DERIVATION OF ACUTE AND CHRONIC TOXICITY CRITERIA
FOR DIELDRIN
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EPA SPECIES MEAN ACUTE VALUES

(values from 10/80 EPA AWQC document, EPA 440/5-80-019 and 3/95 GLI Criteria Update, EPA-820-B-95-004)

Cladoceran *(Daphnia pulex)*

VALUE (ug/L)	REFERENCE
190	Mayer and Ellersieck, 1986
251	Daniels and Allan, 1981
250	Sanders & Cope, 1966
SMAV = 228	(3 results)

Cladoceran *(Simocephalus serrulatus)*

VALUE (ug/L)	REFERENCE
240	Sanders & Cope, 1966
190	Sanders & Cope, 1966
SMAV = 214	(2 results)

Isopod *(Asellus brevicadus)*

VALUE (ug/L)	REFERENCE
5	Sanders, 1972
SMAV = 5	(1 result)

Amphipod *(Gammarus fasciatus)*

VALUE (ug/L)	REFERENCE
640	Sanders, 1972
600	Sanders, 1972
SMAV = 620	(2 results)

Amphipod *(Gammarus lacustris)*

VALUE (ug/L)	REFERENCE
460	Sanders, 1969
SMAV = 460	(1 result)

Glass shrimp *(Palaemonetes kadiakensis)*

VALUE (ug/L)	REFERENCE
20	Sanders, 1972
SMAV = 20	(1 result)

Crayfish *(Orconectes nais)*

VALUE (ug/L)	REFERENCE
740	Sanders, 1972
SMAV = 740	(1 result)

Stonefly *(Pteronarcys californica)*

VALUE (ug/L)	REFERENCE
0.5	Mayer and Ellersieck, 1986
SMAV = 0.5	(1 result)

Stonefly *(Pteronarcella badia)*

VALUE (ug/L)	REFERENCE
0.5	Mayer and Ellersieck, 1986
SMAV = 0.5	(1 result)

Damselfly *(Ischnura verticalis)*

VALUE (ug/L)	REFERENCE
12	Mayer and Ellersieck, 1986
SMAV = 12	(1 result)

Annelid *(Lumbriculus variegatus)*

VALUE (ug/L)	REFERENCE
21.8	USEPA, 1991
SMAV = 21.8	(1 result)

Rainbow trout *(Onchorhynchus mykiss)*

VALUE (ug/L)	METHOD	REFERENCE
0.62	FT, M	Shabat and Curtis, 1986
1.2	S, U	Mayer and Ellersieck, 1986
3	S, U	Van Leeuwen, et al. 1985
9.9	S, U	Katz, 1961
2.4	S, U	Macek, et al. 1969
1.1	S, U	Macek, et al. 1969
1.4	S, U	Macek, et al. 1969
SMAV = 0.62		(1 result, EPA only used the FT, M result)

Coho salmon *(Onchorhynchus kisutch)*

VALUE (ug/L)	REFERENCE
10.8	Katz, 1961
SMAV = 10.8	(1 result)

Chinook salmon *(Onchorhynchus tshawytscha)*

VALUE (ug/L)	REFERENCE
6.1	Katz, 1961
SMAV = 6.1	(1 result)

Cutthroat trout *(Onchorhynchus clarki)*

VALUE (ug/L)	REFERENCE
6	Mayer and Ellersieck, 1986
SMAV = 6	(1 result)

This result was used because the genus is represented in Wisconsin even though the species itself is not. It turns out the result is irrelevant because the GMAV is reduced to equal the SMAV for rainbow trout because of the wide variation for SMAVs in the genus, the flow-through test result for rainbow trout, and its perceived recreational and ecological importance.

Goldfish *(Carassius auratus)*

VALUE (ug/L)	REFERENCE
41	Henderson, et al. 1959
1.8	Mayer and Ellersieck, 1986
SMAV = 8.6	(2 results)

NOTE: EPA guidance (1985) says results should be rejected when there is greater than a 10-fold difference in the results. However, both results were used to come up with a SMAV for goldfish, possibly because it wasn't clear which result should be rejected.

