Rule 57 Aquatic Values Data Sheet

Chemical: Vanadium
CAS #: 7440-62-2

Developed by: Dennis Bush *FAV: 160 ug/l* *(Tier: II)*
Approved by: [illegible] *AMV: 79 ug/l* *(Tier: II)*
Approval date: 4/22/11 *FCV: 27 ug/l* *(Tier: II)*
Literature search date: 3/28/2011 *Acute CF: ----* *Chronic CF: ----*

ACUTE DATA

Species	Endpoint (EC or LC50)	Duration (hours)	Test Type (FT,M, etc.)	Hardness mg/L	Test Chemical	LC50/EC50 ug/L	SMAV ug/L	GMAV ug/L	Rank	Reference
Amphipod	LC50	96	FT,M	100	Na_3VO_4	792	963	963	1	6
(*Hyalella azteca*)	LC50	96	FT,M	100	Na_3VO_4	1,172				6
Water Flea	LC50	48	S,M	-----	V_2O_5	1,580	1,282	1,282	2	1
(Daphnia magna)	LC50	48	S,M	-----	V_2O_5	1,460				1
	LC50	48	S,M	80-100	Na_3VO_4	913				6
Fathead Minnow	LC50	96	FT,M	100	Na_3VO_4	1,854	2,241	2,241	3	6
(Pimephales promelas)	LC50	96	FT,M	100	Na_3VO_4	2,709				6
Bonytail Chub	LC50	96	S,U	197	$NaVO_3$	5,300	3,903	3,903	4	2
(Gila elegans)	LC50	96	S,U	197	$NaVO_3$	2,200				2
	LC50	96	S,U	197	$NaVO_3$	5,100				2
Razorback Sucker	LC50	96	S,U	197	$NaVO_3$	8,800	4,727	4,727	5	2
(Xyrauchen texanus)	LC50	96	S,U	197	$NaVO_3$	4,000				2
	LC50	96	S,U	197	$NaVO_3$	3,000				2
Colorado Squawfish	LC50	96	S,U	197	$NaVO_3$	7,800	5,033	5,033	6	2
(Ptychocheilus lucius)	LC50	96	S,U	197	$NaVO_3$	3,800				2
	LC50	96	S,U	197	$NaVO_3$	4,300				2
Guppy	LC50	96	SR,U	223	$NaVO_3$	6,100	7,888	7,888	7	3

(Poecilia reticulata)	LC50	96	SR,U	223	$NaVO_3$	10,200				3
Brook Trout	LC50	96	FT,M	35	V_2O_5	7,000	10,247	10,247	8	7
(Salvelinus fontinalis)	LC50	96	FT,M	35	V_2O_5	15,000				
Flannelmouth Sucker *(Catostomus latipinnis)*	LC50	96	S,U	144	$NaVO_3$	11,500	11,500	11,500	9	4
Chinook Salmon *(Oncorhynchus tschawytscha)*	LC50	96	S,U	211	Na_3VO_4	16,500	16,500	16,500	10	5

CHRONIC DATA

Species	Test type (ELS, etc.)	Duration (days)	Study Conditions (FT,M etc.)	Hardness mg/L	Test Chemical	NOEC ug/L	LOEC ug/L	MATC ug/L	Rank	Reference
Water Flea (*Daphnia magna*)	LC	21	SR,M	80-100	Na_3VO_4	105	218	151	1	6
Amphipod (*Hyalella azteca*)	LC	42	FT,M	100	Na_3VO_4	134*	251	183	2	6
Fathead Minnow *(Pimephales promelas)*	ELS	32	FT,M	100	Na_3VO_4	248	462	338	3	6

* The control group in this study only had 0.32 neonates per female which is lower than the > 2 neonates per female recommended by USEPA. Since a value of > 2 neonates per female is a recommendation, not a requirement, this result did not preclude the use of the study.

Table 1. Acute-to-chronic ratios (ACR) for vanadium (all units in ug/L).

Species	LC50	MATC	ACR	Reference
Water flea	913	151	6.05	ENVIRON (2009)
Fathead minnow	2,241	338	6.63	ENVIRON (2009)
Amphipod	963	183	5.26	ENVIRON (2009)

VANADIUM REFERENCES

References:

1. #004743: Kimball, G. 1978. The Effects of Lesser Known Metals and One Organic to Fathead Minnows (*Pimephales promelas*) and *Daphnia magna*. Manuscript, Dept. of Entomology, Fisheries and Wildlife, University of Minnesota, Minneapolis, MN:88 pp.

2. #014544: Hamilton, S. J. 1995. Hazard assessment of inorganics to three endangered fish in the Green River, Utah. Ecotoxicol. Environ. Saf. 30(2): 134-142.

3. #018161: Beusen, J. M. and B. Neven. 1987. Toxicity of vanadium to different freshwater organisms. Bull. Environ. Contam. Toxicol. 39(2): 194-201. (zebrafish test results not used because they are not resident species; insufficient information provided on test methods/conditions for daphnid tests).

