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Date Out EFB: 25 MAY 1982

To: Product Manager 25 Taylor
TS-767

From: Dr. Willa Garner
Chief, Review Section No. 1
Environmental Fate Branch

Attached please find the environmental fate review of:

Reg./File No.: 524-316

Chemical: Alachlor

Type Product: Herbicide

Product Name:

Company Name:

Submission Purpose: Exposure studies 070591

ZBB Code: other

Date in: 4/6/82

Date Completed: 25 MAY 1982

Deferrals To:

_____ Ecological Effects Branch

_X_ Residue Chemistry Branch

_____ Toxicology Branch

ACTION CODE: 400

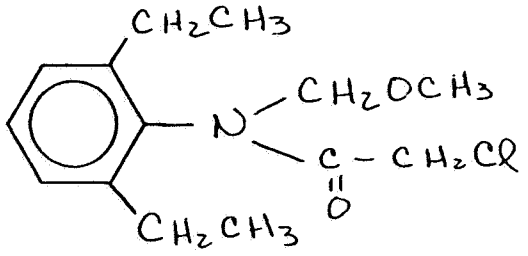
EFB #: 271

| TAIS (level II) | Days |
|---|---|
| 67 | 7 |

1.0 INTRODUCTION

Monsanto has submitted data in support of the registration of alachlor, a herbicide.

2.0 Lasso: Alachlor



2-chloro-2',6'-diethyl-N-(methoxymethyl)-acetanilide

3.0 DISCUSSION

3.1 Aerial and Ground Applicator Exposure Studies with Lasso® Herbicide Under Actual Field Conditions. R. Lauer and D.D. Arras, Report No.: MSL-1889, October, 1981. EPA Acc No: 070591.

This study measured the worker exposure to alachlor during aerial and ground applications of the herbicide. The exposure to mixer/loader, pilot, and flagman was measured during aerial application while mixer/loader and applicator exposure to EC and granular formulations was measured during ground application. Ground application with the EC was followed by incorporation. Air concentrations [redacted] were also measured during all operations.

Inhalation and dermal exposures to alachlor were measured during all operations. Inhalation exposure was measured using high volume samplers fitted with PUF plugs and personal air monitoring pumps fitted with silica gel tubes. In addition exposure [redacted] by pumping air through charcoal sampling tubes. All inhalation exposure methods were in the vicinity of the worker's breathing zone.

Dermal exposure and the degree of protection afforded by protective clothing for each operation (mixing/loading, application/incorporation, and reentry) was measured by attaching two interlocked 12 ply 4x4 in surgical gauze pads to various body parts. Pads were backed with glassine paper and taped to clothing. Pads were located on top of head, forehead, shoulder, chest, back, thigh, right bicep, left forearm, and ankle on top of clothing and on right forearm, left bicep, and ankle under clothing (disposable coveralls). Dermal exposure to the hands was measured by analyzing levels in cotton knit gloves. Mixer/loaders in addition wore heavy natural latex rubber gloves. An example of a sample calculation to determine exposure levels is given in Figure 1.

Monsanto used the calculation model presented in the DER for triallate (J. Jensen, EFB, 3/27/81) for Lasso. This model assumed a 60 kg female applicator and that mixing/loading/application operations were performed by the same worker. For Lasso, the mixing/loading and application operations will be separated for aerial spraying. For ground application they can remain combined since the mixer/loader and applicator are usually the same person. In addition, a 70 kg male is assumed to be the farm worker. The 10% absorption value used by Monsanto will not be used by EFB. EFB defers to Tox Branch the determination of the dermal absorption value.

Soil samples were taken before and after application of alachlor and at the time of reentry to a depth of two inches.

Field and lab fortifications and blanks were run. Alachlor extraction was with nanograde acetone and further purified using column chromatography. Detection and quantitation was by GLC using a $^{63}$Ni electron capture detector. [redacted] and quantitated using GLC equipped with flame ionization detector.

Method sensitivity: 0.005 ug/cm$^2$ for gauze pads, 0.012 ug/cm$^2$ for rubber and cotton gloves, 0.10 ug/cm$^2$ for PUF, 0.67 ug/cm$^2$ for silica gel, 0.10 ppm for a 50 g soil sample and 2.7 mg/m$^3$ for [redacted]

Figure 1.

SAMPLE CALCULATIONS

A. Dermal: Aerial Applicator Exposure Tank-fill and Mix

1. Calculate the average µg/cm²/min for forhead, chest, back and hands listed for tank fill (Table XXXIII).

| Raw data µg found (cm²) | Exposure time (min) | µg/cm²/min | Average µg/cm²/min |
|---|---|---|---|
| Forehead: 0.026 | 13.0 | 0.0020 | |
| 0.097 | 13.0 | 0.0075 | 0.00475 |
| Chest : 7.040 | 13.0 | 0.5415 | |
| 2.315 | 13.0 | 0.1781 | 0.35980 |
| Back : 0.031 | 13.0 | 0.0024 | |
| 0.070 | 13.0 | 0.0054 | 0.00390 |
| Hands : 0.051 | 13.0 | 0.0039 | |
| 1.409 | 13.0 | 0.1084 | 0.0562 |

2. Multiply the average values times the appropriate skin surface area [skin areas: face = 650 cm²; back of neck = 110 cm²; front of neck and "V" of chest = 150 cm² and hands = 820 cm² (11, 14)] to get the average µg/min. These were then totaled.

| Location | Average µg/cm²/min | Skin area exposed (cm²) | Average µg/min |
|---|---|---|---|
| Forehead: | 0.00475 | 650 | 3.088 |
| Chest : | 0.35980 | 150 | 53.970 |
| Back : | 0.00390 | 110 | 0.429 |
| Hands : | 0.05620 | 820 | 46.040 |
| | | Total | 103.527 |

3. The totaled average µg/min (103.527) was multiplied by 60 min/hr to convert the number into an average exposure level (µg/exposed area/hour).

$$103.527 \frac{\mu g}{min} \times 60 \frac{min}{hr} = 6{,}211.62 \frac{\mu g}{hr}$$

4. The range was calculated by selecting the lowest and highest values from the forehead, back, chest pads and gloves listed in Table XXXIII, and carried through the calculations described in 1-3.

5. The time (in hours) for 100 acre application per airplane tank-fill was 0.2 (13 min ÷ 60 = 0.2 hours)

6. The unit dermal exposure per 100 acres treated was calculated on the basis of a 60 kg female operater (12).

$$6{,}211.62 \frac{\mu g}{hr} \times \frac{0.2 \text{ hr}}{100 \text{ acre}} \div 60 \text{ kg} = 20.71 \ \mu g/kg \text{ bw}/100 \text{ acres treated}$$

7. To calculate "Total Dermal Exposure", add values for airplane tank-fill and application (pilot).

$20.71 + 5.38 = 26.09$ µg/kg bw/100 acres treated

8. Multiply this number by assumed 10% skin absorption rate.

$$26.06 \frac{\mu g}{kg \text{ bw}/100 \text{ acres}} \times 0.1 = 2.61 \frac{\mu g}{kg \text{ bw}/100 \text{ acres treated}}$$

B. Inhalation: Aerial Applicator Exposure Tank-fill and Mix

1. Calculate the average µg/m³ on polyurethane foam and silica gel (Table XXXIII).

| Sampling techniques | Raw data µg/m³ found | | Average µg/m³ found |
|---|---|---|---|
| | Rep 1 | Rep 2 | |
| PUF | 6.04 | 10.32 | |
| | 7.03 | 4.69 | 7.02 |
| Silica gel | 14.46 | 39.08 | |
| | 14.92 | 35.69 | 26.04 |
| | | Total Average | 16.53 µg/m³ |

2. The time (in hours) for 100 acre application per airplane tank-fill was 0.2.

$16.53 \ \mu g/m^3 \times 0.2 = 3.31 \ \mu g/m^3$ for 100 acre application.

