EEB BRANCH REVIEW

DATE: IN ______ OUT ______ IN 2/1/78 OUT 4/17/78 IN ______ OUT ______

FISH & WILDLIFE — ENVIRONMENTAL CHEMISTRY — EFFICACY

FILE OR REG. NO. 38338-EUP-1

PETITION OR EXP. PERMIT NO. ______

DATE DIV. RECEIVED ______

DATE OF SUBMISSION ______

DATE SUBMISSION ACCEPTED ______

TYPE PRODUCT(S): (I,) D, H, F, N, R, S ______

PRODUCT MGR. NO. SRS L. Zink

PRODUCT NAME(S) Methoxychlor

COMPANY NAME Idaho Woolgrowers Assoc. Resch. Committee

SUBMISSION PURPOSE EUP aquatic use(irrigation canals)

CHEMICAL & FORMULATION Methoxychlor

1.0 **Introduction**

1.1 Methoxychlor-methoxy-DDT

1.2 **Percent Active**: 25

[redacted]-contains 2 lbs. a.i./gallon.

1.3 This is a resubmission of 38338-EUP-1 of 6/16/77, that was denied, we will assume the program to be the same because nothing has been ~~omitted~~ routed on the program.

1.4 A total of 1480 lbs. (370 lbs. a.i.) are to be shipped for use in irrigation canals in Idaho.

1.5 There are 3 questions for addressing in this EUP.

1. Permit itself
2. Applicant Protocol
3. Applicant questions/comments.

1.6 This review was interrupted from 2/24/78-3/2/78 and 3/7/78-3/10/78 for Generic Standards.

2.0 **Directions for Use**

Taken from 38338-EUP-1, no label submitted.

The Black Fly Control Program in Idaho is based on controlling larval generations in irrigation canals. Six treatments will be applied to irrigation canals in eastern Idaho and 10-12 treatments in southcentral Idaho. Dates of application and number of exact treatments were not given. Material will be applied at a metered flow rate of 0.3 ppm (not stated whether active ingredient or formulated product) to irrigation water for a period of 15'.

2.1 **Disposal**

Not submitted.

3.0 Discussion of Data

Data submitted in response to our comments from EUP-38338-EUP-1/6-16/77. In a private conversation with Environmental Safety, they requested a routing to them of all data available. It is the belief of this reviewer that all the data presented should be reviewed for methoxy-DDT in this proposed aquatic use. Data not validated for registration, but presented for the permit only.

Data submitted. (All new)

3.1 Methoxychlor and DDT Degradation in Water: Rate and Products

N. Lee Wolfe, Richard G. Lepp, Doris F. Paris, George L. Baughman and Reginald C. Hollis. Environmental Research Laboratory U.S. EPA, Athens, Ga.

3.2 Light Induced Transformations of Methoxychlor in Aquatic Systems

Richard G. Lepp, N. Lee Wolfe, John A. Gordon, and Robert C. Fincher. Environmental Research Laboratory U.S. EPA, Athens, Georgia.

3.3 Comparative Uptake and Biodegradability of DDT and Methoxychlor by Aquatic Organisms

Illinois Natural History Survey Bulletin Vol. 30, Article 6, June 1971. Kenneth A. Reinbold, et al.

3.4 Methoxychlor: Its Effects on Environmental Quality

National Research Council of Canada: NRC Associate Committee on Scientific Criteria for Environmental Quality. D.R. Gardner and J.R. Bailey, NRCC #14102, 1975.

3.5 Methoxychlor as a Blackfly Larvicide, Persistence of its Residues in Fish and its Effect on Stream Arthropods

New York Fish and Game Journal Vol. 15, July, 1968, No. 2, G.E. Burdick, et al.

