UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

DATE: April 13, 1978

SUBJECT: Metolachlor - Generic Standard

FROM: Ecologist, Ecological Effects Branch, Criteria & Evaluation Division

TO: James Skaptason, Metolachlor Team Leader

Attached is the chapter on Non-Target Organisms with my corrections.

The section is technically correct, and I have noted only a few minor typographical errors.

John S. Leitzke

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cc. Clayton Bushong
Dr. William G. Phillips

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TOXICITY TO AQUATIC INVERTEBRATES

Experimental Toxic Effects

Acute Toxicity to Aquatic Invertebrates (162.72-2)

The minimum data requirement for acute toxicity on aquatic invertebrates is for evaluation of one aquatic invertebrate.

Data are available on the acute toxicity of technical metolachlor to the water flea (Daphnia magnar STRAUS) (Vilkas 1976). The 48 hour on effect level was determined to be 5.6 ppm. The 48 hour LC50 with 95% confidence limits is 25.1 (21.6-29.2) ppm indicating metolachlor is slightly toxic to aquatic invertebrates.

This information satisfies the requirement for acute toxicity data on aquatic invertebrates.

No precautionary labeling regarding aquatic invertebrates is required.

Acute Toxicity to Estuarine and Marine Invertebrates (162.72-3)

Estuarine and marine orgainism toxicity tests are not required to support the registration of the technical or a the presently registered formulated product. The pesticide is not intended for direct application to the estuarine or marine environment nor is it expected to enter this environment in significant concentrations because of its use or mobility.

Life-Cycle Studies of Aquatic Invertebrates (162.72-4)

The need for this test is still under consideration. Environmental chemistry exposure data are needed to determine if conditions for requiring this test have been met. On the other hand, toxicity at low levels in the fish life-cycle test would indicate a possible hazard to the invertebrates.

Aquatic Organism Toxicity and Residue Studies (162.72-5)

The need for this test is still under consideration. Environmental chemistry exposure data are needed to determine if conditions for requiring this test have been met.

Accident Exposure Experience

No accidents with technical metolachlor have been reported.

Mode of Action

No data have been identified on this subject. No current requirement for this kind of data exists.

Symptomatogy and Pathology

No data have been identified on this subject. No current requirement for this kind of data exists.

Effects Assessment for Aquatic Invertebrates

An acute laboratory study determined a no effect level to a freshwater invertebrate (Daphnia magnar) to be 5.6 ppm. Metolachlor yields an LC50 - measured by immobility - in Daphnia at 25.1 ppm. Therefore, metolachlor is judged to be slightly toxic to aquatic invertebrates.

TOXICITY TO FISH

Experimental Toxic Effects

Fish Acute LC50 (162.72-1)

The minimum data requirements for acute toxicity are tests on one cold water species (preferably rainbow trout) and one warm water species (preferably bluegill).

Data on the acute toxicity of technical metolachlor to fish is limited to the work conducted by Sachsse and Ullman (1974b).

The data presented on a cold water species--rainbow trout (Salmo gairdneri) are not adequate to establish the acute 96 hour LC50 due to various deviations from recommended protocols. The most significant deviation was aeration during the study. This practice may have resulted in volatilization of the toxicant from the medium.

Data are presented on four species of warm water fish:

Species	96 Hour LC50 (ppm)	95% Confidence Limits
Crucian Carp (Carassius carassius)	4.9	3.6 - 6.8
Channel Catfish (Ictaluris punctatus)	4.9	3.6 - 6.8
Bluegill (Lepomis macrochirus)	15.0	*
Guppy (Lebistes reticulatus)	8.6	7.4 - 10.5

The data are acceptable to establish that metolachlor is moderately toxic to warm water fish acute LC50 data. However, prior to registration of technical metolachlor the basic study, 96-hour acute LC50 for a cold water species (rainbow trout) of fish, is required as per Sec 3 Regulations and the proposed Guidelines.

Based on the available information and currently acceptable uses for this data requirement a tentative determination is made that no labeling precaution regarding hazard to fish is required.

Acute Toxicity to Estuarine and Marine Fish (162.72-3)

Estuarine and marine organism toxicity tests are not required to support the registration of the technical or a presently registered formulated product. The pesticide is not intended for direct application nor is it expected to enter this environment in significant concentrations because of its use or mobility.

Embryo-Larvae and Life Cycle Studies (162.72-4)

Prior to registration of formulated products containing metolachlor this study on the technical is required as per Sec. 3 Regulations and the proposed Guidelines. The study is needed to perform a hazard assessment. The fish life-cycle test on a freshwater fish (fathead minnow, preferably) is required in lieu of the embryo study.

