

ILLINOIS POLLUTION CONTROL BOARD
June 17, 1982

IN THE MATTER OF:)
)
AMENDMENTS TO TITLE 35:)
ENVIRONMENTAL PROTECTION;) R 81-23
SUBTITLE C: WATER POLLUTION;)
CHAPTER I: POLLUTION CONTROL)
BOARD (Ammonia Nitrogen))

Proposed Rule. Second Notice.

OPINION AND ORDER OF THE BOARD (by J.D. Dumelle):

On February 4, 1982 the Board issued a Proposed Opinion and Order in this matter based upon three "inquiry" hearings which had been held in response to the Department of Energy and Natural Resources having submitted its review of existing Rule 203(f) of Chapter 3: Water Pollution, as it relates to ammonia nitrogen (Doc. 81/23). On March 19, 1982 the Board entered a Proposed Rule/First Notice Order. First Notice was published in the Illinois Register on April 30, 1982. Thereafter, two additional hearings were held to consider the Board's proposal. The first was held April 30, 1982 at the Board Meeting Room in Chicago. The other was held May 4, 1982 at the Peoria Public Library. The Board's comment period and the First Notice period both expired on June 14, 1982.

As noted in the February 4, 1982 Proposed Opinion, the Board has codified Chapter 3 during the pendency of this proceeding. Since the Board expects State Library certification of that codification prior to the close of the Second Notice period, all references in this Order will be to the codified rules. The following table is provided to aid in referencing old Board rule numbers to section numbers pursuant to codification:

Chapter 3: Water Pollution Rule Number	35 Ill. Admin. Code Number	Rule Name
203(f)	302.208	General Use WQS [*] - Chemical Constituents
402	304.105	Violation of WQS
402.1	304.301	Temporary Effluent Standards
406	304.122	General Effluent Standards - Nitrogen
409	304.140	Delays in Upgrading

*WQS = Water Quality Standards

RESPONSE TO COMMENTS

On April 21, 1982 the Agency filed a "recommendation" which was entered as Exhibit 12 at the April 30, 1982 hearing. Final Agency comments were filed on June 14, 1982 which reiterated the Agency's position presented in the recommendation: first, that the termination date for the Section 304.301(d) exemption be extended to July 1, 1988 rather than July 1, 1986 and, second, that the un-ionized ammonia alternative water quality standard be removed or at least that an upper limit be set on the ammonia nitrogen standard regardless of the calculated un-ionized level.

The Agency's rationale for extending the termination date to 1988 is based upon the "Municipal Wastewater Treatment Construction Grant Amendments of 1981" which extended the compliance date for municipalities to meet secondary treatment requirements or more stringent state requirements from July 1, 1983 to July 1, 1988. Therefore, municipalities required to meet ammonia limits could be issued NPDES permits which expire July 1, 1988 if the Board's termination date were set in accordance with the federal date. The shorter term permits allowed by the Board's proposed 1986 date are argued to cause increased costs to the applicant and the Agency due to an increase in permit renewals, review and issuance.

Part of the Agency's rationale for deletion of the un-ionized ammonia alternative water quality standard is the difficulty of monitoring since there is not yet any reliable, easily accomplished method of direct measurement of un-ionized ammonia concentrations. Further, the Agency argues that mathematical conversion of ammonia nitrogen concentrations to un-ionized ammonia nitrogen concentrations using pH and temperature fails to take into consideration other significant factors that affect the conversion. Also, fluctuations of pH can be sufficiently large and difficult to predict that the discharger would generally have to overcontrol to assure compliance with the water quality standard such that the discharger would not be able to rely on the proposed, relaxed alternative standard.

The Agency finally argues that the Board's proposed standard would allow ammonia nitrogen levels at least as high as 325 mg/l to be discharged and that such discharges could lead to unacceptable oxygen depletion and fish toxicity. Based on this the Agency recommends that at a minimum the Board impose an upper limit on the ammonia nitrogen discharge regardless of the un-ionized ammonia concentration.

Linda Huff of Huff & Huff, Inc., an environmental consulting firm, testified that the proposed un-ionized ammonia standard is a positive step "to prioritize the pollution expenditures and reduce the cost of providing acceptable levels of wastewater treatment," despite the more complex determination of compliance (R.393-394).

She also testified that some treatment works may be able to eliminate nitrification, and therefore reduce costs under the Board's proposal on a sophisticated site-specific basis (R.394-395). Finally, she supported the Agency's recommendation of an upper limit on ammonia nitrogen levels, although she was uncertain as to what that level should be (R.395).

