



Ethylbenzene ( $C_8H_{10}$ ) has a CAS registry number of 100-41-4 (Howard 1989). It occurs naturally in coal, tar, and petroleum and is found in many consumer products such as paint, ink, pesticides, and gasoline (ATSDR 1990). Ethylbenzene is used for producing styrene and as a solvent in the chemical and rubber industries (Environment Canada 1984; Howard 1989; CIS 1994). It has a water solubility of  $12\text{--}866\text{ mg}\cdot\text{L}^{-1}$ , a vapour pressure of  $933\text{--}1990\text{ Pa}$ , and a Henry's law constant of  $851\text{ Pa}\cdot\text{m}^3\cdot\text{mol}^{-1}$  (Verschuereen 1983; Howard 1989; Koch 1991).

Ethylbenzene can enter the environment during production, use, storage, transportation, and spills. It has been detected throughout North America in effluents from municipalities and industries, industrialized river basins, groundwater, sediments, soil, and air (Fishbein 1985; Howard 1989; ATSDR 1990). There is little tendency for ethylbenzene to accumulate in the environment, and ambient levels remain low due to physical, chemical, and biological processes that remove ethylbenzene from all media (OMOEE 1994).

When released into the aquatic environment, ethylbenzene may volatilize within a few hours, but can remain for a few weeks, depending on local conditions (Howard 1989). The average volatilization half-life of ethylbenzene from surface water is 3.1 h (Thomas 1982). Mackay's Level I fugacity model predicts that 99.57% of the compound will partition into air, 0.32% into water, 0.05% into sediment, and 0.05% into soil (ASTER 1995). If ethylbenzene volatilizes into the atmosphere, it will remain until it is removed by physical processes (e.g., precipitation) or chemical processes (e.g., photodegradation) (ATSDR 1990). Photooxidation is the main removal process of ethylbenzene from air, with a half-life between 12 h and 2 d (Howard 1989).

Aerobic degradation of ethylbenzene in surface water is expected to be rapid, with a half-life of 2 d (Howard 1989). Microflora acclimated to gasoline were found to degrade ethylbenzene within 8 d ( $13^\circ\text{C}$ ) in aerobic conditions (Jamison et al. 1976). Anaerobic degradation in sediments may also take place (Howard 1989). Ethylbenzene is resistant to hydrolysis, and photolysis in water is minimal (Howard 1989).

Ethylbenzene has a log octanol-water partition coefficient ( $\log K_{ow}$ ) of 3.2, suggesting that it may be adsorbed to sediment (Chiou and Schmedding 1982). Bioconcentration in fish, however, is considered unlikely (Mabey et al. 1982; Hawker and Connell 1988; Howard 1989). Ogata et al.

(1984) reported a BCF of 15.5 for goldfish (*Carassius auratus*). The USEPA (1980) reported a BCF of 37.5 for the edible part of the fish.

### Water Quality Guideline Derivation

The interim Canadian water quality guidelines for ethylbenzene for the protection of aquatic life were developed based on the CCME protocol (CCME 1991). The freshwater guideline was modified from OMOEE (1994).

### Freshwater Life

Estimates of acute toxicity (96-h  $LC_{50}$ ) of ethylbenzene to freshwater fish range from  $4.2\text{ mg}\cdot\text{L}^{-1}$  for rainbow trout (*Oncorhynchus mykiss*) (Galassi et al. 1988) to  $210\text{ mg}\cdot\text{L}^{-1}$  for channel catfish (*Ictalurus punctatus*) (Johnson and Finley 1980). Estimates of toxicity for the invertebrate *Daphnia magna* range from  $1.8\text{ mg}\cdot\text{L}^{-1}$  for a 48-h  $EC_{50}$  (immobilization) (Vigano 1993) to  $77\text{ mg}\cdot\text{L}^{-1}$  for a 24-h  $LC_{50}$  (LeBlanc 1980).

Chronic studies on freshwater fish were not found. Data for the rotifer *Dicranophorus forcipatus* indicate a 6-d  $EC_{54}$  (growth) of  $173\text{ mg}\cdot\text{L}^{-1}$  (Erben 1978). Several studies on plants report inhibition of growth and toxicity thresholds ranging from  $4.6$  to  $4.8\text{ mg}\cdot\text{L}^{-1}$  (Herman et al. 1990).

The available data indicate that freshwater species have a similar sensitivity to ethylbenzene, with *D. magna*, *O. mykiss*, and *Selenastrum capricornutum* being the most sensitive indicator species.

The interim water quality guideline for ethylbenzene for the protection of freshwater life is  $90\text{ }\mu\text{g}\cdot\text{L}^{-1}$  (CCME 1996). It was derived by multiplying the 48-h  $EC_{50}$  (immobilization) of  $1800\text{ }\mu\text{g}\cdot\text{L}^{-1}$  for the most sensitive organism, *D. magna* (Vigano 1993), by a safety factor of 0.05 for nonpersistent substances in an acute study (CCME 1991).

**Table 1. Water quality guidelines for ethylbenzene for the protection of aquatic life (CCME 1996).**

Aquatic life	Guideline value ( $\mu\text{g}\cdot\text{L}^{-1}$ )
Freshwater	90*
Marine	25*

\*Interim guideline.

