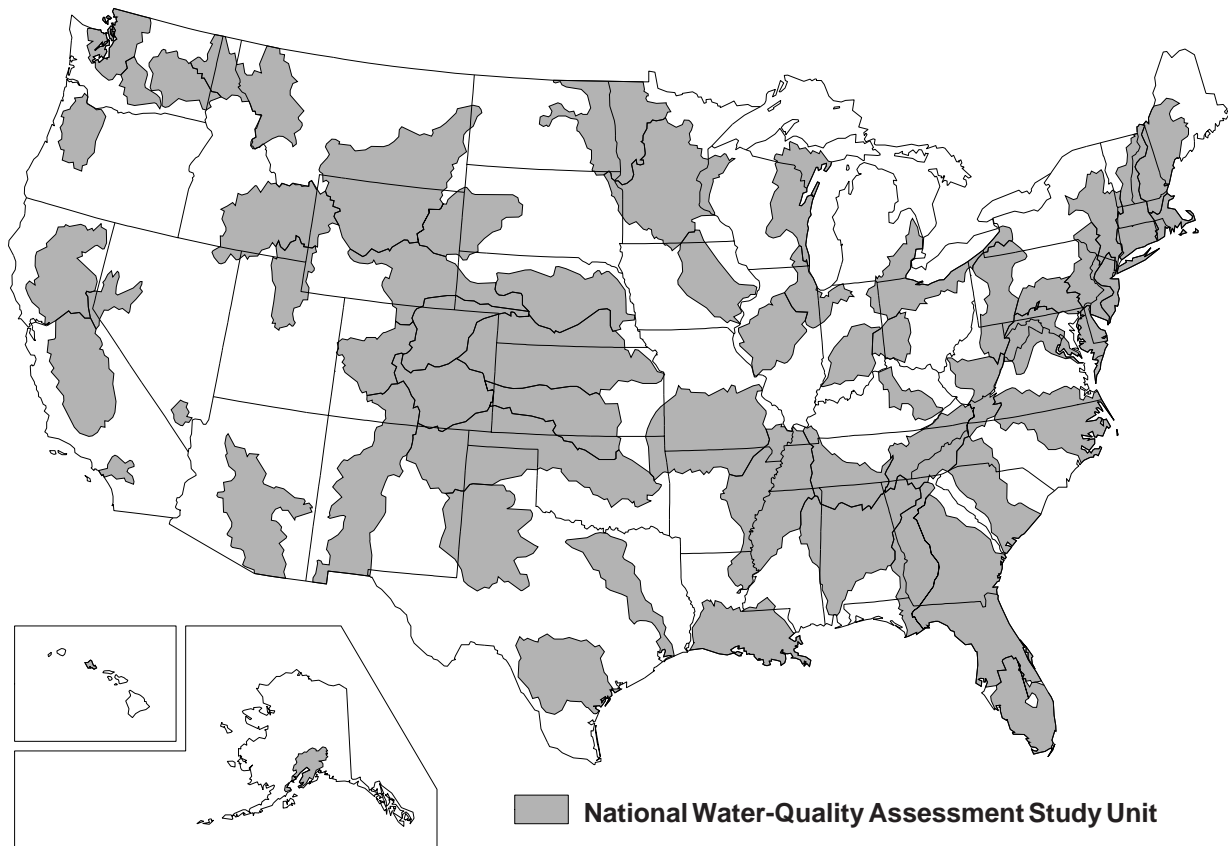


# SUMMARY OF PUBLISHED AQUATIC TOXICITY INFORMATION AND WATER-QUALITY CRITERIA FOR SELECTED VOLATILE ORGANIC COMPOUNDS

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U.S. GEOLOGICAL SURVEY

Open-File Report 97-563



NATIONAL WATER-QUALITY ASSESSMENT PROGRAM



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By Barbara L. Rowe, Sondra J. Landrigan, and Thomas J. Lopes

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U.S. GEOLOGICAL SURVEY

Open-File Report 97-563

Rapid City, South Dakota  
1997



U.S. DEPARTMENT OF THE INTERIOR  
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY  
Gordon P. Eaton, Director

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# FOREWORD

The mission of the U.S. Geological Survey (USGS) is to assess the quantity and quality of the earth resources of the Nation and to provide information that will assist resource managers and policy-makers at Federal, State, and local levels in making sound decisions. Assessment of water-quality conditions and trends is an important part of this overall mission.

One of the greatest challenges faced by water-resources scientists is acquiring reliable information that will guide the use and protection of the Nation's water resources. That challenge is being addressed by Federal, State, interstate, and local water-resource agencies and by many academic institutions. These organizations are collecting water-quality data for a host of purposes that include: compliance with permits and water-supply standards; development of remediation plans for a specific contamination problem; operational decisions on industrial, wastewater, or water-supply facilities; and research on factors that affect water quality. An additional need for water-quality information is to provide a basis on which regional and national-level policy decisions can be based. Wise decisions must be based on sound information. As a society we need to know whether certain types of water-quality problems are isolated or ubiquitous, whether there are significant differences in conditions among regions, whether the conditions are changing over time, and why these conditions change from place to place and over time. The information can be used to help determine the efficacy of existing water-quality policies and to help analysts determine the need for and likely consequences of new policies.

To address these needs, the Congress appropriated funds in 1986 for the USGS to begin a pilot program in seven project areas to develop and refine the National Water-Quality Assessment (NAWQA) Program. In 1991, the USGS began full implementation of the program. The NAWQA Program builds upon an existing base of water-quality studies of the USGS, as well as those of other Federal, State, and local agencies. The objectives of the NAWQA Program are to:

- Describe current water-quality conditions for a large part of the Nation's freshwater streams, rivers, and aquifers.

- Describe how water quality is changing over time.

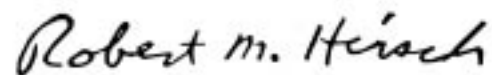
- Improve understanding of the primary natural and human factors that affect water-quality conditions.

This information will help support the development and evaluation of management, regulatory, and monitoring decisions by other Federal, State, and local agencies to protect, use, and enhance water resources.

The goals of the NAWQA Program are being achieved through ongoing and proposed investigations of 59 of the Nation's most important river basins and aquifer systems, which are referred to as Study Units. These Study Units are distributed throughout the Nation and cover a diversity of hydrogeologic settings. More than two-thirds of the Nation's freshwater use occurs within the 59 Study Units and more than two-thirds of the people served by public water-supply systems live within their boundaries.

National synthesis of data analysis, based on aggregation of comparable information obtained from the Study Units, is a major component of the program. This effort focuses on selected water-quality topics using nationally consistent information. Comparative studies will explain differences and similarities in observed water-quality conditions among study areas and will identify changes and trends and their causes. The first topics addressed by the national synthesis are pesticides, nutrients, volatile organic compounds, and aquatic biology. Discussions on these and other water-quality topics will be published in periodic summaries of the quality of the Nation's ground and surface water as the information becomes available.

This report is an element of the comprehensive body of information developed as part of the NAWQA Program. The program depends heavily on the advice, cooperation, and information from many Federal, State, interstate, Tribal, and local agencies and the public. The assistance and suggestions of all are greatly appreciated.



Robert M. Hirsch  
Chief Hydrologist



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# Summary of Published Aquatic Toxicity Information and Water-Quality Criteria for Selected Volatile Organic Compounds

By Barbara L. Rowe, Sondra J. Landrigan, and Thomas J. Lopes

## ABSTRACT

Volatile organic compounds (VOCs) are being measured in stream samples as part of the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program. Published freshwater aquatic toxicity information and water-quality criteria for VOCs were compiled to compare with the measured concentrations. Aquatic toxicity information for VOCs was retrieved from the U.S. Environmental Protection Agency's (USEPA's) toxicity data base, AQUatic toxicity Information REtrieval (AQUIRE). Toxicity information that had complete or moderately complete documentation was available for 60 of the 87 VOCs that are being measured in water samples. Most toxicity information was from studies of 96 hours or less, and species mortality was typically the endpoint of the toxicity test. A number of published studies using the same species, duration, and endpoint were available for some VOCs. In these instances, only the two studies that reported the lowest concentrations that had an effect were included in the summary. VOCs that had the lowest concentrations that affected a species ranged between 6.5 µg/L (micrograms per liter) for 1,1,2,3,4,4-hexachloro-1,3-butadiene and 5,091,000 µg/L for 2-butanone.

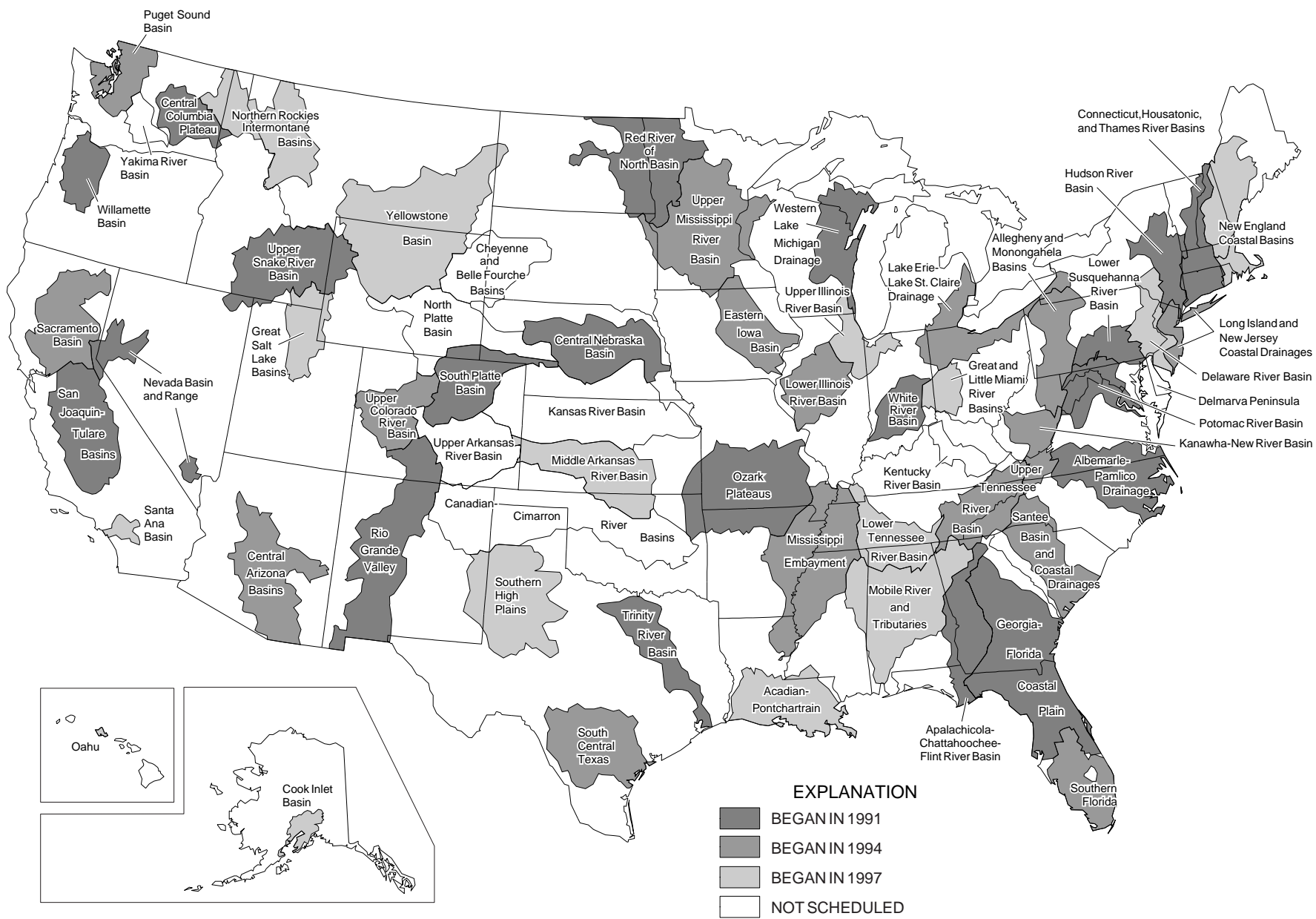
The USEPA and Canadian Council of Resource and Environment Ministers have established water-quality criteria and guidelines for 39 of the 87 VOCs measured in water samples by the NAWQA Program. Criteria and guidelines range

from 0.1 µg/L for 1,1,2,3,4,4-hexachloro-1,3-butadiene to 860,000 µg/L for 3-chloro-1-propene and chloroethane. These water-quality criteria, guidelines, and toxicity information will be used by NAWQA to assess the status of the Nation's water quality and are available for use by individuals, agencies, and organizations to evaluate the potential effect of VOCs on aquatic life in streams and rivers.

## INTRODUCTION

The National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey (USGS) is a systematic assessment of the quality of the Nation's water resources. The primary goals of NAWQA are to describe the status and trends in the quality of a large, representative part of the Nation's surface-water and ground-water resources and to identify the primary natural and human factors affecting the quality of these resources. The design of NAWQA, discussed in detail by Gilliom and others (1995), is organized around 59 Study Units (fig. 1) that include sections of most of the Nation's major river basins and aquifers. The starting dates of Study-Unit Investigations are staggered between fiscal years 1991 and 1997, and at any time water-quality data are being collected in about 16 to 20 Study Units.

Another component of the NAWQA Program is National Synthesis Investigations (NSIs), which are focused on specific groups of contaminants. In part, these investigations compile, analyze, and report water-quality data (collected by Study Units) on a



**Figure 1.** Location of National Water-Quality Assessment Program Study Units and their proposed implementation dates (modified from Gilliom and others, 1995, fig. 1).



national scale. The NSI for pesticides and the NSI for nutrients began in 1991, and the NSI for volatile organic compounds (VOCs) began in 1993. Two additional NSIs are in the planning process, including aquatic ecology and trace elements. VOCs are being sampled mostly in areas with predominantly residential and commercial land use in metropolitan areas with a population of 250,000 or more (Squillace and Price, 1996; Lopes and Price, 1997).

Water samples collected for the NAWQA Program are analyzed for VOCs at the USGS National Water-Quality Laboratory (NWQL) in Arvada, Colorado, using a new analytical method. This method quantifies low levels of VOCs in ambient surface water and ground water. The method is based upon U.S. Environmental Protection Agency (USEPA) Method 524.2, Revision 4.0 (Eichelberger and Budde, 1989) and USGS Open-File Report 94-708 (Rose and Schroeder, 1994), with improvement of instrument-operating conditions, increased number of compounds analyzed, modifications to identification criteria, and inclusion of data-reporting strategies for low-level detections. Due to the increasing need for lower concentration data, in part, to identify potentially harmful environmental contaminants in water, the NWQL quantifies 87 analytes at or below the methods detection level if (1) all criteria for analyte identification are met, and (2) the laboratory analysis is not limited by laboratory contamination of VOC samples.

Analytes measured using the new USGS VOC method are divided into two groups: NAWQA target analytes (55 compounds), and other analytes (32 compounds). NAWQA target analytes were selected for emphasis in the NAWQA Program because of their known human-health and (or) aquatic-life concern or because of their high frequency of occurrence in surface water and ground water (John Zogorski, USGS, written commun., 1994). The "other analytes" measured using the new VOC method (table 1) were included because they are on the USEPA's revised method for drinking water.

The purpose of this report is to summarize published aquatic toxicity information and water-quality criteria and guidelines for VOCs that are measured by the NAWQA Program. This published information is needed for comparisons with concentrations measured in streams and rivers by the NAWQA Program and for assessing the status of water quality.

All aquatic toxicity information presented in this report was retrieved from AQUatic toxicity Informa-

tion REtrieval (AQUIRE) (U.S. Environmental Protection Agency, 1996a). Toxicity data have been reviewed to update AQUIRE on a quarterly basis during the past 14 years. Data exchanges with the Organization for Economic Cooperation and Development, Paris, France, and with the Borok Institute, Nekouz, Yaroslavsky Region, Russian Republic, have made AQUIRE a centralized, international source for toxic effects information.

Water-quality criteria and guidelines were compiled from the Integrated Risk Information System (IRIS) (U.S. Environmental Protection Agency, 1996b) and from the Canadian Council of Resource and Environment Ministers (1991).

## DESCRIPTION OF AQUATIC TOXICITY INFORMATION

Toxicity tests typically are conducted by exposing organisms to a range of contaminant concentrations under controlled conditions and measuring the response of the organisms (Rand and Petrocelli, 1985). Acute toxicity tests are used to determine if solutions are toxic to species during short-duration exposures (typically 96 hours or less), and species mortality is the most common endpoint. Chronic toxicity tests use a longer duration of exposure (typically 7 days or more). Responses other than species mortality typically are measured during chronic tests and may include growth, reproduction, and behavior. No exact duration or response, however, distinguishes acute and chronic toxicity tests. Laboratory controls are an important part of toxicity tests and are used to ensure that species mortality or other adverse reactions of a test organism are due to the contaminant and not the testing procedure or natural causes. Laboratory controls are performed the same as toxicity tests; however, organisms are not exposed to the contaminant.

The majority of published information for VOCs are median lethal concentration ( $LC_{50}$ ) values, which are the estimated concentrations at which 50 percent of the organisms died during the toxicity test. The  $LC_{50}$  is estimated by interpolating species mortality rates from the range in concentrations used in the toxicity test. If the largest concentration did not result in 50-percent mortality, then the  $LC_{50}$  is reported as greater than the largest concentration. The effective mean concentration ( $EC_{50}$ ) is the estimated concentration that affects 50 percent of the organisms; however, the endpoint of the test is an effect other than mortality.