Hydrolysis (Ref. 3.1 and 3.4)

(3.1) Methoxychlor at pH values from 3-7, at 27°C, gave a t1/2, estimated at ~ 367 days. Methoxychlor from pH 3-8, is pH independent; above pH 8 (9-12), the compound is pH dependent to hydrolysis (decreasing half-life ~ 200-2d). Methoxychlor at pH (3-8) was shown to be temperature dependent with a estimated t1/2 of 10 hrs (pH 4-6, 85°C). Major product of methoxychlor hydrolysis are:

1. Anisoin
2. Anisil
3. 2, 2-bis (p-methoxyphenyl)-1,1-dichloroethylene. Hydrolysis products were reported to be as stable or more stable than parent. An estimated t1/2 for hydrolysis product (B) > 10 yrs. N-Octanol water coefficients for methoxychlor were reported to be $2.5 \times 10^3$ (DDT is $7.8 \times 10^4$). Kd ? — Sediment-water coefficient is $6.2 \times 10^2$ (DDT is $4\text{-}8 \times 10^4$, bacteria, fungi, and algae to water are $0.12\text{-}4.8 \times 10^4$, $5.2 \times 10^3$, $8.4 \times 10^3$ (DDT $3.3\text{-}4.3 \times 10^3$, (bacteria), $1.3\text{-}2.7 \times 10^3$ (algae).

(3.4) There are no actual data submitted, but the following comments are as follows:

Luczak (1969) studied the disappearance of methoxychlor from "slightly polluted" surface water. (The nature of the pollutants is not known.) An application of 1.5 mg/l of the pesticide was reduced to 0.5 mg/l in 98-112 days and to 0.15 mg/l in 155-169 days, remaining at this level up to 460 days, which was the end of the period of observation. Bender and Eisele's laboratory studies (1971) indicated that the rate of methoxychlor disappearance in water was a function of the organic content. A 50 mg/l sample of methoxychlor in distilled water at pH 7 or 9 decreased in concentration by less than 50% in 240 days. This persistence has been confirmed for a sample of methoxychlor in distilled water kept in the dark (Gardner and Morley 1973). The half-life of a 40 μg/l sample of methoxychlor was 7 days in aged water

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containing particulate matter and microorganisms, while in aerated creekwater exposed to sunlight there was a rapid initial loss followed by a much slower rate of loss (Bender and Eisele 1971). Aeration (causing volatilization) and adsorption to container walls probably accounted for the initial rapid loss. Similar results were observed by Gardner and Morley (1973).

Photolysis

(Ref. 3.2). Direct photolysis of methoxychlor (25 ppb) in air-saturated distilled water (pH6.3) by> 280 mm light yielded an estimated t1/2 of 4.5 months, using a procedure with a computer analysis. The major photo products are:

1. 2,2-bis(p-methoxyphenyl)-1,1-dichloroethylene) DMDE a DDE analogue.

2. p-methoxy benzaldehyde.
DMDE was the major product in degassed water. DMDE was found to photolyze more rapidly than that of methoxychlor with midday half-live of 40 and 50 min. in water.

Half-lives in some natural river waters with pH values from 4.7-8.2 were found to have half-lives of 2.2-5.4 d, indicating other functions contribute to the degradation.

Fish Accumulation

(Ref. 3.3, 3.4, 3.5)

(Ref. 3.3) Two species of fish, Tilapia and Green Sunfish, were exposed to (3) concentrations of methoxychlor (0.001, 0.003, 0.01 ppm) and exposed for 31 days (samples taken at 3, 10, 31d). Results are as follows:

| Insecticide Concentration in Water in ppm | Days of Exposure to Insecticide | Insecticide Concentration in ppm in Tilapia | Insecticide Concentration in ppm in Green Sunfish | Bioaccumulation Factor Whole Fish | |
|---|---|---|---|---|---|
| | | Methoxy- | Methoxychlor | Tilapia | Green Fish |
| 0.001 | 3 | 0.8 | 0.8 | 800 | 800 |
| | 10 | 0.2 | 0.3 | 200 | 300 |
| | 31 | 0.2 | 0.2 | 200 | 200 |
| 0.003 | 3 | 1.8 | ** | 600 | - |
| | 10 | 0.3 | 0.6 | 100 | 200 |
| | 31 | 0.6 | 0.6 | 200 | 200 |
| 0.01 | 3 | 9.0 | 7.4 | 900 | 740 |
| | 10 | 1.0 | 1.9 | 100 | 190 |
| | 31 | 2.0 | 2.7 | 200 | 270 |

