

Rule 57 Aquatic Values Data Sheet

7/12/2007

Chemical or product name: Boron
 Manufacturer (WTAs): -----
 C.A.S #: 7440-42-8

Developed by: Christopher Hull
 Approved by: D. Bush
 Approval date: 7/30/07
 CAS, AQUIRE, QSAR Searches: 10/31/97
 Clearinghouse search date: -----

FAV*: 55,000 ug/l (Tier: I)
 AMV*: 28,000 ug/l (Tier: I)
 FCV*: 5,000 ug/l (Tier: II)
 Acute CF: --- Chronic CF: ---

ACUTE DATA

Species	Test type (EC or LC50)	Duration (hours)	Test conditions (FT,M, etc.)	Hardness mg/L	Chemical	LC50/EC50 ug/L	SMAV ug/L	GMAV ug/L	Rank	Reference
Fathead Minnow (<i>Pimephales promelas</i>)	LC50	96	SR,M	84	H ₃ BO ₃	75,900	75,900	75,900	1	1
Water Flea (<i>Ceriodaphnia dubia</i>)	LC50	48	SR,M	84	H ₃ BO ₃	85,200	85,200	85,200	2	1
Amphipod (<i>Hyalella azteca</i>)	LC50	96	SR,M	84	H ₃ BO ₃	94,900	94,900	94,900	3	1
Water Flea (<i>Daphnia magna</i>)	LC50	48	S,U	166	H ₃ BO ₃	226,000	161,830	161,830	4	2
	LC50	48	S,M	85	Na ₂ B ₄ O ₇	141,000				3
	LC50	48	S,U	148	H ₃ BO ₃	133,000				4
Razorback Sucker (<i>Xyrauchen texanus</i>)	LC50	96	S,U	233-330	H ₃ BO ₃	233,000	254,965	254,965	5	5
	LC50	96	S,U	233-330	H ₃ BO ₃	279,000				5
Annelid (<i>Lumbriculus variegatus</i>)	LC50	96	S,M	110-135	H ₃ BO ₃	261,000	269,366	269,366	6	6
	LC50	96	S,M	110-135	H ₃ BO ₃	278,000				6
Colorado Squawfish (<i>Ptychocheilus lucius</i>)	LC50	96	S,U	233-330	H ₃ BO ₃	279,000	383,499	383,449	7	5
	LC50	96	S,U	233-330	H ₃ BO ₃	527,000				5
Bonytail (<i>Gila elegans</i>)	LC50	96	S,U	233-330	H ₃ BO ₃	280,000	393,141	393,141	8	5
	LC50	96	S,U	233-330	H ₃ BO ₃	552,000			(cont'd.)	5

Chinook Salmon (<i>Oncorhynchus tshawytscha</i>)	LC50	96	S,U	211	H ₃ BO ₃	725,000	800,366	598,133	9	7
	LC50	96	S,U	41.7	H ₃ BO ₃	566,000				7
	LC50	96	S,U	41.7	H ₃ BO ₃	>1,000,000 ¹				7
	LC50	96	S,U	41.7	H ₃ BO ₃	>1,000,000 ¹				7
Coho Salmon (<i>O. kisutch</i>)	LC50	96	S,U	211	H ₃ BO ₃	447,000	447,000			7
Midge (<i>Chironomus tentans</i>)	LC50	48	S,M	110-135	H ₃ BO ₃	1,503,000	1,296,309	1,296,309	10	6
	LC50	48	S,M	110-135	H ₃ BO ₃	1,503,000				6
	LC50	48	S,U	115	H ₃ BO ₃	964,290				8
Brown Planarian (<i>Dugesia tigrina</i>)	LC50	96	SR,M	32	H ₃ BO ₃	1,357,720	1,357,720	1,357,720	11	1

CHRONIC DATA

Species	Test type (ELS, etc.)	Duration (days)	Study		Chemical	MATC ug/L	SMCV ug/L	GMCV ug/L	Rank	Reference
			Conditions (FT,M etc.)	Hardness mg/L						
Water Flea (<i>Daphnia magna</i>)	LC	21	SR,M	148	H ₃ BO ₃	9,330	9,330	9,330	1	4
Fathead Minnow (<i>Pimephales promelas</i>)	LSG	7	SR,M	60	H ₃ BO ₃	14,100	14,100	14,100	2	1

* Value rounded to 2 significant figures.

¹ Value not used to calculate SMAV, because definitive values are preferred over indefinite values.

Figure 1. Tier I FAV calculation for boron, 7/07.

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FAV.EXE
HOW MANY SMAUs OR SMCUs ARE IN THE DATA SET?
? 11
WHAT ARE THE 4 LOWEST VALUES?
? 75900
? 85200
? 94900
? 161830
FAV = 55194.99
Do you want to run another calculation? <Y or N>
? n
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Table 1. Calculation of *Daphnia magna* MATC and ACR from Reference #4.

48-hr. LC50 (Ref. #4) = 133,000 µg/L.

Reproduction NOEC = 6,400 µg/L; LOEC = 13,600 µg/L; MATC = \bar{x}_g = 9,330 µg/L.

$$ACR = \frac{48\text{-hr. LC50 (Ref. #4)}}{21\text{-day MATC (Ref. #4)}} = \frac{133,000 \mu\text{g/L}}{9,330 \mu\text{g/L}} = \underline{14.255091}$$

TABLE 2. MATC AND ACR CALCULATIONS FOR FATHEAD MINNOW FROM REF. #1.