**Table 1.** Volatile organic compounds measured by the U.S. Geological Survey National Water-Quality Assessment Program [Compounds are identified by the following: PCODE, U.S. Geological Survey parameter code; CAS no., Chemical Abstract Services number; IUPAC, International Union of Pure and Applied Chemistry]

PCODE	CAS no.	IUPAC compound name (chemical formula) (common name(s))	PCODE	CAS no.	IUPAC compound name (chemical formula) (common name(s))
<b>Target analytes</b>					
34030	71-43-2	Benzene (C <sub>6</sub> H <sub>6</sub> )	34541	78-87-5	1,2-Dichloropropane (C <sub>3</sub> H <sub>6</sub> Cl <sub>2</sub> ) (propylene dichloride)
32101	75-27-4	Bromodichloromethane (CHBrCl <sub>2</sub> ) (dichlorobromomethane)	34704	10061-01-5	<i>cis</i> -1,3-Dichloropropene (C <sub>3</sub> H <sub>4</sub> Cl <sub>2</sub> ) ( <i>Z</i> )-1,3-dichloropropene)
50002	593-60-2	Bromoethene (C <sub>2</sub> H <sub>3</sub> Br) (vinyl bromide)	34699	10061-02-6	<i>trans</i> -1,3-Dichloropropene (C <sub>3</sub> H <sub>4</sub> Cl <sub>2</sub> ) ( <i>E</i> )-1,3-dichloropropene)
34413	74-83-9	Bromomethane (CH <sub>3</sub> Br) (methyl bromide)	77135	95-47-6	1,2-Dimethylbenzene (C <sub>8</sub> H <sub>10</sub> ) ( <i>o</i> -xylene)
77342	104-51-8	<i>n</i> -Butylbenzene (C <sub>10</sub> H <sub>14</sub> ) (1-phenylbutane)	85795	108-38-3	1,3-Dimethylbenzene (C <sub>8</sub> H <sub>10</sub> ) ( <i>m</i> -xylene) <b>and</b>
34301	108-90-7	Chlorobenzene (C <sub>6</sub> H <sub>5</sub> Cl) (monochlorobenzene)	106-42-3	1,4-Dimethylbenzene (C <sub>8</sub> H <sub>10</sub> ) ( <i>p</i> -xylene)	
34311	75-00-3	Chloroethane (C <sub>2</sub> H <sub>5</sub> Cl) (ethyl chloride)	77128	100-42-5	Ethenylbenzene (C <sub>8</sub> H <sub>8</sub> ) (styrene)
39175	75-01-4	Chloroethene (C <sub>2</sub> H <sub>3</sub> Cl) (vinyl chloride)	50004	637-92-3	2-Ethoxy-2-methylpropane (C <sub>6</sub> H <sub>14</sub> O) (ethyl <i>tert</i> -butyl ether, ETBE)
34418	74-87-3	Chloromethane (CH <sub>3</sub> Cl) (methyl chloride)	34371	100-41-4	Ethylbenzene (C <sub>8</sub> H <sub>10</sub> ) (phenylethane)
82625	96-12-8	1,2-Dibromo-3-chloropropane (C <sub>3</sub> H <sub>5</sub> Br <sub>2</sub> Cl) (dibromochloropropane, DBCP)	39702	87-68-3	1,1,2,3,4,4-Hexachloro-1,3-butadiene (C <sub>4</sub> Cl <sub>6</sub> ) (hexachlorobutadiene)
32105	124-48-1	Dibromochloromethane (CHBr <sub>2</sub> Cl) (chlorodibromomethane)	34396	67-72-1	1,1,1,2,2,2-Hexachloroethane (C <sub>2</sub> Cl <sub>6</sub> ) (carbon hexachloride)
77651	106-93-4	1,2-Dibromoethane (C <sub>2</sub> H <sub>4</sub> Br <sub>2</sub> ) (ethylene dibromide, EDB)	50005	994-05-8	2-Methoxy-2-methylbutane (C <sub>6</sub> H <sub>14</sub> O) ( <i>tert</i> -amyl methyl ether, TAME)
34536	95-50-1	1,2-Dichlorobenzene (C <sub>6</sub> H <sub>4</sub> Cl <sub>2</sub> ) ( <i>o</i> -dichlorobenzene)	78032	1634-04-4	2-Methoxy-2-methylpropane (C <sub>5</sub> H <sub>12</sub> O) (methyl <i>tert</i> -butyl ether, MTBE)
34566	541-73-1	1,3-Dichlorobenzene (C <sub>6</sub> H <sub>4</sub> Cl <sub>2</sub> ) ( <i>m</i> -dichlorobenzene)	34010	108-88-3	Methylbenzene (C <sub>7</sub> H <sub>8</sub> ) (toluene)
34571	106-46-7	1,4-Dichlorobenzene (C <sub>6</sub> H <sub>4</sub> Cl <sub>2</sub> ) ( <i>p</i> -dichlorobenzene)	77223	98-82-8	(1-Methylethyl)benzene (C <sub>9</sub> H <sub>12</sub> ) (isopropylbenzene)
34668	75-71-8	Dichlorodifluoromethane (CCl <sub>2</sub> F <sub>2</sub> ) (CFC 12)	34696	91-20-3	Naphthalene (C <sub>10</sub> H <sub>8</sub> )
34496	75-34-3	1,1-Dichloroethane (C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub> ) (ethylidene chloride)	81577	108-20-3	2,2'-oxybis[propane] (C <sub>6</sub> H <sub>14</sub> O) (diisopropyl ether, DIPE)
32103	107-06-2	1,2-Dichloroethane (C <sub>2</sub> H <sub>4</sub> Cl <sub>2</sub> ) (ethylene dichloride)	34210	107-02-8	2-Propenal (C <sub>3</sub> H <sub>4</sub> O) (acrolein)
34501	75-35-4	1,1-Dichloroethene (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> ) (vinylidene chloride)	34215	107-13-1	2-Propenenitrile (C <sub>3</sub> H <sub>3</sub> N) (acrylonitrile)
77093	156-59-2	<i>cis</i> -1,2-Dichloroethene (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> ) ( <i>Z</i> )-1,2-dichloroethene)	77224	103-65-1	<i>n</i> -Propylbenzene (C <sub>9</sub> H <sub>12</sub> ) (1-phenylpropane)
34546	156-60-5	<i>trans</i> -1,2-Dichloroethene (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> ) ( <i>E</i> )-1,2-dichloroethene)	34475	127-18-4	Tetrachloroethene (C <sub>2</sub> Cl <sub>4</sub> ) (perchloroethene, PCE)
34423	75-09-2	Dichloromethane (CH <sub>2</sub> Cl <sub>2</sub> ) (methylene chloride)	32102	56-23-5	Tetrachloromethane (CCl <sub>4</sub> ) (carbon tetrachloride)

**Table 1.** Volatile organic compounds measured by the U.S. Geological Survey National Water-Quality Assessment Program—Continued

PCODE	CAS no.	IUPAC compound name (chemical formula) (common name(s))	PCODE	CAS no.	IUPAC compound name (chemical formula) (common name(s))
<b>Target analytes—Continued</b>					
32104	75-25-2	Tribromomethane (CHBr <sub>3</sub> ) (bromoform)	39180	79-01-6	Trichloroethene (C <sub>2</sub> HCl <sub>3</sub> ) (trichloroethylene, TCE)
77652	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane (C <sub>2</sub> Cl <sub>3</sub> F <sub>3</sub> ) (CFC 113)	34488	75-69-4	Trichlorofluoromethane (CCl <sub>3</sub> F) (CFC 11)
77613	87-61-6	1,2,3-Trichlorobenzene (C <sub>6</sub> H <sub>3</sub> Cl <sub>3</sub> )	32106	67-66-3	Trichloromethane (CHCl <sub>3</sub> ) (chloroform)
34551	120-82-1	1,2,4-Trichlorobenzene (C <sub>6</sub> H <sub>3</sub> Cl <sub>3</sub> )	77443	96-18-4	1,2,3-Trichloropropane (C <sub>3</sub> H <sub>5</sub> Cl <sub>3</sub> ) (allyl trichloride)
34506	71-55-6	1,1,1-Trichloroethane (C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub> ) (methylchloroform)	77222	95-63-6	1,2,4-Trimethylbenzene (C <sub>9</sub> H <sub>12</sub> ) (pseudocumene)
34511	79-00-5	1,1,2-Trichloroethane (C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub> ) (vinyl trichloride)			
<b>Other analytes</b>					
81555	108-86-1	Bromobenzene (C <sub>6</sub> H <sub>5</sub> Br) (phenyl bromide)	77103	591-78-6	2-Hexanone (C <sub>6</sub> H <sub>12</sub> O) (butyl methyl ketone, MBK)
77297	74-97-5	Bromochloromethane (CH <sub>2</sub> BrCl) (methylene chlorobromide)	77424	74-88-4	Iodomethane (CH <sub>3</sub> I) (methyl iodide)
81595	78-93-3	2-Butanone (C <sub>4</sub> H <sub>8</sub> O) (methyl ethyl ketone, MEK)	77356	99-87-6	1-Isopropyl-4-methylbenzene (C <sub>10</sub> H <sub>14</sub> ) ( <i>p</i> -isopropyltoluene)
77041	75-15-0	Carbon disulfide (CS <sub>2</sub> )	81597	80-62-6	Methyl 2-methyl-2-propenoate (C <sub>5</sub> H <sub>8</sub> O <sub>2</sub> ) (methyl methacrylate)
77275	95-49-8	1-Chloro-2-methylbenzene (C <sub>7</sub> H <sub>7</sub> Cl) ( <i>o</i> -chlorotoluene)	78133	108-10-1	4-Methyl-2-pentanone (C <sub>6</sub> H <sub>12</sub> O) (isobutyl methyl ketone, MIK)
77277	106-43-4	1-Chloro-4-methylbenzene (C <sub>7</sub> H <sub>7</sub> Cl) ( <i>p</i> -chlorotoluene)	81593	126-98-7	2-Methyl-2-propenenitrile (C <sub>4</sub> H <sub>5</sub> N) (methyl acrylonitrile)
78109	107-05-1	3-Chloro-1-propene (C <sub>3</sub> H <sub>5</sub> Cl) (allyl chloride)	49991	96-33-3	Methyl-2-propenoate (C <sub>4</sub> H <sub>6</sub> O <sub>2</sub> ) (methyl acrylate)
30217	74-95-3	Dibromomethane (CH <sub>2</sub> Br <sub>2</sub> ) (methylene bromide)	77350	135-98-8	(1-Methylpropyl)benzene (C <sub>10</sub> H <sub>14</sub> ) ( <i>sec</i> -butylbenzene)
73547	110-57-6	<i>trans</i> -1,4-Dichloro-2-butene (C <sub>4</sub> H <sub>6</sub> Cl <sub>2</sub> ) (( <i>E</i> )-1,4-dichloro-2-butene)	81576	60-29-7	1,1'-Oxybisethane (C <sub>4</sub> H <sub>10</sub> O) (diethyl ether)
77173	142-28-9	1,3-Dichloropropane (C <sub>3</sub> H <sub>6</sub> Cl <sub>2</sub> ) (trimethylene dichloride)	81552	67-64-1	2-Propanone (C <sub>3</sub> H <sub>6</sub> O) (acetone)
77170	594-20-7	2,2-Dichloropropane (C <sub>3</sub> H <sub>6</sub> Cl <sub>2</sub> )	77562	630-20-6	1,1,1,2-Tetrachloroethane (C <sub>2</sub> H <sub>2</sub> Cl <sub>4</sub> )
77168	563-58-6	1,1-Dichloropropene (C <sub>3</sub> H <sub>4</sub> Cl <sub>2</sub> )	34516	79-34-5	1,1,2,2-Tetrachloroethane (C <sub>2</sub> H <sub>2</sub> Cl <sub>4</sub> )
77353	98-06-6	(1,1-Dimethylethyl)benzene ( <i>tert</i> -butylbenzene)	49999	488-23-3	1,2,3,4-Tetramethylbenzene (C <sub>10</sub> H <sub>14</sub> ) (prehitene)
81607	109-99-9	1,4-Epoxybutane (C <sub>4</sub> H <sub>8</sub> O) (tetrahydrofuran)	50000	527-53-7	1,2,3,5-Tetramethylbenzene (C <sub>10</sub> H <sub>14</sub> ) (isodurene)
77220	611-14-3	1-Ethyl-2-methylbenzene (C <sub>9</sub> H <sub>12</sub> ) (2-ethyltoluene)	77221	526-73-8	1,2,3-Trimethylbenzene (C <sub>9</sub> H <sub>12</sub> ) (hemimellitene)
73570	97-63-2	Ethyl 2-methyl-2-propenoate (C <sub>6</sub> H <sub>10</sub> O <sub>2</sub> ) (ethyl methacrylate)	77226	108-67-8	1,3,5-Trimethylbenzene (C <sub>9</sub> H <sub>12</sub> ) (mesitylene)

Other toxicity information for VOCs include: (1) no-observed effective concentration (NOEC), the highest concentration at which observed effects are not found or are not statistically significant; (2) lowest-observed effective concentration (LOEC), the lowest concentration producing a statistically significant effect; and (3) maximum-acceptable toxicant concentration, the chronic value representing the hypothetical threshold concentration that is the geometric mean between the NOEC and LOEC concentrations.

For most VOCs, toxicity information is available for only one or two test species. AQUIRE had no information for 13 NAWQA target analytes and 13 other analytes (table 2).

## Retrieval from AQUIRE

Selected toxicity information was retrieved from AQUIRE by specifying the VOC and ancillary information including: chemical name recognized by the International Union of Pure and Applied Chemistry and common name, Chemical Abstracts registry number, taxonomic classification (latin and common name) of test species, number of studies (n) performed on each VOC, duration of exposure, concentration of the endpoint (for example, LC<sub>50</sub>), measured effect code that qualifies the documentation of test procedures, and source number indicating the study reference. Not all entries in AQUIRE have the ancillary information that were specified in the retrievals.

## Criteria for Compilation of Information

To be included in this report, information from AQUIRE was reviewed to determine if the following two criteria were met: (1) studies must have been conducted in freshwater, and (2) studies must have complete or moderately complete documentation of test procedures. A number of studies using the same species, duration, and endpoint were available for some VOCs. In these instances, only the two studies that reported the lowest concentrations that had an effect were included in the compilation at the end of this report in the Aquatic Toxicity Information for Selected Volatile Organic Compounds section (table 5) and in the References Containing Aquatic Toxicity Information section (table 6).

**Table 2.** Volatile organic compounds with no available aquatic toxicity information

[IUPAC, International Union of Pure and Applied Chemistry]

IUPAC Compound Name
<b>Target analytes</b>
Bromodichloromethane
Bromoethene
Chloroethane
Chloroethene
Dichlorodifluoromethane
1,1-Dichloroethane
<i>cis</i> -1,2-Dichloroethene
<i>cis</i> -1,3-Dichloropropene
<i>trans</i> -1,3-Dichloropropene
2-Ethoxy-2-methylpropane
2-Methoxy-2-methylbutane
1,1,2-Trichloro-1,2,2-trifluoroethane
Trichlorofluoromethane
<b>Other analytes</b>
Bromobenzene
Dibromomethane
<i>trans</i> -1,4-Dichloro-2-butene
2,2-Dichloropropane
1,1-Dichloropropene
1-Ethyl-2-methylbenzene
Ethyl 2-methyl-2-propenoate
Iodomethane
2-Methyl-2-propenenitrile
(1-Methylpropyl) benzene
1,2,3,4-Tetramethylbenzene
1,2,3,5-Tetramethylbenzene
1,2,3-Trimethylbenzene

## Lowest Concentrations of Volatile Organic Compounds that Affect a Species

Some species are more sensitive to certain contaminants than others and are affected at lower concentrations. For this reason, aquatic toxicity information was reviewed for the lowest concentration that had any effect on any species. This information is summarized in table 3. Some compounds are acutely toxic to a species over a relatively narrow concentration range. When this occurs, the lowest concentration that affects the species is reported as a range rather than a single value.

