Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade
Chemical Review Committee
Third meeting
Rome, 20–23 March 2007
Item 5 (b) (iii) of the provisional agenda*
Listing of chemicals in Annex III of the Rotterdam Convention:
review of notifications of final regulatory actions to ban
or severely restrict a chemical: endosulfan

Endosulfan

Note by the Secretariat

The Secretariat has the honour to provide, in the annex to the present note, additional documentation received from the European Commission to support its notification of final regulatory action on endosulfan.

Further supporting information has already been circulated in the annex to document UNEP/CRC.3/10/Add.1. In addition, the following documentation will be made available at the current meeting: European Commission – Peer Review Programme – ECCO Meetings – Endosulfan-Volume 1, December 1999; European Commission – Peer Review Programme – ECCO Meetings – Endosulfan-Volume 3, Annex B, December 1999.

Annex

- Annex B – Endosulfan – Addendum B-6: Toxicology and Metabolism (May 2001)
- Annex B – Endosulfan – Addendum B-6: Toxicology and Metabolism (November 2003)
ADDENDUM TO ANNEX B

ENDOSULFAN

B - 6 : TOXICOLOGY AND METABOLISM
B.6.14 Exposure data (IIIA, 7.2)

B.6.14.1 Excel applicant

Operator exposure

Operator exposure, in the context of this section, refers to potential exposure to the person or persons involved in mixing, loading and/or spray application of a plant protection product.

Endocel 35 EC is applied using field crop sprayers and hand held sprayers.

**ESTIMATES OF OPERATOR EXPOSURE UK MODEL**

**Hand held sprayers - no PPE**

**A. PRODUCT DATA**

1. Name Endocel 35 EC
2a. Active Ingredient Endosulfan
2b. Concentration 350 mg/ml
3. Formulation type EC
4a. Main solvent
4b. Concentration of solvent
5. Maximum in-use as concentration 2 mg/ml

**B. EXPOSURE DURING MIXING AND LOADING**

1a. Container size 1 litre
1b. Hand contamination/operation 0.01 ml
2. Application dose 2 litres product/ha
3. Work rate 1 ha/day
4. Number of operations 4/day
5. Hand contamination 0.04 ml/day
6. Protective clothing NONE
7. Transmission to skin 100%
8. Dermal exposure to formulation 0.04 ml/day

**C. EXPOSURE DURING SPRAY APPLICATION**

1. Application technique
2. Application volume 350 l spray/ha
<table>
<thead>
<tr>
<th>Addendum</th>
<th>Volume III</th>
<th>Chapter 6</th>
<th>142</th>
<th>Endosulfan</th>
<th>May 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Volume of surface contamination</td>
<td>50 ml/h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hands</td>
<td>Trunk</td>
<td>Legs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Distribution</td>
<td>25%</td>
<td>25%</td>
<td>50%</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Clothing</td>
<td>None</td>
<td>Perm.</td>
<td>Perm.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Penetration</td>
<td>100%</td>
<td>20%</td>
<td>18%</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Dermal exposure</td>
<td>10</td>
<td>2.5</td>
<td>4.5</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Duration of exposure</td>
<td></td>
<td></td>
<td>6 h</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Total dermal exposure to spray</td>
<td>102 ml/day</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### D. ABSORBED DOSE

<table>
<thead>
<tr>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dermal exposure</td>
<td>0.04 ml/day 102 ml/day</td>
</tr>
<tr>
<td>2. Concentration of as</td>
<td>350 mg/ml 2 mg/ml</td>
</tr>
<tr>
<td>3. Dermal exposure to as</td>
<td>14 mg/day 204 mg/day</td>
</tr>
<tr>
<td>4. Percent absorbed</td>
<td>20% 20%</td>
</tr>
<tr>
<td>5. Absorbed dose</td>
<td>2.8 mg/day 40.8 mg/day</td>
</tr>
</tbody>
</table>

### E. INHALED EXPOSURE DURING SPRAY APPLICATION

| Inhalation exposure | 0.02 ml/h |
| Duration of exposure | 6 h |
| Concentration of as | 2 mg/ml |
| Inhalational exposure to as | 0.24 mg/day |
| Percent absorbed | 100% |
| Absorbed dose | 0.24 mg/day |

### F. PREDICTED EXPOSURE

| Total absorbed dose | 43.84 mg/day |
| Operator body weight | 60 kg |
| Operator exposure | 0.731 mg/kg bw/day |
Hand held sprayers- with PPE (Gloves for mixer/loader and applicator)

A. PRODUCT DATA
1. Name Endocel 35 EC
2a. Active Ingredient Endosulfan
2b. Concentration 350 mg/ml
3. Formulation type EC
4a. Main solvent
4b. Concentration of solvent
5. Maximum in-use as concentration 2 mg/ml

B. EXPOSURE DURING MIXING AND LOADING
1a. Container size 1 litre
1b. Hand contamination/operation 0.01 ml
2. Application dose 2 litres product/ha
3. Work rate 1 ha/day
4. Number of operations 4/day
5. Hand contamination 0.04 ml/day
6. Protective clothing Gloves
7. Transmission to skin 1%
8. Dermal exposure to formulation 0.0004 ml/day

C. EXPOSURE DURING SPRAY APPLICATION
1. Application technique
2. Application volume 350 l spray/ha
3. Volume of surface contamination 50 ml/h
   Hands Trunk Legs
4. Distribution 25% 25% 50%
6. Penetration 1% 20% 18%
7. Dermal exposure 0.125 2.5 4.5
8. Duration of exposure 6 h
9. Total dermal exposure to spray 42.75 ml/day

D. ABSORBED DOSE
1. Dermal exposure 0.0004 ml/day 42.75 ml/day
2. Concentration of as 350 mg/ml 2 mg/ml
3. Dermal exposure to as 0.14 mg/day 85.5 mg/day
4. Percent absorbed 20% 20%
5. Absorbed dose 0.028 mg/day 17.1 mg/day
### E. INHALED EXPOSURE DURING SPRAY APPLICATION

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inhalation exposure</td>
<td>0.02 ml/h</td>
</tr>
<tr>
<td>2</td>
<td>Duration of exposure</td>
<td>6 h</td>
</tr>
<tr>
<td>3</td>
<td>Concentration of as</td>
<td>2 mg/ml</td>
</tr>
<tr>
<td>4</td>
<td>Inhalational exposure to as</td>
<td>0.24 mg/day</td>
</tr>
<tr>
<td>5</td>
<td>Percent absorbed</td>
<td>100%</td>
</tr>
<tr>
<td>6</td>
<td>Absorbed dose</td>
<td>0.24 mg/day</td>
</tr>
</tbody>
</table>