3. A 1.5 m³/hr breathing rate is assumed (12).

$3.31 \times 1.5 = 4.959 \ \mu g/m^3/hr$ for 100 acre application.

4. Assuming a 60 kg female (12), the Unit Inhalation Exposure (µg/kg bw/100 acres treated) was calculated.

$4.959 \ \mu g/m^3/hr \div 60 \text{ kg} = 0.08$ µg/kg bw/100 acres treated

5. To calculate "Total Inhalation Exposure" add values for airplane tank-fill and application (pilot).

$0.08 + 0.23 = 0.31$ µg/kg bw/100 acres treated

6. 100% absorbtion was assumed.

C. Total Body Dose Estimates

1. Add total dermal exposure (airplane tank-fill and pilot µg/kg bw/100 acres treated) to total inhalation exposure (airplane tank-fill and pilot µg/kg bw/100 acres treated) to get total body dose estimates for dermal and inhalation (µg/kg bw/100 acres).

   2.61 + 0.31 = 2.92 µg/kg bw/100 acres treated

2. To calculate total body dose for dermal and inhalation on µg/kg bw/pound applied, divide 2.92 by 300 lbs. (aerial application 300 lbs/100 acres).

   2.92 µg/kg bw/100 acres ÷ 300 = 0.010 µg/kg bw/pound applied

3. Repeat same procedure for other operations and formulation.

3.1.1 Aerial Applicator Exposure Study

The aerial applicator study was conducted near Fort Morgan, Colorado. The terrain is flat and heavily irrigated. Two 100 acre plots were treated with alachlor using a fixed-wing aircraft. The effective swath width was 80 ft. from a boom that was equipped with 70 whirl jet nozzles and 8 rain drop nozzles.

The mixing/loading procedure involved a two step operation. The first was the open pouring of 75 gal alachlor into a mix-tank to which was added 25 gal of water. This was followed by pumping the mix-tank contents into the airplane hopper to which another 200 gal of water were added. The application rate was 3 lb ai/acre. A flagman was used to mark successive passes.

Results of Aerial Applicator Study

In calculating dermal exposure values, it was assumed that the only exposed skin areas would be face, neck, and hands on the operator. For both dermal and respiratory exposure, the following exposure trend resulted: flagman> tank-fill operator> pilot. The tank-fill operation resulted in the highest levels [redacted] Results are shown in Table XLVIII-LIV. As is expected, dermal exposure contributes more to total exposure than does inhalation exposure.

EFB believes that the mixer/loader and applicator exposures should be separately considered and not combined as Monsanto has done. Most pilots do not mix/load pesticides into their aircraft. In addition EFB believes the worker would most likely be a 70 kg male rather than a 60 kg female. Recalculated values are in Table 1.

3.1.2 Ground Application Exposure Study

The ground applicator exposure study was done in south central Illinois in an area where corn and soybeans are grown. The application equipment consisted of a closed-cab tractor. The boom nozzles were about 20 in high mounted to the front frame of the disc. Tillage depth was 2.5-4 inches depending on equipment.

The spray solution was made partially filling the mix tank with water and then adding 2 five gal cans of herbicide. Additional water was added to obtain proper dilution. The effective application rate was 4 lb ai/acre. In addition

to the open-pouring tank fill, tank fills using a probe transfer system were used. The concentrate was added to the mix tank through tubing inserted into open parts on the tank.

Granules were applied using a granular applicator attached to the rear of an 8 row model 400 international cyclo planter. The effective application rate was 1.2 lb ai/acre. Hopper fill was accomplished by open pouring of bags of alachlor granules.

Results of the Ground Applicator Study

Two studies were conducted, one using the EC formulation and one with the granular formulation. A simulation of an open-cab tractor driver was attempted by placing a "pseudo-operator" on the outside of a closed-cab tractor by the back window. The operator was covered with dirt and any residue levels were considered to be unrealistic and not used in final calculations. [redacted] below TLV of 350 mg/$m^3$. These results are found in Tables XLVIII-LIV. Recalculated values are in Table 1.

The use of probe-type transfer systems on 5 gal and 55 gal drums reduced the exposure somewhat. This was not a completely closed transfer system. These results are in Table LII and in Table 2.

3.1.3 Soil and Reentry Studies and Efficacy of Protective Gloves

Thirty minute walk-through experiments on treated fields were conducted to determine possible exposures upon re-entry. Results are shown in Tables XXXIX, XL, XLIV and XLV. Levels of alachlor were below limits of detection when granules were applied. Very low levels were noted in the re-entry experiments using EC formulations.

Soil analysis from fields treated with alachlor to verify application rates showed that amounts found were less than amounts theoretically applied (Table XLVIIIA). Two explanations are given: loss through evaporation and/or non-homogeneous incorporation. The conversion factor 2.5 ppm alachlor is 1.0 lb/acre in two inches of soil was used.

As a part of the study, the protective value of gloves was determined. A comparison of the levels found in cotton gloves (hand exposure) worn under the rubber gloves indicates that at least two orders of magnitude higher deposition on rubber gloves when compared to cotton gloves (Table LV).

Conclusions

Tables 1 and 2 summarize the results obtained by Monsanto for applicator exposure with the changes incorporated by EFB. The major differences in the calculation are that (1) EFB used a 70 kg person (male) as the worker rather than a 60 kg female and (2) mixer/loader and applicator exposures were kept separated rather than combined for the aerial applicator exposure study. In addition the 10% skin absorption factor was not used by EFB in its calculation. EFB defers to Tox Branch the assignment of a dermal absorption value and recommends that Tox Branch use the recalculated EFB values in its risk assessment determination.

This is a well planned and executed study which provides valuable data on exposure to applicators, effectiveness of protective clothing and equipment, and re-entry data. In addition the use of two formulation types (EC and granular) indicates that the use of granular results in lower dermal exposures in all phases of the ground application, respiratory exposure is higher for the mixer/loader.

EFB also defers to Tox Branch the determination of the toxicological significance of [redacted].