Relative Percentages of Insecticides and Their Metabolites Found in Fishes

| Methoxychlor Initial Concl. | | In Tilapia $A^a$ | In Tilapia $B^b$ | In Tilapia $C^b$ | In Green Sunfish $A^a$ | In Green Sunfish $B^b$ | In Green Sunfish $C^b$ |
|---|---|---|---|---|---|---|---|
| 0.01 | 3 | 43.4 | 45.2 | 11.4 | 59.0 | 29.8 | 11.2 |
| | 31 | 13.9 | 71.3 | 14.8 | 66.3 | 26.9 | 6.8 |
| ppm. | 3 | 3.9 | 46.0 | 1.03 | 4.36 | 1.59 | .88 |
| Bioaccm Factor | 3 | 390. | 406 | 103 | 436 | 159 | 88 |
| | 31 | 125 | 641 | 133 | 49 | 199 | 50 |

$A^a$=Parent
$B^b$= (2-(p-methoxyphenyl)-2-(p-hydroxyphenyl)-1,1,1-trichloroethane)
$C^c$= (2,2-bis-(p-hydroxyphenyl)-1,1,1-trichloroethane).

Daphnia were exposed to 0.001, 0.003, and 0.01 concentrations of methoxychlor. The results are as follows:

Table 3--Comparative uptake from water of $^3$H-methoxychlor by daphnia.

| Insecticide Concentration in Water in ppm | Days of Exposure to Insecticide | Insecticide Concentration in ppm in Daphnia | |
|---|---|---|---|
| | | Methoxychlor | Bioaccumulation Factor |
| 0.001 | 3 | 11 | 11,000 |
| | 6 | 9 | 9,000 |
| 0.003 | 3 | 37 | 12,333 |
| | 6 | 22 | 7,333 |
| 0.01 | 3 | 143 | 14,300 |
| | 6 | ** | |

*All such concentrations were calculated on a dry-weight basis.

Another experiment was conducted with tilapia, Daphnia, and snails that were exposed to 0.003 ppm methoxychlor and then removed and placed in fresh water for varying times. The results are as follows:

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Comparative uptake and excretion of $^{3}H$-methoxychlor by tilapia, daphnia, and snails on exposure to water containing 0.003 ppm of insecticide and subsequently to water with no insecticide.

| Days of Exposure to Insecticide | Days in Clean Water Following Exposure | Insecticide Concentration* in ppm in Tilapia | | Insecticide Concentration* in ppm in Daphnia | | Insecticide Concentration* in ppm in Snails | |
|---|---|---|---|---|---|---|---|
| | | Methoxychlor | Bioaccumulation factor | Methoxychlor | Bioaccumulation factor | Methoxychlor | Bioaccumulation factor |
| 2 | 0 | ... | | 17.0 | 5666 | 15.0 | 5000 |
| | 1 | ... | | 11.0 | 3666 | 14.0 | 4666 |
| | 2 | ... | | 8.0 | 2666 | 12.0 | 4000 |
| | 4 | ... | | 2.0 | 666 | 12.0 | 4000 |
| | 6 | ... | | ... | | 11.0 | 3666 |
| 3 | 0 | 2.0 | 666.6 | ... | | ... | |
| 4 | 0 | ... | | 31.0 | 10,333 | 28.0 | 9333 |
| 6 | 0 | 4.0 | 1333 | ... | | 38.0 | 12,666 |
| | 1 | ... | | ... | | ... | |
| | 3 | ... | | ... | | 36.0 | 12,000 |
| | 5 | ... | | ... | | 23.0 | 7666 |
| 9 | 0 | 5.0 | 1666 | ... | | ... | |
| 12 | 0 | 8.0 | 2666 | ... | | ... | |
| | 2 | 2.0 | 666 | ... | | ... | |
| | 5 | 2.0 | 666 | ... | | ... | |
| | 9 | 2.0 | 666 | ... | | ... | |
| | 11 | ... | | ... | | ... | |
| | 12 | 0.2 | 66 | ... | | ... | |
| | 15 | 0.0001 | .03 | ... | | ... | |

* All such concentrations were calculated on a dry-weight basis.

