

MINNESOTA POLLUTION CONTROL AGENCY

AQUATIC LIFE CRITERIA

Page 1 SUMMARY

Revised Feb. 1993

A. Chemical: Arsenic CAS# 7440-38-2 Date April 6, 1990

B. Minnesota Criterion: ug/l (unless noted otherwise)

Water Class	Use	CC	MC	FAV	Basis*
1,2A	DW, Salmonid	2.0	360	720	PCA, Hs
1,2B,2C	DW, NonSalmonid	2.0	360	720	PCA, Hs
2B,2C	NonSalmonid	53	360	720	PCA, Hs
	Other	none			

Toxicity related to water quality: no
 If yes, above criteria values determined for: _____
 Slope: Acute: N/A Chronic: N/A

Formulas: _____ EPA:CC: N/A
 MPCA: N/A MC: _____
 FAV: _____

Notes:

C. EPA Criterion: ug/l CCC: 188.9 Basis: T1
 Date: 1985 MC: 359.1 Basis: T1
 FAV: 718.2 Basis: T1

Notes:

Criterion for As III
 As V has greater ACR (28) and algae may be very sensitive, lowest animal
 LC50 = 850 µg/L

D. Other Criteria: value Source
 ug/l 50 IJC for drinking water

E. Notes:

*Criteria basis codes for part B:

- EPA = From EPA criterion
- PCA = Criterion developed by Minnesota Pollution Control Agency staff
- T1 = Direct aquatic life toxicity, EPA national criteria procedures used
- T2 = Direct aquatic life toxicity, EPA advisory procedures used
- Hs = Human health systemic effects
- Hc = Human health carcinogenic effects
- R = Tissue residue (bioaccumulation)
- W = Wildlife effects
- O = Organoleptic (taste and odor)
- Other = Criterion based on other end point

A. Chemical Arsenic CAS# 7440-38-2 Date April 6, 1989

B. EPA Criterion ug/l CCC: 190 Basis: FAV/ACR
Date: 1985 MCC: 360
FAV: 720 Basis: FAV

As III

1. Related to water quality: No

2. Toxicity FAV: 718.2 N: 14 ACR: 3.803
ug/l Chronic value: 188.9 N: N/A

3. Residue

FDA action level: _____
BCF Final: _____ N total: _____ N used: _____
geo mean at 1% lipid: _____
% lipid: _____
geo mean unadjusted for lipid: _____

C. MPCA Evaluation Of EPA Criterion

1. Four lowest GMAVs: 1. Gammarus 3. Ceriodaphnia
2. Simocephalus 4. Daphnia

2. Commercially or recreationally important species: No

3. Plant data: one algal species very sensitive to As V

4. Extrapolation of water quality effects: N/A

5. Chronic data No. of values: As III, 4; As V, 1
ug/l No. below criterion: None

Notes:

As III: D. magna 914 Mysid 895
Fathead 3,086 As V: Fathead Minnow 892
Flagfish 2,962

6. ACRs ACR used by EPA: 3.803 As III N: 4
Geo. mean, all ACRs: 3.8003 As III N: 4
ACR used by MPCA: 10.45 N: 2 (5 total)

Notes:

		<u>Acute</u>	<u>Chronic</u>	<u>ACR</u>
As V	Fathead	<u>25,600</u>	<u>891.6</u>	<u>28.71</u>

Final ACR: geometric mean of 3.803 and 28.71 so criterion is for total As.

D. Cool/Warm Water Criterion ug/l

No. of Salmonids deleted from lowest 4 GMAVs: None
N(nonsal): _____ FAV: _____ MC: _____ CC: _____
Adjustments to FAV: _____

E. Notes:

Lowest 4 GMAVs all nonsalmonids.
No changes to toxicity-based criterion, Feb. 1993.

