DERIVATION OF ACUTE AND CHRONIC TOXICITY CRITERIA
FOR CHROMIUM (+6)
PREPARED BY: JIM SCHMIDT - WDNR
August, 2001

EPA SPECIES MEAN ACUTE VALUES

(values from 1/85 EPA AWQC document, EPA 440/5-84-029 and 3/95 GLI Criteria Update, EPA-820-B-95-004)

Snail (*Physa heterostropha*)

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	16800	S	U	Patrick, et al. 1968
45	17300	S	U	Patrick, et al. 1968, ANS, 1960
45	17300	S	U	ANS, 1960
171	40600	S	U	ANS, 1960
171	31600	S	U	ANS, 1960
76.76	23010.33			GEOMEAN (5 results)

Cladoceran *(Ceriodaphnia reticulata)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	45.2	FT	M	Mount, 1982
45	45	FT	M	Mount and Norberg, 1984
45	45.10			GEOMEAN (2 results)

Cladoceran *(Daphnia pulex)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	36.3	S	M	Cairns, et al. 1978
45	40.9	S	U	Mount and Norberg, 1984
45	50	FT	M	Mount, 1982
not given	170	S	M	Dorn, et al. 1987
not given	190	S	U	Dorn, et al. 1987
not given	20	S	M	Dorn, et al. 1987
not given	20	S	U	Dorn, et al. 1987
not given	40	S	M	Dorn, et al. 1987
not given	40	S	U	Dorn, et al. 1987
not given	122	S	U	Elnabarawy, et al. 1986
not given	180	S	M	Jop, et al. 1987
not given	180	S	U	Jop, et al. 1987
45	36.3			GEOMEAN (1 FT result)

Cladoceran *(Daphnia magna)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
not given	< 103	S	U	Anderson, 1946
not given	< 123	S	U	Anderson, 1946
not given	141	S	U	Dowden and Bennett, 1965
not given	3490	S	U	Dowden and Bennett, 1965
213	212	S	M	Call, et al. 1981 (pH 8.2 – 8.4)
196	85.7	S	M	Call, et al. 1981 (pH 7.5 – 7.6)
50	19.9	S	M	Call, et al. 1981 (pH 7.5)
45	900	S	M	Cairns, et al. 1978
not given	50	S	M	Trabalke and Gehrs, 1977
100	175	S	M	White, 1979
92	157	S	M	White, 1979
185	131	S	M	Call, et al. 1981 (pH 8.2 – 8.4)
196	73.6	S	M	Call, et al. 1981 (pH 7.5 – 7.6)
50	21.3	S	M	Call, et al. 1981 (pH 7.5)
212	157	S	M	Call, et al. 1981 (pH 8.2 – 8.4)
188	66.7	S	M	Call, et al. 1981 (pH 7.5 – 7.6)
50	15.3	S	M	Call, et al. 1981 (pH 7.5)
185	164	S	M	Call, et al. 1981 (pH 8.2 – 8.4)
213	75.8	S	M	Call, et al. 1981 (pH 7.5 – 7.6)
50	20.6	S	M	Call, et al. 1981 (pH 7.5)
240	81	S	U	Stephenson and Watts, 1984
240	110	S	U	Stephenson and Watts, 1984
240	35	S	U	Stephenson and Watts, 1984
45	24.2	FT	M	Mount, 1982
45	22	FT	M	Mount and Norberg, 1984
not given	900	S	U	Berglind and Dave, 1984
not given	112	S	U	Elnabarawy, et al. 1986
45	23.07			GEOMEAN (2 FT results)

Cladoceran *(Simocephalus serrulatus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	40.9	FT	M	Mount, 1982
45	40.9			GEOMEAN (1 result)

Cladoceran *(Simocephalus vetulus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	50	S	U	Mount and Norberg, 1984
45	32.3	FT	M	Mount, 1982
45	32.3			GEOMEAN (1 FT result)

Amphipod *(Hyalella azteca)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
50	630	S	M	Call, et al. 1981
50	630			GEOMEAN (1 result)

Amphipod *(Crangonyx pseudogracilis)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
not given	420	R	U	Martin and Holdich, 1986
not given	810	R	U	Martin and Holdich, 1986
	583.27			GEOMEAN (2 results)

Amphipod *(Gammarus pseudolimnaeus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
50	101	S	M	Call, et al. 1981
48	94.1	S	U	Call, et al. 1983
48	67.1	FT	M	Call, et al. 1983
48	67.1			GEOMEAN (1 FT result)

