

**NOTE OF EXPLANATION FOR AQUATIC FACT SHEETS FOR
HEXAVALENT CHROMIUM**

The Aquatic Type numerical values for hexavalent chromium are supported by more than one Fact Sheet. The freshwater values are supported by the Fact Sheet dated March 1998. The saltwater values are supported by the two Fact Sheets dated May 23, 1985 and September 7, 1984, as explained on the separate cover sheet dated September 13, 1985. The reader should disregard the documentation for the freshwater values in the 1984 and 1985 Fact Sheets.

FACT SHEET, REVISED 9-13-85

FACT SHEET, REVISED

SURFACE WATER QUALITY
STANDARD DOCUMENTATION

Chromium, hexavalent

The numerical standards for this substance are supported by the two attached fact sheets. The original fact sheet was prepared in 1984 prior to the public hearings for the standards and the May 1985 fact sheet was prepared subsequent to the hearings. The 1985 fact sheet reflects a change by EPA in the basis for water quality criteria. The Department promulgated the latter values when they were slightly less stringent and would therefore have no economic impact on the dischargers which have this substance as a water quality-based effluent limitation in their permits. When values from the 1985 fact sheet were more stringent, they were not promulgated and the original values were used. Consequently, the standards are supported by information from both fact sheets.

Date: May 23, 1985

Surface Water Quality
Standard Documentation

Chemical: Chromium, hexavalent

C.A.S, No.(s): N/A

Basis (Human/Aquatic): Aquatic

Standard by Water Classification:

	<u>ug/l</u>	<u>Notes</u>
Classes AA,AA-s;A;A-s;B;C	11	H
Class D	16	H
Classes SA;SB;SC;I	50	H
Class SD	1,100	H

Remarks: Standards apply to the acid-soluble form.

Summary of Information

1. EPA. 1980. Ambient water quality criteria for chromium. EPA 440/5-80-035, USEPA, Wash., D.C. 105 pp + vii.
 - hexavalent chromium criteria derived following the National Guidelines:
 - freshwater: 0.29 ug/l as an average and 21 ug/l not to be exceeded at anytime.
 - saltwater: 18 ug/l as an average and 1,260 ug/l not to be exceeded at anytime.
2. EPA. 1985. Ambient aquatic life water quality criteria for chromium. [proposed final]. USEPA, Washington, D.C., 98 pages.
 - hexavalent chromium criteria derived following the revised national guidelines:
 - freshwater: 11 ug/l as a four day average and 16 ug/l as a one hour average.
 - saltwater: 50 ug/l as a four day average and 1,100 ug/l as a one hour average.

- criteria are expressed as acid-soluble hexavalent chromium, operationally defined as the hexavalent chromium that passes through a 0.45 micron membrane filter after the sample is acidified to pH 1.5 to 2.0 with nitric acid.
- the significant relaxation of criteria from EPA (1980) reflects the expanded database, most significantly for chronic effects, and the use of the revised guidelines.

Criteria Derivation

The EPA (1985) proposed criteria are the product of the most recent review and evaluation of the literature on hexavalent chromium toxicity. The fresh and salt water "one hour average" should be adopted as the standards for classes D and SD, respectively. The fresh and salt water "four day averages" should be adopted as the standards for all other fresh and salt water classes, respectively.

Although the current EPA average criterion for freshwater is a significant relaxation recent data demonstrates that the value should prevent chronic toxicity. The criterion of 11 ug/l exceeds the geometric mean of the chronic values for Daphnia magna, but it is equal to the geometric mean of the chronic values for all cladocerans, the most sensitive group.

"Acid-soluble" is currently the best estimate of the bioavailable form of hexavalent chromium and should be used for the NYS standard.

