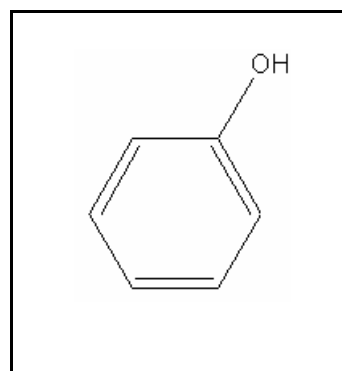




TIER I ACUTE AND TIER II CHRONIC AQUATIC LIFE VALUES

PHENOL

CAS RN: 108-95-2
Water Solubility: 8.28 g/100 mL
Log K_{ow} : 1.46



Standard

The procedures described in the Tier I and Tier II methodologies indicate that, except possibly where a locally important species is very sensitive, aquatic organisms should not be affected unacceptably if the four (4) day average concentration of phenol does not exceed 180 $\mu\text{g/L}$ more than once every three (3) years on the average and if the one (1) hour average concentration does not exceed 1,300 $\mu\text{g/L}$ more than once every three (3) years on the average.

Calculations

Acute Aquatic Life:

Four Lowest GMAVs:

Bluegill	20,393 $\mu\text{g/L}$
White Sucker	10,600 $\mu\text{g/L}$
Rainbow Trout	10,073 $\mu\text{g/L}$
Cladoceran	3,100 $\mu\text{g/L}$

$$S^2 = 49.7691$$

$$S = 7.0547$$

$$L = 6.3132$$

$$A = 7.8907$$

$$FAV = 2,672$$

$$CMC = FAV/2 = 1,300 \mu\text{g/L}$$

Chronic Aquatic Life:

$$SCV = SAV/SACR$$

$$SACR = 14.75 \text{ (geometric mean of 18, 18, and 9.898)}$$

$$SCV = 2,672/14.75 = 180 \mu\text{g/L}$$

Calculation of ACR's

Fathead Minnow

$$MATC = 2,556 \mu\text{g/L} \text{ (geometric mean of LOEC and NOEC)}$$

$$ACR = LC_{50}/MATC = 25,300/2,556 = 9.898$$

Data

Table 1. GMAVs and SMAVs for phenol

<u>Genus Mean Acute Value ($\mu\text{g/L}$)</u>	<u>Species</u>	<u>Species Mean Acute Value ($\mu\text{g/L}$)</u>	<u>Acute- Chronic Ratio</u>	<u>Reference Number</u>
30,772	Fathead Minnow <u>Pimephales promelas</u>	28,000		1
	Fathead Minnow <u>Pimephales promelas</u>	24,900		2
	Fathead Minnow <u>Pimephales promelas</u>	23,000		3
	Fathead Minnow <u>Pimephales promelas</u>	43,700		3

	Fathead Minnow <u>Pimephales promelas</u>	31,200	3
	Fathead Minnow <u>Pimephales promelas</u>	25,600	4
	Fathead Minnow <u>Pimephales promelas</u>	34,300	5
	Fathead Minnow <u>Pimephales promelas</u>	32,000	5
	Fathead Minnow <u>Pimephales promelas</u>	28,800	6
	Fathead Minnow <u>Pimephales promelas</u>	32,400	6
	Fathead Minnow <u>Pimephales promelas</u>	49,700	6
	Fathead Minnow <u>Pimephales</u>	25,300	15
10,073	Rainbow Trout <u>Oncorhynchus mykiss</u>	8,900	2
	Rainbow Trout <u>Oncorhynchus mykiss</u>	9,900	7
	Rainbow Trout <u>Oncorhynchus mykiss</u>	11,600	8
20,393	Bluegill <u>Lepomis macrochirus</u>	23,900	5
	Bluegill <u>Lepomis macrochirus</u>	17,400	15
39,200	Guppy <u>Poecilia reticulata</u>	39,200	5
44,500	Goldfish <u>Carassius auratus</u>	44,500	5

36,300	Flagfish <u>Jordanella floridae</u>	36,300	8
34,823	Cladoceran <u>Daphnia magna</u>	15,000	9
	Cladoceran <u>Daphnia magna</u>	14,500	10
	Cladoceran <u>Daphnia magna</u>	13,300	10
	Cladoceran <u>Daphnia magna</u>	11,200	10
	Cladoceran <u>Daphnia magna</u>	12,000	11
	Cladoceran <u>Daphnia magna</u>	19,800	4
	Cladoceran <u>Daphnia magna</u>	6,600	12
	Cladoceran <u>Daphnia magna</u>	4,240	13
	Cladoceran <u>Daphnia magna</u>	10,700	13
	Cladoceran <u>Daphnia magna</u>	12,600	15
	Cladoceran <u>Daphnia pulicaria</u>	109,000	2
3,100	Cladoceran <u>Ceriodaphnia dubia</u>	3,100	14
10,600	White Sucker <u>Catostomus commersoni</u>	10,600	15
>51,100	Midge <u>Tanytarsus dissimilis</u>	>51,100	15
>51,100	Snail <u>Aplexa hypnorum</u>	>51,100	15

