Greater Chicago; Mr. Tim Bachman, Director of Waste Treatment Operations of the Urbana & Champaign, Illinois Sanitary District, Mr. Michael Zima Director of the Dekalb, Illinois Sanitary District and Mr. James Daugherty, District Manager of the Thorn Creek Basic Sanitary District. Each of these individuals will provide testimony relevant to their area of expertise and experience in critical areas of this matter.

Background of J. Michael Callahan

I have a Bachelor of Science Degree in Biological Sciences and Environmental Health (double major) from Illinois State University, Normal, Illinois. I further obtained a Master of Arts Degree in Biological Sciences from the University of Missouri, Columbia, Missouri. I pursued Doctoral Studies at Illinois State University in Biological Sciences. All of my graduate studies involved nutrient cycling in biological systems. I am a member of the Phi Sigma Biological Sciences Honor Society.

I have been employed by the Bloomington and Normal Water Reclamation District (BNWRD) of Bloomington, Illinois since 1973. Since 1988 I have been the Executive Director of the BNWRD. The BNWRD and/or I have received awards for operational or program excellence from USEPA, the Agency and various professional organizations during my tenure as Executive Director. I have held an Illinois Environmental Protection Agency Class I Wastewater Treatment Plant Operator License since 1977. I have authored and presented many papers on a variety of issues concerning municipal sector wastewater treatment topics.

I have been a member of many professional organizations and have held offices in many of these organizations, including President of the Illinois Association of Wastewater Agencies,

President of the Illinois Water Pollution Control Operators Association, and Chairman and Trustee of the Illinois Section of the Central States Water Environment Association. I have belonged to the Water Environment Federation since 1975.

Development History of the Current Illinois Ammonia Water Quality Standard

I ask the Board to bear with me in revisiting the complicated sequence of historical events that have resulted in the present ammonia regulatory picture in Illinois. This history has direct bearing on the standard I am advocating to be developed from the 1999 USEPA guidance. This history is reflective of the importance to IAWA of the Board's adoption of the proposed ammonia water quality standard. This history also illustrates the overwhelming need, as the Board is acutely aware, for adoption of water quality standards for Illinois that are founded on complete scientific investigation, that are economically justifiable and that are technically attainable.

The present ammonia nitrogen water quality standard for Illinois was developed through Board Docket R94-1. The rule was finally adopted in 1996 amidst considerable input and compromise by all participating parties. The original proposal of R94-1 by the Agency was derived from the 1984 USEPA National Criteria Document for ammonia. The 1984 guidance was modified to consider ammonia toxicity of only warm water species indigenous to Illinois. The Agency proposal also addressed the fact that the water quality standard derived from that document would result in effluent NPDES permit limits that pushed the limit of technical attainability of many of the treatment facilities in Illinois, particularly in the winter season. Mr. Jim Daugherty, representing the IAWA in the R94-1 proceedings, testified to that point. At the Agency's request prior to the R94-1 proceedings, the IAWA undertook a member survey for nitrification capabilities of existing treatment facilities. This survey consisted of two years actual

daily operating nitrification data collected from approximately 45 wastewater treatment plants within Illinois. This survey, and its subsequent review by the Agency, was the partial basis for the Agency testimony in R94-1 that 1.5 mg/L and 4.0 mg/L were the existing consistent levels of treatment attainability for nitrification in Illinois.

The 1984 USEPA guidance document proposed ammonia toxicity in a manner that has since been found to be errant. The 1999 USEPA guidance subsequently addressed this error and now considers ammonia toxicity through a different mechanism than that used by the 1984 document. Dr. Robert Sheehan will elaborate on this mechanism in his testimony today. However, at this time I would like to offer a brief and simple explanation of the two different toxicity assessments to illustrate the difference in the subsequently derived water quality standards resulting from each USEPA guidance document.

Ammonia exists in aquatic systems in the form of a dynamic equilibrium between the un-ionized ammonia molecule form (NH_3) and the ammonium ion form (NH_4^+). This equilibrium is very dynamic and is responsive to both temperature and pH. Essentially, the mechanism employed in the 1984 guidance document assigned all of the ammonia toxicity to the un-ionized (NH_3) ammonia molecule. The assignment of all such toxicity to the un-ionized ammonia form of the equilibrium resulted in very low concentrations of un-ionized ammonia being indicated as necessary to protect aquatic life. The 1999 USEPA guidance assigns toxicity to total ammonia, not just un-ionized ammonia.

The present water quality standard in Illinois is derived from this errant consideration of the toxicity mechanism. Since the ammonia equilibrium is temperature responsive, both winter and summer acute and chronic standards were developed as a result of R94-1. The current standard, when back calculated into NPDES permit limits, does not present many difficulties in

terms of technical attainability and compliance during warm summer months even though the standard for such periods is much lower than that enacted for cold winter months. Wastewater treatment processes are much more efficient at the biological oxidation of ammonia at warm temperatures than they are at cold temperatures.