Crayfish *(Orconectes rusticus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	176000	S	M	White, Manuscript
138.56	176000			GEOMEAN (1 result)

Damselfly *(Enallagma aspersum)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	140000	S	M	White, Manuscript
138.56	140000			GEOMEAN (1 result)

Stonefly *(Neophasganophora capitata)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	1870000	S	M	White, Manuscript
138.56	1870000			GEOMEAN (1 result)

Midge *(Chironomus tentans)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
101	61000	S	M	Batac-Catalan and White, 1983
101	61000			GEOMEAN (1 result)

Midge *(Tanytarsus dissimilis)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
47	57300	FT	M	Call, et al. 1983
47	57300			GEOMEAN (1 result)

Bryozoan *(Pectinatella magnifica)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
205	1440	S	U	Pardue and Wood, 1980
205	1440			GEOMEAN (1 result)

Bryozoan *(Lophopodella carteri)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
205	1560	S	U	Pardue and Wood, 1980
205	1560			GEOMEAN (1 result)

Bryozoan *(Plumatella emarginata)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
205	650	S	U	Pardue and Wood, 1980
205	650			GEOMEAN (1 result)

Rainbow trout *(Onchorhynchus mykiss)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	69000	FT	M	Benoit, 1976
45	69000			GEOMEAN (1 result)

Brook trout *(Salvelinus fontinalis)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	59000	FT	M	Benoit, 1976
45	59000			GEOMEAN (1 result)

Central stoneroller *(Campostoma anomalum)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	51250	S	M	White, Manuscript
138.56	51250			GEOMEAN (1 result)

Emerald shiner *(Notropis atherinoides)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	48400	S	M	White, Manuscript
138.56	48400			GEOMEAN (1 result)

Striped shiner *(Notropis chrysocephalus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	85600	S	M	White, Manuscript
138.56	85600			GEOMEAN (1 result)

Sand shiner *(Notropis stramineus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	74600	S	M	White, Manuscript
138.56	74600			GEOMEAN (1 result)

Goldfish *(Carassius auratus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
20	37500	S	U	Pickering and Henderson, 1966
not given	110000	S	U	Riva, et al. 1981
220	123000	FT	M	Adelman and Smith, 1976
220	123000	FT	M	Adelman and Smith, 1976
220	90000	FT	M	Adelman and Smith, 1976
220	125000	FT	M	Adelman and Smith, 1976
220	109000	FT	M	Adelman and Smith, 1976
220	135000	FT	M	Adelman and Smith, 1976
220	110000	FT	M	Adelman and Smith, 1976
220	129000	FT	M	Adelman and Smith, 1976
220	98000	FT	M	Adelman and Smith, 1976
220	133000	FT	M	Adelman and Smith, 1976
220	102000	FT	M	Adelman and Smith, 1976
220	133000	FT	M	Adelman and Smith, 1976
220	126000	FT	M	Adelman and Smith, 1976
220	126000	FT	M	Adelman and Smith, 1976
220	133000	FT	M	Adelman and Smith, 1976
220	126000	FT	M	Adelman and Smith, 1976
220	124000	FT	M	Adelman and Smith, 1976
220	119522.10			GEOMEAN (17 FT results)

Bluntnose minnow *(Pimephales notatus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	54225	S	M	White, Manuscript
138.56	54225			GEOMEAN (1 result)

Fathead minnow *(Pimephales promelas)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120-160	58000	S	M	White, Manuscript
209	39700	S	U	Pickering, 1980
209	32700	S	U	Pickering, 1980
20	17600	S	U	Pickering and Henderson, 1966
360	27300	S	U	Pickering and Henderson, 1966
20	45600	S	U	Pickering and Henderson, 1966
209	37700	FT	M	Pickering, 1980
209	37000	FT	M	Pickering, 1980
209	35900	FT	M	Pickering, 1980
not given	52000	FT	M	Ruesink and Smith, 1975
not given	37000	FT	M	Ruesink and Smith, 1975
400	24140	FT	M	Waheda, 1977
400	22580	FT	M	Waheda, 1977
not given	46000	S	M	Jop, et al. 1987
not given	34000	S	M	Jop, et al. 1987
not given	26130	S	U	Dorn, et al. 1987
not given	26410	S	M	Dorn, et al. 1987
220	56000	FT	M	Adelman and Smith, 1976