Date: September 7, 1984

Surface Water Quality
Standard Documentation

Chemical: Chromium, hexavalent, dissolved

C.A.S. No.(s): N/A

Basis (Human/Aquatic): Aquatic

Standard by Water Classification:

	<u>ug/l</u>	<u>Notes</u>
Classes AA,AA-s;A;A-s;B;C	7.2	H
Class D	11	H
Classes SA;SB;SC;I	54	H
Class SD	1,200	H

Remarks:

Summary of Information

1. EPA. 1980. Ambient water quality criteria for chromium. EPA 440/5-80-035, USEPA, Wash., D.C. 105 pp + vii.

-hexavalent chromium criteria derived following the National Guidelines:

-freshwater: 0.29 ug/l as an average and 21 ug/l not to be exceeded at anytime.
-saltwater: 18 ug/l as an average and 1,260 ug/l not to be exceeded at anytime.
2. EPA. 1983. Revised section B of ambient water quality criteria for chromium-draft. USEPA, Wash., D.C. 82 pp. (availability announced in the February 7, 1984 Fed. Reg., p4551.)

-hexavalent chromium criteria derived following the revised National Guidelines:

-freshwater: 7.2 ug/l as an average and 11 ug/l as a maximum.
-saltwater: 54 ug/l as an average and 1,200 ug/l as a maximum.

-the significant relaxation of criteria from EPA (1980) reflects the expanded database, most significantly for chronic effects, and the use of the revised Guidelines.

Criteria Derivation

The EPA (1983) proposed criteria are the product of the most recent review and evaluation of the literature on hexavalent chromium toxicity. The fresh and salt water maxima should be adopted as the standards for classes D and SD, respectively. The fresh and salt water averages should be adopted as the standards for all other fresh and salt water classes, respectively.

Although the current EPA average criterion for freshwater is a significant relaxation recent data demonstrates that the value should prevent chronic toxicity. The criterion of 7.2 ug/l exceeds the geometric mean of the chronic values for Daphnia magna, but it is less than the geometric mean of the chronic values for all cladocerans, the most sensitive group.

Fact Sheet Date: March 12, 1998

**NEW YORK STATE
-AQUATIC FACT SHEET-**

**Ambient Water Quality Values
for Protection of Aquatic Life**

SUBSTANCE: Chromium (VI),
dissolved

CAS REGISTRY NUMBER: Not Applicable

TYPE:	BASIS:	FRESHWATER AMBIENT WATER QUALITY VALUE (ug/L):
Chronic	Propagation	11
Acute	Survival	16

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 (VI) 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 dissolved form is made using the factors of 0.962 and 0.982 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.

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 14, 1997

ATTACHMENT

GREAT LAKES WATER QUALITY INITIATIVE

Tier 1 Aquatic Life Criterion for Chromium(VI)

The new acceptable acute data for chromium(VI) are given in Table D1; no new acceptable chronic data were used. These new data were used with those given in Tables 1 and 2 of the criteria document for chromium (U.S. EPA 1985) to obtain the values given in Table D2.

Criterion Maximum Concentration (CMC)

The Final Acute Value (FAV) was calculated using the four lowest Genus Mean Acute Values given in Table D2, resulting in a FAV of 32.04 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 16.02 ug/L, as total recoverable chromium(VI).

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). Eight SMACRs were available (Table D2), but three were high SMACRs that were obtained with resistant species and one was a "greater than" value. Of the eight, only four were appropriate for use in calculating the FACR and the four were within a factor of 6. The FACR was calculated as the geometric mean of these four and was 2.917. The FCV = FAV/FACR = (32.04 ug/L)/(2.917) = 10.98 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 10.98 ug/L, as total recoverable chromium(VI).

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(VI) does not exceed 10.98 ug/L more than once every three years on the average and if the one-hour average concentration does not exceed 16.02 ug/L more than once every three years on the average.

