

OHIO EPA SURFACE WATER QUALITY CRITERION FACT SHEET

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Chemical Name: Molybdenum Developed by: Chris J. SkalskiCAS # 7439-98-7Reviewed by: Bob HeitzmanInternal Code # ----- Data Retrieval Date: 6-10-05Fact Sheet Preparation Date: 6-20-05ACUTE DATA

<u>SPECIES</u>	<u>EC₅₀/LC₅₀</u> <u>(µg/l)</u>	<u>TEST TYPE^a</u>	<u>DURATION</u> <u>(HOURS)</u>	<u>SMAV^b</u> <u>(µg/l)</u>	<u>GMAV^b</u> <u>(µg/l)</u>	<u>REFERENCE</u> <u>NUMBER</u>
Cladoceran	203,200 ^{eg}	S,U	48	2,104,000	2,104,000	1
<i>Daphnia magna</i>	210,300 ^{eg}	S,U	48			1
	2,104,000	S,M	48			11
	3,220,000 ^f	S,U	48			10
Fathead Minnow	577,000 ^{eg}	S,M	96	7,630,000	7,630,000	1
<i>Pimephales promelas</i>	678,000 ^{eg}	S,M	96			1
	370,000 ^{cg}	S,U	96			2
	70,000 ^{cg}	S,U	96			2
	7,630,000	S,U	96			10
Coho Salmon	>1,000,000	S,U	96	>1,000,000	>1,391,348	3
<i>Oncorhynchus kisutch</i>	>1,000,000	S,U	96			3
Chinook Salmon	>1,000,000	S,U	96	>1,000,000		3
<i>Oncorhynchus tshawytscha</i>	>1,000,000	S,U	96			3
Rainbow Trout	1,320,000 ^d	S,U	96	2,693,441		4
<i>Oncorhynchus mykiss</i>	800,000 ^d	R,M	96			4
	1,320,000	S,U	96			7
	800,000	R,M	96			7
	7,340,000	S,U	96			10
	6,790,000	S,U	96			10
Bluegill	157,000 ^g	S,U	96	2,993,794	2,993,794	8
<i>Lepomis macrochirus</i>	86,600 ^g	S,U	96			8
	6,790,000	S,U	96			10
	1,320,000	S,U	96			12
Channel Catfish	>10,000,000	S,U	96	>10,000,000	>10,000,000	10
<i>Ictalurus punctatus</i>						
Flannelmouth Sucker	1,940,000	S,U	96	1,940,000	1,940,000	9
<i>Catostomus latipinnis</i>						
Amphipod	2,650,000	R,U	96	2,650,000	2,650,000	5
<i>Crangonyx pseudogracilis</i>						
Oligochaete	28,910 ^e	R,U	96	5,560,545	5,560,545	6
<i>Tubifex tubifex</i>	6,296,000	R,M	96			11
	4,911,000	R,M	96			11

^a S = static; R= renewal; U = unmeasured; M = measured.^b SMAV = Species Mean Acute Value; GMAV = Genus Mean Acute Value^c Data not used to calculate the SMAV since the tests were only considered "exploratory" by the authors.^d Duplicate data not used to calculate the SMAV.^e Data not used to calculate the SMAV since the data for this species vary by more than an order of magnitude and data for other test organisms with the sodium salt indicate a low order toxicity for molybdenum.^f Data not used to calculate the SMAV since the test organisms were fed during the test.^g Data not used to calculate the SMAV; only tests conducted with the sodium salt were used for the SMAV.

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These tests were conducted using either molybdenum trioxide or ammonium molybdate.

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<u>SPECIES</u>	<u>CHRONIC VALUE</u> ($\mu\text{g/l}$)	<u>METHOD</u>	<u>SMCV^a</u> ($\mu\text{g/l}$)	<u>GMCV^a</u> ($\mu\text{g/l}$)	<u>REFERENCE</u> <u>NUMBER</u>
Cladoceran <i>Daphnia magna</i>	670 - 1,150 878 ^{cd}	Life Cycle			1
Cladoceran <i>Daphnia magna</i>	57,000 - 174,000 99,589	Life Cycle	99,589	99,589	11
Cladoceran <i>Ceriodaphnia dubia</i>	47,500 ^b	Three-Brood Static-Renewal			13

^a SMCV = Species Mean Chronic Value; GMCV = Genus Mean Chronic Value.

^b This value is an IC₂₅

^c Data not used to calculate the SMAV since the data for this species vary by more than an order of magnitude and data for other test organisms with the sodium salt indicate a low order toxicity for molybdenum.

^d Data not used to calculate the SMAV; only tests conducted with the sodium salt were used for the SMAV. This test was conducted using molybdenum trioxide.

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Selenium Combinations to *Ceriodaphnia dubia*. Environ. Toxicol. Chem. 14(2):329-336.

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<u>Data Requirement</u> <u>OAC 3745-1-36(A)(1)</u>	<u>SPECIES</u>	<u>GMAV</u> <u>(µg/l)</u>
(a)	Salmonids	>1,391,348 ^b
(b)	Bluegill	2,993,794
(c)	Flannelmouth Sucker	1,940,000
(d)	<i>Daphnia magna</i>	2,104,000
(e)	Amphipod	2,650,000
(g)	Oligochaete	5,560,545

Secondary Acute Factor (SAF) = 5.2

Secondary Acute Value (SAV) = Lowest GMAV ÷ SAF
 = 1,940,000 ÷ 5.2
 = 373,077 = 370,000 µg/l = 370 mg/l

Tier II Acute Aquatic Value (AAV) = SAV ÷ 2
 = 373,077 ÷ 2
 = 186,538 = 190,000 µg/l = 190 mg/l

^a See Ohio Administrative Code 3745-1-36 effective February 22, 2002.

^b GMAV not used to calculate the SAV since a definitive value was not determined for other species in this genus.

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Experimentally determined Acute-Chronic Ratios (ACRs):

<u>SPECIES</u>	<u>ACUTE VALUE</u> <u>($\mu\text{g/l}$)</u>	<u>CHRONIC VALUE</u> <u>($\mu\text{g/l}$)</u>	<u>ACUTE-CHRONIC</u> <u>RATIO</u>	<u>SPECIES MEAN</u> <u>ACR</u>
Clodoceran <i>Daphnia magna</i>	2,104,000	99,589	21.13	21.13

$$\text{Secondary Acute Chronic Ratio (SACR)} = \sqrt[3]{(21.13)(18)(18)} = 18.99$$

$$\begin{aligned} \text{Chronic Aquatic Value (CAV)} &= \text{SAV} \div \text{SACR} \\ &= 373,077 \div 18.99 \\ &= 19,649 = 20,000 \mu\text{g/l} = 20 \text{ mg/l}^b \end{aligned}$$

^a See Ohio Administrative Code 3745-1-36 effective February 22, 2002.

^b Chronic toxicity data from Naddy et. al. (1995) indicate that addition of molybdenum greatly increases the toxicity of selenium. Hamilton and Buhl (1990) also reported an additive impact to the toxicity of selenium. Whole effluent toxicity testing is advisable when combinations of these metals are present to assure permit limits based on chemical-specific criteria do not result in effluent toxicity.