Drs. Muchmore and Heidinger, authors of the economic impact study in this matter, commented on June 14, 1982, that they supported the alternative standard with a 10 mg/l ammonia nitrogen concentration limitation and that they saw little real difficulty with the mathematical conversion method of monitoring un-ionized ammonia concentrations.

Also, on June 14, 1982, Borg-Warner commented that the Board's proposal "would make the existing water quality standard more reasonable" and that it is fully supported by the record. However, Borg-Warner contends that the same rationale for the water quality standard supports the deletion of the effluent standards of Section 304.122 which are applicable to dischargers to the Illinois River, Des Plaines River, Chicago River System, and the Calumet River System.

The Galesburg Sanitary District filed comments on June 15, 1982, a day after the close of the comment period, but the Board will consider them. The District generally supports the Board's proposal as cost saving while adequately protecting the environment. However, it supports a higher un-ionized ammonia standard for those streams which support a low variety of fish, perhaps up to 0.07 to 0.10 mg/l. In effect it supports an even more site-specific approach to this regulatory scheme.

The City of Lockport also filed late comments on June 16, 1982 which will be considered. The City is supportive of the Board's proposal, citing potential cost savings of \$800,000 in construction costs for the upgrading of its facility.

BOARD ACTION

Based upon the hearings and the comments during the First Notice period, the Board has determined that an upper limit should be placed upon the ammonia nitrogen concentration. The Board will set that upper limit at 15 mg/l as part of new Section 302.212. The Board will also modify the language establishing the alternative standard for purposes of clarity [Section 302.212(a), (b) and (c)], include an equation for the mathematical conversion of ammonia nitrogen concentrations to un-ionized ammonia concentrations [Section 302.212(d)], and include a table of acceptable levels of ammonia nitrogen under various pH and temperature conditions [Section 302.212(e)]. The Board has also extended the Section 304.301 compliance date until July 1, 1988. Otherwise, the Board's proposal remains unchanged.

JUSTIFICATION

The Board has followed the Agency's recommendation that the compliance date of Section 304.301 be extended to July 1, 1988. The Agency states that there is considerable pressure upon it from regulations other than Section 304.301 to insure that appropriate ammonia control will be required at the earliest possible time. The Board has extended the date with the understanding that stream studies under R79-6 will proceed as expeditiously as possible.

The Board has declined to follow the suggestion of the City of Galesburg to raise the proposed un-ionized ammonia alternative standard. The proposed standard is an interim standard pending the completion of studies which may allow for ammonia standards on a stream-specific basis, which is essentially what Galesburg is suggesting be done in this proceeding for streams which do not support a high variety of fish. In setting the 0.04 mg/l standard the Board has loosened the ammonia limitations as much as is supportable generally throughout the State. The present record is inadequate to support greater specificity in terms of stream use. The Board expects that to be accomplished sometime prior to 1986.

The Board has further declined to follow Borg-Warner's suggestion that the Section 304.122 standards be deleted. As noted by other commenters, the alternative standard proposed allows considerably higher ammonia nitrogen discharges which could have an effect upon the dissolved oxygen levels downstream of the discharge.

When the Board adopted old Rule 406 (Section 304.122), the Board in fact found that the river systems covered suffered from a unique dissolved oxygen problem. Deletion of that Section could, therefore, exacerbate an existing problem. Borg-Warner itself acknowledges that no testimony in this record is directed specifically at these river systems to show that there has been significant enough improvement in dissolved oxygen levels to warrant such deletion. If such evidence exists, or if an alternative strategy for dissolved oxygen control can be shown to remedy that problem, e.g. through the use of in-stream aeration, that evidence could be presented in a future regulatory proceeding directed at Section 304.122. This record, however, fails to support such deletion.

The Board has also declined to follow the Agency's recommendation that the un-ionized ammonia alternative standard be dropped. The Agency's concerns over the difficulty of monitoring, possible problems with dissolved oxygen levels and ammonia nitrogen toxicity, and a lack of cost savings have not been adequately supported.