**Table 3.** Lowest concentrations of volatile organic compounds that affect a species

[IUPAC, International Union of Pure and Applied Chemistry; when available, the lowest concentration is given in the following order of precedence: MATC, maximum-acceptable toxicant concentration; LOEC, lowest-observed effective concentration; EC<sub>50</sub>, median effective concentration; LC<sub>50</sub>, median lethal concentration; --, not reported; nv, no value; <, less than; >, greater than; endpoint effect: AVO, avoidance; BEH, behavior; BMS, biomass; CLR, chlorophyll; GRO, growth; IMM, immobilization; MOR, mortality, effect expressed as percentage of death; PSE, photosynthesis; PTR, phototactic response; REP, reproduction; TER, teratogenesis]

IUPAC compound name	Taxonomic classification	Genus, species/ Common name	Lowest concentration (micrograms per liter)				End-point effect	Duration of test (hours)
			MATC	LOEC	EC <sub>50</sub>	LC <sub>50</sub>		
<b>Target analytes</b>								
Benzene	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	17,200	--	--	GRO	168
Bromomethane	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	nv	nv	400	--	BEH	96
<i>n</i> -Butylbenzene	insects	<i>Daphnia magna</i> / Water flea	490	--	--	--	IMM	48
Chlorobenzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	585	--	IMM	48
Chloromethane	fish	<i>Lepomis macrochirus</i> / Bluegill	nv	nv	nv	550,000	MOR	96
Dibromochloromethane	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	nv	nv	nv	34,000	MOR	72-120
1,2-Dibromo-3-chloropropane	fish	<i>Lepomis macrochirus</i> / Bluegill	nv	nv	nv	20,000	MOR	48
1,2-Dibromoethane	fish	<i>Micropterus salmoides</i> / Largemouth bass	nv	nv	nv	15,000	MOR	24
1,2-Dichlorobenzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	550	--	REP	336
1,3-Dichlorobenzene	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	555-1,040	--	--	--	GRO	768
1,4-Dichlorobenzene	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	565-1,040	--	--	--	GRO	768
Dichlorobenzene (all isomers)	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	nv	nv	nv	10,000	MOR	48
1,2-Dichloroethane	fish	<i>Pimephales promelas</i> / Fathead minnow	29,000-59,000	--	--	--	GRO	768
1,1-Dichloroethene	plants	<i>Scenedesmus abundans</i> / Green algae	nv	nv	410,000	--	GRO	96
Dichloroethene (all isomers)	fish	<i>Lepomis macrochirus</i> / Bluegill	nv	nv	nv	140,000	MOR	96
<i>trans</i> -1,2-Dichloroethene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	nv	220,000	MOR	48
Dichloromethane	amphibians	<i>Rana catesbeiana</i> / Bullfrog	nv	nv	17,780	--	TER	192
1,2-Dichloropropane	fish	<i>Pimephales promelas</i> / Fathead minnow	6,000-11,000	--	--	--	GRO	768
1,3-Dichloropropene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	90	--	IMM	48

**Table 3.** Lowest concentrations of volatile organic compounds that affect a species—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ Common name	Lowest concentration (micrograms per liter)				End-point effect	Duration of test (hours)
			MATC	LOEC	EC <sub>50</sub>	LC <sub>50</sub>		
<b>Target analytes—Continued</b>								
1,2-Dimethylbenzene	fish	<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	nv	nv	600	--	AVO	1
1,3-Dimethylbenzene	plants	<i>Selenastrum capricornutum</i> / Green algae	nv	nv	3,900	--	GRO	192
1,4-Dimethylbenzene	plants	<i>Selenastrum capricornutum</i> / Green algae	nv	nv	3,200	--	GRO	72
Dimethylbenzene (all isomers)	invertebrates, misc.	<i>Brachionus calyciflorus</i> / Rotifer	nv	40,000	--	--	REP	48
Ethenylbenzene	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	nv	nv	nv	2,500	MOR	24
Ethylbenzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	1,810	--	IMM	24
1,1,2,3,4,4-Hexachloro-1,3-butadiene	fish	<i>Pimephales promelas</i> / Fathead minnow	6.5-13	--	--	--	GRO	768
1,1,1,2,2,2-Hexachloroethane	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	67-207	--	--	--	GRO	768
2-Methoxy-2-methylpropane	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	nv	nv	672,000	MOR	96
Methylbenzene	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	6,000	--	--	GRO	768
(1-Methylethyl) benzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	601	--	IMM	48
Naphthalene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	690	--	PTR	2
2,2-Oxybis[propane]	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	nv	nv	91,700	MOR	96
2-Propenal	insects	<i>Daphnia magna</i> / Water flea	nv	nv	51	--	IMM	48
2-Propenenitrile	insects	<i>Daphnia magna</i> / Water flea	nv	nv	10,950	--	IMM	48
<i>n</i> -Propylbenzene	plants	<i>Selenastrum capricornutum</i> / Green algae	nv	nv	1,800	--	GRO	72
Tetrachloroethene	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	500-1,400	--	--	--	GRO	768
Tetrachloromethane	fish	<i>Pimephales promelas</i> / Fathead minnow	52,100	--	--	--	MOR	168
Tribromomethane	plants	<i>Selenastrum capricornutum</i> / Green algae	nv	nv	38,600	--	CLR	96

**Table 3.** Lowest concentrations of volatile organic compounds that affect a species—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ Common name	Lowest concentration (micrograms per liter)				End-point effect	Duration of test (hours)
			MATC	LOEC	EC <sub>50</sub>	LC <sub>50</sub>		
<b>Target analytes—Continued</b>								
1,2,3-Trichlorobenzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	200	--	REP	336
1,2,4-Trichlorobenzene	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	406	--	--	--	GRO	1,080
1,1,1-Trichloroethane	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	nv	11,100	--	IMM	72
1,1,2-Trichloroethane	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	6,000-14,800	--	--	--	GRO	768
Trichloroethene	fish	<i>Jordanella floridae</i> / Flagfish	nv	11,000	--	--	MOR	240
Trichloromethane	amphibians	<i>Hyla crucifer</i> / Spring peeper	nv	nv	270	--	TER	168
1,2,3-Trichloropropane	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	nv	nv	66,500	MOR	96
1,2,4-Trimethylbenzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	3,600	--	IMM	48
<b>Other analytes</b>								
Bromochloromethane	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	nv	nv	nv	67,000	MOR	72-120
2-Butanone	insects	<i>Daphnia magna</i> / Water flea	nv	nv	5,091,000	--	IMM	48
Carbon disulfide	plants	<i>Chorella pyrenoidosa</i> / Green algae	nv	nv	21,000	--	GRO	96
1-Chloro-2-methylbenzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	20,000	--	IMM	24
1-Chloro-4-methylbenzene	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	nv	nv	nv	4,400	MOR	672
3-Chloro-1-propene	amphibians	<i>Xenopus laevis</i> / Clawed toad	nv	nv	nv	340	MOR	48
1,3-Dichloropropane	fish	<i>Pimephales promelas</i> / Fathead minnow	8,000-16,000	--	--	--	GRO	768
(1,1-Dimethylethyl)benzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	nv	41,000	MOR	24
1,4-Epoxybutane	fish	<i>Carassius auratus</i> / Goldfish	nv	nv	nv	2,400,000	MOR	48
Ethenylethanoate	fish	<i>Carassius auratus</i> / Goldfish	nv	nv	nv	42,330	MOR	24
2-Hexanone	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	nv	nv	428,000	MOR	96
1-Isopropyl-4-methylbenzene	plants	<i>Skeletonema costatum</i> / Diatom	nv	nv	22,000	--	PSE	96

**Table 3.** Lowest concentrations of volatile organic compounds that affect a species—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ Common name	Lowest concentration (micrograms per liter)				End-point effect	Duration of test (hours)
			MATC	LOEC	EC <sub>50</sub>	LC <sub>50</sub>		
<b>Other analytes—Continued</b>								
Methyl 2-methyl-2-propenoate	fish	<i>Pimephales promelas</i> / Fathead minnow	nv	nv	nv	130,000	MOR	96
4-Methyl-2-pentanone	plants	<i>Scenedesmus subspicatus</i> / Green algae	nv	nv	980,000	--	BMS	48
Methyl-2-propenoate	fish	<i>Osteichthyes</i> / Bony fish class	nv	nv	nv	5,000	MOR	72
1,1'-Oxybisethane	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	nv	nv	nv	>1,000,000	MOR	24
2-Propanone	insects	<i>Daphnia magna</i> / Water flea	>1,103,200- <2,206,400	--	--	--	MOR	672
1,1,1,2-Tetrachloroethane	fish	<i>Lepomis macrochirus</i> / Bluegill	nv	nv	nv	20,000	MOR	24
1,1,2,2-Tetrachloroethane	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1,400-4,000	--	--	--	GRO	768
1,3,5-Trimethylbenzene	insects	<i>Daphnia magna</i> / Water flea	nv	nv	6,011	--	IMM	48

### WATER-QUALITY CRITERIA AND GUIDELINES FOR VOLATILE ORGANIC COMPOUNDS

Water-quality criteria and guidelines for 39 VOCs (table 4) measured by the USGS have been established by USEPA (U.S. Environmental Protection Agency, 1996a) and Canada (Canadian Council of Resource and Environment Ministers, 1991) to protect freshwater biota. When toxicity information is insufficient to develop criteria, USEPA uses values equal to the LOEC. Canadian water-quality guidelines, which are nonenforceable guidelines that may provide the basis for Provincial Standards or Objectives (Richard Aucoin, Environment Canada, oral commun., 1997) are lower than the USEPA criteria. This may be attributed to procedures for determining the values. Canadian Water-Quality Guidelines, which " \* \* \* are set at such values as to protect all forms of aquatic life and all aspects of the aquatic life cycles" (Canadian Council of Resource and Environment Ministers, 1991), contrasts with the USEPA approach in which " \* \* \* protection of all species at all times and places is not deemed necessary" (Stephan and others, 1985). Canadian guidelines are derived from the most sensitive of the

following: (1) "no negative effect" data obtained from life-stage tests of chronic toxicity; (2) thresholds for the tainting of fish flesh; or (3) concentrations in the water that would result in acceptable concentrations in the edible portions of marketable fish (or the protection of natural consumers). If sufficient chronic toxicity data are not available, Canadian guidelines are based on short-term toxicity data (96 hour LC<sub>50</sub>) of the most sensitive species multiplied by application factors of 0.05 for nonpersistent effects and 0.01 for persistent effects.

The USEPA's aquatic-life criteria are nonenforceable scientific recommendations that may provide the basis for State standards. Acute and chronic criteria issued under the 1985 guidelines (Stephan and others, 1985) are the criterion maximum concentration (CMC) and the criterion continuous concentration (CCC), respectively. The acute and chronic criteria are based on the highest concentration of a pollutant that freshwater aquatic organisms can be exposed to for an established period of time without deleterious effects—1 hour for CMC and 4 days for CCC. Water-quality criteria are based on guidelines established using extensive data requirements and complex mathematical derivations.



**Table 4.** Water-quality criteria and guidelines for volatile organic compounds

[IUPAC, International Union of Pure and Applied Chemistry; USEPA, U.S. Environmental Protection Agency; all values are in micrograms per liter; --, criteria does not exist]

IUPAC compound name	USEPA freshwater acute criteria/guidelines <sup>1</sup>	USEPA freshwater chronic criteria/guidelines <sup>1</sup>	Canadian water-quality guidelines <sup>2</sup>
<b>Target analytes</b>			
Benzene	5,300	--	300
Bromodichloromethane	11,000	--	--
Bromomethane	11,000	--	--
Chlorobenzene	250	50	15
Chloroethane	<sup>3</sup> 860,000	<sup>4</sup> 230,000	--
Dibromochloromethane	11,000	--	--
1,2-Dichlorobenzene	1,120	763	2.5
1,3-Dichlorobenzene	1,120	763	2.5
1,4-Dichlorobenzene	--	--	4
Dichlorodifluoromethane	11,000	--	--
1,2-Dichloroethane	118,000	20,000	100
1,1-Dichloroethene	11,600	--	--
<i>cis</i> -1,2-Dichloroethene	11,600	--	--
<i>trans</i> -1,2-Dichloroethene	11,600	--	--
Dichloromethane	11,000	--	98
<i>cis</i> -1,3-Dichloropropene	6,600	244	--
<i>trans</i> -1,3-Dichloropropene	6,600	244	--
Ethylbenzene	32,000	--	90
1,1,2,3,4,4-Hexachloro-1,3-butadiene	90	9.3	.1
1,1,1,2,2,2-Hexachloroethane	980	540	--
Methylbenzene	17,500	--	2
Naphthalene	2,300	620	--
2-Propenal	68	21	1,000
2-Propenenitrile	7,550	2,600	--
Tetrachloroethene	--	--	110
Tetrachloromethane	35,200	--	13
Tribromomethane	11,000	--	--
1,2,3-Trichlorobenzene	--	--	.9
1,2,4-Trichlorobenzene	250	50	.5
1,1,1-Trichloroethane	18,000	--	--
1,1,2-Trichloroethane	18,000	9,400	--
Trichloroethene	45,000	21,900	20
Trichlorofluoromethane	11,000	--	--
Trichloromethane	28,900	1,240	2
<b>Other analytes</b>			
Bromochloromethane	11,000	--	--
Carbon disulfide	--	2	--
3-Chloro-1-propene	<sup>3</sup> 860,000	<sup>4</sup> 230,000	--
1,1,1,2-Tetrachloroethane	9,320	--	--
1,1,2,2-Tetrachloroethane	9,320	2,400	--

<sup>1</sup>U.S. Environmental Protection Agency, 1996b.

<sup>2</sup>Canadian Council of Resource and Environment Ministers, 1991.

<sup>3</sup>1-hour average, freshwater acute water-quality criteria.

<sup>4</sup>4-day average, freshwater chronic water-quality criteria.

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## AQUATIC TOXICITY INFORMATION

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## EXPLANATION OF TERMS USED IN TABLE 5

**IUPAC compound name:** (International Union of Pure and Applied Chemistry) Internationally recognized system of accepted chemical names.

**Taxonomic classification:** Represented by phylum, class, order, genus, species, and so forth.

**n:** Total number of studies that used the chemical on a designated genus/species. Includes only studies with acceptable experimental design; that is, freshwater only and documentation codes C and M. The lowest effective concentration of a specified compound is listed first, and if data are available, the second lowest concentration is also recorded. The second lowest number may be from the same cited reference as the lowest number, or it may be from a different study conducted within the same experimental parameters (see "Documentation Codes" and "Endpoint Effect Codes" below).

**Duration:** Length of exposure is coded in time units (that is, hours), depending on the species. For a fluctuating or intermittent dosing experiment, the total exposure time is recorded.

**Measures of toxicity:**

(<, less than; >, greater than) see MATC definitions, this page.

**LC<sub>50</sub>:** (Median Lethal Concentration) Statistically estimated concentration that is expected to be lethal to 50 percent of a group of organisms tested after an exposure time—24-96 hours or less.

**EC<sub>50</sub>:** (Median Effective Concentration) Effective concentration for 50 percent of the organisms tested. Used when an effect other than death is the observed endpoint.

**LOEC:** (Lowest-Observed Effective Concentration) The lowest concentration producing a statistically significant effect.

**MATC:** (Maximum-Acceptable Toxicant Concentration) Hypothetical toxic concentration lying in a range bounded at the lower end by the highest tested concentration having no-observed effect (NOEC) and at the higher end by the lowest tested concentration having a significant toxic effect (LOEC) in a life cycle (full chronic) or partial cycle (partial chronic) test. NOEC < MATC < LOEC.

**NOEC:** (No-Observed Effective Concentration) The highest concentration at which observed effects are not found or are not statistically significant.

**Endpoint Effect Codes** denoted by the following: **ABN**=abnormality; **AVO**=avoidance; **BEH**=behavior; **BMS**=biomass; **CLR**=chlorophyll; **CYT**=cytogenetic; **DET**=detachment; **ENZ**=enzyme; **EQU**=equilibrium, change in ability to maintain balance; **FOC**=food consumption; **GRO**=growth; **HAT**= hatchability, change in percentage of hatch, time to hatch number of eggs hatched; **IMM**=immobilization; **IRR**=irritation; **LOC**=locomotor behavior; **MIG**=migration; **MOR**=mortality, effect expressed as a percentage of death; **NR**=no response; **PGR**=population growth; **PRB**=predatory behavior; **PRV**=predatory vulnerability; **PSE**=photosynthesis; **REP**=reproduction; **RGN**= regeneration; **STR**=stress; **SVC**=shell valve closure; **TER**=teratogenesis; **THL**= thermal.

**DC:** (Documentation Code) **DC= C:** (Complete) meets the following criteria: methodology section cites published or well-documented procedures; satisfactory control; toxicant concentration measured; for organic and nonmetallic inorganic chemicals, the test water temperature, pH, and dissolved oxygen are reported; alkalinity or hardness are reported.

**DC= M:** (Moderate) procedures generally satisfactory; that is, followed some standard methods but one or more of the following pieces of information are missing or incomplete: control mortality, solvent control when a solvent is used in the test, toxicant concentration, test water chemistry.

**Source no.:** Number assigned to a study, indicating the reference where information was found. Number may be used to retrieve citation from AQUIRE data base (U.S. Environmental Protection Agency, 1996a). Full citations are listed by source numbers in table 6.

--: Indicates unavailable data or designates space for which toxicity data are addressed in a separate column.

