



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY  
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EEED FILE

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OFFICE OF  
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Methoxychlor Registration Standard

FROM: James W. Akerman, Chief *H.T. Craven*  
Ecological Effects Branch  
Environmental Fate and  
Effects Division (TS- 769C)

TO: Ed Allen, Product Manager  
Insecticide-Rodenticide Branch  
Registration Division (TS-767C)

Attached are the Disciplinary Review, Topical Summaries, and Generic Data Requirements for the Ecological Effects Chapter of the Methoxychlor Registration Standard. If you have any questions call Harry Craven on 557-0320.

Attachment

cc: J. Heckman (MSS) (Memorandum only)  
K. Barbehenn (SIPS)  
H. Henry Craven (EFED/EEB)

*Sum ✓  
(this is the topical review)*

*✓*

ECOLOGICAL EFFECTS TOPICAL SUMMARIES

A. Effects on Birds

Eight studies in five documents were evaluated under this topic. All studies were acceptable for use in a hazard assessment.

| <u>No.</u> | <u>Author</u> | <u>Date</u> | <u>M R I D</u> |
|------------|---------------|-------------|----------------|
|            | Hudson et al. | 1984        | 16000          |
|            | Beavers       | 1982        | 141503         |
|            | Beavers       | 1982        | 141502         |
|            | Beavers       | 1982        | 141501         |
|            | Hill et al.   | 1975        | 22923          |

In order to establish the toxicity of methoxychlor to birds, the minimum data required on the technical material are:

- o An avian single-dose LD<sub>50</sub> test with either one species of waterfowl, preferably the mallard, or one species of upland game bird, preferably bobwhite, and
- o Two avian dietary LC<sub>50</sub> tests with one species of waterfowl, preferably the mallard, and one species of upland game bird, preferably bobwhite.

1. Avian Acute Oral Toxicity

The acceptable acute oral toxicity data on technical methoxychlor are listed below:

| <u>Species</u>      | <u>% ai</u>       | <u>LD<sub>50</sub><br/>(mg/kg)</u> | <u>Author</u> | <u>Date</u> | <u>MRID<br/>No.</u> | <u>Fulfills<br/>Requirement</u> |
|---------------------|-------------------|------------------------------------|---------------|-------------|---------------------|---------------------------------|
| Mallard             | 88                | > 2000                             | Hudson et al. | 1984        | 160000              | Partial <sub>1</sub> /          |
| California quail    | 88                | > 2000                             | Hudson et al. | 1984        | 160000              | Partial <sub>1</sub> /          |
| Bobwhite            | 40 <sub>1</sub> / | > 2510                             | Beavers       | 1982        | 141501              | No                              |
| Sharp-tailed grouse | 88                | > 2000                             | Hudson et al. | 1984        | 160000              | Partial <sub>1</sub> /          |

<sub>1</sub>/ Incomplete reporting of results.

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The data indicate that technical methoxychlor is practically nontoxic to birds on an acute oral basis. Although the Guidelines Requirements are not fully satisfied by one study, the collection of studies fulfills the requirement.

## 2. Avian Dietary Toxicity

The acceptable avian dietary toxicity studies on technical methoxychlor are listed below:

| <u>Species</u> | <u>% ai</u> | <u>LC<sub>50</sub><br/>(ppm)</u> | <u>Author</u> | <u>Date</u> | <u>MRID<br/>No.</u> | <u>Fulfills<br/>Requirement</u> |
|----------------|-------------|----------------------------------|---------------|-------------|---------------------|---------------------------------|
| Bobwhite       | 40          | > 5620                           | Beavers       | 1982        | 141503              | No                              |
| Bobwhite       | 89          | > 5620                           | Hill et al.   | 1975        | 22923               | Yes                             |
| Mallard        | 40          | > 5620                           | Beavers       | 1982        | 141502              | No                              |
| Mallard        | 89          | > 5000                           | Hill et al.   | 1975        | 22923               | Yes                             |

These data indicate that technical methoxychlor is practically nontoxic to upland game birds and waterfowl on a dietary basis. The Guidelines requirement for avian dietary studies is fulfilled.

## 3. Avian Reproduction Studies

Avian reproduction studies on bobwhite and mallard are required for technical methoxychlor because most of the use patterns would subject birds to repeated exposure during the breeding season.

No acceptable data on avian reproduction have been submitted. Therefore, the Guideline requirement has not been fulfilled.

### Precautionary Labeling

Based upon the data in the above sections, no precautionary statement for wildlife is required for methoxychlor.

## B. Effects on Freshwater Fish

Twelve studies in four documents were evaluated under this topic. Twelve studies were found to be acceptable for use in a hazard assessment.

| <u>Author</u>    | <u>Date</u> | <u>MRID No.</u> |
|------------------|-------------|-----------------|
| McKee            | 1982        | 141504          |
| McCann           | 1971        | 98800           |
| Macek            | 1969        | 141505          |
| Johnson & Finley | 1980        | 40094602        |

The minimum data required for establishing the acute toxicity of methoxychlor to fish are the results from two 96-hour studies with the technical grade material. The studies should be conducted with one coldwater species (preferably rainbow trout) and one warmwater species (preferably bluegill).

