MINNESOTA POLLUTION CONTROL AGENCY — AQUATIC LIFE CRITERIA

Page 1 SUMMARY — Revised Feb. 1993

A. Chemical: Pentachlorophenol CAS# 87865 Date Nov. 1989

B. Minnesota Criterion: ug/l (unless noted otherwise)

Water Class	Use	CC	MC	FAV	Basis*
1,2A	DW, Salmonid	0.93	9.1	18	PCA Hc
1,2B,2C	DW, NonSalmonid	1.9	9.1	18	PCA Hc
2B,2C	NonSalmonid	5.5	9.1	18	PCA HcT1
	Other				

Toxicity related to water quality: yes, pH
If yes, above criteria values determined for: pH of 7.0
Slope: Acute: Chronic: 1.005

Formulas:
MPCA: Same as EPA
EPA: CC: e(1.005(pH)-5.290)
MC: e(1.005(pH)-4.830)
FAV: e(1.005(pH)-4.1373)

Notes:

C. EPA Criterion: ug/l
Date: 1986
CCC: e(1.005(pH)-5.290) Basis: FAV/3.166
MC: e(1.005(pH)-4.830) Basis: FAV/2
FAV: e 1.005(pH)-4.1373 Basis: tox

Notes:

D. Other Criteria:

ug/l	value	Source
	none	IJC

E. Notes: 2B,2C Standard, toxicity-based criterion applies up to pH of 6.96. Above this pH, human health-based criterion applies.

*Criteria basis codes for part B:
EPA = From EPA criterion
PCA = Criterion developed by Minnesota Pollution Control Agency staff
T1 = Direct aquatic life toxicity, EPA national criteria procedures used
T2 = Direct aquatic life toxicity, EPA advisory procedures used
Hs = Human health systemic effects
Hc = Human health carcinogenic effects
R = Tissue residue (bioaccumulation)
W = Wildlife effects
O = Organoleptic (taste and odor)
Other = Criterion based on other end point

MINNESOTA POLLUTION CONTROL AGENCY AQUATIC LIFE CRITERIA

Page 2 DIRECT AQUATIC LIFE TOXICITY
EPA Criterion Available Revised Feb. 1993

A. Chemical Pentachlorophenol CAS# 87865 Date Nov. 1989

B. EPA Criterion ug/l CCC: e(1.005(pH)-5.290) Basis: FAV/3.166
Date: 1986 MCC: e(1.005(pH)-4.830)
FAV: e 1.005(pH)-4.1373 Basis: FAV

1. Related to water quality: Yes, pH

2. Toxicity ug/l FAV: 10.97 at pH 6.5 N: 33 ACR: 3.166
Chronic value: 3.465 at pH 6.5 N: --

3. Residue
FDA action level: NA
BCF Final: N total: N used:
geo mean at 1% lipid:
% lipid:
geo mean unadjusted for lipid:

C. MPCA Evaluation Of EPA Criterion
1. Four lowest GMAVs: 1. Carp 3. Oncorhynchus
2. Channel catfish 4. Brook trout

2. Commercially or recreationally important species: no

3. Plant data: OK

4. Extrapolation of water quality effects: OK

5. Chronic data ug/l No. of values: 9 for 6 species
No. below criterion: 1 for Ceriodaphnia reticulata
Notes:

6. ACRs ACR used by EPA: 3.166 N: 5
Geo. mean, all ACRs: 4.71 N: 7
ACR used by MPCA: 3.166 N: 5
Notes:

D. Cool/Warm Water Criterion ug/l
No. of Salmonids deleted from lowest 4 GMAVs: 2
N(nonsal): 30 FAV: 10.584 MC: 5.292 CC: 3.343 at pH of 6.5
Adjustments to FAV: nonsalmonid FAV adjusted to equal national FAV
Notes:

CC = 1.005(pH) - 5.32563

E. Summary of changes made to EPA criterion

No changes made.
No changes to toxicity-based criterion, Feb. 1993.

