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

# TIER II ACUTE AND CHRONIC AQUATIC LIFE VALUES

# COBALT

CAS RN: 7440-48-4
Water Solubility: <0.1 g/100 mL
Log $K_{ow}$:

## 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 cobalt does not exceed 19 µg/L more than once every three (3) years on the average and if the one (1) hour average concentration does not exceed 120 µg/L more than once every three (3) years on the average.

## Calculations

Acute Aquatic Life:

SAV = lowest GMAV/SAF

Lowest GMAV = 1,406 µg/L
SAF = 6.1

SAV = 1,406/6.1 = 230.5 µg/L

SMC = SAV/2 = 230.5/2 = **120 µg/L**

Chronic Aquatic Life:

SCV = SAV/SACR

SACR = 12 (geometric mean of 18, 18, and 5.2)

SCV = 230.5/12 = **19 μg/L**

Calculation of ACR's

*Fathead Minnow*

MATC for growth = 413.6 μg/L (geometric mean of 290 and 560)

ACR = $LC_{50}$/MATC = 3,610/413.6 = 8.7

MATC for mortality = 1140 μg/L
ACR = $LC_{50}$/MATC = 3,610/1140 = 3.2

Fathead minnow ACR = 5.2

Notes:

NONE

## Data

Table 1. GMAVs and SMAVs for cobalt

| Genus Mean Acute Value (μg/L) | Species | Species Mean Acute Value (μg/L) | Acute-Chronic Ratio | Reference Number |
|---|---|---|---|---|
| 139,320 | Tubificid Worm Tubifex tubifex | 139,320 | | 1 |
| 4,037 | Cladoceran Daphnia magna | 1,490 | | 2 |

| | | | |
|---|---|---|---|
| | Cladoceran<br>Daphnia magna | 7,370 | 4 |
| | Cladoceran<br>Daphnia magna | 5,990 | 4 |
| 39,200 | Amphipod<br>Crangonyx pseudogracilis | 39,200 | 3 |
| 3,610 | Fathead Minnow<br>Pimephales promelas | 3,610 | 4 |
| 1,406 | Rainbow Trout<br>Oncorhychus mykiss | 1,406 | 5 |

## References


1. Khangarot, B.S. 1991. Toxicity of metals to a freshwater tubificid worm, Tubifex tubifex (Muller). Bull. Environ. Contam. Toxicol. 46: 906-912.

2. Khangarot, B.J. and P.K. Ray 1989. Investigation of correlation between physicochemical properties of metals and their toxicity to the water flea Daphnia magna Straus. Ecotoxicol. Environ. Saf. 18(2): 109-120.

3. Martin, T.R. and D.M. Holdich 1986. The acute lethal toxicity of heavy metals to percarid crustaceans (with particular reference to asellids and gammarids). Water Res. 20(9): 1137-1147.

4. Kimball, G. 1978. The effects of lesser known metals and one organic to fathead minnows (Pimephales promelas) and Daphnia magna. Manuscript, Department of Entomology, Fisheries and Wildlife, University of Minnesota, Minneapolis, MN. 88 p.

5. Marr, J.C.A, J.A. Hansen, J.S. Meyer, D. Cacela, T. Poddrabsky, J. Lipton, and H.L. Bergman 1998. Toxicity of cobalt and copper to rainbow trout: application of a mechanistic model for predicting survival. Aquatic Toxicol. 43: 225-238.


## 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

March 26, 1999 Values first developed
January 12, 2001 New search for data. Rainbow trout data added.

## 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