### 1. Technical Methoxychlor

The fish acute toxicity data that are acceptable for use in a hazard assessment are listed below.

| <u>Species</u> | <u>% ai</u> | <u>LC<sub>50</sub><br/>(ppm)</u> | <u>Author</u> | <u>Date</u> | <u>Fiche<br/>ID No.</u> | <u>Fulfills<br/>Requirement</u> |
|----------------|-------------|----------------------------------|---------------|-------------|-------------------------|---------------------------------|
| Bluegill       | -           | 0.41                             | McKee         | 1982        | 141504                  | Partial <sup>2/</sup>           |
| Rainbow        | -           | 1.31                             | McKee         | 1982        | 141505                  | Partial <sup>2/</sup>           |
| Bluegill       | -           | 0.075                            | Macek         | 1969        | 5003107                 | Partial <sup>2/</sup>           |
| Rainbow        | -           | 0.062                            | Macek         | 1969        | 5003107                 | Partial <sup>2/</sup>           |
| Rainbow        | 88.5        | 0.062                            | Johnson       | 1980        | 40094602                | Yes                             |
| Bluegill       | 88.5        | 0.032                            | Johnson       | 1980        | 40094602                | Yes                             |
| Cutthroat      | 89.5        | 0.015                            | Johnson       | 1980        | 40094602                | Yes                             |
| Brook          | 89.5        | 0.019                            | Johnson       | 1980        | 40094602                | Yes                             |

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LC<sub>50</sub> = 164 ppb  
524 ppb

2/ Among other deficiencies, these studies did not report the purity of the test substances.

These data indicate that methoxychlor is very highly toxic to warmwater and coldwater fish. The Guidelines requirements for acute toxicity testing with fish are fulfilled.

### 2. Formulated Products

Acute aquatic toxicity studies on fish with the formulated product may be required when the product will be introduced directly into water or when the maximum expected environmental concentration (MEEC) or the estimated environmental concentration (EEC) exceeds the LC<sub>50</sub> of the technical material to fish. Current registered uses include direct application to water. The potential degradation of methoxychlor in aquatic environments is unclear. However, it appears that there is a potential for residues in water to exceed fish LC<sub>50</sub> values for methoxychlor fol-

lowing multiple applications for all uses except seed treatment, indoor, premise, commercial and industrial uses.

The fish acute toxicity data on formulated products that are acceptable for use in a hazard assessment are listed below.

RAINBOW

| <u>Species</u>     | <u>% ai</u> | <u>LC<sub>50</sub><br/>(ppm)</u> | <u>LC<sub>50</sub><br/>(ppm ai)</u> | <u>Author</u> | <u>Date</u> | <u>MRID<br/>No.</u> | <u>Fulfills<br/>Requirement</u> |
|--------------------|-------------|----------------------------------|-------------------------------------|---------------|-------------|---------------------|---------------------------------|
| Rainbow            | 3*          | 0.132                            |                                     | McCann        | 1971        | 98800               | Yes                             |
| Brook              | 50G         | 0.012                            |                                     | Johnson       | 1980        | 40094602            | Yes                             |
| Atlantic<br>salmon | 50G         | 0.002                            |                                     | Johnson       | 1980        | 40094602            | Yes                             |
| Yellow<br>perch    | 50G         | 0.017                            |                                     | Johnson       | 1980        | 40094602            | Yes                             |

\*Formulated with 75% captan (orthocidide methoxychlor 75-3).

These data indicate that the 3 percent formulation of methoxychlor with 75% captan is highly toxic to coldwater fish. Granular methoxychlor is very highly toxic to coldwater fish. As indicated above, formulated product testing is required. The Guidelines requirement for fish acute toxicity tests with a typical end-use product (EP) of methoxychlor containing up to 50% G is fulfilled. A typical end-use product formulated as an 25% EC is required since direct application to water is indicated in the Index Entry.

### 3. Fish Early Life-Stage Test

No studies were evaluated under this topic.

Toxicity data on technical methoxychlor from fish early life stage tests are required to support the registration of an EP when the product is expected to be applied directly to water or be transported to water from the intended use site and the acute toxicity of the technical material is less than 1 mg/L or the EEC in water is equal to or greater than 0.01 times the LC<sub>50</sub> from acute testing. The lowest fish acute LC<sub>50</sub> on the technical material is 0.02 mg/L, and the aquatic EECs for single applications are 0.003 mg/L at the lowest rate of 0.5 lb ai/A to 0.05 mg/l at the highest application rate of 7.5 lb a.i./A following runoff. All rates exceed the safety factor of 0.01 X the LC<sub>50</sub>. Therefore, the fish early life stage test is required.

### 4. Fish Life Cycle Test

No studies were evaluated under this topic.

Data from life cycle tests on fish are required to support the registration of an EP that is expected to be applied directly to or be transported to water from the intended use site when the EEC is equal to or greater than one-tenth of the no-effect level in the fish early life stage test. Although no early life stage or invertebrate life cycle data are available, EECs are estimated to be at least one-fifth of the lowest fish LC<sub>50</sub>. Therefore, it is expected that the fish life cycle test will be required, based on the results of the early life stage data and the EEC, unless it can be demonstrated that actual residues are considerably lower than estimated (see section E on Field Testing and Monitoring Studies).

#### Precautionary Labeling

Based on data in the above sections, a precautionary statement for fish is required for methoxychlor.

#### C. Effects on Freshwater Invertebrates

Four studies in three documents were evaluated under this topic. Three studies are acceptable for use in a hazard assessment.

| <u>Author</u>    | <u>Date</u> | <u>MRID No.</u> |
|------------------|-------------|-----------------|
| Boudreau         | 1982        | 144868          |
| Cheah            | 1978        | 84745           |
| Johnson & Finley | 1980        | 40094602        |

The minimum data required for establishing the acute toxicity of methoxychlor to freshwater invertebrates are the results from a 48-hour study with the technical material on first instar Daphnia magna (preferably) or on early instar amphipods, stoneflies, or mayflies.

##### 1. Technical Methoxychlor

The acceptable data on the acute toxicity of technical methoxychlor to freshwater invertebrates are listed below:

| <u>Species</u> | <u>% ai</u> | <u>LC<sub>50</sub><br/>(ppm)</u> | <u>Author</u> | <u>Date</u> | <u>MRID<br/>No.</u> | <u>Fulfills<br/>Requirement</u> |
|----------------|-------------|----------------------------------|---------------|-------------|---------------------|---------------------------------|
| Pteronarcys    | 89.5        | 0.0014                           | Johnson       | 1980        | 40094602            | Yes                             |
| Daphnid        | 89.5        | 0.078                            | Johnson       | 1980        | 40094602            | Yes                             |

The data indicate that technical methoxychlor is highly toxic to freshwater invertebrates. The Guidelines requirement for an

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acute toxicity study on aquatic invertebrates with technical methoxychlor is fulfilled.

