

SEP 1 1991  
Fact Sheet Date: \_\_\_\_\_

**- AQUATIC LIFE FACT SHEET -  
- Ambient Water Quality Value-**

**SUBSTANCE(S):** AMMONIA, Un-ionized (as NH<sub>3</sub>)

**CAS REGISTRY NUMBER(S):** NA

BASIS	VALUE (ug/L)	
	FRESHWATER	SALTWATER
Fish Propagation, Survival and Tainting	*	Not Available
Fish Survival and Tainting	*	Not Available

**REMARKS:**

\* Proposed standards for the pH range of 6.5 to 9.0 and the temperature range of 0°C to 30°C are listed in Tables 1 and 2.

**SUMMARY OF INFORMATION:**

EPA (1976) published a criterion of 0.02 mg/l (as un-ionized ammonia) for protection of freshwater aquatic life. The Great Lakes Water Quality Board (1978) recommended the same criterion.

EPA (1983) proposed that ammonia criteria should vary depending on receiving water pH and temperature. At that time, EPA also recommended use of a maximum to protect against acute toxicity and a 30-day average to protect against chronic toxicity. These criteria were determined to be applicable to New York waters and protective of aquatic life and were adopted in 1985 as water quality standards for Class D and Classes A-C, respectively.

The draft ammonia criteria of 1983 were revised and finalized in 1985. In addition to modifications to the acute and chronic formulae, EPA (1985) made two other changes to the criteria. Separate formulae were developed for waters in which salmonids and other sensitive coldwater species are present and one for waters in which these species are absent. Also, the acute criteria were expressed as one-hour averages and the chronic criteria were expressed as 4-day averages, neither to be exceeded more than once every 3 years on the average. Where limited variability of effluent ammonia concentrations and resultant concentrations in receiving waters can be demonstrated, it was recommended that the averaging period may be up to 30 days.

The species and range of water quality parameters tested as reported in EPA (1985) are representative of NYS, and are therefore applicable in the state. To determine whether the criteria would be protective, a comparison of the current standards with the EPA (1985) criteria was made. For each fish acute value reported in Table 1 and each fish chronic value in Table 2 of the EPA criteria document, the appropriate current and proposed acute or chronic criterion for salmonids and non-salmonids was calculated at the pH and temperatures reported. For salmonids, the EPA (1985) formulae for "salmonids or other sensitive coldwater species present" were used and for all other species, the EPA (1985) formulae for "salmonids and other sensitive coldwater species absent" were used. Ratios were then calculated for each test result to its respective criterion. Using the formulae in the current standards, it was found that for salmonids 5 of 140 and for non-salmonids 1 of 124 of the ratios of acute values to standards were less than 2, and for salmonids 4 of 10 and non-salmonids 0 of 14 of the ratios of chronic values to standards were less than 1. Using the formulae in EPA (1985) it was found that for salmonids 8 of 140 and for non-salmonids 2 of 124 of the ratios of acute values to criteria were less than 2, and for salmonids 1 of 10 and for non-salmonids 0 of 14 of the ratios of chronic values to criteria were less than 1. According to EPA criteria development guidelines, acute effects can be expected if the acute value to criterion ratio is less than 2, and chronic effects can be expected if the chronic value to criterion ratio is less than 1. Therefore, although the EPA (1985) acute formulae have been modified since EPA (1983) criteria were adopted as standards, the more recent salmonid formula provides about 94% protection and the non-salmonid formula provides about 98% protection when compared with actual test results. The EPA (1985) chronic formulae also provide better than 95% protection when compared with actual test results which is somewhat more protection than current standards provide. Site-specific studies have also supported both the acute and chronic criteria developed by EPA (Alexander *et al.* 1986, Mayes *et al.* 1986). It is concluded that the EPA (1985) criteria for salmonids and all other fish species would be protective of aquatic resources in NYS since invertebrates are generally more tolerant of ammonia than fish.