### F. PREDICTED EXPOSURE

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Total absorbed dose</td>
<td>17.368 mg/day</td>
</tr>
<tr>
<td>2</td>
<td>Operator body weight</td>
<td>60 kg</td>
</tr>
<tr>
<td>3</td>
<td>Operator exposure</td>
<td>0.289 mg/kg bw/day</td>
</tr>
</tbody>
</table>
Estimates of operator exposure-German model

**Endocel 35 EC, calculation of exposure for mixer/loader and spray application by tractor. No PPE**

Maximum Application Rate (kg ai/ha) : 0.7

Specific Exposure and Work Rate

<table>
<thead>
<tr>
<th>Mixing and Loading (mg/person x kg ai)</th>
<th>Spray Application (mg/person x kg ai)</th>
<th>Work Rate (ha/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_M = 0.0006$</td>
<td>$I_A = 0.001$</td>
<td>20</td>
</tr>
<tr>
<td>$D_{M(H)} = 2.4$</td>
<td>$D_{A(C)} = 0.06$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$D_{A(H)} = 0.38$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$D_{A(B)} = 1.6$</td>
<td></td>
</tr>
</tbody>
</table>

Expected Inhalation Exposure:

$$I_M = I_M^* x R x A = 0.0006 x 0.7 x 20 = 0.0084 \text{ mg/person/day}$$
$$I_A = I_A^* x R x A = 0.001 x 0.7 x 20 = 0.014 \text{ mg/person/day}$$

Expected Dermal Exposure:

$$D_{M(H)} = D_{M(H)}^* x R x A = 2.4 x 0.7 x 20 = 33.6 \text{ mg/person/day}$$
$$D_{A(H)} = D_{A(H)}^* x R x A = 0.38 x 0.7 x 20 = 5.32 \text{ mg/person/day}$$
$$D_{A(C)} = D_{A(C)}^* x R x A = 0.06 x 0.7 x 20 = 0.84 \text{ mg/person/day}$$
$$D_{A(B)} = D_{A(B)}^* x R x A = 1.6 x 0.7 x 20 = 22.4 \text{ mg/person/day}$$

*Inhalation exposure* = 0.0084 + 0.014 mg ai/person = **0.0224 mg ai/person**

Total dermal exposure = **62.16 mg ai/person**

Total dermal exposure based on dermal absorption in humans of 20% = **12.432 mg ai/person**

Total systemic exposure = inhalation + dermal exposure = 12.454 mg ai/person

Total systemic exposure for a 70 kg person = **0.178 mg ai/kg/day**
With PPE (Gloves 1% mixing/loading 1%; gloves during application 1%; protection cloth during application 5% and hear protection during application 50%):

Dermal exposure:

\[ D_{M(H)} = 0.336 \text{mg/person/day} \quad (1\%) \]
\[ D_{A(H)} = 0.0532 \text{mg/person/day} \quad (1\%) \]
\[ D_{A(C)} = 0.42 \text{mg/person/day} \quad (50\%) \]
\[ D_{A(B)} = 1.12 \text{mg/person/day} \quad (5\%) \]

Total dermal exposure = 1.9292 mg ai/person

Total dermal exposure based on dermal absorption in humans of 20% = 0.386 mg ai/person

Total systemic exposure = inhalation + dermal exposure = 0.408 mg ai/person

Total systemic exposure for a 70 kg person = 0.006 mg ai/kg/day

- ESTIMATES OF OPERATOR EXPOSURE UK MODEL

Tractor mounted boom (with cab) with hydraulic nozzles- no PPE

A. PRODUCT DATA

1. Name
   Endocel 35 EC
2a. Active Ingredient
   Endosulfan
2b. Concentration
   350 mg/ml
3. Formulation type
   EC
4a. Main solvent
4b. Concentration of solvent
5. Maximum in-use as concentration
   2 mg/ml

B. EXPOSURE DURING MIXING AND LOADING

1a. Container size
   1 litre
1b. Hand contamination/operation
   0.01 ml
2. Application dose
   2 litres product/ha
3. Work rate
   50 ha/day
4. Number of operations
   100/day
5. Hand contamination
   1 ml/day
6. Protective clothing
   NONE
7. Transmission to skin
   100%
8. Dermal exposure to formulation
   1 ml/day
C. EXPOSURE DURING SPRAY APPLICATION

1. Application technique
2. Application volume 350 l spray/ha
3. Volume of surface contamination 10 ml/h
4. Distribution
   - Hands: 65%
   - Trunk: 10%
   - Legs: 25%
5. Clothing
   - None
   - Perm.
   - Perm.
6. Penetration
   - 100%
   - 50%
   - 15%
7. Dermal exposure
   - 6.5
   - 0.5
   - 0.375
8. Duration of exposure 6 h
9. Total dermal exposure to spray 44.25 ml/day

D. ABSORBED DOSE

<table>
<thead>
<tr>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dermal exposure 1 ml/day</td>
<td>44.25 ml/day</td>
</tr>
<tr>
<td>2. Concentration of as 350 mg/ml</td>
<td>2 mg/ml</td>
</tr>
<tr>
<td>3. Dermal exposure to as 350 mg/day</td>
<td>88.5 mg/day</td>
</tr>
<tr>
<td>4. Percent absorbed 20%</td>
<td>20%</td>
</tr>
<tr>
<td>5. Absorbed dose 70 mg/day</td>
<td>17.7 mg/day</td>
</tr>
</tbody>
</table>

E. INHALED EXPOSURE DURING SPRAY APPLICATION

1. Inhalation exposure 0.01 ml/h
2. Duration of exposure 6 h
3. Concentration of as 2 mg/ml
4. Inhalational exposure to as 0.12 mg/day
5. Percent absorbed 100%
6. Absorbed dose 0.12 mg/day

F. PREDICTED EXPOSURE

1. Total absorbed dose 87.82 mg/day
2. Operator body weight 60 kg
3. Operator exposure \(1.464 \text{ mg/kg bw/day}\)
Tractor mounted boom (with cab) with hydraulic nozzles- with PPE (Gloves for mixer/loader and applicator)

