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/linuron

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To: I. Sunzenauer  
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JCR

Attached please find the EAB review of...

Reg./File No.: \_\_\_\_\_

Chemical: LinuronType Product: HerbicideProduct Name: LoroxCompany Name: Du PontSubmission Purpose: Aerial Applicator Exposure AssessmentACTION CODE: 827Date In: 2/13/85EAB # 5274Date Completed: 3/14/85TAIS (level II) Days14

Deferrals To:

\_\_\_\_\_ Ecological Effects Branch

\_\_\_\_\_ Residue Chemistry Branch

\_\_\_\_\_ Toxicology Branch

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## 1.0 INTRODUCTION

An exposure assessment has been conducted in response to the request by E. I. du Pont de Nemours & Co., Inc. to reinstate aerial use on the Lorox and Lorox L labels. Lorox and Lorox L are herbicides that contain linuron, a chemical currently under special review by the Agency. Exposure estimates were calculated for mixer/loaders, pilots, and flaggers based on surrogate data available in the literature.

Aerial use of linuron is proposed for asparagus, carrots, potatoes, soybeans, and wheat. BUD has determined that carrots are the only site of consequence related to aerial application of linuron. This assessment will therefore be restricted to aerial use on carrots.

## 2.0 ASSUMPTIONS

In conducting the exposure assessment, EAB has made several assumptions.

- 1) The average worker weighs 70 kg.
- 2) The different tasks (mixing/loading, piloting, and flagging) will be performed by separate individuals.
- 3) No difference in exposure to mixer/loaders using a closed versus open loading system will occur. A review of exposure studies investigating exposure to workers using the two types of loading systems has not conclusively indicated that the closed loading system affords greater protection than the open system. Although a closed system will theoretically reduce mixer/loader exposure, variations in equipment efficiency and individual worker habits appear to have greater impacts on mixer/loader exposure potential. Therefore for the purpose of this assessment, the type of loading system was ignored.
- 4) Adjustment of worker exposure to account for the use of protective clothing was not performed. Published literature generally does not include sufficient information to permit such adjustments. To account for the label requirement that mixer/loaders must wear chemical resistant gloves, surrogate data in which the mixer/loaders wore gloves were used.
- 5) Adjustment of worker exposure for dermal penetration was not done. EAB defers to the Toxicology Branch to determine dermal absorption.

## 3.0 SUMMARY OF SURROGATE STUDIES

3.1 Maddy et al (1) monitored the dermal and respiratory exposure of mixer/loaders, pilots, and flaggers involved in spraying crops with phosdrin. Phosdrin was applied at an average application rate of 0.58 lbs a.i./acre by fixed wing aircraft. The mixer/loaders wore long sleeve overalls, heavy rubber gloves, and rubber boots. The spray tanks were loaded using a closed system. The pilots wore long pants

and long sleeve shirts and the flaggers wore overalls and long sleeve shirts. Exposure was measured using gauze patches attached to exposed skin and skin protected by clothing, hand washes, and a personal air sampler. Four replicates were measured for the mixer/loaders and the pilots. Eight replicates were measured for the flaggers. The estimated exposures (ug/kg/hr) were as follows:

| JOB     | DERMAL   |      | RESPIRATORY |      |
|---------|----------|------|-------------|------|
|         | Range    | Mean | Range       | Mean |
| M/L     | 0.63-2.5 | 1.5  | 0.06-0.31   | 0.18 |
| Pilot   | 0.0-0.59 | 0.19 | 0.09-0.37   | 0.21 |
| Flagger | 0.0-18   | 2.6  | 0.0 -1.6    | 0.30 |

3.2 Knarr et al.(2) estimated the dermal and respiratory exposure of workers applying Ordam 8E (molinate) to rice. The reference did not state the application rate; however, the Ordam 8E label indicates that molinate should be applied at the rate of 4 pts/acre. Ordam 8E contains 8 lbs a.i./gallon which would yield an application rate of 4 lbs a.i./acre. Exposure was monitored using gauze patches both above and under the clothing, hand rinses, and personal air samplers. The workers wore overalls and it is assumed gloves. The estimated exposures (ug/kg/hr) were as follows:

| JOB     | DERMAL | RESPIRATORY |
|---------|--------|-------------|
| M/L     | 2,900  | 1.1         |
| Pilot   | 0.44   | 0.23        |
| Flagger | 97     | 4.3         |