The current summer standard resulting from the Board's ruling in R94-1, in many situations throughout the State, allows for NPPES permits limits higher than the monthly average limit of 1.5 mg/L generally allowed within the State by the standard that preceded it. Likewise this proposed standard may allow for NPDES permit limits for ammonia greater than the customary 1.5 mg/L summer NPDES permit limit. However, anti-backsliding constraints generally result in previous permit limits being retained. Consequently, these anti-backsliding requirements will continue to provide a very conservative level of ammonia protection during the early life stage present period.

The acute winter standard does not present many such compliance difficulties due to the relatively high acute toxicity tolerance of ammonia as compared to the alleged chronic toxicity tolerance. The difficulty experienced with the current ammonia water quality standard exists when the winter chronic toxicity water quality standard is back-calculated into winter NPDES discharge permit limits. The chronic toxicity standard is roughly equivalent to the monthly average standard contained in such permits. The consideration by the 1984 guidance document of all ammonia toxicity resulting from the un-ionized form of the ammonia equilibrium resulted in the development of unnecessarily low un-ionized ammonia standards. Even though cold temperatures drive the ammonia equilibrium toward the ionized (NH_4^+) form of the equilibrium, the mistaken assignment of all ammonia toxicity to the un-ionized form resulted in winter

chronic NPDES permit limits that were at or below the limit of technical attainability in many wastewater treatment processes in place throughout Illinois.

In recognition of this dilemma, the Agency proposed, and the Board approved, a concept in R94-1 called effluent modified waters (EMW). The EMW concept allows for exceedance of the chronic toxicity water quality standard downstream of an NPDES permitted discharge to the distance necessary to achieve compliance with the chronic toxicity standard by depletion of ammonia through the natural nitrification capability of the receiving stream. Discharges into such an EMW were not allowed to exceed a monthly average NPDES permit limit of 4.0 mg/l ammonia during the winter season (November through March) and 1.5 mg/l during the summer season (April through October). An additional condition of EMW designation required that no ammonia impairment exist in the water body so designated. An EMW designation did not allow dischargers relief from the acute toxicity standard. As discussed previously, the only relief really needed, and therefore requested, by the regulated community was from the very low winter chronic standard.

The EMW concept had been approved by USEPA prior to the R94-1 proceeding. The Board action in R94-1 approved the ammonia nitrogen water quality standard and the concept of effluent modified waters. The Board action did not address the implementation policy concerning either the standard or the EMW designation. The Agency preferred at that time to retain development of these policies as their own implementation rules and codify them through the Joint Committee on Administrative Rulemaking (JCAR). In testimony during R94-1, the Agency indicated that no biological sampling in waters thought to qualify for EMW status had indicated biological ammonia impairment. Therefore the interpretation of the Board rule by the Agency and the regulated community was that EMW designation could be extended state-wide

in situations where the chronic water quality standard would require NPDES permit limits less than 4.0 mg/L during the winter or 1.5 mg/L during the summer.

Upon issuance of the Board rule, the Agency began issuing NPDES permits using the EMW designation and also began codification of its implementation policy with JCAR. At this time a sixty day notice of intent to sue was served on USEPA Region V alleging that the EMW concept in Illinois was not affording adequate protection of the State's waters as required by the Clean Water Act. In response to this notice, USEPA advised the Agency that it would not approve the implementation policy that was being developed for proposal to JCAR. The result of the intervention of USEPA into development of the implementation policy by the Agency was a significant change in the manner by which EMW relief could be given.

The implementation policy that resulted from this intervention demands that an exhaustive field evaluation of candidate receiving streams be undertaken which included hydrologic, physical, chemical, habitat and biological considerations. Additionally, submission of all known existing data relevant to the stream was required as well as consultation by the Agency with other natural resource agencies within the State. The net effect of this modified implementation policy is to tremendously complicate both the application for and approval of EMW designation. The unfortunate aspect of this existing EMW policy lies in the fact that it was taken to avoid a lawsuit and in no way allowed for public hearing of the issues in an open forum such as that provided by the Board rulemaking process.

The IAWA had supported the Board's adoption of the new water quality standards in R94-1 despite strong reservations about the appropriateness of the toxicity mechanism used in the USEPA 1984 guidance document. This reservation is stated in Mr. Daugherty's testimony in

R94-1. Such support had, however, been ultimately extended with the understanding that the EMW designation would allow assignment of the 1.5 mg/L summer and 4.0 mg/L winter monthly average NPDES permit limits. This support was also extended with the understanding that the Agency's testimony indicated no ammonia impairment existed within the State that would prohibit EMW designations. Such EMW designations would not, therefore, involve lengthy and complicated site by site demonstration of the appropriateness of each such designation.