220	51000	FT	M	Adelman and Smith, 1976
220	53000	FT	M	Adelman and Smith, 1976
220	49000	FT	M	Adelman and Smith, 1976
220	48000	FT	M	Adelman and Smith, 1976
220	60000	FT	M	Adelman and Smith, 1976
220	50000	FT	M	Adelman and Smith, 1976
220	53000	FT	M	Adelman and Smith, 1976
220	49000	FT	M	Adelman and Smith, 1976
220	37000	FT	M	Adelman and Smith, 1976
220	66000	FT	M	Adelman and Smith, 1976
220	55000	FT	M	Adelman and Smith, 1976
220	38000	FT	M	Adelman and Smith, 1976
220	34000	FT	M	Adelman and Smith, 1976
220	29000	FT	M	Adelman and Smith, 1976
220	34000	FT	M	Adelman and Smith, 1976
220	26000	FT	M	Adelman and Smith, 1976
220	33200	FT	M	Broderius and Smith, 1976
230.19 *	41049.62			GEOMEAN (25 FT results)

* - Geometric mean of only the 23 FT results with hardness information.

White crappie *(Pomoxis annularis)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	72600	S	M	White, Manuscript
138.56	72600			GEOMEAN (1 result)

Striped bass *(Morone saxatilis)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
35	35000	S	U	Hughes, 1973
35	26500	S	U	Hughes, 1973
35	30455			GEOMEAN (2 results)

Johnny darter *(Etheostoma nigrum)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	46000	S	M	White, Manuscript
138.56	46000			GEOMEAN (1 result)

Yellow perch *(Perca flavescens)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
120 – 160	36300	S	M	White, Manuscript
138.56	36300			GEOMEAN (1 result)

Green sunfish *(Lepomis cyanellus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
400	89160	FT	M	Waheda, 1977
400	147560	FT	M	Waheda, 1977
400	114702			GEOMEAN (2 results)

Bluegill *(Lepomis macrochirus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
20	118000	S	U	Pickering and Henderson, 1966
360	133000	S	U	Pickering and Henderson, 1966
45	110000	S	U	Trama and Benoit, 1960
45	170000	S	U	Trama and Benoit, 1960
44	113000	S	U	Cairns and Scheier, 1958, 1959, 1968, Patrick, et al. 1968
44	113000	S	U	Cairns and Scheier, 1959
44	113000	S	U	Cairns and Scheier, 1959
44	120000	S	U	Cairns and Scheier, 1959
44	168800	S	U	Cairns and Scheier, 1959, Patrick, et al. 1968
44	147000	S	U	Cairns and Scheier, 1959
171	135000	S	U	ANS, 1960
171	130400	S	U	ANS, 1960
120 – 160	144500	S	M	White, Manuscript
20 – 22, 42 - 44	132890	FT	M	Cairns, et al. 1981
not given	182000	S	M	Jop, et al. 1987
not given	154000	S	M	Jop, et al. 1987
not given	201240	S	M	Jop, et al. 1987
not given	164730	S	U	Dorn, et al. 1987
not given	199200	S	M	Dorn, et al. 1987
not given	158360	S	U	Dorn, et al. 1987
not given	148310	S	M	Dorn, et al. 1987
not given	146530	S	U	Dorn, et al. 1987
30.03	132890			GEOMEAN (1 FT result)

Species with chromium (+6) acute toxicity data that are not resident to Wisconsin include silverjaw minnow (*Ericymba buccata*) and guppy (*Poecilia reticulata*); these were excluded from the database used to calculate GMAVs.

MINIMUM DATABASE REQUIREMENT EVALUATION

According to s. NR 105.05(1)(a), acute toxicity criteria can be calculated if data are available on one or more species of freshwater animal in at least 8 different families, provided that of the 8 species:

1. At least one is a salmonid fish in the family Salmonidae in the class Osteichthyes,
2. At least one is a non-salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important species,
3. At least one is a planktonic crustacean (e.g., cladoceran, copepod),
4. At least one is a benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish),
5. At least one is an insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge),
6. At least one is a fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions,
7. At least one is an organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca), and
8. At least one is an organism from a family in any order of insect or any other phylum not already represented in subds. 1. to 7.

