Canadian Water Quality Guidelines for the Protection of Aquatic Life

METOLACHLOR

Metolachlor ($C_{15}H_{22}ClNO_2$) is the common name for the chloroacetamide herbicide with a CAS name and number of 2-chloro-*N*-(2-ethyl-6-methylphenyl)-*N*-(2-methoxy-1-methylethyl)-acetamide and 51218-45-2, respectively (Tomlin 1994). Metolachlor was first registered in 1977 under the trade names Dual7, Primextra, and Galex (Agriculture Canada 1989). Reported imports of metolachlor to Canada were 4839, 4522, and 4322 t in 1985, 1986, and 1987, respectively (Statistics Canada 1986, 1988).

Metolachlor is used to control annual grasses and some broadleaf weeds in corn, soybeans, potatoes, snap beans, dry beans, lima beans, sorghum, sugar beets, and rutabagas (Chesters et al. 1989; OMAF 1988). It is a selective herbicide that inhibits germination and is absorbed by the hypocotyls and shoots of plants (Tomlin 1994).

Metolachlor may enter the aquatic environment through spillage, accidental discharge, waste disposal during production, packaging, storage, and use, or as a result of surface or subsurface intrusions from treated lands (Thomson 1979; Chesters et al. 1989). Data on metolachlor concentrations in Canadian waters are limited and have only been reported in Ontario and Quebec, ranging from 0.4 to 105 $\mu g \cdot L^{-1}$ (OMOE 1987a, 1987b; Giroux et al. 1997).

Little information related to the persistence of metolachlor in the aquatic environment is available. The aqueous hydrolysis of metolachlor is slow, with a half-life >200 d at pH 1, 5, 7, and 9 at 20ºC. Similarly, little aqueous photolysis occurs. When metolachlor was exposed to natural sunlight in aqueous suspension, total photolytic decomposition of only 6% took place over 1 month (LeBaron et al. 1988).

The soil fungus *Chaetomium globosum* degrades 45% of an aerobic liquid suspension of metolachlor in 144 h (McGahen and Tiedje 1978). The anaerobic biodegradation of metolachlor in eutrophic lake sediments took 8 weeks (McGahen and Tiedje 1980).

Water Quality Guideline Derivation

The interim Canadian water quality guideline for metolachlor for the protection of freshwater life was developed based on the CCME protocol with minor deviations (CCME 1991b).

Freshwater Life

Many of the available toxicity data are proprietary, and unpublished information is available only through USEPA summary reviews. Thus, the exact procedures and grade or formulation used were often not available. Acute toxicities (96-h LC_{50}) for metolachlor range from 2.0 to 15 $mg \cdot L^{-1}$ for six species of freshwater fish, one of which was a salmonid (Sachsse and Ullman 1974; Buccafusco 1978a, 1978b; Dionne 1978; WSSA 1983; Mayer and Ellersieck 1986). Invertebrate toxicity data are available for only two species, the cladoceran *Daphnia magna* and the midge larva *Chironomus plumosus*. The 48-h EC_{50} and LC_{50} for *D. magna* are 23.5 and 25.1 $mg \cdot L^{-1}$, respectively. The midge had static 48-h EC_{50}s of 3.8 and 4.4 $mg \cdot L^{-1}$, respectively, for technical grade metolachlor and an emulsifiable concentrate formulation (Vilkas 1976; Mayer and Ellersieck 1986). A NOEL of 5.6 $mg \cdot L^{-1}$ for a 48-h exposure was reported by Vilkas (1976) for *D. magna*.

A review of the aquatic toxicity data, much of which was unpublished, was undertaken by the USEPA (1987). The following three studies contained sufficient quality assurance information for the work to be approved by the

Table 1. Water quality guidelines for metolachlor for the protection of aquatic life (CCME 1991a).

Aquatic life	Guideline value ($\mu g \cdot L^{-1}$)
Freshwater	7.8*
Marine	NRG†

*Interim guideline.

†No recommended guideline.

USEPA for derivation of acute and chronic advisory concentrations. The acute toxicities (96-h LC_{50}s) for fish were reported to be 10 $mg \cdot L^{-1}$ for the bluegill, *Lepomis macrochirus*, and 3.9 $mg \cdot L^{-1}$ for rainbow trout, *Salmo gairdneri* (Buccafusco 1978a, 1978b). A chronic study on the reproduction of fathead minnows, *Pimephales promelas*, reported a 28-d SMATC of 780 $\mu g \cdot L^{-1}$ (Dionne 1978). The toxicity data of Mayer and Ellersieck (1986) were not reviewed by the USEPA (1987), however, the test procedures used are USEPA-approved test methods.

The interim water quality guideline for metolachlor for the protection of freshwater life is 7.8 $\mu g \cdot L^{-1}$. It was derived by multiplying the SMATC (reproduction) of 780 $\mu g \cdot L^{-1}$ (Dionne 1978) for the most sensitive organism, the fathead minnow *(P. promelas)*, by a safety factor of 0.01 (CCME 1991a). A safety factor of 0.01 was used due to the limited data on the chemical fate and chronic toxicity of metolachlor.

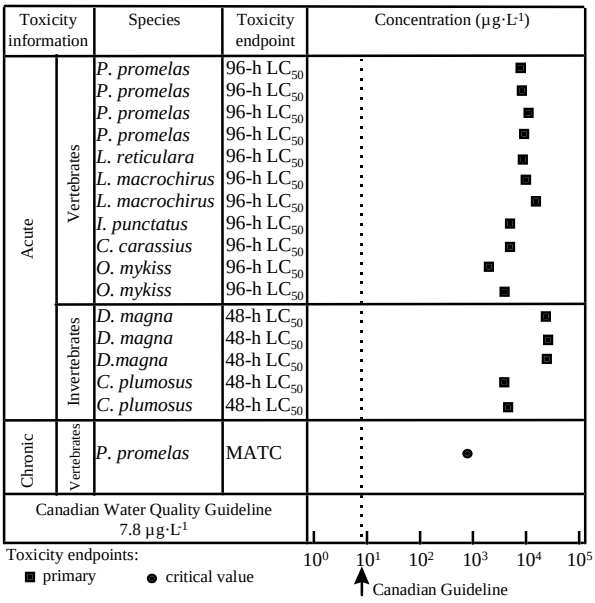

Figure 1. Select freshwater toxicity data for metolachlor.

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