Fish Toxicity and Residue Studies (162.72-5)

The need for this test is still under consideration. Environmental chemistry exposure data are needed to determine if conditions for requiring this test have been met.

Accident Exposure Experience

No data have been identified on this subject. No current requirement for this kind of data exists.

Mode of Action

No data have been identified on this subject. No current requirement for this kind of data exists.

Symptomatology and Pathology

Mortality, hypersensitivity, loss of equilibrium and later apathy were observed at 2.1 ppm of pesticide for the crucian carp and the channel catfish. These symptoms were also observed in the bluegill at 21 ppm and the guppy at 6.5 ppm (Sachsse et al. 1974b.)

Effects Assessment for Fish

Acute laboratory studies on several species of warm water fish demonstrated hypersensitivity, loss of equilibrium, apathy and finally mortality at 2.1 ppm. Metolachlor yielded an LC50 of 4.9 ppm, indicating it is moderately toxic to fish.

TOXICITY TO BIRDS

Experimental Toxic Effects

Avian Single-Dose Oral LD50 (162.71-1)

The minimum data requirement for avian oral testing is testing on one avian species, either a wild waterfowl (preferably the mallard) or an upland game bird (preferably the bobwhite or other native quail), or the ring-necked pheasant. The species shall be the same as one of the species selected for avian dietary LC50 testing.

Data on the single dose oral toxicity of metolachlor to avian wildlife are limited to the work reported by Fink (1976); the acute oral LD50 for mallards (Anas platyrhynchos). was recalculated from given cumulative mortality data to be 4640 (3000-7200) mg/kg.

A review of the study revealed deviations of test procedures from generally accepted guidelines, gross errors in the original statistical analysis and discrepancies in body weights and efficiency of feed utilization. Deviations of test procedures included: use of ducklings that were too young; test duration was too short; no pre-test fasting period; average body weights of ducklings differing markedly across test groups.

The study gives data that can be regarded as only supplemental about the acute oral toxicity to avian wildlife and does not meet the registration requirement for this toxicity data.

Avian Dietary LC50 (162.71-2)

The minimum data requirements for avian dietary testing are testing on two avian species, one species of wild waterfowl (preferably the mallard duck) and one species of upland game bird (preferably the bobwhite ~~quail~~ or other native quail), or the ring-necked pheasant.

Fink has conducted studies on the mallard duck (Anas platyrhychos) (1974a) and the bobwhite quail (Colinus virginianus) (1974b). The 5 (+3)-day dietary LC50 for both species exceeded 10,000 ppm.

The data are sufficient to satisfy the requirement for avian dietary LC50.

Avian Reproduction (162.71-4)

Prior to registration of formulated products containing metolachlor the following conditional study on the technical is required as per the Sec. 3 Regulations and the proposed Guidelines if the pesticide is persistent, is stored in plant or animal tissue or is used repeatedly or continuously. Since the Environmental Fate sections on Accumulation (162.62-1), specifically rotational crops and fish accumulation, and General Assessment are still in preparation and have not been received, no definitive statement that an avian reproduction study is required prior to registration can be made at this time. However, since tolerances were granted only on corn grain and not forage, fodder, or silage and since rotational crops other than corn within 18 months after application are prohibited, it appears that metolachlor might be persistent or stored in plant or animal tissue. Therefore, a requirement for an avian reproduction test is anticipated.

Accident Exposure Experience

No accidents with technical metolachlor have been reported.

Mode of Action

No data have been identified on this subject. No current requirement for this kind of data exists.

Symptomatology and Pathology

In the avian dietary LC50 wing droop and lethargy were observed in bobwhite quail at the highest dosage level, 10,000 ppm. In the avian single dose oral LD50 loss of co-ordination, salivation, and convulsions were observed preceding death at 4640 mg/kg dosage.

Effects Assessment for Birds

The data generally indicate that metolachlor should pose little or, at the most, moderate short-term toxicity to avian wildlife.

TOXICITY TO WILD MAMMALS

Experimental Toxic Effects

Applicability of Laboratory Animal Data

The data on laboratory animals can generally be considered sufficient for assessment of the potential hazard to wild mammals but only on a case by case basis.

Mammalian Acute Toxicity (162.71-3)

Data on acute toxicity to wild mammals are required to support the registration of a formulated product when the proposed use pattern of the pesticide indicates that wild mammals may be exposed to the pesticide and the toxicity data required pursuant to Subpart F are not sufficient for assessment of the potential hazard to wild mammals. This data is not required due to the general acceptability of the laboratory animal data.

The acute oral LD50 in the laboratory rat is 2780 mg/kg with 95% confidence limits of 2130-3545 mg/kg (Bathe, 1973).