Using the above numbering scheme, the following species are represented in the minimum database requirements for criteria calculation. If any of the 8 categories are not represented in the database, a

criterion cannot be calculated under ch. NR 105. Instead, a secondary value must be calculated.

1. Rainbow trout
2. Bluegill
3. Cladoceran *(D. magna)*
4. Amphipod (*G. pseudolimnaeus*)
5. Midge *(T. dissimilis)*
6. Fathead minnow, family Cyprinidae
7. Snail (*P. heterostropha*)
8. Yellow perch, family Percidae

CONCLUSION: An acute toxicity criterion can be calculated for chromium (+6) according to ch. NR 105.

EPA did not pursue the hardness vs. toxicity relationship at this time. Bluegill had information over a wide range of hardness, but the relationship between the two parameters was deemed to be insignificant (results were not significantly different in hard vs. soft water). Fathead minnow had data over a wide range of hardness, but any parameter relationships were unclear due to the combination of static and flow-through tests data. With a majority of the fathead minnow results at 220 PPM hardness, any r^2 calculations could easily be misinterpreted. The only other organism with a larger database over a wide range of hardness was *Daphnia magna*, but given the questions about the other species with data it could not be assumed that any relationship for one species should be extrapolated to all organisms. As a result, only genus mean acute values were calculated.

		GMAV	CLASSIFICATIONS *			
GENUS NAME (w/ component species)		(ug/L)	CW	WW	LFF	LAL
Neophasganophora		1870000	x	x	x	x
Orconectes		176000	x	x	x	x
Enallagma		140000	x	x	x	x
Lepomis:		123461.29	x	x		
L. macrochirus	132890					
L. cyanellus	114702					
Carassius		119522.10	x	x	x	
Pomoxis		72600	x	x		
Onchorhynchus		69000	x			
Notropis:		67611.30	x	x	x	
N. atherinoides	48400					
N. chrysocephalus	85600					
N. stramineus	74600					
Chironomus		61000	x	x	x	x
Salvelinus		59000	x			
Tanytarsus		57300	x	x	x	x
Campostoma		51250	x	x	x	
Pimephales:		47179.61	x	x	x	
P. notatus	54225					
P. promelas	41049.62					
Etheostoma		46000	x	x	x	
Perca		36300	x	x		
Morone		30454.88	x	x		
Physa		23010.33	x	x	x	x

[continued on next page]

[continued]		GMAV	CLASSIFICATIONS *			
GENUS NAME (w/ component species)		(ug/L)	CW	WW	LFF	LAL
Lophopodella	1560	x	x	x	x	
Pectinatella		1440	x	x	x	x
Plumatella		650	x	x	x	x
Hyalella		630	x	x	x	x
Crangonyx		583.27	x	x	x	x
Gammarus		67.10	x	x	x	x
Ceriodaphnia		45.10	x	x	x	x
Simocephalus:		36.35	x	x	x	x
S. serrulatus	40.90					
S. vetulus	32.30					
Daphnia:		28.94	x	x	x	x
D. pulex	36.30					
D. magna	23.07					
TOTAL NUMBER OF GENERA REPRESENTED:			26	24	20	15

* - KEY TO CLASSIFICATIONS (an X is listed for species considered in each):

CW = Coldwater community, all genera are considered here.

WW = Warmwater sportfish community, only the coldwater fish are excluded from this database (also includes warmwater forage).

LFF = Limited forage fish community, all sport fish are excluded from this database.

LAL = Limited aquatic life, all fish are excluded from this database.

The four most sensitive genera in each classification are used to calculate the criteria under each classification, pursuant to s. NR 105.05 (2). For chromium (+6), the four most sensitive genera are in every classification, meaning the coldwater criterion (based on 26 genera) shall be applied to all surface waters of the state. No relief is available in other classifications because the same sensitive organisms are in all waters. From this point, the results of the calculation are shown using the variables listed in sub. (2).