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey

[Information was retrieved from U.S. Environmental Protection Agency's data base, AQUIRE. A number of studies using the same species, duration, and endpoint were available for some VOCs. In these instances, only the two studies that reported the lowest concentration that had an effect were included in the compilation]

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes												
Benzene	amphibians	<i>Ambystoma mexicanum</i> / Mexican axolotl	1	48	370,000	--	--	--	--	MOR	M	9740
	amphibians	<i>Xenopus laevis</i> / Clawed toad	2	48	190,000	--	--	--	--	MOR	M	9740
				48	190,000	--	--	--	--	MOR	M	12152
	crustaceans	<i>Diaptomus forbesi</i> / Calanoid copepod	1	96	710,000	--	--	--	--	MOR	M	11282
	crustaceans	<i>Gammarus fossarum</i> / Scud	5	120	66,007	--	--	--	--	MOR	M	13419
				96	68,283	--	--	--	--	MOR	M	13419
	crustaceans	<i>Gammarus pulex</i> / Scud	1	48	42,000	--	--	--	--	MOR	M	15788
	fish	<i>Carassius auratus</i> / Goldfish	4	24	34,420	--	--	--	--	MOR	C	728
				48	34,420	--	--	--	--	MOR	C	728
	fish	<i>Cottus cognatus</i> / Slimy sculpin	1	96	13,541	--	--	--	--	MOR	M	5622
	fish	<i>Gambusia affinis</i> / Mosquitofish	3	96	386,000	--	--	--	--	MOR	C	508
				24	395,000	--	--	--	--	MOR	C	508
	fish	<i>Gasterosteus aculeatus</i> / Three spine stickleback	1	96	21,818	--	--	--	--	MOR	M	5622
	fish	<i>Ictalurus punctatus</i> / Channel catfish	1	96	425,000	--	--	--	--	MOR	C	666
	fish	<i>Lepomis macrochirus</i> / Bluegill	6	24	20,000	--	--	--	--	MOR	C	922
				48	20,000	--	--	--	--	MOR	C	922
	fish	<i>Oncorhynchus gorbuscha</i> / Pink salmon	3	96	4,640	--	--	--	--	MOR	M	5622
				96	15,017	--	--	--	--	MOR	M	5622
	fish	<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	3	96	8,611	--	--	--	--	MOR	M	5622
				96	12,381	--	--	--	--	MOR	M	5622
fish	<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	2	1	--	1,740	--	--	--	AVO	M	15211	
			1	--	1,750	--	--	--	AVO	M	15211	
fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	5	96	5,300	--	--	--	--	MOR	C	15131	
			96	5,900	--	--	--	--	MOR	M	13142	
fish	<i>Oncorhynchus nerka</i> / Sockeye salmon	1	96	9,455	--	--	--	--	MOR	M	5622	
fish	<i>Oncorhynchus tshawytscha</i> / Chinook salmon	1	96	10,307	--	--	--	--	MOR	M	5622	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Benzene—Continued	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	7	24	54,000	--	--	--	--	MOR	M	12497
				48	54,000	--	--	--	--	MOR	M	12497
	fish	<i>Pimephales promelas</i> / Fathead minnow	12	96	12,600	--	--	--	--	MOR	C	3217
				168	14,010	--	--	--	--	MOR	C	3910
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	168	--	171	--	--	--	BMS	C	3910
				168	--	262	--	--	--	GRO	C	3910
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	168	--	--	17,200	--	--	GRO	M	3910
				168	--	--	17,200	--	--	MOR	M	3910
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	168	--	--	--	--	10,200	GRO	M	3910
				168	--	--	--	--	10,200	MOR	M	3910
	fish	<i>Poecilia reticulata</i> / Guppy	4	96	28,600	--	--	--	--	MOR	M	13142
				24	36,600	--	--	--	--	MOR	C	728
	fish	<i>Salmo trutta</i> / Brown trout	1	1	12,000	--	--	--	--	MOR	C	448
	fish	<i>Salvelinus malma</i> / Dolly varden	2	96	10,457	--	--	--	--	MOR	M	5622
				96	10,509	--	--	--	--	MOR	M	5622
	fish	<i>Thymallus arcticus</i> / Arctic grayling	1	96	12,926	--	--	--	--	MOR	M	5622
	insects	<i>Aedes aegypti</i> / Mosquito	1	48	200,000	--	--	--	--	MOR	M	10574
	insects	<i>Aedes aegypti</i> / Mosquito	1	24	--	59,270	--	--	--	IMM	M	5700
	insects	<i>Asellus aquaticus</i> / Aquatic sowbug	6	48	120,000	--	--	--	--	MOR	M	15788
				120	284,511	--	--	--	--	MOR	M	13419
	insects	<i>Chironomidae</i> / Midge family	1	96	--	1,370,000	--	--	--	IMM	M	770
	insects	<i>Chironomus thummi</i> / Midge	1	48	100,000	--	--	--	--	MOR	M	15788
	insects	<i>Cloeon dipterum</i> / Mayfly	1	48	34,000	--	--	--	--	MOR	M	15788
	insects	<i>Corixa punctata</i> / Water boatman	1	48	48,000	--	--	--	--	MOR	M	15788
	insects	<i>Culex pipiens</i> / Mosquito	1	48	71,000	--	--	--	--	MOR	M	10574

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Benzene—Continued	insects	<i>Daphnia cucullata</i> / Water flea	2	48	356,000	--	--	--	--	MOR	M	2017
				48	390,000	--	--	--	--	MOR	M	2017
	insects	<i>Daphnia magna</i> / Water flea	10	48	200,000	--	--	--	--	MOR	C	5184
				24	250,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	6	1	--	6,300	--	--	--	ENZ	M	6516
				24	--	10,000	--	--	--	IMM	M	6516
	insects	<i>Daphnia pulex</i> / Water flea	3	96	15,000	--	--	--	--	MOR	M	15337
				48	265,000	--	--	--	--	MOR	M	2017
	insects	<i>Ischnura elegans</i> / Dragonfly	1	48	10,000	--	--	--	--	MOR	M	15788
	insects	<i>Nemoura cinerea</i> / Stonefly	1	48	130,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Amphimelania holandri</i> / Snail	5	120	671,446	--	--	--	--	MOR	M	13419
				96	819,392	--	--	--	--	MOR	M	13419
	invertebrates, misc.	<i>Brachionus calyciflorus</i> / Rotifer	2	24	>1,000	--	--	--	--	MOR	C	6002
				24	>1,000,000	--	--	--	--	MOR	M	9385
	invertebrates, misc.	<i>Dugesia lugubris</i> / Turbellarian, flatworm	1	48	74,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Erpobdella octoculata</i> / Leech	1	48	>320,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Hydra oligactis</i> / Hydra	2	48	34,000	--	--	--	--	MOR	M	10574
				48	34,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Lymnaea stagnalis</i> / Great pond snail	7	48	230,000	--	--	--	--	MOR	M	10574
				48	230,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	Oligochaeta (order)/ Tubificidae (family)	1	48	>320,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Viviparus bengalensis</i> / Snail	1	96	--	970,000	--	--	--	IMM	M	770
	plants	<i>Chlorella vulgaris</i> / Green algae	1	24	--	525,000	--	--	--	GRO	M	2215
	plants	<i>Scenedesmus abundans</i> / Green algae	1	96	--	>1,360,000	--	--	--	GRO	M	11677
	plants	<i>Selenastrum capricornutum</i> / Green algae	2	72	--	29,000	--	--	--	GRO	M	13142
				192	--	41,000	--	--	--	GRO	M	3550

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Bromomethane	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	1	4	14,300	--	--	--	--	MOR	M	10516
	fish	<i>Lepomis macrochirus</i> / Bluegill	1	96	11,000	--	--	--	--	MOR	C	863
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	3	96	700	--	--	--	--	MOR	C	5331
				216	900	--	--	--	--	MOR	C	5331
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	4	96	--	400	--	--	--	BEH	C	5331
				24	--	500	--	--	--	BEH	C	5331
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	4	2,191	--	--	--	--	320	BEH	M	6059
				2,191	--	--	--	--	320	GRO	M	6059
	fish	<i>Poecilia reticulata</i> / Guppy	4	96	0.800	--	--	--	--	MOR	C	5331
				72	800	--	--	--	--	MOR	C	5331
	fish	<i>Poecilia reticulata</i> / Guppy	8	96	--	0.600	--	--	--	IMM	C	5331
				72	--	0.800	--	--	--	IMM	C	5331
	fish	<i>Poecilia reticulata</i> / Guppy	2	504	--	--	--	--	100	BEH	M	6059
				504	--	--	--	--	320	MOR	M	6059
	insects	<i>Daphnia magna</i> / Water flea	1	48	2,200	--	--	--	--	MOR	C	5331
insects	<i>Daphnia magna</i> / Water flea	2	48	--	1,700	--	--	--	BEH	C	5331	
			48	--	2,000	--	--	--	IMM	C	5331	
plants	<i>Chlorella pyrenoidosa</i> / Green algae	2	48	--	5,000	--	--	--	GRO	C	5331	
			24	--	2,100-6,700	--	--	--	GRO	C	5331	
plants	<i>Scenedesmus quadricauda</i> / Green algae	2	24	--	2,200	--	--	--	GRO	C	5331	
			48	--	3,200	--	--	--	GRO	C	5331	
<i>n</i> -Butylbenzene	insects	<i>Daphnia magna</i> / Water flea	8	48	--	340	--	--	--	IMM	C	6984
				48	--	380	--	--	--	IMM	C	6984
	insects	<i>Daphnia magna</i> / Water flea	1	48	--	--	--	490	--	IMM	C	6984
Chlorobenzene	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	2	672	10,300	--	--	--	--	MOR	M	3279
				48	10,500	--	--	--	--	MOR	M	15526
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	4	168	--	--	--	--	8,500	REP	M	3279
				336	--	--	--	--	8,500	REP	M	3279
	fish	<i>Carassius auratus</i> / Goldfish	11	180	880	--	--	--	--	MOR	C	538
			192	880	--	--	--	--	MOR	C	563	



**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Chlorobenzene— Continued	fish	<i>Lepomis macrochirus</i> / Bluegill	19	24	4,500	--	--	--	--	MOR	C	7398
				48	4,500	--	--	--	--	MOR	C	7398
	fish	<i>Micropterus salmoides</i> / Largemouth bass	8	156	50	--	--	--	--	MOR	C	538
				180	50	--	--	--	--	MOR	C	563
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	5	384	<90	--	--	--	--	MOR	C	563
				384	<90	--	--	--	--	MOR	C	563
	fish	<i>Pimephales promelas</i> / Fathead minnow	13	96	16,900	--	--	--	--	MOR	C	3217
				96	22,200	--	--	--	--	MOR	C	10432
	fish	<i>Poecilia reticulata</i> / Guppy	4	24	5,630	--	--	--	--	MOR	M	4038
				24	45,530	--	--	--	--	MOR	C	728
	insects	<i>Ceriodaphnia dubia</i> / Water flea	10	48	7,900	--	--	--	--	MOR	C	10810
				48	8,900	--	--	--	--	MOR	C	10810
	insects	<i>Ceriodaphnia dubia</i> / Water flea	3	168-240	--	14,000	--	--	--	MOR	C	212
				168-240	--	22,000	--	--	--	MOR	C	212
	insects	<i>Ceriodaphnia dubia</i> / Water flea	4	168-240	--	--	--	--	3,890	MOR	M	212
				168-240	--	--	--	--	12,000	REP	M	212
	insects	<i>Chironomus riparius</i> / Midge	1	96-98	--	--	--	--	720	BEH	C	14176
	insects	<i>Daphnia magna</i> / Water flea	13	48	8,600	--	--	--	--	MOR	C	10810
				48	10,700	--	--	--	--	MOR	C	10810
	insects	<i>Daphnia magna</i> / Water flea	8	48	--	585	--	--	--	IMM	M	10805
				336	--	2,500	--	--	--	REP	M	15526
	insects	<i>Daphnia magna</i> / Water flea	4	216-264	--	--	--	--	6,500	REP	M	212
				216-264	--	--	--	--	11,000	REP	M	212
	plants	<i>Cyclotella meneghiniana</i> / Diatom	1	48	--	235,740	--	--	--	CYT	C	88
	plants	<i>Selenastrum capricornutum</i> / Green algae	4	96	--	202,000	--	--	--	PGR	M	9607
				96	--	210,000	--	--	--	CLR	M	9607
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<100,000	CLR	M	9607
Chloromethane	fish	<i>Lepomis macrochirus</i> / Bluegill	1	96	550,000	--	--	--	--	MOR	C	863
1,2-Dibromo-3-chloro- propane	fish	<i>Lepomis macrochirus</i> / Bluegill	3	48	20,000	--	--	--	--	MOR	C	2786
				24	50,000	--	--	--	--	MOR	C	2786
	fish	<i>Micropterus salmoides</i> / Largemouth bass	3	48	20,000	--	--	--	--	MOR	C	2786
				24	30,000	--	--	--	--	MOR	C	2786

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.	
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC				
<b>Target analytes—Continued</b>													
1,2-Dibromo-3-chloro- propane—Continued	invertebrates, misc.	<i>Cipangopaludina malleata</i> / Mud snail	1	48	53,000	--	--	--	--	MOR	M	9158	
	invertebrates, misc.	<i>Indoplanorbis exustus</i> / Snail	1	48	57,000	--	--	--	--	MOR	M	9158	
	invertebrates, misc.	<i>Physa acuta</i> / Bladder snail	1	48	24,000	--	--	--	--	MOR	M	9158	
	invertebrates, misc.	<i>Semisulcospira libertina</i> / Marsh snail	1	48	50,000	--	--	--	--	MOR	M	9158	
Dibromochloromethane	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	2	72-120	34,000	--	--	--	--	MOR	M	6360	
				.74	52,000	--	--	--	--	MOR	M	6360	
1,2-Dibromoethane	fish	<i>Lepomis macrochirus</i> / Bluegill	3	24	18,000	--	--	--	--	MOR	C	2786	
				48	18,000	--	--	--	--	MOR	C	2786	
	fish	<i>Micropterus salmoides</i> / Largemouth bass	3	24	15,000	--	--	--	--	MOR	C	2786	
				48	15,000	--	--	--	--	MOR	C	2786	
1,2-Dichlorobenzene	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	1	48	6,800	--	--	--	--	MOR	M	15526	
													fish
	24	6,300	--	--	--	--	MOR	C	5590				
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	7	144	1,540	--	--	--	--	MOR	C	10579	
				48	1,580	--	--	--	--	MOR	C	10579	
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	--	1,550	--	--	--	--	LOC	C	4433
	96	9,470	--	--	--	--	MOR	C	12858				
	fish	<i>Poecilia reticulata</i> / Guppy	1	96	4,792	--	--	--	--	--	MOR	M	7257
48	2,400	--	--	--	--	MOR	C	5184					
insects	<i>Daphnia magna</i> / Water flea	6	336	--	550	--	--	--	--	REP	M	15526	
			24	--	780	--	--	--	--	IMM	M	15526	
insects	<i>Daphnia magna</i> / Water flea	1	504	--	--	--	--	--	630	REP	M	847	
													insects
24	19,900	--	--	--	--	MOR	C	10579					

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
1,2-Dichlorobenzene— Continued	plants	<i>Cyclotella meneghiniana</i> / Diatom	1	48	--	23,330	--	--	--	CYT	C	88
	plants	<i>Scenedesmus subspicatus</i> / Green algae	2	48	--	13,500	--	--	--	GRO	M	2997
					--	14,000	--	--	BMS	M	2997	
	plants	<i>Selenastrum capricornutum</i> / Green algae	5	24	--	65,800	--	--	--	CLR	M	9607
--					71,100	--	--	CLR	M	9607		
plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<10,000	CLR	M	9607	
1,3-Dichlorobenzene	fish	<i>Lepomis macrochirus</i> / Bluegill	2	96	5,000	--	--	--	--	MOR	C	5590
				24	22,000	--	--	--	MOR	C	5590	
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	2	768	--	--	--	555-1,040	--	GRO	C	4433
				768	--	--	--	555-1,040	--	MOR	C	4433
	fish	<i>Pimephales promelas</i> / Fathead minnow	3	96	7,800	--	--	--	--	MOR	C	10183
				96	7,800	--	--	--	MOR	C	12124	
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	2,300	--	--	MOR	M	12124
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	--	--	--	1,500	--	MOR	C	12124
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	--	--	1,000	MOR	M	12124
	insects	<i>Chironomus riparius</i> / Midge	1	96-98	--	--	--	--	37	BEH	C	14176
	insects	<i>Daphnia magna</i> / Water flea	5	48	1,700	--	--	--	--	MOR	M	5675
				48	7,200	--	--	--	MOR	C	15981	
	insects	<i>Daphnia magna</i> / Water flea	5	384	--	1,400	--	--	--	REP	M	5675
				48	--	4,200	--	--	IMM	C	15981	
insects	<i>Daphnia magna</i> / Water flea	2	384	--	--	--	--	300	GRO	C	12872	
			504	--	--	--	500	REP	C	847		
plants	<i>Cyclotella meneghiniana</i> / Diatom	1	48	--	51,880	--	--	--	CYT	C	88	
plants	<i>Scenedesmus subspicatus</i> / Green algae	2	48	--	19,000	--	--	--	BMS	M	2997	
			48	--	30,000	--	--	GRO	M	2997		
plants	<i>Selenastrum capricornutum</i> / Green algae	5	96	--	114,000	--	--	--	PGR	M	9607	
			72	--	124,000	--	--	CLR	M	9607		
plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	32,000	CLR	M	9607	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
1,4-Dichlorobenzene	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	3	672	2,700	--	--	--	--	MOR	M	3279
				24	4,200	--	--	--	--	MOR	M	10712
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	4	168	--	--	--	--	2,100	REP	M	3279
				336	--	--	--	--	2,100	REP	M	3279
	fish	<i>Jordanella floridae</i> / Flagfish	7	72	2,053	--	--	--	--	MOR	M	140
				96	2,053	--	--	--	--	MOR	M	140
	fish	<i>Jordanella floridae</i> / Flagfish	3	240	--	--	263	--	--	MOR	M	140
				672	--	--	>349	--	--	GRO	M	140
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	96	4,300	--	--	--	--	MOR	C	5590
				24	4,500	--	--	--	--	MOR	C	5590
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	8	336	800	--	--	--	--	MOR	M	10712
				96	1,120	--	--	--	--	MOR	C	10579
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	--	1,100	--	--	--	EQU	C	4433
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	2	768	--	--	--	565-1,040	--	GRO	C	4433
				768	--	--	--	565-1,040	--	MOR	C	4433
	fish	<i>Pimephales promelas</i> / Fathead minnow	14	96	2,400	--	--	--	--	MOR	C	5735
				96	2,852	--	--	--	--	MOR	M	7257
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	1,000	--	--	MOR	M	12124
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	96	--	--	--	760	--	MOR	C	12124
				168	--	--	--	2,850	--	MOR	C	257
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	--	--	570	MOR	M	12124
	fish	<i>Poecilia reticulata</i> / Guppy	1	96	2,896	--	--	--	--	MOR	M	7257
	insects	<i>Chironomus riparius</i> / Midge	1	48	12,000	--	--	--	--	MOR	C	4072
	insects	<i>Chironomus riparius</i> / Midge	1	48	--	--	--	--	940	MOR	M	4072
	insects	<i>Daphnia magna</i> / Water flea	2	48	11,000	--	--	--	--	MOR	C	5184
				24	42,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	4	336	--	930	--	--	--	REP	M	15526
				24	--	1,600	--	--	--	IMM	M	10712