Regrettably, when the Agency finally codified the ammonia implementation procedure in June, 9 1999, the IAWA membership and all other point source dischargers throughout Illinois were facing the grim prospect of complying with effluent limits which were at or below the edge of technical attainability with very limited prospects of relief. Realization of an EMW designation had become such a complicated and onerous undertaking, as a result of the implementation procedure eventually codified, that the regulated community saw little chance of being successful in realizing any such designation. To date, six years after adoption of the Board's rule, I am not aware of one EMW application in Illinois that has been attempted. The net effect of the procedures by which the current ammonia water quality standard had been implemented was to offer the regulated community conditional relief from the chronic winter standard for which compliance had been determined to be marginal at best and, then, pull that relief out at the last minute. The regulated community had been left hanging.

Needless to say there was great relief felt throughout the Illinois regulated community when, within two months of the codification of the existing implementation procedure, the 1999 USEPA guidance was released and indicated that the 1984 guidance was in error. Further, this guidance recommended a different mechanism by which to consider ammonia toxicity. Of

greatest irony was the fact that the mechanism advocated by the 1999 USEPA guidance results in a winter ammonia chronic toxicity standard which is attainable by existing wastewater treatment processes. This relief afforded by the 1999 USEPA guidance is the motivation for the IAWA current petition before the Board to adopt the proposed water quality standard.

Development of the Proposed Standard

Upon receipt of the 1999 USEPA guidance, the IAWA strongly encouraged the Agency to immediately undertake a new rulemaking which would result in adoption of the criteria recommended in the guidance as the Illinois water quality standard for ammonia. The Agency regrettably told IAWA that the other program development requirements before it at that time did not allow enough personnel to initiate such action. The IAWA thus decided in January of 2000 to undertake the action itself. The Agency subsequently told IAWA that it would support such an effort providing that the resulting proposed rule satisfied all Agency concerns regarding both compliance with the 1999 USEPA guidance and necessary protection of Illinois waters.

The 1999 USEPA guidance itself is a compelling testament for the standard presented to the Board for consideration today. The IAWA did not revisit any of the methodology used in development of the 1999 USEPA guidance, but rather, drafted the proposed standard directly from the formulae in the document. The IAWA proposal, however, does not contain the provisions for protection of cold water species. The proposed standard is not applicable to Lake Michigan. That portion of the regulations is not proposed to be changed by these proceedings. The generally agreed upon consensus within the State is that cold water species are not indigenous to any of the waters of Illinois other than Lake Michigan.

The IAWA subcommittee assigned to the development of this proposal initially canvassed the IAWA membership to determine the capability of existing facilities in Illinois to

maintain compliance with the NPDES permit limits which would result from adoption of this proposal. Many of the facilities queried indicated that ammonia limits lower than those in effect prior to R94-1 would probably be added to NPDES permits as a result of this proposal. However, the membership also determined that existing wastewater technology could consistently achieve compliance with these limits.

The proposed standard differs from previous attempts to regulate ammonia in Illinois by recognizing an increased ammonia toxicity by the early life stages of fish as compared to adult fish individuals. The 1999 document also finds that early life stages of fish species are more sensitive to ammonia than are invertebrate species. To evaluate the correct manner by which to apply this concept of early life stage protection in Illinois, the IAWA retained Dr. Sheehan as a consultant. Dr. Sheehan will elaborate upon his developmental work on this issue in later testimony. In essence, Dr. Sheehan and IAWA were comfortable initially in advocating an early life stage present period of April through October. This season is the same as the existing regulation's summer season. The early life stage absent period thus becomes November through March. Some uncertainty remained with this determination, however, due to the waters of southern Illinois warming earlier in the year than those of northern Illinois. Also, the northern pike has a life history indicating that it could begin the spawn in March. The northern pike is essentially limited to northern Illinois. Consequently, the IAWA included a clause in the proposal which stipulates the Agency is empowered to assign early life stage present protection to selected waters on a site specific basis as may be found appropriate. This clause is found at Section 302.212(e). Upon review of the proposal, Agency biologists indicated that they would be more comfortable in extending total early life stage protection to the month of March. The Agency thus advocated an early life stage present period of March through October and an early

life stage absent period of November through February. The IAWA agreed to this request and such is the format currently before the Board. The IAWA did, however, retain the clause at Section 302.212(e) such that the Agency is empowered to extend early life stage protection to winter months on a site specific basis or to the extent that such protection is found to be warranted in the future.

The language and format of the proposed regulation was drafted by Ms. Debra Williams, counsel for the Agency and Mr. Roy Harsch, counsel for IAWA. The language of the proposal thus is such that the Agency is comfortable with the water quality protection extended, the compatibility of the regulation with other Agency regulations and the regulation's ability to be enforced.

