DERIVATION OF ACUTE AND CHRONIC TOXICITY CRITERIA FOR PENTACHLOROPHENOL
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(for NR 105 revision in 1997)

Source: EPA criteria document EPA 440/5-86-009

ACUTE TOXICITY CRITERIA

EPA SPECIES MEAN ACUTE VALUES

NOTE: Normalized pH and pentachlorophenol values are listed for a species when information was available over a sufficient range. Normalized pH equals the difference between the individual result and the arithmetic mean, since pH already is an exponent (of hydrogen ion concentrations), there is no need to calculate the natural log for normalizing or criteria calculations. Normalized value equals individual result / geometric mean result (rounded to 3 dec. places).

DATA USED FOR SLOPE CALCULATIONS (data with common references over a series with a range of pH values)

Cladoceran *(Simocephalus vetulus)*

pH (s.u.)	VALUE (ug/L)	METHOD		NORMALIZED pH	NORMALIZED VALUE	REFERENCE
7.3	160	FT	M	-0.525	0.648	Hadtke, et al. 1986
7.7	250	FT	M	-0.125	1.013	Hadtke, et al. 1986
8.0	255	FT	M	0.175	1.033	Hadtke, et al. 1986
8.3	364	FT	M	0.475	1.475	Hadtke, et al. 1986
7.825	246.85					**MEAN** (4 results)

Amphipod *(Crangonyx pseudogracilis)*

pH (s.u.)	VALUE (ug/L)	METHOD		NORMALIZED pH	NORMALIZED VALUE	REFERENCE
6.5	139	FT	M	-1.125	0.261	Spehar, et al. 1985
7.5	465	FT	M	-0.125	0.872	Spehar, et al. 1985
8.0	929	FT	M	0.375	1.743	Spehar, et al. 1985
8.5	1344	FT	M	0.875	2.522	Spehar, et al. 1985
7.625	532.99					**MEAN** (4 results)

Amphipod *(Gammarus pseudolimnaeus)*

pH (s.u.)	VALUE (ug/L)	METHOD		NORMALIZED pH	NORMALIZED VALUE	REFERENCE
6.5	92	FT	M	-1.125	0.360	Spehar, et al. 1985
7.5	121	FT	M	-0.125	0.474	Spehar, et al. 1985
8.0	484	FT	M	0.375	1.895	Spehar, et al. 1985
8.5	790	FT	M	0.875	3.093	Spehar, et al. 1985
7.625	255.42					**MEAN** (4 results)

Fathead minnow *(Pimephales promelas)*

pH (s.u.)	VALUE (ug/L)	METHOD		NORMALIZED pH	NORMALIZED VALUE	REFERENCE
6.5	95	FT	M	-1.125	0.447	Spehar, et al. 1985
7.5	218	FT	M	-0.125	1.025	Spehar, et al. 1985
8.0	261	FT	M	0.375	1.228	Spehar, et al. 1985
8.5	378	FT	M	0.875	1.778	Spehar, et al. 1985
7.625	212.61					**MEAN** (4 results)

Guppy *(Poecilia reticulata)*

pH (s.u.)	VALUE (ug/L)	METHOD		NORMALIZED pH	NORMALIZED VALUE	REFERENCE
5	42.6	R	U	-1.5	0.201	Saarikoski & Viluksela, 1981-82
6	117	R	U	-0.5	0.553	Saarikoski & Viluksela, 1981-82
7	442	R	U	0.5	2.088	Saarikoski & Viluksela, 1981-82
8	911	R	U	1.5	4.304	Saarikoski & Viluksela, 1981-82
6.5	211.66					**MEAN** (4 results)

SLOPE OF ATC EQUATION (from normalized data) = 1.0054 (r-squared = 0.925).