### A. PRODUCT DATA

1. **Name**  
   Endocel 35 EC

2a. **Active Ingredient**  
   Endosulfan

2b. **Concentration**  
   350 mg/ml

3. **Formulation type**  
   EC

4a. **Main solvent**

4b. **Concentration of solvent**

5. **Maximum in-use as concentration**  
   2 mg/ml

### B. EXPOSURE DURING MIXING AND LOADING

1a. **Container size**  
   1 litre

1b. **Hand contamination/operation**  
   0.01 ml

2. **Application dose**  
   2 litres product/ha

3. **Work rate**  
   50 ha/day

4. **Number of operations**  
   100/day

5. **Hand contamination**  
   1 ml/day

6. **Protective clothing**  
   Gloves

7. **Transmission to skin**  
   1%

8. **Dermal exposure to formulation**  
   0.01 ml/day

### C. EXPOSURE DURING SPRAY APPLICATION

1. **Application technique**

2. **Application volume**  
   350 l spray/ha

3. **Volume of surface contamination**  
   10 ml/h

   - **Distribution**
     - Hands: 65%
     - Trunk: 10%
     - Legs: 25%

4. **Clothing**
   - Gloves: Perm.
   - Perm.:

5. **Penetration**  
   - 1%  
   - 50%  
   - 15%

6. **Dermal exposure**  
   - 0.065  
   - 0.5  
   - 0.375

7. **Duration of exposure**  
   6 h

8. **Total dermal exposure to spray**  
   5.64 ml/day

### D. ABSORBED DOSE

<table>
<thead>
<tr>
<th></th>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dermal exposure</td>
<td>0.01 ml/day</td>
<td>5.64 ml/day</td>
</tr>
<tr>
<td>2. Concentration of as</td>
<td>350 mg/ml</td>
<td>2 mg/ml</td>
</tr>
<tr>
<td>3. Dermal exposure to as</td>
<td>3.5 mg/day</td>
<td>11.28 mg/day</td>
</tr>
<tr>
<td>4. Percent absorbed</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>5. Absorbed dose</td>
<td>0.7 mg/day</td>
<td>2.256 mg/day</td>
</tr>
</tbody>
</table>

endosulfan_addendum_tox.doc
E. INHALED EXPOSURE DURING SPRAY APPLICATION

1. Inhalation exposure          0.01 ml/h
2. Duration of exposure        6 h
3. Concentration of as         2 mg/ml
4. Inhalational exposure to as 0.12 mg/day
5. Percent absorbed            100%
6. Absorbed dose               0.12 mg/day

F. PREDICTED EXPOSURE

1. Total absorbed dose        3.076 mg/day
2. Operator body weight       60 kg
3. Operator exposure          0.051 mg/kg bw/day
B.6.14.1b Calliope applicant

Operator exposure

The following assumptions have been used in calculation operator exposure:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Projected spray</th>
<th>Pneumatic systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum application rate</td>
<td>610 g of a.i/ha, corresponding with 1,74 l of product/ha</td>
<td></td>
</tr>
<tr>
<td>Spray volume</td>
<td>400-1000 l/ha</td>
<td>80-150 l/ha</td>
</tr>
<tr>
<td>Maximum in-use a.i. concentration</td>
<td>1,53 mg/ml</td>
<td>7,63 mg/ml</td>
</tr>
<tr>
<td>Container size</td>
<td>5 litres (63 mm neck diameter)</td>
<td></td>
</tr>
<tr>
<td>Application techniques</td>
<td>Tractor mounted boom (with cab) with hydraulic nozzles</td>
<td>Tractor mounted boom (with cab) with rotary discs</td>
</tr>
<tr>
<td></td>
<td>Tractor mounted (without cab) air assisted: application volume 100 l/ha</td>
<td></td>
</tr>
</tbody>
</table>
Estimates of operator exposure—German model

**Callistar, calculation of exposure for mixer/loader and spray application by tractor** - No PPE

Maximum Application Rate (kg ai/ha): 0.61

Specific Exposure and Work Rate

<table>
<thead>
<tr>
<th>Mixing and Loading (mg/person x kg ai)</th>
<th>Spray Application (mg/person x kg ai)</th>
<th>Work Rate (ha/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_M^* = 0.0006$</td>
<td>$I_A^* = 0.001$</td>
<td>20</td>
</tr>
<tr>
<td>$D_M^{M(H)} = 2.4$</td>
<td>$D_A^{A(C)} = 0.06$</td>
<td></td>
</tr>
<tr>
<td>$D_A^{A(B)} = 1.6$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Expected Inhalation Exposure:

\[ I_M = I_M^* x R x A = 0.0006 \times 0.61 \times 20 = 0.00732 \text{ mg/person/day} \]
\[ I_A = I_A^* x R x A = 0.001 \times 0.61 \times 20 = 0.0122 \text{ mg/person/day} \]

Expected Dermal Exposure:

\[ D_M^{M(H)} = D_M^{M(H)} x R x A = 2.4 \times 0.61 \times 20 = 29.28 \text{ mg/person/day} \]
\[ D_A^{A(B)} = D_A^{A(B)} x R x A = 0.38 \times 0.61 \times 20 = 4.636 \text{ mg/person/day} \]
\[ D_A^{A(C)} = D_A^{A(C)} x R x A = 0.06 \times 0.61 \times 20 = 0.732 \text{ mg/person/day} \]
\[ D_A^{A(B)} = D_A^{A(B)} x R x A = 1.6 \times 0.61 \times 20 = 19.52 \text{ mg/person/day} \]

**Inhalation exposure** = 0.00732 + 0.0122 mg ai/person = 0.01952 mg ai/person

Total dermal exposure = 54.168 mg ai/person

Total dermal exposure based on dermal absorption in humans of 20% = 10.834 mg ai/person

Total systemic exposure = inhalation + dermal exposure = 10.853 mg ai/person

Total systemic exposure for a 70 kg person = 0.155 mg ai/kg/day
With PPE (Gloves during mixing/loading 1%; gloves during application 1%; protection cloth during application 5% and hear protection during application 50%):

Dermal exposure:

\[
D_{M(H)} = 0.293 \text{ mg/person/day (1%)} \\
D_{A(H)} = 0.04636 \text{ mg/person/day (1%)} \\
D_{A(C)} = 0.366 \text{ mg/person/day (5%)} \\
D_{A(B)} = 0.976 \text{ mg/person/day (5%)}
\]

Total dermal exposure = 1.681 mg ai/person

Total dermal exposure based on dermal absorption in humans of 20% = 0.3362 mg ai/person

Total systemic exposure = inhalation + dermal exposure = 0.356 mg ai/person

Total systemic exposure for a 70 kg person = 0.005 mg ai/kg/day

**ESTIMATES OF OPERATOR EXPOSURE UK MODEL**

**Tractor mounted boom (with cab) with hydraulic nozzles - no PPE**

**A. PRODUCT DATA**

1. Name: Callistar
2a. Active Ingredient: Endosulfan
2b. Concentration: 350 mg/ml
3. Formulation type: EC
4a. Main solvent:
4b. Concentration of solvent:
5. Maximum in-use as concentration: 1.53 mg/ml

