Fact Sheet Date: March 12, 1998

NEW YORK STATE
-AQUATIC FACT SHEET-

Ambient Water Quality Values for Protection of Aquatic Life

SUBSTANCE: Chromium, dissolved* **CAS REGISTRY NUMBER:** Not Applicable

TYPE:	BASIS:	FRESHWATER AMBIENT WATER QUALITY VALUE (ug/L):
Chronic	Propagation	$(0.86)e^{(0.819[\ln \text{ppm hardness}] + 0.6848)}$
Acute	Survival	$(0.316)e^{(0.819[\ln \text{ppm hardness}] + 3.7256)}$

REMARK: *Does not include hexavalent chromium

INTRODUCTION

These values apply to the water column and are derived to protect aquatic life from the effects of waterborne contaminants. Values for the protection of propagation of aquatic life are referred to as Aquatic (Chronic) or A(C) values. Values for the protection of survival of aquatic life are referred to as Aquatic (Acute) or A(A) values.

SUMMARY OF INFORMATION AND DERIVATION OF VALUE

U.S. EPA (1995a,b) has derived acute and chronic aquatic life criteria for dissolved chromium III for the Great Lakes Water Quality Initiative (GLI). The Department has reviewed these criteria and determined that they are based on appropriate data and derived according to the scientific procedures in current and proposed 6 NYCRR Part 702. They are thus determined to be appropriate ambient water quality values for protection of aquatic life for New York State.

The attachment to this fact sheet provides U.S. EPA's derivation of the values expressed as total metal. Conversion to the dissolved form is made using the factors of 0.86 and 0.316 for chronic and acute, respectively, presented in U.S. EPA (1995a). U.S. EPA's Criterion Continuous Concentration (CCC) and Criterion Maximum Concentration (CMC) are equivalent to New York's Aquatic (Chronic) and Aquatic (Acute) values respectively.

U.S. EPA's criteria are expressed as chromium III, dissolved. There is, however, no readily available or practical analytical method to distinguish chromium III from other species except chromium VI or to evaluate the various transformations of chromium in ambient waters. Because the measurement of chromium in ambient waters and the specification of effluent limitations will include species other than chromium III, it is reasonable to specify the ambient standard to include all species of dissolved chromium, except chromium VI. Chromium VI is more toxic than other species of chromium and a separate standard for chromium VI has been derived.

REFERENCES

U.S. EPA (Environmental Protection Agency). 1995a. Final Water Quality Guidance for the Great Lakes System. 60 Federal Register: 15366 - 15425. March 23, 1995.

U.S. EPA (Environmental Protection Agency) 1995b. Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water. EPA-820-B-95-004. March 1995.

New York State Department of Environmental Conservation
Division of Water
SJS
January 29, 1997

ATTACHMENT

GREAT LAKES WATER QUALITY INITIATIVE

Tier 1 Aquatic Life Criterion for Chromium(III)

The new acceptable acute data for chromium(III) are given in Table C1; no new acceptable chronic data were found. These data were used with those given in Tables 1 and 2 of the criteria document for chromium (U.S. EPA 1984) to obtain the values given in Table C2. Because the toxicity of chromium(III) is hardness-dependent, all acute values in Table C2 have been adjusted to a hardness of 50 mg/L.

Criterion Maximum Concentration (CMC)

The Final Acute Value (FAV) was calculated using the four lowest Genus Mean Acute Values in Table C2, resulting in an FAV of 2044 ug/L at a hardness of 50 mg/L. This value did not need to be lowered to protect a commercially or recreationally important species of the Great Lakes System. The CMC was calculated by dividing the FAV by 2, resulting in a CMC of 1022 ug/L, as total recoverable chromium(III), at a hardness of 50 mg/L. The CMC was related to hardness using the slope of 0.819 that was derived in U.S. EPA (1985):

$$CMC = e^{0.819(\ln \text{hardness}) + 3.7256}$$

Criterion Continuous Concentration (CCC)