DATA USED FOR SMAV CALCULATIONS (all data listed above plus the other flow-through data only when there's a combination of FT and static data, shaded results were not used to calculate SMAV)

Cladoceran *(SImocephalus vetulus)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.3	160	FT	M	Hadtke, et al. 1986
7.7	250	FT	M	Hadtke, et al. 1986
8.0	255	FT	M	Hadtke, et al. 1986
8.3	364	FT	M	Hadtke, et al. 1986
8.15	196	FT	M	Hadtke, et al. 1986
7.3	203.3	S	U	Mount & Norberg, 1984
7.89	235.72			**MEAN** (5 FT results)

Fathead minnow *(Pimephales promelas)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.92 – 8.20 (8.06)	194	FT	M	Ruesink & Smith, 1975
7.91 – 8.20 (8.005)	314	FT	M	Ruesink & Smith, 1975
7.82	200	FT	M	Adelman & Smith, 1976
7.83	180	FT	M	Adelman & Smith, 1976
7.72	220	FT	M	Adelman & Smith, 1976
7.72	180	FT	M	Adelman & Smith, 1976
7.69	190	FT	M	Adelman & Smith, 1976
7.68	210	FT	M	Adelman & Smith, 1976
7.86	220	FT	M	Adelman & Smith, 1976
7.78	180	FT	M	Adelman & Smith, 1976
7.59	190	FT	M	Adelman & Smith, 1976
7.62	190	FT	M	Adelman & Smith, 1976
7.65	240	FT	M	Adelman & Smith, 1976
7.65	200	FT	M	Adelman & Smith, 1976
7.63	200	FT	M	Adelman & Smith, 1976
7.58	190	FT	M	Adelman & Smith, 1976
7.83	270	FT	M	Adelman & Smith, 1976
7.82	230	FT	M	Adelman & Smith, 1976
7.83	285	FT	M	Cardwell, et al. 1976
7.41 – 8.33 (7.87)	220	FT	M	Phipps, et al. 1981
7.41 – 8.33 (7.87)	230	FT	M	Phipps, et al. 1981
7.41 – 8.33 (7.87)	232	FT	M	Phipps, et al. 1981
6.5	95	FT	M	Spehar, et al. 1985

7.5	218	FT	M	Spehar, et al. 1985
8.0	261	FT	M	Spehar, et al. 1985
8.5	378	FT	M	Spehar, et al. 1985
7.1 – 7.8 (7.45)	223	FT	M	Phipps & Holcombe, 1985
7.1 – 7.8 (7.45)	286	FT	M	Phipps & Holcombe, 1985
7.1 – 7.8 (7.45)	244	FT	M	Phipps & Holcombe, 1985
8.01	266	FT	M	Thurston, et al. 1985
7.2 – 7.5 (7.35)	196.8	S	U	Johnson & Finley, 1980
7.7	18	S	U	Hall, et al. 1986
7.73	218.79			**MEAN** (30 FT results)

Guppy *(Poecilia reticulata)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.0	400	R	M	Salkinoj a-Salonen et al. 1981
5	42.6	R	U	Saarikoski & Viluksela, 1981-82
6	117	R	U	Saarikoski & Viluksela, 1981-82
7	442	R	U	Saarikoski & Viluksela, 1981-82
8	911	R	U	Saarikoski & Viluksela, 1981-82
8.1	970	R	U	Gupta et al. 1982
8.1	711	R	U	Gupta et al. 1982
7.7	204	R	U	Khangarot, 1983
7.2	1020	R	U	Brown, et al. 1985
7.12	365.08			**MEAN** (results)

Amphipod *(Crangonyx pseudogracilis)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
6.5	139	FT	M	Spehar, et al. 1985
7.5	465	FT	M	Spehar, et al. 1985
8.0	929	FT	M	Spehar, et al. 1985
8.5	1344	FT	M	Spehar, et al. 1985
7.625	532.99			**MEAN** (4 results)

Amphipod *(Gammarus pseudolimnaeus)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
6.5	92	FT	M	Spehar, et al. 1985
7.5	121	FT	M	Spehar, et al. 1985
8.0	484	FT	M	Spehar, et al. 1985
8.5	790	FT	M	Spehar, et al. 1985
7.625	255.42			**MEAN** (4 results)