CRITERION CALCULATION:		all waters
GMAI RANKS		
	4	67.10
	3	45.10
	2	36.35
	1	28.94
n		26
ln GMAI		
	4	4.206184
	3	3.8088798
	2	3.5930986
	1	3.3652576
(ln GMAI)^2		
	4	17.691984
	3	14.507565
	2	12.910358
	1	11.324959
P		
	4	0.1481481
	3	0.1111111
	2	0.0740741
	1	0.037037
sq rt P		
	4	0.3849002
	3	0.3333333
	2	0.2721655
	1	0.1924501
EV		14.97342
EW		56.434866
EP		0.3703704
EPR		1.1828491
J		0.05
S		4.3190406
L		2.4661617
A		3.4319285
FAV		30.936246
ATC		15.468123

The calculated coldwater criterion is more stringent than the EPA criterion (16.02 ug/L) calculated in the 1995 document for GLI; this is because the non-resident guppy was deleted from EPA's database for application in Wisconsin waters. Since Wisconsin's database is a subset of EPA's, it is recommended that the Wisconsin acute criteria be set equal to EPA's in recognition that no relief is available as a result of the consideration of the database subset of species resident to the Great Lakes states.

Acute toxicity criterion for chromium (+6): ATC = 16.02 ug/L (all classifications)

EPA SPECIES MEAN CHRONIC VALUES

(values from January 1985 EPA AWQC document, EPA 440/5-84-029, and 3/95 GLI Criteria Update, EPA-820-B-95-004)

Cladoceran *(Ceriodaphnia reticulata)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	40		LC	Mount, 1982
45	40			GEOMEAN (1 result)

Cladoceran *(Daphnia magna)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
not given	< 10 *		LC	Trabalka and Gehrs, 1977
45	< 2.5 *		LC	Mount, 1982

* - A no observable effect concentration was not found in the test. so a chronic value could not be calculated.

Cladoceran *(Daphnia pulex)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	6.132		LC	Mount, 1982
45	6.132			GEOMEAN (1 result)

Cladoceran *(Simocephalus serrulatus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	19.90		LC	Mount, 1982
45	19.90			GEOMEAN (1 result)

Cladoceran *(Simocephalus vetulus)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	6.132		LC	Mount, 1982
45	6.132			GEOMEAN (1 result)

Rainbow trout *(Onchorhynchus mykiss)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
34	73.18		ELS	Sauter, et al. 1976
45	264.6		ELS	Benoit, 1976
39.12	139.15			GEOMEAN (2 results)

Brook trout *(Salvelinus fontinalis)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
45	264.6		LC	Benoit, 1976
45	264.6			GEOMEAN (1 result)

Fathead minnow *(Pimephales promelas)*

HARDNESS (PPM)	VALUE (ug/L)	METHOD		REFERENCE
209	1987		LC	Pickering, 1980
209	1987			GEOMEAN (1 result)

EPA ACUTE-CHRONIC RATIOS:

Not enough data are available to permit the calculation of independent chronic toxicity criteria (only three families of organisms have data). Instead, acute-chronic ratios (ACRs) must be developed such that the chronic criterion equals the final acute value divided by the appropriate ACR. The following table summarizes the calculation procedure for the ACRs using the procedure in s. NR 105.06 (5).

SPECIES	REFERENCE	HARD-NESS	ACUTE VALUE	CHRONIC VALUE	TEST ACR	SMACR
Daphnia magna:						> 6.96
	Trabalka & Gehrs, 1977	?	50	< 10	> 5	
	Mount, 1982	45	24.2	< 2.5	> 9.68	
C. reticulata	Mount, 1982	45	45.2	40.00	1.13	1.13
Daphnia pulex	Mount, 1982	45	36.3	6.132	5.92	5.92
S. serrulatus	Mount, 1982	45	40.9	19.9	2.06	2.06
S. vetulus	Mount, 1982	45	32.3	6.132	5.27	5.27
Rainbow trout	Benoit, 1976	45	69000	264.6	260.8	260.8
Brook trout	Benoit, 1976	45	59000	264.6	223.0	223.0
Fathead minnow	Pickering, 1980	209	36860*	1987	18.55	18.55

* - Mean of three values at indicated hardness.

The ratios for the three fish species are much higher than the invertebrates, but the fish species are much more tolerant of chromium (+6). Pursuant to s. NR 105.06(5)(e), the cladoceran ratios were used to calculate the FACR. The D. magna ratio was excluded from this calculation because of the “great than” value, an indication that the NOEC was not found as part of the chronic value determination. The geometric mean of the other four cladoceran ratios is 2.917. Since these organisms are associated with all classifications, the 2.917 ratio is used to calculate all chronic criteria.

FACR = 2.917

Chronic toxicity criteria for chromium (+6):
All waters = 16.02 X 2 / 2.917 = 10.98 ug/L

This criterion agrees with the EPA criterion in the GLI.