The Agency was the only participant at the hearing to question the mathematical conversion technique to determine the un-ionized ammonia concentration, citing interference factors of turbidity and heavy metals (R.387-388). However, neither interference could be quantified, and the heavy metal interference is offset by the fact that ammonia complexed with heavy metals is less toxic than the un-ionized form (R.388-389). Further, several conversion tables exist and are in close agreement, and Drs. Muchmore and Heidinger did not feel that the conversion suffered from significant infirmities. The Board has determined that the table generated by the Agency and appearing in Exhibit 12 is in general agreement with other tables, as is the equation on which it is based [see Emerson, Kenneth; R.C. Russo; R.E. Lund; and R.V. Thurston; "Aqueous Ammonia Equilibrium Calculations: Effects of pH and Temperature," Journal Fisheries Research Board of Canada, Vol. 32, No. 12, pp. 2379-2383 (1975)]. The Board has included both the equation and a table in Section 302.212 to give both an easy reference to the water quality standard at typical pH and temperature levels and a means for calculating values which do not appear in the table.

The only evidence presented regarding ammonia nitrogen toxicity is based upon a 1962 study by Tabata and a 1978 study by Armstrong, et al. (R61-362). However, the applicability of these studies to Illinois fish is undetermined and the conclusions are quite general. Further, the imposition of an upper limit on ammonia nitrogen should help avoid any potential problems and the economic impact study (Ex.1) clearly indicates that the focus of the regulation should be on un-ionized ammonia toxicity rather than on ammonia nitrogen. The Agency itself admitted that there "is very limited information on the toxicity of combined forms of ammonia" (R.374).

Finally, the Board is modifying its proposal to establish an upper limit on the ammonia nitrogen concentration regardless of the un-ionized ammonia concentration. The Board has set that limit at 15 mg/l, which is higher than the 10 mg/l limitation recommended by the Agency and supported by Drs. Heidinger and Muchmore, but somewhat less than the normal influent loading to municipal treatment plants.

The Board has set that level in order to relieve municipalities from the burden of ammonia control where such control does not appear necessary to protect the environment. James Park, Manager of Technical Standards, Division of Water Pollution Control for the Agency, testified that some municipal plants without ammonia controls may discharge up to 30 mg/l of ammonia nitrogen, but that most fall in the 15-20 mg/l range (R.377). In its comments Galesburg states that 20 mg/l is "generally acceptable" as the concentration found in untreated wastewater of domestic origin.

Setting an upper limit at this time is somewhat difficult. If the Board were to rely on the Tabata data which indicates that ammonia nitrogen is somewhat less than one-fiftieth as toxic to fish as un-ionized ammonia, the upper limit would be set at somewhat higher than 2.0 mg/l. If, however, the Board were to conclude that the present state of knowledge regarding ammonia nitrogen toxicity is insufficient to necessitate control, a standard of 30 mg/l would be appropriate to allow most, if not all, municipal plants to be uncontrolled.

Given the burdensome costs associated with controls to reach the lower end of that range and the sparse evidence of toxicity, a standard as low as 2.0 mg/l is unjustifiable at this time. On the other hand, allowing a total absence of control in light of suspected environmental harm is equally unsupportable. The Board has, therefore, concluded that a middle ground of 15 mg/l is appropriate at this time. Since most municipal plants are exempted under Section 304.301, in any case, this standard is currently one more of form than of substance. Only after July 1, 1988 would it have general applicability. During the interim studies can proceed and data can be collected to establish a more meaningful standard. If future studies show that ammonia nitrogen toxicity at that level is a real problem or that the 15 mg/l standard can be raised without causing significant toxicity problems, that can be addressed in future regulatory proceedings. Based on the record in this proceeding a 15 mg/l limitation seems adequate to protect the environment.

ORDER

The Board hereby directs the Clerk to proceed to Second Notice in this matter, and proposes the following amendments to Title 35: Environmental Protection; Subtitle C: Water Pollution; Chapter I: Pollution Control Board (deleted language is lined through; added language is underlined):

Section 302.208 Chemical Constituents

The following levels of chemical constituents shall not be exceeded:

CONSTITUENT	STORET NUMBER	CONCENTRATION (mg/l)
Ammonia Nitrogen (as N)	00610	1.5
Arsenic (total)	01002	1.0
Barium (total)	01007	5.0
Boron (total)	01022	1.0
Cadmium (total)	01027	0.05
Chloride	00940	500.
Chromium (total hexavalent)	01032	0.05
Chromium (total trivalent)	01033	1.0
Copper (total)	01042	0.02