>51,100	Clawed Frog <u>Xenopus laevis</u>	>51,100	15
25,000	Isopod <u>Asellus intermedius</u>	25,000	16
>100,000	Annelid <u>Lumbriculus variegatus</u>	>100,000	16

References

1. Phipps, G.L., G.W. Holcombe, and J.T. Fiandt 1981. Acute toxicity of phenol and substituted phenols to the fathead minnow. Bull. Environ. Contam. Toxicol. 26: 585-593.
2. DeGraeve, G.M., D.L. Geiger, J.S. Meyer, and H.L. Bergman 1980. Acute and embryolarval toxicity of phenolic compounds to aquatic biota. Arch. Environ. Contam. Toxicol. 9: 557-568.
3. Mayes, M.A., H.C. Alexander, and D.C. Dill 1983. A study to assess the influence of age on the response of fathead minnows in static acute toxicity tests 1983. Bull. Environ. Contam. Toxicol. 31: 139-147.
4. Millemann, R.E., W.J. Birge, J.A. Black, R.M. Cushman, K.L. Daniels, P.J. Franco, J.M. Giddings, J.F. McCarthy, and A.J. Stewart 1984. Comparative acute toxicity to aquatic organisms of components of coal-derived synthetic fuels. Trans. Am. Fish. Soc. 113: 74-85.
5. Pickering, Q.H. and C. Henderson 1966. Acute toxicity of some important petrochemicals to fish. J. Wat. Pollut. Contr. Fed. 88: 1419-1429.
6. Geiger, D.L., C.E. Northcott, D.J. Call 1985. Acute Toxicities of Organic Chemicals to Fathead Minnows (Pimephales promelas). Vol II. Center for Lake Superior Environmental Studies University of Wisconsin-Superior. 326 pp.
7. Qureshi, A.A., K.W. Flood, S.R. Thompson, S.M. Janhurst, C.S. Inniss, and D.A. Rokosh 1982. Comparison of a luminescent bacterial test with other bioassays for determining toxicity of pure compounds and complex effluents. In: J.G. Pearson, R.B. Foster and W.E. Bishop (Eds.), Aquatic Toxicology and Hazard Assessment, 5th Conference, ASTM STP 766, Philadelphia, PA: 179-195.

8. Fogels, A., and J.B. Sprague 1977. Comparative short-term tolerance of zebrafish, flagfish, and rainbow trout to five poisons including potential reference toxicants. *Water Res.* 11: 811-817.
9. Janssen, C.R. and G. Persoone 1993. Rapid toxicity screening tests for aquatic biota. 1. Methodology and experiments with *Daphnia magna*. *Environ. Toxicol. Chem.* 12: 711-717.
10. Gersich, F.M., F.A. Blanchard, S.L. Applegarth, and C.N. Park 1986. The precision of Daphnid (*Daphnia magna* Straus, 1820) static acute toxicity tests. *Arch. Environ. Contam. Toxicol.* 15: 741-749.
11. LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24: 684-691.
12. Keen, R. and C.R. Baillod 1985. Toxicity to *Daphnia* of the end products of wet oxidation of phenol and substituted phenols. *Water Res.* 19: 767-772.
13. Lewis, M.A. 1983. Effects of loading density on the acute toxicities of surfactants, copper, and phenol to *Daphnia magna* Straus. *Arch. Environ. Contam. Toxicol.* 12: 51-55.
14. Oris, J.T., R.W. Winner and V.M. Moore 1991. A four-day survival and reproduction toxicity test for *Ceriodaphnia dubia*. *Environ. Toxicol. Chem.* 10: 217-224.
15. Holcombe, G.W., G.L. Phipps, A.H. Sulaiman, and A.D. Hoffman. 1987. Simultaneous multiple species testing: Acute toxicity of 13 chemicals to 12 diverse freshwater amphibians, fish and invertebrate families. *Arch. Environ. Contam. Toxicol.* 16: 697-710.
16. Ewell, W.S., J.W. Gorsuch, R.O. Kringle, K.A. Robillard, and R.C. Spiegel 1986. Simultaneous evaluation of the acute effects of chemicals on seven aquatic species. *Environ. Toxicol. Chem.* 5(9):831-840.

Acronyms/Abbreviations

CAS RN	Chemical Abstract Service Registry Number
K _{ow}	Octanol-Water Partition Coefficient
P (superscript)	Predicted value

SAV	Secondary Acute Value
GMAV	Genus Mean Acute Value
SAF	Secondary Acute Factor
SMC	Secondary Maximum Concentration
SCC	Secondary Continuous Concentration
SACR	Secondary Acute-Chronic Ratio
FT	Flow-through
S	Static
U	Unmeasured
M	Measured
EVISTRA	Evaluation and Interpretation of Suitable Test Results in AQUIRE (EPA quality checking method/database)

Revision History

April 7, 1999 Values first developed
September 19, 2001 New search for data. No studies added.
May 22, 2002 Isopod and annelid data added. Tier I acute criterion calculated.

Contact Information

David B. Kallander
Water Quality Standards Section
Indiana Department of Environmental Management
100 North Senate Ave., P.O. Box 6015
Indianapolis, IN 46206-6015
(317) 233-2472
Email: dkalland@dem.state.in.us