Dr. Sheehan and various IAWA ammonia regulation subcommittee members then attempted to discuss the newly drafted and Agency approved proposal with various stakeholders throughout Illinois. Dr. Sheehan will elaborate upon his discussions in this regard. We believe that all individuals with whom this proposal was discussed were satisfied with the ammonia protection it affords. Included in this proceeding as IAWA's Exhibit 10 are letters from me to Mr. Joel Cross, Division of Fisheries, Illinois Department of Natural Resources (IDNR), Mr.Glenn Kruse. Division of Natural History (IDNR) and Mr. Keith Shank, Division of Endangered Species (IDNR). These letters formally follow up on verbal discussions of the proposal between Dr. Sheehan and these gentlemen of the Illinois Department of Natural Resources. The proposed regulation accompanied each of these letters. Each letter requests follow up contact if difficulties with the regulation are foreseen. The IAWA has not received any response to these letters.

The Agency submitted the proposed regulation to USEPA Region V for comment. Region V responded by raising four issues. Included with Exhibit 10 is a letter from Mr. Tom Muth, IAWA President to Mr. David Pfeifer, Region V, USEPA, responding to three of these comments. The comment not addressed by Mr. Muth's letter involved consideration of flows in determination of effluent NPDES permit limits. This issue is addressed by the Agency's use of it's mass balance calculation procedure for determination of effluent limits and also by the Agency's allowance for no dilution of ammonia concentrations on zero low flow streams.

The first of the Region V comments concerned the early life stage presence time period. This issue was discussed among Dr. Sheehan, Dr. Brooks Burr, Professor of Fisheries and Zoology, Southern Illinois University and Mr. Brian Thompson of Region V USEPA. It is our understanding that this discussion concluded with agreement that the proposed standard extends adequate ammonia early life stage protection. Dr. Sheehan will elaborate on this issue in later testimony.

The second issue raised by the USEPA Region V comment involved the use of the selected percentile rankings of pH and temperature for determining the appropriate water quality standard. This issue, while of fundamental importance in the successful implementation of this proposed rule, is listed as a Section 355 modification and is thus not before the Board for action at this time. However, prudence and past experience (as discussed above) requires IAWA to offer a complete explanation of this matter to the Board should further action be necessary. The procedure used in the proposed regulation is exactly that presently used for the existing ammonia water quality standard. The 75^{th} percentile temperature and pH of the water body are used for the determination of the acute and chronic early life stage present and early life stage absent standards. If use of the 75^{th} percentile pH value results in a chronic effluent standard less than

1.5 mg/L for the early life stage present period or 4.0 mg/L for the early file stage absent period, the 50th percentile shall be used to recalculate these chronic standards. The standards obtained with the use of the 50th percentile shall be met. Under no circumstances shall use of the 50th percentile pH result in standards greater that 1.5 mg/L for the early life stage present period or 4.0 mg/L for the early life stage absent period. The sub-chronic standard is 2.5 times the final calculated chronic standard.

The chronic standard is a thirty (30) day average. A monthly average standard assumes that half of the variance can be in excess of the standard and half of the variance can be less than the standard. Consequently, the use of the median (50th percentile) value for determination of this standard is mathematically appropriate. Dr. Sheehan will discuss this issue further in his testimony.

The fourth issue raised in the USEPA Region V comment addressed protection of mussels. The 1999 USDA guidance considered mussels in the analysis of invertebrate species. The Region V comment states recent research work indicates that the 1999 USEPA guidance might not provide adequate protection to mussel species.

Dr. Sheehan and I have attempted to review some of this work for this proceeding. I am not an authority on the Mollusca. However, I was unable to find much of it referenced in the customary abstract indices. I was finally able to obtain some of these citation references by requesting them from the Agency. A significant portion of this research is unpublished. Some of the work has been published but, in some of the published work, the experimental designs are not necessarily appropriate for application to development of national criteria guidance. One of the citations referenced by USEPA is for a paper published jointly by Dr. Sheehan and others which

Dr. Sheehan indicates might not be appropriate for criteria development purposes, Again, Dr. Sheehan will address this matter in his testimony.

At this time I would like to address a component of the contemporary rulemaking process which I find indirectly related to this consideration of mussel protection. This issue is referenced in Mr. Muth's letter to Mr. Pfeiffer. Specifically, none of the data which has been referenced suggesting potential lack of mussel protection generated through recent research work nor the peer reviewed or non-peer reviewed articles generated therefrom has been subjected to the Federal criteria guidance public review process. I am very concerned with the consideration of research results for rulemaking purposes which have not yet withstood the rigors of public review and comment. Such a rush to regulate for the sake of regulation seems to be an extraordinary opportunity to repeat the error inherent in the 1984 USEPA ammonia guidance document. The IAWA objected before the Board to the basic tenants of toxicity modeling associated with the 1984 USEPA document. However, those objections were essentially mollified by the fact that the document had been through the national review process and thus stood as the basis from which water quality standards should be derived. The IAWA accepted this situation as the necessary due process in rulemaking. I maintain that the same standard needs to be held to the 1999 USEPA guidance and action which originates from it.