Table 1. Summary of Recalculated Potential Worker Exposure Estimates to Alachlor[1/]

Aerial and Ground Application: Open Pouring (Unit: ug/kg bw/day).

| | Dermal Exposure | Respiratory Exposure | Total Exposure | [redacted] Exposure |
|---|---|---|---|---|
| **Aerial Application (EC)** | | | | |
| Mixer/Loader | 17.8 | 0.07 | 17.9 | 41.7 |
| Pilot | 4.6 | 0.2 | 4.8 | ND[3/] |
| Flagman | 1.1 | 181.9 | 183. | ND |
| **Ground Application (EC)** | | | | |
| Mixer/Loader | 96. | 0.16 | 96.2 | 101.0 |
| Applicator/Inc | 18.1 | 0.16 | 18.3 | 168.4 |
| Combined | 114.1 | 0.32 | 114.4 | 269.4 |
| **Ground Application (Granular)** | | | | |
| Mixer/Loader | 18.4 | 1.8 | 20.2 | |
| Applicator/Inc | ND | 0.17 | 0.17 | |
| Combined | 18.4 | 2 | 20.4 | |

1/ Assume: 100% absorption for respiratory and dermal absorption; 70 kg male

[redacted]

3/ ND: non-detectable

Table 2. Summary of Recalculated Potential Worker Exposure Estimates to Alachlor

Ground Application: Probe Transfer System (Unit: ug/kg bw/day)

| 5 gal probe | Dermal Exposure | Respiratory Exposure | Total Exposure |
|---|---|---|---|
| Mixer/Loader | 24.9 | 0.09 | 25. |
| Applicator/Inc | 18.1 | 0.16 | 18.3 |
| Combined | 43.0 | 0.25 | 43.3 |
| 55 gal probe | | | |
| Mixer/Loader | 48.0 | 0.18 | 48.2 |
| Applicator/Inc | 18.1 | 0.16 | 18.3 |
| Combined | 66.1 | 0.34 | 66.4 |

## Table XLVIII

### Total Body Dose Estimates

### Combined Inhalation & Dermal Exposure

| | Operation | 1 Unit Inhalation Exposure[1,2] | 2 Total Inhalation Exposure[1,3] | 3 Total Daily Inhalation Exposure[1,4] 100% Absorption Assumed | 4 Unit Dermal Exposure[1,5] | 5 Total Dermal Exposure[1,3] | 6 Total Daily Dermal Exposure[1,6] 10% Absorption Assumed | 7 Total Body Dose Dermal & Inhalation (ug/kg bw/100 acres)[7] | 8 Total Body Dose Dermal & Inhalation (ug/kg bw/pound applied)[8] |
|---|---|---|---|---|---|---|---|---|---|
| LASSO EC | Tank Fill (airplane) | 0.08 | | | 20.71 | | | | |
| | Application (pilot) | 0.23 | 0.31 | 0.31 | 5.38 | 26.09 | 2.61 | 2.92 | 0.010 |
| | Application (flag-man) | 1.31 | 1.31 | 1.31 | 211.47 | 211.47 | 21.15 | 22.46 | 0.075 |
| | Tank Fill (tractor) | 0.19 | | | 111.61 | | | | |
| | Application/Inc. (inside cab) | 0.19 | 0.38 | 0.38 | 21.00 | 132.61 | 13.26 | 13.64 | 0.034 |
| LASSO E | Hopper Fill (planter) | 2.11 | | | 21.41 | | | | |
| | Application (inside cab) | 0.20 | 2.31 | 2.31 | N.D. | 21.41 | 2.14 | 4.45 | 0.011 |

1 ug/kg bw/acres treated (refer to footnotes in tables 49 and 50 for explanation of assumptions used).
2 Unit inhalation values are from table 49, column 5.
3 Additive total of tankfill values and application values.
4 Column 2 multiplied by absorption rate.
5 Unit dermal exposure values are from table 50, column 5.
6 Column 5 multiplied by absorption rate.
7 Additive total of columns 3 and 6.
8 Aerial application calculated at 300 lbs/100 acres; ground application calculated at 400 lbs/100 acres.

Table XLIX

Applicator Exposure to Alachlor Through Inhalation

| | Operation | 1 Average Exposure Level (ug/M³)[1] | 2 Range (ug/M³) | 3 Number of Samples | 4 Time (in hours) for 100 acre application | 5 Unit Inhalation Exposure (ug/kg bw/100 acres treated)[2] |
|---|---|---|---|---|---|---|
| LASSO EC | Tank Fill (airplane) | 16.53 | 4.7-39.1 | 8 | 0.2 | 0.08 |
| | Application (pilot) | 13.14 | 7.5-17.1 | 4 | 0.7 | 0.23 |
| | Application (flag-man) | 130.50 | 96.5-168.9 | 4 | 0.4 | 1.31 |
| | Tank Fill (tractor) | 6.80 | 1.9-20.4 | 8 | 1.1 | 0.19 |
| | Application/Inc. (inside cab) | 1.30 | 1.1-1.40 | 4 | 5.7 | 0.19 |
| LASSO H | Hopper Fill (planter) | 64.85 | 1.4-193.0 | 8 | 1.3 | 2.11 |
| | Application (inside cab) | 0.80 | 0.6-1.0 | 4 | 10.0 | 0.20 |

[1] Inside tractor cab air concentration values were used for application/incorporation operations.
[2] A 60 kg female body weight is assumed; a 1.5 M³/hr breathing rate is assumed.
[3] Multiply the value in column 1 by column 4, then multiply by 1.5 M³/hr, and then divide by 60 kg.

Table 1.

Applicator Exposure to Alachlor Via Dermal Deposition

| | Operation | 1 Average Exposure Level[1,2,3,4] | 2 Range[1,5] | 3 Number of Samples | 4 Time (in hours) for 100 acre application | 5 Unit Dermal Exposure[6,7] (ug/kg bw/100 acres treated) |
|---|---|---|---|---|---|---|
| LASSO EC | Tank Fill (airplane) | 6,212 | 1,889-10,535 | 2 | 0.2 | 20.71 |
| | Application (pilot) | 461 | 325-591 | 2 | 0.7 | 5.38 |
| | Application (flag-man) | 31,721 | 9,985-53,552 | 2 | 0.4 | 211.47 |
| | Tank Fill (tractor) | 6,088 | 2,004-10,173 | 2 | 1.1 | 111.61 |
| | Application/Inc. (inside cab) | 221 | 44-398 | 2 | 5.7 | 21.00 |
| LASSO II | Hopper Fill (planter) | 988 | 264-1,711 | 2 | 1.3 | 21.41 |
| | Application (inside cab) | N.D. | N.D. | 2 | 10.0 | N.D. |

1. µg/exposed area.
2. The pads located on the forehead and back of neck, and the gloves were considered representative of the exposed skin on the face, back of neck, "V" of the chest and hands.
3. It is assumed that a long-sleeved shirt is worn.
4. Exposed areas: face = 650 $cm^2$; back of neck = 110 $cm^2$; front of neck and "V" of chest = 150 $cm^2$; hands = 820 $cm^2$. Based on W. J. Hayse, Toxicology of Pesticides and Durham and Wolfe, Bull. Who 26, 75-91 (1962).
5. Range: lowest and highest values from forehend, back, chest pads and hand gloves, divided by exposure time (minutes), multiplied by 60 min/hr, multiplied by the appropriate surface areas listed in footnote 4.
6. A 60 kg body weight is assumed.
7. Multiply column 1 by column 4, then divide by 60 kg body weight.

