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Attached, please find the EAB review of...

Reg./File No.: 50534-7

Chemical: Chlorothalonil

Type Product: Fungicide

Product Name: Bravo

Company Name: Fermenta Plant Protection (SDS Biotech Corp.)

Submission Purpose: Exposure Assessment

Date In: 15 SEPT 86

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EAB #: 60866

Deferrals To:

Ecological Effects Branch

Residue Chemistry Branch

Toxicology Branch

Benefits and Use Division

Monitoring study requested by EAB:

Monitoring study voluntarily conducted by registrant: XX

1.0 INTRODUCTION

SDS Biotech Corporation (now Fermenta Plant Protection) has submitted a revised estimation of potential chlorothalonil doses to agricultural applicators from the study, "Applicator Exposure Studies with Chlorothalonil (Bravo 500) Fungicide." The following use sites were addressed: celery and tomatoes. Chlorothalonil has been classified as a B₂ probable human carcinogen by the Toxicology Branch Peer Review Committee.

2.0 DISCUSSION OF DATA

The submission, as presented, cannot be evaluated. The registrant did not resubmit the original study and, without these supporting data, EAB can draw no conclusions from the submission. However, EAB has performed an exposure assessment based on surrogate data. A number of assumptions are necessary for this assessment, namely:

1. An average worker has a mass of 70 kg.
2. Exposure is not adjusted for dermal absorption.
3. For ground application, the mixer/loader and applicator are the same person. Separate persons perform these tasks for the aerial operation.

2.1 USAGE DATA

The following usage data were obtained from BUD and will be employed in this assessment (1).

	<u>Celery</u>	<u>Tomatoes</u>
Application Rate (lb ai/A)	0.75-2.25	1.1-2.2
Average Acreage		
CA	130	152
FL	642	102
Potential Exposure Time (Applicators)		
<u>Ground Boom - CA</u>		
hr/day	6	6
days/yr	21	14
<u>Ground Boom - FL</u>		
hr/day	6	6
days/yr	60	44

	<u>Celery</u>	<u>Tomatoes</u>
<u>Private Aerial - FL</u>		
min/day	71	
hr/day	1.2	
days/yr	20	
<u>Commercial Aerial</u>		
min/day	48	48
hr/day	0.8	0.8
days/yr	140	140

BUD has also stated that an applicator can treat 7.3 A/hr by ground and 540 A/hr (9 A/min) by air. Workers using chlorothalonil employ normal work clothing and gloves when mixing/loading and applying the product. Face shields or goggles are required during mixing/loading only.

2.2 SURROGATE MIXER/LOADER EXPOSURE

EAB utilized two studies from the published literature to estimate mixer/loader exposure (2,3). The label for chlorothalonil requires closed loading. Both studies employed workers wearing long-sleeved shirts, long pants and protective gloves performing closed loading. A summary of the exposure estimates and clothing scenarios is provided below.

<u>Study</u>	<u>Replicates</u>	<u>Exposure (mg/lb ai)</u>	<u>Clothing</u>
Dubelman	9	0.0041	long-sleeved shirt, long pants - 50% protection protective gloves - actual measurement
Peoples	9	0.025	long-sleeved shirt, long pants, protective gloves - actual measurement

The 18 replicates give a mean exposure of 0.015 mg/lb ai handled. The lb ai handled by each mixer/loader per day for each scenario can be calculated as follows. EAB will assume that one mixer/loader will mix all of the product to be applied in a day. Knowing the application rate, the spray rate and the hours spent spraying per day, the total lb ai mixed per day can be calculated. Multiplying this by the days per year, the lb ai handled/yr per mixer/loader is calculated. Adjusting this exposure to the lb ai handled by a mixer/loader of chlorothalonil, the following exposures can be calculated.

