



Canadian Water Quality Guidelines for the Protection of Aquatic Life

HALOGENATED METHANES tetrachloromethane (carbon tetrachloride)

Tetrachloromethane (CCl_4) is a clear, colourless, nonflammable liquid with a CAS number of 56-23-5. The common name for tetrachloromethane is carbon tetrachloride. Canadian production of tetrachloromethane ceased in 1995, but it is still imported for limited use as a feedstock (Y. Bovet, 1997, Commercial Chemicals Evaluation Branch, Environment Canada, Ottawa, pers. com.). Tetrachloromethane was previously used in manufacturing refrigerants, aerosols, and fire-resistant chemicals, as well as being used as an agricultural fumigant and an industrial solvent (Pearson and McConnell 1975; IARC 1979; Merck Index 1989).

Before the 1995 phaseout of most uses, tetrachloromethane entered the aquatic environment primarily through industrial effluents and to a lesser degree as aerosol propellants and refrigerants (USEPA 1980a). In 1980–81, for example, the concentration and gross loading of tetrachloromethane in Cornwall, Ontario, municipal and industrial effluents were $\leq 45.5 \text{ mg}\cdot\text{L}^{-1}$ and $42.1 \text{ kg}\cdot\text{d}^{-1}$, respectively. Water samples from the St. Lawrence River at Cornwall had up to $16\,000 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ tetrachloromethane (Environment Canada 1984). Tetrachloromethane levels of $1\text{--}10 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ were detected in final effluents of petrochemical plants discharging into the St. Clair River (Environment Canada 1984). The St. Clair River and Lake St. Clair had concentrations up to $100 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ and $900 \text{ ng}\cdot\text{L}^{-1}$, respectively (Munroe et al. 1985; Kaiser and Comba 1986). Groundwater may become contaminated from landfill leachates. Leachates from a chemical company landfill near Sarnia, Ontario, contained tetrachloromethane concentrations up to $1000 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ (King and Sherbin 1986).

Volatilization is the major fate process by which tetrachloromethane is removed from freshwater. Half-life estimates range from 0.3 to 300 d for rivers, lakes, and aquifers (Zoeteman et al. 1980). Hydrolysis, photolysis, and sorption are not important degradation processes for tetrachloromethane in aqueous solutions (Sabljic 1987; Jeffers et al. 1989; USEPA 1989).

The low $\log K_{ow}$ (2.62–2.83) for tetrachloromethane suggests a low potential for bioaccumulation (Pearson and McConnell 1975; Hansch and Leo 1979). A BCF of 30

was measured in bluegills (*Lepomis macrochirus*) exposed for 21 d (USEPA 1978, 1980b). Tetrachloromethane levels up to $209 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ have been reported in marine fish and molluscs (Pearson and McConnell 1975; Dickson and Riley 1976).

Water Quality Guideline Derivation

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

Freshwater Life

Acute toxicity data for tetrachloromethane is limited. Larvae of fathead minnows (*Pimephales promelas*) and rainbow trout (*Oncorhynchus mykiss*) are reported to have 9- and 27-d LC_{50} s of 4.0 and $1.97 \text{ mg}\cdot\text{L}^{-1}$, respectively (Black et al. 1982). Larval bullfrogs (*Rana catesbeiana*) have an 8-d LC_{50} of $900 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ and an 8-d EC_{10} for teratogenesis of $133 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ (Birge et al. 1980). Algae are less sensitive to tetrachloromethane. For example, green (*Scenedesmus quadricauda*) and blue-green algae (*Anacystis aeruginosa*) suffer reduced population growth at concentrations $\geq 105 \text{ mg}\cdot\text{L}^{-1}$ (Bringmann and Kühn 1978, 1980).

The interim water quality guideline for tetrachloromethane for the protection of freshwater life is $13.3 \text{ }\mu\text{g}\cdot\text{L}^{-1}$. It was derived by multiplying the LOEC of $133 \text{ }\mu\text{g}\cdot\text{L}^{-1}$ for teratogenesis in bullfrogs by a safety factor of 0.1 (CCME 1991, 1992).

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

Aquatic life	Guideline value ($\mu\text{g}\cdot\text{L}^{-1}$)
Freshwater	13.3*
Marine	NRG†

* Interim guideline.

† No recommended guideline.

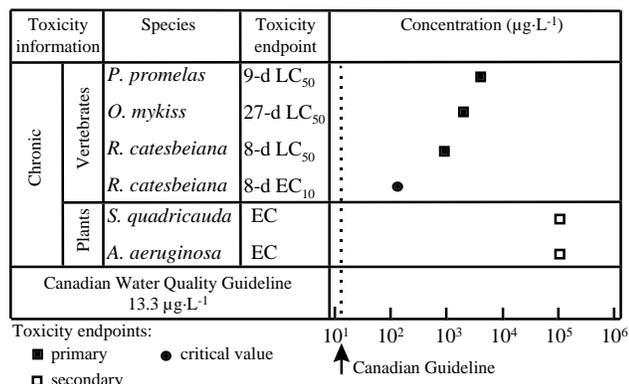


Figure 1. Select freshwater toxicity data for tetrachloromethane.

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