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Metolachlor - Generic Standard

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Attached is the chapter on Non-Target Organisms with my corrections and additions for the wildlife sections and suggestions and comments for the others. I have talked over with Dennis McLane and Rick Stevens the problem of specific tests (and data gaps) that are present due to the formulation and its use patterns but which must be done with the technical as per the Guidelines. I have suggested to them that such tests (and data gaps) be cited in both the technical and the formulation standards with a sentence or two stating the reason why.


John S. Leitzke

Attachment

cc: Clayton Bushong
Dr. William G. Phillips

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EFFECTS ASSESSMENT - OTHER NON-TARGET ORGANISMS

TOXICITY TO TERRESTRIAL INVERTEBRATES

Experimental Toxic Effects

Soil Microbes (162.62 - 8.f.3.)

Three studies were submitted to fulfill the Effect of Pesticides on Microbes data requirement. Two of the studies [1,2] were evaluated by the population approach and one [3] was evaluated by the functional approach. These studies, listed by Little, were as follows:

1. Houseworth; L.D. (1973) Effect of CGA-24705 on Microbial Populations in Two Soils.
2. Ercegovich, Charles D., E.R. Bogus and R.L. Buly. The Effects of 5,25, and 125 ppm of Metolachlor, [2-chloro-N-(2-Ethyl-6-Methylphenyl)-N-(2-Methoxy-1-Methylethyl) Acetamide] on Actinomycetes, Bacteria, and Fungi in Laboratory Culture Tests.
3. Ercegovich, Charles D., R.P. Vellejo, and E.R. Bogus. The Effects of 5,25, and 125 ppm Metolachlor, [2-chloro-N-(2-Ethyl-6-Methylphenyl)-N-(2-Methoxy-1-Methylethyl) Acetamide], in Soil Nitrification.

In study number [1] we agree in the overall approach to fulfill the data requirement (by the dilution plate method using differential agar, [with two soil types] to separate bacteria, fungi, and actinomycetes). The information contained in the study does not fulfill the data requirement and could not be used to support any use for metolachlor (that requires this type of data) and can not be used to support the other two [2,3] studies submitted. The reasons for the lack of fulfillment or support are as follows: No attempt was made to classify the organisms (bacteria, fungi, and actinomycetes) either by Linnaean or common name that have significance to soil fertility such as Azotobacter, Clostridium, Nostoc, Nitrosomonas, Nitrobacter, Bacillus, Pseudomonas, Arthrobacter, Cellulomonas, Cytophaga, Streptomyces, Pencillium, Flavobacterium, Tricoderra, Aspergillus, Chaetomium and Fusarium. Significant variation in tabulated results can be seen, and questions of aggregation, dilution, dispersion, and enumeration would have to be satisfied before the study could support either proposed uses or other submitted studies. An acceptable study [2] (that fulfills the data requirement) has been submitted and the deficiencies aforementioned will not have to be addressed.

In study [2] a diverse selection of soil micro-organisms (27sp.) including representatives classified by Linnaean name from the following genera: Actinomycetes (family), Bacillus, Cellulomonas, Cytophaga, Flavobacterium, Pseudomonas, Achromobacter, Aspergillus, Chaetomium, Fusarium, Pencillium, and Tricoderma were evaluated against three concentrations of metolachlor, 5, 25, and 125 ppm. At 5 ppm 4/27sp., 9/27sp. at 25 ppm 19/27sp. at 125 ppm were inhibited (static-not tidal effect). At 5 ppm 4/27sp. had increased counts and 1sp. did not show any effect at all three concentrations. Potential degraders could also be estimated from this study, and 10/27sp. could have this capability. In application rates normally used for metolachlor (1-3 lbs. ai/A) the slight inhibitory (static) effect on soil commensal populations by 5 ppm conc. in the lab test would not be as significant and would alleviate with time. The populations would recover (as supported by study number [3]) and/or the effect of the pesticide would be minimized by further reduction of the pesticide concentration by physico-chemical means (photolysis is a major means).