Table LI

Applicator Exposure to [redacted]

| Operation | 1 Average Exposure Level ($ug/M^3$)[1] | 2 Range ($ug/M^3$) | 3 Number of Samples | 4 Time (in hours) for 100 acre application | 5 Unit Inhalation Exposure (ug/kg bw/100 acres treated)[2,3] |
|---|---|---|---|---|---|
| LASSO EC | | | | | |
| Tank Fill (airplane) | 9,691 | 8,033-12,424 | 4 | 0.2 | 48.46 |
| Application (pilot) | N.D. | N.D. | 4 | 0.7 | N.D. |
| Application (flag-man) | N.D. | N.D. | 4 | 0.4 | N.D. |
| Tank Fill (open pour) | 6,408 | 4,651-9,177 | 4 | 1.1 | 117.48 |
| Tank Fill (5 gal. probe) | N.D. | N.D. | 4 | 1.1 | N.D. |
| Tank Fill (55 gal. probe) | 11,102 | 7,142-16,650 | 4 | 0.9 | 166.53 |
| Application/Inc. (inside cab) | 1,375 | 1,239-1,525 | 4 | 5.7 | 195.87 |

1 Inside tractor cab air concentration values were used for application/incorporation operations.
2 A 60 kg female body weight is assumed; a 1.5 $M^3$/hr breathing rate is assumed.
3 Multiply the value in column 1 by column 4, then multiply by 1.5 $M^3$/hr, and then divide by 60 kg.

Table LII

Total Body Dose Estimates

Combined Inhalation & Dermal Exposure

| | Operation | 1 Unit Inhalation Exposure[1,2] | 2 Total Inhalation Exposure[1,3] | 3 Total Daily Inhalation Exposure[1,4] 100% Absorption Assumed | 4 Unit Dermal Exposure[1,5] | 5 Total Dermal Exposure[1,3] | 6 Total Daily Dermal Exposure[1,6] 10% Absorption Assumed | 7 Total Body Dose Dermal & Inhalation (ug/kg bw/100 acres)[7] | 8 Total Body Dose Dermal & Inhalation (ug/kg bw/pound applied) |
|---|---|---|---|---|---|---|---|---|---|
| LASSO SC | Tank Fill (5 gal. probe) | 0.11 | | | 28.93 | | | | |
| | Application/Inc. (inside cab) | 0.19 | 0.30 | 0.30 | 21.00 | 49.93 | 4.99 | 5.29 | 0.013 |
| | Tank Fill (55 gal. probe) | 0.21 | | | 55.83 | | | | |
| | Application/Inc. (inside cab) | 0.19 | 0.40 | 0.40 | 21.00 | 76.83 | 7.68 | 8.08 | 0.020 |

1. ug/kg bw/acres treated (refer to footnotes in tables 53 and 54 for explanation of assumptions used).
2. Unit inhalation values are from table 53, column 5.
3. Additive total of tankfill values and application values.
4. Column 2 multiplied by absorption rate.
5. Unit dermal exposure values are from table 54, column 5.
6. Column 5 multiplied by absorption rate.
7. Additive total of columns 3 and 6.
8. Application calculated at 400 lbs/100 acres.

## Table LIII

### Applicator Exposure to Alachlor Through Inhalation

| | Operation | 1 Average Exposure Level ($ug/M^3$) | 2 Range ($ug/M^3$) | 3 Number of Samples | 4 Time (in hours) for 100 acre application | 5 Unit Inhalation Exposure (ug/kg bw/100 acres treated)[1,2] |
|---|---|---|---|---|---|---|
| LASSO EC | Tank Fill (5 gal. probe) | 3.83 | 1.2-9.1 | 8 | 1.1 | 0.11 |
| | Tank Fill (55 gal. probe) | 9.34 | 3.0-28.5 | 8 | 0.9 | 0.21 |

1 A 60 kg female body weight is assumed; a 1.5 $M^3$/hr breathing rate is assumed.
2. Multiply the value in column 1 by column 4, then multiply by 1.5 $M^3$/hr, and then divide by 60 kg.

Table LIV

Applicator Exposure to Alachlor Via Dermal Deposition

| | Operation | 1 Average Exposure Level[1,2,3,4] | 2 Range[1,5] | 3 Number of Samples | 4 Time (in hours) for 100 acre application | 5 Unit Dermal Exposure (ug/kg bw/100 acres treated)[6,7] |
|---|---|---|---|---|---|---|
| LASSO EC | Tank Fill (5 gal. probe) | 1,578 | 114-3,042 | 2 | 1.1 | 28.93 |
| | Tank Fill (55 gal. probe) | 3,722 | 1,843-5,595 | 2 | 0.9 | 55,83 |

1. µg/exposed area.
2. The pads located on the forehead and back of neck and the gloves were considered representative of the exposed skin on the face, back of neck and "V" of the chest and hands.
3. It is assumed that a long-sleeved shirt is worn.
4. Exposed areas: face = 650 $cm^2$; back of neck = 110 $cm^2$; front of neck and "V" of chest = 150 $cm^2$; hands = 820 $cm^2$. Based on W. J. Hayse, Toxicology of Pesticides and Durham and Wolfe, Bull. Who 26, 75-91 (1962).
5. Range: lowest and highest values from forehead, back, chest pads and hand gloves, divided by exposure time (minutes), multiplied by 60 min/hr, multiplied by the appropriate surface areas listed in footnote 4.
6. A 60 kg body weight is assumed.
7. Multiply column 1 by column 4, then divide by 60 kg body weight.

Table LV

MEASURED DEPOSITION OF ALACHLOR

ON THE SURFACE OF PROTECTIVE RUBBER GLOVES

DURING TANK FILLS USING GROUND BASED EQUIPMENT

| Operation | Total ug Found | $ug/cm^2$ |
|---|---|---|
| Lasso EC open pour tank fill | 39,987.66 | 48.77 |
| Lasso EC open pour tank fill | 16,861.66 | 20.56 |
| Lasso EC 55 gal probe transfer | 18,475.62 | 22.53 |
| Lasso EC 55 gal probe transfer | 10 195.15 | 12.43 |
| Lasso EC 5 gal probe transfer | 26,932.57 | 32.84 |
| Lasso EC 5 gal probe transfer | 35,003.34 | 42.69 |
| Lasso II hopper fill | 98.60 | 0.12 |
| Lasso II hopper fill | 75.75 | 0.09 |

Table XX IX

FIELD RE-ENTRY (REP-1) GROUND APPLICATOR EXPOSURE

AFTER

LASSO EC APPLICATION

| | | 3 D.A.T. | 7 D.A.T. |
|---|---|---|---|
| SAMPLING CONDITIONS | Wind (mph-direction): | 12 NE | 12 NNW |
| | Humidity: | 50% | 89% |
| | Air Temperature (°C): | 17 | 10 |
| | Sampling Time (min): | 30 | 30 |
| Measured Concentration of Alachlor in Air (ug/m³) | | | |
| | (silica gel) | 4.13 | <0.67[1] |
| | | 3.00 | <0.67[1] |
| Measured Concentration [redacted] | (charcoal) | <2,667.0[2] | <2,667.0[2] |
| | | <2,667.0[2] | <2,667.0[2] |
| Dermal Deposition of Alachlor (ug/cm²) | Hands: | 0.013 | <0.012 |
| | Head: | <0.005 | <0.005 |
| | Forehead: | 0.010 | <0.005 |
| | Shoulder: | 0.007 | <0.005 |
| | Chest: | 0.005 | <0.005 |
| | Back: | 0.012 | <0.005 |
| | Thigh: | 0.019 | <0.005 |
| | Forearm (under): | 0.008 | <0.005 |
| | Forearm (outer): | <0.005 | <0.005 |
| | Bicep (under): | <0.005 | <0.005 |
| | Bicep (outer): | <0.005 | <0.005 |
| | Ankle (under): | 0.091 | <0.005 |
| | Ankle (outer): | 0.007 | 0.005 |

[1] Based on 0.10 ug sensitivity and volume of air sampled.
[2] Based on 200 ug sensitivity and volume of air sampled.

