Fact Sheet Date: March 12, 1998

NEW YORK STATE
-AQUATIC FACT SHEET-

Ambient Water Quality Values for Protection of Aquatic Life

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

TYPE:	BASIS:	FRESHWATER AMBIENT WATER QUALITY VALUE (ug/L):
Chronic	Propagation	4.6

INTRODUCTION

This value applies to the water column and is 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.

SUMMARY OF INFORMATION AND DERIVATION OF VALUE

U.S. EPA (1995a,b) has derived acute and chronic aquatic life criteria for dissolved selenium for the Great Lakes Water Quality Initiative (GLI). In 1996, the acute criterion was vacated by a court decision. The Department has reviewed the chronic criterion and determined that it is based on appropriate data and derived according to the scientific procedures in current and proposed 6 NYCRR Part 702. It is thus determined to be an appropriate ambient water quality value for protection of aquatic life for New York State. The attachment to this fact sheet provides U.S. EPA's derivation of the value for total metal. Conversion to the dissolved form is made using the factor of 0.922, presented in U.S. EPA (1995a). U.S. EPA's Criterion Continuous Concentration (CCC) and Criterion is equivalent to New York's Aquatic (Chronic) value. The reader should disregard U.S. EPA's presentation of a Criterion Maximum Concentration (CMC) in the attachment, as it represents the vacated acute criterion.

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 17, 1997

ATTACHMENT

GREAT LAKES WATER QUALITY INITIATIVE

Tier 1 Aquatic Life Criterion for Selenium

The new acceptable acute data for selenium are given in Table O1; no new acceptable chronic data were found. These new data were used with those given in Tables 1 and 2 of the criteria document for selenium (U.S. EPA 1987) to obtain the values given in Tables O2 and O3.

Selenium(IV):

Criterion Maximum Concentration (CMC)

The Final Acute Value (FAV) was calculated using the four lowest Genus Mean Acute Values given in Table O2, resulting in a FAV of 371.8 ug/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 185.9 ug/L.

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). Four Species Mean ACRs were available (Table O2), but the one determined with the acutely resistant species was higher than the other three; the three were within a factor of 2.4. The FACR was calculated as the geometric mean of the three and was 7.998. The FCV = FAV/FACR = (371.8 ug/L)/(7.998) = 46.49 ug/L. As in U.S. EPA (1987), this value was lowered to 27.6 ug/L to protect the commercially and recreationally important rainbow trout. The CCC was 27.6 ug/L.

Selenium(VI):

Criterion Maximum Concentration (CMC)

The Final Acute Value (FAV) was calculated using the four lowest Genus Mean Acute Values given in Table O3, resulting in a FAV of 25.066 ug/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 12.533 ug/L.

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). Three Species Mean ACRs were available (Table O3), and they increased as the acute sensitivities of the species increased. To make the FACR appropriate for sensitive species, it was set equal to the SMACR of 2.651 for the sensitive Daphnia magna. The FCV = FAV/FACR = (25.066 ug/L)/(2.651) = 9.455 ug/L. This value did not need to be lowered to protect a commercially or recreationally important species of the Great Lakes System. The CCC was 9.455 ug/L.

Total selenium:

As discussed in U.S. EPA (1987), field studies conducted on Belews Lake in North Carolina suggested that selenium might be more toxic to certain species of freshwater fish than had been observed in laboratory chronic toxicity tests. Based upon these field studies and some laboratory studies, the CCC for total selenium was set at 5 ug/L. The Final Acute-Chronic Ratio for total selenium was calculated as the geometric mean of the six ACRs in Tables O2 and O3 that are between 2.5 and 16.5 and was 7.737. The FAV was calculated by multiplying the CCC by the FACR and was 38.68 ug/L. The CMC was calculated by dividing the FAV by 2, resulting in a CMC of 19.34 ug/L as total recoverable selenium.

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 selenium does not exceed 5 ug/L more than once every three years on the average and if the one-hour average concentration does not exceed 19.34 ug/L more than once every three years on the average.

Table O1. New Acute Values for Selenium

Species	Method*	Chemical	Acute Value (ug/L)	Reference
Cladoceran, Daphnia magna	S,U	Na-selenite [Selenium(IV)]	680	Johnston 1987
Cladoceran, Daphnia magna	S,U	Na-selenate [Selenium(VI)]	750	Johnston 1987

* S = static, U = unmeasured.