**B. EXPOSURE DURING MIXING AND LOADING**

1a. Container size: 5 litre
1b. Hand contamination/operation: 0.01 ml
2. Application dose: 1.74 litres product/ha
3. Work rate: 50 ha/day
4. Number of operations: 18/day
5. Hand contamination: 0.18 ml/day
6. Protective clothing: NONE
7. Transmission to skin: 100%
8. Dermal exposure to formulation: 0.18 ml/day
C. EXPOSURE DURING SPRAY APPLICATION

1. Application technique
2. Application volume 400 l spray/ha
3. Volume of surface contamination 10 ml/h
4. Distribution 65% 10% 25%
5. Clothing None Perm. Perm.
6. Penetration 100% 50% 15%
7. Dermal exposure 6.5 0.5 0.375
8. Duration of exposure 6 h
9. Total dermal exposure to spray 44.25 ml/day

D. ABSORBED DOSE

<table>
<thead>
<tr>
<th></th>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dermal exposure</td>
<td>0.18 ml/day</td>
<td>44.25 ml/day</td>
</tr>
<tr>
<td>Concentration of as</td>
<td>350 mg/ml</td>
<td>1.53 mg/ml</td>
</tr>
<tr>
<td>Dermal exposure to as</td>
<td>63 mg/day</td>
<td>67.70 mg/day</td>
</tr>
<tr>
<td>Percent absorbed</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Absorbed dose</td>
<td>12.6 mg/day</td>
<td>13.54 mg/day</td>
</tr>
</tbody>
</table>

E. INHALED EXPOSURE DURING SPRAY APPLICATION

1. Inhalation exposure 0.01 ml/h
2. Duration of exposure 6 h
3. Concentration of as 1.53 mg/ml
4. Inhalational exposure to as 0.092 mg/day
5. Percent absorbed 100%
6. Absorbed dose 0.092 mg/day

F. PREDICTED EXPOSURE

1. Total absorbed dose 26.232 mg/day
2. Operator body weight 60 kg
3. Operator exposure 0.437 mg/kg bw/day
### A. PRODUCT DATA

2. Name: Callistar  
2a. Active Ingredient: Endosulfan  
2b. Concentration: 350 mg/ml  
3. Formulation type: EC  
4a. Main solvent  
4b. Concentration of solvent  
5. Maximum in-use as concentration: 1.53 mg/ml

### B. EXPOSURE DURING MIXING AND LOADING

1a. Container size: 5 litre  
1b. Hand contamination/operation: 0.01 ml  
2. Application dose: 1.74 litres product/ha  
3. Work rate: 50 ha/day  
4. Number of operations: 18/day  
5. Hand contamination: 0.18 ml/day  
6. Protective clothing: Gloves  
7. Transmission to skin: 1%  
8. Dermal exposure to formulation: 0.0018 ml/day

### C. EXPOSURE DURING SPRAY APPLICATION

1. Application technique  
2. Application volume: 400 l spray/ha  
3. Volume of surface contamination: 10 ml/h  
4. Distribution: 65% Hands, 10% Trunk, 25% Legs  
6. Penetration: 1% Hands, 50% Trunk, 15% Legs  
7. Dermal exposure: 0.065 ml/day Hands, 0.5 ml/day Trunk, 0.375 ml/day Legs  
8. Duration of exposure: 6 h  
9. Total dermal exposure to spray: 5.64 ml/day

### D. ABSORBED DOSE

<table>
<thead>
<tr>
<th></th>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dermal exposure</td>
<td>0.0018 ml/day</td>
<td>5.64 ml/day</td>
</tr>
<tr>
<td>2. Concentration of as</td>
<td>350 mg/ml</td>
<td>1.53 mg/ml</td>
</tr>
<tr>
<td>3. Dermal exposure to as</td>
<td>0.63 mg/day</td>
<td>8.63 mg/day</td>
</tr>
<tr>
<td>4. Percent absorbed</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>5. Absorbed dose</td>
<td>0.126 mg/day</td>
<td>1.726 mg/day</td>
</tr>
</tbody>
</table>

endosulfan_addendum_tox.doc
E. INHALED EXPOSURE DURING SPRAY APPLICATION

1. Inhalation exposure 0.01 ml/h
2. Duration of exposure 6 h
3. Concentration of as 1.53 mg/ml
4. Inhalational exposure to as 0.092 mg/day
5. Percent absorbed 100%
6. Absorbed dose 0.092 mg/day

F. PREDICTED EXPOSURE

1. Total absorbed dose 1.944 mg/day
2. Operator body weight 60 kg
3. Operator exposure 0.0324 mg/kg bw/day

ESTIMATES OF OPERATOR EXPOSURE UK MODEL

Tractor mounted boom (with cab) with rotary discs- No PPE

A. PRODUCT DATA

3. Name Callistar
2a. Active Ingredient Endosulfan
2b. Concentration 350 mg/ml
3. Formulation type EC
4a. Main solvent
4b. Concentration of solvent
5. Maximum in-use as concentration 7.63 mg/ml

B. EXPOSURE DURING MIXING AND LOADING

1a. Container size 5 litre
1b. Hand contamination/operation 0.01 ml
2. Application dose 1.74 litres product/ha
3. Work rate 50 ha/day
4. Number of operations 18/day
5. Hand contamination 0.18 ml/day
6. Protective clothing NONE
7. Transmission to skin 100%
8. Dermal exposure to formulation 0.18 ml/day

C. EXPOSURE DURING SPRAY APPLICATION

1. Application technique
2. Application volume 80 l spray/ha
3. Volume of surface contamination 2 ml/h

Hands Trunk Legs
4. Distribution     75% 15% 10%
5. Clothing      None Perm. Perm.
6. Penetration     100% 5% 5%
7. Dermal exposure     1.5 0.015 0.01
8. Duration of exposure     6 h
9. Total dermal exposure to spray     9.15 ml/day

D. ABSORBED DOSE

Mix/load Application
1. Dermal exposure    0.18 ml/day 9.15 ml/day
2. Concentration of as   350 mg/ml 7.63 mg/ml
3. Dermal exposure to as   63 mg/day 69.81 mg/day
4. Percent absorbed    20%  20%
5. Absorbed dose    12.6 mg/day 13.962 mg/day