Table XL

FIELD RE-ENTRY (REP-2) GROUND APPLICATOR EXPOSURE

AFTER

LASSO EC APPLICATION

| | | 1 D.A.T. | 4 D.A.T. |
|---|---|---|---|
| SAMPLING CONDITIONS | Wind (mph-direction): | 5 S | 12 NNW |
| | Humidity: | 58% | 89% |
| | Air Temperature (°C): | 18 | 10 |
| | Sampling Time (min): | 30 | 30 |
| Measured Concentration of Alachlor in Air (ug/m³) | | | |
| | (silica gel) | 1.07 | <0.67[1] |
| | | 1.07 | <0.67[1] |
| Measured Concentration of [redacted] | (charcoal) | <2,667.0[2] | <2,667.0[2] |
| | | <2,667.0[2] | <2,667.0[2] |
| Dermal Deposition of Alachlor (ug/cm²) | Hands: | <0.012 | <0.012 |
| | Head: | <0.005 | <0.005 |
| | Forehead: | <0.005 | <0.005 |
| | Shoulder: | <0.005 | <0.005 |
| | Chest: | <0.005 | <0.005 |
| | Back: | <0.005 | <0.005 |
| | Thigh: | <0.005 | <0.005 |
| | Forearm (under): | <0.005 | <0.005 |
| | Forearm (outer): | <0.005 | <0.005 |
| | Bicep (under): | <0.005 | <0.005 |
| | Bicep (outer): | <0.005 | <0.005 |
| | Ankle (under): | 0.017 | <0.005 |
| | Ankle (outer): | 0.012 | <0.005 |

[1] Based on 0.10 ug sensitivity and volume of air sampled.
[2] Based on 200 ug sensitivity and volume of air sampled.

Table XLIV

FIELD RE-ENTRY (REP-1) GROUND APPLICATOR EXPOSURE

AFTER

LASSO II GRANULES APPLICATION

| | | 1 D.A.T. | 3 D.A.T. | 7 D.A.T. |
|---|---|---|---|---|
| SAMPLING CONDITIONS | Wind (mph-direction): | 3 S | 10 SW | 23 SW |
| | Humidity: | 78% | 56% | 49% |
| | Air Temperature (°C): | 24 | 35 | 35 |
| | Sampling Time (min): | 30 | 30 | 30 |
| Measured Concentration of Alachlor in Air ($ug/m^3$) | | | | |
| | (silica gel) | <0.67[1] | <0.67[1] | <0.67[1] |
| | | <0.67[1] | <0.67[1] | <0.67[1] |
| Dermal Deposition of Alachlor ($ug/cm^2$) | Hands: | <0.012 | <0.012 | <0.012 |
| | Head: | <0.005 | <0.005 | <0.005 |
| | Forehead: | <0.005 | <0.005 | <0.005 |
| | Shoulder: | <0.005 | <0.005 | <0.005 |
| | Chest: | <0.005 | <0.005 | <0.005 |
| | Back: | <0.005 | <0.005 | <0.005 |
| | Thigh: | <0.005 | <0.005 | <0.005 |
| | Forearm (under): | <0.005 | <0.005 | <0.005 |
| | Forearm (outer): | <0.005 | <0.005 | <0.005 |
| | Bicep (under): | <0.005 | <0.005 | <0.005 |
| | Bicep (outer): | <0.005 | <0.005 | <0.005 |
| | Ankle (under): | <0.005 | <0.005 | <0.005 |
| | Ankle (outer): | <0.005 | <0.005 | <0.005 |

[1] Based on 0.10 ug sensitivity and volume of air sampled.

Table V

FIELD RE-ENTRY (REP-2) GROUND APPLICATOR EXPOSURE

AFTER

LASSO II GRANULES APPLICATION

| | | 1 D.A.T. | 3 D.A.T. | 7 D.A.T. |
|---|---|---|---|---|
| SAMPLING CONDITIONS | Wind (mph-direction): | 3 S | 10 SW | 23 SW |
| | Humidity: | 78% | 56% | 49% |
| | Air Temperature (°C): | 24 | 35 | 35 |
| | Sampling Time (min): | 30 | 30 | 30 |
| Measured Concentration of Alachlor in Air ($ug/m^3$) | | | | |
| | (silica gel) | <0.67[1] | <0.67[1] | <0.67[1] |
| | | <0.67[1] | <0.67[1] | <0.67[1] |
| Dermal Deposition of Alachlor ($ug/cm^2$) | Hands: | <0.012 | <0.012 | <0.012 |
| | Head: | <0.005 | <0.005 | <0.005 |
| | Forehead: | <0.005 | <0.005 | <0.005 |
| | Shoulder: | <0.005 | <0.005 | <0.005 |
| | Chest: | <0.005 | <0.005 | <0.005 |
| | Back: | <0.005 | <0.005 | <0.005 |
| | Thigh: | <0.005 | <0.005 | <0.005 |
| | Forearm (under): | <0.005 | <0.005 | <0.005 |
| | Forearm (outer): | <0.005 | <0.005 | <0.005 |
| | Bicep (under): | <0.005 | <0.005 | <0.005 |
| | Bicep (outer): | <0.005 | <0.005 | <0.005 |
| | Ankle (under): | <0.005 | <0.005 | <0.005 |
| | Ankle (outer): | <0.005 | <0.005 | <0.005 |

[1] Based on 0.10 ug sensitivity and volume of air sampled.