Worm *(Limnodrilus hoffmeisteri)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7	303.8	R	U	Chapman et al., 1982
7	478.7	R	U	Chapman et al., 1982
7	451	R	U	Chapman et al., 1982
6	303.8	R	U	Chapman et al., 1982
8	345.2	R	U	Chapman et al., 1982
7.0	369.40			**MEAN** (5 results)

Worm *(Tubifex tubifex)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7	349.8	R	U	Chapman et al., 1982
7	607.5	R	U	Chapman et al., 1982
7	405	R	U	Chapman et al., 1982
6	340.6	R	U	Chapman et al., 1982
8	598.3	R	U	Chapman et al., 1982
7.0	445.45			MEAN (5 results)

Worm *(Stylodrilus heringianus)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7	579.9	R	U	Chapman et al., 1982
7	1638	R	U	Chapman et al., 1982
7	681.2	R	U	Chapman et al., 1982
6	690.4	R	U	Chapman et al., 1982
8	674.5	R	U	Chapman et al., 1982
7.0	828.63			MEAN (5 results)

Snail *(Aplexa hypnorum)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.4	157	FT	M	Phipps & Holcombe, 1985
7.4	142	FT	M	Phipps & Holcombe, 1985
7.40	149.31			**MEAN** (2 results)

Snail *(Gillia altilis)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
6.7	810	S	U	Stuart & Robertson, 1985
6,7	300	R	U	Stuart & Robertson, 1985
6.7	492.95			**MEAN** (2 results)

Rainbow trout *(Onchorhynchus mykiss)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
8.0 – 8.3 (8.15)	210	FT	M	Fogels & Sprague, 1977
7.6 – 8.2 (7.9)	160	FT	M	Hodson et al. 1984
7.85	115	FT	M	Thurston et al. 1983
6.96	85	S	U	Davis & Hoos, 1975
7	89	S	U	Davis & Hoos, 1975
7	46	S	U	Davis & Hoos, 1975
7.02	92	S	U	Davis & Hoos, 1975
5.7	44	S	U	Davis & Hoos, 1975
7	69	S	U	Davis & Hoos, 1975
7	75	S	U	Bentley et al. 1975
7.5	92	S	U	Bentley et al. 1975
6.2 – 6.8 (6.5)	83	S	U	Vigers & Maynard 1977
7.2 – 7.5 (7.35)	49.92	S	U	Johnson & Finley 1980
7.2 – 7.5	45.72	S	U	Johnson & Finley 1980

(7.35)				
7.4	66	FT	U	Dominguez & Chapman 1984
7.2	3000	R	U	Van Leeuwen et al. 1985
7.2	1300	R	U	Van Leeuwen et al. 1985
7.2	3000	R	U	Van Leeuwen et al. 1985
7.2	480	R	U	Van Leeuwen et al. 1985
7.2	32	R	U	Van Leeuwen et al. 1985
7.2	18	R	U	Van Leeuwen et al. 1985
7.5	47.2	S	M	Brook et al. Manuscript
7.97	156.92			**MEAN** (3 FT results)

Cladoceran ***(Daphnia magna)***

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.4 – 9.4 (8.4)	680	S	U	LeBlanc 1980
7.2 – 7.4 (7.3)	134	S	U	Mount & Norberg 1984
8.58	145	S	M	Thurston et al. 1985
8.5	300	S	U	Lewis & Weber 1985
8.5	350	S	U	Lewis & Weber 1985
8.5	380	S	U	Lewis & Weber 1985
8.5	300	S	U	Lewis & Weber 1985
8.5	350	S	U	Lewis & Weber 1985
8.5	300	S	U	Lewis & Weber 1985
8.5	280	S	U	Lewis & Weber 1985
8.5	310	S	U	Lewis & Weber 1985
8.5	290	S	U	Lewis & Weber 1985
8.5	370	S	U	Lewis & Weber 1985
8.5	350	S	U	Lewis & Weber 1985
8.5	370	S	U	Lewis & Weber 1985
8.5	340	S	U	Lewis & Weber 1985
8.5	510	S	U	Lewis & Weber 1985
8.5	840	S	U	Lewis & Weber 1985
8.5	510	S	U	Lewis & Weber 1985
7.7	450	S	U	Hall et al. 1986
7.7	1030	S	U	Hall et al. 1986
7.8	960	S	U	Hall et al. 1986
7.8	830	S	U	Hall et al. 1986
8.0	1000	S	U	Elnabarawy et al. 1986
7.5	183	S	M	Brooks et al. Manuscript
8.27	366.26			**MEAN** (25 results)

