Canadian Water Quality Guidelines for the Protection of Aquatic Life

CHLORINATED BENZENES

1,3-dichlorobenzene

Liquid 1,3-dichlorobenzene (CAS 541-73-1, molecular weight 147.01) is not imported, produced, or used in any industrial process or product in Canada. There is evidence, however, of some minor creation of dichlorobenzenes during the chlorination of benzene-containing sewage, from the dehalogenation of more highly chlorinated benzenes, and during incineration of organic matter containing chlorine (Government of Canada 1993). 1,3-Dichlorobenzene concentrations in the Great Lakes watershed ranged from not detectable (limit of detection from 0.000 02 to 0.002 $\mu g \cdot L^{-1}$) to 0.0188 $\mu g \cdot L^{-1}$, but effluent levels as high as 0.014 $\mu g \cdot L^{-1}$ were found (Oliver and Nicol 1982; Stevens and Neilson 1989; Merriman et al. 1991). Oliver and Nicol (1982) reported levels of 1,3-dichlorobenzene in Great Lakes salmonid fish ranging from 0.3 to 3 $\mu g \cdot kg^{-1}$.

Mackay et al. (1992) have modelled the environmental fate of each of the chlorobenzenes using several versions of a fugacity-based model and available information. These modelling results indicate that chlorobenzene behaviour varies as a function of the degree of chlorination. The simplest model, Fugacity Level I, demonstrates that 1,3-dichlorobenzene tends to partition into air, with small amounts going to water and soil, because of its moderate vapour pressure (307 Pa) and low water solubility (120 $mg \cdot L^{-1}$). Level II modelling indicates that the primary removal processes for all chlorobenzenes are in air. For 1,3-dichlorobenzene, removal is by advection (e.g., deposition, sedimentation) and chemical reaction. Photodegradation is slow, resulting in atmospheric half-lives of 2–6 weeks. In the aquatic environment, 1,3-dichlorobenzene is found mostly in organic phases (organisms, sediments) or associated with suspended/dissolved organic material rather than dissolved in the water phase (log octanol–water partition coefficient 3.4), with half-lives of 6–18 weeks in the water and 1.1–3.4 years in the sediment.

Water Quality Guideline Derivation

The interim Canadian water quality guideline for 1,3-dichlorobenzene for the protection of freshwater life was developed based on the CCME protocol (CCME 1991). For more information, see the supporting document (Environment Canada 1997).

Freshwater Life

The USEPA (1980) reported a 96-h LC_{50} for fathead minnows *(Pimephales promelas)* of 7790 $\mu g \cdot L^{-1}$. Acute results for *Daphnia magna* are a 48-h LC_{50} of 4870 $\mu g \cdot L^{-1}$ (Abernethy et al. 1988) and a 96-h LC_{50} of 8085 $\mu g \cdot L^{-1}$ (Ikemoto et al. 1992).

The interim water quality guideline for 1,3-dichlorobenzene for the protection of freshwater life is 150 $\mu g \cdot L^{-1}$. It was derived by multiplying the 32-d early life-stage LOEC (growth) of 1500 $\mu g \cdot L^{-1}$ (Carlson and Kosian 1987) for the most sensitive organism to 1,3-dichlorobenzene, the fathead minnow *(P. promelas)*, by a safety factor of 0.1 (CCME 1991). An early life-stage LOEC (growth) of 1510 $\mu g \cdot L^{-1}$ for the fathead minnow *(P.*

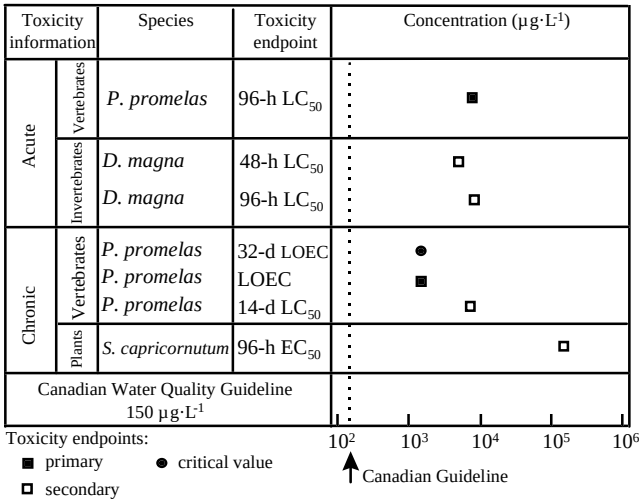

Figure 1. Select freshwater toxicity data for 1,3-dichlorobenzene.

Table 1. Water quality guidelines for 1,3-dichlorobenzene for the protection of aquatic life (Environment Canada 1997).

Aquatic life	Guideline value ($\mu g \cdot L^{-1}$)
Freshwater	150*
Marine	NRG†

*Interim guideline.

†No recommended guideline.

promelas) was also reported (USEPA 1980). Konemann (1981) found a 14-d LC_{50} for the guppy *Poecilia reticulata* of 7370 $\mu g \cdot L^{-1}$. A recent study with midges *(Chironomus riparius)* by van der Zandt et al. (1994) reported a 96-h NOEC at 37 $\mu g \cdot L^{-1}$ based on some behavioural changes. Even though this study is of acceptable quality, and reports the lowest concentration, it was not used in the guideline derivation, as neither behavioural changes or NOECs are acceptable endpoints.

The USEPA (1978) reported chronic data where the alga *Selenastrum capricornutum* exhibited a 96-h EC_{50} of 149 000 $\mu g \cdot L^{-1}$, based on change in cell numbers.

Marine Life

Insufficient information exists to derive an interim marine guideline for 1,3-dichlorobenzene. Heitmuller et al. (1981) reported a 96-h NOEC of 4200 $\mu g \cdot L^{-1}$ for sheepshead minnows *(Cyprinodon aggregata).* The USEPA (1978) reported a 96-h LC_{50} of 3850 $\mu g \cdot L^{-1}$ (the lowest-effect-level) for opossum shrimp *(Mysidopsis bahia).*

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