Another study was conducted where Daphnia were exposed to methoxychlor and then fed to fish to see the comparative uptake in the food chain. The results are as follows:

--Uptake of $^3$H-methoxychlor in a daphnia-to-guppy food chain

| Insecticide Concentration in Daphnia in ppm | Days Fish Fed on Daphnia Exposed to Insecticide | Insecticide Concentration in Fish in ppm | Rate of Insecticide Uptake From Food By Fish ppm in Fish / ppm in Daphnia |
|---|---|---|---|
| Methoxychlor | | | |
| 22.6 | 6 | 0.14 | 0.0006 |
| 21.3 | 8 | 0.07 | 0.0003 |
| 21.7 | 20 | 0.17 | 0.0008 |

(Ref. 3.5)

A lab study in which Brook Trout (four) were exposed to a 0.005 mg/l solution of Methoxychlor for 7 days. Results are as follows:

| Analyzed for | Wet Weight (grms. | 0.1 (Per cent) | Residue (ug/g) in oil | Net wt. | Bio Accumulation Factor |
|---|---|---|---|---|---|
| Exposure[1] | 30.33 | 2.08 | 125.4 | 2.61 | 522 |
| Exposure[2] | 22.71 | 0.34 | 269.9 | 0.907 | 182 |
| Death After | | | | | |
| Exposure Plus 4 days in clean $H_2O$ | 17.63 | 3.11 | 142.4 | 4.44 | 888 |
| Exposure plus 7 days in clean water | 28.60 | 3.05 | 30.5 | 0.030 | 186 |

Another study was done at a 2-day exposure with the fish transferred to clean water at different intervals. The results are as follows:

RESIDUES OF METHOXYCHLOR IN BROOK TROUT (12/fish)
EXPOSED TO SOLUTION* OF CHEMICAL FOR TWO
2-DAY PERIODS A WEEK APART

| Fish | Wet weight (grams) | Oil (percent) | Residue (micrograms per gram) In Oil | In wet weight Amount | In wet weight Average | Reduction following exposure (percent) | Bioaccumulation factor |
|---|---|---|---|---|---|---|---|
| **Immediately after exposure** | | | | | | | |
| 1........ | 57.57 | 4.90 | 15.10 | 0.74 | | | |
| 2........ | 51.42 | 4.78 | 17.35 | 0.83 | 0.863 | xxx | 172 |
| 3........ | 51.21 | 3.67 | 27.78 | 1.02 | | | |
| **After 1 week in running water following exposure** | | | | | | | |
| 4........ | 42.01 | 5.38 | 5.58 | 0.30 | | | |
| 5........ | 49.09 | 7.11 | 7.31 | 0.52 | 0.507 | 41.3 | 101 |
| 6........ | 47.45 | 5.16 | 13.56 | 0.70 | | | |
| **After 3 months in running water following exposure** | | | | | | | |
| 7........ | 128.39 | 6.35 | | | | | |
| 8........ | 102.16 | 7.26 | | | | | |
| 9........ | 118.91 | 7.05 | | | | | |
| 10........ | 89.88 | 7.07 | | | 0.0 | 100.0 | 0 |
| 11........ | 102.54 | 6.70 | | | | | |
| 12........ | 107.49 | 7.67 | | | | | |

* Concentration of 0.005 milligrams of methoxychlor per liter; solution changed twice daily.
Not detectable.

A pond was treated with methoxychlor at a rate of 5 ppb. Sunfish and bullhead were put into the pond and analyzed for methoxychlor. The results are as follows.