Goldfish ***(Carassius auratus)***

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.81	210	FT	M	Adelman & Smith 1976
7.78	220	FT	M	Adelman & Smith 1976
7.77	230	FT	M	Adelman & Smith 1976
7.75	210	FT	M	Adelman & Smith 1976
7.62	170	FT	M	Adelman & Smith 1976
7.68	170	FT	M	Adelman & Smith 1976
7.54	220	FT	M	Adelman & Smith 1976
7.59	230	FT	M	Adelman & Smith 1976
7.58	240	FT	M	Adelman & Smith 1976
7.59	240	FT	M	Adelman & Smith 1976

7.58	200	FT	M	Adelman & Smith 1976
7.60	190	FT	M	Adelman & Smith 1976
7.83	290	FT	M	Adelman & Smith 1976
7.84	300	FT	M	Adelman & Smith 1976
7.73	200	FT	M	Adelman & Smith 1976
7.76	250	FT	M	Adelman & Smith 1976
7.1 – 7.8 (7.45)	117	FT	M	Phipps & Holcombe 1985
7.1 – 7.8 (7.45)	156	FT	M	Phipps & Holcombe 1985
7.1 – 7.8 (7.45)	191	FT	M	Phipps & Holcombe 1985
7.94	328	FT	M	Thurston et al. 1985
7.84	200	FT	M	Thurston et al. 1985
7.68	211.97			**MEAN** (21 results)

Cladoceran *(Daphnia pulex)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.7	1000	S	U	Hall et al. 1986
7.8	960	S	U	Hall et al. 1986
7.8	1050	S	U	Hall et al. 1986
8.2	260	S	U	Lewis & Weber 1985
8.2	490	S	U	Lewis & Weber 1985
8.2	480	S	U	Lewis & Weber 1985
8.2	470	S	U	Lewis & Weber 1985
8.2	290	S	U	Lewis & Weber 1985
8.2	170	S	U	Lewis & Weber 1985
8.2	250	S	U	Lewis & Weber 1985
8.2	390	S	U	Lewis & Weber 1985
8.2	190	S	U	Lewis & Weber 1985
8.2	330	S	U	Lewis & Weber 1985
8.2	560	S	U	Lewis & Weber 1985
8.2	550	S	U	Lewis & Weber 1985
8.2	560	S	U	Lewis & Weber 1985
8.2	440	S	U	Lewis & Weber 1985
8.2	590	S	U	Lewis & Weber 1985
8.2	550	S	U	Lewis & Weber 1985
8.2	680	S	U	Lewis & Weber 1985
8.2	350	S	U	Lewis & Weber 1985
8.0	1100	S	U	Elnabarawy et al. 1986
8.13	468.25			**MEAN** (22 results)

Channel catfish *(Ictalurus punctatus)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.1 – 7.8 (7.45)	54	FT	M	Phipps & Holcombe 1985
7.1 – 7.8 (7.45)	54	FT	M	Phipps & Holcombe 1985
7.71	132	FT	M	Thurston et al. 1985
7.1 – 7.8 (7.45)	< 53	FT	M	Phipps & Holcombe 1985
7.2 – 7.5 (7.35)	65.28	S	U	Johnson & Finley 1980

7.2 – 7.5 (7.35)	64.01	S	U	Johnson & Finley 1980
7.54	72.74			**MEAN** (3 FT results)

