To: Lois Rossi  
    Product Manager #21  
    Registration Division (TS-767C)

From: Michael P. Firestone, PhD, Chief  
    Special Review Section  
    Exposure Assessment Branch  
    Hazard Evaluation Division (TS-769C)

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  
ACTION CODE: 400

Date Completed: 17 NOV 87  
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).

<table>
<thead>
<tr>
<th></th>
<th>Celery</th>
<th>Tomatoes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Rate (lb ai/A)</td>
<td>0.75-2.25</td>
<td>1.1-2.2</td>
</tr>
<tr>
<td>Average Acreage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA</td>
<td>130</td>
<td>152</td>
</tr>
<tr>
<td>FL</td>
<td>642</td>
<td>102</td>
</tr>
</tbody>
</table>

Potential Exposure
Time (Applicators)

<table>
<thead>
<tr>
<th></th>
<th>CA</th>
<th>FL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground Boom - CA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hr/day</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>days/yr</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>Ground Boom - FL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>hr/day</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>days/yr</td>
<td>60</td>
<td>44</td>
</tr>
</tbody>
</table>
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.

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

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:

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

Mean Application Rate:

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

High Application Rate:

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

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

Tomatoes

Low Application Rate:

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

Mean Application Rate:

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

High Application Rate:

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

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.

<table>
<thead>
<tr>
<th>Study</th>
<th>Replicates</th>
<th>Exposure (mg/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbott</td>
<td>18</td>
<td>8.7</td>
</tr>
<tr>
<td>Maitlen</td>
<td>21</td>
<td>0.079</td>
</tr>
<tr>
<td>Dubelman</td>
<td>12</td>
<td>0.72</td>
</tr>
<tr>
<td>Wojleck</td>
<td>23</td>
<td>41.6</td>
</tr>
</tbody>
</table>

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**

<table>
<thead>
<tr>
<th>Study</th>
<th>Replicates</th>
<th>Exposure (mg/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lavy</td>
<td>3</td>
<td>0.10</td>
</tr>
<tr>
<td>Maddy</td>
<td>4</td>
<td>0.021</td>
</tr>
<tr>
<td>Peoples</td>
<td>11</td>
<td>0.86</td>
</tr>
<tr>
<td>Mumma</td>
<td>6</td>
<td>0.80</td>
</tr>
<tr>
<td>Atallah</td>
<td>4</td>
<td>0.38</td>
</tr>
</tbody>
</table>

**FLAGGER**

<table>
<thead>
<tr>
<th>Study</th>
<th>Replicates</th>
<th>Exposure (mg/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peoples</td>
<td>9</td>
<td>1.1</td>
</tr>
<tr>
<td>Maddy</td>
<td>8</td>
<td>0.36</td>
</tr>
<tr>
<td>Atallah</td>
<td>3</td>
<td>17.2</td>
</tr>
</tbody>
</table>

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:

\[
\frac{0.58 \text{ mg/hr} \times \frac{1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}}}{100} \times \frac{0.75 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.15 \text{ mg/kg/yr}
\]

Mean Application Rate:

\[
\frac{0.58 \text{ mg/hr} \times \frac{1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}}}{100} \times \frac{1.50 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.30 \text{ mg/kg/yr}
\]

High Application Rate:

\[
\frac{0.58 \text{ mg/hr} \times \frac{1.2 \text{ hr/dy} \times 20 \text{ dy/yr}}{70 \text{ kg individual}}}{100} \times \frac{2.25 \text{ lb ai/A}}{1.0 \text{ lb ai/A}} = 0.45 \text{ mg/kg/yr}
\]

Exposure: 0.30 mg/kg/yr (Range: 0.15-0.45 mg/kg/yr)
2. Flagger Exposure - Private Farm

Celery - FL

Low Application Rate:

\[
\frac{3.2 \text{ mg/hr} \times \frac{1.2 \text{ hr/dy}}{70 \text{ kg individual}} \times 20 \text{ dy/yr}}{1.25 \text{ lb ai/A}} \times 1.0 \text{ lb ai/A} = 0.82 \text{ mg/kg/yr}
\]

Mean Application Rate:

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

High Application Rate:

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

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

3. Pilot Exposure - Commercial

Celery

Low Application Rate:

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

Mean Application Rate:

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

High Application Rate:

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

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

Tomatoes

Low Application Rate:

\[
\frac{0.58 \text{ mg/hr} \times \frac{0.8 \text{ hr/dy}}{70 \text{ kg individual}} \times 140 \text{ dy/yr}}{1.1 \text{ lb ai/A}} \times 1.0 \text{ lb ai/A} = 1.0 \text{ mg/kg/yr}
\]
Mean Application Rate:

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

High Application Rate:

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

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

4. Flagger Exposure - Commercial

Celery

Low Application Rate:

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

Mean Application Rate:

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

High Application Rate:

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

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

Tomatoes

Low Application Rate:

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

Mean Application Rate:

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

High Application Rate:

\[
\frac{3.2 \text{ mg/hr} \times 0.8 \text{ hr/dy} \times 140 \text{ dy/yr}}{70 \text{ kg individual}} \times 2.2 \text{ lb ai/A} = 11 \text{ mg/kg/yr}
\]
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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Exposure Assessment Branch  
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REFERENCES