ANALYSES OF SAMPLE FISH FROM THE POND
TREATED WITH METHOXYCHLOR

| Species | Age | Days after last treatment | Wet weight (grams) | Oil (per cent) | Residue (micrograms per gram) | | Bio-accumulation factor |
|---|---|---|---|---|---|---|---|
| | | | | | In oil | In wet weight | |
| 1965 | | | | | | | |
| Sunfish...... | 0+ | 36 | 0.3817* | 2.32 | § | .. | 0 |
| | | 118 | 0.4632* | 1.72 | § | .. | 0 |
| | Adult | 36 | 22.84 | 5.02 | § | .. | 0 |
| | | 36 | 48.98 | 5.33 | § | .. | 0 |
| | | 36 | 43.03 | 5.10 | § | .. | 0 |
| | | 36 | 42.06 | 5.37 | § | .. | 0 |
| | | 118 | 49.74 | 5.70 | § | .. | 0 |
| Bullhead..... | Adult | 36 | 26.77 | 3.37 | § | .. | 0 |
| | | 36 | 35.32 | 4.24 | § | .. | 0 |
| | | 36 | 101.26 | 2.24 | § | .. | 0 |
| | | 36 | 29.95 | 4.32 | § | .. | 0 |
| | | 36 | 33.87 | 4.68 | § | .. | 0 |
| | | 36 | 29.01 | 2.92 | § | .. | 0 |

* Average for sample (see Table 4)
Not detectable.

ANALYSES OF SAMPLE FISH FROM THE POND
TREATED WITH METHOXYCHLOR

| Species | Age | Days after last treatment | Wet weight (grams) | Oil (per cent) | Residue (micrograms per gram) | | Bio-accum-ulation factor |
|---|---|---|---|---|---|---|---|
| | | | | | In oil | In wet weight | |
| 1965 | | | | | | | |
| Sunfish...... | 0+ | 63 | 1.7527* | 2.07 | § | .. | 0 |
| | I+ | 63 | 3.7430* | 1.20 | § | .. | 0 |
| | Adult | 63 | 38.93 | 1.90 | § | .. | 0 |
| | | 63 | 33.74 | 1.46 | § | .. | 0 |
| | | 63 | 45.88 | 2.00 | § | .. | 0 |
| Bullhead..... | Adult | 63 | 68.19 | 3.66 | § | .. | 0 |
| | | 63 | 113.81 | 1.47 | § | .. | 0 |
| | | 63 | 79.61 | 2.18 | § | .. | 0 |

* Average for sample (see Table 4)
Not detectable.

Exposure time was only two days and then the fish were put into fresh water at varying intervals as shown above.

Soil Metabolism (Ref. 3.4)

Very little data submitted, the following comments were elucidated from context.

Methoxychlor does not appear to be readily removed from soil by runoff. Edwards and Glass (1971) measured the concentration of MeO-DDT in runoff water in a field study. They found that over a 14-month period the total amount of MeO-DDT removed by runoff was only 0.8 g/ha or 0.004% of that applied (22.4 kg/ha). The range varied from 0.1 $\mu$g/l to 8.8 $\mu$g/l. The data do not show any trend towards decreasing methoxychlor concentrations in the runoff with time. However, it is not clear whether the low percentage runoff figure was due to MeO-DDT remaining adsorbed to the soil, or due to processes such as photolytic degradation or volatilization.

In the laboratory, Castro and Yoshida (1971) studied the degradation of methoxychlor in four Philippine soil types[a] under upland (80% moisture content) and flooded (submerged soil samples) conditions. MeO-DDT disappeared more rapidly in the submerged soil samples (see Section 2.1.2). They also found that the higher organic matter content, the greater the rate of degradation. For example, in Casiguran sandy loam (organic content 4.4%) 100% disappeared in 1 month (submerged sample), whereas in Pila clay loam (organic matter 1.5%) only 75% had disappeared at the end of 3 months. Obuchouska (1969) reported that for sandy loam soils

[a] Maahas clay (pH 6.6; organic matter 2%; total nitrogen 0.14%); Luisiana clay (pH 4.7; organic matter 3.2%; total nitrogen 0.21%); Pila clay loam (pH 7.6; organic matter 1.5%; total nitrogen 0.09%); Casiguran sandy loam (pH 4.8; organic matter 4.4%; total nitrogen 0.2%).

plus 3% water, experimentally-applied MeO-DDT (20 mg/kg) disappeared to only "trace levels" in 30-38 weeks, while 10% water increased the disappearance rate to a "trace level" by 20-26 weeks. Jar experiments by Carlo et al. (1952) suggested that methoxychlor (200 mg/kg) disappeared rapidly (75%) in the first 2 weeks (using a colorimetric determination which gave a 90% recovery). Their soil sample consisted of Stephenville fine sandy loam which was rich in organic matter. Experiments were carried out at controlled temperature and humidity; the soil was shaken periodically to expose new layers to the air, and the pH was controlled by addition of calcium hydroxide. Table 1 shows the rate of MeO-DDT loss with time at three pH values. A high pH favored faster MeO-DDT disappearance.