E. INHALED EXPOSURE DURING SPRAY APPLICATION

1. Inhalation exposure    0.005 ml/h
2. Duration of exposure    6 h
3. Concentration of as   7.63 mg/ml
4. Inhalational exposure to as   0.2289 mg/day
5. Percent absorbed     100%
6. Absorbed dose     0.2289 mg/day

F. PREDICTED EXPOSURE

1. Total absorbed dose    26.791 mg/day
2. Operator body weight    60 kg
3. Operator exposure   0.447 mg/kg bw/day

Tractor mounted boom (with cab) with rotary discs- - with PPE (Gloves for mixer/loader and applicator)

A. PRODUCT DATA
4. Name      Callistar
2a. Active Ingredient     Endosulfan
2b. Concentration   350 mg/ml
3. Formulation type     EC
4a. Main solvent
4b. Concentration of solvent
5. Maximum in-use as concentration     7.63 mg/ml

B. EXPOSURE DURING MIXING AND LOADING
1a. Container size     5 litre
1b. Hand contamination/operation     0.01 ml
2. Application dose 1.74 litres product/ha
3. Work rate 50 ha/day
4. Number of operations 18/day
5. Hand contamination 0.18 ml/day
6. Protective clothing Gloves
7. Transmission to skin 1%
8. Dermal exposure to formulation 0.0018 ml/day

**C. EXPOSURE DURING SPRAY APPLICATION**
1. Application technique
2. Application volume 80 l spray/ha
3. Volume of surface contamination 2 ml/h
   - Hands
   - Trunk
   - Legs
4. Distribution 75% 15% 10%
6. Penetration 1% 5% 5%
7. Dermal exposure 0.015 0.015 0.01
8. Duration of exposure 6 h
9. Total dermal exposure to spray 0.24 ml/day

**D. ABSORBED DOSE**
- **Mix/load Application**
  1. Dermal exposure 0.0018 ml/day 0.24 ml/day
  2. Concentration of as 350 mg/ml 7.63 mg/ml
  3. Dermal exposure to as 0.63 mg/day 1.83 mg/day
  4. Percent absorbed 20% 20%
  5. Absorbed dose 0.126 mg/day 1.566 mg/day

**E. INHALED EXPOSURE DURING SPRAY APPLICATION**
1. Inhalation exposure 0.005 ml/h
2. Duration of exposure 6 h
3. Concentration of as 7.63 mg/ml
4. Inhalational exposure to as 0.2289 mg/day
5. Percent absorbed 100%
6. Absorbed dose 0.2289 mg/day

**F. PREDICTED EXPOSURE**
1. Total absorbed dose 1.9209 mg/day
2. Operator body weight 60 kg
3. Operator exposure 0.032 mg/kg bw/day

endosulfan_addendum_tox.doc
B.6.14.1c AgrEvo applicant

Operator exposure
The exposure to endosulfan in Thiodan-EC35 is predicted according to the German BBA-Model and the
UK Model

Scenario 1: Tractor mounted boom sprayers in field crops
The maximum application rate in maize is 1.05 Kg a.s/ha (equivalent to 3.0 l product/ha) applied in 400
to 1000 l of water (depending on the growth stage of the crop).

Scenario 2: Airblast spraying in high crops with tractor –mounted equipment
The worst case for this scenario is airblast spraying in citrus orchards with a maximum application rate of
1.05 kg a.s./ha (equivalent to 3.0 l of product/ha) and a water volume of 1000 to 3000 l/ha.
Estimates of operator exposure-German model

Scenario 1: Tractor-mounted boom sprayers in field crop

Maximum Application Rate (kg ai/ha): 1.05

Specific Exposure and Work Rate

<table>
<thead>
<tr>
<th>Mixing and Loading</th>
<th>Spray Application</th>
<th>Work Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>(mg/person x kg ai)</td>
<td>(mg/person x kg ai)</td>
<td>(ha/day)</td>
</tr>
<tr>
<td>$I_M^* = 0.0006$</td>
<td>$I_A^* = 0.001$</td>
<td>20</td>
</tr>
<tr>
<td>$D_{MH} = 2.4$</td>
<td>$D_{AC} = 0.06$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$D_{AIB} = 0.38$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$D_{AIB} = 1.6$</td>
<td></td>
</tr>
</tbody>
</table>

Expected Inhalation Exposure:

\[ I_M = I_M^* \times R \times A = 0.0006 \times 1.05 \times 20 = 0.0126 \text{ mg/person/day} \]

\[ I_A = I_A^* \times R \times A = 0.001 \times 1.05 \times 20 = 0.021 \text{ mg/person/day} \]

Expected Dermal Exposure:

\[ D_{MH} = D_{MH}^* \times R \times A = 2.4 \times 1.05 \times 20 = 50.4 \text{ mg/person/day} \]

\[ D_{AIB} = D_{AIB}^* \times R \times A = 0.38 \times 1.05 \times 20 = 7.98 \text{ mg/person/day} \]

\[ D_{AC} = D_{AC}^* \times R \times A = 0.06 \times 1.05 \times 20 = 1.26 \text{ mg/person/day} \]

\[ D_{AIB} = D_{AIB}^* \times R \times A = 1.6 \times 1.05 \times 20 = 33.6 \text{ mg/person/day} \]

\[ \text{Inhalation exposure} = 0.0126 + 0.021 \text{ mg ai/person} = 0.0336 \text{ mg ai/person} \]

Total dermal exposure = 93.24 mg ai/person

Total dermal exposure based on dermal absorption in humans of 20% = 18.648 mg ai/person

Total systemic exposure = inhalation + dermal exposure = 18.682 mg ai/person

Total systemic exposure for a 70 kg person = 0.267 mg ai/kg/day
With PPE (Gloves 1% during mixing/loading/application, protection cloth during application 5% and hear protection during application 50%):

Dermal exposure:

\[
\begin{align*}
D_{M(1)} &= 0.504 \text{ mg/person/day} \\
D_{A(1)} &= 0.0798 \text{ mg/person/day} \\
D_{A(C)} &= 0.63 \text{ mg/person/day} \\
D_{A(B)} &= 1.68 \text{ mg/person/day}
\end{align*}
\]

Total dermal exposure = 2.894 mg ai/person

Total dermal exposure based on dermal absorption in humans of 20% = 0.579 mg ai/person

