



Canadian Water Quality Guidelines for the Protection of Aquatic Life

HALOGENATED METHANES dichloromethane (methylene chloride)

Dichloromethane (CH_2Cl_2) is a clear, colourless, nonflammable liquid. Its common name is methylene chloride and it has a CAS number of 75-09-2. Dichloromethane is an industrial solvent for lipophilic substances and is registered in Canada as an insecticidal fumigant for stored grains (WHO 1984). It is also a common by-product of pulp and paper bleaching (White et al. 1996). Canada imports rather than produces dichloromethane (CIS 1989).

Dichloromethane primarily enters the aquatic environment through industrial effluents, though natural sources have also been suggested (NAS 1978; USEPA 1980). In 1980–81, the concentration and gross loading of dichloromethane in Cornwall, Ontario, municipal and industrial effluents were $\leq 331 \mu\text{g}\cdot\text{L}^{-1}$ and $10.9 \text{ kg}\cdot\text{d}^{-1}$, respectively. Water from the St. Lawrence River at Cornwall was contaminated with $5\text{--}23.9 \mu\text{g}\cdot\text{L}^{-1}$ (Environment Canada 1984). The highest degree of contamination ($100 \mu\text{g}\cdot\text{L}^{-1}$) was detected in the St. Clair River, followed by $39.5 \mu\text{g}\cdot\text{L}^{-1}$ in the Niagara River, (Environment Canada/Ontario Ministry of the Environment 1981; Munroe et al. 1985). Groundwater may be contaminated through landfill leachates, as seen in landfills in Guelph, Muskoka, and Sarnia, Ontario, where leachates containing dichloromethane concentrations of 1008, 350, and $160 \mu\text{g}\cdot\text{L}^{-1}$, respectively, were found (King and Sherbin 1986; Lesage et al. 1989; McBride et al. 1989).

Volatilization, followed by biodegradation are the two major processes by which dichloromethane is removed from freshwater. Volatilization half-life estimates range from 25 min to 5.6 h under various laboratory conditions (Dilling et al. 1976; Rathbun and Tai 1981). Microbes in activated sewage sludge rapidly degrade dichloromethane at rates that exceed 92% in 6–8 h (Rittman and McCarty 1980; Davis et al. 1981; Stover and Kincannon 1983). Hydrolysis, photolysis, and sorption do not act significantly on dichloromethane in aqueous solutions (Dilling et al. 1975; Gordon 1976; Mabey and Mill 1976). The low $\log K_{ow}$ (1.25) for dichloromethane suggests a low potential for bioaccumulation (WHO 1984).

Water Quality Guideline Derivation

The interim Canadian water quality guideline for dichloromethane for the protection of freshwater life was developed based on the CCME protocol (CCME 1991).

Freshwater Life

Acute toxicity data for dichloromethane is limited. Larvae of fathead minnows (*Pimephales promelas*) and rainbow trout (*Oncorhynchus mykiss*) have 9- and 27-d LC_{50} s of 34.0 and $13.2 \text{ mg}\cdot\text{L}^{-1}$, respectively (Black et al. 1982). Bullfrogs (*Rana catesbeiana*) have an 8-d EC_{10} for teratogenesis of $981 \mu\text{g}\cdot\text{L}^{-1}$ (Birge et al. 1980). Invertebrates are more tolerant to dichloromethane. For example, the 48-h EC_{50} for immobility of water fleas (*Daphnia magna*) is reported as $136 \text{ mg}\cdot\text{L}^{-1}$ (Abernethy et al. 1986). Blue-green algae (*Anacystis aeruginosa*) suffer reduced population growth at $550 \text{ mg}\cdot\text{L}^{-1}$ (Bringmann and Kühn 1978, 1980a). Protozoans (*Uronema parduczi*) are the most tolerant species, with a 20-h EC_5 of $16\,000 \text{ mg}\cdot\text{L}^{-1}$ for inhibition of cell proliferation (Bringmann and Kühn 1980b).

The interim water quality guideline for dichloromethane for the protection of freshwater life is $98.1 \mu\text{g}\cdot\text{L}^{-1}$. It was

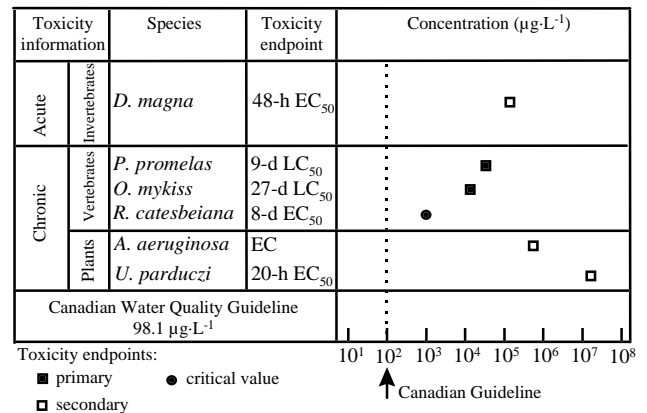


Figure 1. Select freshwater toxicity data for dichloromethane.

Table 1. Water quality guidelines for dichloromethane for the protection of aquatic life (CCME 1992).

Aquatic life	Guideline value ($\mu\text{g}\cdot\text{L}^{-1}$)
Freshwater	98.1*
Marine	NRG [†]

* Interim guideline.

[†] No recommended guideline.

derived by multiplying the LOEC of $981 \mu\text{g}\cdot\text{L}^{-1}$ for teratogenesis in bullfrogs by a safety factor of 0.1 (CCME 1991, 1992).

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