As a part of a study after elm tree treatment MeO-DDT, Hunt and Sacho (1969) measured MeO-DDT residues in the study area soil (Table 2). The last application of MeO-DDT, in April 1963, remained mainly in the top inch of the soil.

Concentrations (mg/500 g soil) of MeO-DDT recovered from soil at stated intervals after application. (From Carlo et al. 1952.)

| Time Interval | Acid pH 4.7 | Untreated pH 6.5 | Basic pH 7.8 |
|---|---|---|---|
| 1 week (av. 2 samples) | 51.4 | 54.4 | 39.8 |
| 2 weeks (av. 2 samples) | 30.8 | 32.5 | 23.4 |
| 4 weeks (av. 2 samples) | 28.2 | 29.3 | 17.4 |
| 8 weeks (av. 2 samples) | 23.4 | 23.1 | 17.2 |

Insecticides in soil after elm tree treatment with DDT or MeO-DDT.[a] (From Hunt and Sacho 1969. Reprinted with permission of the Journal of Wildlife Management and the Wildlife Society.)

| | | Residues (mg/kg dry weight) |
|---|---|---|
| Date Sampled | Depth (inches) | MeO-DDT |
| **Area A** | | |
| August 1963 | 0-1 | 8.6 |
| | 1-3 | 1.4 |
| | 3-6 | 0.9 |
| | 0-6 | 1.8 |
| | 0-3 | 3.0 |
| April 1964 | 0-3 | 1.8 |
| **Area B** | | |
| April 1964 | 0-3 | 1.1 |

a Methoxychlor was applied in 1962, 1963 and 1964 at 10.7 lb/a, 11.2 lb/a and 10.6 lb/a respectively. All spraying was done in late March or early April.

## Microbial Degradation

Under anaerobic conditions (incubation time 118 hours), approximately 75% of a 200 μg sample of analytical grade MeO-DDT (acetone vehicle) was degraded to MeO-DDE by Aerobacter aerogenes. However, under aerobic conditions only 10% of the MeO-DDT was degraded to MeO-DDE (Mendel *et al*. 1967).

Castro and Yoshida (1971) studied the degradation of methoxychlor in Philippine soil samples at 30°C under upland (80% moisture) and flooded (submerged) conditions. MeO-DDT disappeared more rapidly under the flooded conditions.

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Reductive hydrodechlorination has been observed under anaerobic conditions but the amount of MeO-DDD formed is small and this reaction is not consistently observed (Mendel et al. 1967). Johnson and Kennedy (1973) reported that A. aerogenes and B. subtilis, when incubated with 1 μg/l of labelled MeO-DDT (analytical grade, acetone vehicle), accumulated both pesticides from the medium (80-90% in the first 30 minutes) but in 24 hours there was no evidence of degradation. Mendel et al. (1967) also did not detect any degradation products after 24 hours but found that they were present during a 114-hour incubation period. It would appear that accumulation of MeO-DDT by the organisms (Johnson and Kennedy 1973) was merely a passive process since autoclaved cells also accumulated the pesticides, a process which could be reversed by transfer to a pesticide-free medium. It has been reported that growth and lactic acid production of Streptococcus lactus (strain A254) and Lactobacillus casei were unaffected by MeO-DDT at levels up to 100 mg/l during a 48-hour incubation period. However, no attempt was made to determine if these organisms were degrading the pesticide (Kim 1970).

Sethunathan and Yoshida (1973) demonstrated that 10 mg/l labelled MeO-DDT was degraded after 2 hours of incubation with a Clostridium species and that little degradation occurred in the presence of heat-killed cells. However, they did not identify the degradation products. Richardson and Miller (1960) reported that a concentration of 25 mg/l of MeO-DDT was weakly fungitoxic to Rhizoctonia solani, inhibiting growth by 20%. Again, however, no attempt was made to determine whether or not this organism could metabolize either pesticide.