Chinook salmon *(Onchorhynchus tshawytscha)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.2-7.5 (7.35)	65.28	S	U	Johnson & Finley 1980
7.2-7.5 (7.35)	56.53	S	U	Johnson & Finley 1980
7.35	60.75			**MEAN** (2 results)

Mosquitofish *(Gambusia affinis)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
8.05	288	FT	M	Thurston et al. 1985
8.02	278	FT	M	Thurston et al. 1985
8.04	284.96			**MEAN** (2 results)

Sockeye salmon *(Onchorhynchus nerka)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
6.8	58	FT	U	Webb & Brett 1973
7.19	46	S	U	Davis & Hoos 1975
7.70	120	S	U	Davis & Hoos 1975
7.23	68.41			**MEAN** (3 results)

All three values were used because the FT test result was unmeasured.

Coho salmon *(Onchorhynchus kisutch)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
6.9 – 7.5 (7.2)	60	FT	U	Iwama & Greer 1980
7.01	89	S	U	Davis & Hoos 1975
7.01	34	S	U	Davis & Hoos 1975
7.07	56.62			**MEAN** (3 results)

All three values were used because the FT test result was unmeasured.

Scyomizid *(Sepedon fuscipennis)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
8	28000	S	U	McCoy & Joy 1977
7	30000	S	U	McCoy & Joy 1977
7.50	28982.7			**MEAN** (2 results)

Bluegill *(Lepomis macrochirus)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.2	1020	R	U	Brown et al. 1985
7.0	60	S	U	Bentley et al. 1975
7.5	77	S	U	Bentley et al. 1975
7.2 – 7.7 (7.45)	260	R	U	Pruitt et al. 1977
7.2 – 7.7 (7.45)	305	R	U	Pruitt et al. 1977

7.2 – 7.5 (7.35)	30.72	S	U	Johnson & Finley 1980
7.2 – 7.5 (7.35)	36.58	S	U	Johnson & Finley 1980
7.1 – 7.8 (7.45)	150	FT	M	Phipps & Holcombe 1985
7.1 – 7.8 (7.45)	152	FT	M	Phipps & Holcombe 1985
7.1 – 7.8 (7.45)	115	FT	M	Phipps & Holcombe 1985
8.03	202	FT	M	Thurston et al. 1985
7.60	151.70			**MEAN** (4 FT results)

Largemouth bass *(Micropterus salmoides)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.2	287	R	U	Johansen et al. 1985
7.2	275	R	U	Johansen et al. 1985
7.2	136	R	U	Johansen et al. 1985
7.2	189	R	U	Johansen et al. 1985
7.20	212.23			**MEAN** (4 results)

Cladoceran *(Ceriodaphnia reticulata)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
7.2 – 7.4 (7.3)	153.7	S	U	Mount & Norberg 1984
7.7	260	S	U	Hall et al. 1986
7.7	510	S	U	Hall et al. 1986
7.8	290	S	U	Hall et al. 1986
7.8	410	S	U	Hall et al. 1986
8.0	900	S	U	Elnabarawy et al. 1986
7.3	150	FT	M	Hedtke et al. 1986
7.3	150			**MEAN** (1 FT result)

Midge *(Tanytarsus dissimilis)*

pH (s.u.)	VALUE (ug/L)	METHOD		REFERENCE
8.51	31300	S	M	Thurston et al. 1985
8.55	19000	S	M	Thurston et al. 1985
7.9	46000	FT	M	Call et al. 1983
7.9	46000			**MEAN** (1 FT result)

Species with single results:

SPECIES	**pH (s.u.)**	**VALUE (ug/L)**	**REFERENCE**
Worm (Branchiura sowerbyi)	7.00	257.70	Chapman et al. 1982
Worm (Quistadrilus multisetosus)	7.00	524.70	Chapman et al. 1982
Worm (Rhyacodrilus montana)	7.00	690.40	Chapman et al. 1982
Worm (Spirosperma ferox)	7.00	395.80	Chapman et al. 1982
Worm (Spirosperma nikolskyi)	7.00	902.10	Chapman et al. 1982
Worm (Varichaeta pacifica)	7.00	96.65	Chapman et al. 1982
Snail (Physa gyrina)	7.20	267	Hedtke et al. 1986
Amphipod (Hyalella azteca)	7.50	239	Brooks et al. manuscript
Crayfish (Orconectes immunis)	7.92	183000	Thurston et al. 1985
Brook trout (Salvelinus fontinalis)	7.89	138	Cardwell et al. 1976
Carp (Cyprinus carpio)	7.2	8.8	Verma et al. 1981
Flagfish (Jordanella sp.)	8.15	1610	FOgels & Sprague 1977

Bullfrog (Rana sp.) 8.3 207 Thurston et al. 1985

pH DATA: Arithmetic mean of all results = 7.707 (only the results used for SMAV calculation)
Mean + 2 standard deviations = 8.80
Mean - 2 standard deviations = 6.61
Range over which acute criteria are applied = 6.61 – 8.80 std. units

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 (Tanytarsus dissimilis)
6. Fathead minnow, family Cyprinidae
7. Crayfish, family Astacidae
8. Channel catfish, family Ictaluridae

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

Normalize mean toxicity values to intercepts @ hardness = pH 0 using the slope of 1.0054 relating ln LC50 to pH. Species are arranged in the following table by genus names in alphabetical order).

Genus/species	Mean pH	Mean LC50/EC50	SMAI (LC50/EC50 @ pH 0)
Aplexa	7.40	149.31	0.08772
Branchiura	7.00	257.70	0.2263
Carassius	7.68	211.97	0.09442
Ceriodaphnia	7.30	150.00	0.09744
Crangonyx	7.63	532.99	0.2497
Cyprinus	7.20	8.8	0.006321
Daphnia			GMAI = 0.1087
D. magna	8.27	366.26	0.0896
D. pulex	8.13	468.25	0.1318
Gambusia	8.04	282.96	0.08779

Gammarus	7.63		255.42	0.1197
Gillia	6.70		492.95	0.5854
Hyalella	7.50		239.00	0.1270
Ictalurus	7.54		72.74	0.03725
Jordanella	8.15		1610	0.4450
Lepomis	7.60		151.7	0.07326
Limnodrilus	7.00		369.4	0.3244
Micropterus	7.20		212.23	0.1524
Onchorhynchus				GMAI = 0.04557
Coho salmon	7.07		56.62	0.04620
Chinook salmon		7.35	60.75	0.03753
Sockeye salmon	7.23		68.41	0.04768
Rainbow trout	7.97		156.92	0.05215
Orconectes	7.92		183000	63.74
Physa	7.20		267	0.1918
Pimephales	7.73		218.79	0.09244
Poecilia	7.12		365.08	0.2836
Quistadrilus	7.00		524.70	0.4608
Rana	8.30		207.00	0.04920
Rhyacodrilus	7.00		690.4	0.6064
Salvelinus	7.89		138	0.04954
Sepedon	7.50		28982.7	15.40
Simocephalus	7.89		235.72	0.08461
Spirosperma				GMAI = 0.5248
S. nikolskyi	7.00		902.10	0.7923
S. ferox	7.00		395.80	0.3476
Stylodrilus	7.00		828.63	0.7278
Tanytarsus	7.90		46000	16.35
Tubifex	7.00		445.45	0.3912
Variechaeta	7.00		96.65	0.08489

Genus Mean Acute Intercept calculations from above table (geometric means calculated if more than one species in a genus has data). The GMAIs are sorted from high to low and the representative receiving water classifications in Wisconsin are also noted.