Table XLVIII A



SOIL ANALYSIS FROM LASSO APPLICATOR EXPOSURE STUDY

| Rep no. | Type of Sample | Herbicide Applied | Rate (lbs/A) | % Moisture | PPM Found | PPM Corrected for $H_2O$ and Av. Rec. | lbs/. Found |
|---|---|---|---|---|---|---|---|
| 1 | check | none | 0.0 | 1.9 | ---- | ---- | ---- |
| 1 | check | none | 0.0 | 1.9 | ---- | ---- | ---- |
| 1 | aerial app. | Lasso EC | 3.0 | 1.9 | 1.04 | 1.15 | 0.46 |
| 1 | aerial app. | Lasso EC | 3.0 | 1.9 | 0.98 | 1.09 | 0.44 |
| 2 | check | none | 0.0 | 2.4 | ---- | ---- | ---- |
| 2 | check | none | 0.0 | 2.4 | ---- | ---- | ---- |
| 2 | aerial app. | Lasso EC | 3.0 | 1.4 | 2.18 | 2.40 | 0.96 |
| 2 | aerial app. | Lasso EC | 3.0 | 1.4 | 2.06 | 2.27 | 0.91 |
| 1 | check | none | 0.0 | 2.8 | ---- | ---- | ---- |
| 1 | check | none | 0.0 | 2.8 | ---- | ---- | ---- |
| 1 | ground app. | Lasso EC | 4.0 | 2.4 | 3.25 | 3.63 | 1.45 |
| 1 | ground app. | Lasso EC | 4.0 | 2.4 | 2.44 | 2.72 | 1.09 |
| 1 | 3 DAT | none | 0.0 | 2.6 | not | | |
| 1 | 3 DAT | none | 0.0 | 2.6 | analyzed | | |
| 1 | 7 DAT | none | 0.0 | 2.3 | 3.20 | 3.56 | 1.42 |
| 1 | 7 DAT | none | 0.0 | 2.3 | 3.04 | 3.38 | 1.35 |
| 2 | check | none | 0.0 | 2.2 | 0.10 | 0.11 | 0.04 |
| 2 | check | none | 0.0 | 2.2 | 0.10 | 0.11 | 0.04 |
| 2 | ground app. | Lasso EC | 4.0 | 2.4 | 2.73 | 3.04 | 1.22 |
| 2 | ground app. | Lasso EC | 4.0 | 2.4 | 2.76 | 3.07 | 1.23 |
| 2 | 1 DAT | none | 0.0 | 2.0 | 4.77 | 5.29 | 2.1 |
| 2 | 1 DAT | none | 0.0 | 2.0 | 5.11 | 5.67 | 2.27 |
| 2 | 4 DAT | none | 0.0 | 2.4 | 1.32 | 1.47 | 0.59 |
| 2 | 4 DAT | none | 0.0 | 2.4 | 1.38 | 1.54 | 0.62 |
| 1 | check | none | 0.0 | 1.8 | 0.11 | 0.12 | 0.05 |
| 1 | check | none | 0.0 | 1.8 | ---- | ---- | ---- |
| 1 | ground app. | Lasso II | 4.0 | 1.7 | 7.74 | 8.56 | 3.42 |
| 1 | ground app. | Lasso II | 4.0 | 1.7 | 6.97 | 7.71 | 3.08 |
| 1 | 1 DAT | none | 0.0 | 1.5 | 5.74 | 6.33 | 2.53 |
| 1 | 1 DAT | none | 0.0 | 1.5 | 5.83 | 6.43 | 2.57 |
| 1 | 3 DAT | none | 0.0 | 1.5 | 4.60 | 5.08 | 2.03 |
| 1 | 3 DAT | none | 0.0 | 1.5 | 5.78 | 6.38 | 2.55 |
| 1 | 7 DAT | none | 0.0 | 1.5 | 8.01 | 8.84 | 3.54 |
| 1 | 7 DAT | none | 0.0 | 1.5 | 7.90 | 8.72 | 3.49 |
| 2 | check | none | 0.0 | 1.8 | 0.11 | 0.12 | 0.05 |
| 2 | check | none | 0.0 | 1.8 | ---- | ---- | ---- |
| 2 | ground app. | Lasso II | 4.0 | 1.7 | 8.40 | 9.29 | 3.72 |
| 2 | ground app. | Lasso II | 4.0 | 1.7 | 7.65 | 8.46 | 3.39 |
| 2 | 1 DAT | none | 0.0 | 2.0 | 3.92 | 4.35 | 1.74 |
| 2 | 1 DAT | none | 0.0 | 2.0 | lost | | |
| 2 | 3 DAT | none | 0.0 | 1.6 | 5.21 | 5.76 | 2.30 |
| 2 | 3 DAT | none | 0.0 | 1.6 | 4.63 | 5.11 | 2.04 |
| 2 | 7 DAT | none | 0.0 | 1.3 | 4.44 | 4.89 | 1.96 |
| 2 | 7 DAT | none | 0.0 | 1.3 | 4.77 | 5.25 | 2.10 |

---- indicates less than 0.10 PPM.
DAT indicates days after treatment.
PPM's are corrected for 92% average recovery.

Table LV

MEASURED DEPOSITION OF ALACHLOR

ON THE SURFACE OF PROTECTIVE RUBBER GLOVES

DURING TANK FILLS USING GROUND BASED EQUIPMENT

| Operation | Total ug Found | ug/cm$^2$ |
|---|---|---|
| Lasso EC open pour tank fill | 39,987.66 | 48.77 |
| Lasso EC open pour tank fill | 16,861.66 | 20.56 |
| Lasso EC 55 gal probe transfer | 18.475.62 | 22.53 |
| Lasso EC 55 gal probe transfer | 10 195.15 | 12.43 |
| Lasso EC 5 gal probe transfer | 26,932.57 | 32.84 |
| Lasso EC 5 gal probe transfer | 35,003.34 | 42.69 |
| Lasso II hopper fill | 98.60 | 0.12 |
| Lasso II hopper fill | 75.75 | 0.09 |

3.2 Dermal Absorption Studies. Report compiled by R.W. Street, Report No. MSL-1983.

EFB does not review dermal absorption studies.

3.3 Glove Penetration Studies. Report compiled by R.W. Street, Jan. 5, 1982, Parts 1 and 2, Acc No 070593.

3.3.1 Part 1. Alachlor Penetration Study Through Rubber Gloves, R. Lauer and S. Dubelman, Aug. 1981, Report No. MSL-1806

The permeation cells used are similar to those developed for the ASTM standard permeation test method. The procedure measures the time required for initial breakthrough and then the rate of penetration of the chemical (alachlor) through the membrane. One chamber of the cell contains the chemical and the other the sampling solution which is withdrawn and analyzed for residue levels. The chambers are separated from each other by the membrane to be tested. Residue levels of the alachlor in this study that permeated various glove materials was determined by GC using $Ni^{63}$ electron capture detector. Figure 9 provides a sketch of the permeation cell; Table 10 lists the various gloves materials tested.

The method used simulates worst case conditions which are equivalent to holding a hand in glove in constant contact with alachlor for 24 hr. Tables 1-8 show the breakthrough times for the gloves tested. Only one glove offered complete and continuous protection; these give adequate protection; and four had low breakthrough times.

Conclusion

This is an ancillary study and not required as a condition of registration.

With the development of the ASTM method for determination of breakthrough times and permeation rates, EFB is supportive of a continuation of this type of work by registrants to determine efficacy of protective clothing and equipment.

27.