Technical metolachlor in corn oil has been shown to be emetic in Beagle dogs to an extent that precludes the establishment of an oral LD50 in dogs (Affiliated Medical Research, 1974 e&f). The study did, however, establish the emetic dose50 to be 19.0 mg/kg $\pm$ 9.7.

Accident Exposure Experience

No data have been identified on this subject. No current requirement for this kind of data exists.

Mode of Action

No data have been identified on this subject. No current requirement for this kind of data exists.

Symptomatology and Pathology

This section under Human and Domestic Animal Effects is still in preparation and has not been received.

Effects Assessment for Wild Mammals

Since the Human and Domestic Animal sections on Effects and summary are still in preparation and have not been received, no assessment for wild mammals can be made at this time.

TOXICITY TO NON-TARGET PLANTS

Experimental Toxic Effects

Applicability of Target Plant Data

This data is only applicable to field corn.

Data on Treated Crop

Occasional instances of phytotoxicity were encountered. These were generally attributable to adverse weather conditions during the time the seeds were germinating or the seedlings were becoming established. The corn was able to outgrow the phytotoxic effects before harvest and no yield reduction was found to be associated with phytotoxic reactions. (CIBA-GEIGY Corporation 1975 a,e,g; 1977 j,k,l,m) (Harvey et al. 1974).

Data on Other Exposed Non-Target Plants

No data have been identified on this subject. No current requirement for this kind of data exists.

Accident Exposure Experience

No data have been identified on this subject. No current requirement for this kind of data exists.

Mode of Action

Metolachlor is used as a Pre-plant or Preemergence application on corn and is most effective for the control of grass species. A few broadleaf weeds have been shown to be controlled. Basically, metolachlor inhibits the germination of seeds (Gerber et al. 1976 and Pillai et al. 1976). Corn is not affected by metolachlor at the concentrations that are effective for weed control. This is attributed to the large seed size of corn as well as its ability to metabolize metolachlor (Gerber et al. 1974).

Uptake of metolachlor is mainly through shoot tissue of grass species with relatively little taken up through the roots. Cotton and soybeans were more sensitive to root exposure (Diner et al. 1977 and Gerber et al. 1974). In tests using corn, barley, and peas where metolachlor was limited to specific plant areas, uptake by grasses was greatest in the shoot area, but peas were injured only when metolachlor was present in the root, seed and shoot areas (Pillai et al. 1977). Broadleaf plants are not generally affected since the shoot tissue is protected by the cotyledons until after the plants emerge from the soil.

Pillai et al. (1975) tested metolachlor for its effects on photosynthesis and respiration of plants. They found that metolachlor was not an effective inhibitor of photosynthesis. Metolachlor stimulated respiration of Chlorella and mitochondria isolated from bean hypocotyls. In other tests it was found that metolachlor did not significantly affect leucine uptake or its incorporation into protein (Pillai et al. 1976). Metolachlor was also tested to determine its effect on root membrane permeability (Pillai et al. 1976 and Pillai et al. 1977). Test plants were onion, cucumber and corn which are sensitive, moderately sensitive and tolerant to root membrane permeability effects respectively. Concentrations of 10^{-4} and 10^{-5} M concentrations of Metolachlor caused leakage of previously absorbed ^{32}P from the roots. This indicates that the mode of action of metolachlor involves membrane damage. It was possible by using 1,8-napthalic anhydride to protect the roots of onion from permeability changes caused by metolachlor which lends support to this proposed mode of action.

Symptomatology and Pathology

In the data on treated crops stunting occurred which was attributable to adverse weather conditions.

Effects Assessment for Non-Target Plants

The data did not contribute sufficient information to determine the effect on field corn.

DATA GAPS

Prior to reregistration of technical metolachlor certain studies are required as per Sec. 3 Regulations and the proposed Guidelines. The following studies are needed to perform a hazard assessment:

(a) The avian acute oral LD50 for one species of waterfowl (preferably the mallard duck) or one species of upland game bird (preferably the bobwhite or other native quail) or the ring-necked pheasant- Sec. 162.71-1.

(b) The 96-hour acute LC50 for a cold water species (rainbow trout) of fish - Sec. 162.72-1.

The following studies on the technical are required as per the Sec. 3 Regulations, and the proposed Guidelines. This study is required to assess the hazard associated with use of formulated products:

The fish life-cycle test on a freshwater fish (fathead minnow, preferably) (162.72-4).

The following study is anticipated to be needed to perform a hazard assessment:

The avian reproduction study is on bobwhite quail and mallard duck (162.71-4).

LABEL REQUIREMENTS

In order to reduce the amount of metolachlor reaching aquatic sites during the manufacturing of metolachlor, the following precautionary labeling is required.

"Do not discharge into lakes, streams, ponds, or public waters unless in accordance with an NPDES permit. For guidance contact your Regional Office of the EPA."

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