United States Environmental Protection Agency.
2001. *Supporting documentation used in the derivation of selected freshwater Tier 2 ESBs*. Office of Research and Development, Atlantic Ecology Division, Narragansett, RI USA.
(http://www.epa.gov/nheerl/publications/)

Users of this document are encouraged to consult with the original scientific literature to ensure an understanding of the context and accuracy of the data used here.

This is contribution AED-08-044 of the Office of Research and Development National Health and Environmental Effects Research Laboratory's Atlantic Ecology Division.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

BIPHENYL

CASRN 92-52-4

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL BIPHENYL CASRN 92-52-4

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
792	3, 4, 9 (Daphnid)		
5184	7 (Daphnid)		
10120	8, 10, 11 (Daphnid)		
11936	12 (Daphnid)		
11926	13, 14 (Daphnid)		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Dill, D.C., M.A. Mayes, C.G. Mendoza, G.U. Boggs, and J.A. Emmitte. 1982. Comparison of the toxicities of biphenyl, monochlorobiphenyl, and 2,2',4,4'-tetrachloro-biphenyl to fish and daphnids. In J.G. Pearson, R.B. Foster, and W.E. Bishop (eds.), Aquatic Toxicology and Hazard Assessment, 5th Conference, ASTM STP 766, Philadelphia, PA:245-256. (AQUIRE Reference Number, ARN: 10120)

Gersich, F.M., E.A. Bartlett, P.G. Murphy, and D.P. Milazzo. 1989. Chronic toxicity of biphenyl to *Daphnia magna* Straus. *Bull. Environ. Contam. Toxicol.* 43(3):355-362. (ARN: 792)

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

Rejected:

Abernethy, S., A.M. Bobra, W.Y. Shiu, P.G. Wells, and D. MacKay. 1986. Acute lethal toxicity of hydrocarbons and chlorinated hydrocarbons to two planktonic crustaceans: The key role of organism-water partitioning. *Aquat. Toxicol.* 8(3):163-174 (Publ. in part as 11936) (ARN: 11926)

Bobra, A.M., W.Y. Shiu, and D. MacKay. 1983. A predictive correlation for the acute toxicity of hydrocarbons and chlorinated hydrocarbons to the water flea (*Daphnia magna*). *Chemosphere* 12(9-10):1121-1129. (ARN: 11936)

TABLE 1. ACUTE TOXICITY OF BIPHENYL TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Daphnia magna	<24 h	R,M	360		Gersich et al. 1989
Cladoceran, Daphnia magna	<24 h	S,M	4,700*		LeBlanc 1980
Cladoceran, Daphnia magna	<24 h	S,U	2,100	869.5	Dill et al. 1982
Rainbow trout, Oncorhynchus mykiss	60d	S,U	1,500	1,500	Dill et al. 1982
Bluegill, Lepomis macrochirus	60 d	S,U	4,700	4,700	Dill et al. 1982

* = Not used in calculation of SMAV

TABLE 2A. CHRONIC TOXICITY OF BIPHENYL TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
FRESHWATER SPECIES					
Cladoceran, *Daphnia magna*	LC	170-320	233.2	232.2	Gersich et al. 1989
SALTWATER SPECIES					

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR BIPHENYL

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
		FRESHWATER SPECIES		
Cladoceran, *Daphnia magna*	360	233.2	1.544	Gersich et al. 1989
		SALTWATER SPECIES		

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES — CHEMICAL BIPHENYL

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
3	4,700	Bluegill, *Lepomis macrochirus*	4,700	
2	1,500	Rainbow trout, *Oncorhynchus mykiss*	1,500	
1	869.5	Cladoceran, *Daphnia magna*	869.5	1.544

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV CHEMICAL BIPHENYL

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 2:

MDR	Species
(1)	Oncorhynchus mykiss
(2)	Lepomis macrochirus
(3)	___
(4)	Daphnia magna
(5)	___
(6)	___
(7)	___
(8)	___

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 3

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ μg/L
______ μg/L
______ μg/L
______ μg/L

FAV = ______ μg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = 869.5 μg/L

SAF = 8.0 (from Section 2)

SUMMARY OF AVAILABLE VALUES CHEMICAL BIPHENYL

Retain 4 significant digits in all calculated results.

FAV = ______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{\text{SAF}} = \frac{869.5}{8.0} = 108.7 \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 1.544, 18, 18 = 7.938

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{108.7}{7.938} = 13.69 \ \mu g/L$$

CALCULATION OF TIER 2 ESB   CHEMICAL ___BIPHENYL

Retain 4 significant digits in all calculated results.

FCV = ______________ μg/L OR SCV = __13.69_ μg/L

log K_{ow} = __3.96__ (From Sam Karickhoff via John Miller, not USEPA Draft Report)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = __3.893

$K_{oc} = 10^{\log Koc}$ = __7816__ L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in μg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = __110__ μg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

4-BROMOPHENYL PHENYL ETHER

CASRN 101-55-3

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL 4-BROMOPHENYL PHENYL ETHER CASRN 101-55-3

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
5184	2 (Daphnid)		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Buccafusco, R.J., S.J. Ells, and G.A. LeBlanc. 1981. Acute toxicity of priority pollutants to bluegill (*Lepomis macrochirus*). *Bull. Environ. Contam. Toxicol.* 26:446-452. (ARN:5590)

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

USEPA. 1978. In-depth studies on health and environmental impacts of selected water pollutants. Contract No. 68-01-4646. (Table of data available from Charles E. Stephan, U.S. EPA, Duluth, MN.)

Rejected:

None

TABLE 1. ACUTE TOXICITY OF 4-BROMOPHENYL PHENYL ETHER TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Daphnia magna	<24 h	S,M	360	360	LeBlanc 1980
Bluegill, Lepomis macrochirus	juvenile	S,U	5,900	5,900	Buccafusco et al. 1981

TABLE 2A. CHRONIC TOXICITY OF 4-BROMOPHENYL PHENYL ETHER TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (μg/L)	Species Mean Chronic Value	Reference
			FRESHWATER SPECIES		
Fathead minnow, Pimephales promelas	?	>89<167	121.9	121.9	USEPA 1978
			SALTWATER SPECIES		

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR 4-BROMOPHENYL PHENYL ETHER

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference

FRESHWATER SPECIES

There are no acceptable acute-chronic ratios for freshwater species.

SALTWATER SPECIES

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL 4-BROMOPHENYL PHENYL ETHER

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (μg/L)	Species	Species Mean Acute Value (μg/L)	Species Mean Acute-Chronic Ratio
2	5,900	Bluegill, Lepomis macrochirus	5,900	–
1	360	Cladoceran, Daphnia magna	360	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV   CHEMICAL __4-BROMOPHENYL PHENYL ETHER

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given from Section 2:

MDR	Species
(1)	______________________________
(2)	Lepomis macrochirus
(3)	______________________________
(4)	Daphnia magna
(5)	______________________________
(6)	______________________________
(7)	______________________________
(8)	______________________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = __2

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ µg/L
______ µg/L
______ µg/L
______ µg/L

FAV = ______ µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = __360__ µg/L

SAF = __13.0__ (from Section 2)

SUMMARY OF AVAILABLE VALUES CHEMICAL 4-BROMOPHENYL PHENYL ETHER

Retain 4 significant digits in all calculated results.

FAV = ______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{SAF} = \frac{360}{13.0} = 27.69\ \mu g/L$$

FACR = _____________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = 18

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{27.69}{18} = 1.538\ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL 4-BROMOPHENYL PHENYL ETHER

Retain 4 significant digits in all calculated results.

FCV = ________________ μg/L OR SCV = 1.538 μg/L

log K_{ow} = 5.00 (From 4/10/95 USEPA Draft Report, S.W. Karickhoff and J.M. Long)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 4.915

$K_{oc} = 10^{\log K_{oc}}$ = 82220 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in μg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 130 μg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

BUTYL BENZYL PHTHALATE

CASRN 85-68-7

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL BUTYL BENZYL PHTHALATE CASRN 85-68-7

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
5184	3 (Daphnid)		
7884	1, 4 (Daphnid)		
5590	5		
15239	2 (Daphnid), 6, 7		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Buccafusco, R.J., S.J. Ells, and G.A. LeBlanc. 1981. Acute toxicity of priority pollutants to bluegill (*Lepomis macrochirus*). *Bull. Environ. Contam. Toxicol.* 26(4):446-452. (ARN: 5590)

Gledhill, W.E., R.G. Kaley, W.J. Adams, O. Hicks, P.R. Michael, V.W. Saeger, and G.A. LeBlanc. 1980. An environmental safety assessment of butyl benzyl phthalate. *Environ. Sci. Technol.* 14(3):301-305. (ARN: 15239)

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

Ziegenfuss, P.S., W.J. Renaudette, and W.J. Adams. 1986. Methodology for assessing the acute toxicity of chemicals sorbed to sediments: Testing the equilibrium partitioning theory. In T.M. Poston and R. Purdy (eds.), *Aquatic toxicology and environmental fate*, 9th Vol., ASTM STP 921, Philadelphia, PA. pp.479-493. (ARN: 7884)

Rejected:

None

TABLE 1. ACUTE TOXICITY OF BUTYL BENZYL PHTHALATE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Daphnia magna	< 24 hr	S,U	92,000*		LeBlanc 1980
Cladoceran, Daphnia magna	?	S,M	3,700		Gledhill et al. 1980
Cladoceran, Daphnia magna	< 24 hr	S,M	1,800	2,581	Ziegenfuss et al. 1986
Midge, Chironomus tentans	2nd instar	S,M	1,600	1,600	Ziegenfuss et al. 1986
Rainbow trout, Oncorhynchus mykiss	?	S,U	3,300	3,300	Gledhill et al. 1980
Fathead minnow, Pimephales promelas	?	S,U	2,100		Gledhill et al. 1980
Fathead minnow, Pimephales promelas	?	S,U	5,300		Gledhill et al. 1980
Fathead minnow, Pimephales promelas	?	F,M	2,320	2,320	Gledhill et al. 1980

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Bluegill, Lepomis macrochirus	juvenile	S,U	43,000*		Buccafusco et al. 1981
Bluegill, Lepomis macrochirus	?	S,U	1,700	1,700	Gledhill et al. 1980

*Not used in calculation of SMAV

TABLE 2A. CHRONIC TOXICITY OF BUTYL BENZYL PHTHALATE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
			FRESHWATER SPECIES		
Cladoceran, *Daphnia magna*	S, M	260-760	444.5	444.5	Gledhill et al. 1980

SALTWATER SPECIES

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR BUTYL BENZYL PHTHALATE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
FRESHWATER SPECIES				
Cladoceran Daphnia magna	3,700	444.5	8.324	Gledhill et al. 1980
SALTWATER SPECIES				

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL BUTYL BENZYL PHTHALATE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
5	3,300	Rainbow trout, Oncorhynchus mykiss	3,300	–
4	2,581	Cladoceran, Daphnia magna	2,581	8.324
3	2,320	Fathead minnow, Pimephales promelas	2,320	–
2	1,700	Bluegill, Lepomis macrochirus	1,700	–
1	1,600	Midge, Chironomus tentans	1,600	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV CHEMICAL BUTYL BENZYL PHTHALATE

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 2:

MDR Species

(1) Oncorhynchus mykiss

(2) Lepomis macrochirus

(3) Pimephales promelas

(4) Daphnia magna

(5) ______________________

(6) Chironomus tentans

(7) ______________________

(8) ______________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 5

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ μg/L
______ μg/L
______ μg/L
______ μg/L

FAV = ______ μg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = 1,600 μg/L

SAF = 6.1 (from Section 2)

SUMMARY OF AVAILABLE VALUES CHEMICAL BUTYL BENZYL PHTHALATE

Retain 4 significant digits in all calculated results.

FAV = ______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{\text{SAF}} = \frac{1{,}600}{6.1} = 262.3\ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 8.324, 18, 18 = 13.92

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{262.3}{13.92} = 18.84\ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL BUTYL BENZYL PHTHALATE

Retain 4 significant digits in all calculated results.