4. #017546: Hamilton, S. J. and K.J. Buhl. 1997. Hazard evaluation of inorganics, singly and in mixtures, to flannelmouth sucker *Catostomus latipinnis* in the San Juan River, New Mexico. Ecotoxicol.Environ.Saf. 38(3): 296-308.

5. #015322: Hamilton, S. J. and K.J. Buhl. 1990. Safety assessment of selected inorganic elements to fry of Chinook salmon (*Oncorhynchus tshawytscha*). Ecotoxicol. Environ. Saf. 20(3): 307-324.

6. ENVIRON. 2009. Revision of Indiana Tier II Vanadium Values. Project Number: 20-20250A (Insufficient information was provided for the assessment of the quality of the non-GLP daphnid study. ENVIRON (2009) stated that the same methodology used by Beusen and Neven (1987) was used for this study. Since we rejected the daphnid study conducted by Beusen and Neven (1987) and specific details of the current study were not provided, we rejected the non-GLP).

7. Ernst, W.R. and E.T. Garside. 1986. Lethal effects of vanadium to two life stages of brook trout *Salvelinus fontinalis* (Mitchell). Can. J. Zool. 65:628-634. (the alevin results from this study were rejected due to excessive control mortality)

Min. Data Req. met	Acute Factor
2	13
3	8
4	7
5	6.1
6	5.2
7	4.3

RULE 57 AQUATIC VALUES WORK SHEET-ACUTE

Chemical Name: **Vanadium**
CAS #: **7440-62-2**
Developed by: **Dennis Bush**
Date: **4/12/2011**

AQUATIC MAXIMUM VALUE CALCULATIONS

A. Minimum 8-species requirement for Tier I is **not** met (Tier II): _.

1. Minimum requirements met = 5 (i, ii, iii, iv,v).

2. Minimum requirements missing for Tier I = 3 (vi, vii, viii).

3. Acute Factor = 6.1.

4. Toxicity is **not** dependent upon a water quality characteristic: _.

a. FAV calculation: Tier II FAV = Lowest GMAV / Acute Factor = 963 ug/l / 6.1 = **158 ug/l = 160 ug/l**.

5. Toxicity **is** dependent upon a water quality characteristic: _.

a. Slope = _____ (Table_____).

b. FAV equation: Tier II FAV = _____ = _____ = _____.

6. Go to C.

B. Minimum 8-species requirement **is** met (Tier I): _.

1. Toxicity is **not** dependent upon a water quality characteristic: _____.

a. Tier I FAV calculation: _____ (_____).

2. Toxicity **is** dependent upon a water quality characteristic: _____.

a. Slope = _____ (Table_____).

b. Ranked genus mean acute intercepts: Table _____.

c. Final acute intercept = _____ (_____).

ln of final acute intercept = _____.

d. FAV equation: Tier I FAV = _____ = _____ = _____.

C. Aquatic Maximum Value (AMV) calculation: Tier II AMV = FAV / 2 = 158 ug/l / 2 = **79 ug/l**.

RULE 57 AQUATIC VALUES WORK SHEET-CHRONIC

Chemical Name: **Vanadium**
CAS #: **7440-62-2**
Developed by: **Dennis Bush**
Date: **4/12/2011**

FINAL CHRONIC VALUE CALCULATIONS

A. Minimum 8-species requirement for GMCV-based Tier I is **not** met: _.

1. Minimum requirements met = 3 (ii, iv,v).

2. Minimum requirements missing = 5 (i, iii, iv, vii, viii).

B. Minimum 8-species requirement for GMCV-based Tier I **is** met: _.

1. Toxicity is **not** dependent upon a water quality characteristic: _____.

   a. Tier I FCV = _____ (Fig. _____).

2. Toxicity **is** dependent upon a water quality characteristic: _____.

   a. Slope = _____ (Table_____).

   b. Ranked Genus Mean Chronic Intercepts: Table _____.

   c. Final Chronic Intercept = _____ (Fig. _____).

   d. ln of Final Chronic Intercept = _____.

   e. FCV equation = Tier I FCV = _____ = _____ = _____.

C. Acute-to-Chronic-Ratio method: _.

1. Acute-to-Chronic Ratio:

   a. Number of ACRs meeting minimum data requirements = 3 (Table 1).

   b. Tier II Acute-to-Chronic Ratio = Default Values = Xg(6.05, 6.63, 5.26) = **5.95**.

2. Toxicity is **not** dependent upon a water quality characteristic: _.

   Tier II FCV = Tier II FAV / Tier II ACR = 157.87 ug/l / 5.95 = **26.5 ug/l = 27 ug/l**.

3. Toxicity **is** dependent upon a water quality characteristic: _.

   a. Slope = _____ (Table_____).

   b. Aquatic Chronic Intercept = _____ (Table _____).

   c. ln of Aquatic Chronic Intercept = _____.

   d. FCV equation = Tier _____ FCV = _____ = _____ = _____.