A. Chemical: Pentachlorophenol CAS#: 87865 Date: 1-30-90

B. EPA Human Health Criterion: df: 1010 f: 29,400 d: --
ug/l
ADI/Ref.dose: 0.03 mg/kg/day slope:
Final BCF: 11 %lipid: 3
K: 1

C. Minnesota Human Health Criterion

1. Ref.dose: mg/kg/day Source:
K: Source:

2. Potency slope: 0.12 Source: IRIS, MDH

3. Measured BAFs:

Species/Tissue	BAF	%lipid	Norm. BAF
1. Rainbow trout	67	9.0	7.4
2. Lake trout	200	14.5	13.8
3. Brown trout	400	10.4	38.5
4. Coho salmon (mean of 2 sizes)	266	3.4	78.3
Geo mean:			23.6

4. Measured BCFs

Species/Tissue	BCF	%lipid	Norm. BCF
1. Fathead minnow	770	7.6	101.3
2. Salmonid	216	13.25	16.3
3. Salt water species	27	3.6	7.5
4.			
5.			
6.			
Geo mean: of 2 freshwater species			40.6

5. Edible portion BAF or BCF

	BAF	BCF
Cold water: 6.0 % lipid	141.6	
Warm water: 1.5 % lipid	35.4	

6. Geo mean unadjusted for lipid: BAF: BCF:

7. log Kow: 4.1 meas. X QSAR Est. BCF:
adjust. for % lipid:

8. Parachor: 410

9. BCF to BAF conversion factor: not used because BAFs available

10. Final BAF: 2A: 142 2B,2C: 35

11. Criteria: 2A: 0.93 2Bd: 1.9 2B/2C: 5.5 RAL: 200 List No.3 Jan. 1991
ug/l

D. Organoleptic: 30 Source: EPA
ug/l

F. Notes: 1. BAF data in C.3. used.
2. 2B/2C standard toxicity-based up to pH of 6.96. Above a pH of 6.96 human health-based criterion applies.

MINNESOTA POLLUTION CONTROL AGENCY AQUATIC LIFE CRITERIA

Page 1 SUMMARY

A. Chemical: Pentachlorophenol CAS# 87865 Date Nov. 1989

B. Minnesota Criterion: ug/l (unless noted otherwise)

Water Class	Use	CC	MC	FAV	Basis*
1,2A	DW, Salmonid	5.7	9.1	18	EPA,T1
1,2B,2C	DW, NonSalmonid	5.7	9.1	18	EPA,T1
2B,2C	NonSalmonid	5.7	9.1	18	EPA,T1
	Other				

Toxicity related to water quality: yes, pH
If yes, above criteria values determined for: pH of 7.0
Slope: Acute: 1.005 Chronic: 1.005

Formulas:
MPCA: Crit pH = 2.732$^{(pH-7)}$ x crit pH$_7$
EPA: CC: e(1.005(pH)-5.290)
MC: e(1.005(pH)-4.830)
FAV: e(1.005(pH)-4.1373)
Notes:

C. EPA Criterion: ug/l
Date: 1986
CCC: e(1.005(pH)-5.290) Basis: FAV/3.166
MC: e(1.005(pH)-4.830) Basis: FAV/2
FAV: e 1.005(pH)-4.1373 Basis: tox
Notes:

D. Other Criteria:

ug/l	value	Source
	none	IJC

E. Notes:

*Criteria basis codes for part B:
EPA = From EPA criterion
PCA = Criterion developed by Minnesota Pollution Control Agency staff
T1 = Direct aquatic life toxicity, EPA national criteria procedures used
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Hs = Human health systemic effects
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MINNESOTA POLLUTION CONTROL AGENCY AQUATIC LIFE CRITERIA

Page 2 DIRECT AQUATIC LIFE TOXICITY
EPA Criterion Available

A. Chemical Pentachlorophenol CAS# 87865 Date Nov. 1989

B. EPA Criterion ug/l CCC: e(1.005(pH)-5.290) Basis: FAV/3.166
Date: 1986 MCC: e(1.005(pH)-4.830)
FAV: e(1.005(pH)-4.1373 Basis: FAV