FCV = ________________ μg/L OR SCV = 18.84 μg/L

log K_{ow} = 4.84 (From 4/10/95 USEPA Draft Report, S.W. Karickhoff and J.M. Long)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 4.758

$K_{oc} = 10^{\log K_{oc}}$ = 57279 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in μg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 1100 μg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

1,2-DICHLOROBENZENE

CASRN 95-50-1

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL 1,2-DICHLOROBENZENE CASRN 95-50-1

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
5184	6 (Daphnid)		
863	8		
5590	9		
10579	14, 15, 26		
875	19		
5735	20		
2965	21		
12858	22		
7257	23, 24		
6629	29		
10805	32		
11936	33		
11926	34		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Buccafusco, R.J., S.J. Ells, and G.A. LeBlanc. 1981. Acute toxicity of priority pollutants to bluegill (*Lepomis macrochirus*). *Bull. Environ. Contam. Toxicol.* 26(4):446-452. (ARN: 5590)

Call, D.J., L.T. Brooke, N. Ahmad, and J.E. Richter. 1983. Toxicity and metabolism studies with EPA priority pollutants and related chemicals in freshwater organisms. EPA 600/3-83-095, U.S. EPA, Duluth, MN. (ARN: 10579)

Canton, J.H., W. Slooff, H.J. Kool, J. Struys, T.J.M. Gouw, R.C.C. Wegman, and G.J. Piet. 1985. Toxicity, biodegrability and accumulation of a number of Cl/N-containing compounds for classification and establishing water quality criteria. *Regul. Toxicol. Pharmacol.* 5:123-131 (ARN: 6629)

Curtis, M.W., T.L. Copeland, and C.H. Ward. 1978. Aquatic toxicity of substances proposed for spill prevention regulation. In *Proc. Natl. Conf. Control of Hazardous Material Spills*, Miami Beach, FL, pp. 93-103. (ARN: 5735)

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Kuehn, R., M. Pattard, K. Pernak, and A. Winter. 1989. Results of the harmful effects of water pollutants to *Daphnia magna* in the 21-day reproduction test. *Water Res.* 23(4):501-520. (ARN: 847)

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

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Rejected:

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Bobra, A.M., W.Y. Shiu, and D. MacKay. 1983. A predictive correlation for the acute toxicity of hydrocarbons and chlorinated hydrocarbons to the water flea (*Daphnia magna*). *Chemosphere* 12(9-10):1121-1129. (ARN: 11936)

Bobra, A., W.Y. Shiu, and D. MacKay. 1985. Quantitative structure-activity relationships for the acute toxicity of chlorobenzenes to *Daphnia magna*. *Environ. Toxicol. Chem.* 4(3):297-305. (ARN: 10805)

Curtis, M.W., T.L. Copeland, and C.H. Ward. 1979. Acute toxicity of 12 industrial chemicals to freshwater and saltwater organisms. *Water Res.* 13(2):137-141. (ARN: 875)

Curtis, M.W., and C.H. Ward. 1981. Aquatic toxicity of forty industrial chemicals: Testing in support of hazardous substance spill prevention regulation. *J. Hydrol.* 51:359-367. (ARN: 2965)

TABLE 1. ACUTE TOXICITY OF 1,2-DICHLOROBENZENE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, <u>Daphnia</u> <u>magna</u>	?	S,M	2,200		Canton et al. 1978
Cladoceran, <u>Daphnia</u> <u>magna</u>	<24-hour	S,U	2,400		LeBlanc 1980
Cladoceran, <u>Daphnia</u> <u>magna</u>	<2-day	S,U	3,752	2,706	Hermens et al. 1984
Midge, <u>Tanytarsus</u> <u>dissimilis</u>	3rd or 4th instar	S,U	12,000	12,000	Call et al. 1983
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	juvenile	F,M	1,580	1,580	Call et al. 1983
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	3-month	S,M	6,027*		Sijm et al. 1993
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	?	S,M	5,700		Curtis et al. 1978
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	32-day	S,M	9,470	6,877	Geiger et al. 1985
Guppy, <u>Poecilia</u> <u>reticulata</u>	3-month	S,M	4,793**	4,793	Sijm et al. 1993

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Bluegill, *Lepomis macrochirus*	juvenile	S,U	5,600		Buccafusco et al. 1981
Bluegill, *Lepomis macrochirus*	juvenile	S,U	27,000	12,296	Dawson et al. 1977

* Converted from 41.0 µmol/L x $\frac{\text{mol}}{10^6\ \mu\text{mol}}$ x $\frac{147.01\ \text{g}}{\text{mol}}$ x $\frac{10^6\ \mu\text{g}}{\text{g}}$ = 6,027 µg/L

** Converted from 32.6 µmol/L x $\frac{\text{mol}}{10^6\ \mu\text{mol}}$ x $\frac{147.01\ \text{g}}{\text{mol}}$ x $\frac{10^6\ \mu\text{g}}{\text{g}}$ = 4,793 µg/L

TABLE 2A. CHRONIC TOXICITY OF 1,2-DICHLOROBENZENE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
			FRESHWATER SPECIES		
Cladoceran, Daphnia magna	LC	not given	0.63 NOEC		Kuhn et al. 1989
Fathead minnow, Pimephales promelas	?	1600-2500	2000	2000	USEPA 1978

SALTWATER SPECIES

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR 1,2-DICHLOROBENZENE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference

FRESHWATER SPECIES

There are no acceptable acute-chronic ratios for freshwater species.

SALTWATER SPECIES

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL 1,2-DICHLOROBENZENE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
6	12,296	Bluegill, Lepomis macrochirus	12,296	–
5	12,000	Midge, Tanytarsus dissimilis	12,000	–
4	6,877	Fathead minnow, Pimephales promelas	6,877	–
3	4,793	Guppy, Poecilia reticulata	4,793	–
2	2,706	Cladoceran, Daphnia magna	2,706	–
1	1,580	Rainbow trout, Oncorhynchus mykiss	1,580	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV CHEMICAL 1,2-DICHLOROBENZENE

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 2:

MDR	Species
(1)	Oncorhynchus mykiss
(2)	Lepomis macrochirus
(3)	Pimephales promelas
(4)	Daphnia magna
(5)	____________________________
(6)	Tanytarsus dissimilis
(7)	____________________________
(8)	____________________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 5

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ μg/L
______ μg/L
______ μg/L
______ μg/L

FAV = ______ μg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = 1,580 μg/L

SAF = 6.1 (from Section 2)

SUMMARY OF AVAILABLE VALUES CHEMICAL 1,2-DICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FAV = ______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{SAF} = \frac{1{,}580}{6.1} = 259.0 \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = 18

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{259.0}{18} = 14.39 \ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL 1,2-DICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FCV = ________________ μg/L OR SCV = 14.39 μg/L

log K_{ow} = 3.43 (From 4/10/95 USEPA Draft Report, S.W. Karickhoff and J.M. Long)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 3.372

$K_{oc} = 10^{\log K_{oc}}$ = 2355 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in μg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 34 μg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

1,3-DICHLOROBENZENE

CASRN 541-73-1

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL 1,3-DICHLOROBENZENE CASRN 541-73-1

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
847	2 (Daphnid)		
12124	3, 5, 12		
5184	7 (Daphnid)		
15981	8, 9, 17, & 18 (Daphnids)		
5675	10 (Daphnid)		
10183	11		
12858	13		
6629	15 (Daphnid)		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Broderius, S., and M. Kahl. 1985. Acute toxicity of organic chemical mixtures to the fathead minnow. *Aquatic Toxicol.* 6:307-322.

Buccafusco, R.J., S.J. Ellis, and G.A. LeBlanc. 1981. Acute toxicity of priority pollutants to bluegill (*Leomis macrochirus*). *Bull. Environ. Contam. Toxicol*. 26:446-452. (ARN: 5590)

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Call, D.J., L.T. Brooke, N. Ahmad, and J.E. Richter. 1983. *Toxicity and metabolism studies with EPA (Environmental Protection Agency) priority pollutants and related chemicals in freshwater organisms*. EPA-600/3-83-095. U.S. Environmental Protection Agency, Office of Research and Development, Duluth, MN. (ARN:10579)

Carlson, A.R. and P.A. Kosian. 1987. Toxicity of chlorinated benzenes to fathead minnows (*Pimephales promelas*). *Arch. Environ. Contam. Toxicol.* 16(2):129-135. (ARN: 12124)

Geiger, D.L., S.H. Poirier, L.T. Brooke, and D.J. Call. 1986. Acute toxicities of organic chemicals to fathead minnows (*Pimephales promelas*), Vol. 3. Center for Lake Superior Environmental Studies, University of Wisconsin, Superior, WI. (ARN: 12858, contains data also found in 10183, 15823)

Hermens, J., H. Canton, N. Steyger, and R. Wegman. 1984. Joint effects of a mixture of 14 chemicals on mortality and inhibition of reproduction of *Daphnia magna*. *Aquat. Toxicol.* 5(4):315-322. (ARN: 5675)

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LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

Richter, J.E., S.F. Peterson, and C.F. Kleiner. 1983. Acute and chronic toxicity of some chlorinated benzenes, chlorinated ethanes, and tetrachloroethylene to *Daphnia magna*. *Arch. Environ. Contam. Toxicol.* 12(6):679-684. (ARN: 15981)

Rejected:

None

TABLE 1. ACUTE TOXICITY OF 1,3-DICHLOROBENZENE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, *Daphnia magna*	<24h	S,M	1,700		Hermens et al. 1984
Cladoceran, *Daphnia magna*	<24h	S,M	7,400		Richter et al. 1983
Cladoceran *Daphnia magna*	<24h	S,M	6,800		Canton et al. 1985
Cladoceran, *Daphnia magna*	<24h	S,U	28,000		LeBlanc 1980
Cladoceran, *Daphnia magna*	<24h	S,M	7,230	7,042	Call et al. 1983
Fathead minnow, *Pimephales promelas*	juvenile	F,M	9,120		Broderius and Kahl 1985
Fathead minnow, *Pimephales promelas*	juvenile	F,M	7,800		Carlson and Kosian 1987
Fathead minnow, *Pimephales promelas*	juvenile	F,M	8,030	8,297	Geiger et al. 1986
Bluegill, *Lepomis macrochirus*	juvenile	S,U	5,000	5,000	Buccafusco et al. 1981

TABLE 2A. CHRONIC TOXICITY OF 1,3-DICHLOROBENZENE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
			FRESHWATER SPECIES		
Cladoceran, *Daphnia magna*	LC	690-1500	1,017		Richter et al. 1983
Cladoceran, *Daphnia magna*	LC	not reported	800 NOEC	902.0	Kuhn et al. 1989
Fathead minnow *Pimephales promelas*	ELS	1000-2300	1,517	1,517	Carlson and Kosian 1987

SALTWATER SPECIES

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR 1,3-DICHLOROBENZENE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
		FRESHWATER SPECIES		
Cladoceran, Daphnia magna	7,400	1,017	7.276	Richter et al. 1983
Fathead minnow Pimephales promelas	7800	1,517	5.142	Carlson and Kosian 1987
		SALTWATER SPECIES		

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL 1,3-DICHLOROBENZENE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
3	8,297	Fathead minnow, Pimephales promelas	8,297	5.142
2	7,042	Cladoceran, Daphnia magna	7,042	7.276
1	5,000	Bluegill, Lepomis macrochirus	5,000	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV CHEMICAL 1,3-DICHLOROBENZENE

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 2:

MDR	Species
(1)	____________________________
(2)	Lepomis macrochirus
(3)	Pimephales promelas
(4)	Daphnia magna
(5)	____________________________
(6)	____________________________
(7)	____________________________
(8)	____________________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 3

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ µg/L
______ µg/L
______ µg/L
______ µg/L

FAV = ______ µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = 5,000 µg/L

SAF = 8.0 (from Section 2)

SUMMARY OF AVAILABLE VALUES CHEMICAL 1,3-DICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FAV = ______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{\text{SAF}} = \frac{5{,}000}{8.0} = 625.0 \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 7.276, 5.142, 18 = 8.765

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{625.0}{8.765} = 71.31 \ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL 1,3-DICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FCV = ______________ μg/L OR SCV = 71.31 μg/L

log K_{ow} = 3.43 (Arithmetic mean of log K_{ow}s from 4/10/95 USEPA Draft Report, S.W. Karickhoff and J.M. Long, for 1,2- and 1,4-dichlorobenzene, as per EPA/ORD-Duluth)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 3.372

$K_{oc} = 10^{\log K_{oc}}$ = 2355 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in μg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 170 μg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

1,4-DICHLOROBENZENE

CASRN 106-46-7

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL 1,4-DICHLOROBENZENE CASRN 106-46-7

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
4072	7, 16, 21		
847	8 (Daphnid)		
12124	9, 10, 15, 50		
140	12, 13, 14, 29, 30		
5184	23 (Daphnid)		
10579	36, 54		
5735	42, 43		
875	44		
2965	45		
10183	46		
10432	47, 48, 49		
7257	51, 52		
6629	56 (Daphnid)		
10712	37		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Buccafusco, R.J., S.J. Ellis, and G.A. LeBlanc. 1981. Acute toxicity of priority pollutants to bluegill (*Leomis macrochirus*). *Bull. Environ. Contam. Toxicol*. 26:446-452. (ARN: 5590)

Call, D.J., L.T. Brooke, N. Ahmad, and J.E. Richter. 1983. Toxicity and metabolism studies with EPA priority pollutants and related chemicals in freshwater organisms. EPA 600/3-83-095, U.S. EPA, Duluth, MN. (ARN: 10579)

Canton, J.H., W. Slooff, H.J. Kool, J. Struys, T.J.M. Gouw, R.C.C. Wegman, and G.J. Piet. 1985. Toxicity, biodegrability and accumulation of a number of Cl/N-containing compounds for classification and establishing water quality criteria. *Regul. Toxicol. Pharmacol.* 5:123-131. (ARN: 6629)