FIGURE 9

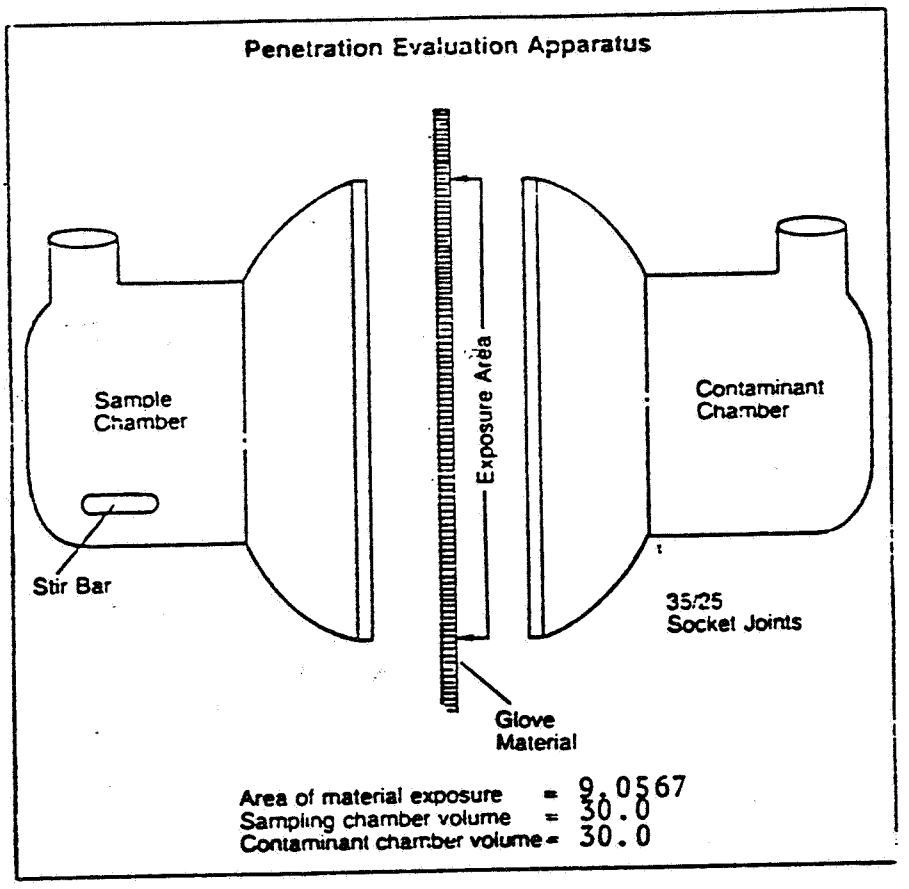


TABLE 10

GLOVE MATERIAL

1. Norton Viton Gloves:
   Cat. No. F-121; 12 Mils; 11" length;
   Size 10

2. Norton Nitrile Latex Gloves:
   Cat. No. LA-256-EB; 25 Mils; 18" length;
   Size 10

3. Norton Butyl Rubber Gloves:
   Cat. No. B-147; 14" Length; Size 10

4. Fisher (brand) Natural Rubber Gloves:
   Cat. No. 11-394-30B; 46 Mils; extra-heavy
   smooth finish

5. Edmont® Neoprene Unsupported Line Gloves:
   Cat. No. 29-840; 15 Mils; 11" length;
   Size 10

6. Edmont® Sol-Vex Unsupported Solvent Resistant
   Gloves:
   Cat. No. 37-145; 11 Mils; 12" length;
   Size 10

7. Surety Natural Rubber Latex Gloves
   Cat. No. 30-242T; 17 Mils; 12" length;
   Size 10

8. Surety Sureseal Milled Nitrile Gloves:
   Cat. No. 10-116R; 10 Mils; 11" length;
   Size 10

5.

TABLE I

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Norton Viton Glove | 12 | 0.5 | No | -- | -- |
| | | 1.0 | No | -- | -- |
| | | 2.0 | No | -- | -- |
| | | 4.0 | No | -- | -- |
| | | 6.0 | No | -- | -- |
| | | 24.0 | No | -- | 0.20 |

-- <0.005 µg/cm$^2$ (sensitivity limit)

6.

TABLE 2

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Norton Nitrile Latex Glove | 25 | 0.5 | No | -- | -- |
| | | 1.0 | No | -- | -- |
| | | 2.0 | No | -- | -- |
| | | 4.0 | No | -- | -- |
| | | 6.0 | swelling | -- | 42.01 |
| | | 24.0 | swelling | 0.64 | 252.62 |

-- <0.005 µg/cm$^2$

7.

TABLE 3

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Norton Butyl Rubber Glove | | 0.5 | No | -- | -- |
| | | 1.0 | No | -- | 1.70 |
| | | 2.0 | No | -- | 2.15 |
| | | 4.0 | No | -- | 3.88 |
| | | 6.0 | swelling | -- | 76.14 |
| | | 24.0 | swelling | 21.04 | 320.08 |

— <0.005 µg/cm$^2$

8.

TABLE 4

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Fisher (brand) Natural Rubber Glove (extra-heavy) | 46 | 0.5 | No | -- | -- |
| | | 1.0 | No | -- | 0.26 |
| | | 2.0 | No | -- | 1.50 |
| | | 4.0 | swelling | -- | 76.08 |
| | | 6.0 | swelling | -- | 199.53 |
| | | 24.0 | swelling | 96.03 | 398.61 |

-- <0.005 µg/cm$^2$

9.

TABLE 5

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Neoprene unsupported Line Glove | 19 | 0.5 | No | -- | -- |
| | | 1.0 | No | -- | 11.99 |
| | | 2.0 | swelling | -- | 129.25 |
| | | 4.0 | swelling | -- | 308.20 |
| | | 6.0 | loss of shape | 0.59 | 507.53 |
| | | 24.0 | loss of shape | 173.52 | 1050.20 |

-- <0.005 µg/cm$^2$

10.

TABLE 6

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Surety Natural Rubber Latex Glove | 17 | 0.5 | No | -- | 25.86 |
| | | 1.0 | swelling | -- | 96.25 |
| | | 2.0 | swelling | 0.52 | 272.80 |
| | | 4.0 | loss of shape | 29.60 | 496.34 |
| | | 6.0 | loss of shape | 124.10 | 721.31 |
| | | 24.0 | loss of shape | 430.86 | 986.30 |

-- <0.005 µg/cm$^2$

11.

TABLE 7

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Surety sureseal milled nitrile glove | 10 | 0.5 | No | -- | 0.30 |
| | | 1.0 | No | -- | 0.82 |
| | | 2.0 | swelling | -- | 62.82 |
| | | 4.0 | swelling | -- | 279.10 |
| | | 6.0 | loss of shape | -- | 491.56 |
| | | 24.0 | loss of shape | 178.80 | 1370.77 |

-- <0.05 µg/cm$^2$

12.

TABLE 8

Penetration of Alachlor through Rubber Gloves

| Material | Thickness Mils | Sampling Time | Physical Change | Microgr./cm$^2$ Spray Tank (conc.) | Microgr./cm$^2$ Lasso EC Formulation |
|---|---|---|---|---|---|
| Sol-Vex unsupported solvent resistant glove | 11 | 0.5 | No | -- | 0.02 |
| | | 1.0 | No | -- | 0.27 |
| | | 2.0 | swelling | -- | 35.91 |
| | | 4.0 | swelling | -- | 242.10 |
| | | 6.0 | loss of shape | -- | 469.17 |
| | | 24.0 | loss of shape | 1.25 | 22716.62 |