Fathead minnow *(Pimephales promelas)*

VALUE (ug/L) – all S,U	REFERENCE
18	Henderson, et al. 1959
18	Henderson, et al. 1959
36	Tarzwell & Henderson, 1957
24	Tarzwell & Henderson, 1957
16	Tarzwell & Henderson, 1957
25	Tarzwell & Henderson, 1957
23	Tarzwell & Henderson, 1957
3.8	Mayer and Ellersieck, 1986
SMAV = 17.7	(8 results)

Guppy *(Poecilia reticulata)*

EPA SMAV is not used in Wisconsin since Genus Poecilia is non-resident to Wisconsin, Iowa, and the other Great Lakes states.

Green sunfish *(Lepomis cyanellus)*

VALUE (ug/L)	REFERENCE
6	Tarzwell & Henderson, 1957
SMAV = 6	(1 result)

Pumpkinseed *(Lepomis gibbosus)*

VALUE (ug/L)	REFERENCE
6.7	Cairns and Scheier, 1964
SMAV = 6.7	(1 result)

Bluegill *(Lepomis macrochirus)*

VALUE (ug/L) – all S,U	REFERENCE
9	Henderson, et al. 1959
17	Macek, et al. 1969
14	Macek, et al. 1969
8.8	Macek, et al. 1969
32	Tarzwell & Henderson, 1957
18	Tarzwell & Henderson, 1957
8	Tarzwell & Henderson, 1957
22	Tarzwell & Henderson, 1957
3.1	Mayer and Ellersieck, 1986
7	Sanders, 1972
SMAV = 11.5	(10 results)

Channel catfish *(Ictalurus punctatus)*

VALUE (ug/L)	REFERENCE
4.5	Mayer & Ellersieck, 1986
SMAV = 4.5	(1 result)

Largemouth bass *(Micropterus salmoides)*

VALUE (ug/L)	REFERENCE
3.5	Mayer & Ellersieck, 1986
SMAV = 3.5	(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. pulex)*
4. Amphipod (*G. fasciatus*)
5. Stonefly *(P. californica)*
6. Fathead minnow, family Cyprinidae
7. Annelid (*L. variegatus*)
8. Channel catfish, family Ictaluridae

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

GENUS NAME (w/ component species)		GMAV (ug/L)	CLASSIFICATIONS * CW	WW	LFF	LAL
Orconectes		740	x	x	x	x
Gammarus		534	x	x	x	x
G. lacustris	460					
G. fasciatus	620					
Daphnia		228	x	x	x	x
Simocephalus		214	x	x	x	x
Lumbriculus		21.8	x	x	x	x
Palaemontes		20	x	x	x	x
Pimephales		17.7	x	x	x	
Ischnura		12	x	x	x	x
Carassius		8.6	x	x	x	
Lepomis		8.5	x	x		
Pumpkinseed	6.7					
Bluegill	11.5					
Green sunfish	8.1					
Asellus		5	x	x	x	x
Ictalurus		4.5	x	x		
Micropterus		3.5	x	x		
Oncorhynchus		0.62	x			
Rainbow trout FT	0.62					
Claasenia		0.6	x	x	x	x
Pteronarcys		0.5	x	x	x	x
Pteronarcella		0.5	x	x	x	x
TOTAL NUMBER OF GENERA REPRESENTED:			17	16	13	11

* - 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). From this point, the results of the calculation are shown using the variables listed in sub. (2).

CRITERION CALCULATION:

		CW	**WW**	**LFF**	**LAL**
GMAV RANKS					
	4	0.62	3.5	5.00	5.00
	3	0.6	0.6	0.6	0.6
	2	0.5	0.5	0.5	0.5
	1	0.5	0.5	0.5	0.5
	n	17	16	13	11
ln GMAV					
	4	-0.478036	1.252763	1.6094379	1.6094379
	3	-0.510826	-0.510826	-0.510826	-0.510826
	2	-0.693147	-0.693147	-0.693147	-0.693147
	1	-0.693147	-0.693147	-0.693147	-0.693147
(ln GMAV)^2					
	4	0.2285182	1.5694151	2.5902904	2.5902904
	3	0.2609428	0.2609428	0.2609428	0.2609428
	2	0.480453	0.480453	0.480453	0.480453
	1	0.480453	0.480453	0.480453	0.480453
P					
	4	0.2222222	0.2352941	0.2857143	0.3333333
	3	0.1666667	0.1764706	0.2142857	0.25
	2	0.1111111	0.1176471	0.1428571	0.1666667
	1	0.0555556	0.0588235	0.0714286	0.0833333
sq rt P					
	4	0.4714045	0.4850713	0.5345225	0.5773503
	3	0.4082483	0.420084	0.46291	0.5
	2	0.3333333	0.3429972	0.3779645	0.4082483
	1	0.2357023	0.2425356	0.2672612	0.2886751
EV		-2.375156	-0.644357	-0.287682	-0.287682
EW		1.4503671	2.7912639	3.8121392	3.8121392
EP		0.5555556	0.5882353	0.7142857	0.8333333
EPR		1.4486884	1.4906881	1.6426582	1.7742737
J		0.05	0.05	0.05	0.05
S		1.1384769	9.0659581	9.7720228	9.0471351
L		-1.006114	-3.539718	-4.084944	-4.084944
A		-0.751542	-1.512508	-1.899853	-2.061943
FAV		0.4716386	0.2203566	0.1495906	0.1272066
ATC		0.2358193	0.1101783	0.0747953	0.0636033

CRITERIA:

	CW	**WW**	**LFF**	**LAL**
calc. ATC	0.2358	0.1102	0.0748	0.0636

Since the criteria for warmwater, limited forage, and limited aquatic life are all less than the coldwater criterion, they are set equal to the coldwater criterion. Essentially, this means that there is no relief available for the criteria in these other classifications due to either the amount of data or the results of the acute tests, or both, and since those species are all included in the "larger" databases already (coldwater), it was deemed appropriate to set the criteria equal to those for the coldwater databases rather than having more restrictive criteria applied to these "subset" classifications.

Acute toxicity criteria for dieldrin:
ATC = 0.24 ug/L (all classifications)

EPA SPECIES MEAN CHRONIC VALUES

(values from 10/80 EPA AWQC document, EPA 440/5-80-019 and 3/95 GLI Criteria Update, EPA-820-B-95-004)

Cladoceran *(Daphnia magna)*

VALUE (ug/L)	METHOD	REFERENCE
57	LC	Adema, 1978
SMCV = 57		(1 result)

Rainbow trout *(Onchorhynchus mykiss)*

VALUE (ug/L)	METHOD	REFERENCE
0.22	ELS	Chadwisck and Shumway, 1969
SMCV = 0.22		(1 result)

USED ONLY FOR ACR CALCULATION (not resident species):

Guppy *(Poecilia reticulata)*

VALUE (ug/L)	METHOD	REFERENCE
0.45	LC	Roelofs, 1971 (compared to mean of 38 static acute results from Chadwick & Kilgemagi, 1968, 4.1 ug/L)
SMCV = 0.45		(1 result)

Mysid shrimp *(Mysidopsis bahia)*

VALUE (ug/L)	METHOD	REFERENCE
0.73	LC	USEPA, 1980 (compared to FT acute result of 4.5 ug/L by USEPA, 1980)
SMCV = 0.73		(1 result)

EPA ACUTE-CHRONIC RATIOS:

Not enough data are available to permit the calculation of independent chronic toxicity criteria (see table below). 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
Daphnia magna	no value	57	no ratio	
Rainbow trout	2.5	0.22	11.36	11.36
Guppy	4.1	0.45	9.11	9.11
Mysid shrimp (saltwater)	4.5	0.73	6.16	6.16

The guppy and mysid ratios were used because there are no ratios available for either invertebrates, warmwater sport fish, or forage fish. The Final ACRs for each classification are as follows:

Coldwater = Geo. mean of 11.36, 9.11, and 6.16 = 8.61
Warmwater, limited forage, and limited aqu. life = Geo. mean of 9.11 and 6.16 = 7.49

Chronic toxicity criteria for dieldrin:
CW = 0.4716 / 8.61 = 0.055 ug/L
WW, LFF, LAL = 0.4716 / 7.49 = 0.064 ug/L

2001 Note) The criteria published in NR 105 for WW, LFF and LAL had chronic criteria of 0.077 ug/L based only on the mysid ACR. This should be changed at the next rule revision, but is not a priority because the human cancer criteria are much lower than CTC and would control in most/all discharge situations.