## 2. Formulated Products

Acute aquatic toxicity studies on freshwater invertebrates with the formulated product may be required when the product will be introduced directly into water or when the MEEC or the EEC exceeds the LC<sub>50</sub> of the technical material to freshwater invertebrates. Because the lowest aquatic EEC (0.003 ppb) exceeds the Pteronarcys LC<sub>50</sub> (0.0014 ppm) by 2 times and methoxychlor has aquatic uses, data are required on the toxicity of a typical EP (25%EC and a 50% G or WP) to freshwater invertebrates.

The acceptable data on the acute toxicity of formulated product testing to freshwater invertebrates are listed below:

| <u>Species</u> | <u>% ai</u>                    | <u>LC<sub>50</sub><br/>(ppm)</u> | <u>Author</u> | <u>Date</u>     | <u>MRID<br/>No.</u> | <u>Fulfills<br/>Requirement</u> |
|----------------|--------------------------------|----------------------------------|---------------|-----------------|---------------------|---------------------------------|
| Daphnid        | 40 <sub>1</sub> /<br><u>18</u> | <del>18</del><br>708 ppb         | Boudreau      | 1982<br>4/23/93 | 144868              | Yes                             |

1/ MIS-16, a clear yellow liquid.

## 3. Aquatic Invertebrate Life Cycle

No studies were evaluated under this topic.

Data on the toxicity of technical methoxychlor to aquatic invertebrate life cycles are required to support the registration of an EP when the product is applied directly to water or is expected to be transported to water from the intended use site and the acute toxicity of the technical material is less than 1 mg/L or the EEC in water is equal to or greater than 0.01 times the acute LC<sub>50</sub>. The aquatic invertebrate LC<sub>50</sub> (1.4 ug/L) is considerably below 1 mg/L and the EECs for all uses ( $\geq 3.3$  ppb) are at least twice as great as the LC<sub>50</sub>. Therefore, the aquatic invertebrate life cycle test is required.

### Precautionary Labeling

Based upon data in the above sections, a precautionary statement for aquatic invertebrates is required for methoxychlor.

## D. Effects on Estuarine and Marine Organisms

Acute toxicity testing with estuarine and marine organisms is required for a chemical when the EP is intended for direct application to the marine/estuarine environment or is expected to reach this environment in significant concentrations when the

product is used as directed. Methoxychlor is used as an insecticide in water, corn, and soybeans which may result in exposure to estuarine environments through direct application, drift, runoff, and drainage.

Seven studies in one document were evaluated under this topic. They are all acceptable for use in a hazard assessment.

1. Technical Product

The minimum data for establishing the acute toxicity of technical methoxychlor to estuarine and marine organisms are:

a. A 96-hour LC<sub>50</sub> study for a fish, preferably Menidia sp. or spot, Leiostomus xanthurus,

b. A 96-hour LC<sub>50</sub> study on an invertebrate, preferably a species of penaid shrimp, and

c. A 48-hour EC<sub>50</sub> study with oyster embryolarvae or a 96-hour LC<sub>50</sub> oyster shell deposition study.

The acceptable data on the acute toxicity of technical methoxychlor to estuarine/marine organisms are listed below:

| <u>Species</u> | <u>% ai</u> | <u>(ppb)</u> | <u>LC<sub>50</sub><br/>Author</u> | <u>Date</u> | <u>MRID<br/>No.</u> | <u>Fulfills<br/>Requirement</u> |
|----------------|-------------|--------------|-----------------------------------|-------------|---------------------|---------------------------------|
| Brown shrimp   | 100         | 3.6          | Mayer                             | 1986        | 40228401            | Yes                             |
| Pink shrimp    | 100         | 6.8          | Mayer                             | 1986        | 40228401            | Yes                             |
| Grass shrimp   | 100         | 20.0         | Mayer                             | 1986        | 40228401            | Yes                             |
| Blue crab      | 100         | 320.0        | Mayer                             | 1986        | 40228401            | No <sub>1/</sub>                |
| Eastern oyster | 100         | 90.0         | Mayer                             | 1986        | 40228401            | Yes                             |
| Spot           | 100         | 23.0         | Mayer                             | 1986        | 40228401            | Yes                             |
| Striped mullet | 100         | 32.0         | Mayer                             | 1986        | 40228401            | Yes                             |

<sub>1/</sub> Not a recommended species.

The data indicate that technical methoxychlor is highly toxic to estuarine/marine organisms. The Guideline requirements for acute toxicity testing with methoxychlor on estuarine and marine organisms is fulfilled.



## 2. Formulated Product

When the EC<sub>50</sub> or LC<sub>50</sub> of the technical material to estuarine organisms is less than the EEC for estuarine environments, acute toxicity testing of the EP on estuarine or marine organisms is required.

No acceptable data on EPs of methoxychlor have been submitted. Testing is required on the toxicity of a typical EP (25% EC and 50% G or WP) to an estuarine/marine fish, shrimp and mollusc.

### E. Field Testing and Monitoring Studies

No studies were evaluated under this topic.

Simulated or actual field studies and residue monitoring studies are required on a case-by-case basis depending upon the intended use pattern of the chemical, the toxicity to nontarget organisms, and relevant environmental fate characteristics.

Methoxychlor is very highly toxic to aquatic organisms and the intended use patterns are such that aquatic environments may be exposed through direct application, drift, runoff, or drainage. Calculated EECs indicate that applied methoxychlor could be transported to water resulting in concentrations above aquatic LC<sub>50</sub> values, which would require a field study in aquatic environments. However, the environmental fate characteristics and degradation products are unclear, and it is unknown if sufficient residues to cause toxic effects would occur in aquatic environments. Therefore, actual field studies are required unless residue monitoring or mesocosm studies are conducted and demonstrate that methoxychlor is not present in aquatic environments near use sites at a concentration below one-half the aquatic invertebrate LC<sub>50</sub> (LC<sub>50</sub> = 1.4 ppb).