-- <0.005 µg/cm$^2$

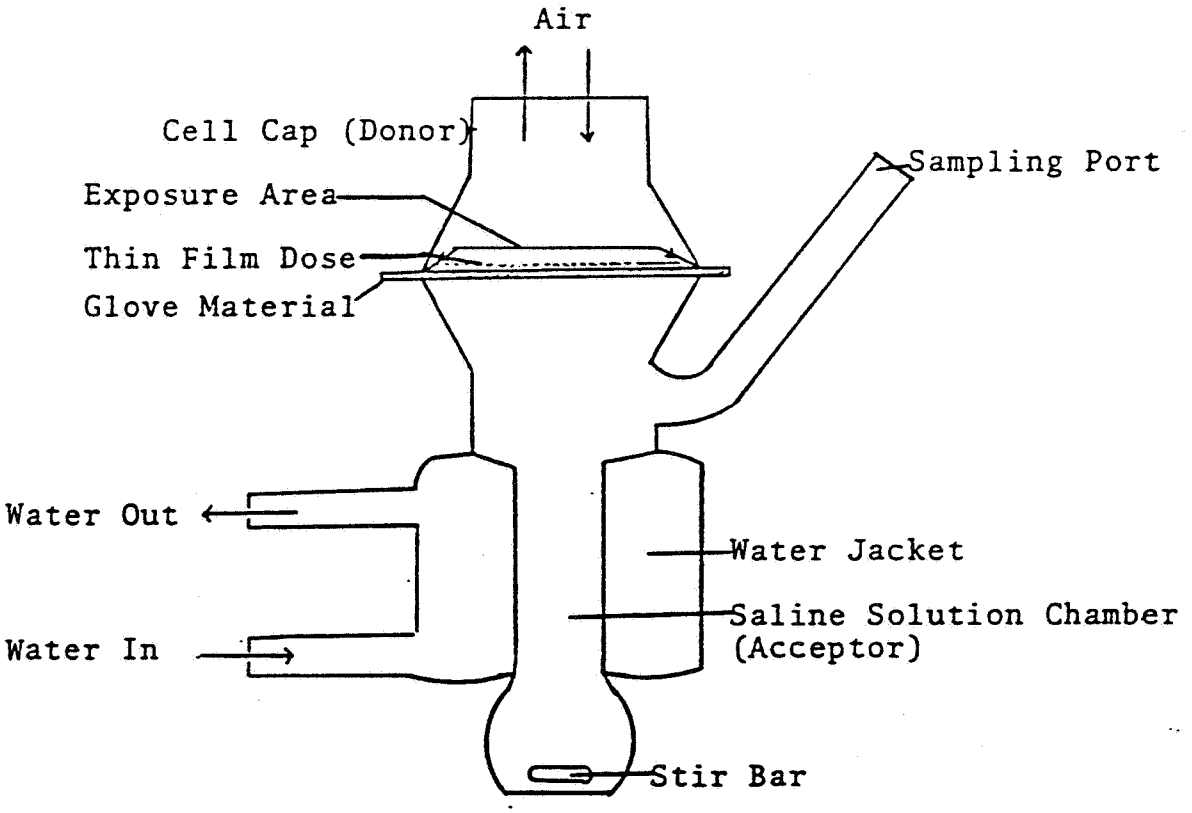
3.3.2 Part 2, Permeation of Protective Glove Materials by Lasso® EC Herbicide, C.C. Ting and J.W. Worley, 1981, Report No. MSL-1907.

The previous study (Part 1) employed the constant contact (infinite dose) technique while this study uses a "finite dose" technique while this study uses a "finite dose" technique which is believed to simulate reality to a greater degree than the infinite dose way. This technique places the pesticide on top of the membrane. This side is kept open to the atmosphere to allow for possible evaporation. A sketch of the apparatus is in Figure 2. Residues were analyzed using HPLC techniques. Table II lists the glove materials tested. The results are summarized in Table III for both finite and infinite methods. Apparently this technique indicates that gloves provide about 10X more protection than indicated by the infinite dose test method.

Conclusions

This is an ancillary study as well that provides valuable data concerning the effectiveness of protective clothing tested under possibly more realistic conditions.

Figure 2. Configurations of Permeation Cells for "Finite Dose" Technique




Area of material exposure = 3.93 $cm^2$

Acceptor chamber volume = 16.5 ml

TABLE II. Glove Materials Employed for Permeation Investigation

| No. | Glove Material | Catalogue No. | Thickness (mm)[a] |
|---|---|---|---|
| 1. | Norton Viton Gloves | F-121 | 0.030 |
| 2. | Norton Nitrile Latex Gloves | LA-256-EB | 0.059 |
| 3. | Norton Butyl Rubber Gloves | B-147 | 0.037 |
| 4. | Fisher (brand) Natural Rubber (extra heavy) Gloves | 11-394-30B | 0.11 |
| 5. | Edmont® Neoprene Unsupported Line Gloves | 29-875 | 0.040 |
| 6. | Edmont® Sol-Vex (Nitrile Butyl Rubber) Unsupported | 37-185 | 0.054 |
| 7. | Surety Natural Rubber Latex Gloves | 30-242T | 0.033 |
| 8. | Surety Sureseal Milled Nitrile Gloves | 10-116R | 0.034 |

[a]Based on average of three measurements by arbitrary selection of the gloves.

## II. SUMMARY AND RECOMMENDATIONS

Permeation experimental results of undiluted Lasso® EC and Spray Tank Mix using both "infinite dose" and "finite dose" techniques are summarized below.

| | Infinite Dose | | | | Finite Dose | | | |
|---|---|---|---|---|---|---|---|---|
| | Lasso EC | | Lasso EC Spray Tank Mix | | Lasso EC | | Lasso EC Spray Tank M | |
| | (Breakthrough Time, HR) | | | | (Breakthrough) | | | |
| Glove Material | [redacted] | Alachlor | [redacted] | Alachlor | [redacted] | Alachlor | [redacted] | Alachl |
| Norton Viton | >48 | >48 | >48 | >48 | NO | NO | NO | NO |
| Norton Nitrile | 4.0 | 6.0 | 20 | 24 | NO | NO | NO | NO |
| Norton Butyl Rubber | 3.8 | 4.0 | 16 | 20 | NO | NO | NO | NO |
| Other Natural Rubber | 2.0 | 3.5 | 5.5 | 10 | D2[a] | D2[a] | NO | NO |
| Edmont Neoprene | 0.5 | 1.0 | 4.6 | 6.0 | D2[a] | D2[a] | NO | NO |
| Edmont Sol-Vex | 3.8 | 4.0 | 24 | >34 | NO | NO | NO | NO |
| Surety Natural Rubber | 0.2 | 0.2 | 1.2 | 2.0 | D1[b] | D1[b] | NO | D1[b] |
| Surety Milled Nitrile | 1.0 | 1.0 | 6.0 | 8.0 | NO | NO | NO | NO |

[a]Permeation breakthrough was observed on the second day application.
[b]Permeation breakthrough was observed on the first day application.

The results for alachlor breakthrough by the infinite dose procedure agree closely with those reported by Lauer and Dubelman. In addition, breakthrough of [redacted] always faster than alachlor. That [redacted] serve as a "carrier" of alachlor is indicated by results from the "finite dose" technique.

## 4.0 EXECUTIVE SUMMARY AND CONCLUSIONS

- Exposures to both ground and aerial applicators are summarized in Tables 1 and 2.
- Granular formulation of alachlor result in lower exposures than EC formulations.
- Mixer/loaders face potentially higher exposures than applicators.
- Mechanical transfer systems help reduce exposures.
- Protective clothing is a factor in reducing exposure (for example, gloves).
- Use of standard test methods may indicate effectiveness of protective clothing materials.

## 5.0 RECOMMENDATIONS

- EFB believes the exposure studies to be scientifically valid and provide useful data to be used in determining appropriate protective clothing.
- EFB defers to Tox Branch:
  1) The determination of the risk assessment using the recalculated exposure values in Tables 1 and 2; and
  2) The determination of the possible toxicological significance of the exposures to the formulation solvent, [redacted]
- The two ancillary studies on glove permeation provide interesting results concerning the "protectiveness" of protective clothing. What methodologies are developed and accepted to determine breakthrough times, permeation, and penetrations may have significant influence upon the wording of precautionary statements found on the label.

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