1. Related to water quality: Yes, pH

2. Toxicity ug/l FAV: 10.97 at pH 6.5 N: 33 ACR: 3.166
Chronic value: 3.465 at pH 6.5 N: --

3. Residue
FDA action level: NA
BCF Final: N total: N used:
geo mean at 1% lipid:
% lipid:
geo mean unadjusted for lipid:

C. MPCA Evaluation Of EPA Criterion
1. Four lowest GMAVs: 1. Carp 3. Oncorhynchus
2. Channel catfish 4. Brook trout

2. Commercially or recreationally important species: no

3. Plant data: ok

4. Extrapolation of water quality effects: ok

5. Chronic data ug/l No. of values: 9 for 6 species
No. below criterion: 1 for Ceriodaphnia reticulata
Notes:

6. ACRs ACR used by EPA: 3.166 N: 5
Geo. mean, all ACRs: 4.71 N: 7
ACR used by MPCA: 3.166 N: 5
Notes:

D. Cool/Warm Water Criterion ug/l
No. of Salmonids deleted from lowest 4 GMAVs: 2
N(nonsal): 30 FAV: 10.584 MC: 5.292 CC: 3.343 at pH of
Adjustments to FAV: nonsalmonid FAV adjusted to equal national FAV
Notes:

E. Summary of changes made to EPA criterion

No changes made.

MINNESOTA POLLUTION CONTROL AGENCY AQUATIC LIFE CRITERIA

Page 4 HUMAN HEALTH

A. Chemical: Pentachlorophenol CAS#: 87865 Date: 1-30-90

B. EPA Human Health Criterion: df: 1010 f: 29,400 d: --
ug/l
ADI/Ref.dose: 0.03 mg/kg/day slope:
Final BCF: 11 %lipid: 3
K: 1

C. Minnesota Human Health Criterion

1. Ref.dose: 0.03 mg/kg/day Source: MDH
K: 0.2 Source: MPCA

2. Potency slope: Source:

3. Measured BAFs:

Species/Tissue	BAF	%lipid	Norm. BAF
1. Salmonids	1000		
2. Gambusia affinis (mosquito fish)	296		
3. Mussel	345		
4.			
5.			
6.			
Geo mean:	467		

4. Measured BCFs

Species/Tissue	BCF	%lipid	Norm. BCF
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Geo mean:			

5. Edible portion BAF or BCF

	BAF	BCF
Cold water: 6.0 % lipid		
Warm water: 1.5 % lipid		

6. Geo mean unadjusted for lipid: BAF: BCF:

7. log Kow: 4.1 meas. X QSAR Est. BCF:
adjust. for % lipid:

8. Parachor: 410

9. BCF to BAF conversion factor: not used because BAFs available

10. Final BAF: 2A: 467 2B,2C: 467

11. Criteria: df(2A): 26.2 df(2B,2C): 26.2 f: 30 RAL: 220
ug/l

D. Organoleptic: 30 Source: EPA
ug/l

F. Notes:

*** MINNESOTA - AQUATIC LIFE CRITERIA ***

Chemical: Pentachlorophenol Recalculation Date: Nov. 22, 1989

New Rank	Genus Mean Acute Value (ug/L)		Species Mean Acute Value (ug/L)	Resident/ Salmonid	Species
	(1)				
33	43,920		43,920	R	Crayfish (Orconectes immunis)
32	11,260		11,260	R	Midge (Tanytarsus dissimilis)
31	10,610		10,610	R	Sciomyzid (Sepedon fuscipennis)
30	417.7		418	NR	Tubificid worm (Rhyacodrilus montana)
29	408.2		408	R	Tubificid worm (Stylodrilus heringianus)
28	403.2		403	NR	Snail (Gillia altilis)
27	361.6	*	546	R	Tubificid worm (Spirosperma nikolskyi)
27	361.6	*	240	R	Tubificid worm (Spirosperma ferox)
26	317.5		318	R	Tubificid worm (Quistradrilus multisetosus)
25	291.6		292	NR	Flagfish (Jordanella floridae)
24	224.2		224	R	Tubificid worm (Tubifex tubifex)
23	195.4		195	NR	Guppy (Lebistes reticulata)
22	182.5		183	R	Tubificid worm (Limnodrilus hoftmeisteri)
21	172.1		172	R	Amphipod (Crangonyx pseudogracilis)
20	155.9		156	R	Tubificid worm (Branchiura sowerbyi)
19	132.1		132	R	Snail (Physa gyrina)
18	121.1		121	R	Amphipod (Gammarus pseudolimnaeus)
17	105.0		105	R	Largemouth bass (Micropterus salmoides)
16	87.48		87	R	Amphipod (Hyalella azteca)
15	78.10	!	67	R	Cladoceran (Daphnia magna)
15	78.10	!	91	R	Cladoceran (Daphnia pulex)
14	67.13		67	R	Cladoceran (Ceriodaphnia reticulata)
13	65.53		66	R	Goldfish (Carassius auratus)
12	63.11		63	R	Fathead minnow (Pimephales promelas)
11	60.50		61	NR	Mosquitofish (Gambusia affinis)
10	60.43		60	R	Snail (Aplexa hypnorum)
9	58.47		58	NR	Tubificid worm (Varichaeta pacifica)
8	57.72		58	R	Cladoceran (Simocephalus vetulus)
7	56.41		56	R	Bluegill (Lepomis macrochirus)
6	44.48		44	R	Bullfrog (Rana catesblana)
5	35.34		35	SR	Rainbow trout (Salmo gairdneri)
4	34.13		34	SR	Brook trout (Salvellnus fontinalis)
3	30.01	$	26	SR	Chinook salmon (Oncorhynchus tshawytscha)
3	30.01	$	33	SR	Sockeye salmon (Oncorhynchus nerka)
3	30.01	$	32	SR	Coho salmon (Oncorhynchus kisutch)
2	26.54		27	R	Channel catfish (Ictalurus punctatus)
1	4.355		4	R	Common carp (Cyprinus carpio)
====	========		========		
	33		37		

(1) Genus value equals geometric mean of species values.
NR = nonresident
SR = salmonid

*** MINNESOTA CLASS 2B/2C AQUATIC LIFE CRITERIA ***
(Non-salmonids excluded from lowest four)

Chemical: Pentachlorophenol Recalculation Date: Nov. 22, 1989

Rank	(1,2) Genus Mean Acute Value (ug/L)	(1) Species Mean Acute Value (ug/L)	Resident/ Salmonid	Species
7	56.410	56	R	Bluegill (Lepomis macrochirus)
6	44.480	44	R	Bullfrog (Rana catesblana)
2	26.540	27	R	Channel catfish (Ictalurus punctatus)
1	4.355	4	R	Common carp (Cyprinus carpio)

(1) Genus and Species mean acute values water quality related: no
(2) Lowest 4 genus mean acute values.

FAV CALCULATION: (Non-Salmonid)

R = Rank	GMAV or SMAV	X = ln(GMAV) or ln(SMAV)	X^2	Y^2 = R/(N+1)	Y
4	56.410	4.03265	16.2622	0.1290	0.3592
3	44.480	3.79504	14.4023	0.0968	0.3111
2	26.540	3.27865	10.7496	0.0645	0.2540
1	4.355	1.47132	2.1648	0.0323	0.1796
	Sum	12.57766	43.5789	0.3226	1.1039

N = 30 Slope = 1.005

M = 0.06671 ACR = 3.166

A = 2.35937 BCF = NA

FAV = 10.584 ug/L
MC = 5.292 ug/l
CC = 3.343 ug/l

Recalculated nonsalmonid FAV not used becuase it is lower than national FAV

Table 5b. BIOCONCENTRATION DATA: 87865 PENTACHLOROPHENOL

Species Latin Name Species Common Name	Effect	FW/SW	Dur (days)	Ex Ty	R C	BCF or BAF	Percent Lipid	Tissue Type	M d.	Ref No.
Gambusia affinis Mosquito fish	BAF	FRESH	2			296				Lu, et al., 1975
Mytilus edulis Mussel	BAF					345				Geyer, et al., 1982
Salmonids	BAF	FRESH				1000				Niimi, 1985