1. Mixer/Loader - Ground Application

Celery - CA

Low Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 0.75 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 21 \text{ dy/yr}}{70 \text{ kg individual}} = 0.15 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.50 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 21 \text{ dy/yr}}{70 \text{ kg individual}} = 0.30 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 2.25 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 21 \text{ dy/yr}}{70 \text{ kg individual}} = 0.44 \text{ mg/kg/yr}$$

Exposure: 0.30 mg/kg/yr (Range: 0.15–0.44 mg/kg/yr)

Celery - FL

Low Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 0.75 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 60 \text{ dy/yr}}{70 \text{ kg individual}} = 0.42 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.50 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 60 \text{ dy/yr}}{70 \text{ kg individual}} = 0.84 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 2.25 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 60 \text{ dy/yr}}{70 \text{ kg individual}} = 1.3 \text{ mg/kg/yr}$$

Exposure: 0.84 mg/kg/yr (Range: 0.42–1.3 mg/kg/yr)

Tomatoes - CA

Low Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.1 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 14 \text{ dy/yr}}{70 \text{ kg individual}} = 0.14 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.7 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 14 \text{ dy/yr}}{70 \text{ kg individual}} = 0.22 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 2.2 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 14 \text{ dy/yr}}{70 \text{ kg individual}} = 0.29 \text{ mg/kg/yr}$$

Exposure: 0.22 mg/kg/yr (Range: 0.14–0.29 mg/kg/yr)

Tomatoes - FL

Low Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.1 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 44 \text{ dy/yr}}{70 \text{ kg individual}} = 0.45 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.7 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 44 \text{ dy/yr}}{70 \text{ kg individual}} = 0.68 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 2.2 \text{ lb ai/A} \times 7.3 \text{ A/hr} \times 6 \text{ hr/dy} \times 44 \text{ dy/yr}}{70 \text{ kg individual}} = 0.91 \text{ mg/kg/yr}$$

Exposure: 0.68 mg/kg/yr (Range: 0.45–0.91 mg/kg/yr)

2. Mixer/Loader - Private Aerial Application

Celery - FL

Low Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 0.75 \text{ lb ai/A} \times 9 \text{ A/min} \times 71 \text{ min/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} = 2.1 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.50 \text{ lb ai/A} \times 9 \text{ A/min} \times 71 \text{ min/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} = 4.1 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 2.25 \text{ lb ai/A} \times 9 \text{ A/min} \times 71 \text{ min/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} = 6.2 \text{ mg/kg/yr}$$

Exposure: 4.1 mg/kg/yr (Range: 2.1-6.2 mg/kg/yr)

3. Mixer/Loader - Commercial Aerial Application

Celery

Low Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 0.75 \text{ lb ai/A} \times 9 \text{ A/min} \times 48 \text{ min/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} = 9.7 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.50 \text{ lb ai/A} \times 9 \text{ A/min} \times 48 \text{ min/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} = 19 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 2.25 \text{ lb ai/A} \times 9 \text{ A/min} \times 48 \text{ min/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} = 29 \text{ mg/kg/yr}$$

Exposure: 19 mg/kg/yr (Range: 9.7-29 mg/kg/yr)

Tomatoes

Low Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.1 \text{ lb ai/A} \times 9 \text{ A/min} \times 48 \text{ min/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} = 14 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 1.7 \text{ lb ai/A} \times 9 \text{ A/min} \times 48 \text{ min/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} = 22 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.015 \text{ mg/lb ai} \times 2.2 \text{ lb ai/A} \times 9 \text{ A/min} \times 48 \text{ min/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} = 29 \text{ mg/kg/yr}$$

Exposure: 22 mg/kg/yr (Range: 14-29 mg/kg/yr)

2.3 SURROGATE GROUND BOOM EXPOSURE

EAB used four studies found in the published literature to estimate dermal exposure to ground boom applicators (2,4,5,6). This scenario assumes workers wearing long-sleeved shirts and long pants that provide 50% protection to the covered

areas and gloves that provide 90% protection to the hands. The exposures are presented below.

<u>Study</u>	<u>Replicates</u>	<u>Exposure (mg/hr)</u>
Abbott	18	8.7
Maitlen	21	0.079
Dubelman	12	0.72
Wojeck	23	41.6

The 74 replicates have a weighted geometric mean exposure of 2.5 mg/hr. This is normalized to an application rate of 1.0 lb ai/A. Adjusting this to the application rates for chlorothalonil, the following exposures can be calculated.

