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

TIER II ACUTE AND CHRONIC AQUATIC LIFE VALUES

FLUORIDE

CAS RN: 16984-48-8
Water Solubility:
Log K_{ow}:
Henry's Law Constant:
Environmental Partitioning
@25 ^{0}C:
Hydrolysis Half-life:

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 fluoride does not exceed 3,400 µg/L more than once every three (3) years on the average and if the one (1) hour average concentration does not exceed 12,000 µg/L more than once every three (3) years on the average.

Calculations

Acute Aquatic Life:

SAV = lowest GMAV/SAF

Lowest GMAV = 101,600 µg/L
SAF = 4.3

SAV = 101,600/4.3 = 23,628 µg/L

SMC = SAV/2 = 23,628/2 = **12,000 µg/L**

Chronic Aquatic Life:

SCV = SAV/SACR

SACR = 6.991 (Geometric mean of 18, 2.4, 7.91)

SCV = 23,628/6.991 = **3,400 µg/L**

Calculation of ACR's

Daphnia magna

NOEC = 25 mg/L
LOEC = 40 mg/L

CV = Geometric Mean of 25 and 40 = 31.62
ACR =250/31.62 = 7.91

Pimephales promelas

NOEC = 66.6 mg/L
LOEC = 134.3 mg/L

CV = Geometric mean of 66.6 and 134.3 = 94.57
ACR = 225.1/94.57 = 2.4

Data

Table 1. Toxicity data used in the derivation of the acute and chronic aquatic life values.

Species	LC_{50}/EC_{50} (µg/L)	Duration (hr)	Test Type	Chemical Form	SMAV (µg/L)	GMAV (µg/L)	Reference Number	EVISTRA Score N, U, M
Rainbow Trout Oncorhynchus mykiss	**147,000**	**96**	**S,U**	**Sodium fluoride**	**147,000**	**156,000**	**1,4**	
Brown Trout Salmo trutta	**164,500**	**96**	**S,U**	**Sodium fluoride**	**164,500**	**165,700**	**1**	
Fathead Minnow Pimephales promelas	**180,000**	**96**	**S,U**	**Sodium fluoride**			**4**	
Fathead Minnow Pimephales promelas	**112,200**	**96**	**FT,M**	**Sodium fluoride**			**6**	

Fathead Minnow Pimephales promelas	**225,100**	**96**	**FT,M**	**Sodium fluoride**			**6**	
Worm Lumbriculus variegatus	**93,500**	**96**	**R,M**	**Sodium fluoride**	**119,000**	**119,000**	**6**	
Worm Lumbriculus variegatus	**113,100**	**96**	**R,M**	**Sodium fluoride**			**6**	
Worm Lumbriculus variegatus	**>160,000**	**96**	**R,M**	**Sodium fluoride**			**6**	
Cladoceran Daphnia magna	**250,000**	**48**	**S,U**	**Sodium fluoride**	**250,000**	**250,000**	**2,3**	
Snail Physa spp.	**231,700**	**96**	**R,M**	**Sodium fluoride**	**194,000**	**194,000**	**6**	
Snail Physa spp.	**163,100**	**96**	**R,M**	**Sodium fluoride**			**6**	
Midge Chironomous tentans	**93,100**	**48**	**R,M**	**Sodium fluoride**	**101,600**	**101,600**	**6**	
Midge Chironomous tentans	**110,900**	**48**	**R,M**	**Sodium fluoride**			**6**	
Stickleback Gasterosteus	**340,000**	**96**	**S,U**	**Sodium fluoride**	**340,000**	**340,000**	**4**	
Mussel Actinonaias pectorosa	**347,000**	**96**		**Sodium fluoride**	**265,000**	**265,000**	**5**	
Mussel Actinonaias pectorosa	**178,000**	**96**		**Sodium fluoride**			**5**	
Mussel Actinonaias pectorosa	**300,000**	**96**		**Sodium fluoride**			**5**	
Mussel Alasmidonta raveneliana	**303,000**	**96**		**Sodium fluoride**	**303,000**	**303,000**	**5**	

References

1. Camargo, J.A. and J.V. Tarazona 1991. Short-term toxicity of fluoride ion (F-) in soft water to rainbow trout (Salmo gairdneri) and brown trout (Salmo trutta fario). Fluoride

24(2): 76-83.

2. Fieser, A.H., J.L. Sykora, M.S. Kostalos 1986. Effect of fluorides on survival and reproduction of Daphnia magna. J. Water Pollut. Contr. Fed. 58(1): 82-86.

3. LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (Daphnia magna). Bull. Environ. Contam. Toxicol. 24(5): 684-691.

4. Smith, L.R., T.M. Holsen, N.C. Ibay 1985. Studies on the acute toxicity of fluoride ion to stickleback, fathead minnow and rainbow trout. Chemosphere 14: 1383-1389.

5. Keller, A. 1999. USEPA Region IV Unpublished data.

6. The Advent Group, Inc. 2000. Toxicity Test Results: Fluoride Water Quality Criteria. Prepared for U.S. Steel, Gary Works, by The Advent Group, Inc. Unpublished data.

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-thru
S	Static
U	Unmeasured

M	Measured
EVISTRA	Evaluation and Interpretation of Suitable Test Results in AQUIRE (EPA quality checking method/database)

Revision History

January 22, 1997 – Values first developed.
June 17, 1999 - Values updated with unpublished data from Anne Keller.
May 18, 2000 - Values updated with data submitted by The Advent Group, Inc.

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