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
1,4-Dichlorobenzene— Continued	insects	<i>Daphnia magna</i> / Water flea	1	504	--	--	--	--	300	REP	M	847
	insects	<i>Tanytarsus dissimilis</i> / Midge	2	48	13,000	--	--	--	--	MOR	C	10579
				24	22,100	--	--	--	MOR	C	10579	
	plants	<i>Cyclotella meneghiniana</i> / diatom	1	48	--	34,300	--	--	--	CYT	C	88
	plants	<i>Scenedesmus subspicatus</i> / Green algae	2	48	--	28,000	--	--	--	BMS	M	2997
				48	--	38,000	--	--	GRO	M	2997	
	plants	<i>Selenastrum capricornutum</i> / Green algae	7	96	--	1,600	--	--	--	GRO	M	10712
3				--	5,200	--	--	PSE	M	10712		
plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	5,600	CLR	M	9607	
1,2-Dichloroethane	amphibians	<i>Ambystoma gracile</i> / Salamander	2	228	2,540	--	--	--	--	MOR	C	15418
				132	6,530	--	--	--	MOR	C	15418	
	amphibians	<i>Rana pipiens</i> / Leopard frog	2	216	4,400	--	--	--	--	MOR	C	15418
				120	4,520	--	--	--	MOR	C	15418	
	crustaceans	<i>Gammarus fasciatus</i> / Scud	1	96	>100,000	--	--	--	--	MOR	C	666
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	4	552	34	--	--	--	--	MOR	C	15418
				672	34	--	--	--	MOR	C	15418	
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	6	24	1,100,000	--	--	--	--	MOR	M	12497
				48	1,100,000	--	--	--	MOR	M	12497	
	fish	<i>Pimephales promelas</i> / Fathead minnow	5	72	116,000	--	--	--	--	MOR	C	11227
				96	116,000	--	--	--	MOR	C	11227	
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	--	29,000- 59,000	--	GRO	C	15301
	insects	<i>Daphnia magna</i> / Water flea	6	48	220,000	--	--	--	--	MOR	C	5184
				24	250,000	--	--	--	MOR	C	5184	
insects	<i>Pteronarcys californica</i> / Stonefly	1	96	>100,000	--	--	--	--	MOR	C	666	
insects	<i>Daphnia magna</i> / Water flea	5	48	--	160,000	--	--	--	IMM	C	15981	
			48	--	180,000	--	--	IMM	C	15981		
1,1-Dichloroethene	fish	<i>Lepomis macrochirus</i> / Bluegill	3	24	74,000	--	--	--	--	MOR	C	5590
				96	74,000	--	--	--	MOR	C	5590	
	fish	<i>Pimephales promelas</i> / Fathead minnow	15	168	29,000	--	--	--	--	MOR	C	5741
				192	29,000	--	--	--	MOR	C	5741	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
1,1-Dichloroethene— Continued	insects	<i>Daphnia magna</i> / Water flea	4	24	11,600	--	--	--	--	MOR	C	5741
				48	11,600	--	--	--	--	MOR	C	5741
	plants	<i>Scenedesmus abundans</i> / Green algae	1	96	--	410,000	--	--	--	GRO	M	11677
	plants	<i>Selenastrum capricornutum</i> / Green algae	5	24	--	>560,000	--	--	--	CLR	M	9607
				48	--	>560,000	--	--	CLR	M	9607	
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<56,000	CLR	M	9607
<i>trans</i> -1,2- Dichloroethene	insects	<i>Daphnia magna</i> / Water flea	2	48	220,000	--	--	--	--	MOR	C	5184
				24	230,000	--	--	--	--	MOR	C	5184
Dichloromethane	amphibians	<i>Bufo woodhousei fowleri</i> / Fowler's toad	2	72	--	>32,000	--	--	--	TER	C	6187
				168	--	>32,000	--	--	--	TER	C	6187
	amphibians	<i>Rana catesbeiana</i> / Bullfrog	2	192	--	17,780	--	--	--	TER	C	6187
				96	--	30,610	--	--	--	TER	C	6187
	amphibians	<i>Rana palustris</i> / Pickeral frog	2	8	--	>32,000	--	--	--	TER	C	6187
				96	--	>32,000	--	--	--	TER	C	6187
	fish	<i>Carassius auratus</i> / Goldfish	1	24	420,000	--	--	--	--	MOR	M	5773
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	48	220,000	--	--	--	--	MOR	C	5590
				24	230,000	--	--	--	--	MOR	C	5590
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	6	24	840,000	--	--	--	--	MOR	M	12497
				48	840,000	--	--	--	--	MOR	M	12497
	fish	<i>Pimephales promelas</i> / Fathead minnow	8	96	193,000	--	--	--	--	MOR	C	973
72				232,400	--	--	--	--	MOR	C	973	
fish	<i>Pimephales promelas</i> / Fathead minnow	4	48	--	99,000	--	--	--	IMM	C	973	
			72	--	99,000	--	--	--	IMM	C	973	
insects	<i>Daphnia magna</i> / Water flea	3	48	220,000	--	--	--	--	MOR	C	5184	
			24	310,000	--	--	--	--	MOR	C	5184	
insects	<i>Daphnia magna</i> / Water flea	3	48	--	135,803	--	--	--	IMM	M	11926	
			48	--	1,682,000	--	--	--	IMM	M	846	
plants	<i>Lemna minor</i> / Duckweed	1	<504	--	2,000,000	--	--	--	GRO	M	3881	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Dichloromethane— Continued	plants	<i>Selenastrum capricornutum</i> / Green algae	5	24	--	>500,000	--	--	--	CLR	M	9607
				48	--	>500,000	--	--	--	CLR	M	9607
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	56,000	CLR	M	9607
1,2-Dichloropropane	fish	<i>Lepomis macrochirus</i> / Bluegill	3	96	280,000	--	--	--	--	MOR	C	5590
				96	320,000	--	--	--	--	MOR	C	863
	fish	<i>Pimephales promelas</i> / Fathead minnow	5	96	127,000	--	--	--	--	MOR	C	12447
				96	140,000	--	--	--	--	MOR	C	11227
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	--	6,000- 11,000	--	GRO	C	15301
insects	<i>Daphnia magna</i> / Water flea	2	48	52,000	--	--	--	--	MOR	C	5184	
			24	99,000	--	--	--	--	MOR	C	5184	
1,2-Dimethylbenzene	amphibians	<i>Xenopus laevis</i> / Clawed toad	1	48	73,000	--	--	--	--	MOR	M	12152
	fish	<i>Carassius auratus</i> / Goldfish	2	24	13,000	--	--	--	--	MOR	C	623
				96	16,100	--	--	--	--	MOR	C	12665
	fish	<i>Catostomus commersoni</i> / White sucker	1	96	16,100	--	--	--	--	MOR	C	12665
	fish	<i>Lepomis macrochirus</i> / Bluegill	1	96	16,100	--	--	--	--	MOR	C	12665
	fish	<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	2	1	--	600	--	--	--	AVO	M	15211
				1	--	760	--	--	--	AVO	M	15211
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	2	96	7,600	--	--	--	--	MOR	M	13142
				96	8,050	--	--	--	--	MOR	C	12665
	fish	<i>Pimephales promelas</i> / Fathead minnow	3	96	16,100	--	--	--	--	MOR	C	12665
				96	16,400	--	--	--	--	MOR	C	3217
	fish	<i>Poecilia reticulata</i> / Guppy	1	96	12,000	--	--	--	--	MOR	M	13142
insects	<i>Daphnia magna</i> / Water flea	3	24	--	1,000	--	--	--	IMM	M	13142	
			48	--	3,185	--	--	--	IMM	C	11936	
invertebrates, misc.	<i>Aplexa hypnorum</i> / Snail	1	96	>22,400	--	--	--	--	MOR	C	12665	
plants	<i>Chlorella vulgaris</i> / Green algae	1	24	--	55,000	--	--	--	GRO	M	2215	
plants	<i>Selenastrum capricornutum</i> / Green algae	2	192	--	4,200	--	--	--	GRO	M	3550	
			72	--	4,700	--	--	--	GRO	M	13142	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
1,3-Dimethylbenzene	fish	<i>Carassius auratus</i> / Goldfish	1	24	16,000	--	--	--	--	MOR	C	623
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	8,400	--	--	--	--	MOR	M	13142
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	16,000	--	--	--	--	MOR	C	3217
	fish	<i>Poecilia reticulata</i> / Guppy	1	96	12,900	--	--	--	--	MOR	M	13142
	insects	<i>Daphnia magna</i> / Water flea	2	24 48	-- --	4,700 9,556	-- --	-- --	-- --	IMM IMM	M C	13142 11936
	plants	<i>Selenastrum capricornutum</i> / Green algae	2	192 72	-- --	3,900 4,900	-- --	-- --	-- --	GRO GRO	M M	3550 13142
1,4-Dimethylbenzene	fish	<i>Carassius auratus</i> / Goldfish	1	24	18,000	--	--	--	--	MOR	C	623
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	2,600	--	--	--	--	MOR	M	13142
	fish	<i>Poecilia reticulata</i> / Guppy	1	96	8,800	--	--	--	--	MOR	M	13142
	insects	<i>Daphnia magna</i> / Water flea	3	24 48	-- --	3,600 8,494	-- --	-- --	-- --	IMM IMM	M C	13142 11936
	plants	<i>Selenastrum capricornutum</i> / Green algae	2	72 192	-- --	3,200 4,400	-- --	-- --	-- --	GRO GRO	M M	13142 3550
	Ethenylbenzene	crustaceans	<i>Gammarus fossarum</i> / Scud	5	120 96	61,817 64,025	-- --	-- --	-- --	-- --	MOR MOR	M M
fish		<i>Carassius auratus</i> / Goldfish	5	24 24	25,000 26,000	-- --	-- --	-- --	-- --	MOR MOR	M C	5773 623
fish		<i>Lepomis macrochirus</i> / Bluegill	3	24 48	25,050 25,050	-- --	-- --	-- --	-- --	MOR MOR	C C	728 728
fish		<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	24	2,500	--	--	--	--	MOR	M	15923
fish		<i>Pimephales promelas</i> / Fathead minnow	17	96 48	4,020 29,000	-- --	-- --	-- --	-- --	MOR MOR	C M	3217 719
fish		<i>Poecilia reticulata</i> / Guppy	3	24 48	74,830 74,830	-- --	-- --	-- --	-- --	MOR MOR	C C	728 728



**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Ethenylbenzene— Continued	insects	<i>Asellus aquaticus</i> / Aquatic sowbug	5	120	59,609	--	--	--	--	MOR	M	13419
				96	65,129	--	--	--	--	MOR	M	13419
	insects	<i>Daphnia magna</i> / Water flea	4	120	23,000	--	--	--	--	MOR	C	5184
				96	27,000	--	--	--	--	MOR	C	5184
	invertebrates, misc.	<i>Amphimelania holandri</i> / Snail	5	120	113,699	--	--	--	--	MOR	M	13419
				96	119,337	--	--	--	--	MOR	M	13419
	invertebrates, misc.	<i>Lymnaea stagnalis</i> / Great pond snail	5	120	518,821	--	--	--	--	MOR	M	13419
				96	562,976	--	--	--	--	MOR	M	13419
Ethylbenzene	fish	<i>Carassius auratus</i> / Goldfish	3	24	94,440	--	--	--	--	MOR	C	728
				48	94,440	--	--	--	--	MOR	C	728
	fish	<i>Ictalurus punctatus</i> / Channel catfish	1	96	210,000	--	--	--	--	MOR	C	666
	fish	<i>Lepomis macrochirus</i> / Bluegill	6	48	32,000	--	--	--	--	MOR	C	728
				96	32,000	--	--	--	--	MOR	C	728
	fish	<i>Menidia menidia</i> / Atlantic silverside	4	96	5,100	--	--	--	--	MOR	C	4189
				72	5,800	--	--	--	--	MOR	C	4189
	fish	<i>Menidia menidia</i> / Atlantic silverside	1	96	--	--	--	--	3,300	MOR	M	4189
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	2	96	4,200	--	--	--	--	MOR	M	13142
				96	14,000	--	--	--	--	MOR	C	666
	fish	<i>Pimephales promelas</i> / Fathead minnow	8	96	9,090	--	--	--	--	MOR	C	3217
				96	12,100	--	--	--	--	MOR	C	12858
	fish	<i>Poecilia reticulata</i> / Guppy	4	96	9,600	--	--	--	--	MOR	M	13142
				96	97,100	--	--	--	--	MOR	C	728
	insects	<i>Daphnia magna</i> / Water flea	3	48	75,000	--	--	--	--	MOR	C	5184
				24	77,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	12	24	--	1,810	--	--	--	IMM	C	6984
				24	--	1,930	--	--	--	IMM	C	6984
	plants	<i>Selenastrum capricornutum</i> / Green algae	7	72	--	4,600	--	--	--	GRO	M	13142
				192	--	4,800	--	--	--	GRO	M	3350
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<1,000	CLR	M	9607
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	1	48	1,000	--	--	--	--	MOR	M	5938
	fish	<i>Carassius auratus</i> / Goldfish	1	96	90	--	--	--	--	MOR	M	540

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
1,1,2,3,4,4-Hexachloro- 1,3-butadiene	fish	<i>Lepomis macrochirus</i> / Bluegill	3	192	318	--	--	--	--	MOR	C	10579
				96	324	--	--	--	--	MOR	C	10579
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	4	192	121	--	--	--	--	MOR	C	10579
				96	320	--	--	--	--	MOR	C	10579
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	--	140	--	--	--	LOC	C	4433
	fish	<i>Pimephales promelas</i> / Fathead minnow	4	96	90	--	--	--	--	MOR	C	12447
				96	100	--	--	--	--	MOR	C	11227
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	768	--	--	--	6.5-13	--	GRO	C	15301
				768	--	--	--	6.5-13	--	MOR	C	15301
	insects	<i>Asellus aquaticus</i> / Aquatic sowbug	2	96	130	--	--	--	--	MOR	M	540
				72	160	--	--	--	--	MOR	M	540
	invertebrates, misc.	<i>Lymnaea stagnalis</i> / Great pond snail	4	24	210	--	--	--	--	MOR	M	540
				48	210	--	--	--	--	MOR	M	540
1,1,1,2,2,2-Hexachloro- ethane	amphibians	<i>Rana catesbeiana</i> / Bullfrog	3	96	2,440	--	--	--	--	MOR	C	12004
				96	2,817	--	--	--	--	MOR	M	5876
	crustaceans	<i>Orconectes immunitis</i> / Crayfish	3	96	>2,100	--	--	--	--	MOR	C	10775
				96	2,699	--	--	--	--	MOR	M	5876
	fish	<i>Carassius auratus</i> / Goldfish	3	96	1,326	--	--	--	--	MOR	C	5876
				96	1,420	--	--	--	--	MOR	C	12004
	fish	<i>Gambusia affinis</i> / Mosquitofish	2	96	1,380	--	--	--	--	MOR	C	12004
				96	1,380	--	--	--	--	MOR	M	5876
	fish	<i>Ictalurus punctatus</i> / Channel catfish	6	96	1,520	--	--	--	--	MOR	C	10775
				72	1,600	--	--	--	--	MOR	C	10775
	fish	<i>Lepomis macrochirus</i> / Bluegill	8	96	856	--	--	--	--	MOR	C	12004
				96	857	--	--	--	--	MOR	M	5876
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	12	192	770	--	--	--	--	MOR	C	10579
				96	840	--	--	--	--	MOR	C	4433
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	--	840	--	--	--	EQU	C	4433
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	768	--	--	--	67-207	--	GRO	C	4433
	fish	<i>Pimephales promelas</i> / Fathead minnow	13	96	1,100	--	--	--	--	MOR	C	12004
				96	1,230	--	--	--	--	MOR	C	10775