Carlson, A.R., and P.A. Kosian. 1987. Toxicity of chlorinated benzenes to fathead minnows (*Pimephales promelas*). *Arch. Environ. Contam. Toxicol.* 16(2):129-135. (ARN: 12124)

Curtis, M.W., T.L. Copeland, and C.H. Ward. 1978. Aquatic toxicity of substances proposed for spill prevention regulation. In *Proc. Natl. Conf. Control of Hazardous Material Spills,* Miami Beach, FL, April 11-13, 1978, pp. 93-103. (ARN: 5735)

Curtis, M.W., T.L. Copeland, and C.H. Ward. 1979. Acute toxicity of 12 industrial chemicals to freshwater and saltwater organisms. *Water Res.* 13(2):137-141. (ARN: 875)

Curtis, M.W., and C.H. Ward. 1981. Aquatic toxicity of forty industrial chemicals: testing in support of hazardous substance spill prevention regulation. *J. Hydrol.* 51:359-367 (ARN: 2965)

Kuehn, R., M. Pattard, K. Pernak, and A. Winter. 1989. Results of the harmful effects of water pollutants to *Daphnia magna* in the 21-day reproduction test. *Water Res.* 23(4):501-510. (ARN: 847)

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Sijm, D.T.H.M., M. Schipper, and A. Opperhuizen. 1993. Toxicokinetics of halogenated benzenes in fish: Lethal body burden as a toxicological end point. *Environ. Toxicol. Chem.* 12:1117-1127. (ARN: 7257)

Smith, A.D., A. Bharath, C. Mallard, D. Orr, K. Smith, J.A.Sutton, J.Vukmanich, L.S.McCarty, and G.W.Ozburn. 1991. The acute and chronic toxicity of ten clorinated organic compounds to the American flagfish (*Jordanella floridae*). *Arch. Environ. Contam. Toxicol.* 20(1):94-102. (ARN: 140)

Veith, G.D., D.J. Call, and L.T. Brooke. 1983. Estimating the acute toxicity of narcotic industrial chemicals to fathead minnows. In W.E. Bishop, R.D. Cardwell, and B.B. Heidolph (eds.), *Aquatic Toxicology and Hazard Assessment*, 6th Symposium, ASTM STP 802, Philadelphia, PA:90-97 (ARN: 10183, most LC50 data published as 12448, 12447, 12858, 12859, 3217)

<u>Rejected:</u>

Calamari, D., S. Galassi, and F. Setti. 1982. Evaluating the hazard of organic substances on aquatic life: The paradichlorobenzene example. *Ecotoxicol. Environ. Saf.* 6(4):369-378. (ARN: 10712, accepted except as noted)

TABLE 1. ACUTE TOXICITY OF 1,4-DICHLOROBENZENE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, *Daphnia magna*	<24h	S,M	2,200		Canton et al. 1985
Cladoceran, *Daphnia magna*	<24h	S,U	11,000	4,920	LeBlanc 1980
Midge, *Chironomus riparius*	3rd instar	S,M	12,000	12,000	Roghair et al. 1994
Midge, *Tanytarsus dissimilis*	3rd-4th instar	S,M	13,000	13,000	Call et al. 1983
Rainbow trout, *Oncorhynchus mykiss*	juvenile	F,M	1,120	1,120	Call et al. 1983
Fathead minnow, *Pimephales promelas*	juvenile	S,M	30,000		Curtis and Ward 1981
Fathead minnow, *Pimephales promelas*	juvenile	S,U	34,500		Curtis et al. 1978
Fathead minnow, *Pimephales promelas*	juvenile	S,M	2,400		Curtis et al. 1979
Fathead minnow, *Pimephales promelas*	juvenile	R,M	2,852*		Sijm et al. 1993

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Fathead minnow, Pimephales promelas	juvenile	S,U	14,200		Mayes et al. 1983
Fathead minnow, Pimephales promelas	fry	S,U	3,600		Mayes et al. 1983
Fathead minnow, Pimephales promelas	subadult	S,U	11,700		Mayes et al. 1983
Fathead minnow, Pimephales promelas	juvenile	F,M	4,000		Veith et al. 1983
Fathead minnow, Pimephales promelas	juvenile	F,M	4,200	4,090	Carlson and Kosian 1987
Flagfish, Jordanella floridae	juvenile	R,M	4,480		Smith et al. 1991
Flagfish, Jordanella floridae	juvenile	F,M	2,053	2,053	Smith et al. 1991
Guppy, Poecilia reticulata	juvenile	R,M	2,896**	2,896	Sijm et al. 1993
Bluegill, Lepomis macrochirus	juvenile	S,U	4,300	4,300	Buccafusco et al. 1981

*Converted from 19.4 µmol/L x $\frac{\text{mol}}{10^6\ \mu\text{mol}}$ x $\frac{147.01\ \text{g}}{\text{mol}}$ x $\frac{10^6\ \mu\text{g}}{\text{g}}$ = 2,852 µg/L

**Converted from 19.7 µmol/L x $\frac{\text{mol}}{10^6\ \mu\text{mol}}$ x $\frac{147.01\ \text{g}}{\text{mol}}$ x $\frac{10^6\ \mu\text{g}}{\text{g}}$ = 2,896 µg/L

TABLE 2A. CHRONIC TOXICITY OF 1,4-DICHLOROBENZENE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
FRESHWATER SPECIES					
Cladoceran, Daphnia magna	LC	not reported	500 NOEC	500	Kuhn et al. 1989
Fathead minnow, Pimephales promelas	ELS	570-1000	760	760	Carlson and Kosian 1987
SALTWATER SPECIES					

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR 1,4-DICHLOROBENZENE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
FRESHWATER SPECIES				
Fathead minnow, Pimephales promelas	4,200	760	5.53	Carlson and Kosian 1987
SALTWATER SPECIES				

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL 1,4-DICHLOROBENZENE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
8	13,000	Midge, Tanytarsus dissimilis	13,000	–
7	12,000	Midge, Chironomus riparius	12,000	–
6	4,920	Cladoceran, Daphnia magna	4,920	–
5	4,300	Bluegill, Lepomis macrochirus	4,300	–
4	4,090	Fathead minnow, Pimephales promelas	4,090	5.53
3	2,896	Guppy, Poecilia reticulata	2,896	–
2	2,053	Flagfish, Jordanella floridae	2,053	–
1	1,120	Rainbow trout, Oncorhynchus mykiss	1,120	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV

CHEMICAL 1,4-DICHLOROBENZENE

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR	Species
(1)	Oncorhynchus mykiss
(2)	Lepomis macrochirus
(3)	Pimephales promelas
(4)	Daphnia magna
(5)	______
(6)	Chironomus tentans
(7)	______
(8)	______

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 5

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ μg/L
______ μg/L
______ μg/L
______ μg/L

FAV = ______ μg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = 1,120 μg/L

SAF = 6.1 (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL 1,4-DICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FAV = ______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{\text{SAF}} = \frac{1{,}120}{6.1} = 183.6\ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 5.53, 18, 18 = 12.15

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{183.6}{12.15} = 15.11\ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL 1,4-DICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FCV = ________________ μg/L OR SCV = 15.11 μg/L

log K_{ow} = 3.42 (Karickhoff and Long, 1995)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 3.362

$K_{oc} = 10^{\log K_{oc}}$ = 2301 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in μg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 35 μg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

HEXACHLOROETHANE

CASRN 67-72-1

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL HEXACHLOROETHANE CASRN 67-72-1

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
10755	1, 3, 18, 25, 35, 39, 48		
5876	2, 13, 17, 24, 33, 38		
12004	4, 11 (Daphnid), 14, 19,		
	20, 26, 36, 40, 52, 53,		
	55, 56, 60		
11181	5, 10 & 12 (Daphnids), 57		
5184	7 (Daphnid)		
15981	8 & 9 (Daphnids)		
10579	34, 58		
5876	47, 54, 59, 63		
11227	49		
12447	50, 51		
12258	62, 64 & 67 (Daphnids)		
15981	65 & 66 (Daphnids)		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Buccafusco, R.J., S.J. Ells, and G.A. LeBlanc. 1981. Acute toxicity of priority pollutants to bluegill *(Lepomis macrochirus*). *Bull. Environ. Contam. Toxicol.* 26:446-452. (ARN:5590)

Call, D.J., L.T. Brooke, N. Ahmad, and J.E. Richter. 1983. *Toxicity and metabolism studies with EPA priority pollutants and related chemicals in freshwater organisms.* EPA 600/3-83-095, U.S. EPA, Duluth, MN. (ARN: 10579)

Elnabarawy, M.T., A.N. Welter, and R.R. Robideau. 1986. Relative sensitivity of three daphnid species to selected organic and inorganic chemicals. *Environ. Toxicol. Chem.* 5(4):393-398. (ARN: 12258)

Geiger, D.L., C.E. Northcutt, D.J. Call, and L.T. Brooke. 1985. Acute toxicities of organic chemicals to fathead minnows (*Pimephales promelas*), Vol. 2. Center for Lake Superior Environmental Studies, University of Wisconsin, Superior, WI:326 p. (ARN: 12447, contains data also found in 10183, 15823)

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

Mount, D.I., and T.J. Norberg. 1984. A seven-day life-cycle cladoceran toxicity test. *Environ. Toxicol. Chem.* 3(3):425-434 (ARN: 11181)

Phipps, G.L., and G.W. Holcombe. 1985. A method for aquatic multiple species toxicant testing: Acute toxicity of 10 chemicals to 5 vertebrates and 2 invertebrates. *Environ. Pollut. Ser. A Ecol. Biol.* 38(2):141-157 (ARN: 10775)

Richter, J.E., S.F. Peterson, and C.F. Kleiner. 1983. Acute and chronic toxicity of some chlorinated benzenes, chlorinated ethanes, and tetrachloroethylene to *Daphnia magna*. *Arch. Environ. Contam. Toxicol.* 12(6):679-684. (ARN: 15981)

Thurston, R.V., T.A. Gilfoil, E.L. Meyn, R.K. Zajdel, T.L. Aoki, and G.D. Veith. 1985. Comparative toxicity of ten organic chemicals to ten common aquatic species. *Water Res.* 19(9):1145-1155. (ARN: 12004)

Walbridge, C.T., J.T. Fiandt, G.L. Phipps, and G.W. Holcombe. 1983. Acute toxicity of ten chlorinated aliphatic hydrocarbons to the fathead minnow (*Pimephales promelas*). *Arch. Environ. Contam. Toxicol.* 12(6):661-666 (ARN: 11227)

Rejected:

Bottger, A., et. al. 1988. Belastung der Anwohner von Chemisch-Reinigungsanlegen durch Tetrachlorethylen Vortrag: Tagung der Deutschen Gesellschaft fr Hygiene und Mikrobiologie, Kiel 9:29-30. (ARN: 5876, unavailable)

TABLE 1. ACUTE TOXICITY OF HEXACHLOROETHANE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Ceriodaphnia reticulata	<4 h	S,U	3,300		Mount and Norberg 1984
Cladoceran, Ceriodaphnia reticulata	<24 h	S,U	6,800	4,737	Elnabarawy et al. 1986
Cladoceran, Daphnia magna	<24 h	S,U	8,070		LeBlanc 1980
Cladoceran, Daphnia magna	<24 h	S,U	2,700		Mount and Norberg 1984
Cladoceran, Daphnia magna	<24 h	S,M	2,100		Call et al. 1983, Richter et al. 1983
Cladoceran, Daphnia magna	<24 h	S*,M	1,360		Thurston et al. 1985
Cladoceran, Daphnia magna	<24 h	S,U	10,000	3,621	Elnabarawy et al. 1986
Cladoceran, Daphnia pulex	<24 h	S,U	>10,000		Mount and Norberg 1984
Cladoceran, Daphnia pulex	<24 h	S,U	13,000	11,400	Elnabaraway et al. 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Simocephalus vertulus	<24 h	S,U	5,800	5,800	Mount and Norberg 1984
Midge, Tanytarsus dissimilis	3rd and 4th instar	S*,M	1,230	1,230	Thurston et al. 1985
Crayfish, Orconectes immunis	?	F,M	2,100		Phipps and Holcombe 1985
Crayfish, Orconectes immunis	?	F,M	2,700	2,381	Thurston et al. 1985
Snail, Aplexa hypnorum	adult	F,M	2,100	2,100	Phipps and Holcombe 1985
Rainbow trout, Oncorhynchus mykiss	juvenile	F,M	1,180		Thurston et al. 1985
Rainbow trout, Oncorhynchus mykiss	?	F,M	970	1,070	Phipps and Holcombe 1985
Goldfish, Carassius auratus	?	F,M	2,100		Phipps and Holcombe 1985
Goldfish, Carassius auratus	juvenile	F,M	1,420	1,727	Thurston et al. 1985
Fathead minnow, Pimephales promelas	juvenile	F,M	1,390		Thurston et al. 1985

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Fathead minnow, Pimephales promelas	juvenile	F,M	1,100		Thurston et al. 1985
Fathead minnow, Pimephales promelas	32 d	S,M	1,530		Geiger et al. 1985
Fathead minnow, Pimephales promelas	44 d	S,M	1,320		Geiger et al. 1985
Fathead minnow, Pimephales promelas	?	F,M	1,230		Phipps and Holcombe 1985
Fathead minnow, Pimephales promelas	30-35 d	F,M	1,510	1,298	Walbridge et al. 1983
Channel catfish, Ictalurus punctatus	?	F,M	1,520		Phipps and Holcombe 1985
Channel catfish, Ictalurus punctatus	juvenile	F,M	2,360		Thurston et al. 1985
Channel catfish, Ictalurus punctatus	juvenile	F,M	1,770	1,852	Thurston et al. 1985
Mosquitofish, Gambusia affinis	juvenile	F,M	1,380	1,380	Thurston et al. 1985
Bluegill, Lepomis macrochirus	?	S,U	980		Buccafusco et al. 1981

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	?	F,M	970		Phipps and Holcombe 1985
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	juvenile	F,M	856	911.2	Thurston et al. 1985
Frog, <u>Rana</u> <u>catesbiana</u>	tadpole	F,M	3,180		Thurston et al. 1985
Frog, <u>Rana</u> <u>catesbiana</u>	tadpole	F,M	2,440	2,786	Thurston et al. 1985

*Sealed containers.