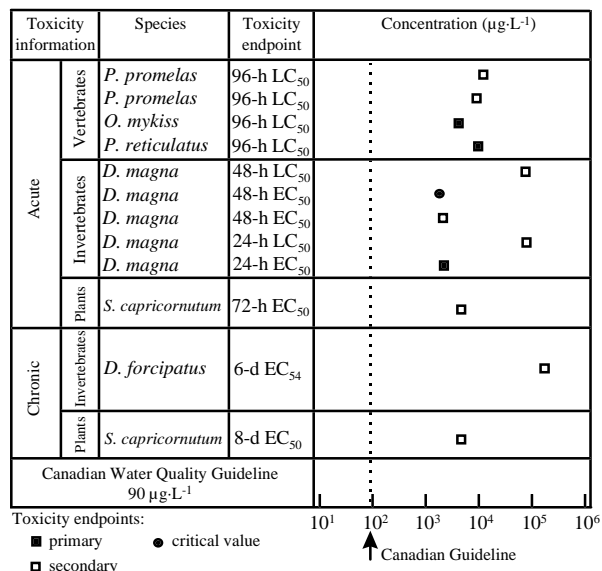


Figure 1. Select freshwater toxicity data for ethylbenzene.

Marine Life

Estimates of acute toxicity for marine fish range from 4.3 mg·L<sup>-1</sup> (24-h and 96-h LC<sub>50</sub>s) for striped bass (*Morone saxatilis*) (Benville and Korn 1977) to 360 mg·L<sup>-1</sup> (48-h LC<sub>50</sub>) for sheepshead minnows (*Cyprinodon variegatus*) (Heitmüller et al. 1981). Estimates of acute toxicity for invertebrates range from 0.49 mg·L<sup>-1</sup> (24-h LC<sub>50</sub>) for bay shrimp (*Crago franciscorum*) (Benville and Korn 1977) to 5.2 mg·L<sup>-1</sup> (24-h and 48-h LC<sub>50</sub>s) for mysid shrimp (*Mysidopsis bahia*) (Masten et al. 1994).

The available data indicate that marine organisms have similar sensitivities to ethylbenzene, with sheepshead minnows being less sensitive and bay shrimp and bacteria being more sensitive. The most sensitive nonlethal effect concentration is the 16-h EC<sub>50</sub> (growth) of 0.1136 mg·L<sup>-1</sup> (calculated) for 13 bacteria (Warne et al. 1989). This study, however, was ranked unacceptable and was not considered in the guideline derivation because the species composition of the culture may have been altered by toxicants. The results, therefore, are not reliable.

The interim water quality guideline for ethylbenzene for the protection of marine life is 25 µg·L<sup>-1</sup> (CCME 1996). It was derived by multiplying the 96-h LC<sub>50</sub> of 490 µg·L<sup>-1</sup> for the most sensitive organism, the bay shrimp (*C. franciscorum*) (Benville and Korn 1977), by a safety factor of 0.05 for nonpersistent substances in an acute study (CCME 1991).

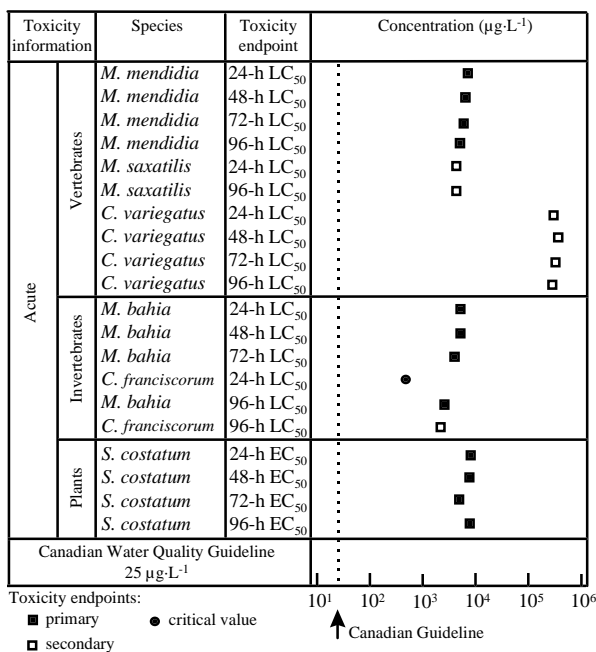


Figure 2. Select marine toxicity data for ethylbenzene.

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For further scientific information, contact:

Environment Canada  
Guidelines and Standards Division  
351 St. Joseph Blvd.  
Hull, QC K1A 0H3  
Phone: (819) 953-1550  
Facsimile: (819) 953-0461  
E-mail: ceqg-rcqe@ec.gc.ca  
Internet: <http://www.ec.gc.ca>

For additional copies, contact:

CCME Documents  
c/o Manitoba Statutory Publications  
200 Vaughan St.  
Winnipeg, MB R3C 1T5  
Phone: (204) 945-4664  
Facsimile: (204) 945-7172  
E-mail: [spcme@chc.gov.mb.ca](mailto:spcme@chc.gov.mb.ca)