Methoxychlor is practically nontoxic to birds on a dietary basis and on an acute oral basis. Estimated EECs are up to 1350 ppm for stone fruits. Data are lacking to assess the reproductive effects on birds. If the required avian reproduction study indicates that effects occur at or above the EECs for any of the various use patterns, then field studies are required to support those use patterns.

### F. Plant Protection

No studies were evaluated under this topic. According to 40 CFR Part 158.150, data are required for pesticides to be used in forests and natural grasslands. The required studies are seed germination/seedling emergence, vegetative vigor and aquatic plant growth.

## ECOLOGICAL EFFECTS DISCIPLINARY REVIEW

### I. ECOLOGICAL EFFECTS PROFILE

#### A. Technical Product

##### 1. Avian Studies

There is sufficient information to suggest that technical methoxychlor is practically nontoxic to birds both on an acute oral and subacute dietary basis. An acute oral LD<sub>50</sub> value is reported to be >2510 mg/kg (Beavers 1982, 141501). The dietary LC<sub>50</sub> values are reported to be > 5620 ppm (Beavers 1982, 141502 and 141503).

##### 2. Aquatic Studies

There is sufficient information to suggest that methoxychlor is very highly toxic to fish and moderately toxic to aquatic invertebrates. Acute LC<sub>50</sub> values for fish range from 1.31 ppm for rainbow trout (McKee 1982, 141505) to 0.015 ppm for cutthroat trout (Johnson 1980, 40094602). The aquatic invertebrate LC<sub>50</sub> value is 1.8 ppm for daphnid (Boudreau 1982, 144868) to 0.0014 for Pteronarcys (Johnson 1980, 40094602).

#### B. Formulated Products

##### 1. Aquatic Studies

There is sufficient information to suggest that 3% Orthocide Methoxychlor 75-3 (formulated with 75% captan) is highly toxic to fish. The acute LC<sub>50</sub> value is 0.132 ppm for rainbow trout (McCann 1971, 98800). A 50% granular formulation ranges from 0.002 ppm for Atlantic salmon to 0.07 ppm for yellow perch (Johnson 1980, 40094602).

### II. FORMULATIONS AND USE

Information in this section was extracted from 1) "Qualitative Use Assessment for Insecticidal Uses of Methoxychlor" prepared by William L. Gross, Jr., SSB/BUD, July 25, 1988; 2) "Preliminary Quantitative Usage Analysis of Methoxychlor" prepared by R. Holtorf, EAB/BUD, June 1988; and 3) the draft Index Entry for Methoxychlor prepared by SSB/BUD, December 30, 1987.

In addition to the 99.9 percent technical<sup>1</sup>, methoxychlor exists as EPs in the form of 0.25 to 11% dusts, 5 percent G, 2 to 50 percent wettable powders, 1.6 to 4.0 lb/gal emulsifiable concentrates and 2.0 lb/gal soluble concentrates. There are 140 single active ingredient registrations and 332 multiple active ingredient registrations containing methoxychlor. There are 25 section 24(c) registrations (CA, AR, FL, ID, MA, MD, MS, NE, NV, NY, OR, PA, UT, and WA).

Methoxychlor is a chlorinated hydrocarbon insecticide. It is registered as an insecticide/acaricide for use on a number of agricultural food and nonfood crops, ornamentals, farm premises, garbage dumps, commercial institutional and industrial areas, commercial transportation vehicles, fruit trees, livestock, and pets. Data available to the Agency indicate that alfalfa, livestock, home orchards and ornamentals are the high volume use sites. Approximately 500,000 to 900,000 lb ai were used in the United States during 1986. Approximately 5.4 percent was used on alfalfa, 8.9 percent on livestock, 11.5 percent on home orchards, and 11.5 percent on ornamentals. It is reported that 37.6 percent was used on all crops (wheat, barley, vegetables, and soybeans). The remaining uses are 5.4 percent on other sites/farm premises, 1.0 percent seed treatment, 2.5 percent grain storage, 11.5 percent industrial/commercial, 0.9 percent general pest control, and 3.9 percent flea and tick control. Some of the major uses are summarized as follows:

#### Alfalfa

Methoxychlor is applied as a foliar spray to alfalfa when pests first appear, and repeated at 7-day intervals, or as needed. Rates range from 0.5 to 4.5 lb ai/A with dusts, wettable powders and registered ECs. Application can be made by ground or air.

#### Home Orchards (Apples)

Methoxychlor is applied as a foliar spray using compressed air sprayers, knapsack sprayers or air blast sprayers when leaves first show, and continued at 7-day intervals until bloom. Additional sprays should be made at petal-fall, 7 days later, then repeated at 2-week intervals until 7 days before harvest. Rates are 3.75 to 7.5 lb ai/A.

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<sup>1</sup> The Index entry identifies technical methoxychlor as 88 percent 2,2 bis (p-methoxyphenyl)-1,1,1-trichloroethane and 12 percent related copounds.

### Ornamental Shade Trees

Methoxychlor is applied to ornamental shade trees as a foliar spray using compressed air sprayers, knapsack sprayers or air-blast sprayers when pests first appear, and is applied at 5- to 7-day intervals until pests are controlled. Rates range from 2 to 2.5 lb ai/A.

### Other Uses

The other major uses (cattle dip and livestock treatments) are not expected to present sufficient exposure to nontarget organisms. Other nonmajor uses (greenhouse food crops, domestic dwellings, indoor uses, agricultural premises and equipment, and commercial and industrial uses) are also not expected to present sufficient exposure to nontarget organisms and will not be represented in the hazard assessment. Some of the other uses are summarized in Table 1.