The Board will shortly hear testimony from representatives of two municipalities in our State that are potentially facing millions of dollars of plant upgrade expense to comply with the exiting Illinois water quality standard which was derived from the 1984 USEPA criteria guidance document. These municipalities, specifically the taxpayers of these municipalities, will not have to face this expense with the proposed water quality standard derived from the 1999 USEPA guidance. The 1999 USEPA document must stand as the present basis from which cost

to the public must be considered. If future scientific investigation and subsequent public review indicates that additional ammonia treatment and associated expense is warranted then decisions on how to affect such treatment can be made at that time. If future investigation determines that such additional treatment and expense is not warranted, the cost to these communities, if forced to construct facilities now, cannot be recovered. There is no trade-in or redemption value for unnecessary capital wastewater treatment facilities.

Conclusion

The Board has historically been very mindful of the economic impact of the regulations it enacts. The citizens of Illinois can be very grateful to the Board for demonstrating that wisdom. Balancing necessary environmental protection with responsible stewardship of public money is a task of the Board which most people find unenviable. A misinterpretation of the mechanism of ammonia toxicity in the 1984 USEPA guidance document has resulted in the Board enacting, in good faith, an overly protective and economically unjustifiable water quality standard for ammonia, based on that document. The Board at that time, and rightly so, felt the existing standard was necessary to protect the waters of Illinois. The Board recognized the need to extend some form of relief to the regulated community from the seemingly unrealistic demands of the winter chronic ammonia standard resulting from the 1984 guidance document and did so. Regrettably, that relief was virtually eliminated in a venue beyond the Board's jurisdiction through threat of judicial action against USEPA. The water quality standard presented to the Board today provides for adequate water quality protection as recognized by sound and accepted contemporary science.

The IAWA is adamantly committed to providing levels of wastewater treatment necessary to protect the waters of our State. The historic presence of the IAWA before the Board

is testament to that commitment. The IAWA is grateful to the Board for providing an open public forum where such matters can be freely discussed and resolved. The proposed water quality standard which the Board is hereby requested to consider for adoption strikes the necessary balance between water quality protection and public cost which the Board and IAWA have both historically sought.

CH01/12210923.1

BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	
PROPOSED AMENDMENTS TO	)	**R 02-19**
AMMONIA NITROGEN STANDARDS	)	**(Rulemaking – Water)**
35 Ill. Adm. Code	)	

WRITTEN TESTIMONY OF ROBERT J. SHEEHAN

Justification and Approach for Adoption of the United States Environmental Protection Agency's Approach for Setting Ambient Water Quality Criteria for Ammonia in Illinois Surface Waters

I am Robert J. Sheehan, Professor of Fisheries in Zoology and Assistant Director of the Fisheries and Illinois Aquaculture Center, Southern Illinois University Carbondale. My purpose here today is to explain the justification and approach for what I believe Illinois should use to establish water quality criteria for the state's surface waters. I believe that recent information indicates that current ammonia water quality criteria used by Illinois appear to not be protective enough under certain circumstances and they appear to be overly protective under other circumstances. I believe that Illinois should use methods described by the United States Environmental Protection Agency (USEPA) in their latest National Criteria Document for ammonia, the 1999 Update of Ambient Water Quality Criteria for Ammonia ("1999 Ammonia Update") .

I. Professional Credentials:

I base my testimony on more than 15 years of experience with ammonia toxicity issues. For example, colleagues and I published in the international journal *Hydrobiologia* what is to my knowledge the first paper examining the tolerance of larval (glochidia) unionid mussels to ammonia (Goudreau et al. 1993). This paper was considered in the 1999 Ammonia Update. A colleague and I also published in

Transactions of the American Fisheries Society a study (Sheehan and Lewis 1986) that was also included as part of the database upon which the 1999 Ammonia Update was based. This work was the basis for two best paper awards conferred on us by the American Fisheries Society. I was selected by the Cadmus Group, a consulting firm employed by USEPA, to be one of the five national reviewers for the 1999 Ammonia Update; I was the only biologist among the reviewers (Cadmus 1997). I have taught a graduate level class (Zoology 565, Environmental Physiology of Fishes) for more than ten years that covers in depth the methods for calculation of numeric and narrative water quality criteria. I have also taught these methods in the University of Illinois' Envirovet curriculum; Envirovet is a program for training veterinarians in aquatic animal health. I am the Illinois Chapter of the American Fisheries Society's representative to the Illinois Environmental Protection Agency's (IEPA) Total Maximum Daily Load Work Group. I am a member of IEPA's Science Committee for developing water quality standards for nutrients.