Table D1. New Acute Values for Chromium(VI)

Species	Method*	Chemical	Acute Value (ug/L)	Reference
Cladoceran, Daphnia magna	S,U	K-dichromate	900**	Berglind and Dave 1984
Cladoceran, Daphnia magna	S,U	Na-dichromate	112**	Elnabarawy et al. 1986
Cladoceran, Daphnia pulex	S,M	K-dichromate	170**	Dorn et al. 1987
Cladoceran, Daphnia pulex	S,U	K-dichromate	190**	Dorn, et al. 1987
Cladoceran, Daphnia pulex	S,M	K-dichromate	20**	Dorn, et al. 1987
Cladoceran, Daphnia pulex	S,U	K-dichromate	20**	Dorn, et al. 1987
Cladoceran, Daphnia pulex	S,M	K-dichromate	40**	Dorn, et al. 1987
Cladoceran, Daphnia pulex	S,U	K-dichromate	40**	Dorn, et al. 1987
Cladoceran, Daphnia pulex	S,U	Na-dichromate	122**	Elnabarawy et al. 1986
Cladoceran, Daphnia pulex	S,M	K-dichromate	180**	Jop et al. 1987
Cladoceran, Daphnia pulex	S,M	K-dichromate	180**	Jop et al. 1987
Amphipod, Crangonyx pseudogracilis	R,U	K-dichromate	420	Martin and Holdich 1986
Amphipod, Crangonyx pseudogracilis	R,U	K-dichromate	810	Martin and Holdich 1986
Bluegill, Lepomis macrochirus	S,M	K-dichromate	182,000**	Jop et al. 1987
Bluegill, Lepomis macrochirus	S,M	K-dichromate	154,000**	Jop et al. 1987
Bluegill, Lepomis macrochirus	S,M	K-dichromate	201,240**	Dorn et al. 1987

Table D1. (Cont.)

Species	Method*	Chemical	Acute Value (ug/L)	Reference
Bluegill, Lepomis macrochirus	S,U	K-dichromate	164,730**	Dorn et al. 1987
Bluegill, Lepomis macrochirus	S,M	K-dichromate	199,200**	Dorn et al. 1987
Bluegill, Lepomis macrochirus	S,U	K-dichromate	158,360**	Dorn et al. 1987
Bluegill, Lepomis macrochirus	S,M	K-dichromate	148,310**	Dorn et al. 1987
Bluegill, Lepomis macrochirus	S,U	K-dichromate	146,530**	Dorn et al. 1987
Fathead minnow, Pimephales promelas	S,M	K-dichromate	46,000**	Jop et al. 1987
Fathead minnow, Pimephales promelas	S,M	K-dichromate	34,000**	Jop et al. 1987
Fathead minnow, Pimephales promelas	S,U	K-dichromate	26,130**	Dorn et al. 1987
Fathead minnow, Pimephales promelas	S,M	K-dichromate	26,410**	Dorn et al. 1987

* S = static, FT = flow-through, M = measured, U = unmeasured.

** Not used in the calculation of the SMAV because data were available for this species from a "FT,M" test.

Table D2. Ranked Genus Mean Acute Values for Chromium(VI)

Rank*	Genus Mean Acute Value (ug/L)	Species	Species Mean Acute Value (ug/L)	Species Mean Acute-Chronic Ratio
28	1,870,000	Stonefly, <i>Neophasganophora capitata</i>	1,870,000	-----
27	176,000	Crayfish, <i>Orconectes rusticus</i>	176,000	-----
26	140,000	Damselfly, <i>Enallagma aspersum</i>	140,000	-----
25	123,500	Green sunfish, <i>Lepomis cyanellus</i>	114,700	-----
		Bluegill, <i>Lepomis macrochirus</i>	132,900	-----
24	119,500	Goldfish, <i>Carassius auratus</i>	119,500	-----
23	72,600	White crappie, <i>Pomoxis annularis</i>	72,600	-----
22	69,000	Rainbow trout, <i>Oncorhynchus mykiss</i>	69,000	260.8**
21	67,610	Emerald shiner, <i>Notropis atherinoides</i>	48,400	-----
		Striped shiner, <i>Notropis chrysocephalus</i>	85,600	-----
		Sand shiner, <i>Notropis stramineus</i>	74,600	-----
20	61,000	Midge, <i>Chironomus tentans</i>	61,000	-----
19	59,000	Brook trout, <i>Salvelinus fontinalis</i>	59,000	223**
18	57,300	Midge, <i>Tanytarsus dissimilis</i>	57,300	-----
17	51,250	Central stoneroller, <i>Campostoma anomalum</i>	51,250	-----
16	49,600	Silverjaw minnow, <i>Ericymba buccata</i>	49,600	-----

Table D2. (Cont.)