Table 1. Some Crops and Use Rates for Methoxychlor

| <u>Crop</u>             | <u>lb ai/A</u> | <u>Maximum Rate<br/>lb ai/A<br/>(No. Appl.)</u> |
|-------------------------|----------------|---|
| Stone Fruits            | 3 - 12         | 12 (4)  |
| Beans                   | 1 - 5          | Repeat as needed                                |
| Broccoli                | 0.9 - 5        | 5.0   |
| Carrots                 | 0.9 - 5        | 5.0   |
| Clover                  | 0.5 - 3        | Repeat as needed                                |
| Corn                    | 0.5 - 3        | 3.0   |
| Cranberry               | 1 - 5          | 5.0   |
| Grapes                  | 1 - 6          | 6.0   |
| Grasses                 | 0.5 - 3        | 3.0   |
| Lettuce                 | 0.9 - 2.25     | 2.25  |
| Peanuts                 | 0.5 - 3        | 3.0   |
| Peppers                 | 1 - 2.25       | 2.25  |
| Potatoes                | 0.9 - 2.25     | 2.25  |
| Soybeans                | 0.5 - 3        | 3.0   |
| Noncrop<br>(Mosquitoes) | 1.0            | 1.0   |
| Aquatic<br>(Mosquitoes) | 0.5 - 1.0      | 1.0   |
| Forestry                | 0.16 - 0.25    | 0.25  |

### III. ENVIRONMENTAL FATE AND RESIDUES

All of the environmental fate data requirements have to be satisfied. During personal communication with Dana Spatz of EAB, I learned that none of the available data is adequate for a risk assessment.

#### Terrestrial Residues

Foliar spray applications of methoxychlor are made at rates ranging from 0.16 to 7.5 lb ai/A, depending on the crop or site. Residues may occur on the crop itself or on associated vegetation or media. Based on EEB's nomograph (from Hoerger and Kenaga 1973), the following residues could occur immediately after a single application:

| <u>Substrate</u>               | <u>Maximum (and Typical) Residues (ppm) at Specified Rates of Application (lb ai/A)</u> |            |            |            |            |
|--------------------------------|---|------------|------------|------------|------------|
|                                | <u>0.16</u>   | <u>0.5</u> | <u>1.0</u> | <u>3.0</u> | <u>5.0</u> |
| Short grass                    | 38 (20)   | 120 (63)   | 240 (125)  | 720 (375)  | 1200 (625) |
| Long grass                     | 18 (14)   | 55 (46)    | 110 (92)   | 330 (276)  | 550 (460)  |
| Leaves and<br>Leafy Crops      | 20 (5)  | 62 (18)    | 125 (35)   | 375 (105)  | 625 (175)  |
| Forage, small<br>insects       | 9 (5)   | 29 (17)    | 58 (33)    | 174 (99)   | 290 (165)  |
| Seed pods,<br>large<br>insects | 2 (.5)  | 6 (2)      | 12 (3)     | 36 (9)     | 60 (15)    |
| Fruit                          | 1 (.3)  | 4 (1)      | 7 (2)      | 21 (5)     | 35 (10)    |
| Soil (top 0.1<br>inch)         | 3   | 11         | 22         | 66         | 110        |

Residue on adjacent vegetation could occur from spray drift and could be up to 10 percent of the applied amount within 100 feet of the edge of the crop, or 11 ppm on long grass adjacent to the crop for each 1 lb ai/A applied. Understory vegetation in orchards may only have 30 percent of the applied amount as residues. Thus, understory long grass could have 33 ppm residues for each 1 lb ai/A applied.

The potential for residues to accumulate resulting from multiple applications cannot be determined. Degradation rates were not known as of this writing. Illustrating hypothetically, if the spray interval were 14 days, and the half-life on wildlife

food items was 14 days, then every 2 weeks 50 percent of the initial amount would exist to be added to the next application. On the other hand, with a spray interval of 7 days and a half-life of 28 days, then assuming straight line degradation kinetics, residue increments after spraying on the 14th day would be 264 percent of the single application residues. Half-lives may be much higher since methoxychlor is a chlorinated hydrocarbon.

### Aquatic Residues

A direct application to water of 1 lb ai/A would result in residues of 734 ppb in the top 6 inches or 61.2 ppb in 6 feet of water. Direct application to water is expected for mosquito control. Additionally, a pond located 100 meters from a treated site could receive 5 percent of the applied amount as spray drift. This would amount to 36.7 ppb in the top 6 inches or 3.1 ppb in 6 feet of water. With a low water solubility, 1 percent or less runoff may be expected. Using the standard EEB pond model of 10 acres of runoff feeding into a 1-acre pond 6 feet deep, maximum residues from a single 1 lb ai/A application would be 3.7 ppb. The combined exposure from drift and runoff (or drainage) could be as high as 6.8 ppb for each 1 lb ai/A applied. Aquatic residues based on this scenario are presented for specific crops in Table 2.

Table 2. Estimated Environmental Concentrations (EEC) of Methoxychlor in a 6 acre-foot pond Following a Single Application.

| <u>Use</u>     | <u>Rate</u><br><u>lb ai/A</u> | <u>EEC (ppb)</u> |
|----------------|-------------------------------|------------------|
| Stone Fruits   | 3.0 to 12.0                   | 20.4 to 81.6     |
| Corn           | 0.5 to 3.0                    | 3.4 to 20.4      |
| Potatoes       | 0.9 to 2.25                   | 6.1 to 15.3      |
| Soybeans       | 0.5 to 3.0                    | 3.4 to 20.4      |
| Noncrop        | 1.0                           | 6.8              |
| Seed Treatment | N/A <sup>1/</sup>             |                  |

<sup>1/</sup> Seed treatment uses are not expected to result in runoff in sufficient quantities to expose aquatic organisms.