Other indications of my professional stature include the more than $2,000,000 of funding I have received for research in aquatic systems. This funding was obtained from approximately twenty different sources. Most of this research has been directed at Illinois surface waters, and in particular rivers and streams, but some has been international (e.g., Amazon River) in scope. I have authored more than twenty-five peer-reviewed publications on river and stream organisms. These include: 1) invited author of the "Large Rivers" chapter (Sheehan and Rasmussen 1993) in the American Fisheries Society's textbook on fisheries management, *Inland Fisheries Management in North America*—an updated revision of that work has recently been completed (Sheehan and

Rasmussen 1999); and 2) invited author of the chapter on "Wetlands and Fisheries Resources of the Mississippi River" in the Pennsylvania Academy of Science book, *Ecology of Wetlands and Associated Systems.* I serve as a member of numerous government agency teams or committees, such as the Mississippi River Coordination Team and the Lower Platte River Task Force. I have been an expert witness for the Washington University Environmental Law Clinic at a hearing before the Missouri Clean Water Commission. I have also been an expert witness in a hearing before the Illinois Pollution Control Board that concerned ammonia in the Galesburg Sanitary District discharge. Lastly, I was appointed to the Pallid Sturgeon Recovery Team by the Director of the U.S. Fish and Wildlife Service; this is the only federally listed endangered fish species in the Mississippi River.

II. Justification

As Mr. Callahan testified, ammonia exists in solution in a dynamic equilibrium in two forms, as ammonium ion (NH_4^+) and as an unionized molecule (NH_3). Current water quality standards for Illinois are derived from the U.S. Environmental Protection Agency's National Criteria Document, *Ambient Water Quality Criteria for Ammonia—1984,* which was published in 1985 (hereafter referred to as "1985 Ammonia Guidance"). The 1985 Ammonia Guidance was formulated under the so-called joint toxicity theory, which holds that unionized ammonia is the more toxic form, but ionized ammonia is also toxic. Further, as pH, temperature or both decrease, the proportion of the toxicity attributable to ionized ammonia will increase, due to the effects of temperature and pH on the ammonia equilibrium. Toxicity appears to increase as pH, temperature, or both decrease if one only considers unionized ammonia concentrations, because more ionized

ammonia will be found in lower pH and/or lower temperature solutions. Thus, the 1985 Ammonia Guidance expressed water quality criteria in terms of unionized ammonia with corrections for the effects of temperature and pH on ammonia toxicity. It was noted in the 1985 Ammonia Guidance that the joint toxicity model did not appear to be consistent with some data sets that were available at that time.

In the 1999 Ammonia Update, USEPA concluded that a definitive, thorough theoretical approach for describing pH effects on ammonia toxicity is lacking. Further, USEPA concluded in the 1999 Ammonia Update that there is no adequate theoretical basis or scientific understanding for specifying how temperature adjustments to unionized ammonia criteria can be made. Rather than trying to make "square-peg" data fit into the "round-hole" joint toxicity theory, the 1999 Ammonia Update took an empirical approach to describe how pH and temperature affect ammonia toxicity. This meant that in the opinion of USEPA in the 1999 Ammonia Update, the approach used in the 1985 Ammonia Guidance was flawed because it was formulated based on the belief in the joint toxicity theory, a belief that seemed to be refuted, especially when applied to temperature effects on ammonia toxicity.

Application of the 1999 Ammonia Update to Illinois water quality laws is warranted at this time. The 1999 Ammonia Update is superior to the 1985 Ammonia Guidance approach for a number of reasons. First, the 1999 Ammonia Update recognizes that the effects of temperature on ammonia toxicity are not strongly indicative of joint toxicity. Second, models used to describe the effects of pH on ammonia toxicity use empirical components in recognition of the incomplete knowledge of joint toxicity effects. Third, expressing ammonia toxicity on the basis of total ammonia eliminated the

need for a temperature correction for ammonia Criterion Maximum Concentrations. Fourth, using total ammonia to express ammonia toxicity generally resulted in reduced variability among data sets and better fit to existing data sets. Fifth, permit limits are usually expressed in total ammonia, so expressing criteria on the basis of total ammonia would eliminate conversions to unionized ammonia. Sixth, another water quality criterion that 1999 Ammonia Update believes is necessary to protect aquatic life will be established, wherein the highest four-day average will not be allowed to exceed 2.5 times the chronic criterion. Lastly, the results of more than 40 new scientific studies with a number of additional species were added to the ammonia toxicity data base. Studies representing a broad range of species are necessary for developing adequately protective water quality criteria. More data in general reduces the risk of criteria being overprotective as well as under protective.

III. Proposed changes to Part 302, Subpart B, Section 302.212:

Methods for calculating water quality criteria are taken from the 1999 Ammonia Update. All criteria will be on the basis of total ammonia. The 1999 Ammonia Update provides two relationships for calculating the Criterion Maximum Concentration (CMC) or acute criterion for ammonia. One equation is used when salmonid fishes are present and the other when they are absent. Since no reproducing salmonid populations are found in Illinois waters that receive NPDES point source discharges, the salmonid fishes absent approach is warranted in Illinois.