TABLE 2A. CHRONIC TOXICITY OF HEXACHLOROETHANE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference

FRESHWATER SPECIES

There are no acceptable chronic toxicity test results for freshwater species.

SALTWATER SPECIES

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR HEXACHLOROETHANE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference

FRESHWATER SPECIES

There are no acceptable acute-chronic ratios for freshwater species.

SALTWATER SPECIES

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL HEXACHLOROETHANE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
		Cladoceran, Daphnia pulex	11,400	–
13	6,425	Cladoceran, Daphnia magna	3,621	–
12	5,800	Cladoceran, Simocephalus vertulus	5,800	–
11	4,737	Cladoceran, Ceriodaphnia reticulata	4,737	–
10	2,786	Frog, Rana catesbiana	2,786	–
9	2,381	Crayfish, Orconectes immunis	2,381	–
8	2,100	Snail, Aptexa hypnorum	2,100	–
7	1,852	Channel catfish, Ictalurus punctatus	1,852	–
6	1,727	Goldfish, Carassius auratus	1,727	–
5	1,380	Mosquitofish, Gambussia affinis	1,380	–
4	1,298	Fathead minnow, Pimephales promelas	1,298	–
3	1,230	Midge, Tanytarsus dissimilus	1,230	–
2	1,070	Rainbow trout, Oncorhynchus mykiss	1,070	–
1	911.2	Bluegill, Lepomis macrochirus	911.2	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV   CHEMICAL HEXACHLOROETHANE

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR   Species

(1)   Oncorhynchus mykiss

(2)   Ictalurus punctatus

(3)   Pimephales promelas

(4)   Ceriodaphnia reticulata

(5)   Orconectes immunis

(6)   Tanytarsus dissimilus

(7)   Aplexa hypnorum

(8)   ______________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 7

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ μg/L
______ μg/L
______ μg/L
______ μg/L

FAV = ______ μg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = 911.2 μg/L

SAF = 4.3 (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL HEXACHLOROETHANE

Retain 4 significant digits in all calculated results.

FAV = ______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{\text{SAF}} = \frac{911.2}{4.3} = 211.9\ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = 18

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \text{\_\_\_\_\_\_} = \text{\_\_\_\_\_\_}\ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \text{\_\_\_\_\_\_} = \text{\_\_\_\_\_\_}\ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \text{\_\_\_\_\_\_} = \text{\_\_\_\_\_\_}\ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{211.9}{18} = 11.77\ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL HEXACHLOROETHANE

Retain 4 significant digits in all calculated results.

FCV = ______________ μg/L OR SCV = 11.77 μg/L

log K_{ow} = 4.00 (Karickhoff and Long, 1995)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 3.932

$K_{oc} = 10^{\log K_{oc}}$ = 8551 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in μg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 100 μg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

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DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

MALATHION

CASRN 121-75-5

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL MALATHION CASRN 121-75-5

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
995	7, 8, 9, 11, 12, 446	2085	463-465
640	17, 20, 36, 468, 469,	942	466, 555
	545, 546	966	497
883	22, 23	964	502, 503, 506, 511, 578,
2238	75, 81, 82, 218, 219		579
2667	76, 215	887	522, 532, 533
2891	91, 212	7775	540
610	96, 135, 142, 143, 165,	528	565
	166, 170, 176, 180, 190,	672	597
	206, 220	5194	620 (Daphnid)
2893	161, 203, 204, 209	2160	554
528	228, 384, 408, 430	888	635, 640, 641
859	232, 354, 390, 458,		
	492, 498, 552		
887	261, 400-402		
563	284, 285		
889	329, 561, 566		
885	409		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Bailey, H.C., and D.H.W. Liu. 1980. *Lumbriculus variegatus*, a benthic oligochaete, as a bioassay organism. In J.C. Eaton, P.R. Parrish, and A.C. Hendricks (eds.), *Aquatic Toxicology and Hazard Assessment*, 3rd Symposium, ASTM STP 707, Philadelphia, PA, pp.205-215. (ARN: 6502)

Bender, M.E., and J.R. Westman. 1976. The toxicity of malathion and its hydrolysis products to the eastern mudminnow, *Umbra pygmaea* (DeKay). *Chesapeake Sci.* 17(2):125-128. (ARN: 672)

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TABLE 1. ACUTE TOXICITY OF MALATHION TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Worm, *Lumbriculus variegatus*	?	S,U	20,500	20,500	Bailey and Liu 1980
Cladoceran, *Daphnia magna*	< 24 hr	S,U	2.1		Dortland 1980
Cladoceran, *Daphnia magna*	< 24 hr	S,U	2.2		Dortland 1980
Cladoceran, *Daphnia magna*	<1 day	S,M	33		Hermens et al. 1984
Cladoceran, *Daphnia magna*	1st instar	S,U	1.0	3.514	Mayer and Ellersieck 1986
Cladoceran, *Daphnia pulex*	1st instar	S,U	1.8	1.8	Mayer and Ellersieck 1986
Cladoceran, *Simocephalus serrulatus*	1st instar	S,U	0.59		Mayer and Ellersieck 1986
Cladoceran, *Simocephalus serrulatus*	1st instar	S,U	3.5		Mayer and Ellersieck 1986
Cladoceran, *Simocephalus serrulatus*	1st instar	S,U	6.2	2.339	Mayer and Ellersieck 1986

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Ostracod, Cypridopsis vidua	mature	S,U	47	47	Mayer and Ellersieck 1986
Isopod, Ascellus brevicaudus	mature	S,U	3,000	3,000	Mayer and Ellersieck 1986
Amphipod, Gammarus fasciatus	mature	S,U	0.76		Mayer and Ellersieck 1986
Amphipod, Gammarus fasciatus	mature	S,U	0.90		Mayer and Ellersieck 1986
Amphipod, Gammarus fasciatus	mature	F,U	0.50	0.6993	Mayer and Ellersieck 1986
Prawn, Palaeomonetes kadiakensis	mature	S,U	32		Mayer and Ellersieck 1986
Prawn, Palaeomonetes kadiakensis	mature	S,U	90		Mayer and Ellersieck 1986
Prawn, Palaeomonetes kadiakensis	mature	F,U	12	32.57	Mayer and Ellersieck 1986
Crayfish, Oronectes nais	early instar	S,U	180		Mayer and Ellersieck 1986
Crayfish, Oronectes nais	mature	S,U	>10,000*	180	Mayer and Ellersieck 1986

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Red swamp crawfish, Procambarus clarkii	?	S,U	50,000	50,000	Cheah et al. 1980
Stonefly, Claassenia sabulosa	2nd year class	S,U	2.8	2.8	Mayer and Ellersieck 1986
Stonefly, Isoperla sp.	naiad	S,U	0.69	0.69	Mayer and Ellersieck 1986
Stonefly, Pteronarcella badia	1st year class	S,U	8.8		Mayer and Ellersieck 1986
Stonefly, Pteronarcella badia	1st year class	S,U	6.2		Mayer and Ellersieck 1986
Stonefly, Pteronarcella badia	2nd year class	S,U	1.1	3.915	Mayer and Ellersieck 1986
Stonefly, Pteronarcys californica	2nd year class	S,U	10	10	Mayer and Ellersieck 1986
Damselfly, Lestes congener	early instar	S,U	10	10	Mayer and Ellersieck 1986
Caddisfly, Hydropsyche sp.	early instar	S,U	5	5	Mayer and Ellersieck 1986
Caddisfly, Limnephilus sp.	late instar	S,U	1.3	1.3	Mayer and Ellersieck 1986

TABLE 1. Continued

	Life	Test	LC50 or EC50	Species Mean

Species	Stage	Method	(µg/L)	Acute Value	Reference
Snipe fly, Atherix variegata	late instar	S,U	385	385	Mayer and Ellersieck 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	280		Mayer and Ellersieck 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	270		Mayer and Ellersieck 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	174		Mayer and Ellersieck 1986
Cutthroat trout, Onchorhynchus clarki	juvenile	S,U	237		Mayer and Ellersieck 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	230	235.0	Mayer and Ellersieck 1986
Coho salmon, Oncorhynchus kisutch	juvenile	S,U	170		Mayer and Ellersieck 1986
Coho salmon, Oncorhynchus kisutch	juvenile	S,U	177	173.5	Mayer and Ellersieck 1986
Rainbow trout, Oncorhynchus mykiss	?	S,U	160		McKim et al., 1987
Rainbow trout, Oncorhynchus mykiss	?	S,U	190		Marking et al. 1984

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference

Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	?	S,U	200		Marking et al. 1984
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	?	S,U	191		Marking et al. 1984
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	?	S,U	234		Marking et al. 1984
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	?	S,U	111		Marking et al. 1984
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	?	?,?	70.0		Marking and Dawson 1975
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	juvenile	S,U	200		Mayer and Ellersieck 1986
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	juvenile	S,U	138		Mayer and Ellersieck 1986
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	juvenile	S,U	80		Mayer and Ellersieck 1986
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	juvenile	S,U	66		Mayer and Ellersieck 1986
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	juvenile	S,U	100		Mayer and Ellersieck 1986

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference

Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	4.1**		Mayer and Ellersieck 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	94	129.5	Mayer and Ellersieck 1986
Brown trout, Salmo trutta	juvenile	S,U	101	101	Mayer and Ellersieck 1986
Lake trout, Salvelinus namaycush	juvenile	S,U	76		Mayer and Ellersieck 1986
Lake trout, Salvelinus namaycush	juvenile	S,U	142	103.9	Mayer and Ellersieck 1986
Eastern mudminnow, Umbra pygmaea	?	S,M	240	240	Bender and Westman 1976
Goldfish, Carassius auratus	juvenile	S,U	10,700	10,700	Mayer and Ellersieck 1986
Carp, Cyprinus carpio	juvenile	S,U	6,590	6,590	Mayer and Ellersieck 1986
Bonytail, Gila elegans	1 d	R,M	15,300	15,300	Beyers et al. 1994
Colorado squawfish, Ptychocheilus lucius	22 d	R,M	9,140	9,140	Beyers et al. 1994

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Fathead minnow,					

Pimephales promelas	29-30 d	S,M	14,100		Geiger et al. 1988
Fathead minnow, Pimephales promelas	juvenile	S,U	8,650		Mayer and Ellersieck 1986
Fathead minnow, Pimephales promelas	juvenile	S,U	11,000	11,030	Mayer and Ellersieck 1986
Black bullhead, Ameiurus melas	juvenile	S,U	12,900		Mayer and Ellersieck 1986
Black bullhead, Ameiurus melas	juvenile	S,U	11,700	12,290	Mayer and Ellersieck 1986
Channel catfish, Ictalurus punctatus	juvenile	S,U	8,970		Mayer and Ellersieck 1986
Channel catfish, Ictalurus punctatus	juvenile	S,U	7,620	8,267	Mayer and Ellersieck 1986
Guppy, Poecilia reticulata	?	S,M	819	819	Desi et al. 1976
Striped bass, Morone saxatilis	56 d	S,U	24.5	24.5	Palawski et al. 1985
Green sunfish, Lepomis cyanellus	juvenile	S,U	175		Mayer and Ellersieck 1986

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Green sunfish, Lepomis cyanellus	juvenile	S,U	170		Mayer and Ellersieck 1986

Green sunfish, Lepomis cyanellus	juvenile	S,U	146	163.2	Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	103		Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	110		Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	87		Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	84		Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	55		Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	40		Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	20		Mayer and Ellersieck 1986
Bluegill, Lepomis macrochirus	juvenile	S,U	30	56.86	Mayer and Ellersieck 1986

TABLE 1. Continued

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Redear sunfish, Lepomis microlophus	juvenile	S,U	62	62	Mayer and Ellersieck 1986