Total systemic exposure = inhalation + dermal exposure = 0.612 mg ai/person

Total systemic exposure for a 70 kg person = 0.009 mg ai/kg/day

- ESTIMATES OF OPERATOR EXPOSURE UK MODEL

**Tractor mounted boom (with cab) with hydraulic nozzles- no PPE**

**A. PRODUCT DATA**

5. Name Thiodan EC 35

2a. Active Ingredient Endosulfan

2b. Concentration 350 mg/ml

3. Formulation type EC

4a. Main solvent

4b. Concentration of solvent

5. Maximum in-use as concentration 2.625 mg/ml

**B. EXPOSURE DURING MIXING AND LOADING**

1a. Container size 1 litre

1b. Hand contamination/operation 0.01 ml

2. Application dose 3 litres product/ha

3. Work rate 50 ha/day

4. Number of operations 150/day

5. Hand contamination 1.5 ml/day

6. Protective clothing NONE

7. Transmission to skin 100%
8. Dermal exposure to formulation 1.5 ml/day

**C. EXPOSURE DURING SPRAY APPLICATION**

1. Application technique
2. Application volume 400 l spray/ha
3. Volume of surface contamination 10 ml/h
   - Hands: 65%
   - Trunk: 10%
   - Legs: 25%
4. Distribution
   - None
   - Perm.
   - Perm.
5. Penetration
   - 100%
   - 50%
   - 15%
6. Dermal exposure
   - 6.5 ml/day
   - 0.5 ml/day
   - 0.375 ml/day
7. Duration of exposure 6 h
8. Total dermal exposure to spray 44.25 ml/day

**D. ABSORBED DOSE**

<table>
<thead>
<tr>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dermal exposure</td>
<td>1.5 ml/day</td>
</tr>
<tr>
<td>2. Concentration of as</td>
<td>350 mg/ml</td>
</tr>
<tr>
<td>3. Dermal exposure to as</td>
<td>525 mg/day</td>
</tr>
<tr>
<td>4. Percent absorbed</td>
<td>20%</td>
</tr>
<tr>
<td>5. Absorbed dose</td>
<td>105 mg/day</td>
</tr>
</tbody>
</table>

**E. INHALED EXPOSURE DURING SPRAY APPLICATION**

<table>
<thead>
<tr>
<th>Inhalation exposure</th>
<th>0.01 ml/h</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of exposure</td>
<td>6 h</td>
</tr>
<tr>
<td>Concentration of as</td>
<td>2.625 mg/ml</td>
</tr>
<tr>
<td>Inhalational exposure to as</td>
<td>0.158 mg/day</td>
</tr>
<tr>
<td>Percent absorbed</td>
<td>100%</td>
</tr>
<tr>
<td>Absorbed dose</td>
<td>0.158 mg/day</td>
</tr>
</tbody>
</table>

**F. PREDICTED EXPOSURE**

| Total absorbed dose | 128.39 mg/day |
| Operator body weight | 60 kg         |
| Operator exposure   | 2.14 mg/kg bw/day |
Tractor mounted boom (with cab) with hydraulic nozzles- with PPE (Gloves for mixer/loader and applicator)

A. PRODUCT DATA

6. Name: Thiodan EC 35
2a. Active Ingredient: Endosulfan
2b. Concentration: 350 mg/ml
3. Formulation type: EC
4a. Main solvent
4b. Concentration of solvent
5. Maximum in-use as concentration: 2.625 mg/ml

B. EXPOSURE DURING MIXING AND LOADING

1a. Container size: 1 litre
1b. Hand contamination/operation: 0.01 ml
2. Application dose: 3 litres product/ha
3. Work rate: 50 ha/day
4. Number of operations: 150/day
5. Hand contamination: 1.5 ml/day
6. Protective clothing: Gloves
7. Transmission to skin: 1%
8. Dermal exposure to formulation: 0.015 ml/day

C. EXPOSURE DURING SPRAY APPLICATION

1. Application technique
2. Application volume: 400 l spray/ha
3. Volume of surface contamination: 10 ml/h
   Hands Trunk Legs
4. Distribution: 65% 10% 25%
5. Clothing:
   Gloves Perm. Perm.
6. Penetration: 1% 50% 15%
7. Dermal exposure:
   0.065 0.5 0.375
8. Duration of exposure: 6 h
9. Total dermal exposure to spray: 5.64 ml/day

D. ABSORBED DOSE

<table>
<thead>
<tr>
<th></th>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Dermal exposure</td>
<td>0.015 ml/day</td>
<td>5.64 ml/day</td>
</tr>
<tr>
<td>2. Concentration of as</td>
<td>350 mg/ml</td>
<td>2.625 mg/ml</td>
</tr>
<tr>
<td>3. Dermal exposure to as</td>
<td>5.25 mg/day</td>
<td>14.81 mg/day</td>
</tr>
<tr>
<td>4. Percent absorbed</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>5. Absorbed dose</td>
<td>1.05 mg/day</td>
<td>2.962 mg/day</td>
</tr>
</tbody>
</table>
E. INHALED EXPOSURE DURING SPRAY APPLICATION

1. Inhalation exposure: 0.01 ml/h
2. Duration of exposure: 6 h
3. Concentration of as: 2.625 mg/ml
4. Inhalational exposure to as: 0.158 mg/day
5. Percent absorbed: 100%
6. Absorbed dose: 0.158 mg/day

F. PREDICTED EXPOSURE

1. Total absorbed dose: 4.17 mg/day
2. Operator body weight: 60 kg
3. Operator exposure: 0.07 mg/kg bw/day

Estimates of operator exposure-German model

Scenario 2: Airblast spraying in high crops with tractor-mounted equipment

Maximum Application Rate (kg ai/ha): 1.05

Specific Exposure and Work Rate

<table>
<thead>
<tr>
<th>Mixing and Loading (mg/person x kg ai)</th>
<th>Spray Application (mg/person x kg ai)</th>
<th>Work Rate (ha/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( I_M = 0.0006 )</td>
<td>( \Delta = 0.018 )</td>
<td>8</td>
</tr>
<tr>
<td>( D_{M(1)} = 2.4 )</td>
<td>( D_{A(C)} = 1.2 )</td>
<td></td>
</tr>
<tr>
<td>( D_{A(H)} = 0.7 )</td>
<td>( D_{A(B)} = 9.6 )</td>
<td></td>
</tr>
</tbody>
</table>

Expected Inhalation Exposure:

\[
I_M = I_M \times R \times A = 0.0006 \times 1.05 \times 8 = 0.00504 \text{ mg/person/day}
\]

\[
I_A = I_A \times R \times A = 0.018 \times 1.05 \times 8 = 0.1512 \text{ mg/person/day}
\]