Page 2 (Arsenic Cont.)
DIRECT AQUATIC LIFE TOXICITY
EPA Criterion Available

E. Summary of changes made to EPA criterion

1. Larger ACR (mean of As III and As V ACRs) used because As criterion will apply to total As rather than just As III as is the case of national criterion.
2. $CC = FAV \text{ of } 718.2/10.45 = 68.73 = 70$
3. Acute toxicity of As V and As III to animals in the same range; therefore it seems appropriate to use the As III FAV.

Further rationale for using a lower CC than is used by EPA.

1. Application of criterion will be as total As.
2. Plants are sensitive to As

As V <u>Scenedesmus obliquus</u>	14 day EC-50	48 µg/L
As V <u>Melosira granulata</u>	decreased growth	75 µg/L
As V <u>Ochromanas vallesiaca</u>	decreased growth	75 µg/L
3. Other data includes some low values

Rainbow trout	EC10	28-day	134 µg/L
Narrow mouth toad	EC50	7-day	40 µg/L
4. Concern that As may be found to be an oral carcinogen.

A. Chemical: Arsenic CAS#: 7440-38-2 Date: April 6, 1989B. EPA Human Health Criterion: df: 0.022 f: 0.175 d: _____
ug/lADI/Ref.dose: _____ mg/kg/day slope: 0.014Final BCF: 44 %lipid: N/AK: N/A

C. Minnesota Human Health Criterion

1. Ref.dose: 0.0003 mg/kg/day Source: IRIS, MDHK: 0.2 Source: MPCA default

2. Potency slope: _____ Source: _____

3. Measured BAFs: Species/Tissue BAF %lipid Norm. BAF

1. _____

2. _____

3. _____

4. _____

Geo mean: _____

4. Measured BCFs Species/Tissue BCF %lipid Norm. BCF

1. Stagnicola emarginata WB 2.7 N/A _____2. Helisoma companulation WB 6.7 N/A _____3. Daphnia Magna WB 5.0 N/A _____4. Pteronarcys dorsate WB 7.9 N/A _____5. Rainbow trout WB 0~1 N/A _____6. Bluegill WB 4 N/A _____7. Fathead minnow WB 3 N/A _____8. Gammarus pseudolimnaeus WB 0~1 N/A _____Geo mean: of three fish species 2.3 _____

5. Edible portion BAF or BCF BAF BCF

Cold water: 6.0 % lipid N/A N/A

Warm water: 1.5 % lipid _____

6. Geo mean unadjusted for lipid: BAF: N/A BCF: _____7. QSAR est. log p: N/A BCF: _____

adjust. for % lipid: _____

8. BCF to BAF conversion factor: N/A9. Final BAF: 2A: 2.3 2B,2C: 2.310. Criteria: df(2A): 2.0 df(2B,2C): 2.0 f: 53 RAL: 0.2 list 3, Jan, 1991
ug/lD. Organoleptic: N/A Source: _____

ug/l

F. Notes:

Saltwater BCF: Eastern Oyster soft parts 350

EPA drinking water standard of 50 ug/L.

EPA 1980 human health-based criterion not used because of lack of information supporting Arsenic as an oral carcinogen.

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1,2B,2C	DW, NonSalmonid	50	360	720	EPA,Hs
2B,2C	NonSalmonid	70	360	720	EPA,T1,M
	Other	None			

Toxicity related to water quality: No

If yes, above criteria values determined for: _____

Slope: Acute: N/A Chronic: N/A

Formulas: EPA:CC: N/A

MPCA: N/A MC: _____

FAV: _____

Notes:

C. EPA Criterion: ug/l CCC: 188.9 Basis: T1
 Date: 1985 MC: 359.1 Basis: T1
 FAV: 718.2 Basis: T1

Notes:

Criterion for As III
 As V has greater ACR (28) and algae may be very sensitive, lowest animal LC50 = 850 ug/L

D. Other Criteria:

ug/l	value	Source
	<u>50</u>	<u>IJC for drinking water</u>
	_____	_____
	_____	_____
	_____	_____