3.3 Lavy et al.(3) conducted a study to measure the exposure of workers to the aerial application of 2,4-D in forests. The 2,4-D was applied at an application rate of 2 lbs a.i./acre. The workers wore normal working clothes. This is assumed to be long pants, short sleeved shirt, and a hat. In addition, the mixer/loaders wore rubber gloves. Dermal exposure to two mixer/loaders utilizing a closed system was (7.7 and 680 ug/kg/hr) 340 ug/kg/hr. The transfer pump for a third mixer/loader failed and the spray tanks were manually loaded by pail. The dermal exposure to the third mixer/loader was 460 ug/kg/hr. Dermal exposure to the pilots averaged 13 ug/kg/hr. Respiratory levels of 2,4-D for all workers was below the detection limit of 0.05 ug 2,4-D on the XAD-2 resin.

3.4 Peoples et al.(4) measured the exposure of pilots and flaggers to DEF and Folex. The DEF and Folex were aerially applied to cotton fields at application rates of 1.32 and 1.5 lbs a.i./acre, respectively. The flaggers wore overalls and caps; the pilots wore ordinary clothing. The estimated exposures (ug/kg/hr) were as follows:

| CHEMICAL | JOB     | DERMAL  |      | RESPIRATORY |      |
|----------|---------|---------|------|-------------|------|
|          |         | Range   | Mean | Range       | Mean |
| DEF      | Pilot   | 10 - 40 | 20   | 0.1 - 2     | 0.7  |
|          | Flagger | 3 - 200 | 40   | 0.3 - 20    | 4    |
| Folex    | Pilot   | 10 - 20 | 20   | 0.1 - 0.2   | 0.1  |
|          | Flagger | 2 - 80  | 40   | 0.4 - 3     | 2    |

3.5 Maitlen et al.(5) measured the dermal exposure of mixer/loaders, pilots, and flaggers to aerially applied Sevimol 4, a liquid suspension containing 40% carbaryl. The carbaryl was applied to corn at 2 lbs a.i./acre. The exposure to mixer/loaders was 49 ug/kg/hr with gloves and 570 ug/kg/hr when gloves were not worn. The pilots had an exposure of 380 ug/kg/hr; however, they also adjusted the spray nozzles. If hand exposure is excluded, the dermal exposure would be 11 ug/kg/hr. The estimated exposure to the flaggers was 5,500 ug/kg/hr.

#### 4.0 CALCULATION OF LINURON EXPOSURE

4.1 Adjustment of surrogate application rates to 1 lb a.i./acre  
So that the surrogate data may be used to estimate linuron exposure, the surrogate exposures are adjusted to a 1 lb a.i./acre application rate.

##### Mixer/Loaders (dermal):

Phosdrin-  $1.5 \text{ ug/kg/hr} \times 1.0/0.58 = 2.6 \text{ ug/kg/hr}$   
Ordam 8E-  $2,900 \text{ ug/kg/hr} \times 1.0/4.0 = 730 \text{ ug/kg/hr}$   
2,4-D-  $340 \text{ ug/kg/hr} \times 1.0/2.0 = 170 \text{ ug/kg/hr}$   
2,4-D-  $460 \text{ ug/kg/hr} \times 1.0/2.0 = 230 \text{ ug/kg/hr}$   
Sevimol 4-  $49 \text{ ug/kg/hr} \times 1.0/2.0 = 25 \text{ ug/kg/hr}$

Mean = 230 ug/kg/hr

##### Mixer/Loaders (Respiratory):

Phosdrin-  $0.18 \text{ ug/kg/hr} \times 1.0/0.58 = 0.31 \text{ ug/kg/hr}$   
Ordam 8E-  $1.1 \text{ ug/kg/hr} \times 1.0/4.0 = 0.28 \text{ ug/kg/hr}$

Mean = 0.30 ug/kg/hr

##### Pilots (Dermal):

Phosdrin-  $0.19 \text{ ug/kg/hr} \times 1.0/0.58 = 0.33 \text{ ug/kg/hr}$   
Ordam 8E-  $0.44 \text{ ug/kg/hr} \times 1.0/4.0 = 0.11 \text{ ug/kg/hr}$   
2,4-D-  $13 \text{ ug/kg/hr} \times 1.0/2.0 = 6.5 \text{ ug/kg/hr}$   
DEF-  $20 \text{ ug/kg/hr} \times 1.0/1.32 = 15 \text{ ug/kg/hr}$   
Folex-  $20 \text{ ug/kg/hr} \times 1.0/1.5 = 13 \text{ ug/kg/hr}^*$   
Sevimol 4-  $11 \text{ ug/kg/hr} \times 1.0/2.0 = 5.5 \text{ ug/kg/hr}$

Mean = 6.7 ug/kg/hr

\* Excludes hand exposure. Pilots adjusted nozzles.