Expected Dermal Exposure:

\[
D_{M(1)} = D_{M(1)} \times R \times A = 2.4 \times 1.05 \times 8 = 20.16 \text{ mg/person/day}
\]

\[
D_{A(H)} = D_{A(H)} \times R \times A = 0.7 \times 1.05 \times 8 = 5.88 \text{ mg/person/day}
\]

\[
D_{A(C)} = D_{A(C)} \times R \times A = 1.2 \times 1.05 \times 8 = 10.08 \text{ mg/person/day}
\]

\[
D_{A(B)} = D_{A(B)} \times R \times A = 9.6 \times 1.05 \times 8 = 80.64 \text{ mg/person/day}
\]

\[
\text{Inhalation exposure} = 0.00504 + 0.1512 = 0.15624 \text{ mg ai/person}
\]

Total dermal exposure = 116.76 mg ai/person

Total dermal exposure based on dermal absorption in humans of 20% = 23.352 mg ai/person
Total systemic exposure = inhalation + dermal exposure = 23.508 mg ai/person

Total systemic exposure for a 70 kg person = 0.336 mg ai/kg/day
With PPE (Gloves during mixing/loading/application 1%; protection cloth during application 5%; during application 20% and hear protection during application 50%):

Inhalation exposure = **0.0313 mg ai/person** (20%)

Dermal exposure:

\[
D_{M(H)} = 0.2016 \text{ mg/person/day} \quad (1%) \\
D_{A(H)} = 0.0588 \text{ mg/person/day} \quad (1%) \\
D_{A(C)} = 5.04 \text{ mg/person/day} \quad (10%) \\
D_{A(B)} = 4.032 \text{ mg/person/day} \quad (5%)
\]

Total dermal exposure = **9.3324 mg ai/person**

Total dermal exposure based on dermal absorption in humans of 20% = **1.866 mg ai/person**

Total systemic exposure = inhalation + dermal exposure = **1.898 mg ai/person**

Total systemic exposure for a 70 kg person = **0.027 mg ai/kg/day**

- **ESTIMATES OF OPERATOR EXPOSURE UK MODEL**

  Tractor mounted (without cab) air assisted: application volume 1000l/ha- No PPE

**A. PRODUCT DATA**

<table>
<thead>
<tr>
<th>7. Name</th>
<th>Thidan EC 35</th>
</tr>
</thead>
<tbody>
<tr>
<td>2a. Active Ingredient</td>
<td>Endosulfan</td>
</tr>
<tr>
<td>2b. Concentration</td>
<td>350 mg/ml</td>
</tr>
<tr>
<td>3. Formulation type</td>
<td>EC</td>
</tr>
<tr>
<td>4a. Main solvent</td>
<td></td>
</tr>
<tr>
<td>4b. Concentration of solvent</td>
<td></td>
</tr>
<tr>
<td>5. Maximum in-use as concentration</td>
<td>1.05 mg/ml</td>
</tr>
</tbody>
</table>

**B. EXPOSURE DURING MIXING AND LOADING**

<table>
<thead>
<tr>
<th>1a. Container size</th>
<th>1 litre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1b. Hand contamination/operation</td>
<td>0.01 ml</td>
</tr>
<tr>
<td>2. Application dose</td>
<td>3 litres product/ha</td>
</tr>
<tr>
<td>3. Work rate</td>
<td>50 ha/day</td>
</tr>
<tr>
<td>4. Number of operations</td>
<td>150/day</td>
</tr>
<tr>
<td>5. Hand contamination</td>
<td>1.5 ml/day</td>
</tr>
<tr>
<td>6. Protective clothing</td>
<td>NONE</td>
</tr>
<tr>
<td>7. Transmission to skin</td>
<td>100%</td>
</tr>
<tr>
<td>8. Dermal exposure to formulation</td>
<td>1.5 ml/day</td>
</tr>
</tbody>
</table>
C. EXPOSURE DURING SPRAY APPLICATION
1. Application technique
2. Application volume 1000 l spray/ha
3. Volume of surface contamination 400 ml/h  
   Hands  Trunk  Legs
4. Distribution 10%  65%  25%
5. Clothing None Perm. Perm.
6. Penetration 100%  2%  5%
7. Dermal exposure 10  5.2  5
8. Duration of exposure 6 h
9. Total dermal exposure to spray 121.2 ml/day

D. ABSORBED DOSE
Mix/load  Application
1. Dermal exposure 1.5 ml/day 121.2 ml/day
2. Concentration of as 350 mg/ml 1.05 mg/ml
3. Dermal exposure to as 525 mg/day 127.26 mg/day
4. Percent absorbed 20%  20%
5. Absorbed dose 105 mg/day 25.452 mg/day

E. INHALED EXPOSURE DURING SPRAY APPLICATION
1. Inhalation exposure 0.05 ml/h
2. Duration of exposure 6 h
3. Concentration of as 1.05 mg/ml
4. Inhalational exposure to as 0.315 mg/day
5. Percent absorbed 100%
6. Absorbed dose 0.315 mg/day

F. PREDICTED EXPOSURE
1. Total absorbed dose 130.767 mg/day
2. Operator body weight 60 kg
3. Operator exposure 2.179 mg/kg bw/day
**Tractor mounted (without cab) air assisted: application volume 1000l/ha - with PPE (Gloves for mixer/loader and applicator)**

### A. PRODUCT DATA

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td>Name</td>
</tr>
<tr>
<td>2a.</td>
<td>Active Ingredient</td>
</tr>
<tr>
<td>2b.</td>
<td>Concentration</td>
</tr>
<tr>
<td>3.</td>
<td>Formulation type</td>
</tr>
<tr>
<td>4a.</td>
<td>Main solvent</td>
</tr>
<tr>
<td>4b.</td>
<td>Concentration of solvent</td>
</tr>
<tr>
<td>5.</td>
<td>Maximum in-use as concentration</td>
</tr>
</tbody>
</table>

### B. EXPOSURE DURING MIXING AND LOADING

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1a.</td>
<td>Container size</td>
</tr>
<tr>
<td>1b.</td>
<td>Hand contamination/operation</td>
</tr>
<tr>
<td>2.</td>
<td>Application dose</td>
</tr>
<tr>
<td>3.</td>
<td>Work rate</td>
</tr>
<tr>
<td>4.</td>
<td>Number of operations</td>
</tr>
<tr>
<td>5.</td>
<td>Hand contamination</td>
</tr>
<tr>
<td>6.</td>
<td>Protective clothing</td>
</tr>
<tr>
<td>7.</td>
<td>Transmission to skin</td>
</tr>
<tr>
<td>8.</td>
<td>Dermal exposure to formulation</td>
</tr>
</tbody>
</table>

