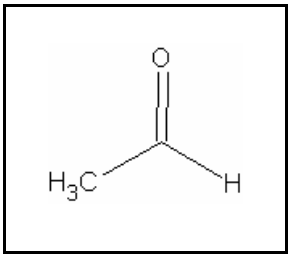
Indiana Department of Environmental Management
Office of Water - Water Quality Standards Section

TIER II ACUTE AND CHRONIC AQUATIC LIFE VALUES

2,4-DICHLOROPHENOXYACETIC ACID (2,4-D)

CAS RN: 94-75-7
Water Solubility: 0.0890 g/100 mL
Log K_{ow}: 2.80^{P}



Standard

The procedures described in the Tier II methodology 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 2,4-D does not exceed 240 µg/L more than once every three (3) years on the average and if the one (1) hour average concentration does not exceed 2,500 µg/L more than once every three (3) years on the average.

Calculations

Acute Aquatic Life:

SAV = lowest GMAV/SAF

Lowest GMAV = 30,166 µg/L
SAF = 6.1

SAV = 30,166/6.1 = 4,945 µg/L

SMC = SAV/2 = 4,945/2 = **2,500 µg/L**

Chronic Aquatic Life:

SCV = SAV/SACR

SACR = 20.46 (Geometric mean of 18, 68, 7)

SCV = 4,945/20.46 = 240 **µg/L**

Calculation of ACR's

Ceriodaphnia dubia

NOEC = 23,300 µg/L
LOEC = 48,800 µg/L

CV = Geometric Mean of 23300 and 48800 = 33,720

ACR = 236,000/33,720 = 7.0

Medaka

CV = 40,800
ACR = 2,780,000/40,800 = 68

Data

Table 1. GMAVs and SMAVs for 2,4-D

Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Acute-Chronic Ratio	Reference Number
30,166	Cladoceran Daphnia magna	25,000		1
	Cladoceran Daphnia magna	36,400		1
320,000	Fathead Minnow Pimephales promelas	320,000		1

157,733	Bluegill Lepomis macrochirus	263,000		1
	Pumpkinseed Lepomis gibbosus	94,600		3
358,000	Rainbow Trout Oncorhynchus mykiss	358,000		1
122,200	Annelid Lumbriculus variegatus	122,200		2
236,000	Cladoceran Ceriodaphnia dubia	236,000	7	3
52,952	Striped Bass Morone saxatilis	70,100		3
	White Perch Morone americanus	40,000		3
300,600	American Eel	300,600		3
37,768	Carp Cyprinus carpio	134,800		4
	Carp Cyprinus carpio	24,150		5
	Carp Cyprinus carpio	31,250		5
	Carp Cyprinus carpio	20,000		6
2,780,000	Medaka Oryzias latipes	2,780,000	68	7

References

1. Alexander, H.C., F.M. Gersich, and M.A. Mayes 1985. Acute toxicity of four phenoxy herbicides to aquatic organisms. Bull. Environ. Contam. Toxicol. 35(3): 314-321.

2. Bailey, H.C., and D.H.W. Liu 1980. Lumbriculus variegatus, a benthic oligochaete, as a bioassay organism. In: Aquatic Toxicology and Hazard Assessment, 3rd Symposium. J.C. Eaton, P.R. Parrish and A.C. Hendricks, Eds. ASTM STP 707, Philadelphia, P.A. 205-215.

3. Rehwoldt, R.E., E. Kelley, and M. Mahoney 1977. Investigations into the acute toxicity and some chronic effects of selected herbicides and pesticides on several fresh water fish species.

4. Sarkar, S.K. 1990. Acute toxicity of herbicide 2,4-D on common carp fry Cyprinus carpio. Environ. Ecol. 8(4): 1316-1318.

5. Vardia, H.K. and V.S. Durve 1981. The toxicity of 2,4-D to Cyprinus carpio var. communis in relation to the seasonal variation in the temperature. Hydrobiologia 77: 155-159.

6. Vardia, H.K. and V.S. Durve 1981. Bioassay study on some freshwater fishes exposed to 2,4-dichlorophenoxyacetic acid. Acta Hydrochim. Hydrobiol. 9(2): 219-223.

7. Holcombe, G.W., D.A. Benoit, D.E. Hammermeister, E.N. Leonard, and R.D. Johnson 1995. Acute and long-term effects of nine chemicals on the Japanese Medaka. Arch. Environ. Contam. Toxicol. 28: 287-297.

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

February 24, 1999 Values first developed
February 8, 2001 New search for data. Medaka data point added.

Contact Information

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