The 1999 Ammonia Update provides two relationships for calculating the Criterion Continuous Concentration (CCC) or chronic criterion for ammonia. One relationship is to be used when early life history stages of fish are present and the other

when they are not. The equation used when early life history stages are present results in a more protective water quality criterion, which is necessary to protect fishes during sensitive developmental stages.

I compiled a list of spawning dates for fish species in Illinois to determine when the "early life history stages present" water quality criteria should be applied. These spawning dates may be found as IAWA's Exhibit 11. Spawning dates were derived from many sources and based on the best information available. Although spawning dates have been reported for most species, information specific to Illinois is not available for many species, so professional judgment was also used. Primary sources of spawning date information included *Fishes of Illinois* (Smith 1979), *The Fishes of Missouri* (Pflieger 1997), and *Fishes of Wisconsin* (Becker 1983).

I consulted with Dr. Brooks Burr, an ichthyologist at my institution. I also consulted with Mr. Brian Thompson of the U.S. Environmental Protection Agency, Region V. It is my understanding that Mr. Thompson then consulted with a colleague in his office, Mr. Ed Hammer. Mr. Hammer is knowledgeable of fishes in Illinois. To the best of my knowledge, the following rationale for determining periods when early life history stages of fishes are present in Illinois waters is representative of and consistent with the outcome of those consultations.

Most Illinois fish species spawn in the spring and summer seasons, so the months of April through August are without doubt within the "early life history stages present" period. The earliest spawning species in Illinois' inland waters is the harlequin darter *Etheostoma histrio,* which is believed to spawn as early as February. The harlequin darter is found in Illinois in the Embarras River between the towns of Charleston and

Newton and in the Wabash River between Beall Woods State Park and the town of Rising Sun. It is reasonable that the "early life history stages present" should be considered to begin in February in these two river reaches to afford protection to the harlequin darter, unless this species proves to be relatively tolerant to ammonia.

Elsewhere in the waters of Illinois, exclusive of Lake Michigan, the earliest spawning species are most probably members of the Esocidae, the grass pickeral *Esox americanus* and the northern pike *E. lucius*. These two esocids probably typically initiate spawning in most of their Illinois range in March. Consequently, designating March as the beginning of the "early life history stages present" period in waters where the harlequin darter is not found is warranted.

Illinois fish species that spawn as late in the year as September include the sand shiner *Notropis ludibundus,* banded killifish *Fundulus diaphanous*, and mosquitofish *Gambusia affinis*. However, time should be permitted for the young of these species to grow out of the most sensitive developmental stages, so it appears justifiable to extend the "early life history stages present" period through October.

Two species that reportedly spawn in winter were not used to determine when early life history stages are present for the following reasons. The burbot *Lota lota* has been found in the Illinois River. It is thought to spawn during the winter, but it is doubtful that this species reproduces in any Illinois waters with the exception of Lake Michigan. The spring cavefish *Chologaster agassizi* may spawn at various times of the year, including winter, but this species is subterranean and unlikely to be affected by ammonia in discharges.

In summary, the "early life history stages not present" period should be considered to be November through February in most of the state. In waters where the harlequin darter occurs, however, the "early life history stages present" period should be considered to be November through January unless it can be shown that this species is relatively tolerant to ammonia. The "early life history stages not present" period could be extended through February in harlequin darter waters if this species is not very sensitive to ammonia.

The 1999 Ammonia Update suggests the use of a third criterion, a 4-day average that should not exceed 2.5 times the CCC. I believe that there is justification for this "subchronic" ammonia criterion. It will afford an additional level of protection for the state's aquatic biota that is not present in the existing law.

IV. Use of the 50th percentile pH to calculate chronic effluent standards:

Stephan et al. (1984) defined USEPA's general guidelines for deriving numerical national water quality criteria for the protection of aquatic organisms and their uses. This document established USEPA's intent in regard to water quality criteria development. The 1999 Ammonia Update is an example of the mechanics of water quality criteria development for a particular toxic—ammonia. According to Stephan et al. (1984), ". . . the concentration of a pollutant in a body of water can be above the CCC without causing an unacceptable effect if (a) the magnitudes and durations of the excursions above the CCC are appropriately limited and (b) there are compensating periods of time during which the concentration is below the CCC." The 1999 Ammonia Update approach establishing a subchronic standard effectively accomplishes (a) above—it limits the

magnitudes and durations of excursions above the CCC. This protection is not present under current law.

Since unionized ammonia is considered the more toxic form, solutions become more toxic at elevated pH values. This is an important consideration when protecting organisms from lethal concentrations. Thus, a very conservative 75^{th} percentile pH is used to calculate effluent standards to meet acute criteria. However, chronic effects deal with important yet less harmful responses, such as effects on growth. The intent of the CCC is to prevent unacceptable chronic effects, such as unacceptable effects on growth. By using the 50^{th} percentile pH, excursions above the CCC will be completely compensated for by periods when pH is below the 50^{th} percentile. Thus, a chronic effect, such as reduced growth, will be no worse on average than is considered acceptable, based on the CCC.

