

OHIO EPA SURFACE WATER QUALITY CRITERION FACT SHEET

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Chemical Name: Strontium Developed by: Chris J. SkalskiCAS # 7440-24-6 Data Retrieval Date: 1-05-05Internal Code # --- Fact Sheet Preparation Date: 3-01-06Reviewed by: Bob HeitzmanACUTE 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	162,930	S,U	48	143,662	103,801	1
<i>Daphnia magna</i>	125,000	S,U	48			2
	94,000	S,U	48			1
	140,770	S,U	48			6
	227,070	S,U	48			7
Cladoceran	75,000	S,U	48	75,000		3
<i>Daphnia hyalina</i>						
Copepod	300,000	S,U	48	300,000	300,000	3
<i>Cyclops abyssorum</i>						
Copepod	180,000	S,U	48	180,000	180,000	3
<i>Eudiaptomus padanus</i>						
Crayfish	910,000	S,M	96	910,000	910,000	4
<i>Orconectes limosus</i>						
Amphipod	198,011	S,U	96	198,011	198,011	8
<i>Hyalella azteca</i>						
Tubificid worm	240,800	R,U	96	240,800	240,800	5
<i>Tubifex tubifex</i>						
Midge	424,456	S,U	48	424,456	424,456	8
<i>Chironomus tentans</i>						
Snail	537,504	S,U	96	537,504	537,504	8
<i>Physa integra</i>						
Rainbow Trout	2,348,110	S,U	96	2,348,110	2,348,110	9
<i>Oncorhynchus mykiss</i>						
Bluegill	6,316,556	S,U	96	6,316,556	6,316,556	8
<i>Lepomis macrochirus</i>						
Fathead Minnow	228,470	R,U	96	178,961	178,961	6
<i>Pimephales promelas</i>	140,180	S,U	96			7

^a S = static; R= renewal; U = unmeasured; M = measured.^b SMAV = Species Mean Acute Value; GMAV = Genus Mean Acute Value

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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>
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None Available

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

1. Khangarot, B.S. 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.
2. Biesinger, K.E. and G.M. Christensen. 1972. Effects of Various Metals on Survival, Growth, Reproduction, and Metabolism of *Daphnia magna*. *J. Fish. Res. Board Can.* 29(12):1691-1700.
3. Baudouin, M.F. and P. Scoppa. 1974. Acute Toxicity of Various Metals to Freshwater Zooplankton. *Bull. Environ. Contam. Toxicol.* 12(6):745-751.
4. Boutet, C. And C. Chaisemartin. 1973. Specific Toxic Properties of Metallic Salts in *Austropotamobius pallipes* and *Orconectes limosus*. *C.R. Soc. Biol. (Paris)* 167(12):1933-1938.
5. Khangarot, B.S. 1991. Toxicity of Metals to a Freshwater Tubificid Worm, *Tubifex tubifex* (Muller). *Bull. Environ. Contam. Toxicol.* 46:906-912.
6. S-F Analytical Laboratories Bioassay Laboratory. 1998. Bioassay Report, Acute Toxicity Tests Conducted January 7 through 11 and 14 through 16, 1998. Unpublished Report, Lab ID No. 7436, prepared for QST Environmental (for Hitachi Magnetics Corp., Cadillac, MI).
7. Owusu-Yaw, J. 1998. Acute Toxicity of Strontium to the Water Flea, *Daphnia magna*, and the Fathead Minnow, *Pimephales promelas*, under Static Test Conditions. Unpublished Report, QST Laboratories, Newberry, FL, QST Project No. 3198202-0100-3100. In: Appendix 1 - Toxicity Test Report for Strontium, In: Environmental Consulting and Technology, Inc. 1998. Acute Toxicity Testing for Lithium and Strontium, Unpublished Report, ECT No. 98065-0100 March, 1998.
8. Environmental Science and Engineering, Inc. 2000. Acute Toxicity of Strontium and Lithium to *Hyalella azteca*, *Chironomus tentans*, *Lepomis macrochirus*, and *Physa integra* under Static Test Conditions. Unpublished Report ESE No. 3100208-0100-3100. Prepared for Martin Marietta Magnesia Specialties, Inc. and Copper Range Company, Inc., July 11, 2000.