	GMAI	CLASSIFICATIONS *			
GENUS NAME	(ug/L)	CW	WW	LFF	LAL
Orconectes	63.74	x	x	x	x
Tanytarsus	16.35	x	x	x	x
Sepedon	15.40	x	x	x	x
Stylodrilus	0.7278	x	x	x	x
Rhyacodrilus	0.6064	x	x	x	x
Gillia	0.5854	x	x	x	x
Spirosperma	0.5248	x	x	x	x
Quistadrilus	0.4608	x	x	x	x
Jordanella	0.4450	#			
Tubifex	0.3912	x	x	x	x
Limnodrilus	0.3244	x	x	x	x
Poecilia	0.2836	#			
Crangonyx	0.2497	x	x	x	x
Branchiura	0.2263	x	x	x	x
Physa	0.1918	x	x	x	x
Micropterus	0.1524	x	x		
Hyalella	0.1270	x	x	x	x

Gammarus	0.1197	x	x	x	x
Daphnia	0.1087	x	x	x	x
Ceriodaphnia	0.09744	x	x	x	x
Carassius	0.09442	x	x	x	
Pimephales	0.09244	x	x	x	
Gambusia	0.08779	#			
Aplexa	0.08772	x	x	x	x
Varichaeta	0.08489	x	x	x	x
Simocephalus	0.08461	x	x	x	x
Lepomis	0.07326	x	x		
Salvelinus	0.04954	x			
Rana	0.04920	x	x	x	x
Onchorhynchus	0.04557	x			
Ictalurus	0.03725	x	x		
Cyprinus	0.006321	x	x	x	
TOTAL NUMBER REPRESENTED:		32	27	24	21

* - 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.

- Gambusia, poecilia, jordanella are not Wisconsin- or Great Lakes-resident fish species. They are included in the overall (coldwater) database but not included in the other classifications since they are also not among the most sensitive organisms. Including them in the overall database should give a criterion result that more closely approximates EPA's criterion (and thereby reducing the possibility of criteria more stringent than EPA's, which is what would happen with a smaller database but the same organisms as most sensitive).

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).

CRITERIA CALCULATION (values here are rounded, un-rounded values are used in the actual calculation of criteria):

		CW	WW	LFF	LAL
GMAI RANKS					
	4	0.0492038	0.0732560	0.0848867	0.0877168
	3	0.0455659	0.0492038	0.0846126	0.0848867
	2	0.0372481	0.0372481	0.0492038	0.0846126
	1	0.0063211	0.0063211	0.0063211	0.0492038
n		32	27	24	21
ln GMAI					
	4	-3.011785	-2.613795	-2.466437	-2.433642
	3	-3.088595	-3.011785	-2.469672	-2.466437
	2	-3.290154	-3.290154	-3.011785	-2.469672
	1	-5.063854	-5.063854	-5.063854	-3.011785
(ln GMAI)^2					
	4	9.0708501	6.8319239	6.0833128	5.9226125
	3	9.5394211	9.0708501	6.0992810	6.0833128
	2	10.825116	10.825116	9.0708501	6.0992810
	1	25.642619	25.642619	25.642619	9.0708501
P					
	4	0.1212121	0.1428571	0.16	0.1818182
	3	0.0909091	0.1071429	0.12	0.1363636
	2	0.0606061	0.0714286	0.08	0.0909091
	1	0.0303030	0.0357143	0.04	0.0450454
sq rt P					
	4	0.3481553	0.3779645	0.4	0.4264014
	3	0.3015113	0.3273268	0.3464102	0.3692745
	2	0.2461830	0.2672612	0.2828427	0.3015113
	1	0.1740777	0.1889822	0.2	0.2132007
EV		-14.45439	-13.97959	-13.01175	-10.38154
EW		55.078006	52.370509	46.896063	27.176056
EP		0.3030303	0.3571429	0.4	0.4545455
EPR		1.0699273	1.1615348	1.2292529	1.310388
J		0.05	0.05	0.05	0.05
S		12.997706	13.303119	14.33606	3.030903
L		-7.090247	-7.357906	-7.658598	-3.588033
A		-4.183872	-4.383238	-4.452958	-2.910484
FAI		0.0152394	0.0124849	0.0116441	0.0544494
ACI		0.0076197	0.0062424	0.005822	0.0272247
ln ACI		-4.877019	-5.076385	-5.146105	-3.603631

The WW and LFF criteria are set equal to the CW criterion. The calculated equations resulted in more stringent criteria, but since the organisms are already protected within the CW criteria database, there was no need to make criteria more protective for WW or LFF waters. The classification-specific criteria are only used when less stringent criteria are adequately protective.