In study [3] the effect of metolachlor at 5, 25, 125 ppm was evaluated on the soil function known as nitrification, with two soil types (Morrison sandy loam and Hagerstown silt loam). Morrison sandy loam did not show any effect (inhibition) at any of the three rates evaluated. Hagerstown silt loam at 5 and 25 ppm did not show any inhibitory effect. The 25 ppm treatment did show an inhibitory effect for 7 weeks and then a recovery, starting at the eighth week and continuing until the end of the evaluation time (10 weeks). In both soils, increased rates of nitrification were observed from 5-6 weeks and continued for up to 8-10 weeks. Rates between the two soils varied considerably. As a single study this study could not fulfill the data requirement and could not be used to support any use for metolachlor, where this data is not required. The reasons that this study does not satisfy the aforementioned points are as follows: No effects (functional approach) on nitrogen fixation, degradation of cellulose, starch, and the protein were evaluated. An acceptable study [2] (that fulfills the data requirement) has been submitted and the deficiencies aforementioned will not have to be addressed. This study can and does support the data evaluation in study [2] and has been used in that context.

The Effect of Pesticide on Microbes studies submitted constitute an acceptable study (to fill the data requirement) and no further data will be required.

Earthworms

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Pollinating Insects

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Predators and Parasites

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Other Terrestrial Invertebrates

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Accident Exposure Experience

No accidents with technical metolachlor have been reported.

Mode of Action

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Symptomology and Pathology

^{acceptable on soil microbe}
The first ~~study~~ ^{study} did not show any effect at all three concentrations. In the second study the 125 ppm treatment in Hagerstown silt loam inhibited nitrification for 7 weeks with recovery starting at the eighth week.

Effect Assessment for Terrestrial Invertebrates

^{by soil microbes}
Nitrification ~~was~~ inhibited for at 125ppm in Hagerstown silt.

No data on earthworms, pollinating insects, predators and parasites or other terrestrial invertebrates have been identified on this subject, and no current requirement for this kind of data exists.

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 magna Straus) (Vilkas 1976). The 48 hour LC50 with 95% confidence limits is 25.1 (21.6-29.2) ppm which indicates that metolachlor is slightly toxic to aquatic invertebrates.

This information is sufficient to satisfy the requirements 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 organism toxicity tests are not required to support the registration of a formulated product. The pesticide is not intended for direct application to the estuarine or expected to enter the environment in significant concentrations due its expected use or mobility pattern.

Embryo - Larvae and Life-Cycle Studies of Aquatic Invertebrates (162.72-4)

The requirement of this test is still under consideration due to lack of environmental chemistry exposure data and fish life-cycle test. The environmental chemistry exposure data is needed to determine if the guidelines have been triggered. On the other hand, an unexpected toxicity in the fish life-cycle test would indicate a possible hazard to the invertebrates.

Aquatic Organism Toxicity and Residue Studies (162.72-5)

Aquatic ecosystem testing is not required to support the registration of all formulated products, after an analysis of the pesticide properties, the individual use patterns, and the results of previous tests, it has been determined that use of the pesticide will not result in adverse effects on the non-target organisms in aquatic environments, including those of the water column and bottom sediments.

(why no blurb about Simulated or Actual Field Testing - [162.72-6]-?)
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Accident, Exposure Experience

No accidents with technical metolachlor have been reported.

Mode of Action

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Symptomatology and Pathology

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Effects Assessment for Aquatic Invertebrates

No description of effects is available for assessment.

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 Ulman (1947b).

The data presented on a cold water species--rainbow trout (Salmo gairdner) is not considered valid to establish the acute 96 hour LC50 due to various deviations from desirable protocols. The most significant ^{is} volatilization of the toxicant from the medium.