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
1,1,1,2,2,2-Hexachloroethane—Continued	insects	<i>Ceriodaphnia reticulata</i> / Water flea	1	48	3,300	--	--	--	--	MOR	C	11181
	insects	<i>Ceriodaphnia reticulata</i> / Water flea	1	48	--	6,800	--	--	--	IMM	M	12258
	insects	<i>Daphnia magna</i> / Water flea	6	48	1,360	--	--	--	--	MOR	C	12004
				48	2,400	--	--	--	--	MOR	C	15981
	insects	<i>Daphnia magna</i> / Water flea	3	48	--	1,800	--	--	--	IMM	C	15981
				48	--	2,100	--	--	--	IMM	C	15981
	insects	<i>Daphnia pulex</i> / Water flea	1	48	>10,000	--	--	--	--	MOR	C	11181
	insects	<i>Daphnia pulex</i> / Water flea	1	48	--	13,000	--	--	--	IMM	M	12258
	insects	<i>Simocephalus vetulus</i> / Water flea	1	48	5,800	--	--	--	--	MOR	C	11181
	insects	<i>Tanytarsus dissimilis</i> / Midge	4	48	1,230	--	--	--	--	MOR	C	12004
				48	1,231	--	--	--	--	MOR	M	5876
	invertebrates, misc.	<i>Aplexa hypnorum</i> / Snail	1	96	>2,100	--	--	--	--	MOR	C	10775
	plants	<i>Selenastrum capricornutum</i> / Green algae	5	48	--	67,300	--	--	--	CLR	M	9607
96				--	87,000	--	--	--	CLR	M	9607	
plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<5,600	CLR	M	9607	
2-Methoxy-2-methylpropane	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	672,000	--	--	--	--	MOR	C	12859
Methylbenzene	crustaceans	<i>Diaptomus forbesi</i> / Calanoid copepod	1	96	447,000	--	--	--	--	MOR	M	11282
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	1	48	25,000	--	--	--	--	MOR	M	5938
	fish	<i>Carassius auratus</i> / Goldfish	9	96	22,800	--	--	--	--	MOR	C	416
				72	25,330	--	--	--	--	MOR	C	416
	fish	<i>Clarias lazera</i> / Catfish	4	96	26,200	--	--	--	--	MOR	C	3997
				72	29,500	--	--	--	--	MOR	C	3997
	fish	<i>Gambusia affinis</i> / Mosquitofish	3	96	1,180,000	--	--	--	--	MOR	C	508
48				1,260,000	--	--	--	--	MOR	C	508	
fish	<i>Ictalurus punctatus</i> / Channel catfish	1	96	240,000	--	--	--	--	MOR	C	666	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
Methylbenzene— Continued	fish	<i>Lepomis macrochirus</i> / Bluegill	6	96	13,000	--	--	--	--	MOR	C	5590
				24	17,000	--	--	--	--	MOR	C	5590
	fish	<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	2	96	5,500	--	--	--	--	MOR	M	15191
				96	8,110	--	--	--	--	MOR	M	477
	fish	<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	2	1	--	1,650	--	--	--	AVO	M	15211
				1	--	2,340	--	--	--	AVO	M	15211
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	2	96	5,800	--	--	--	--	MOR	M	13142
				96	24,000	--	--	--	--	MOR	C	666
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	3	96	54,000	--	--	--	--	MOR	M	5580
				48	63,000	--	--	--	--	MOR	M	5580
	fish	<i>Pimephales promelas</i> / Fathead minnow	31	168	9,390	--	--	--	--	MOR	C	3910
				96	12,600	--	--	--	--	MOR	C	5087
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	168	--	82.7	--	--	--	BMS	C	3910
				168	--	110.3	--	--	--	GRO	C	3910
	fish	<i>Pimephales promelas</i> / Fathead minnow	3	768	--	--	6,000	--	--	GRO	M	12405
				168	--	--	8,040	--	--	GRO	M	3910
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	168	--	--	--	--	5,440	GRO	M	3910
				168	--	--	--	--	5,440	MOR	M	3910
	fish	<i>Poecilia reticulata</i> / Guppy	4	96	28,200	--	--	--	--	MOR	M	13142
				96	59,300	--	--	--	--	MOR	C	728
	insects	<i>Aedes aegypti</i> / Mosquito	1	24	--	21,520	--	--	--	IMM	M	5700
	insects	<i>Chironomus riparius</i> / Midge	1	48	47,000	--	--	--	--	MOR	C	4072
	insects	<i>Chironomus riparius</i> / Midge	2	96-98	--	--	--	--	922	BEH	C	14176
				48	--	--	--	--	5,600	MOR	M	4072
	insects	<i>Daphnia magna</i> / Water flea	3	24	310,000	--	--	--	--	MOR	C	5184
				48	310,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	7	1	--	3,600	--	--	--	ENZ	M	6516
				48	--	6,000	--	--	--	IMM	M	6516
	insects	<i>Daphnia magna</i> / Water flea	1	504	--	--	--	--	1,000	REP	M	847
	invertebrates, misc.	<i>Brachionus calyciflorus</i> / Rotifer	2	24	113,000	--	--	--	--	MOR	M	9385
				24	113,300	--	--	--	--	MOR	C	6002

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Methylbenzene— Continued	plants	<i>Chlorella vulgaris</i> / Green algae	1	24	--	245,000	--	--	--	GRO	M	2215
	plants	<i>Scenedesmus subspicatus</i> / Green algae	2	48	--	125,000	--	--	--	GRO	M	2997
					--	160,000	--	--	--	BMS	M	2997
	plants	<i>Selenastrum capricornutum</i> / Green algae	2	192	--	9,400	--	--	--	GRO	M	3550
				72	--	12,500	--	--	--	GRO	M	13142
(1-Methylethyl)benzene	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	2,700	--	--	--	--	MOR	M	13142
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	6,320	--	--	--	--	MOR	C	12858
	fish	<i>Poecilia reticulata</i> / Guppy	1	96	5,100	--	--	--	--	MOR	M	13142
	insects	<i>Daphnia magna</i> / Water flea	1	24	95,000	--	--	--	--	MOR	C	5718
	insects	<i>Daphnia magna</i> / Water flea	2	48	--	601	--	--	--	IMM	C	11936
					--	1,400	--	--	--	IMM	M	13142
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	72	--	2,600	--	--	--	GRO	M	13142
	Naphthalene	crustaceans	<i>Diaptomus forbesi</i> / Calanoid copepod	1	96	67,800	--	--	--	--	MOR	M
crustaceans		<i>Gammarus minus</i> / Scud	1	48	3,930	--	--	--	--	MOR	M	11725
fish		<i>Gambusia affinis</i> / Mosquitofish	3	96	165,000	--	--	--	--	MOR	C	508
					150,000	--	--	--	--	MOR	C	508
fish		<i>Micropterus salmoides</i> / Largemouth bass	3	72	>240	--	--	--	--	MOR	C	10056
					168	510	--	--	--	MOR	C	10056
fish		<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	2	96	2,100	--	--	--	--	MOR	M	15191
					96	3,220	--	--	--	MOR	M	477
fish		<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	10	648	110	--	--	--	--	MOR	C	10056
					552	120	--	--	--	MOR	C	10056
fish		<i>Pimephales promelas</i> / Fathead minnow	7	96	1,990	--	--	--	--	MOR	M	11725
					72	6,080	--	--	--	MOR	C	10954
insects	<i>Chironomus attenuatus</i> / Midge	5	48	2,810	--	--	--	--	MOR	M	11725	
				24	13,000	--	--	--	MOR	C	7049	
insects	<i>Daphnia magna</i> / Water flea	8	48	2,160	--	--	--	--	MOR	M	11725	
				48	3,400	--	--	--	MOR	C	10359	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
Naphthalene—Continued	insects	<i>Daphnia magna</i> / Water flea	6	2	--	690	--	--	--	PTR	M	46
				48	--	2,194	--	--	IMM	M	6026	
	insects	<i>Daphnia pulex</i> / Water flea	2	96	1,000	--	--	--	--	MOR	M	15337
				48	2,920-3,890	--	--	--	MOR	C	15293	
	insects	<i>Daphnia pulex</i> / Water flea	2	48	--	4,663	--	--	--	IMM	C	3283
	insects	<i>Somatochlora cingulata</i> / Dragonfly	1	96	1,000-2,500	--	--	--	--	MOR	M	15486
	insects	<i>Tanytarsus dissimilis</i> / Midge	4	48	12,200	--	--	--	--	MOR	C	4399
				48	12,600	--	--	--	MOR	C	7049	
	invertebrates, misc.	<i>Physa gyrina</i> / Pouch snail	1	48	5,020	--	--	--	--	MOR	M	11725
plants	<i>Chlorella vulgaris</i> / Green algae	1	24	--	33,000	--	--	--	GRO	M	2215	
plants	<i>Nitzschia palea</i> / Diatom	1	4	--	2,820	--	--	--	PSE	M	11725	
plants	<i>Selenastrum capricornutum</i> / Green algae	1	4	--	2,960	--	--	--	PSE	M	11725	
2,2-Oxybis[propane]	fish	<i>Carassius auratus</i> / Goldfish	1	24	380,000	--	--	--	--	MOR	C	623
	fish	<i>Lepomis macrochirus</i> / Bluegill	1	96	7,000,000	--	--	--	--	MOR	C	863
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	96	91,700	--	--	--	--	MOR	C	10183
2-Propenal	amphibians	<i>Xenopus laevis</i> / Clawed toad	1	96	7	--	--	--	--	MOR	C	12665
				fish	<i>Amia calva</i> / Bowfin	1	24	62	--	--	--	MOR
	fish	<i>Carassius auratus</i> / Goldfish	1	24	<80	--	--	--	--	MOR	C	623
	fish	<i>Catostomus commersoni</i> / White sucker	1	96	14	--	--	--	--	MOR	C	12665
	fish	<i>Gambusia affinis</i> / Mosquitofish	2	48	61	--	--	--	--	MOR	C	2092
				24	149	--	--	--	MOR	C	2092	
	fish	<i>Lepomis macrochirus</i> / Bluegill	8	96	33	--	--	--	--	MOR	C	12665
			24	79	--	--	--	--	MOR	C	938	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
2-Propenal—Continued	fish	<i>Micropterus salmoides</i> / Largemouth bass	4	72	160	--	--	--	--	MOR	C	2092
				96	160	--	--	--	--	MOR	C	2092
	fish	<i>Oncorhynchus kisutch</i> / Coho salmon, silver salmon	1	96	68	--	--	--	--	MOR	M	561
					96	16	--	--	--	--	MOR	C
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	3	96	29	--	--	--	--	MOR	M	12182
					96	29	--	--	--	--	MOR	M
	fish	<i>Oncorhynchus tshawytscha</i> / Chinook salmon	1	24	80	--	--	--	--	MOR	M	876
					96	14	--	--	--	--	MOR	C
	fish	<i>Pimephales promelas</i> / Fathead minnow	6	96	14	--	--	--	--	MOR	C	12665
					96	14	--	--	--	--	MOR	C
	fish	<i>Rasbora heteromorpha</i> / Harlequinfish, red rasbora	2	48	60	--	--	--	--	MOR	C	542
					24	140	--	--	--	--	MOR	C
	fish	<i>Salmo trutta</i> / Brown trout	2	24	46	--	--	--	--	MOR	C	938
					48	1,500	--	--	--	--	MOR	C
	insects	<i>Daphnia magna</i> / Water flea	3	48	57	--	--	--	--	MOR	M	632
					48	83	--	--	--	--	MOR	C
	insects	<i>Daphnia magna</i> / Water flea	2	48	--	51	--	--	--	IMM	C	12665
48					--	93	--	--	--	IMM	C	2193
insects	<i>Tanytarsus dissimilis</i> / Midge	1	48	>151	--	--	--	--	MOR	C	12665	
				96	>151	--	--	--	--	MOR	C	12665
invertebrates, misc.	<i>Aplexa hypnorum</i> / Snail	1	96	>151	--	--	--	--	MOR	C	12665	
2-Propenenitrile	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	1	48	15,000	--	--	--	--	MOR	M	5938
					24	24,000	--	--	--	--	MOR	M
	fish	<i>Lepomis macrochirus</i> / Bluegill	19	96	9,300	--	--	--	--	MOR	C	7398
					96	10,000	--	--	--	--	MOR	C
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	2	48	32,000	--	--	--	--	MOR	C	10132
					24	50,000	--	--	--	--	MOR	C
	fish	Osteichthyes/ Bony fish class	1	72	40,000	--	--	--	--	MOR	M	495
					720	2,600	--	--	--	--	MOR	M
fish	<i>Pimephales promelas</i> / Fathead minnow	16	600	3,500	--	--	--	--	MOR	M	923	
				96	33,500	--	--	--	--	MOR	M	923
fish	<i>Poecilia reticulata</i> / Guppy	3	48	33,500	--	--	--	--	MOR	M	923	
				96	33,500	--	--	--	--	MOR	M	923

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
2-Propenenitrile— Continued	insects	<i>Daphnia magna</i> / Water flea	2	48	7,600	--	--	--	--	MOR	C	5184
				24	13,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	1	48	--	10,950	--	--	--	IMM	C	2193
<i>n</i> -Propylbenzene	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	96	1,550	--	--	--	--	MOR	M	13142
	insects	<i>Daphnia magna</i> / Water flea	1	24	--	2,000	--	--	--	IMM	M	13142
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	72	--	1,800	--	--	--	GRO	M	13142
Tetrachloroethene	fish	<i>Jordanella floridae</i> / Flagfish	6	96	4,000	--	--	--	--	MOR	M	140
				96	8,430	--	--	--	--	MOR	M	140
	fish	<i>Jordanella floridae</i> / Flagfish	3	240	--	--	3,100	--	--	MOR	M	140
				672	--	--	3,690	--	--	MOR	M	140
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	96	13,000	--	--	--	--	MOR	C	5590
				24	46,000	--	--	--	--	MOR	C	5590
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	11	768	1,400	--	--	--	--	MOR	C	4433
				24	4,990	--	--	--	--	MOR	C	10579
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	768	--	--	--	500-1,400	--	GRO	C	4433
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	1	48	1,600	--	--	--	--	MOR	M	12513
	fish	<i>Pimephales promelas</i> / Fathead minnow	11	96	13,400	--	--	--	--	MOR	C	11227
				96	13,400	--	--	--	--	MOR	C	12447
	fish	<i>Pimephales promelas</i> / Fathead minnow	4	24	--	14,400	--	--	--	IMM	C	973
				48	--	14,400	--	--	--	IMM	C	973
insects	<i>Daphnia magna</i> / Water flea	4	48	9,100	--	--	--	--	MOR	C	15981	
			24	18,000	--	--	--	--	MOR	C	5184	
insects	<i>Daphnia magna</i> / Water flea	3	24	--	3,200	--	--	--	IMM	M	9196	
			48	--	7,500	--	--	--	IMM	C	15981	
insects	<i>Moina macrocopa</i> / Water flea	1	3	1,800	--	--	--	--	MOR	M	12513	
insects	<i>Tanytarsus dissimilis</i> / Midge	2	48	30,800	--	--	--	--	MOR	C	10579	
			24	54,600	--	--	--	--	MOR	C	10579	



**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Tetrachloroethene— Continued	invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	1,400	--	--	--	--	MOR	M	12513
	invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	--	900	--	--	--	RGN	M	12513
	plants	<i>Selenastrum capricornutum</i> / Green algae	4	24	--	>500,000	--	--	--	CLR	M	9607
				48	--	>500,000	--	--	--	CLR	M	9607
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<500,000	CLR	M	9607
Tetrachloromethane	amphibians	<i>Bufo woodhousei fowleri</i> / Fowler's toad	2	168	--	2,830	--	--	--	TER	C	6187
				72	--	>92,000	--	--	--	TER	C	6187
	amphibians	<i>Rana catesbeiana</i> / Bullfrog	1	96	--	1,500	--	--	--	TER	C	6187
	amphibians	<i>Rana palustris</i> / Pickeral frog	2	192	--	2,370	--	--	--	TER	C	6187
				96	--	3,620	--	--	--	TER	C	6187
	amphibians	<i>Rana pipiens</i> / Leopard frog	1	192	--	900	--	--	--	TER	C	6187
	fish	<i>Lepomis macrochirus</i> / Bluegill	3	96	27,000	--	--	--	--	MOR	C	5590
				24	38,000	--	--	--	--	MOR	C	5590
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	7	48	2,000	--	--	--	--	MOR	M	12513
				24	670,000	--	--	--	--	MOR	M	12497
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	96	41,400	--	--	--	--	MOR	C	3217
				96	43,100	--	--	--	--	MOR	C	3783
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	168	--	--	73,200	--	--	MOR	C	3783
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	168	--	--	--	52,100	--	MOR	C	3783
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	168	--	--	--	--	37,100	MOR	C	3783
	insects	<i>Daphnia magna</i> / Water flea	3	24	35,000	--	--	--	--	MOR	C	5184
			48	35,000	--	--	--	--	MOR	C	5184	
insects	<i>Daphnia magna</i> / Water flea	1	24	--	97,000	--	--	--	IMM	M	9196	
insects	<i>Moina macrocopa</i> / Water flea	1	3	2,300	--	--	--	--	MOR	M	12513	
invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	200	--	--	--	--	MOR	M	12513	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
Tetrachloromethane— Continued	invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	--	1,500	--	--	--	RGN	M	12513
Tribromomethane	fish	<i>Cyprinus carpio</i> / Common, mirror, colored carp	2	72-120	52,000	--	--	--	--	MOR	M	6360
				72-120	80,000	--	--	--	--	MOR	M	6360
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	96	29,000	--	--	--	--	MOR	C	5590
				24	33,000	--	--	--	--	MOR	C	5590
	insects	<i>Daphnia magna</i> / Water flea	2	48	46,000	--	--	--	--	MOR	C	5184
				24	56,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia pulex</i> / Water flea	1	96	44,000	--	--	--	--	MOR	M	6256
	plants	<i>Selenastrum capricornutum</i> / Green algae	5	96	--	38,600	--	--	--	CLR	M	9607
				96	--	40,100	--	--	--	PGR	M	9607
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	10,000	CLR	M	9607
1,2,3-Trichlorobenzene	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	2	672	990	--	--	--	--	MOR	M	3279
				48	3,100	--	--	--	--	MOR	M	15526
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	4	168	--	--	--	--	450	REP	M	3279
				336	--	--	--	--	450	REP	M	3279
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	48	710	--	--	--	--	MOR	M	15526
	fish	<i>Poecilia reticulata</i> / Guppy	3	96	348	--	--	--	--	MOR	M	2422
				24	686	--	--	--	--	MOR	M	2422
	insects	<i>Chironomus riparius</i> / Midge	1	48	1,700	--	--	--	--	MOR	C	4072
	insects	<i>Chironomus riparius</i> / Midge	2	96-98	--	--	--	--	18	BEH	C	14176
				48	--	--	--	--	340	MOR	M	4072
	insects	<i>Daphnia magna</i> / Water flea	7	336	--	200	--	--	--	REP	M	15526
				24	--	350	--	--	--	IMM	M	15526
	insects	<i>Daphnia magna</i> / Water flea	1	96	--	--	--	--	30	REP	M	847
	plants	<i>Cyclotella meneghiniana</i> / Diatom	1	48	--	6,420	--	--	--	CYT	C	88
1,2,4-Trichlorobenzene	crustaceans	<i>Orconectes immunis</i> / Crayfish	1	96	3,020	--	--	--	--	MOR	C	12665