PENTACHLOROPHENOL
ACUTE CRITERION EQUATIONS:

	CW, WW, LFF	LAL
SLOPE	**1.0054**	**1.0054**
ln ACI	-4.877	**-3.6036**

mean pH + 2SD	8.8
MEAN pH - 2 SD	6.6

ATC (in ug/L) @ pH =		
≤ 6.6	**5.25**	**20.74**
7.8	**19.40**	**69.31**
≥ 8.8	**53.01**	**189.41**

Acute toxicity criteria for pentachlorophenol (in ug/L):
Coldwater, warmwater sportfish, warmwater forage fish, limited forage fish:
ATC = EXP ((1.0054 X pH) – 4.877)
Limited aquatic life:
ATC = EXP ((1.0054 X pH) – 3.6036)
where EXP = e raised to the power of the term in parentheses

NOTE: The LAL criterion is not published in ch. NR 105 Table 2 as of August 1997. This should be corrected the next time the tables are updated. This is not considered to be a critical correction given that downstream uses must also be protected and since few permittees detect pentachlorophenol in their effluents.

CHRONIC TOXICITY CRITERIA

EPA CHRONIC VALUES

(values from 9/86 EPA AWQC document, EPA 440/5-86-009)

SPECIES NAME	pH	ACUTE VALUE	CHRONIC VALUE	ACR	SMACR	CHRONIC DATABASE REFERENCE SOURCES
D. magna	?	600	240	2.50	2.50	Adema, 1978
S. vetulus	7.3	160	177.2	0.90	0.89	Hedtke, et al. 1986
	7.9 - 8.4	196	221.2	0.89		Hedtke, et al. 1986
Rainbow trout	7.4	66	14.46	4.56	4.56	Dominguez & Chapman, 1984
Fathead minnow	7.1 - 8.3	224.9	57.25	3.93	4.61	Holcombe, et al. 1982
	6.5	95	23.89	3.98		Spehar, et al. 1985
	7.5	218	40.08	5.44		Spehar, et al. 1985
	8	261	48.99	5.33		Spehar, et al. 1985
	8.5	378	89.23	4.24		Spehar, et al. 1985

Acute chronic ratios used in criteria calculations:
Coldwater = Geo. Mean of 2.50, 0.89, 4.56, 4.61 = 2.62
Warmwater, limited forage fish = Geo. Mean of 2.50, 0.89, 4.61 = 2.18
Limited aquatic life = Geo. Mean of 2.50, 0.89 = 1.50 (< 2, so 2 is used and the chronic and acute criteria are the same)

ln CCI = ln (FAI / ACR)
CW = ln (0.0152394 / 2.62) = -5.1468
WW, LFF = ln (0.0152394 / 2.18) = -4.9617
LAL = ln (0.0544494 / 2) = -3.6036

PENTACHLOROPHENOL
CHRONIC CRITERION EQUATIONS:

	CW	WW, LFF	LAL
SLOPE	**1.0054**	**1.0054**	**1.0054**
ln CCI	-5.1468	**-4.9617**	**-3.6036**
mean pH + 2SD		8.8	
MEAN pH - 2 SD		6.6	
CTC @ pH =			
≤ 6.6	**4.43**	**5.33**	**20.74**
7.8	**14.81**	**17.82**	**69.31**
≥ 8.8	**40.48**	**48.70**	**189.41**

NOTE: The LAL criterion is not published in ch. NR 105 Table 2 as of August 1997. This should be corrected the next time the tables are updated. This is not considered to be a critical correction given that downstream uses must also be protected and since few permittees detect pentachlorophenol in their effluents.