Data ^{are} ~~is~~ presented on four species of warm water fish:

Species	96 Hour LC50 (ppm)	95% Confidence Limits
Crucian Carp (<u>Carassius carassius</u>)	4.9	3.6 - 6.8
Channel Catfish (<u>Ictalurus punctatus</u>)	4.9	3.6 - 6.8
Bluegill (<u>Lepomis macrochirus</u>)	15	*
Guppy (<u>Lebistes reticulatus</u>)	8.6	7.4 - 10.5

*The data reported on the bluegill cannot be confirmed by statistical analysis and was not used in the evaluation.

The data are acceptable to establish that metolachlor is moderately toxic to warm water fish. This information meets the requirement for warm water fish acute LC50 data. However, prior to registration of technical metolachlor the basic study, 96-hour acute LC50 for a coldwater species (rainbow trout) of fish, is required as per the new Sec. B 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 a formulated product. The pesticide is not intended for direct application to the estuarine or it is expected to enter the environment in significant concentrations due to its expected use or mobility pattern.

Embryo and Life Cycle Studies (162.72 -4)

Prior to registration of formulated products containing metolachlor the following conditional study on the technical is required as per the new Sec. B. Regulations and the proposed Guidelines. The following basic study is needed to perform a hazard assessment.

(No rationale?)

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)

Aquatic ecosystem testing is not required to support the registration of all formulated products, after an analysis of the pesticide properties, the individual use patterns, and the results of previous test, it has been determined that use of the pesticide will not result in adverse effects on the non-target organisms in aquatic environments, including those of the water column and bottom sediments.

(why no study)

about simulated or actual field testing [162.72-5] (?)

Accident Exposure Experience

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Mode of Action

No data ^{have} ~~has~~ 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 ~~was~~ observed at 2.1ppm, 6.5ppm, and 10ppm of pesticide for the crucian carp and the channel catfish. These symptoms were also observed in the bluegill at 21ppm and 49 ppm and at 21 ppm, 10ppm and 21ppm for the guppy.

Effects Assessment for Fish

All symptoms developed at a lethal dose.

(do you want a repetition of Sympt + Path - ?)

(? - doses causing mortality)

TOXICITY TO BIRDS

Experimental Toxic Effects

Avian Single-Dose Oral LD50 (162.72-1)

~~Prior to registration of technical metolachlor certain basic study is required as per the new Sec. B regulations and the proposed guidelines. The following basic study is needed to perform a hazard assessment: The avian acute oral LD50 for one species of waterfowl (mallard duck, preferably) or species of upland game bird (ring-necked pheasant or bobwhite quail) - Sec. 162.72-1.~~ *(insert what was originally submitted - a copy is attached)*

Avian Dietary LC50 (162.72-2)

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

~~Frank Truslow Farms Incorporated has conducted studies on the mallard duck (Anas platyrhynchos) (1947) and the bobwhite quail (Colinus virginianus) (1974). The 5 (+3)-day dietary LC50 for both species exceeded the highest dosage tested 10,000 ppm.~~

~~The ^{are} data is sufficient to satisfy the requirements 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 new Sec. B regulations and the proposed guidelines. The following basic study are needed to perform a hazard assessment:~~

~~The avian reproduction study on bobwhite quail and mallard duck.~~

(insert the attached for Avian Reproduction + Simulated Actual Field Tests)

Avian Single-Dose Oral LD₅₀ (Section 162.71-1)

The minimum data requirement for avian acute 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 is limited to the work reported by ~~Truslow Farms Inc.~~ (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.

Prior to registration of formulated products containing metolachlor the following conditional study on the technical is required as per the new Sec. B 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 (162.62-11), 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.

Simulated and Actual Field Condition Testing for Birds (162.71-5)

Cage or pen field tests are required to support registration of a formulated product if, after analysis of the pesticide properties, intended use patterns, and the results of previous laboratory tests, it is determined that use of the pesticide may result in adverse effects to organisms likely to be exposed. More specifically, in the case of avian wildlife, the short-term (small pen) and long-term (large pen) field tests are required on the basis of the results of short-term and reproduction (long-term) tests, respectively.

No such test is required for registration at this time.