CONSTITUENT	STORET NUMBER	CONCENTRATION (mg/l)
Cyanide	00720	0.025
Fluoride	00951	1.4
Iron (total)	01045	1.0
Lead (total)	01051	0.1
Manganese (total)	01055	1.0
Mercury (total)	71900	0.0005
Nickel (total)	01067	1.0
Phenols	32730	0.1
Selenium (total)	01147	1.0
Silver	01077	0.005
Sulfate	00945	500.
Total Dissolved Solids	70300	1000.
Zinc	01092	1.0

Source: 6 Ill. Reg. , effective

Section 302.212 Ammonia Nitrogen and Un-ionized Ammonia

- a) Ammonia nitrogen (as N: Storet Number 31616) shall in no case exceed 15 mg/l.
- b) If ammonia nitrogen is less than 15 mg/l and greater than or equal to 1.5 mg/l, then un-ionized ammonia (as N) shall not exceed 0.04 mg/l.
- c) Ammonia nitrogen concentrations of less than 1.5 mg/l are lawful regardless of un-ionized ammonia concentration.
- d) For purposes of this section the concentration of un-ionized ammonia shall be computed according to the following equation:

$$U = \frac{N}{[0.94412(1 + 10^X) + 0.0559]} \quad \text{where:}$$

$$X = 0.09018 + \frac{2729.92}{(T + 273.16)} - \text{pH}$$

U = Concentration of un-ionized ammonia as N in mg/l

N = Concentration of ammonia nitrogen as N in mg/l

T = Temperature in degrees Celsius

- e) The following table indicates the maximum ammonia nitrogen concentrations allowable for certain combinations of pH and temperature:

TEMP. °C (°F)	AMMONIA NITROGEN WATER QUALITY STANDARD (mg/l)						
	pH						
	6.0	6.5	7.0	7.5	8.0	8.5	9.0
5 (41)	15	15	15	9.6	3.1	1.5	1.5
10 (50)	15	15	15	6.5	2.1	1.5	1.5
15 (59)	15	15	13.9	4.4	1.5	1.5	1.5
20 (68)	15	15	9.6	3.1	1.5	1.5	1.5
25 (77)	15	15	6.7	2.1	1.5	1.5	1.5
30 (86)	15	14.9	4.7	1.5	1.5	1.5	1.5
35 (95)	15	10.7	3.4	1.5	1.5	1.5	1.5

Source: 6 Ill. Reg. , effective

SUBPART (C); TEMPORARY EFFLUENT STANDARDS

Section 304.301 Exception for Ammonia Nitrogen Water Quality Violations

- a. Section 304.105 shall not apply to ~~that portion of~~ Section ~~302.212 302.208 pertaining to ammonia-nitrogen~~ for any effluent from a source in existence on April 1, 1977, having an untreated ammonia influent loading not exceeding 60 pounds per day and not otherwise needing upgrading to meet the requirements of this chapter.
- b. Section 304.105 shall not apply to ~~that portion of~~ Section ~~302.212 302.208 pertaining to ammonia-nitrogen~~ for any source during the months of November through March; except that during the months of November through March no source not exempt under paragraph (a) shall discharge an effluent containing a concentration of ammonia nitrogen greater than 4.0 mg/l if the discharge, alone or in combination with other discharges, causes or contributes to a violation of that portion of Section ~~302.208~~, 302.121 ~~pertaining to ammonia-nitrogen~~.
- c. Compliance with the provisions of paragraph (b) shall be achieved by March 31, 1979, or such other date as required by NPDES permit, or as ordered by the Board under Title VIII or Title IX of the Environmental Protection Act.
- d. After July 1, 1988, the exemptions provided in this section shall terminate.

Source: 6 Ill. Reg. , effective

Section 304.140 Delays in Upgrading

- a. All effluent standards required to be met on December 31, 1973 or December 31, 1974 and in response to Section 304.301 shall be met unless:
1. The discharger is eligible for a construction grant under Section 201(g) of the Clean Water Act; and,
 2. The discharger has filed an application for a construction grant on or before December 31, 1975; and,
 3. The discharger has timely taken all necessary pre-grant and post-grant actions appropriate to the specific grant step for which the discharger is then eligible.
 4. The exemption provided in (a)(1), (a)(2) and (a)(3) above shall terminate upon completion of construction under the grant provided and compliance with the provisions of this Section shall thereafter be required.

Source: 6 Ill. Reg. , effective

IT IS SO ORDERED.

I, Christian L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order was adopted on the 17th day of June, 1982 by a vote of 5-0.

Christian L. Moffett Clerk
Illinois Pollution Control Board