Table O2. Ranked Genus Mean Acute Values for Selenium(IV)

Rank*	Genus Mean Acute Value (ug/L)	Species	Species Mean Acute Value (ug/L)	Species Mean Acute-Chronic Ratio
22	203000	Leech, Nephelopsis obscure	203000	-----
21	42500	Midge, Tanytarsus dissimilis	42500	-----
20	35000	Common carp, Cyprinus carpio	35000	-----
19	34910	Snail, Aplexa hypnorum	34910	-----
18	30176	White sucker, Catostomus commersoni	30176	-----
17	28500	Bluegill, Lepomis macrochirus	28500	-----
16	26100	Goldfish, Carassius auratus	26100	-----
15	25934	Midge, Chironomus plumosus	25934	-----
14	24100	Snail, Physa sp.	24100	-----
13	13600	Channel catfish, Ictalurus punctatus	13600	-----
12	12600	Mosquitofish, Gambusia affinis	12600	-----
11	11700	Yellow Perch, Perca flavescens	11700	-----
10	10490	Rainbow Trout, Oncorhynchus mykiss	10490	141.5**
9	10200	Brook trout, Salvelinus fontinalis	10200	-----
8	6500	Flagfish, Jordanella floridae	6500	-----

Table O2. Ranked Genus Mean Acute Values for Selenium(IV)

| Rank* | Genus Mean Acute Value (ug/L) | Species | Species Mean Acute Value (ug/L) | Species Mean Acute-Chronic Ratio |

7	2704	Amphipod, Gammarus pseudolimnaeus	2704	-----
6	1796	Cladoceran, Daphnia magna	834	13.31
		Cladoceran, Daphnia pulex	3870	5.586
5	1783	Striped bass, Morone saxatilis	1783	-----
4	1700	Hydra, Hydra sp.	1700	-----
3	1601	Fathead minnow, Pimephales promelas	1601	6.881
2	<603.6	Cladoceran, Ceriodaphnia affinis	<603.6	-----
1	340	Amphipod, Hyalella azteca	340	-----

* Ranked from most resistant to most sensitive based on Genus Mean Acute Value.
** Not used in the calculation of the Final Acute-Chronic Ratio.

FAV = 371.8 ug/L

CMC = FAV/2 = 185.9 ug/L

FACR = 7.998

FCV = FAV/FACR = (371.8 ug/L)/(7.998) = 46.49 ug/L

Lowered to protect rainbow trout:

FCV = 27.6 ug/L = CCC

Table O3. Ranked Genus Mean Acute Values for Selenium(VI)

Rank*	Genus Mean Acute Value (ug/L)	Species	Species Mean Acute Value (ug/L)	Species Mean Acute-Chronic Ratio
11	442000	Leech, Hephelopsis obscura	442000	-----
10	193000	Snail, Aplexa hypnorum	193000	-----
9	66000	Channel catfish, Ictalurus punctatus	66000	-----
8	63000	Bluegill, Lepomis macrochirus	63000	-----
7	47000	Rainbow trout, Oncorhynchus mykiss	47000	16.26
6	20000	Midge, Paratanytarsus parthenogeneticus	20000	-----
5	7300	Hydra, Hydra sp.	7300	-----
4	5500	Fathead minnow, Pimephales promelas	5500	9.726
3	760	Amphipod, Hyalella azteca	760	-----
2	550.1	Cladoceran, Daphnia magna	1230	2.651
		Cladoceran, Daphnia pulicaria	246	-----
1	65.38	Amphipod, Gammarus pseudolimnaeus	65.38	-----

* Ranked from most resistant to most sensitive based on Genus Mean Acute Value.

FAV = 25.066 ug/L

CMC = FAV/2 = 12.533 ug/L

FACR = 2.651

FCV = FAV/FACR = (25.066 ug/L)/(2.651) = 9.455 ug/L = CCC

References

Johnston, P.A. 1987. Acute Toxicity of Inorganic Selenium to Daphnia magna (Straus) and the Effect of Sub-acute Exposure upon Growth and Reproduction. Aquatic Toxicol. 10:335-352.

U.S. EPA. 1987. Ambient Aquatic Life Water Quality Criteria for Selenium. EPA 440/5-87-006. National Technical Information Service, Springfield, VA.