Accident Exposure Experience

No accidents with technical metolachlor have been reported.

Mode of Action

No data ^{have} ~~has~~ 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

~~Symptoms occurred at either the highest dosage level, 10,000 ppm, for the avian dietary LC50 dose in the avian single dose oral LD50.~~

The data ~~generally indicate that metolachlor shows little or, at the most, moderate short-term~~ ^{toxicity} ~~to avian~~ ^{toxicity} ~~subacute~~ ^{toxicity}

TOXICITY TO WILD MAMMALS

Experimental Toxic Effects

Applicability of laboratory Animal Data

The data on laboratory animals ^{can generally be considered} is sufficient for assessment of the potential hazard to wild animals. ~~mammals~~ ^{not only} ~~application~~ ^{on a case by case basis.}

Mammalian Acute Toxicity (162.71-3)

~~This data is not required due to the acceptability of the laboratory animal data.~~ ^(insert the attached for Mamm Acute Tox) ^(+ Field Testing)

Accident Exposure Experience

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Mode of Action

No data ^{have} ~~has~~ 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. No data has been identified on this subject. No current requirement for this kind of data exists.~~ ^{and has not been received}

Effects Assessment for Wild Mammals

~~(In preparation)~~ ^{Since the Human and Domestic Animal sections on Effects and Assessment and Summary are still in preparation and 72 have not been received, no assessment for wild mammals can be made at this time.}

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 + 9.7.

Simulated and Actual Field Condition Testing for Mammals (162.71-5)

Cage or pen field tests are required to support registration of a formulated product if, after analysis of the pesticide properties, intended use patterns, and the results of previous laboratory tests, it is determined that use of the pesticide may result in adverse effects to organisms likely to be exposed.

No such test is required at this time.

TOXICITY TO NON-TARGET PLANTS

Experimental Toxic Effects

Applicability of Target Plant Data

(In preparation)

Data on Treated Crop

This data applies only to field corn. 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 phytotoxicity effects before harvest and no yield reduction was found to be associated with phytotoxic reactions. (no response)

Data on other Exposed Non-target Plants

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Accident Exposure Experience

No data ^{have} ~~has~~ been identified on this subject. No current requirement for this kind of data exists.

Symptomatology and Pathology

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

Effects Assessment for Non-target Plants

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

SUMMARY OF EXPECTED EFFECTS - OTHER NON-TARGET ORGANISMS

Soil Microbes

Nitrification was inhibited for at a concentration 125ppm in Hagerstown silt loam.

Aquatic Invertebrates

The 48 hour LC50 with 95% confidence limits is 25.1 ppm which indicates that metolachlor is slightly toxic to aquatic invertebrates.

Fish

All symptoms developed at lethal doses.

Birds

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

Symptoms occurred at either the highest dosage level 10,000ppm, for the avian dietary LC50 or the LD50 dose in the avian single dose oral LD50.

Wild Mammals

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

Non-target Plants

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

Fish

All symptoms developed at lethal doses.

Birds

The data generally indicate that metolachlor should pose little or at the most, moderate short-term hazard to avian wildlife. Symptoms occurred at either the highest dosage level 10,000ppm, for the avian dietary LC50 or the LD50 dose in the avian single dose oral LD50.

Wild Mammals

Since the Human and Domestic Animal sections on Effects and Summary are still in preparation and have not been reviewed, no assessment for wild mammals can be made at this time. No data has been identified on this subject. No current requirement for this kind of data exists.

Non-target Plants

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

DATA GAPS

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

- (a) The avian acute oral LD₅₀ for one species of waterfowl (mallard duck, preferably) or species of upland game bird (ring-necked pheasant or bobwhite quail) - Sec. 162.71-1. *to include other native quail or the ring-necked pheasant - Sec. 162.71-1.*
- (b) The 96-hour acute LC₅₀ for a coldwater species (rainbow trout) of fish - Sec. 162.72-1.

