Fact Sheet Date: June 1998

NEW YORK STATE
- AQUATIC FACT SHEET -

Ambient Water Quality Values
For Protection of Aquatic Life

SUBSTANCE: Benzene **CAS REGISTRY NUMBER:** 71-43-2

TYPE:	BASIS:	Ambient Water Quality Value, ug/L FRESHWATER	SALTWATER
Chronic	Propagation	210	190
Acute	Survival	760	670

INTRODUCTION

These values apply to the water column and are derived to protect aquatic life from the effects of waterborne contaminants. Values for the protection of propagation of aquatic life are referred to as Aquatic (Chronic) or A(C) values. Values for the protection of survival of aquatic life are referred to as Aquatic (Acute) or A(A) values.

SUMMARY OF INFORMATION

The U.S. EPA AQUIRE (**AQU**uatic toxicity **I**nformation **Re**treival System)(U.S. EPA, 1993) was searched for toxicity data on benzene with EC_{50} or LC_{50} toxicity endpoints. The initial search identified 193 toxicity test records. Species Mean Acute Values (SMAVs) were determined from the acceptable benzene toxicity studies obtained from the AQUIRE database. If both flow-through and static test toxicity data were available for the same species, only flow-through data was used. Static toxicity test data was used only if flow-through data was not available. From that original group, only data with a documentation code of C (Complete methods and results documentation), and 96 hour LC_{50} or 48 hour EC_{50} endpoints were selected. This second screening resulted in a final acute toxicity database for benzene of six studies with four freshwater species and nine studies with eight marine species. Ambient water quality values were then calculated in accordance with 6NYCRR Part 706.1.

DERIVATION OF ACUTE VALUES

As shown in Table 1, data are available for four of the eight families necessary to derive a Tier 1 freshwater value. Consequently, the data from the four families are used to derive a Tier 2 freshwater value. Similarly, Table 2 shows that data are available for six of the eight families necessary to derive a Tier 1 saltwater value, so those data are used to derive a Tier 2 saltwater value.

Table 1. Freshwater toxicity data used to derive the benzene acute value. When only an SMAV is listed, the SMAV was the LC_{50} of the test species indicated. NDA means no data was available.

Data Requirement	Species	LC_{50}, ug/L	SMAV, ug/L	AQUIRE Reference
Family Salmonidae	Rainbow trout	21633.7	10707.8	10688
		5300		15131
A second Family in the Class Osteichthyes	Fathead minnow	24600	16906.4	3217
		12600		
		15590		3910
A third family from the phylum Chordata	Goldfish		34420	728
A planktonic crustacean	Daphnia magna		31240	11936
A benthic crustacean	NDA			
An insect	NDA			
A family in a phylum other than Arthropoda or Chordata	NDA			
A family in any order of insect or any other phylum not already represented	NDA			

The lowest SMAV was divided by the appropriate secondary acute factor (SAF) to determine the secondary acute value (SAV). Because four data requirements were

met, a secondary acute factor (SAF) of 7.0 is required. The Tier II value was determined by dividing the SAV by two, and rounding to two significant digits.

SAV = 10707.8 / 7.0 = 1529.6857 ug/L
Freshwater Tier II A(A) value = 1529.6857 ug/L / 2 = 764.8429 ≈ 760 ug/L

Table 2. Saltwater toxicity data used to derive the benzene acute value. When only an SMAV is listed, the SMAV was the LC_{50} of the test species indicated. NDA means no data was available.

Data Requirement	**Species**	**LC_{50} ug/L**	**SMAV ug/L**	**References**
A family from the phylum Chordata	Striped Bass	5096.46	6986.63	558
		9577.83		5812
A second family from the Phylum Chordata	Dover sole		9028	14995
A family in a phylum other than Arthropoda or Chordata	Pacific oyster		924400	8621
Either the Mysidae or Penaeidae family	NDA			
Three other families not in the family Chordata; may include Mysidae or Penaeidae, which ever was not used above	Bay shrimp		17574	558
	Daggerblade grass shrimp		27000	420
	Dungeness crab		108000	5035
Any other family	NDA			

Because six data requirements were met, a secondary acute factor (SAF) of 5.2 is required.

SAV = 6986.63 ug/L / 5.2 = 1343.5827 ug/L
Saltwater Tier II A(A) value = 1343.5827 ug/L / 2 = 671.7914 ≈ 670 ug/L

DERIVATION OF CHRONIC VALUES

The secondary chronic value (SCV) is determined by dividing the SAV by the secondary acute to chronic ratio (SACR). The Tier II A(C) value is equal to the SCV. A species acute to chronic ratio (ACR) is an acute LC_{50} divided by a chronic value for the same species. The chronic value is the geometric mean of the NOEC (No Observed Effects Concentration) and LOEC (Lowest Observed Effects Concentration) values. A minimum of three species ACRs are required to derive a SACR. If three species ACRs are not available, 6NYCRR Part 706.1 requires that a species ACR value of 18 should be substituted for each missing species ACR. The SACR is equal to the cube root of the product of the three species ACRs. Both saltwater and freshwater species data are used to derive a common SACR. Only one study was identified that provided adequate acute and chronic toxicity data as required in 6NYCRR Part 706.1 for deriving a species acute to chronic ratio (Table 3).

Table 3. Data used to derive an acute-to chronic ratio (ACR) for benzene.

Species	Acute value, ug/L	Chronic NOEC, ug/L	Chronic LOEC, ug/L	Chronic Value, ug/L	Study Reference No.
Fathead minnow	15590	10200	17200	13245.3766	3910

Fathead minnow ACR = 15590 / 13245.3766 = 1.1770

SACR = (18 * 18 * 1.1770) = 381.3480; $\sqrt[3]{381.3480} = 7.2517$

The freshwater SCV = 1529.6857 ug/L / 7.2517 = 210.9417 ug/L
Freshwater Tier II A(C) value = 210.9432 ≈ 210 ug/L.

The saltwater SCV = 1343.5827 ug/L / 7.2517 = 185.2783 ug/L
Saltwater Tier II A(C) value = 185.2783 ≈ 190 ug/L.

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