Rank*	Genus Mean Acute Value (ug/L)	Species	Species Mean Acute Value (ug/L)	Species Mean Acute-Chronic Ratio
15	47,180	Bluntnose minnow, <i>Pimephales notatus</i>	54,225	-----
		Fathead minnow, <i>Pimephales promelas</i>	41,050	18.55**
14	46,000	Johnny darter, <i>Etheostoma nigrum</i>	46,000	-----
13	36,300	Yellow perch, <i>Perca flavescens</i>	36,300	-----
12	30,450	Striped bass, <i>Morone saxatilis</i>	30,450	-----
11	30,000	Guppy, <i>Poecilia reticulata</i>	30,000	-----
10	23,010	Snail, <i>Physa heterostropha</i>	23,010	-----
9	1,560	Bryozoan, <i>Lophopodella carteri</i>	1,560	-----
8	1,440	Bryozoan, <i>Pectinatella magnifica</i>	1,440	-----
7	650	Bryozoan, <i>Plumatella emarginata</i>	650	-----
6	630	Amphipod, <i>Hyalella azteca</i>	630	-----
5	583	Amphipod, <i>Crangonyx pseudogracilis</i>	583	-----
4	67.1	Amphipod, <i>Gammarus pseudolimnaeus</i>	67.1	-----
3	45.1	Cladoceran, <i>Ceriodaphnia reticulata</i>	45.1	1.13
2	36.35	Cladoceran, <i>Simocephalus serrulatus</i>	40.9	2.055
		Cladoceran, <i>Simocephalus vetulus</i>	32.3	5.267

Table D2. (Cont.)

Rank*	Genus Mean Acute Value (ug/L)	Species	Species Mean Acute Value (ug/L)	Species Mean Acute-Chronic Ratio
1	28.94	Cladoceran, Daphnia magna	23.07	>6.957**
		Cladoceran, Daphnia pulex	36.3	5.92

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

** Not used in the calculation of the Final Acute-Chronic Ratio.

$$FAV = 32.04 \text{ ug/L}$$

$$CMC = FAV/2 = 16.02 \text{ ug/L}$$

$$FACR = 2.917$$

$$FCV = FAV/FACR = (32.04 \text{ ug/L}) / (2.917) = 10.98 \text{ ug/L} = CCC$$

References

Berglind, R., and G. Dave. 1984. Acute Toxicity of Chromate, DDT, PCP, TPBS, and Zinc to *Daphnia magna* Cultured in Hard and Soft Water. *Bull. Environ. Contam. Toxicol.* 33:63-68.

Dorn, P.B., J.H. Rodgers, Jr., K.M. Jop, J.C. Raia, and K.L. Dickson. 1987. Hexavalent Chromium as a Reference Toxicant in Effluent Toxicity Tests. *Environ. Toxicol. Chem.* 6:435-444.

Elnabarawy, M.T., A.N. Welter, and R.R. Robideau. 1986. Relative Sensitivity of Three *Daphnia* Species to Selected Organic and Inorganic Chemicals. *Environ. Toxicol. Chem.* 5:393-398.

Jop, K.M., T.F. Parkerton, J.H. Rodgers, and K.L. Dickson. 1987. Comparative Toxicity and Speciation of Two Hexavalent Chromium Salts in Acute Toxicity Tests. *Environ. Toxicol. Chem.* 6:697-703.

Martin, J.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 Water Quality Criteria for Chromium - 1984. EPA 440/5-84-029. National Technical Information Service, Springfield, VA.