Prior to registration of formulated products containing metolachlor the following conditional studies on the technical are required as per the new Sec. B Regulations and the proposed Guidelines. The following basic studies are needed to perform a hazard assessment:

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

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

- (b) The fish life-cycle test on a freshwater fish (fathead minnow, preferably) (162.74-4)

LABEL REQUIREMENTS

The following environmental hazards statement is required.

Keep out of lakes, ponds, or streams.

BIBLIOGRAPHY

EFFECTS ASSESSMENT-OTHER NON-TARGET ORGANISMS

(add the attached reference pertaining to Human and Domestic Animals pertaining to wild mammals)

CIBA-GEIGY Corporation (1975a) CGA-24705 Efficacy and Crop Safety Summary: 1973-1974. Received Mar 27, 1975 under 5F1606. (Unpublished report that includes efficacy and crop safety reports 1-51 and rotational bioassay reports 52-71; CDL:94383-A, 94384)

CIBA-GEIGY Corporation (1975e) Efficacy and Crop Safety Summary GA-2-686 15G Herbicide for Corn. Received Feb 9, 1976 under 100-EUP-44. (Unpublished report including summary tables and efficacy tests 1-6, 8-14; CDL:96496-B)

CIBA-GEIGY Corporation (1977d) Application in Liquid Fertilizers. Received Feb 18, 1977 under 100-583. (Unpublished report that includes studies 1-18 with a summary; CDL:228101-E; 228121)

CIBA-GEIGY Corporation (1977l) Dual 6E Alone -- Preemergence. Received Feb 18, 1977 under 100-583. (Unpublished report that includes studies 1-139 with a summary, 1C-70C with a summary, and 1D-12D with summary; CDL:228101-A; 228102; 228103; 228104; 228105; 228106; 228107; 228108)

CIBA-GEIGY Corporation (1977m) Dual^(R) 6E Alone -- Preplant Incorporated. Received Feb 18, 1977 under 100-583. (Unpublished report that includes studies 1-82 with a summary, 1C-52C with a summary, and 1D-11D with summary; CDL:228101-B; 228109; 228110; 228118; 228111; 228112; 228113)

Ercegovich, C.D.; Bogus, E.R.; Buly, R.L. (1978) The Effects of 5, 25, and 125 PPM of Metolachlor, [2-Chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide] on Actinomycetes, Bacteria and Fungi in Laboratory Culture Tests. E-2/1-CG78. Received Feb 6, 1978 under 100-583. (Unpublished report prepared by Pesticide Research Lab., Pennsylvania State University for CIBA-GEIGY Corp., Greensboro, N.C.; CDL:232789-F)

Affiliated Medical Research, Incorporated (1974e) Emetic
Dose 50 in Beagle Dogs with CGA-24705-Technical:
Contract No. 120-2255-34. Received Sep 26, 1974
under 5G1553. (Unpublished report prepared for
CIBA-GEIGY Corp., Greensboro, N.C.; CDL:112840-C)

Affiliated Medical Research, Incorporated (1974f) Emetic
Dose 50 in Beagle Dogs with CGA-24705-6E: Contract
No. 121-2255-34. Received Sep 26, 1974 under 5G1553.
(Unpublished report prepared for CIBA-GEIGY Corp.,
Greensboro, N.C.; CDL:112840-D)

Bathe, R. (1973) Acute Oral LD₅₀ of Technical CGA-24705
in the Rat: Project No. Siss.2979. Received Sep 26,
1974 under 5G1553. (Unpublished report prepared by
CIBA-GEIGY Ltd., Basle, Switzerland; CDL:112840-A)

Ercegovich, C.D.; Vallejo, R.P.; Bogus, E.R. (1978) The Effects of 5, 25, and 125 PPM of Metolachlor, [2-Chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl) acetamide], on Soil Nitrification. E-3/2-CG78. Received Feb 6, 1978 under 100-583. (Unpublished report prepared by Pesticide Research Lab., Pennsylvania State University for CIBA-GEIGY Corp., Greensboro, N.C.; CDL:232789-G)

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