### C. EXPOSURE DURING SPRAY APPLICATION

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Application technique</td>
</tr>
<tr>
<td>2.</td>
<td>Application volume</td>
</tr>
<tr>
<td>3.</td>
<td>Volume of surface contamination</td>
</tr>
<tr>
<td></td>
<td>Hands</td>
</tr>
<tr>
<td>4.</td>
<td>Distribution</td>
</tr>
<tr>
<td>6.</td>
<td>Penetration</td>
</tr>
<tr>
<td>7.</td>
<td>Dermal exposure</td>
</tr>
<tr>
<td>8.</td>
<td>Duration of exposure</td>
</tr>
<tr>
<td>9.</td>
<td>Total dermal exposure to spray</td>
</tr>
</tbody>
</table>

### D. ABSORBED DOSE

<table>
<thead>
<tr>
<th></th>
<th>Mix/load</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dermal exposure</td>
<td>0.015 ml/day</td>
</tr>
<tr>
<td>2.</td>
<td>Concentration of as</td>
<td>350 mg/ml</td>
</tr>
<tr>
<td>3.</td>
<td>Dermal exposure to as</td>
<td>5.25 mg/day</td>
</tr>
<tr>
<td>4.</td>
<td>Percent absorbed</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>--------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>5</td>
<td>Absorbed dose</td>
<td>1.05 mg/day</td>
</tr>
</tbody>
</table>

**E. INHALED EXPOSURE DURING SPRAY APPLICATION**

1. Inhalation exposure  
   0.05 ml/h
2. Duration of exposure  
   6 h
3. Concentration of as  
   1.05 mg/ml
4. Inhalational exposure to as  
   0.315 mg/day
5. Percent absorbed  
   100%
6. Absorbed dose  
   0.315 mg/day

**F. PREDICTED EXPOSURE**

1. Total absorbed dose  
   14.721 mg/day
2. Operator body weight  
   60 kg
3. Operator exposure  
   0.245 mg/kg bw/day
B.5.14.d Summary of predicted exposure

Predicted total systemic exposures from a representative sample of "worst-case" applications are summarised in Table 5.14d

Table 5.14d: Estimated operator exposure from a representative sample of use conditions

<table>
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<tr>
<th>Crop</th>
<th>Product Name</th>
<th>Application equipment</th>
<th>Total systemic exposure (mg/kg bw/day)</th>
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<tr>
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<td></td>
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<td>UK POEM</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>No PPE</td>
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<tr>
<td>Field</td>
<td>Endocel 35 EC</td>
<td>Hand held sprayers</td>
<td>0.731</td>
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<tr>
<td></td>
<td></td>
<td>Tractor mounted boom</td>
<td>1.464</td>
</tr>
<tr>
<td>Field</td>
<td>Callistarr</td>
<td>Tractor mounted boom</td>
<td>0.437</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tractor mounted boom wiht rotary disc</td>
<td>0.447</td>
</tr>
<tr>
<td>Field</td>
<td>Thiodan EC 35</td>
<td>Tractor mounted boom</td>
<td>2.14</td>
</tr>
<tr>
<td>High</td>
<td>Thiodan EC 35</td>
<td>Airblast spraying whit tractor mounted equipment</td>
<td>2.179</td>
</tr>
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</table>
The AOEL for endosulfan has been proposed by the rapporteur at 0.004 mg/kg bw/day

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<td></td>
<td>Total systemic exposure (mg/kg bw/day)</td>
<td>% AOEL</td>
<td>Total systemic exposure (mg/kg bw/day)</td>
<td>% AOEL</td>
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<tr>
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<td>1275</td>
<td>0.006</td>
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<td>PPE</td>
<td>0.032</td>
<td>800</td>
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In conclusion, based on estimates by the German and the UK operator exposure models, all uses of Endosulfan result in exposures over than the AOEL proposed.
### B.6.15 References relied on

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<th>Annex IIA or Annex IIIA point</th>
<th>Author(s)</th>
<th>Year</th>
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<td>IIA/5.2.4</td>
<td>Bremmer</td>
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<td>Primary Dermal Irritation in the rabbit</td>
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<td>IIA/5.2.6</td>
<td>Arcelin</td>
<td>1996</td>
<td>Contact Hypersensitivity in albino guinea pigs. Maximization Test.</td>
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<td>YES</td>
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<td>IIA/5.3.2.1/2</td>
<td>et al</td>
<td>1985</td>
<td>13 week Toxicity study in rats followed by 4-week withdrawal period.</td>
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<td>IIA/5.3.2.3/3</td>
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<td>1-year feeding study to Beagle dogs</td>
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<td>1985a</td>
<td>Subchronic dermal Toxicity in Wistar rats</td>
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<td>Jung, Weigand and Kramer</td>
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<td>Mouse micronucleus test following oral administration.</td>
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<td>IIA/5.4</td>
<td>Völkner, W.</td>
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<td>Chromosome aberration assay in bone marrow cells of the rat with Endosulfan</td>
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<td>IIA/5.4</td>
<td>Sinha, N., Narayan, R., Shanker, R. and Saxena, D.K.</td>
<td>1995</td>
<td>Endosulfan-induced biochemical changes in the testis of rats.</td>
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endosulfan_addendum_tox.doc
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<td>IIA/5.4</td>
<td>Khan, P.K. and Sinha, S.P.</td>
<td>1996</td>
<td>Ameliorating effect of vitamin C on murine sperm toxicity induced by three pesticides (endosulfan, phosphamidon and mancozeb) Published in Mutagenesis, 11: 33-36</td>
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<td>IIA/5.4</td>
<td>Rupa, D.S., Reddy P.P. and Reddi, O.S.</td>
<td>1989</td>
<td>Chromosomal aberrations in peripheral lymphocytes of cotton field workers exposed to pesticides Published in Environmental Research, 49: 1-6</td>
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<td>IIA/5.4</td>
<td>Rupa, D.S., Reddy P.P. and Reddi, O.S.</td>
<td>1991b</td>
<td>Clastogenic effect of pesticides in peripheral lymphocytes of cotton-field workers Published in Mutation Research, 261: 177-180</td>
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<td>IIA/5.4</td>
<td>Ebert, E.</td>
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<td>Toxicological evaluation of the insecticide endosulfan Report No. A67384</td>
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<td>IIA/5.4</td>
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<td>1988</td>
<td>Endosulfan water dispersible powder (50%) subchronic dermal toxicity (21 treatments in 30 days) in the Wistar rat Report No. 87.0664</td>
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<td>IIA/5.4</td>
<td>Thevenaz, Ph., Luetkemeier, H.J., Chevalier, H.J., Vogel, W. &amp; Terrier Ch.</td>
<td>1988</td>
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