## In House Data

Methoxychlor is accumulated by aquatic bacteria, algae and fungi in aqueous solution. A 24-hour maximum adoption is reached with these microorganisms and residue magnification is from 1,400 to 4,300 fold (concentration dependency noted). Some microorganisms evaluated were: Flauobacterium harisonii, Bacillus subtilis, Aspergillius sp, Chlorella pyrenoidosa, and Aerobacter (Enterobactere) aerogenes. We also know that anaerobic degradation may be the means of methoxychlor metabolism in aquatic habitats.

A study by Freedan, et al. on black fly larvae control in the North Saskatchewan River, provides an actual use condition evaluation.

May 23, 1972. A 15 minute injection of methoxychlor was injected into the river to give a 0.309 ppm (mg/l) final concentration. Discharge at that time was $236 m^3/sec$.

$236 m^3/sec \times 900$ sec/15 min.$=2.124 \times 10^5 m^3$/15 min).
$2.124 \times 10^5 m^3$/15 min.$\times 10^3 = 2.124 \times 10^8$ l/15 min.
.309 mg/l final concentration

$$\frac{X}{2.124 \times 10^8 \text{ l/15 min.}} = .309 \text{ mg/l}$$

X= 65.5 kg(ref. stated used 65 kg).

It took 2 hours for the water to flow 3.9 miles and for the concentration to reach 0.16 ppm (1.95 mph or 11.44 ft/sec

It was stated that effectiveness was found 100 miles downstream (100 miles 1.95 mph = 52.83 hour. from time of injection to reach that point).

Since it took 2 hours to go 3.9 miles (15 min. section) and reach 0.16 ppm, this is the dilution half-life.
the vol. of water has to be doubled in that period of time ($2.124 \times 10^8$ l/15 min$\times 2$)$=4.248 \times 10^8$ l/15 min.
52.83 hour traveling time/100 miles ÷ 2 hr./1 dilution half-life.
=26.315 dilution half-lives/100 miles ($a^x$).
At 100 miles the concentration of methoxychlor in the water is 240 ppt (parts per trillion). A very rough dilution rate is calculated to be $\approx 1.05 \times 10^8$ mg/l/min. Approx. 50% of the material is absorbed to the soil sediment 11 miles downstream.

## 4.0 Conclusions

Methoxychlor is persistent and is available for bioaccumulation by certain aquatic species. We did not have a flow through system to evaluate bioconcentration and would probably be higher than shown in the static studies. All exposures in ref. 3.5 were short term and it is thought that they are not too meaningful for long term exposure. Metabolite accumulation may be a problem. The study with the exposed daphnia, fed to guppy's is in discrepancy with other uptake studies. We do not agree with the use of an $^3$H label, it is not stable and if the water is acidic, the $^3$H would leave (substitute) on the molecule even faster. It could be that these studies with $^3$H show either the amount of $^3$H left, or that methoxychlor is present. We wonder why the use of $^{14}$C-DDT and not $^{14}$C-MEO-DDT for comparison, unless to show less accumulation. Blackfly larvae are generally deposited on rocks, etc. at the bottom of rivers, etc, we believe that photolysis would not contribute significant to the degradation (unless near the surface). Degradation will probably be via anaerobic metabolism, of which, we have no data (not required for permit). This is further substantiated by the work of Freedad, et al, which shows the chemical to have a high adsorption rate to the soil sediment.

## 5.0 Recommendation

### 5.1 SRS Note

We note that accumulation of residues occurs in certain aquatic species. We defer to Environmental Safety for their opinion on this phenomenon.

### 5.2 SRS and Environmental Safety Note

We believe that because of the potential high persistence and accumulation of this compound, that the protocol submitted by the applicant (to support registration) is unacceptable. Data should be collected according to protocols that are explained the proposed guidelines. If, however, Environmental Safety determines that hazards are minimal, then this protocol is acceptable to obtain data for the State of Idaho use only.

