DERIVATION OF ACUTE AND CHRONIC TOXICITY CRITERIA FOR CHLORIDE (January, 2000)

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EPA SPECIES MEAN ACUTE VALUES

American eel *(Anguilla rostrata)*

VALUE (mg/L)	METHOD	REFERENCE
13085	S,U	Hinton & Eversole, 1979
10900	S,U	Hinton & Eversole, 1978
SMAV = 11943		(2 results)

Bluegill *(Lepomis macrochirus)*

VALUE (mg/L)	METHOD	REFERENCE
7897	S,U	Patrick, et al. 1968
7646	S,U	Trama 1954
5870	FT,M	Birge et al. 1985
SMAV = 5870	FT, M	(1 result)

Goldfish *(Carassius auratus)*

VALUE (mg/L)	METHOD	REFERENCE
9455	S,U	Threader & Houston, 1983
4454	FT,M	Adelman & Smith, 1976
SMAV = 4454	FT,M	(1 results)

Mosquito *(Culex sp.)*

VALUE (mg/L)	METHOD	REFERENCE
6222	S,U	Dowden & Bennett, 1965
SMAV = 6222		(1 result)

Fathead minnow *(Pimephales promelas)*

VALUE (mg/L)	METHOD	REFERENCE
4600	FT,M	WI State Lab. of Hygiene, 1995
4642	FT,M	Adelman & Smith, 1976
6570	FT,M	Birge, et al. 1985
SMAV = 5196		(3 results)

Midge *(Chironomus attenuatus)*

VALUE (mg/L)	METHOD	REFERENCE
4900	S,U	Thornton & Sauer
SMAV = 4900		(1 result)

Rainbow trout *(Onchorhynchus mykiss)*

VALUE (mg/L)	METHOD	REFERENCE
6743	FT,M	Spehar, 1987
SMAV = 6743		(1 result)

Caddisfly *(Hydroptila angusta)*

VALUE (mg/L)	METHOD	REFERENCE
4039	S,U	Hamilton, et al. 1975

SMAV = 4039		(1 result)

Midge *(Cricotopus trifascia)*

VALUE (mg/L)	METHOD	REFERENCE
3795	S,U	Hamilton, et al. 1975
SMAV = 3795		(1 result)

Isopod *(Lirceus fontinalis)*

VALUE (mg/L)	METHOD	REFERENCE
2950	F,M	Birge, et al. 1985
SMAV = 2950		(1 result)

Snail *(Physa gyrina)*

VALUE (mg/L)	METHOD	REFERENCE
2540	FT,M	Birge, et al. 1985
SMAV = 2540		(1 result)

Cladoceran *(Daphnia magna)*

VALUE (mg/L)	METHOD	REFERENCE
4071	FT,M	Wisconsin State Lab. of Hygiene, 1995
3583	S,U	Dowden & Bennett, 1965
2565	S,U	Biesinger & Christensen, 1972
2024	S,U	Dowden, 1961
3913	S,U	Cowgill & Milazzo, 1990
SMAV = 4071	FT,M	(1 result)

Cladoceran *(Daphnia pulex)*

VALUE (mg/L)	METHOD	REFERENCE
1470	R,M	Birge, et al. 1985
SMAV = 1470		(1 result)

Cladoceran *(Ceriodaphnia dubia)*

VALUE (mg/L)	METHOD	REFERENCE
1596	FT,M	Wisconsin State Lab. of Hygiene, 1995
1309	S,M	Cowgill & Milazzo, 1990
1042	S,M	Mount & Gulley, 1992
SMAV = 1596	FT,M	(1 result)

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. Isopod (*L. fontinalis*)
5. Caddisfly *(H. angusta)*
6. Fathead minnow, family Cyprinidae
7. Snail (*P. gyrina*)
8. American eel, family Anguillidae

CONCLUSION: An acute toxicity criterion can be calculated for chloride according to ch. NR 105.

GENUS NAME (w/ component species)	GMAV (ug/L)	CLASSIFICATIONS * CW	WW	LFF	LAL
Anguilla	11943	x	x		
Onchorhynchus	6743	x			
Culex	6222	x	x	x	x
Lepomis	5870	x	x		
Pimephales	5196	x	x	x	
Chironomus	4900	x	x	x	x
Carassius	4454	x	x	x	
Hydrophila	4039	x	x	x	x
Cricotopus	3795	x	x	x	x
Lirceus	2950	x	x	x	x
Physa	2540	x	x	x	x
Daphnia:	2446	x	x	x	x
D. magna 4071					
D. pulex 1470					
Ceriodaphnia	1596	x	x	x	x
TOTAL NUMBER OF GENERA REPRESENTED:		13	12	10	8

* - 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 chloride, the four most sensitive genera are in every classification, meaning the coldwater criterion (based on 13 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
GMAV RANKS		
	4	2950
	3	2540
	2	2446
	1	1596
n		13
ln GMAV		
	4	7.990
	3	7.840
	2	7.802
	1	7.375
(ln GMAV)^2		
	4	63.833
	3	61.464
	2	60.874
	1	54.394
P		
	4	0.285714
	3	0.214286
	2	0.142857
	1	0.071429
sq rt P		
	4	0.534522
	3	0.46291
	2	0.377964
	1	0.267261
EV		31.007
EW		240.566
EP		0.714
EPR		1.643
J		0.05
S		2.292
L		6.810
A		7.323
FAV		1515
ATC		757

Acute toxicity criterion for chloride: ATC = 757 mg/L (all classifications)

EPA SPECIES MEAN CHRONIC VALUES

Cladoceran *(Daphnia pulex)*

VALUE (ug/L)	METHOD	REFERENCE
372.1	LC	Birge, et al. 1985
SMCV = 372.1		(1 result)

Fathead minnow *(Pimephales promelas)*

VALUE (ug/L)	METHOD	REFERENCE
433.1	ELS	Birge, et al. 1985
SMCV = 433.1		(1 result)

Cladoceran *(Ceriodaphnia dubia)*

VALUE (ug/L)	METHOD	REFERENCE
429	3-brd. reprod.	Wisconsin State Lab. of Hygiene, 1995
SMCV = 429		(1 result)

Rainbow trout *(Onchorhynchus mykiss)*

VALUE (ug/L)	METHOD	REFERENCE
922.7	ELS	Spehar, 1987
SMCV = 433.1		(1 result)

EPA ACUTE-CHRONIC RATIOS:

Not enough data are available to permit the calculation of independent chronic toxicity criteria (only four species 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	ACUTE VALUE	CHRONIC VALUE	TEST ACR	SMACR	ACUTE RANK
Daphnia pulex	1470	372.1	3.95	3.95	1
Ceriodaphnia dubia	1596	429	3.72	3.72	2
Rainbow trout	6743	922.7	7.31	7.31	8
Fathead minnow	6570	433.1	15.17	15.17	10

The FACRs for each classification are calculated using only the two cladoceran ratios since they are lower than the rest and are closest to the acute criterion:
FACR = Geo. mean of 3.95 and 3.72 = 3.83

Chronic toxicity criteria for chloride
CTC = 1514.7 / 3.83 = 394.9 mg/L, round to 395

NOTE: The rounding here to the ratios and to the 3.83 may not give you exactly the 394.9 result; actually what was done was to not do any rounding until the last result, namely the criterion (round to 395). The decimal places were all maintained until that step.