The establishment of the subchronic criterion will provide the level of protection against extended duration and high magnitude excursions above the CCC as described by Stephan et al. (1984) (see (a) above). The subchronic standard and the protection it provides are not present under the current law. This alone provides a great deal of justification for modification of the current law. The 50^{th} percentile pH will ensure that the CCC is met on average, also consistent with the intent of the CCC as described by Stephan et al. (1984) (see (b) above).

Also, the overall approach used in the 1999 Ammonia Update for chronic ammonia criteria development is superior to that of 1985 Ammonia Guidance. In the 1985 Ammonia Guidance, chronic water quality criteria were derived from estimates of chronic effects threshold concentrations, or the geometric mean of the lower and upper

chronic limits; i.e., the highest concentration in a test that did not cause an unacceptable adverse effect and the lowest concentration that caused an unacceptable adverse effect, respectively. There is a high degree of statistical and scientific uncertainty in estimates of chronic effects threshold concentrations using this method. In the 1999 Ammonia Update, chronic criteria are set by interpolating a single value (the EC20) from a concentration-toxicity relationship developed from an entire data set. Thus, in the 1985 Ammonia Guidance chronic criteria are determined using only two data points taken from the portion of the concentration-toxicity relationship where statistical error and scientific uncertainty are high. In the 1999 Ammonia Update, an entire data set (that includes values with lower statistical error rates and higher scientific certainty) is used to develop chronic criteria.

V. Mussels

USEPA Region V has provided a document with a list of studies examining ammonia toxicity in mussels, due to concerns that the 1999 Ammonia Update did not adequately address this taxonomic group. The vast majority of the referenced studies are not published in the peer-reviewed literature, and most certainly had not been subjected to USEPA procedures or public comment regarding their suitability for inclusion in data bases for water quality criteria development. By my count, 13 works were referenced and only two of those were published in the peer-reviewed scientific literature. I am a coauthor (Goudreau et al. 1993) of one of the two published papers. Because of my familiarity with that work, I was somewhat surprised that the LC50 value we obtained was included in the proposed mussel database without any comment regarding its appropriateness. Our study was cutting edge research at the time, the first study to

examine ammonia toxicity in larval (glochidia) mussels. However, the toxic response we measured, closure of the valves, occurred in up to 50% of the control glochidia, a problem we described in the paper. According to generally accepted guidelines for toxicity tests (USEPA 1991), no more than 10% of control group animals should show the toxic response, if a toxicity test is to be considered valid. Some mention of the problem we encountered with control animals should at least have been method. I was also surprised to read in the document provided by Region V USEPA that, "There were no applicable acute:chronic ratios for sublethal ammonia impacts to freshwater mussels", because we reported both an EC50 value and an LC50 value from which an acute-chronic ratio for mussels could have been obtained. It should be mentioned that our Goudreau et al. (1993) paper was considered in the 1999 Ammonia Update, but it did not affect the outcome of chronic criteria that were developed.

Given the lack of both USEPA and public review, as well as a lack of peer review by the scientific community for most of the mussel studies provided in the document from Region V, I do not believe there is compelling evidence regarding the tolerance of mussels to ammonia to justify modification of criteria based on 1999 Ammonia Update at this time.

VI. Summary Conclusions

1. The theoretical framework used to formulate Illinois' ammonia water quality criteria was based on USEPA guidelines; USEPA now questions the theoretical basis of that framework.

2. USEPA now proposes that models developed using empirical methods be used to determine water quality criteria; these models are the best available for this

purpose at this time, and I believe Illinois' regulations should be revised according to the new models proposed by USEPA.

3. The method for calculating chronic criteria that is described in USEPA's latest guidance is superior to the previous method and should be adopted in the state's regulations.

4. I urge that Illinois establish another water quality criterion, the subchronic criterion described in the latest USEPA guidance, to more fully protect the organisms in the state's waters.

5. The early life history states present period, used to establish chronic criteria, should be considered as March through October in most of the state.

6. In waters where the harlequin darter is found, the early life history stages present period should be considered as February through October, unless this species proves to be relatively insensitive to ammonia.

7. Lastly, using the 50th percentile pH for calculating effluent limits to meet chronic ammonia criteria is consistent with current USEPA guidance.

Robert J. Sheehan
Professor of Fisheries in Zoology
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CERTIFICATE OF SERVICE

The undersigned certifies that a copy of the foregoing **Notice of Filing Testimony of James L. Daugherty, Michael Callahan and Robert J. Sheehan** were filed by hand delivery with the Clerk of the Illinois Pollution Control Board and served upon the parties to whom said Notice is directed by first class mail, postage prepaid, by depositing in the U.S. Mail at 321 North Clark Street, Chicago, Illinois on Monday, March 4, 2002.

Sheila H. Deely

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