Largemouth bass, Micropterus salmoides	juvenile	S,U	285		Mayer and Ellersieck 1986
Largemouth bass, Micropterus salmoides	juvenile	S,U	250	266.9	Mayer and Ellersieck 1986
Yellow perch, Perca flavescens	juvenile	S,U	263	263	Mayer and Ellersieck 1986
Walleye, Stizostedion vitreum	juvenile	S,U	64	64	Mayer and Ellersieck 1986
Tilapia, Tilapia mossambica	juvenile	S,U	<2400		Mayer and Ellersieck 1986
Tilapia, Tilapia mossambica	juvenile	S,U	2000	2,191	Mayer and Ellersieck 1986
Fowler's toad Bufo woodhousei fowleri	tadpole	S,U	420	420	Mayer and Ellersieck 1986
Western chorus frog Pseudacris triseriata	tadpole	S,U	200	200	Mayer and Ellersieck 1986

*Not used in calculation of SMAV, more resistant life stage

**Not used in calculation of SMAV, Soap Lake strain

TABLE 2A. CHRONIC TOXICITY OF MALATHION TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
		FRESHWATER SPECIES			
Cladoceran, Daphnia magna	LC	0.3 - 0.6	0.4243	0.4243	Dortland 1980
American flagfish, Jordanella floridae	ELS	13.8-18.8	16.11	16.11	Hermanutz et al. 1985
		SALTWATER SPECIES			
Sheepshead minnow, Cyprinodon variegatus	ELS	4-9	6	6	Hansen and Parrish 1977, Parrish et al. 1977

TABLE 2B. ACUTE-CHRONIC RATIOS FOR MALATHION

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
		FRESHWATER SPECIES		
Cladoceran, Daphnia magna	2.15	0.4243	5.067	Dortland 1980
		SALTWATER SPECIES		
Sheepshead minnow, Cyprinodon variegatus	51	6	8.5	Hansen and Parrish 1977, Parrish et al. 1977

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL MALATHION

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
37	50,000	Red swamp crawfish, Procambarus clarkii	50,000	–
36	20,500	Worm, Lumbriculus variegatus	20,500	–
35	15,300	Bonytail, Gila elegans	15,300	–
34	12,290	Black bullhead, Ameiurus melas	12,290	–
33	11,030	Fathead minnow, Pimephales promelas	11,030	–
32	10,700	Goldfish, Carassius auratus	10,700	–
31	9,140	Colorado squawfish, Ptychocheilus lucius	9,140	–
30	8,267	Channel catfish, Ictalurus punctatus	8,267	–
29	6,590	Carp, Cyprinus carpio	6,590	–
28	3,000	Isopod, Ascellus brevicaudus	3,000	–
27	2,191	Tilapia, Tilapia mossabica	2,191	–
26	819	Guppy, Poecilia reticulata	819	–
25	420	Fowler's toad, Bufo woodhousei fowleri	420	–

TABLE 3. Continued.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
24	385	Snipe fly, Atherix variegata	385	–
23	266.9	Largemouth bass, Micropterus salmoides	266.9	–
22	263	Yellow perch, Perca flavescens	263	–
21	240	Eastern mudminnow, Umbra pygmaea	240	–
20	200	Western chorus frog, Pseudacris triseriata	200	–
19	180	Crayfish, Oronectes nais	180	–
		Cutthroat trout, Oncorhynchus clarki	235.0	–
		Coho salmon, Oncorhynchus kisutch	173.5	–
18	174.1	Rainbow trout, Oncorhynchus mykiss	129.5	–
17	103.9	Lake trout, Salvelinus namaycush	103.9	–
16	101	Brown trout, Salmo trutta	101	–
		Green sunfish, Lepomis cyanellus	163.2	–
		Bluegill, Lepomis macrochirus	56.86	–
15	83.17	Redear sunfish, Lepomis microlophus	62	–
14	64	Walleye, Stizostedion vitreum	64	–

TABLE 3. Continued.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
13	47	Ostracod, Cypridopsis vidua	47	–
12	32.57	Prawn, Palaemonetes kadiakensis	32.57	–
11	24.5	Striped bass, Morone saxatilis	24.5	–
10	10	Damselfly, Lestes congener	10	–
9	10	Stonefly, Pteronarcys californica	10	–
8	5	Caddisfly, Hydropsyche sp.	5	–
7	3.915	Stonefly, Pteronarcella badia	3.915	–
6	2.8	Stonefly, Claassenia sabulosa	2.8	–
		Cladoceran, Daphnia magna	3.514	5.067
5	2.515	Cladoceran, Daphnia pulex	1.8	–
4	2.339	Cladoceran, Simocephalus serrulatus	2.339	–
3	1.3	Caddisfly, Limnephilus sp.	1.3	–
2	0.6993	Amphipod, Gammarus fasciatus	0.6993	–
1	0.69	Stonefly, Isoperla sp.	0.69	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV   CHEMICAL __MALATHION

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR	Species
(1)	Oncorhynchus mykiss
(2)	Lepomis macrochirus
(3)	Pimephales promelas
(4)	Daphnia magna
(5)	Procambarus clarkii
(6)	Pteronarcella badia
(7)	Lumbriculus variegatus
(8)	Hydropsyche sp.

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 8

If all eight MDRs are satisfied:

Total number of GMAVs = 37

Four lowest GMAVs = 0.69 μg/L
0.6993 μg/L
1.3 μg/L
2.339 μg/L

FAV = 0.8884 μg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = ______ μg/L

SAF = ______ (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL MALATHION

Retain 4 significant digits in all calculated results.

FAV = 0.8884 μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{SAF} = \_\_\_\_\_ \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 5.067, 8.5, and 18 = 9.186

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \frac{0.8884}{9.186} = 0.09671 \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_ \ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL MALATHION

Retain 4 significant digits in all calculated results.

FCV = ________________ μg/L OR SCV = 0.09671 μg/L

$\log K_{ow}$ = 2.89 (From Sam Karickhoff via John Miller, not Karickhoff and Long, 1995)

$\log K_{oc} = 0.00028 + 0.983 (\log K_{ow})$ = 2.841

$K_{oc} = 10^{\log Koc}$ = 693.4 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in μg/L
TIER 2 ESB_{oc} is in $\mu g/g_{oc}$

TIER 2 ESB, sediment organic carbon basis = 0.067 $\mu g/g_{oc}$

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

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DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

METHOXYCHLOR

CASRN 72-43-5

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL METHOXYCHLOR CASRN 72-43-5

AQUIRE Reference Nmber	Test Number*	AQUIRE Reference Number	Test Number*
888	4, 7 & 8 (Daphnids)	887	98, 102
666	9 (Daphnid), 30, 31,	5811	106, 113
	51 (Daphnid), 42, 50, 54, 71,	889	117, 188
	83, 85, 87, 96, 99, 103	6502	158
	107, 114, 115, 119,	2879	164
	122, 125, 126, 128, 129	522	168, 172, 176
571	10, 65	878	179
3590	22, 23 & 34 (Daphnids)	2891	182
887	29, 48, 49		
6300	32		
5070	35, 39, 55, 56, 100,		
	104, 105, 111, 112, 130		
885	53		
11641	73		
2085	77, 78, 79, 93, 94, 95		
936	80		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Hansen, D.J., and P.R. Parrish. 1977. Suitability of sheepshead minnow (*Cyprinodon variegatus*) for life-cycle toxicity tests. In Mayer, F.L. and J.L. Hamelink (eds.), *Aquatic Toxicology and Hazard Evaluation*, ASTM STP 634. American Society for Testing and Materials, Philadelphia, PA, pp. 117-126.

Henderson, C., Q.H. Pickering, and C.M. Tarzwell. 1959. Relative toxicity of ten chlorinated hydrocarbon insecticides to four species of fish. *Trans. Am. Fish. Soc.* 88(1):23-32. (ARN: 878, accepted except as noted)

Henderson, C., Q.H. Pickering, and C.M. Tarzwell. 1959b. The toxicity of organic phosphorus and chlorinated hydrocarbon insecticides to fish. In *Trans. Second Sem. Biol. Problems Water Pollut.*, U.S. Public Health Serv., Robert A. Taft Sanit. Eng. Center, Cincinnati, OH (ARN: 936)

Holdway, D.A., and D.G. Dixon. 1985. Acute toxicity of pulse-dosed methoxychlor to juvenile American flagfish (*Jordanella floridae* Goode and Bean) as modified by age and food availability. *Aquat. Toxicol.* 6:243-250.

Katz, M. 1961. Acute toxicity of some organic insecticides to three species of salmonids and to the threespine stickleback. *Trans. Am. Fish. Soc.* 90(3):264-268. (AQUIRE Reference Number, ARN: 522)

Mayer, F.L., and M.R. Ellersieck. 1986. *Manual of acute toxicity: Interpretation and database for 410 chemicals and 66 species of freshwater animals.* Resource Publ. 160. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC.

Oris, J.T., R.W. Winner, and M.V. Moore. 1991. A four-day survival and reproduction toxicity test for *Ceriodaphnia dubia*. *Environ. Toxicol. Chem.* 10(2):217-224. (ARN: 3590)

Parrish, P.R., E.E. Dyar, M.A. Lindberg, C.M. Sanika, and J.M. Enos. 1977. Chronic toxicity of methoxychlor, malathion, and carbofuran to sheepshead minnows (*Cyprinodon variegatus*). PB 272 101 or EPA-600/3-77-059. National Technical Information Service, Springfield, VA.

Rejected:

Anderson, R.L., and D.L.Defoe. 1980. Toxicity and bioaccumulation of endrin and methoxychlor in aquatic invertebrates and fish. *Environ. Pollut.* 22A(2):111-121 (ARN: 571, author communication used)

Bailey, H.C., and D.H.W. Liu. 1980. *Lumbriculus variegatus*, a benthic oligochaete, as a bioassay organism. In J.C.Eaton, P.R.Parrish, and A.C.Hendricks (eds.), *Aquatic Toxicology and Hazard Assessment*, 3rd Symposium, ASTM STP 707, Philadelphia, PA:205-215. (ARN: 6502, nontoxic concentration for this chemical LC50)

Merna, J.W., M.E. Bender, and J.R. Novy. 1972. The effects of methoxychlor on fishes. 1. Acute toxicity and breakdown studies. *Trans. Am. Fish. Soc.* 101(2):298-301. (ARN: 5811)

Merna, J.W., and P.J. Eisele. 1973. *The effects of methoxychlor on aquatic biota.* EPA-R3-73-046. Ecol. Res. Ser., Office of Research and Monitoring, U.S. EPA, Washington, DC. NTIS PB-228643 (ARN: 5070)

Swedburg, D. 1969. Chronic toxicity of insecticides to cold-water fish. *Prog. Sport Fish Res.*, Div. Fish. Res., Bureau Sport Fish Wildl. 88:8-9. (ARN: 2879)

Waiwood, K.G., and P.H.Johansen. 1974. Oxygen consumption and activity of the white sucker (*Catostomus commersoni*), in lethal and nonlethal levels of the organochlorine insecticide, methoxychlor. *Water Res.* 8(7):401-406. (ARN: 6300)