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9. Harding ESE, Inc. 2001. Acute Toxicity of Strontium to *Oncorhynchus mykiss*, and Manganese to *Physa integra* under Static Test Conditions. Unpublished Report, Harding ESE, Inc. for MFG, Inc; Prepared for Copper Range Co. Project ID # 3112130100.

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CALCULATION OF ACUTE AQUATIC CRITERION (AAC)^a

<u>Species</u>	<u>SMAV</u> <u>(µg/l)</u>	<u>Genus</u>	<u>GMAV</u> <u>(µg/l)</u>	<u>Data Set</u> <u>Requirement</u>
Bluegill	6,316,556	<i>Lepomis</i>	6,316,556	b
Rainbow Trout	2,348,110	<i>Oncorhynchus</i>	2,348,110	a
Crayfish	910,000	<i>Orconectes</i>	910,000	
Snail	537,504	<i>Physa</i>	537,504	g
Midge	424,456	<i>Chironomus</i>	424,456	f
Copepod	300,000	<i>Cyclops</i>	300,000	
Oligochaete	240,800	<i>Tubifex</i>	240,800	h
Amphipod	198,011	<i>Hyaella</i>	198,011	e
Copepod	180,000	<i>Eudiaptomus</i>	180,000	
Fathead Minnow	178,961	<i>Pimephales</i>	178,961	c
Cladoceran	143,662	<i>Daphnia</i>		
Cladoceran	75,000	<i>Daphnia</i>	103,801	d

<u>Genus</u>	<u>GMAV</u>	<u>ln(GMAV)</u>	<u>ln(GMAV)²</u>	<u>RANK</u>	<u>P=R/(N+1)</u>	<u>√P</u>
<i>Daphnia</i>	103,801	11.5502	133.4078	1	0.0833	0.2887
<i>Pimephales</i>	178,961	12.0949	146.2872	2	0.1667	0.4082
<i>Eudiaptomus</i>	180,000	12.1007	146.4272	3	0.2500	0.5000
<i>Hyaella</i>	198,011	<u>12.1961</u>	<u>148.7443</u>	4	<u>0.3333</u>	<u>0.5774</u>
TOTALS			47.9419	574.8665		0.8333
1.7743						

$$S^2 = \frac{574.8665 - (47.9419)^2/4}{0.8333 - (1.7743)^2/4} = \frac{0.2590}{0.0463} = 5.5924 \quad S = 2.3648$$

$$L = [47.9419 - ((2.3648)(1.7743)]/4 = 10.9365$$

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$$A = 2.3648(\sqrt{0.05}) + (10.9365) = 11.4653$$

$$\text{Final Acute Value (FAV)} = e^{11.4653} = 95,350 = 95,000 \mu\text{g/l}$$

$$\text{AAC} = \text{FAV} \div 2 = 95,350 \mu\text{g/l} \div 2 = 47,675 = 48,000 \mu\text{g/l}$$

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

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CALCULATION OF CHRONIC AQUATIC VALUE (CAV)^a

Experimentally determined Acute-Chronic Ratios (ACRs):

<u>SPECIES</u>	<u>ACUTE VALUE</u> <u>ACUTE-CHRONIC</u> <u>(µg/l)</u>	<u>CHRONIC VALUE</u> <u>SPECIES MEAN</u> <u>(µg/l)</u>	<u>RATIO</u>	<u>ACR</u>
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None Available

$$\sqrt[3]{(18)(18)(18)} = 18$$

Secondary Acute-Chronic Ratio (SACR)

=

$$\begin{aligned} \text{Chronic Aquatic Value (CAV)} &= \text{FAV} \div \text{SACR} \\ &= 95,350 \div 18 \\ &= 5,297 = 5,300 \text{ µg/l} \end{aligned}$$

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