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
1,2,4-Trichlorobenzene— Continued	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	1	48	6,300	--	--	--	--	MOR	M	15526
	fish	<i>Jordanella floridae</i> / Flagfish	6	96	1,217	--	--	--	--	MOR	M	140
				72	1,285	--	--	--	--	MOR	M	140
	fish	<i>Jordanella floridae</i> / Flagfish	1	240	--	--	1,130	--	--	MOR	M	140
	fish	<i>Lepomis macrochirus</i> / Bluegill	3	96	3,020	--	--	--	--	MOR	C	12665
				96	3,400	--	--	--	--	MOR	C	5590
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	10	192	1,280	--	--	--	--	MOR	C	10579
				96	1,320	--	--	--	--	MOR	C	12665
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	2,304	--	1,270	--	--	--	EQU	C	4433
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	7	2,040	--	--	470	--	--	GRO	M	6914
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	9	1,080	--	--	--	406	--	GRO	C	6914
				2,040	--	--	--	406	--	GRO	C	6914
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	7	1,080	--	--	--	--	350	GRO	M	6914
				2,040	--	--	--	--	350	GRO	M	6914
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	1	48	1,100	--	--	--	--	MOR	M	12513
	fish	<i>Pimephales promelas</i> / Fathead minnow	3	96	2,760	--	--	--	--	MOR	M	12123
				96	2,990	--	--	--	--	MOR	C	3217
	insects	<i>Daphnia magna</i> / Water flea	5	48	1,700	--	--	--	--	MOR	C	15981
				48	2,100	--	--	--	--	MOR	C	15981
	insects	<i>Daphnia magna</i> / Water flea	4	336	--	450	--	--	--	REP	M	15526
			24	--	1,200	--	--	--	IMM	M	15526	
insects	<i>Moina macrocopa</i> / Water flea	1	3	1,400	--	--	--	--	MOR	M	12513	
insects	<i>Tanytarsus dissimilis</i> / Midge	1	48	930	--	--	--	--	MOR	C	12665	
invertebrates, misc.	<i>Aplexa hypnorum</i> / Snail	1	96	3,160	--	--	--	--	MOR	C	12665	
invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	1,100	--	--	--	--	MOR	M	12513	
invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	--	1,100	--	--	--	RGN	M	12513	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
1,2,4-Trichlorobenzene— Continued	plants	<i>Cyclotella meneghiniana</i> / Diatom	1	48	--	2,830	--	--	--	CYT	C	88
	plants	<i>Scenedesmus abundans</i> / Green algae	1	96	--	8,400	--	--	--	GRO	M	11677
	plants	<i>Selenastrum capricornutum</i> / Green algae	5	72 48	-- --	21,700 22,400	-- --	-- --	-- --	CLR CLR	M M	9607 9607
1,1,1-Trichloroethane	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	1	336	--	--	--	--	7,700	GRO	M	489
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	24	40,000	--	--	--	--	MOR	C	5590
			96	40,000	--	--	--	--	MOR	C	5590	
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	6	24	>1,000,000	--	--	--	--	MOR	M	12497
			48	>1,000,000	--	--	--	--	MOR	M	12497	
	fish	<i>Pimephales promelas</i> / Fathead minnow	5	96	42,300	--	--	--	--	MOR	C	12858
			96	52,800	--	--	--	--	MOR	C	973	
	fish	<i>Pimephales promelas</i> / Fathead minnow	4	72	--	11,100	--	--	--	IMM	C	973
			96	--	11,100	--	--	--	IMM	C	973	
	insects	<i>Daphnia magna</i> / Water flea	4	408	5,400	--	--	--	--	MOR	C	489
			24	>530,000	--	--	--	--	MOR	C	5184	
	insects	<i>Daphnia magna</i> / Water flea	2	408	--	--	--	--	1,300	MOR	M	489
			408	--	--	--	--	1,300	REP	M	489	
plants	<i>Selenastrum capricornutum</i> / Green algae	4	24	--	>500,000	--	--	--	CLR	M	9607	
		48	--	>500,000	--	--	--	CLR	M	9607		
plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<125,000	CLR	M	9607	
1,1,2-Trichloroethane	fish	<i>Jordanella floridae</i> / Flagfish	7	96	45,117	--	--	--	--	MOR	M	140
			72	50,142	--	--	--	--	MOR	M	140	
	fish	<i>Jordanella floridae</i> / Flagfish	3	240	--	--	31,200	--	--	MOR	M	140
			672	--	--	47,600	--	--	MOR	M	140	
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	768	--	--	--	6,000- 14,800	--	GRO	C	4433
	fish	<i>Pimephales promelas</i> / Fathead minnow	5	24	81,600	--	--	--	--	MOR	C	11227
			48	81,600	--	--	--	--	MOR	C	11227	
	fish	<i>Poecilia reticulata</i> / Guppy	10	168	40,000	--	--	--	--	MOR	M	15149
			24	43,000	--	--	--	--	MOR	M	15149	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
1,1,2-Trichloroethane— Continued	insects	<i>Chironomus riparius</i> / Midge	1	48	147,000	--	--	--	--	MOR	C	4072
	insects	<i>Chironomus riparius</i> / Midge	1	48	--	--	--	--	<31,000	MOR	M	4072
	insects	<i>Daphnia magna</i> / Water flea	17	48	18,000	--	--	--	--	MOR	C	5184
				24	19,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	3	72	--	32,000	--	--	--	REP	M	15149
				48	--	78,000	--	--	--	IMM	C	15981
	invertebrates, misc.	<i>Dreissena polymorpha</i> / Zebra mussel	3	336	140,000	--	--	--	--	MOR	M	15149
				168	190,000	--	--	--	--	MOR	M	15149
	invertebrates, misc.	<i>Lymnaea stagnalis</i> / Great pond snail	2	384	58,000	--	--	--	--	MOR	M	15149
				96	170,000	--	--	--	--	MOR	M	15149
invertebrates, misc.	<i>Lymnaea stagnalis</i> / Great pond snail	2	384	--	36,000	--	--	--	ABN	M	15149	
			384	--	36,000	--	--	--	HAT	M	15149	
1,1,2-Trichloroethene	amphibians	<i>Xenopus laevis</i> / Clawed toad	1	48	45,000	--	--	--	--	MOR	M	9740
	amphibians	<i>Ambystoma mexicanum</i> / Mexican axolotl	1	48	48,000	--	--	--	--	MOR	M	9740
	crustaceans	<i>Gammarus pulex</i> / Scud	1	48	24,000	--	--	--	--	MOR	M	15788
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	1	48	60,000	--	--	--	--	MOR	M	5938
	fish	<i>Jordanella floridae</i> / Flagfish	7	96	3,100	--	--	--	--	MOR	M	140
				96	28,280	--	--	--	--	MOR	M	140
	fish	<i>Jordanella floridae</i> / Flagfish	3	240	--	--	11,000	--	--	MOR	M	140
				672	--	--	14,850	--	--	MOR	M	140
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	96	45,000	--	--	--	--	MOR	C	5590
				24	>68,000- <100,000	--	--	--	--	MOR	C	5590
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	48	42,000	--	--	--	--	MOR	M	10574
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	8	48	1,900	--	--	--	--	MOR	M	12513
						270,000	--	--	--	--	MOR	M
fish	<i>Pimephales promelas</i> / Fathead minnow	11	72	39,000	--	--	--	--	MOR	C	973	
			96	40,700	--	--	--	--	MOR	C	973	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
Target analytes—Continued												
1,1,2-Trichloroethene— Continued	fish	<i>Pimephales promelas</i> / Fathead minnow	4	96	--	21,900	--	--	--	IMM	C	973
				72	--	22,200	--	--	--	IMM	C	973
	insects	<i>Aedes aegypti</i> / Mosquito	1	48	48,000	--	--	--	--	MOR	M	10574
	insects	<i>Asellus aquaticus</i> / Aquatic sowbug	1	48	30,000	--	--	--	--	MOR	M	15788
	insects	<i>Chironomus thummi</i> / Midge	1	48	64,000	--	--	--	--	MOR	M	15788
	insects	<i>Cloeon dipterum</i> / Mayfly	1	48	42,000	--	--	--	--	MOR	M	15788
	insects	<i>Corixa punctata</i> / Water boatman	1	48	110,000	--	--	--	--	MOR	M	15788
	insects	<i>Culex pipiens</i> / Mosquito	1	48	55,000	--	--	--	--	MOR	M	10574
	insects	<i>Daphnia cucullata</i> / Water flea	2	48	56,000	--	--	--	--	MOR	M	2017
				48	58,000	--	--	--	--	MOR	M	2017
	insects	<i>Daphnia magna</i> / Water flea	9	48	18,000	--	--	--	--	MOR	C	5184
				24	22,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	2	48	--	7,751	--	--	--	IMM	M	11926
				24	--	76,000	--	--	--	IMM	M	9196
	insects	<i>Daphnia pulex</i> / Water flea	2	48	39,000	--	--	--	--	MOR	M	2017
				48	51,000	--	--	--	--	MOR	M	2017
	insects	<i>Ischnura elegans</i> / Dragonfly	1	48	49,000	--	--	--	--	MOR	M	15788
	insects	<i>Moina macrocopa</i> / Water flea	1	3	2,300	--	--	--	--	MOR	M	12513
	insects	<i>Nemoura cinerea</i> / Stonefly	1	48	70,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	1,700	--	--	--	--	MOR	M	12513
	invertebrates, misc.	<i>Dugesia japonica</i> / Flatworm	1	168	--	1,700	--	--	--	RGN	M	12513
	invertebrates, misc.	<i>Dugesia lugubris</i> / Turbellarian, flatworm	1	48	42,000	--	--	--	--	MOR	M	15788

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
1,1,2-Trichloroethene— Continued	invertebrates, misc.	<i>Erpobdella octoculata</i> / Leech	1	48	75,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Hydra oligactis</i> / Hydra	2	48	75,000	--	--	--	--	MOR	M	10574
				48	75,000	--	--	--	MOR	M	15788	
	invertebrates, misc.	<i>Lymnaea stagnalis</i> / Great pond snail	2	48	56,000	--	--	--	--	MOR	M	10574
				48	56,000	--	--	--	MOR	M	15788	
invertebrates, misc.	Oligochaeta (order)/ Tubificidae (family)	1	48	132,000	--	--	--	--	MOR	M	15788	
plants	<i>Scenedesmus abundans</i> / Green algae	1	96	--	450,000	--	--	--	GRO	M	11677	
Trichloromethane	amphibians	<i>Bufo woodhousei fowleri</i> / Fowler's toad	2	168	--	35,140	--	--	--	TER	C	6187
				72	--	>40,000	--	--	--	TER	C	6187
	amphibians	<i>Hyla crucifer</i> / Spring peeper	2	168	--	270	--	--	--	TER	C	6187
				72	--	760	--	--	--	TER	C	6187
	amphibians	<i>Rana palustris</i> / Pickeral frog	2	192	--	20,550	--	--	--	TER	C	6187
				96	--	28,170	--	--	--	TER	C	6187
	amphibians	<i>Rana pipiens</i> / Leopard frog	2	216	--	4,160	--	--	--	TER	C	6187
				120	--	4,560	--	--	--	TER	C	6187
	crustaceans	<i>Penaeus duorarum</i> / Pink shrimp (American)	1	96	--	--	--	--	32,000	MOR	M	2644
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebrafish	1	48	100,000	--	--	--	--	MOR	M	5938
	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	1	72-120	97,000	--	--	--	--	MOR	M	6360
	fish	<i>Ictalurus punctatus</i> / Channel catfish	6	96	75,000	--	--	--	--	MOR	C	5267
				48	101,000	--	--	--	MOR	C	5267	
	fish	<i>Lepomis macrochirus</i> / Bluegill	33	168	2,030	--	--	--	--	MOR	C	5272
				96	13,300	--	--	--	MOR	C	5267	
fish	<i>Lepomis macrochirus</i> / Bluegill	2	96	--	--	--	--	75,000	MOR	M	2644	
			96	--	--	--	100,000	MOR	M	2644		
fish	<i>Micropterus salmoides</i> / Largemouth bass	17	12	45,400	--	--	--	--	MOR	C	5267	
			24	45,400	--	--	--	MOR	C	5267		
fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	29	672	1,240	--	--	--	--	MOR	C	563	
			672	1,240	--	--	--	MOR	C	5272		
fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	2	96	--	--	--	--	24,000	MOR	M	2644	
			96	--	--	--	42,000	MOR	M	2644		

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Target analytes—Continued</b>												
Trichloromethane— Continued	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	6	24	500,000	--	--	--	--	MOR	M	12497
				48	500,000	--	--	--	--	MOR	M	12497
	fish	<i>Pimephales promelas</i> / Fathead minnow	4	96	70,700	--	--	--	--	MOR	C	3217
				96	103,000	--	--	--	--	MOR	C	10432
	insects	<i>Ceriodaphnia dubia</i> / Water flea	2	216	235,000	--	--	--	--	MOR	C	212
				48	290,000	--	--	--	--	MOR	C	212
	insects	<i>Ceriodaphnia dubia</i> / Water flea	3	168-240	--	311,000	--	--	--	REP	C	212
				168-240	--	343,000	--	--	--	REP	C	212
	insects	<i>Ceriodaphnia dubia</i> / Water flea	4	168-240	--	--	--	3,400	MOR	M	212	
				168-240	--	--	--	200,000	REP	M	212	
	insects	<i>Daphnia magna</i> / Water flea	5	24	29,000	--	--	--	--	MOR	C	5184
				48	29,000	--	--	--	--	MOR	C	5184
	insects	<i>Daphnia magna</i> / Water flea	7	48	--	51,568	--	--	--	IMM	M	11926
				24	--	79,000	--	--	--	IMM	C	847
	insects	<i>Daphnia magna</i> / Water flea	5	504	--	--	--	6,300	REP	M	847	
				216-264	--	--	--	120,000	MOR	M	212	
	invertebrates, misc.	<i>Brachionus calyciflorus</i> / Rotifer	1	1	2,000	--	--	--	--	MOR	M	9385
	plants	<i>Scenedesmus subspicatus</i> / Green algae	2	48	--	560,000	--	--	--	BMS	M	2997
				48	--	950,000	--	--	--	GRO	M	2997
1,2,3-Trichloropropane	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	66,500	--	--	--	--	MOR	C	3217
1,2,4-Trimethylbenzene	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	7,720	--	--	--	--	MOR	C	12858
	insects	<i>Daphnia magna</i> / Water flea	1	48	--	3,600	--	--	--	IMM	C	11936
<b>Other analytes</b>												
Bromochloromethane	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	1	72-120	67,000	--	--	--	--	MOR	M	6360
2-Butanone	fish	<i>Carassius auratus</i> / Goldfish	1	24	2,400,000	--	--	--	--	MOR	M	5773
				3	24	5,600,000	--	--	--	--	MOR	C
		<i>Gambusia affinis</i> / Mosquitofish		48	5,600,000	--	--	--	--	MOR	C	508
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	24	5,640,000	--	--	--	--	MOR	C	922
				48	5,640,000	--	--	--	--	MOR	C	922



**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Other analytes—Continued</b>												
2-Butanone—Continued	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	3,220,000	--	--	--	--	MOR	C	12448
	insects	<i>Daphnia magna</i> / Water flea	3	24	>520,000	--	--	--	--	MOR	C	5184
				48	>520,000	--	--	--	MOR	C	5184	
insects	<i>Daphnia magna</i> / Water flea	1	48	--	5,091,000	--	--	--	IMM	C	2193	
Carbon disulfide	fish	<i>Gambusia affinis</i> / Mosquitofish	3	48	135,000	--	--	--	--	MOR	C	508
				96	135,000	--	--	--	MOR	C	508	
	fish	<i>Poecilia reticulata</i> / Guppy	1	96	4,000	--	--	--	MOR	M	11455	
	insects	<i>Daphnia magna</i> / Water flea	1	48	2,100	--	--	--	MOR	M	11455	
	plants	<i>Chorella pyrenoidosa</i> / Green algae	1	96	--	21,000	--	--	--	GRO	M	11455
1-Chloro-2-methylbenzene	insects	<i>Daphnia magna</i> / Water flea	1	24	74,000	--	--	--	--	MOR	C	5718
	insects	<i>Daphnia magna</i> / Water flea	1	24	--	20,000	--	--	--	IMM	C	847
	insects	<i>Daphnia magna</i> / Water flea	1	504	--	--	--	--	140	REP	M	847
	plants	<i>Scenedesmus suspicatus</i> / Green algae	5	48	--	>100,000	--	--	--	BMS	M	2997
				48	--	>100,000	--	--	GRO	M	2997	
1-Chloro-4-methylbenzene	fish	<i>Brachydanio rerio</i> / Zebra danio, zebra fish	1	672	4,400	--	--	--	--	MOR	M	3279
	fish	<i>Brachydanio rerio</i> / Zebra danio, zebra fish	4	336	--	--	--	--	3,400	REP	M	3279
				504	--	--	--	3,400	REP	M	3279	
3-Chloro-1-propene	amphibians	<i>Xenopus laevis</i> / Clawed toad	1	48	340	--	--	--	--	MOR	M	12152
	fish	<i>Carassius auratus</i> / Goldfish	4	24	10,000	--	--	--	--	MOR	C	623
				48	20,870	--	--	--	MOR	C	728	
	fish	<i>Lepomis macrochirus</i> / Bluegill	3	48	42,330	--	--	--	--	MOR	C	728
				96	42,330	--	--	--	MOR	C	728	
	fish	<i>Pimephales promelas</i> / Fathead minnow	6	96	19,780	--	--	--	--	MOR	C	728
				24	24,000	--	--	--	MOR	C	728	
fish	<i>Poecilia reticulata</i> / Guppy	3	96	51,080	--	--	--	--	MOR	C	728	
			48	53,540	--	--	--	--	MOR	C	728	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Other analytes—Continued</b>												
1,3-Dichloropropane	insects	<i>Daphnia magna</i> / Water flea	1	24	250,000	--	--	--	--	MOR	C	5718
	amphibians	<i>Xenopus laevis</i> / Clawed toad	1	48	63,000	--	--	--	--	MOR	M	12152
	fish	<i>Carassius auratus</i> / Goldfish	1	24	160,000	--	--	--	--	MOR	C	623
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	24	>520,000	--	--	--	--	MOR	C	5590
			96	>520,000	--	--	--	--	MOR	C	5590	
	fish	<i>Pimephales promelas</i> / Fathead minnow	6	96	94,200	--	--	--	--	MOR	C	12448
			48	131,000	--	--	--	--	MOR	C	11227	
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	--	8,000- 16,000	--	GRO	C	15301
	insects	<i>Daphnia magna</i> / Water flea	2	48	280,000	--	--	--	--	MOR	C	5184
			24	490,000	--	--	--	--	MOR	C	5184	
plants	<i>Selenastrum capricornutum</i> / Green algae	5	96	--	40,000	--	--	--	CLR	M	9607	
		96	--	60,100	--	--	--	PGR	M	9607		
plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<5,600	CLR	M	9607	
(1,1-Dimethylethyl)benzene	insects	<i>Daphnia magna</i> / Water flea	1	24	41,000	--	--	--	--	MOR	C	5718
1,4-Epoxybutane	fish	<i>Carassius auratus</i> / Goldfish	1	48	2,400,000	--	--	--	--	MOR	M	15192
	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	1	48	4,400,000	--	--	--	--	MOR	M	15192
	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	1	48	5,800,000	--	--	--	--	MOR	M	15192
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	2,160,000	--	--	--	--	MOR	C	12448
	insects	<i>Daphnia magna</i> / Water flea	1	24	>10,000,000	--	--	--	--	MOR	C	5718
	insects	<i>Daphnia pulex</i> / Water flea	1	3	8,900,000	--	--	--	--	MOR	M	15192
	insects	<i>Moina macrocopa</i> / Water flea	1	3	9,800,000	--	--	--	--	MOR	M	15192