E. Notes:

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- M = modified

Page 2 DIRECT AQUATIC LIFE TOXICITY
EPA Criterion Available

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2. Commercially or recreationally important species: No

3. Plant data: one algal species very sensitive to As V

4. Extrapolation of water quality effects:
 N/A

5. Chronic data No. of values: As III, 4; As V, 1
 ug/l No. below criterion: None

Notes:

	D.magna	914	Mysid	895	
As III:	Fathead	3,086			As V: Fathead Minnow 892
	Flagfish	2,962			

6. ACRs ACR used by EPA: 3.803 As III N: 4
 Geo. mean, all ACRs: 3.8003 As III N: 4
 As III ACR used by MPCA: 10.45 N: 2 (5 total)

Notes:

	<u>Acute</u>	<u>Chronic</u>	<u>ACR</u>
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D. Cool/Warm Water Criterion ug/l

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Rainbow trout	EC10	28-day	134 µg/L
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4. Concern that As may be found to be an oral carcinogen.

Page 4 HUMAN HEALTH

A. Chemical: Arsenic CAS#: 7440-38-2 Date: April 6, 1989

B. EPA Human Health Criterion: df: 0.022 f: 0.175 d: _____
 ug/l
 ADI/Ref.dose: _____ mg/kg/day slope: 0.014
 Final BCF: 44 %lipid: N/A
 K: N/A

C. Minnesota Human Health Criterion

1. Ref.dose: None mg/kg/day Source: _____
 K: _____ Source: _____

2. Potency slope: _____ Source: _____

3. Measured BAFs:	Species/Tissue	BAF	%lipid	Norm. BAF
1.	_____	_____	_____	_____
2.	_____	_____	_____	_____
3.	_____	_____	_____	_____
4.	_____	_____	_____	_____
5.	_____	_____	_____	_____
6.	_____	_____	_____	_____
Geo mean:		_____	_____	_____

4. Measured BCFs	Species/Tissue	BCF	%lipid	Norm. BCF
1.	<u>Stagnicola emarginata WB</u>	<u>2.7</u>	<u>N/A</u>	_____
2.	<u>Helisoma companulation WB</u>	<u>6.7</u>	<u>N/A</u>	_____
3.	<u>Daphnia magna WB</u>	<u>5.0</u>	<u>N/A</u>	_____
4.	<u>Pteronarcys dorsate WB</u>	<u>7.9</u>	<u>N/A</u>	_____
5.	<u>Rainbow trout WB</u>	<u>0-1</u>	<u>N/A</u>	_____
6.	<u>Bluegill WB</u>	<u>4</u>	<u>N/A</u>	_____
7.	<u>Fathead minnow WB</u>	<u>3</u>	<u>N/A</u>	_____
8.	<u>Gammarus pseudolimnaeus WB</u>	<u>0-1</u>	<u>N/A</u>	_____
Geo mean: <u>Includes salt water sp.</u>		<u>5.2</u>	_____	_____

from F. below.

Fish BCFs comparable to Invertebrate BCFs so they are treated together.

5. Edible portion BAF or BCF
 Cold water: 6.0 % lipid BAF: N/A BCF: N/A
 Warm water: 1.5 % lipid

6. Geo mean unadjusted for lipid: BAF: N/A BCF: _____

7. QSAR est. log p: N/A BCF: _____
 adjust. for % lipid: _____

8. BCF to BAF conversion factor: N/A

9. Final BAF: 2A: 5.2 2B,2C: 5.2

10. Criteria: df(2A): _____ df(2B,2C): _____ f: 602 RAL: 50
 ug/l

D. Organoleptic: NA Source: _____
 ug/l

F. Notes:

Saltwater BCF: Eastern Oyster soft parts 350
 EPA drinking water standard and MDH RAL of 50 ug/L used for dfCC and fCC.
 EPA 1980 human health-based criterion not used because of lack of information supporting Arsenic as an oral carcinogen.