5.3 Environmental Safety Note

We question the accumulation studies using $^{3}H$-labeled substituted (ring) methoxychlor. Results may be lower than if a $^{14}C$-label was evaluated (the label is unstable and dissociation can occur readily in acidic waters, making quantitation difficult).

The studies were also evaluated for short duration (2-7 days) in some instances and may not reflect maximum concentration levels. No flow through system was evaluated and metabolite accumulation may be just as important as parent compound.

Ref. 3.4 pg. 136 may be pertinent information for your evaluation.

5.4 SRS & Environmental Safety

To address the applicants question of the fish accumulation study using channel catfish and sunfish being biologically unsound, due to the fact these types are not found in the treatment area; the following comment is offered: Pesticides introduced in the environment may enter and accumulate in food webs. A study is needed to determine accumulation, and to assess potential adverse effects on non-target organisms indicated by fish accumulation. Channel catfish and sunfish are used to determine the potential adverse effects for all pesticides/uses in general--and is used because of sensitivity and standardization. However, if Environmental Safety says the fish are biologically unsound for area of use we will consider others for this use in Idaho only.

5.5 Data was reviewed for the permit only and not reviewed/validated for registration.

5.6 All Environmental Chemistry in Section 3 Regulations will be required for Registration. See attached sheet for data requirements.

5.7 SRS coordinate with Environmental Safety as we do not route.

Ronald E. Ney, Jr. 5/30/78

Ronald E. Ney, Jr.
4/12/78

Robert F. Carsel Robert F. Carsel 5/30/78
Environmental Chemistry Section
Efficacy and Ecological Effects Branch

Table 1 - Summary of environmental chemistry data requirements by intended use pattern

| Data Require-ments / Use Patterns | Terrestrial Uses: Domestic Outdoor | Terrestrial Uses: Green-house | Terrestrial Uses: Non-crop | Terrestrial Uses: Tree Fruit-Nut Crop | Terrestrial Uses: Field-Veg Crop | Aquatic Uses: Aquatic Food Crop | Aquatic Uses: Aquatic Non-Crop | Terrestrial/Aquatic Uses: Forest | Aquatic Impact Uses: Direct Discharge | Aquatic Impact Uses: Indirect Discharge | Aquatic Impact Uses: Wastewater Treatment | To Support Registration of: Manu-facturing Use Product | To Support Registration of: Formu-lated Product |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **PHYSICO-CHEMICAL DEGRADATION** | | | | | | | | | | | | | |
| Hydrolysis | X | X | X | X | X | X | X | X | X | X | X | X | X |
| Photodegradation | | | X | X | X | X | X | X | X | | | | X |
| **METABOLISM** | | | | | | | | | | | | | |
| Aerobic soil | X | X | X | X | X | | | X | | | | | X |
| Anaerobic soil | | | | | X | | | | | | | | X |
| Anaerobic aquatic | | | | | | X | X | X | X | | | | X |
| Aerobic aquatic | | | | | | X | X | | X | | | | X |
| Effects of microbes on pesticides | | | X | X | X | X | X | X | X | | | | X |
| Effects of pesticides on microbes | | | X | X | X | X | X | $X^a$ | X | | | | X |
| Activated sludge | | | | | | | | | | X | X | X | X |
| **MOBILITY** | | | | | | | | | | | | | |
| Leaching | | | X | X | X | | | $X^b$ | | | | | X |
| Volatility | | X | | | | | | | | | | | X |
| Adsorption | | | | | | X | X | X | X | | | | X |
| Water dispersal | | | | | | X | X | | X | | | | X |
| **FIELD DISSIPATION** | | | | | | | | | | | | | |
| Soil | X | | X | X | X | X | | X | | | | | X |
| Water | | | | | | X | X | $X^c$ | X | | | | X |
| Ecosystem ($X^d$ combined study with $X^a$ $X^b$ $X^c$ | | | | | | | | $X^d$ | | | | | |
| **ACCUMULATION** | | | | | | | | | | | | | |
| Rotational crop | | | | | X | X | | | | | | | X |
| Irrigated crop | | | | | | X | X | | | | | | X |
| Fish | | | X | X | X | X | X | X | X | | | | X |
| Special fish study | | | | | | | X | | | | | | |