The criteria for salmonids and other fish species are identical except that for salmonids, "caps" were put on the acute and chronic formulae at 20 °C and 15 °C, respectively, whereas for non-salmonids, the "caps" were placed at 25 °C and 20 °C, respectively. EPA (1985) concluded that when salmonids and non-salmonids were tested at the same temperatures, which were suitable for both, the salmonids and non-salmonids exhibited equal sensitivity to ammonia. For salmonids, higher temperatures cause additional stress which led EPA (1985) to conclude that ammonia criteria for these fish should be capped at their thermal optima. In NYS, species which may have thermal requirements similar to salmonids will likely be associated with salmonids and should be protected if criteria for salmonids are applied to all waters with the (T) or (TS) specification.

In its final summation of the criteria, EPA (1985) states that there were little chronic data for non-salmonids at temperatures much below 20 °C, and that EPA would conduct research to fill the "perceived data gaps". In these situations, it was suggested that site-specific criteria may be warranted. Nevertheless, earlier in the document it is stated that the chronic

values at below 20°C appear correct for non-salmonids based on the similarity of acute sensitivity of salmonids and non-salmonids. Recent research with non-salmonids at temperatures less than 20°C verify that non-salmonids are about as sensitive as salmonids in cold water (DeGraeve, et al. 1987).

At the time of the development of this fact sheet, saltwater criteria for ammonia had not been finalized by EPA.

#### **DERIVATION OF VALUES:**

The ammonia criteria published by EPA (1985) were developed in accordance with Stephan et al. (1985). The data evaluated and formulae developed are applicable to New York waters, protective of aquatic resources, and should be adopted as NYS standards. The criteria for waters where "salmonids or other sensitive coldwater species present" should be applied in waters with the (T) or (TS) specification and the criteria for waters where "salmonids and other sensitive coldwater species absent" should be applied to all other classes of fresh surface waters. The "one-hour average" criteria are appropriate for Class D and the "4-day average" criteria are appropriate for all other freshwater classes. Listings of appropriate un-ionized ammonia standards with varying pH and temperature are given for classes AA, AA-s, A, A-s, B, and C (Table 1) and class D (Table 2). Linear interpolations for intermediate temperatures and pH values are appropriate.

Table 1.  
Un-ionized Ammonia Standards (ug/l as NH<sub>3</sub>)  
Classes A, A-S, AA, AA-S, B, C

For Waters With The (T) or (TS) Specification:

<u>pH</u>	<u>0°C</u>	<u>5°C</u>	<u>10°C</u>	<u>15-30°C</u>
6.50	0.7	0.9	1.3	1.9
6.75	1.2	1.7	2.3	3.3
7.00	2.1	2.9	4.2	5.9
7.25	3.7	5.2	7.4	11
7.50	6.6	9.3	13	19
7.75	11	15	22	31
8.0-9.0	13	18	25	35

For Waters Without The (T) or (TS) Specification:

<u>pH</u>	<u>0°C</u>	<u>5°C</u>	<u>10°C</u>	<u>15°C</u>	<u>20-30°C</u>
6.50	0.7	0.9	1.3	1.9	2.6
6.75	1.2	1.7	2.3	3.3	4.7
7.00	2.1	2.9	4.2	5.9	8.3
7.25	3.7	5.2	7.4	11	15
7.50	6.6	9.3	13	19	26
7.75	11	15	22	31	43
8.0-9.0	13	18	25	35	50

Table 2.  
Un-ionized Ammonia Standards (ug/l as NH<sub>3</sub>)  
Class D

<u>pH</u>	<u>0°C</u>	<u>5°C</u>	<u>10°C</u>	<u>15°C</u>	<u>20°C</u>	<u>25-30°C</u>
6.50	9.1	13	18	26	36	51
6.75	15	21	30	42	59	84
7.00	23	33	46	66	93	131
7.25	34	48	68	95	140	190
7.50	45	64	91	130	180	260
7.75	56	80	110	160	220	320
8.0-9.0	65	92	130	180	260	370

## REFERENCES

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