#### IV. RISK ASSESSMENT

##### A. Effects on Terrestrial Organisms

Methoxychlor is considered practically nontoxic to birds on an acute oral and subacute dietary basis. No data are available on the reproductive effects, if any, of methoxychlor to birds. The acute oral LD<sub>50</sub> for rats is reported to be > 6000 mg/kg, which makes methoxychlor practically nontoxic to mammals.

The maximum application rates for methoxychlor range from 2.25 to 12.0 lb ai/A, depending upon the crop. Maximum expected residues immediately following a single application would be 540 to 2880 ppm. With LC<sub>50</sub> values greater than 5000 ppm (no deaths to 5000 ppm), it appears that acute effects in the field are unlikely.

There are no data for assessing the potential hazards of repeated applications or the likelihood of chronic effects. Information is needed on degradation rates in and on wildlife food sources, other environmental fate data, and experimental data on the effects of methoxychlor on avian reproduction. Depending upon the nature of this needed information, field studies may be necessary.

## B. Effects on Aquatic Organisms

Methoxychlor is very highly toxic to aquatic organisms. Fish LC<sub>50</sub> values are as low as 0.015 ppm and aquatic invertebrate LC<sub>50</sub> values are as low 0.001 ppm. EECs resulting from runoff, drainage, drift or direct application following a single application are 15.3 to 732 ppb for the various use patterns. These estimates are not as precise as the SWRRB and EXAMS II (or PRISM) computer models could be, but there are insufficient environmental fate data to employ their use. However, the estimation from the scenario presented in Aquatic Residues affords us an approximation of the impact to aquatic species. The residues for most application rates and uses are above the LC<sub>50</sub> values (or an applied safety factor).

Therefore, there are concerns for direct toxicity to aquatic organisms as well as the concern for loss of the prey base.

There are significant gaps in the available data to assess aquatic impacts. No chronic toxicity data are available and environmental fate data are lacking. The acute toxicity data that are available indicate that, in addition to other laboratory data, aquatic field studies may be necessary to evaluate the potential impacts. It may be possible to demonstrate through modeling or aquatic field monitoring that actual aquatic residues are much lower than estimated. If actual residues in appropriate nearby aquatic environments are less than 0.7 ppb (one-half the lowest invertebrate LC<sub>50</sub>), then the requirement for higher tier aquatic field studies may be removed. Decisions regarding other aquatic studies will be made when chronic data, field monitoring, and environmental fate data are available and reviewed.

## C. Classification

Restricted Use Classification is indicated when residues result in levels that exceed 1/5th the terrestrial wildlife LC<sub>50</sub> values and 1/10th the aquatic organism LC<sub>50</sub> values. Estimated terrestrial residues do not meet these criteria, primarily due to the low-order acute toxicity to birds. Aquatic EECs exceed 1/10 the lowest aquatic LC<sub>50</sub> (1.5 ppb for cutthroat trout) for all uses above 0.9 lb ai/A where runoff would be expected (nonaquatic use sites) and above 0.008 lb ai/A for direct application to water (i.e. aquatic uses for mosquitos). The currently available data would require that all use patterns be classified as Restricted Use, based upon aquatic data. However, final classification will be postponed pending receipt of environmental fate data, further refine EECs.



## Endangered Species

There are sufficient data to suggest that the current registered uses of methoxychlor may affect endangered species. In aquatic environments, all maximum application rates for the various uses are expected to result in EECs above 1/20 the fish and invertebrate LC<sub>50</sub> for tested species. There are substantial concerns for any aquatic species that may be exposed. In terrestrial environments, all use patterns result in EECs that are lower than the no-effect levels (>5000 ppm) for birds. Concerns are reduced for certain uses, i.e., seed treatment, industrial/commercial, domestic, indoor, and farm animals and premises.

Based on acute toxicity, Methoxychlor was included in the "Crop Cluster" in the original PR Notice (87-4) and in the mosquito larvicide cluster (PR Notice 87-5) that addressed some of our concerns. This notice was withdrawn in January 1988, pending refinement of the technical information regarding the range and habitats of the species. EPA plans to resubmit a package of data outlining "may effect levels" for consultation to U.S. Fish and Wildlife Service (FWS) in the near future. If a jeopardy concern is returned by FWS, then methoxychlor will be included in the appropriate cluster and appropriate labeling will be required. The potential risk to listed species from other uses will be evaluated when chronic toxicity data and environmental fate data are available.

No endangered species labeling is being required at this time.

### V. PRECAUTIONARY STATEMENTS

#### A. Manufacturing-Use

This pesticide is toxic to fish. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or public waters unless this product is specifically identified and addressed in an NPDES permit. Do not discharge effluent containing this product to sewer systems without previously notifying the sewage treatment plant authority. For guidance, contact your State Water Board or Regional Office of the EPA.

#### B. Outdoor End-Use Products

##### 1) Non Aquatic (except seed treatment and forestry)

This pesticide is toxic to fish. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not apply directly to water or wetlands (swamps, bogs, marshes, and

potholes). Do not contaminate water when disposing of equipment washwaters.

#### 2) Seed treatments

This pesticide is toxic to fish. Cover or collect treated seeds spilled on soil surface. Do not contaminate water when disposing of equipment washwaters.

#### 3) Forestry

This pesticide is toxic to fish. Do not apply directly to water or wetlands (swamps, bogs, marshes, and potholes), except under the forest canopy. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwaters.

#### 4) Aquatic

This pesticide is toxic to fish. Drift and runoff may be hazardous to aquatic organisms in neighboring areas. Do not contaminate water when disposing of equipment washwaters.