Pilots (Respiratory):

Phosdrin-  $0.21 \text{ ug/kg/hr} \times 1.0/0.58 = 0.36 \text{ ug/kg/hr}$   
Ordam 8E-  $0.23 \text{ ug/kg/hr} \times 1.0/4.0 = 0.06 \text{ ug/kg/hr}$   
DEF-  $0.7 \text{ ug/kg/hr} \times 1.0/1.32 = 0.53 \text{ ug/kg/hr}$   
Folex-  $0.1 \text{ ug/kg/hr} \times 1.0/1.5 = 0.07 \text{ ug/kg/hr}$

Mean =  $0.26 \text{ ug/kg/hr}$

Flaggers (Dermal):

Phosdrin-  $2.6 \text{ ug/kg/hr} \times 1.0/0.58 = 4.5 \text{ ug/kg/hr}$   
Ordam 8E-  $97 \text{ ug/kg/hr} \times 1.0/4.0 = 24 \text{ ug/kg/hr}$   
DEF-  $40 \text{ ug/kg/hr} \times 1.0/1.32 = 30 \text{ ug/kg/hr}$   
Folex-  $40 \text{ ug/kg/hr} \times 1.0/1.5 = 27 \text{ ug/kg/hr}$   
Sevimol 4-  $5,500 \text{ ug/kg/hr} \times 1.0/2.0 = 2800 \text{ ug/kg/hr}$

Mean =  $580 \text{ ug/kg/hr}$

Flaggers (Respiratory):

Phosdrin-  $0.30 \text{ ug/kg/hr} \times 1.0/0.58 = 0.52 \text{ ug/kg/hr}$   
Ordam 8E-  $0.23 \text{ ug/kg/hr} \times 1.0/4.0 = 0.06 \text{ ug/kg/hr}$   
DEF-  $4 \text{ ug/kg/hr} \times 1.0/1.32 = 3.0 \text{ ug/kg/hr}$   
Folex-  $2 \text{ ug/kg/hr} \times 1.0/1.5 = 1.3 \text{ ug/kg/hr}$

Mean =  $1.2 \text{ ug/kg/hr}$

4.2 Carrots

The majority of aerial application to carrots occurs in Florida and the lower San Joaquin Valley. Florida shall be examined as a typical example.

In Florida there is usually one preemergence and two post emergence aerial treatments at an application rate of 0.5 lbs a.i./acre. An average of 200 acres are treated per day during a 2 hour time span. The custom applicators also work 1 to 2 days/week for 6 to 7 months of the year. One to two mixer/loaders and one pilot work on one team. Flaggers are not used (6). This data yields a yearly work time of (2 hrs/day x 1.5 days/wk x 4.3 wks/month x 6.5 months/yr) 84 hours/yr.

Mixer/Loaders:  $230 \text{ ug/kg/hr at } 1 \text{ lb a.i./acre} \times 0.5 \text{ lbs linuron/acre} = 120 \text{ ug/kg/hr}$   
Daily Exposure-  $120 \text{ ug/kg/hr} \times 2 \text{ hrs/day} = 230 \text{ ug/kg/day}$   
 $230 \text{ ug/kg/day} \div 1.5 \text{ persons} = 150 \text{ ug/kg/day}$   
Yearly Exposure-  $120 \text{ ug/kg/hr} \times 84 \text{ hr/yr} = 9700 \text{ ug/kg/yr}$   
 $9700 \text{ ug/kg/yr} \div 1.5 \text{ persons} = 6400 \text{ ug/kg/yr}$

Pilots:  $7.0 \text{ ug/kg/hr at } 1 \text{ lb a.i./acre} \times 0.5 \text{ lbs linuron/acre} = 3.5 \text{ ug/kg/hr}$   
Daily Exposure-  $3.5 \text{ ug/kg/hr} \times 2 \text{ hrs/day} = 7.0 \text{ ug/kg/day}$   
Yearly Exposure-  $3.5 \text{ ug/kg/hr} \times 84 \text{ hr/yr} = 290 \text{ ug/kg/yr}$

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## REFERENCES

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