TABLE 1. ACUTE TOXICITY OF METHOXYCHLOR TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Ceriodaphnia dubia	<12 hr	S,M	14.1	14.1	Oris et al. 1991
Cladoceran, aphnia pulex	1st instar	S,U	0.78	0.78	Mayer and Ellersiek 1986
Cladoceran, Simocephalus serrulatus	1st instar	S,U	5.0		Mayer and Ellersiek 1986
Cladoceran, Simocephalus serrulatus	1st instar	S,U	5.6	5.291	Mayer and Ellersiek 1986
Copepod, Cypridopsis vidua	mature	S,U	32	32	Mayer and Ellersiek 1986
Isopod, Asellus brevicaudus	mature	S,U	34	34	Mayer and Ellersiek 1986
Isopod Gammarus fasciatus	mature	S,U	1.9	1.9	Mayer and Ellersiek 1986
Isopod Gammarus lacustris	mature	S,U	0.8	0.8	Mayer and Ellersiek 1986
Isopod Gammarus pseudolimnaeus	mature	S,U	1.0		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Isopod, Gammarus pseudolimnaeus	mature	S,U	1.3		Mayer and Ellersiek 1986
Isopod, Gammarus pseudolimnaeus	mature	S,U	1.0		Mayer and Ellersiek 1986
Isopod, Gammarus pseudolimnaeus	mature	S,U	3.2	1.428	Mayer and Ellersiek 1986
Prawn, Palaemonetes kadiakensis	mature	S,U	1.05	1.05	Mayer and Ellersiek 1986
Crayfish, Orconectes nais	immature 3-5wk	S,U	0.50	0.50	Mayer and Ellersiek 1986
Stonefly, Pteronarcella badia	1st yr class	S,U	4.95	4.95	Mayer and Ellersiek 1986
Stonefly, Pteronarcys californica	2nd yr class	S,U	1.4	1.4	Mayer and Ellersiek 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	15		Mayer and Ellersiek 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	25		Mayer and Ellersiek 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	9.0		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cutthroat trout, Oncorhynchus clarki	juvenile	S,U	13		Mayer and Ellersiek 1986
Cutthroat trout, Oncorhynchus clarki	juvenile	F,U	6.2	12.22	Mayer and Ellersiek 1986
Coho salmon, Oncorhynchus kisutch	juvenile	S,U	66.2	66.2	Katz 1961
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	15.3		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	11.0		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	17.0		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	62		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	31		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	45		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	61		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Rainbow trout, Oncorhynchus mykiss	juvenile	F,U	61		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	11		Mayer and Ellersiek 1986
Rainbow trout, Oncorhynchus mykiss	juvenile	S,U	62.6	30.21	Katz 1961
Chinook salmon, Oncorhynchus tshawytscha	juvenile	S,U	27.9	27.9	Katz 1961
Atlantic salmon, Salmo salar	juvenile	S,U	17.2		Mayer and Ellersiek 1986
Atlantic salmon, Salmo salar	juvenile	S,U	16.4		Mayer and Ellersiek 1986
Atlantic salmon, Salmo salar	juvenile	S,U	21.0		Mayer and Ellersiek 1986
Atlantic salmon, Salmo salar	swimup fry	S,U	12.2	16.40	Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	19.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	12.3		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	juvenile	S,U	10.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	9.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	8.6		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	12.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	8.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	7.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11.5		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11.7		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	juvenile	S,U	14.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	18.3		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	19.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	12.3		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	10.5		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	8.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	12		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	14		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	19		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	15		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	juvenile	S,U	8.6		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	12		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	9.6		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	13		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	30		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	16		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	21		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	juvenile	S,U	15		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	11		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	7.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	12		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	10		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	9.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	8.6		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	12		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	10		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	21		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	juvenile	S,U	12		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	17		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	14		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	13		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	F,U	12		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	15		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	16		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	21		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	juvenile	S,U	10		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	eyed egg	S,U	>50,000*		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	eyed egg	S,U	>50,000*		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	eyed egg	S,U	10,000*		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	eyed egg	S,U	>50,000*		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	eyed egg	S,U	>50,000*		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	eyed egg	S,U	>50,000*		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	eyed egg	S,U	13.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	9.60		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	10.5		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	12.3		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	8.6		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	swimup fry	S,U	14.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	12.4		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	21.6		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	16.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	16.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	10.6		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	15.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	14.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	11.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	11.6		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Brook trout, Salvelinus fontinalis	swimup fry	S,U	14.2		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	30.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	11.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	14.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	21.0		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	swimup fry	S,U	11		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	yolk-sac fry	S,U	28.5		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	yolk-sac fry	S,U	10.8		Mayer and Ellersiek 1986
Brook trout, Salvelinus fontinalis	yolk-sac fry	S,U	10.8	12.80	Mayer and Ellersiek 1986
Lake trout, Salvelinus namaycush	juvenile	S,U	17		Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Lake trout, Salvelinus namaycush	juvenile	S,U	16	16.49	Mayer and Ellersiek 1986
Northern pike, Esox lucius	juvenile	S,U	11.5	11.5	Mayer and Ellersiek 1986
Goldfish, Carassius auratus	juvenile	S,U	42		Mayer and Ellersiek 1986
Goldfish, Carassius auratus	juvenile	S,U	42		Mayer and Ellersiek 1986
Goldfish, Carassius auratus	juvenile?	S,U	56.0	46.23	Hendersen et al. 1959a,b
Fathead minnow, Pimephales promelas	juvenile	S,U	39		Mayer and Ellersiek 1986
Fathead minnow, Pimephales promelas	adult?	S,U	64.0	49.96	Hendersen et al. 1959a,b
Channel catfish, Ictalurus punctatus	juvenile	S,U	52	52	Mayer and Ellersiek 1986
American flagfish, Jordanella floridae	2-day juvenile	S,U	2000		Holdway and Dixon 1985
American flagfish, Jordanella floridae	4-day juvenile	S,U	1600		Holdway and Dixon 1985

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
American flagfish, <u>Jordanella</u> <u>floridae</u>	8-day juvenile	S,U	3800	2300	Holdway and Dixon 1985
Guppy, <u>Poecilia</u> <u>reticulata</u>	juvenile?	S,U	120.0	120.0	Henderson et al. 1959a,b
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	juvenile	S,U	32		Mayer and Ellersiek 1986
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	juvenile	S,U	79		Mayer and Ellersiek 1986
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	juvenile	S,U	51		Mayer and Ellersiek 1986
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	juvenile	S,U	79		Mayer and Ellersiek 1986
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	juvenile	S,U	25		Mayer and Ellersiek 1986
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	juvenile	S,U	62.0	50.09	Hendersen et al. 1959a,b
Largemouth bass, <u>Micropterus</u> <u>salmoides</u>	juvenile	S,U	16		Mayer and Ellersiek 1986
Largemouth bass, <u>Micropterus</u> <u>salmoides</u>	juvenile	S,U	14	14.97	Mayer and Ellersiek 1986

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Yellow perch, Perca flavescens	juvenile	S,U	30.0		Mayer and Ellersiek 1986
Yellow perch, Perca flavescens	juvenile	S,U	>50		Mayer and Ellersiek 1986
Yellow perch, Perca flavescens	juvenile	S,U	>20	31.07	Mayer and Ellersiek 1986
Tilapia, Tilapia sp.	juvenile	S,U	76	76.00	Mayer and Ellersiek 1986
Western chorus frog	1 wk tadpole	S,U	333	333.0	Mayer and Ellersiek 1986

*Not used in calculation of SMAV.

TABLE 2A. CHRONIC TOXICITY OF METHOXYCHLOR TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
			FRESHWATER SPECIES		
Cladoceran, Ceriodaphnia dubia	LC	not provided	5.6	5.6	Oris et al. 1991
			SALTWATER SPECIES		
Sheepshead minnow, Cyprinodon variegatus	LC	12-23	16.61	16.61	Parrish et al. 1977

TABLE 2B. ACUTE-CHRONIC RATIOS FOR METHOXYCHLOR

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
		FRESHWATER SPECIES		
Cladoceran, *Ceriodaphnia dubia*	14.1	5.6	2.518	Oris et al. 1991
		SALTWATER SPECIES		
Sheepshead minnow, *Cyprinodon variegatus*	49	16.61	2.950	Hansen and Parrish 1977

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL METHOXYCHLOR

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
24	2300	American flagfish, Jordanella floridae	2300	–
23	333	Western chorus frog	333	–
22	120	Guppy, Poecilia reticulata	120	–
21	76	Tilapia, Tilapia sp.	76	–
20	52	Channel catfish, Ictalurus punctatus	52	–
19	50.09	Bluegill, Lepomis macrochirus	50.09	–
18	49.96	Fathead minnow, Pimephales promelas	49.96	–
17	46.23	Goldfish, Carassius auratus	46.23	–
16	34	Isopod, Asellus brevicaudus	34	–
15	32	Copepod, Cypridopsis vidua	32	–
14	31.07	Yellow perch, Perca flavescens	31.07	–

TABLE 3. Continued.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
		Cutthroat trout, Oncorhynchus clarki	12.22	–
		Coho salmon, Oncorhynchus kisutch	66.2	–
		Rainbow trout, Oncorhynchus mykiss	30.21	–
13	28.74	Chinook salmon, Oncorhynchus tshawytscha	27.9	–
12	16.40	Atlantic salmon, Salmo salar	16.40	–
11	14.97	Largemouth bass, Micropterus salmoides	14.9	–
		Brook trout, Salvelinus fontinalis	12.80	–
10	14.53	Lake trout, Salvelinus namaycush	16.49	–
9	14.1	Cladoceran, Ceriodaphnia dubia	14.1	2.518
8	11.5	Northern pike, Esox lucius	11.5	–
7	5.291	Cladoceran, Simocephalus serrulatus	5.291	–
6	4.95	Stonefly, Pteronarcella badia	4.95	–
5	1.4	Stonefly, Pteronarcys californica	1.4	–
4	1.05	Prawn, Palaemonetes kadiakenisis	1.05	–

TABLE 3. Continued.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
		Isopod, Gammarus fasciatus	1.9	–
		Isopod, Gammarus lacustris	0.8	–
3	1.295	Isopod, Gammarus pseudolimnaeus	1.428	–
2	0.78	Cladoceran, Daphnia pulex	0.78	–
1	0.5	Crayfish, Orconectes nais	0.5	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV CHEMICAL __METHOXYCHLOR

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR	Species
(1)	Oncorhynchus mykiss
(2)	Lepomis macrochirus
(3)	Pimephales promelas
(4)	Ceriodaphnia dubia
(5)	Gammarus fasciatus
(6)	Pteronarcys californica
(7)	____________________________
(8)	____________________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = __7

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ µg/L
______ µg/L
______ µg/L
______ µg/L

FAV = ______ µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = ___0.5_ µg/L

SAF = ___5.2_ (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL METHOXYCHLOR

Retain 4 significant digits in all calculated results.

FAV = ______________ µg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{\text{SAF}} = \frac{0.5}{5.2} = 0.0962\ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 2.518, 2.590, 18 = 5.113

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_\ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{0.0962}{5.113} = 0.0188\ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL __METHOXYCHLOR__

Retain 4 significant digits in all calculated results.

FCV = ________________ µg/L OR SCV = __0.0188__ µg/L

log K_{ow} = __5.08__ (Karickhoff and Long, 1995)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = __4.994__

$K_{oc} = 10^{\log K_{oc}}$ = __98628__ L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in µg/L
TIER 2 ESB_{oc} is in µg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = __1.9__ µg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.0.

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DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

PENTACHLOROBENZENE

CASRN 608-93-5

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL PENTACHLOROBENZENE CASRN 608-93-5

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
10805	12 (Daphnid)		
5184	16 (Daphnid)		
12124	21		
3590	7, 8 & 9 (Daphnids)		
2422	22		
11936	13 (Daphnid)		
11926	14 & 15 (Daphnids)		
4072	11		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

REFERENCES CHEMICAL PENTACHLOROBENZENE

Accepted:

Brooke, L. 1987. Memorandum to L. Larson, Center for Lake Superior Environmental Studies, 31 August 1987. Center for Lake Superior Environmental Studies, University of Wisconsin, Superior, WI.

Buccafusco, R.J., et al. 1981. Acute toxicity of priority pollutants to bluegill (*Lepomis macrochirus*). *Bull. Environ. Contam. Toxicol.* 26(4)446-462. (ARN: 5590)

Hermens, J., H. Canton, P. Janssen, and R. De Jong. 1984. Quantitative structure-activity relationships and toxicity studies of mixtures of chemicals with anaesthetic potency: Acute lethal and sublethal toxicity to *Daphnia magna*. *Aquat. Toxicol.* 5:143-154.

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184).

Oris, J.T., R.W. Winner, and M.V. Moore. 1991. A four-day survival and reproduction toxicity test for *Ceriodaphnia dubia*. *Environ. Toxicol. Chem.* 10(2):217-224. (ARN: 3590)

Roghair, C.J., A. Buijze, E.S.E. Yedema, and J.L.M. Hermens. 1994. A QSAR for base-line toxicity to the midge *Chironomus riparius*. *Chemosphere* 28(5):989-997. (ARN: 4072)

Rejected:

Abernethy, S., A.M. Bobra, W.Y. Shiu, P.G. Wells, and D. MacKay. 1986. Acute lethal toxicity of hydrocarbons and chlorinated hydrocarbons to two planktonic crustaceans: The key role of organism-water partitioning. *Aquat. Toxicol.* 8(3):163-174 (ARN: 11926, published in part as 11936)

Bobra, A.M., W.Y. Shiu, and D. MacKay. 1983. A predictive correlation for the acute toxicity of hydrocarbons and chlorinated hydrocarbons to the water flea (*Daphnia magna*). *Chemosphere* 12(9-10):1121-1129. (ARN: 11936)

Bobra, A., W.Y. Shiu, and D. MacKay. 1985. Quantitative structure-activity relationships for the acute toxicity of chlorobenzenes to *Daphnia magna*. *Environ. Toxicol. Chem.* 4(3):297-305. (ARN: 10805)

Call, D.J., L.T. Brooke, N. Ahmad, and J.E. Richter. 1983. Toxicity and metabolism studies with EPA priority pollutants and related chemicals in freshwater organisms. EPA 600/3-83-095, NTIS PB83-263665 (ARN: 10579; did not have 96-hr LC50 for pentachlorobenzene, only estimate)

Carlson, A.R., and P.A. Kosian. 1987. Toxicity of chlorinated benzenes to fathead minnows (*Pimephales promelas*). *Arch. Environ. Contam. Toxicol.* 16(2):129-135. (ARN: 12124)

Van Hoogen, G., and A. Opperhuizen. 1988. Toxicokinetics of chlorobenzenes in fish. *Environ. Toxicol. Chem.* 7(3):213-219. (ARN: 2422)

TABLE 1. ACUTE TOXICITY OF PENTACHLOROBENZENE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Ceriodaphnia dubia	< 12 hr	S,M	1100*		Oris et al. 1991
Cladoceran, Daphnia magna	< 24 hr	S,U	5300*		LeBlanc 1980
Cladoceran, Daphnia magna	< 48 hr	S,U	123**	123	Hermens et al. 1984
Midge, Chironomus riparius	3rd instar	S,M	230	230	Roghair et al. 1994
Amphipod, Gammarus pseudolimnaeus	adult	F,M	51.1	51.1	Brooke 1987
Bluegill, Lepomis macrochirus	juvenile	S,U	250	250	Buccafusco et al. 1981
Fathead minnow, Pimephales promelas	juvenile	F,M	247		Brooke 1987
Fathead minnow, Pimephales promelas	juvenile	S,M	378	247	Brooke 1987

* Not used in calculation of SMAV; LC50 well above solubility of pentachlorobenzene in water (240 µg/L)
** LC50 reported as Log IC50 = -0.31 µmol/L, converted to EC50 = 0.4897 µmol/L
1 µmol pentachlorobenzene = 250.34 µg/µmol, EC50 = 250.34 µg/µmol x 0.4897 µmol/L = 123 µg/L

TABLE 2A. CHRONIC TOXICITY OF PENTACHLOROBENZENE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
			FRESHWATER SPECIES		
Cladoceran, *Ceriodaphnia dubia*	LC	not provided	350*		Oris et al. 1991
			SALTWATER SPECIES		

There are no acceptable chronic toxicity test results for saltwater species.