Celery - CA

Low Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 21 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{0.75 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 3.4 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 21 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.50 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 6.8 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 21 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.25 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 10 \text{ mg/kg/yr}$$

Exposure: 6.8 mg/kg/yr (Range: 3.4-10 mg/kg/yr).

Celery - FL

Low Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 60 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{0.75 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 9.6 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 60 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.50 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 19 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 60 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.25 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 29 \text{ mg/kg/yr}$$

Exposure: 19 mg/kg/yr (Range: 9.6-29 mg/kg/yr)

Tomatoes - CA

Low Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 14 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.1 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 3.3 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 14 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.7 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 5.1 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 14 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.2 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 6.6 \text{ mg/kg/yr}$$

Exposure: 5.1 mg/kg/yr (Range: 3.3-6.6 mg/kg/yr)

Tomatoes - FL

Low Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 44 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.1 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 10 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 44 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.7 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 16 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{2.5 \text{ mg/hr} \times 6 \text{ hr/dy} \times 44 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.2 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 21 \text{ mg/kg/yr}$$

Exposure: 16 mg/kg/yr (Range: 10-21 mg/kg/yr)

2.4 SURROGATE AERIAL EXPOSURE

EAB utilized five studies from the published literature to estimate exposure to pilots and flaggers (3,7,8,9,10). These

calculations are based on the workers employing normal work clothing. The estimated exposures normalized to an application rate of 1.0 lb ai/A are presented below.

PILOT

<u>Study</u>	<u>Replicates</u>	<u>Exposure (mg/hr)</u>
Lavy	3	0.10
Maddy	4	0.021
Peoples	11	0.86
Mumma	6	0.80
Atallah	4	0.38

FLAGGER

<u>Study</u>	<u>Replicates</u>	<u>Exposure (mg/hr)</u>
Peoples	9	1.1
Maddy	8	0.36
Atallah	3	17.2

The weighted mean exposures are 0.58 mg/hr for the pilots and 3.2 mg/hr for the flaggers. Adjusting these to the application rates for chlorothalonil, the following exposures can be calculated.

1. Pilot Exposure - Private Farm

Celery - FL

Low Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{0.75 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.15 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.50 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.30 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.25 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.45 \text{ mg/kg/yr}$$

Exposure: 0.30 mg/kg/yr (Range: 0.15-0.45 mg/kg/yr)

2. Flagger Exposure - Private Farm

Celery - FL

Low Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{0.75 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.82 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.50 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 1.6 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.25 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 2.5 \text{ mg/kg/yr}$$

Exposure: 1.6 mg/kg/yr (Range: 0.82-2.5 mg/kg/yr)

3. Pilot Exposure - Commercial

Celery

Low Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{0.75 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.70 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.50 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 1.4 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.25 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 2.1 \text{ mg/kg/yr}$$

Exposure: 1.4 mg/kg/yr (Range: 0.70- 2.1 mg/kg/yr)

Tomatoes

Low Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.1 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 1.0 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.7 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 1.6 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{0.58 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.2 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 2.0 \text{ mg/kg/yr}$$

Exposure: 1.6 mg/kg/yr (Range: 1.0–2.0 mg/kg/yr)

4. Flagger Exposure - Commercial

Celery

Low Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{0.75 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 3.8 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.50 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 7.7 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.25 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 12 \text{ mg/kg/yr}$$

Exposure: 7.7 mg/kg/yr (Range: 3.8–12 mg/kg/yr)

Tomatoes

Low Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.1 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 5.6 \text{ mg/kg/yr}$$

Mean Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{1.7 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 8.7 \text{ mg/kg/yr}$$

High Application Rate:

$$\frac{3.2 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times \frac{2.2 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 11 \text{ mg/kg/yr}$$

Exposure: 8.7 mg/kg/yr (Range: 5.6-11 mg/kg/yr)

3.0 CONCLUSIONS

EAB has estimated the exposure of ground mixer/loaders and applicators employing normal work clothing and gloves, and aerial mixer/loaders, pilots and flaggers employing normal work clothing and gloves (mixer/loaders only). The results are presented below.