Insufficient chronic toxicity data were available to calculate a Final Chronic Value (FCV) using the eight-family procedure. Sufficient chronic data were available to calculate a FCV by dividing the FAV by the Final Acute-Chronic Ratio (FACR). SMACRs were available for three species (Table C2) and the highest SMACR was obtained with the most resistant of the three. The other two SMACRs were within a factor of 2.4. The FACR was calculated as the geometric mean of the two ACRs and was 41.84. The FCV = FAV/FACR = (2044 ug/L)/(41.84) = 48.85 ug/L at a hardness of 50 mg/L. This value did not need to be lowered to protect a commercially or recreationally important species of the Great Lakes System. Thus the CCC was 48.85 ug/L, as total recoverable chromium(III), at a hardness of 50 mg/L. The CCC, was related to hardness using the slope of 0.819:

$$CCC = e^{0.819(\ln \text{hardness}) + 0.6848}$$

The Criterion

The procedures described in the GLI tier 1 methodology indicate that, except possibly where a locally important species is very sensitive, aquatic organisms should not be affected unacceptably if the four-day average concentration of chromium(III) does not exceed the numerical value (in ug/L) given by the equation

$$CCC = e^{0.819(\ln \text{hardness}) + 0.6848}$$

more than once every three years on the average and if the one-hour average concentration does not exceed the numerical value (in ug/L) given by the equation

$$CMC = e^{0.819(\ln \text{hardness}) + 3.7256}$$

more than once every three years on the average.

Table C1. New Acute Values for Chromium(III)

Species	Method*	Hardness (mg/L as $CaCO_3$)	Acute Value (ug/L)	Adjusted Acute Value (ug/L)**	Reference
Amphipod, Crangonyx pseudogracilis	S,U	50	291,000	291,000	Martin and Holdich 1986

* S = static, U = unmeasured.
** Adjusted to a hardness of 50 mg/L using a slope of 0.819.

Table C2. Ranked Genus Mean Acute Values for Chromium(III)

Rank*	Genus Mean Acute Value (ug/L)**	Species	Species Mean Acute Value (ug/L)**	Species Mean Acute-Chronic Ratio
19	291,000	Amphipod, Crangonyx pseudogracilis	291,000	-----
18	71060	Caddisfly, Hydropsyche betteni	71060	-----
17	50000	Caddisfly, Unidentified sp.	50000	-----
16	43100	Damselfly, Unidentified sp.	43100	-----
15	16010	Cladoceran, Daphnia magna	16010	>356.4***
14	15630	Banded killifish, Fundulus diaphanus	15630	-----
13	15370	Pumpkinseed, Lepomis gibbosus	15720	-----
		Bluegill, Lepomis macrochirus	15020	-----
12	14770	White perch, Morone americana	13320	-----
		Striped bass, Morone saxatilis	16370	-----
11	13230	Common carp, Cyprinus carpio	13230	-----
10	12860	American eel, Anguilla rostrata	12860	-----
9	11000	Midge, Chironomus sp.	11000	-----
8	10320	Fathead minnow, Pimephales promelas	10320	27.30
7	10210	Snail, Amnicola sp.	10210	-----
6	9669	Rainbow trout, Oncorhynchus mykiss	9669	64.11
5	9300	Worm, Nais sp.	9300	-----

Table C2. (Cont.)

Rank*	Genus Mean Acute Value (ug/L)**	Species	Species Mean Acute Value (ug/L)**	Species Mean Acute-Chronic Ratio
4	8684	Goldfish, Carassius auratus	8684	-----

3	7053	Guppy, Poecilia reticulata	7053	-----
2	3200	Amphipod, Gammarus sp.	3200	-----
1	2221	Mayfly, Ephemerella subvaria	2221	-----

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* Ranked from most resistant to most sensitive based on Genus Mean Acute Value.
** At hardness = 50 mg/L.
*** Not used in the calculation of the Final Acute-Chronic Ratio.

At hardness = 50 mg/L:

FAV = 2044 ug/L

CMC = FAV/2 = 1022 ug/L

As a function of hardness:

$$CMC = e^{0.819(\ln \text{hardness}) + 3.7256}$$

FACR = 41.84

At hardness = 50 mg/L:

FCV = FAV/FACR = (2044 mg/L)/(41.84) = 48.85 ug/L = CCC

As a function of hardness:

$$CCC = e^{0.819(\ln \text{hardness}) + 0.6848}$$

References

Martin, T.R., and D.M. Holdich. 1986. The Acute Lethal Toxicity of Heavy Metals to Peracarid Crustaceans (with Particular Reference to Fresh-water Asellids and Gammarids). Water Res. 20:1137-1147.

U.S. EPA. 1985. Ambient Aquatic Life Water Quality Criteria for Chromium(III) - 1984. EPA 440/5-84-029. National Technical Information Service, Springfield, VA.