*Not included; chronic value above solubility of pentachlorobenzene in water (240 µg/L)

TABLE 2B. ACUTE-CHRONIC RATIOS FOR PENTACHLOROBENZENE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference

FRESHWATER SPECIES

There are no acceptable freshwater species test results for determining acute-chronic ratios.

SALTWATER SPECIES

There are no acceptable saltwater species test results for determining acute-chronic ratios.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES   CHEMICAL PENTACHLOROBENZENE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
5	250	Bluegill, *Lepomis macrochirus*	250	–
4	247	Fathead minnow, *Pimephales promelas*	247	–
3	230	Midge, *Chironomus riparius*	230	–
2	123	Cladoceran, *Daphnia magna*	123	–
1	51.1	Amphipod, *Gammarus pseudolimnaeus*	51.1	–

MINIMUM DATA REQUIREMENTS FOR
DERIVING A FRESHWATER FAV   CHEMICAL __PENTACHLOROBENZENE__

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR   Species

(1) ____________________________

(2) Lepomis machrochirus

(3) Pimephales promelas

(4) Daphnia magna

(5) Gammarus pseudolimnaeus

(6) Chironomus riparius

(7) ____________________________

(8) ____________________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = __5__

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ µg/L
______ µg/L
______ µg/L
______ µg/L

FAV = ______ µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = __51.1__ µg/L

SAF = __6.1__ (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL __PENTACHLOROBENZENE__

Retain 4 significant digits in all calculated results.

FAV = ______________ µg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{SAF} = \frac{51.1}{6.1} = 8.377 \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = __18__

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{8.377}{18} = 0.466 \ \mu g/L$$

FCV = ______________ µg/L OR SCV = 0.466 µg/L

log K_{ow} = 5.26 (Karickhoff and Long, 1995)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 5.171

$K_{oc} = 10^{\log K_{oc}}$ = 148300 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in µg/L
TIER 2 ESB_{oc} is in µg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 69 µg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

TETRACHLOROMETHANE (CARBON TETRACHLORIDE)

CASRN 56-23-5

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL __TETRACHLOROMETHANE__ **CASRN __56-23-5__**

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
5184	9 (Daphnid)		
863	11		
3217	14		
3783	15		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Brooke, L.T. 1987. Center for Lake Superior Environmental Studies, University of Wisconsin-Superior, Memo to L.J. Larsen, August 31. [Also cited in Geiger, D.L., L.T. Brooke, and D.J. Call. 1990. Acute toxicities of organic chemicals to fathead minnows (*Pimephales promelas*), Vol. 5, Center for Lake Superior Environmental Studies, University of Wisconsin, Superior, WI. (ARN: 3217; contains data also found in 10183, 15823).]

Dawson, G.W., A.L. Jennings, D. Drozdowski, and E.Rider. 1977. The acute toxicity of 47 industrial chemicals to fresh and saltwater fishes. *J. Hazard. Mater.* 1(4):303-318. (ARN: 863)

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. (ARN: 3783)

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

Rejected:

None

TABLE 1. ACUTE TOXICITY OF TETRACHLOROMETHANE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Daphnia magna	<24 h	S,M	35,000	35,000	LeBlanc 1980
Fathead minnow, Pimephales promelas	8 wk	F,M	43,100		Kimball 1978
Fathead minnow, Pimephales promelas	25-35 d	F,M	41,400	42,240	Brooke 1987, Geiger et al. 1990
Bluegill, Lepomis macrochirus	?	S,U	125,000	125,000	Dawson et al. 1977

TABLE 2A. CHRONIC TOXICITY OF TETRACHLOROMETHANE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference

FRESHWATER SPECIES

There are no acceptable chronic test results for freshwater species.

SALTWATER SPECIES

There are no acceptable chronic test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR TETRACHLOROMETHANE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference

FRESHWATER SPECIES

There are no acceptable acute-chronic ratios for freshwater species.

SALTWATER SPECIES

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL TETRACHLOROMETHANE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
3	125,000	Bluegill, Lepomis macrochirus	125,000	–
2	42,240	Fathead minnow, Pimephales promelas	42,240	–
1	35,000	Cladoceran, Daphnia magna	35,000	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV CHEMICAL __TETRACHLOROMETHANE__

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR	Species
(1)	______________________
(2)	Lepomis macrochirus
(3)	Pimephales promelas
(4)	Daphnia magna
(5)	______________________
(6)	______________________
(7)	______________________
(8)	______________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = __3__

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ µg/L
______ µg/L
______ µg/L
______ µg/L

FAV = ______ µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = __35,000__ µg/L

SAF = __8.0__ (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL TETRACHLOROMETHANE

Retain 4 significant digits in all calculated results.

FAV = ______________ µg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{SAF} = \frac{35{,}000}{8.0} = 4375 \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = 18

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{4375}{18} = 243.1 \ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL TETRACHLOROMETHANE

Retain 4 significant digits in all calculated results.

FCV = ________________ µg/L OR SCV = 243.1 µg/L

$\log K_{ow}$ = 2.73 (Karickhoff and Long, 1995)

$\log K_{oc} = 0.00028 + 0.983 (\log K_{ow}) = 2.684$

$K_{oc} = 10^{\log K_{oc}} = 483.1 \ L/kg_{oc}$

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in µg/L
TIER 2 ESB_{oc} is in µg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = __120__ µg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

TRIBROMOMETHANE (BROMOFORM)

CASRN 75-25-2

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL TRIBROMOMETHANE **CASRN 75-25-2**

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
6360	1, 2		
5184	4 (Daphnid)		
5590	6		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Buccafusco, R.J., S.J. Ells, and G.A. LeBlanc. 1981. Acute toxicity of priority pollutants to bluegill (*Lepomis macrochirus*). *Bull. Environ. Contam. Toxicol.* 26(4):446-452. (ARN: 5590)

LeBlanc, G.A. 1980. Acute toxicity of priority pollutants to water flea (*Daphnia magna*). *Bull. Environ. Contam. Toxicol.* 24(5):684-691. (ARN: 5184)

Ward, G.S., P.R. Parrish, and R.A. Rigby. 1981. Early life stage toxicity tests with a saltwater fish: Effects of eight chemicals on survival, growth, and development of sheepshead minnows (*Cyprinodon variegatus*). *J. Toxicol. Environ. Health* 8(1-2):225-240. (ARN: 9953)

Rejected:

Mattice, J.S., S.C. Tsai, M.B. Burch, and J.J. Beauchamp. 1981. Toxicity of trihalomethanes to common carp embryos. *Trans. Am. Fish. Soc.* 110(2):261-269. (ARN: 6360)

TABLE 1. ACUTE TOXICITY OF TRIBROMOMETHANE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Daphnia magna	<24 h	S,M	46,000	46,000	LeBlanc 1980
Bluegill, Lepomis macrochirus	juvenile	S,U	29,300	29,300	Buccafusco et al. 1981

TABLE 2A. CHRONIC TOXICITY OF TRIBROMOMETHANE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
FRESHWATER SPECIES					
There are no acceptable chronic toxicity test results for freshwater species.					
SALTWATER SPECIES					
Sheepshead minnow, Cyprinodon variegatus	ELS	>4,800 <8,500	6,387	6,387	Ward et al. 1981

TABLE 2B. ACUTE-CHRONIC RATIOS FOR TRIBROMOMETHANE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
FRESHWATER SPECIES				
There are no acceptable acute-chronic ratios for freshwater species.				
SALTWATER SPECIES				
Sheepshead minnow, *Cyprinodon variegatus*	7100	6,387	1.112	Ward et al. 1981

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES CHEMICAL TRIBROMOMETHANE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
2	46,000	Cladoceran, *Daphnia magna*	46,000	–
1	29,300	Bluegill, *Lepomis macrochirus*	29,300	–

MINIMUM DATA REQUIREMENTS FOR DERIVING A FRESHWATER FAV

CHEMICAL __TRIBROMOMETHANE__

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR	Species
(1)	______________________
(2)	Lepomis macrochirus
(3)	______________________
(4)	Daphnia magna
(5)	______________________
(6)	______________________
(7)	______________________
(8)	______________________

NUMBER OF FRESHWATER FAV MINIMUM DATA REQUIREMENTS SATISFIED = __2__

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ µg/L
______ µg/L
______ µg/L
______ µg/L

FAV = ______ µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = __29,300__ µg/L

SAF = __13.0__ (from Section 3)

SUMMARY OF AVAILABLE VALUES   CHEMICAL TRIBROMOMETHANE (BROMOFORM)

Retain 4 significant digits in all calculated results.

FAV = _______________ μg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{SAF} = \frac{29{,}300}{13.0} = 2254 \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 1.112, 18, 18 = 7.116

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{2254}{7.116} = 316.8 \ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL TRIBROMOMETHANE (BROMOFORM)

Retain 4 significant digits in all calculated results.

FCV = _______________ µg/L OR SCV = 316.8 µg/L

log K_{ow} = 2.35 (Karickhoff and Long, 1995)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 2.310

$K_{oc} = 10^{\log K_{oc}}$ = 204.2 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in µg/L
TIER 2 ESB_{oc} is in µg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 65 µg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

1,2,4-TRICHLOROBENZENE

CASRN 120-82-1

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL 124-TRICHLOROBENZENE **CASRN 120-82-1**

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
12665	5 (Daphnid), 8, 22, 31,		
	33, 37, 38		
5184	11 (Daphnid)		
15981	12 & 13 (Daphnids)		
5679	14 (Daphnid)		
12513	15		
140	20, 21		
10579	28		
12210	29, 30		
3217	35		
12123	36		
6914	41-44, 46-62		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

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Hodson, P.V., R. Parisella, B. Blunt, B. Gray, K.L.E. Kaiser. 1991. Quantitative structure-activity relationships for chronic toxicity of phenol, p-chlorophenol, 2,4-Dichlorophenol, pentachlorophenol, p-nitrophenol, and 1,2,4-trichlorobenzene to early life stages of rainbow trout (*Oncorhynchus mykiss*). *Can. Tech. Rep. Fish. Aquat. Sci.* 1784:55 p. (ARN: 6914)

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TABLE 1. ACUTE TOXICITY OF 1,2,4-TRICHLOROBENZENE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Hydroid, Hydra oligactis	?	F,M	3,480	3,480	Sabourin et al. 1986
Snail, Aplexa hypnorum	?	F,M	3,160	3,160	Holcombe et al. 1987
Cladoceran, Daphnia magna	< 24 hr	S,U	50,000*		LeBlanc 1980
Cladoceran, Daphnia magna	?	F,M	3,390		Holcombe et al. 1987
Cladoceran, Daphnia magna	< 24 hr	F,M	2,100		Richter et al. 1983
Cladoceran, Daphnia magna	< 24 hr	S,U	7,690	2,668	Oikari et al. 1992
Crayfish, Orconectes immunis	?	F,M	3,020	3,020	Holcombe et al. 1987
Midge, Tanytarsus dissimilis	?	F,M	930	930	Holcombe et al. 1987
Rainbow trout, Oncorhynchus mykiss	juvenile	F,M	1,530**		Call et al. 1983, Ahmad et al. 1984**