96-hr. LC50 = 75,900 µg/L.

7-DAY GROWTH MATC = 14,000 µg/L; LOEC = 18,000 µg/L;

MATC = \bar{x}_g = 14,100 µg/L.

$$ACR = \frac{96\text{-hr. LC50}}{7\text{-DAY MATC}} = \frac{75,900 \mu\text{g/L}}{14,100 \mu\text{g/L}} = \underline{5.3829987}$$

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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

Chemical Name: BORON
 C.A.S. #: 7440-42-8

AQUATIC MAXIMUM VALUE CALCULATIONS, 7/07

~~A. Minimum 8 species requirement is **not** met (Tier II). Minimum requirements met = _____
 Minimum requirements missing for Tier I = _____
 Acute factor = _____~~

~~1. Toxicity is **not** dependent on a water characteristic~~

~~a. FAV calculation~~

~~2. Toxicity is dependent on a water characteristic~~

~~a. Slope = (Table _____)~~

~~b. FAV equation:~~

~~3. Go to C.~~

B. Minimum 8 species requirement is met (Tier I)

1. Toxicity is **not** dependent on a water characteristic

a. FAV calculation: Fig. 1 : 55,194.99 µg/l

~~2. Toxicity is dependent on a water characteristic~~

~~a. Slope = (Table _____)~~

~~b. Ranked genus mean acute intercepts: Table _____~~

~~c. Final acute intercept = (Att. _____)~~

~~ln of final acute intercept =~~

~~d. FAV equation =~~

C. Aquatic Maximum Value (AMV) calculation: $AMV = \frac{\text{Tier I FAV}}{2} = \frac{55,194.99 \mu\text{g/l}}{2}$

$= \boxed{27,597.495 \mu\text{g/l}}$

Boron :

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FINAL CHRONIC VALUE CALCULATIONS, 7/07

A. Minimum 8 species requirement is not met (Tier II). Minimum requirements met = 2
 Minimum requirements missing for Tier I = GMCV Route = 6 (i, ii, v, vi, vii, viii).
 ACR Route = 1 (any 3rd family)

1. Acute to chronic ratio

a. Number ACRs meeting minimum data requirements = 2 (Tables 1-2)

b. Acute to chronic ratio = \bar{X}_g (Table 1 ACR (A. magna), Table 2 ACR (FHM), 18)

2. Toxicity is not dependent on a water characteristic = \bar{X}_g (14.255091, 5.3829787, 18)

$$FCV = \frac{\text{Tier I FAV}}{\text{Tier II ACR}} = \frac{55,194.99 \text{ } \mu\text{g/L}}{11.136662} = \boxed{4,956.152 \text{ } \mu\text{g/L}} \quad \left[= \boxed{11.136662} \right]$$

~~3. Toxicity is dependent on a water characteristic~~

~~a. Slope = (Table __)~~

~~b. Aquatic chronic intercept = (Table __)~~

~~ln of aquatic chronic intercept =~~

~~c. FCV equation =~~

~~B. Minimum 8 species requirement is met (Tier I)~~

~~1. Toxicity is not dependent on a water characteristic~~

~~a. FCV = (Att. __)~~

~~2. Toxicity is dependent on a water characteristic~~

~~a. Slope = (Table __)~~

~~b. Ranked genus mean chronic intercepts: Table __~~

~~c. Final chronic intercept = (Att. __); ln of final chronic intercept =~~

~~d. FCV equation =~~

BORON REFERENCES, 7/07*

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*This is an incomplete list of references reviewed for this Criteria Development. Most-pertinent references, only, are listed. Less-pertinent CAS, AQUIRE, and Ambient Water Quality Criteria Document references not listed here were reviewed and rejected on the basis of information provided in bibliographies or abstracts.

**For abbreviations used, see attached Appendix.

APPENDIX: REFERENCE ABBREVIATIONS USED, 7/06

AMD = ambient monitoring data.
BCF = bioconcentration factor.
D = data (as a suffix to other abbreviations listed here).
DO = data only (as a suffix to other abbreviations listed here)..
EF = environmental fate.
GWD = groundwater data.
IITM/C = insufficient information on test methods / conditions.
ISD = *in situ* data.
LD = leachate data.
LSER = Linear Solvation Energy Relationship.
MCD = microcosm data.
MIX = mixture (not chemical-specific) test data.
MED = model ecosystem data.
MET = metabolism
MOD = model (theoretical) data / analysis.
NA = not available at this time.
ND = no data (on this chemical).
NIL = not in (MDEQ) Library.
NR = not reviewed.
NUE = no useable endpoint.
O = only (as a suffix to other abbreviations listed here).
PD = phytotoxicity data.
QSAR = Quantitative Structure-Activity Relationship.
RWD = receiving water data.
SD = secondary data.
SED = sediment data or testing.
SW = saltwater.
TATO = test animals too old.
TDI = test duration inappropriate.
TM/CU = test methods / conditions unacceptable.
TONNA = test organisms not North American.
TONS = test organisms not suitable.
UD or UP = uptake data.
WET = whole-effluent testing.