1. Ground Boom Application

MIXER/LOADER/APPLICATOR

Celery - CA

7.1 mg/kg/yr (Range: 3.6-10 mg/kg/yr)

Celery - FL

20 mg/kg/yr (Range: 10-30 mg/kg/yr)

Tomatoes - CA

5.3 mg/kg/yr (Range: 3.4-6.9 mg/kg/yr)

Tomatoes - FL

17 mg/kg/yr (Range: 10-22 mg/kg/yr)

2. Aerial Application - Private

MIXER/LOADER

Celery - FL

4.1 mg/kg/yr (Range: 2.1-6.2 mg/kg/yr)

PILOT

Celery -FL

0.30 mg/kg/yr (Range: 0.15-0.45 mg/kg/yr)

FLAGGER

Celery -FL

1.6 mg/kg/yr (Range: 0.82-2.5 mg/kg/yr)

3. Aerial Application - Commercial

MIXER/LOADER

Celery

19 mg/kg/yr (Range: 9.7-29 mg/kg/yr)

Tomatoes

22 mg/kg/yr (Range: 14-29 mg/kg/yr)

PILOT

Celery

1.4 mg/kg/yr (Range: 0.70-2.1 mg/kg/yr)

Tomatoes

1.6 mg/kg/yr (Range: 1.0-2.0 mg/kg/yr)

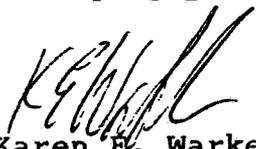
FLAGGER

Celery

7.7 mg/kg/yr (Range: 3.8-12 mg/kg/yr)

Tomatoes

8.7 mg/kg/yr (Range: 5.6-11 mg/kg/yr)


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REFERENCES

1. Memorandum from E. Neil Pelletier to Michael Firestone entitled, "Report on Use Practices and Estimates of Exposure Periods for Application of Chlorothalonil to Celery and Tomatoes." 14 OCT 87.
2. Dubelman, S., et al. 1982. "Operator Exposure Measurements During Application of the Herbicide Diallylate." J. Agric. Food Chem. 30:375-381.
3. Peoples, S. A., et al. 1979. Monitoring of Potential Occupational Exposure of Mixer/Loaders, Pilots, and Flaggers During Application of Tributyl Phosphorotrithioate (DEF) and Tributyl Phosphorothioate (Folex) to Cotton Fields in the San Joaquin Valley of California in 1979. Report HS-676, Worker Health and Safety Unit, California Department of Food and Agriculture. 34 pp.
4. Abbott, I. M., et al. 1987. "Worker Exposure to a Herbicide Applied with Ground Sprayers in the United Kingdom." Am. Ind. Hyg. Assoc. J. 48(2):167-175.
5. Maitlen, J. C., et al. 1982. "Workers in the Agricultural Environment: Dermal Exposure to Carbaryl," in Pesticide Residues and Exposure. ACS Symposium Series 182. ACS Press: Washington, DC. pp. 83-103.
6. Wojeck, G. A., et al. 1983. "Worker Exposure to Paraquat and Diquat." Arch. Environ. Contam. Toxicol. 12:65-70.
7. Lavy, T. C., et al. 1982. "2,4-D Exposure Received by Aerial Application Crews During Forest Spray Operations." J. Agric. Food Chem. 30:375-381.
8. Maddy, K. T., et al. 1982. Monitoring of Potential Occupational Exposure of Mixer/Loaders, Pilots, and Flaggers During Application of Phosdrin (Mevinphos) in Imperial County in 1981. Report HS-889, California Department of Food and Agriculture. 21 pp.
9. Atallah, Y. H., W. P. Cahill and D. M. Whitacre. 1982. "Exposure of Pesticide Applicators and Support Personnel to Ethyl-(4-nitrophenyl) phenylphosphorothioate (EPN)." Arch. Environ. Contam. Toxicol. 11:219-225.
10. Mumma, R. O., G. A. Brandes and C. F. Gordon. 1985. "Exposure of Applicators and Mixer/Loaders During the Application of Mancozeb by Airplanes, Airblast Sprayers, and Compressed-Air Backpack Sprayers," in Dermal Exposure Related to Pesticide Use. ACS Symposium Series 273. ACS Press: Washington, DC. pp. 201-219.