#### REFERENCES

- Hudson, R.H.; Tucker, R.K.; Haegele, M.A. (1984) Handbook of Toxicity of Pesticides to Wildlife., U.S.D.I., Fish and Wildlife Service Resource Publication 153, pp. 52-53 (160000).
- Hill, E.F.; Heath, R.G.; Spann, J.W.; Williams, J.D. Lethal Dietary Toxicities of Environmental Pollutants to Birds. U.S.D.I., Fish and Wildlife Service, Special Scientific Report, Wildlife No. 19 (22923).
- Johnson, W. and M. Finley. (1980) Handbook of Acute Toxicity of Chemicals to Fish and Aquatic Invertebrates. USDI. Publication 137 Washington, D.C. (40094602).
- Mayer, F.L. (1986). Acute Toxicity Handbook of Chemicals to Estuarine Organisms. U.S.EPA, ORD, Gulf Breeze, Fl. (40228401).

Table A  
Generic Data Requirements for Methoxychlor

| Data Requirement   | Composition <sup>1</sup> | Use Pattern <sup>2</sup>      | Does EPA Have Data To Satisfy This Requirement? Yes, No, or Partially? | Citation          | Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B)? | Time Period After EPA Notification to Report Data |
|--|--------------------------|-------------------------------|--|-------------------|---|---|
| <u>Sect. 158.145 Wildlife and Aquatic Organisms</u>                    |                          |                               |  |                   |   |   |
| <u>Avian and Mammalian Testing</u>                                     |                          |                               |  |                   |   |   |
| 71-1<br>Avian Single Dose<br>Oral LD <sub>50</sub>                     | TGAI                     | A, B, C, D, G, I <sup>3</sup> | Yes  | 160000            | No  |   |
| 71-2<br>Avian Dietary LC <sub>150</sub>                                |                          |                               |  |                   |   |   |
| - Upland Game Bird   | TGAI                     | A, B, C, D, G, I <sup>3</sup> | Yes  | 22923             | No  |   |
| - Waterfowl  | TGAI                     | A, B, C, D, G                 | Yes  | 229213            | No  |   |
| 71-3<br>Wild Mammal Toxicity   | TGAI                     |                               | No <sup>4</sup>  |                   | No  |   |
| 71-4<br>Avian Reproduction   |                          |                               |  |                   |   |   |
| - Upland Game Bird   | TGAI                     | A, B, C, D, G                 | No   |                   | Yes <sup>5</sup>  | 24 Months   |
| - Waterfowl  | TGAI                     | A, B, C, D, G                 | No   |                   | Yes <sup>5</sup>  | 24 Months   |
| 71-5<br>Simulated and Actual<br>Field Testing for<br>Birds and Mammals | TEP                      | A, B, C, D, G                 | No   |                   |   | Reserved <sup>6</sup>                             |
| <u>Aquatic Organism Testing</u>  |                          |                               |  |                   |   |   |
| 72-1<br>Freshwater LC <sub>50</sub>                                    |                          |                               |  |                   |   |   |
| - Warmwater  | TGAI                     | A, B, C, D, G, I <sup>3</sup> | Partial  | 141504            | Yes <sup>7</sup>  |   |
|  |                          | A, B, C, D, G, I <sup>3</sup> | Partial  | 5003107           | Yes <sup>7</sup>  |   |
|  |                          | A, B, C, D, G, I <sup>3</sup> | Yes  | 40094602          | No  |   |
|  | TEP<br>(50G, 25EC)       | A, B, C, D, G                 | Partial  | 40094602          | Yes <sup>8</sup>  | 9 Months  |
| - Coldwater  | TGAI                     | A, B, C, D, G                 | Partial  | 141505            | Yes <sup>7</sup>  |   |
|  |                          | A, B, C, D, G                 | Partial  | 5003107           | Yes <sup>7</sup>  |   |
|  |                          | A, B, C, D, G                 | Yes  | 40094602          | No  |   |
|  | TEP<br>(50G, 25EC)       | A, B, C, D, G                 | Partial  | 40094602<br>98800 | Yes <sup>8</sup>  | 9 Months  |
| 72-2<br>Freshwater<br>Invertebrate LC <sub>50</sub>                    | TGAI                     | A, B, C, D, G, I <sup>3</sup> | Yes  | 40094602          | No  |   |
|  | TEP<br>(50G, 25EC)       | A, B, C, D, G                 | Partial  |                   | Yes <sup>9</sup>  | 9 Months  |

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Table A

## Generic Data Requirements for Methoxychlor (Cont'd)

| Data Requirement                                  | Composition <sup>1</sup> | Does EPA Have Data To Satisfy This Requirement? Use Pattern <sup>2</sup> | Yes, No, or Partially?  | Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B) Citation | ?                 | Time Period After EPA Notification to Report Data |
|---|--------------------------|--|-------------------------|---|-------------------|---|
| 72-3  |                          |  |                         |   |                   |   |
| Estuarine and Marine Organisms LC <sub>50</sub>   |                          |  |                         |   |                   |   |
| - Fish  | TGAI<br>TEP              | A,B,C,D,G<br>A,B,C,D,G   | Yes <sup>10</sup><br>No | 40228401  | No                | 12 Months<br>Reserved <sup>11</sup>               |
| - Shrimp  | TGAI<br>TEP              | A,B,C,D,G<br>A,B,C,D,G   | Yes <sup>10</sup><br>No | 40228401  | No                | 12 Months<br>Reserved <sup>11</sup>               |
| - Oyster  | TGAI<br>TEP              | A,B,C,D,G<br>A,B,C,D,G   | Yes <sup>10</sup><br>No | 40228401  | No                | 12 Months<br>Reserved <sup>11</sup>               |
| 72-4  |                          |  |                         |   |                   |   |
| Fish Early Life Stage and Invertebrate Life Cycle |                          |  |                         |   |                   |   |
| - Fish  | TGAI                     | A,B,C,D,G  | No                      |   | Yes <sup>12</sup> | 15 Months   |
| - Invertebrate                                    | TGAI                     | A,B,C,D,G  | No                      |   | Yes <sup>12</sup> | 15 Months   |
| 72-5  |                          |  |                         |   |                   |   |
| Fish Life Cycle                                   | TGAI                     | A,B,C,D,G  | No                      |   |                   | Reserved <sup>13</sup>                            |
| 72-6  |                          |  |                         |   |                   |   |
| Aquatic Organisms Accumulation (Fish)             | TGAI                     | A,B,C,D,G  | No                      |   | Yes <sup>14</sup> |   |
| 72-7  |                          |  |                         |   |                   |   |
| Simulated or Actual Aquatic Field Testing         |                          |  |                         |   |                   |   |
| a. Residue Monitoring                             | TEP                      | A,B,C,D,G  | No                      |   | Yes <sup>15</sup> | 2 Years   |
| b. Mesocosm or Pond                               | TEP                      | A,B,C,D,G  | No                      |   |                   | Reserved <sup>16</sup>                            |
| <u>Sec. 158.150 Plant Protection Testing</u>      |                          |  |                         |   |                   |   |
| <u>Tier I</u>                                     |                          |  |                         |   |                   |   |
| 122-1   |                          |  |                         |   |                   |   |
| Seed Germination/Seedling Emergence               | TGAI                     | C,D,G  | No                      |   | Yes <sup>17</sup> |   |
| 122-1   |                          |  |                         |   |                   |   |
| Vegative Vigor                                    | TGAI                     | G  | No                      |   | Yes <sup>17</sup> |   |
| 122-2   |                          |  |                         |   |                   |   |
| Aquatic Plant Growth                              | TGAI                     | G  | No                      |   | Yes <sup>18</sup> |   |