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Rainbow trout, <u>Oncorhynchus</u> <u>mykiss</u>	?	F,M	1,320	1,421	Holcombe et al. 1987
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	38-43 d	F,M	2,990		Geiger et al. 1990
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	?	F,M	3,010		Holcombe et al. 1987
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	juvenile	F,M	2,900		Veith et al. 1983
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	juvenile	F,M	1,814.5***		Hall et al. 1984
Fathead minnow, <u>Pimephales</u> <u>promelas</u>	juvenile	F,M	2,760	2,650	Ahmad et al. 1984, Broderius and Kahl 1985, Carlson 1987
Channel catfish, <u>Ictalurus</u> <u>punctatus</u>	juvenile	F,M	2,230	2,230	Sabourin et al. 1986
American flagfish, <u>Jordanella</u> <u>floridae</u>	juvenile	R,U	4,000		Smith et al. 1991
American flagfish, <u>Jordanella</u> <u>floridae</u>	juvenile	F,M	1,217	1,217	Smith et al. 1991
Bluegill, <u>Lepomis</u> <u>macrochirus</u>	?	F,M	3,020		Holcombe et al. 1987

TABLE 1. Continued.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Bluegill, *Lepomis macrochirus*	juvenile	S,U	3,400	3,204	Buccafusco et al. 1981

* Not used in calculation of SMAV

** Result from the same test as Call et al. 1983 is reported as 1,520 µg/L in Ahmad et al. 1984

*** Converted from -log (LC50) = 5.00 mol/L (Hall et al.1984), LC50 = 0.00001 mol/L X 181.45 g/mol X 10^6 µg/g = 1,814.5 µg/L

TABLE 2A. CHRONIC TOXICITY OF 1,2,4-TRICHLOROBENZENE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference
			FRESHWATER SPECIES		
Cladoceran, *Daphnia magna*	ELS	360-690	498.4	498.4	Richter et al. 1983
Rainbow trout, *Oncorhynchus mykiss*	ELS	350.2-470	406.4*	406.4	Hodson et al. 1991
Fathead minnow, *Pimephales promelas*	ELS	499-1,008	709.2	709.2	Ahmad et al. 1984
			SALTWATER SPECIES		
Sheepshead minnow, *Cyprinodon variegatus*	ELS	150-330	222.5	222.5	Breteler 1986

* Hodson et al. 1991 reported lowest chronic limits for wet/dry weight at week 4 post swim-up larvae of 1.93-2.59 µmol/L (chronic value = 2.24 µmol/L, Table 11, page 41). These were converted as follows:

$$\text{Value in mol/L} \times \text{mol}/10^6\ \mu\text{mol} \times 181.45\ \text{g/mol} \times 10^6 \mu\text{g/g} = \text{value in } \mu\text{g/L}$$

TABLE 2B. ACUTE-CHRONIC RATIOS FOR 1,2,4-TRICHLOROBENZENE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference
FRESHWATER SPECIES				
Cladoceran, Daphnia magna	2,100	498.4	4.123	Richter et al. 1983
Fathead minnow, Pimephales promelas	2,760	709.2	3.892	Ahmad et al. 1984

SALTWATER SPECIES

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES CHEMICAL 1,2,4-TRICHLOROBENZENE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
10	3,480	Hydroid, Hydra oligactis	3,480	–
9	3,160	Snail, Aplexa hypnorum	3,160	–
8	3,204	Bluegill, Lepomis macrochirus	3,204	–
7	3,020	Crayfish, Orconectes immunis	3,020	–
6	2,668	Cladoceran, Daphnia magna	2,668	5.353
5	2,650	Fathead minnow, Pimephales promelas	2,650	3.725
4	2,230	Channel catfish, Ictalurus punctatus	2,230	–
3	1,421	Rainbow trout, Oncorhynchus mykiss	1,421	1.733
2	1,217	American flagfish, Jordanella floridae	1,217	–
1	930	Midge, Tanytarsus dissimilis	930	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV   CHEMICAL 1,2,4-TRICHLOROBENZENE

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR	Species
(1)	Oncorhynchus mykiss
(2)	Lepomis macrochirus
(3)	Pimephales promelas
(4)	Daphnia magna
(5)	Orconectes immunis
(6)	Tanytarsus dissmilis
(7)	Aplexa hypnorum
(8)	Hydra oligactis

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 8

If all eight MDRs are satisfied:

Total number of GMAVs = 10

Four lowest GMAVs = 930 µg/L
1,217 µg/L
1,421 µg/L
2,230 µg/L

FAV = 699.5 µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = ______ µg/L

SAF = ______ (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL 1,2,4-TRICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FAV = 699.5 µg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{\text{SAF}} = \_\_\_\_\_ \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = geometric mean of 4.213, 3.892, 18 = 6.658

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \frac{699.5}{6.658} = 105.1 \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_ \ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL 1,2,4-TRICHLOROBENZENE

Retain 4 significant digits in all calculated results.

FCV = ______ µg/L OR SCV = 105.1 µg/L

log K_{ow} = 4.01 (Karickhoff and Long, 1995)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 3.942

$K_{oc} = 10^{\log K_{oc}}$ = 8750 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in µg/L
TIER 2 ESB_{oc} is in µg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 920 µg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.

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DOCUMENTATION OF DERIVATION OF FRESHWATER
TIER 2 ESB FOR:

M-XYLENE

CASRN 108-38-3

LIST OF REFERENCES OBTAINED FROM AQUIRE THAT WERE NOT REJECTED BASED ON INFORMATION IN AQUIRE

NAME OF CHEMICAL M-XYLENE **CASRN 108-38-3**

AQUIRE Reference Number	Test Number*	AQUIRE Reference Number	Test Number*
13142	2, 4		
3217	3		
11936	6 (Daphnid)		

* Test number from printed AQUIRE records for "bookkeeping" and notation if test species was a daphnid.

Accepted:

Galassi, S., M. Mingazzini, L. Vigano, D. Cesareo, and M.L. Tosato. 1988. Approaches to modeling toxic responses of aquatic organisms to aromatic hydrocarbons. *Ecotoxicol. Environ. Saf.* 16(2):158-169. (ARN: 13142)

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Hermens, J., H. Canton, P. Janssen, and R. De Jong. 1984. Quantitative structure-activity relationships and toxicity studies of mixtures of chemicals with anaesthetic potency: Acute lethal and sublethal toxicity to *Daphnia magna*. *Aquat. Toxicol*. 5:143-154.

Mount, D.R. 2006 Error in prior calculation of GLI Tier II SCV for m-xylene. Memorandum to Ecological Risk Assessment Forum Tri-Chairs, U.S. Environmental Protection Agency, Office of Research and Development, Duluth, MN, USA.

Rejected:

Bobra, A.M., W.Y. Shiu, and D. MacKay. 1983. A predictive correlation for the acute toxicity of hydrocarbons and chlorinated hydrocarbons to the water flea (*Daphnia magna*). *Chemosphere* 12(9-10):1121-1129. (ARN: 11936)

TABLE 1. ACUTE TOXICITY OF M-XYLENE TO FRESHWATER AQUATIC ANIMALS

Enter freshwater acute toxicity test results that were not rejected during the review. List species in taxonomic order and include common name, species name, and life stage; Test Method: S = static, R = renewal, F = flow-through, M = measured, U = unmeasured; Reference: author(s) year. Retain 4 significant digits in the SMAV.

Species	Life Stage	Test Method	LC50 or EC50 (µg/L)	Species Mean Acute Value	Reference
Cladoceran, Daphnia magna	<2 d	S,U	14,320*	14,320	Hermens et al. 1984
Rainbow trout, Oncorhynchus mykiss	?	R,M	8,400	8,400	Galassi et al. 1988
Fathead minnow, Pimephales promelas	34 d	?,M	16,000	16,000	Geiger et al. 1990
Guppy, Poecilia reticulata	?	R,M	12,900	12,900	Galassi et al. 1988

*Converted from log 2.13 µmol/L x mol/10^6 µmol x 106.17 g/mol x 10^6 µg/g = 14,320 µg/L

TABLE 2A. CHRONIC TOXICITY OF M-XYLENE TO FRESHWATER AND SALTWATER AQUATIC ANIMALS

Enter freshwater and saltwater chronic toxicity test results that were not rejected during the review. List species in taxonomic order and include common name and species name; Type of Test: LC = life-cycle or partial life-cycle, ELS = early life-stage; Reference: author(s) year. Retain 4 significant digits in the chronic value and the SMCV.

Species	Type of Test	Chronic Limits	Chronic Value (µg/L)	Species Mean Chronic Value	Reference

FRESHWATER SPECIES

There are no acceptable chronic toxicity test results for freshwater species.

SALTWATER SPECIES

There are no acceptable chronic toxicity test results for saltwater species.

TABLE 2B. ACUTE-CHRONIC RATIOS FOR M-XYLENE

Enter relevant freshwater and saltwater acute and chronic toxicity test results that were not rejected during the review. Calculate the acute-chronic ratio by dividing the acute value by the chronic value. List from highest acute value to lowest and include common name and species name; Reference: author(s) year. Retain 4 significant digits in the chronic value and the ACR.

Species	Acute Value (µg/L)	Chronic Value (µg/L)	Acute-Chronic Ratio	Reference

FRESHWATER SPECIES

There are no acceptable acute-chronic ratios for freshwater species.

SALTWATER SPECIES

There are no acceptable acute-chronic ratios for saltwater species.

TABLE 3. RANKED FRESHWATER GENUS MEAN ACUTE VALUES AND ASSOCIATED VALUES

CHEMICAL M-XYLENE

Calculate GMAVs from SMAVs in Table 1 and enter the GMAVs in order from highest to lowest; enter the associated SMAVs in alphabetical order. Enter the associated SMACRs from Table 2B. Retain 4 significant digits in the GMAVs and ACRs.

Rank	Genus Mean Acute Value (µg/L)	Species	Species Mean Acute Value (µg/L)	Species Mean Acute-Chronic Ratio
4	16,000	Fathead minnow, Pimephales promelas	16,000	–
3	14,320	Cladoceran, Daphnia magna	14,320	–
2	12,900	Guppy, Poecilia reticulata	12,900	–
1	8,400	Rainbow trout, Oncorhynchus mykiss	8,400	–

MINIMUM DATA REQUIREMENTS
FOR DERIVING A FRESHWATER FAV CHEMICAL M-XYLENE

Enter one or more species from Table 1 that satisfy each of the freshwater acute minimum data requirements given in Section 3:

MDR	Species
(1)	Oncorhynchus mykiss
(2)	Pimephales promelas
(3)	Poecilia reticulata
(4)	Daphnia magna
(5)	______________________________
(6)	______________________________
(7)	______________________________
(8)	______________________________

NUMBER OF FRESHWATER FAV MDRs SATISFIED = 4

If all eight MDRs are satisfied:

Total number of GMAVs =

Four lowest GMAVs = ______ µg/L
______ µg/L
______ µg/L
______ µg/L

FAV = ______ µg/L

If fewer than eight MDRs are satisfied:

Lowest GMAV = 8,400 µg/L

SAF = 7.0 (from Section 3)

SUMMARY OF AVAILABLE VALUES CHEMICAL M-XYLENE

Retain 4 significant digits in all calculated results.

FAV = ______________ µg/L

If an FAV could not be derived,

$$SAV = \frac{\text{lowest GMAV}}{SAF} = \frac{8{,}400}{7.0} = 1{,}200 \ \mu g/L$$

FACR = ______________

If an FACR could not be derived, enter the values whose geometric mean is the SACR:

SACR = 18

Calculate either an FCV or an SCV as appropriate:

$$FCV = \frac{FAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{FAV}{SACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{FACR} = \_\_\_\_\_\_ = \_\_\_\_\_\_ \ \mu g/L$$

$$SCV = \frac{SAV}{SACR} = \frac{1{,}200}{18} = 66.67 \ \mu g/L$$

CALCULATION OF TIER 2 ESB CHEMICAL M-XYLENE

Retain 4 significant digits in all calculated results.

FCV = ______________ µg/L OR SCV = 66.67 µg/L

log K_{ow} = 3.20 (Karickhoff and Long, 1995)

log K_{oc} = 0.00028 + 0.983 (log K_{ow}) = 3.146

$K_{oc} = 10^{\log K_{oc}}$ = 1400 L/kg_{oc}

$$\text{TIER 2 ESB}_{oc} = (\text{FCV or SCV}) * (K_{oc}) * (10^{-3}\ kg_{oc}/g_{oc})$$

Where:

FCV or SCV is in µg/L
TIER 2 ESB_{oc} is in µg/g_{oc}

TIER 2 ESB, sediment organic carbon basis = 93 µg/g_{oc}

In addition, for a particular sediment sample in the NSI, the TIER 2 ESB (formerly referred to as SQAL) is calculated as:

$$\text{TIER 2 ESB} = (\text{TIER 2 ESB}_{oc})(f_{oc})$$

Where:

TIER 2 ESB applies to a particular sediment
TIER 2 ESB_{oc} is generic for the chemical
f_{oc} is the fraction of organic carbon in the particular sediment in g_{oc}/g dry weight sediment

When f_{oc} was not measured for a particular sediment, f_{oc} was assumed to be 0.01.