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Other analytes—Continued</b>												
2-Hexanone	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	428,000	--	--	--	--	MOR	C	12858
1-Isopropyl-4-methyl- benzene	crustaceans	<i>Mysidopsis bahia</i> / Opossum shrimp	1	96	4,400	--	--	--	--	MOR	M	9607
	fish	<i>Cyprinodon variegatus</i> / Sheepshead minnow	4	72	48,000	--	--	--	--	MOR	C	10366
				96	48,000	--	--	--	MOR	C	10366	
	insects	<i>Daphnia magna</i> / Water flea	1	48	6,500	--	--	--	--	MOR	C	5184
plants	<i>Skeletonema costatum</i> / Diatom	1	96	--	22,000	--	--	--	PSE	M	9607	
Methyl 2-methyl- 2-propenoate	fish	<i>Carassius auratus</i> / Goldfish	4	96	277,100	--	--	--	--	MOR	C	728
				24	420,000	--	--	--	MOR	M	5773	
	fish	<i>Lepomis macrochirus</i> / Bluegill	17	96	191,000	--	--	--	--	MOR	C	7398
				96	232,200	--	--	--	MOR	C	728	
	fish	Osteichthyes/ Bony fish class	1	72	550,000	--	--	--	--	MOR	M	495
	fish	<i>Pimephales promelas</i> / Fathead minnow	40	96	130,000	--	--	--	--	MOR	C	728
				96	150,000	--	--	--	MOR	C	728	
	fish	<i>Poecilia reticulata</i> / Guppy	3	24	368,100	--	--	--	--	MOR	C	728
48				368,100	--	--	--	MOR	C	728		
insects	<i>Daphnia magna</i> / Water flea	1	24	1,760,000	--	--	--	--	MOR	C	5718	
4-Methyl-2-pentanone	fish	<i>Carassius auratus</i> / Goldfish	1	24	460,000	--	--	--	--	MOR	C	623
	fish	<i>Pimephales promelas</i> / Fathead minnow	2	96	505,000	--	--	--	--	MOR	C	12448
				96	540,000	--	--	--	MOR	C	12448	
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	768	--	--	--	--	57,000- 105,000	GRO	M	3690
	insects	<i>Chironomus riparius</i> / Midge	1	96-98	--	--	--	--	44,070	BEH	C	14176
	insects	<i>Daphnia magna</i> / Water flea	1	24	4,280,000	--	--	--	--	MOR	C	5718
	insects	<i>Daphnia magna</i> / Water flea	1	24	--	3,682,000	--	--	--	IMM	C	847

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.	
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC				
<b>Other analytes—Continued</b>													
4-Methyl-2-pentanone— Continued	insects	<i>Daphnia magna</i> / Water flea	1	504	--	--	--	--	7,800- 39,000	REP	M	847	
	plants	<i>Scenedesmus subspicatus</i> / Green algae	2	48	--	980,000	--	--	--	BMS	M	2997	
				48	--	2,000,000	--	--	--	GRO	M	2997	
Methyl-2-propenoate	fish	Osteichthyes/ Bony fish class	1	72	5,000	--	--	--	--	MOR	M	495	
1,1'-Oxybisethane	fish	<i>Oryzias latipes</i> / Medaka, high-eyes	6	24	>1,000,000	--	--	--	--	MOR	M	12497	
				48	>1,000,000	--	--	--	--	MOR	M	12497	
	fish	<i>Pimephales promelas</i> / Fathead minnow	1	96	2,560,000	--	--	--	--	MOR	C	12858	
2-Propanone	amphibians	<i>Ambystoma mexicanum</i> / Mexican axolotl	1	48	20,000,000	--	--	--	--	MOR	M	9740	
	amphibians	<i>Xenopus laevis</i> / Clawed toad	1	48	24,000,000	--	--	--	--	MOR	M	9740	
	crustaceans	<i>Gammarus fasciatus</i> / Scud	2	96	>100,000	--	--	--	--	MOR	C	11951	
				48	6,000,000	--	--	--	--	MOR	M	15788	
	crustaceans	<i>Palaemonetes kadiakensis</i> / Grass shrimp, freshwater prawn	1	18	2,610,000	--	--	--	--	MOR	M	2192	
	fish	<i>Carassius auratus</i> / Goldfish	1	48	11,000,000	--	--	--	--	MOR	M	15192	
	fish	<i>Cyprinus carpio</i> / Common, mirror, colored, carp	1	48	15,000,000	--	--	--	--	--	MOR	M	15192
	fish	<i>Gambusia affinis</i> / Mosquitofish	3	48	13,000,000	--	--	--	--	MOR	C	508	
				96	13,000,000	--	--	--	--	MOR	C	508	
	fish	<i>Lepomis macrochirus</i> / Bluegill	7	115	7,052,000	--	--	--	--	MOR	C	2470	
				168	7,052,000	--	--	--	--	MOR	C	2470	
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	3	96	5,540,000	--	--	--	--	MOR	C	666	
				24	6,100,000	--	--	--	--	MOR	C	991	
fish	<i>Oryzias latipes</i> / Medaka, high-eyes	8	24	8,300,000	--	--	--	--	MOR	M	12497		
			48	8,300,000	--	--	--	--	MOR	M	12497		
fish	<i>Pimephales promelas</i> / Fathead minnow	17	96	>100,000	--	--	--	--	MOR	C	11951		
			96	6,210,000	--	--	--	--	MOR	C	12448		
fish	<i>Pimephales promelas</i> / Fathead minnow	2	48	--	8,990,000	--	--	--	EQU	C	4154		
			24	--	9,190,000	--	--	--	EQU	C	4154		

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Other analytes—Continued</b>												
2-Propanone—Continued	fish	<i>Poecilia reticulata</i> / Guppy	1	24	9,500,000	--	--	--	--	MOR	M	7367
	fish	<i>Rasbora heteromorpha</i> / Harlequinfish, red rasbora	2	48	4,000,000	--	--	--	--	MOR	C	542
				24	5,700,000	--	--	--	--	MOR	C	542
	fish	<i>Salvelinus fontinalis</i> / Brook trout	3	104	6,071,000	--	--	--	--	MOR	C	2470
				168	6,071,000	--	--	--	--	MOR	C	2470
	insects	<i>Aedes aegypti</i> / Mosquito	1	48	15,000,000	--	--	--	--	MOR	M	10574
	insects	<i>Asellus aquaticus</i> / Aquatic sowbug	1	48	7,550,000	--	--	--	--	MOR	M	15788
	insects	<i>Asellus intermedius</i> / Aquatic sowbug	1	96	>100,000	--	--	--	--	MOR	C	11951
	insects	<i>Ceriodaphnia dubia</i> / Water flea	2	240	6,693,000	--	--	--	--	MOR	C	212
				48	8,098,000	--	--	--	--	MOR	C	212
	insects	<i>Ceriodaphnia dubia</i> / Water flea	3	168-240	--	5,908,000	--	--	--	REP	C	212
				168-240	--	6,469,000	--	--	--	REP	C	212
	insects	<i>Ceriodaphnia dubia</i> / Water flea	4	168-240	--	--	--	--	1,866,000	REP	M	212
				168-240	--	--	--	--	5,184,000	REP	M	212
	insects	<i>Chironomus tentans</i> / Midge	2	48	13,000,000	--	--	--	--	MOR	M	15788
				48	46,900,000	--	--	--	--	MOR	M	7884
	insects	<i>Cloeon dipterum</i> / Mayfly	1	48	7,600,000	--	--	--	--	MOR	M	15788
	insects	<i>Corixa punctata</i> / Water boatman	1	48	5,000,000	--	--	--	--	MOR	M	15788
	insects	<i>Culex pipiens</i> / Mosquito	1	48	17,000,000	--	--	--	--	MOR	M	10574
	insects	<i>Culex restuans</i> / White dotted mosquito	1	18	6,190,000	--	--	--	--	MOR	M	2192
	insects	<i>Daphnia cucullata</i> / Water flea	2	48	7,460,000	--	--	--	--	MOR	M	2017
				48	7,810,000	--	--	--	--	MOR	M	2017
	insects	<i>Daphnia magna</i> / Water flea	12	24	10,000	--	--	--	--	MOR	M	915
				48	10,000	--	--	--	--	MOR	M	915
	insects	<i>Daphnia magna</i> / Water flea	4	216-264	--	6,389,000	--	--	--	REP	C	212
				216-264	--	6,406,000	--	--	--	REP	C	212
	insects	<i>Daphnia magna</i> / Water flea	1	672	--	--	--	>1,103,200- <2,206,400	--	MOR	C	10694

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Other analytes—Continued</b>												
2-Propanone—Continued	insects	<i>Daphnia magna</i> / Water flea	4	216-264	--	--	--	--	<403,000	MOR	M	212
				216-264	--	--	--	--	3,110,000	REP	M	212
	insects	<i>Daphnia pulex</i> / Water flea	3	18	1,220,000	--	--	--	--	MOR	M	2192
				48	8,800,000	--	--	--	--	MOR	M	2017
	insects	<i>Ischnura elegans</i> / Dragonfly	1	48	6,400,000	--	--	--	--	MOR	M	15788
	insects	<i>Moina macrocopa</i> / Water flea	1	3	15,000,000	--	--	--	--	MOR	M	15192
	insects	<i>Nemoura cinerea</i> / Stonefly	1	48	10,300,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Anodonta imbecillis</i> / Mussel	1	48	33,830	--	--	--	--	MOR	C	8099
	invertebrates, misc.	<i>Brachionus calyciflorus</i> / Rotifer	1	24	51,000	--	--	--	--	MOR	M	9385
	invertebrates, misc.	<i>Cipangopaludina malleata</i> / Mud snail	1	48	48,000,000	--	--	--	--	MOR	M	9158
	invertebrates, misc.	<i>Corbicula manilensis</i> / Asiatic clam	1	96	>20,000,000	--	--	--	--	MOR	M	418
	invertebrates, misc.	<i>Dugesia lugubri</i> / Turbellarian, flatworm	2	96	>100,000	--	--	--	--	MOR	C	11951
				48	7,500,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Erpobdella octoculata</i> / Leech	1	48	7,000,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Helisoma trivolvis</i> / Ramshorn snail	1	96	>100,000	--	--	--	--	MOR	C	11951
	invertebrates, misc.	<i>Hydra oligactis</i> / Hydra	2	48	13,500,000	--	--	--	--	MOR	M	10574
				48	13,500,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Indoplanorbis exustus</i> / Snail	1	48	35,000,000	--	--	--	--	MOR	M	9158
	invertebrates, misc.	<i>Lumbriculus variegatus</i> / Oligochaete	1	96	>100,000	--	--	--	--	MOR	C	11951
	invertebrates, misc.	<i>Lymnaea stagnalis</i> / Great pond snail	2	48	7,000,000	--	--	--	--	MOR	M	10574
				48	7,000,000	--	--	--	--	MOR	M	15788
	invertebrates, misc.	<i>Paramecium caudatum</i> / Ciliate	1	4	5,227,200	--	--	--	--	MOR	M	3029

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End-point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Other analytes—Continued</b>												
2-Propanone—Continued	invertebrates, misc.	<i>Physa acuta</i> / Bladder snail	1	48	35,000,000	--	--	--	--	MOR	M	9158
	invertebrates, misc.	<i>Semisulcospira libertina</i> / Marsh snail	1	48	35,000,000	--	--	--	--	MOR	M	9158
	invertebrates, misc.	Oligochaete (order)/ Tubificidae (family)	1	48	15,000,000	--	--	--	--	MOR	M	15788
	plants	<i>Anabaena cylindrica</i> / Blue-green algae	1	240-336	--	4,568,528	--	--	--	GRO	M	12597
	plants	<i>Anabaena inaequalis</i> / Blue-green algae	1	240-336	--	34,898,477	--	--	--	GRO	M	12597
	plants	<i>Anabaena sp</i> / Blue-green algae	1	240-336	--	7,106,599	--	--	--	GRO	M	12597
	plants	<i>Anabaina variabilis</i> / Blue-green algae	1	240-336	--	46,827,411	--	--	--	GRO	M	12597
	plants	<i>Nitzschia linearis</i> / Diatom	1	120	11,493- 11,727	--	--	--	--	MOR	M	949
	plants	<i>Nostoc sp</i> / Blue-green algae	1	240-336	--	55,583,756	--	--	--	GRO	M	12597
1,1,1,2-Tetrachloroethane	fish	<i>Lepomis macrochirus</i> / Bluegill	2	24	20,000	--	--	--	--	MOR	C	5590
				96	20,000	--	--	--	--	MOR	C	5590
	insects	<i>Daphnia magna</i> / Water flea	2	48	24,000	--	--	--	--	MOR	C	5184
				24	27,000	--	--	--	--	MOR	C	5184
1,1,2,2-Tetrachloroethane	fish	<i>Jordanella floridae</i> / Flagfish	3	240	--	--	7,230	--	--	MOR	M	140
				672	--	--	8,465	--	--	MOR	M	140
	fish	<i>Lepomis macrochirus</i> / Bluegill	2	24	21,000	--	--	--	--	MOR	C	5590
				96	21,000	--	--	--	--	MOR	C	5590
	fish	<i>Oncorhynchus mykiss</i> / Rainbow trout, donaldson trout	1	768	--	--	--	1,400- 4,000	--	GRO	C	4433
	fish	<i>Pimephales promelas</i> / Fathead minnow	5	96	20,300	--	--	--	--	MOR	C	12447
				72	20,400	--	--	--	--	MOR	C	11227
	insects	<i>Daphnia magna</i> / Water flea	4	48	9,300	--	--	--	--	MOR	C	5184
				24	18,000	--	--	--	--	MOR	C	5184
48				--	23,000	--	--	--	IMM	C	15981	
insects	<i>Daphnia magna</i> / Water flea	2	48	--	25,000	--	--	--	IMM	C	15981	

**Table 5.** Aquatic toxicity information for selected volatile organic compounds measured by the U.S. Geological Survey—Continued

IUPAC compound name	Taxonomic classification	Genus, species/ common name	n	Duration (hours)	Measures of toxicity (micrograms per liter)					End- point effect	DC	Source no.
					LC <sub>50</sub>	EC <sub>50</sub>	LOEC	MATC	NOEC			
<b>Other analytes—Continued</b>												
1,1,2,2-Tetrachloro- ethane—Continued	plants	<i>Selenastrum capricornutum</i> / Green algae	5	48	--	73,400	--	--	--	CLR	M	9607
				72	--	76,900	--	--	CLR	M	9607	
	plants	<i>Selenastrum capricornutum</i> / Green algae	1	96	--	--	--	--	<10,000	CLR	M	9607
1,3,5-Trimethylbenzene	fish	<i>Carassius auratus</i> / Goldfish	4	96	12,520	--	--	--	--	MOR	C	416
				72	13,650	--	--	--	MOR	C	416	
	insects	<i>Daphnia magna</i> / Water flea	2	48	--	6,011	--	--	--	IMM	C	11936
				24	--	50,000	--	--	IMM	C	847	
	insects	<i>Daphnia magna</i> / Water flea	1	504	--	--	--	--	400	REP	M	847
	plants	<i>Scenedesmus subspicatus</i> / Green algae	2	48	--	25,000	--	--	--	BMS	M	2997
48				--	53,000	--	--	GRO	M	2997		



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REFERENCES CONTAINING  
AQUATIC TOXICITY INFORMATION

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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study

[Source number may be used to retrieve citation from AQUIRE data base (U.S. Environmental Protection, 1996a)]

Source no. (table 5)	References cited
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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

Source no. (table 5)	References cited
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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

Source no. (table 5)	References cited
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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

Source no. (table 5)	References cited
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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

Source no. (table 5)	References cited
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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

Source no. (table 5)	References cited
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**Table 6.** References containing aquatic toxicity information for selected volatile organic compounds as described in this study—Continued

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