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Table A

## Generic Data Requirements for Methoxychlor (Cont'd)

| Data Requirement                                    | Composition <sup>1</sup> | Does EPA Have Data To Satisfy This Requirement? |                    | Citation | Must Additional Data Be Submitted Under FIFRA Section 3(c)(2)(B) ? | Time Period After EPA Notification to Report Data |
|---|--------------------------|---|--------------------|----------|--|---|
|   |                          | Yes,  | No, or Partially ? |          |  |   |
| <u>Tier II</u>                                      |                          |   |                    |          |  |   |
| 123-1<br>Seed Germination/<br>Seedling<br>Emergence | TGAI                     | C,D,G   | No                 |          | Reserved <sup>19</sup>   |   |
| 123-1<br>Vegetative Vigor                           | TGAI                     | C,D,G   | No                 |          | Reserved <sup>19</sup>   |   |
| 123-2<br>Aquatic Plant<br>Growth                    | TGAI                     | C,D,G   | No                 |          | Reserved <sup>19</sup>   |   |
| <u>Tier III</u>                                     |                          |   |                    |          |  |   |
| 124-1<br>Terrestrial Field                          | TEP                      | C,D,G   | No                 |          | Reserved <sup>20</sup>   |   |

## Notes

1. TGAI = Technical Grade Active Ingredient; TEP = Typical End-Use Product.
2. A = Terrestrial, Food Crop; B = Terrestrial, Nonfood; C = Aquatic, Food Crop; D = Aquatic Nonfood; E = Greenhouse, Food Crop; F = Greenhouse, Nonfood; G = Forestry; H = Domestic Outdoor; I = Indoor.
3. Required to support MUP.
4. No requirement currently exists.
5. Required due to multiple applications.
6. Simulated and Actual field testing for birds is reserved pending results of the required avian reproduction studies.
7. Repairable if the purity of the test product is defined and other test deficiencies in the Data Evaluation Records are corrected.
8. A typical EC formulation is required to support crop and aquatic uses. The requirement for a 50% granular has been satisfied.
9. Required to support all crop and aquatic uses because EECs on technical methoxychlor exceed the aquatic invertebrate LC<sub>50</sub>.
10. Required to support such agricultural uses as citrus, soybeans, corn as well as aquatic and forest uses because of potential exposure of estuarine/marine environments through direct application, runoff, drainage, and drift.
11. Reserved pending the results of acute toxicity testing with technical methoxychlor on marine/estuarine organisms. Required if such testing results in LC<sub>50</sub> value(s) that is (are) below the EEC in estuarine/marine environments.
12. Required to support all crop uses because the acute toxicity of technical methoxychlor is less than 1 mg/L and because the EEC in water is greater than 0.01 times the acute LC<sub>50</sub>.

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13. Reserved pending the results of fish early life stage and aquatic invertebrate life-cycle tests.
14. Data submitted under 165.4 satisfy this requirement.
15. Aquatic residue monitoring studies are required to be conducted in aquatic environments for aquatic uses. Monitoring studies are reserved for terrestrial uses depending upon results of better estimation of aquatic EEC's through modeling. As an alternative, a mesocosm study may be conducted in support of aquatic uses. Protocols should be submitted to the Agency for review and approval prior to the initiation of the monitoring studies.
16. If aquatic residue monitoring studies are not conducted or show aquatic concentrations greater than 0.6 ppb, then mesocosm studies are required for the aquatic uses. Mesocosm testing for terrestrial uses are reserved pending better refinement of aquatic EEC's from modeling. Additionally, full field studies for other use patterns are reserved, pending an evaluation of the results from the above studies and an analysis of their applicability to support other uses. For either mesocosm or full field studies, the study design must include appropriate techniques to determine acute mortality and effects on productivity and diversity of fish and aquatic invertebrates. Protocols for conducting residue monitoring, mesocosm, or full field studies should be submitted to the Agency for review and approval prior to the initiation of the study. A Guidance Document is available from the Agency, that outlines an acceptable approach to mesocosm studies. This document also provides relevant, although general, guidance for full field studies, which, if selected in place of mesocosm studies, must include multiple treated ponds and control ponds. The Agency encourages registrants to consult with EEB staff for assistance as needed.
17. Data are required for pesticides to be used in forests.
18. Only the algae Selenastrum capricornutum is required initially. Based on results of this study, the testing of additional species may required.
19. Reserved pending results of Tier I studies.
20. Reserved pending the results of the Tier II studies.