MEMORANDUM

SUBJECT: Inhalation Exposure for Permethrin

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

TO: George LaRocca, PM #15
Registration Division (TS-767C)

EAB has been asked to provide an exposure estimate for homeowners exposed to cypermethrin applied as a termiticide. In order to expedite the process of exposure assessment and perhaps eliminate the need for such a long and expensive study, EAB has calculated a theoretical maximum exposure based on the vapor pressure for cypermethrin provided by the registrant, ICI Americas. This value was provided by phone by Barbara Kaminski of ICI Americas, 12 June 1987. She got this value from her technical staff. EAB has no other specific validation for this number but it will be used for the purpose of this assessment as it is the best available data at this time.

EAB has calculated a worst-case exposure scenario for cypermethrin via the inhalation route. This theoretical calculation is based on the following assumptions: 100% saturation of the cypermethrin in the air; a total of 15 hours spent in the home, 5 hours at light work and 10 hours at rest; and a 60 kg individual which accounts for the presence of women and children in the home. The respiratory rates used are those given in Subdivision U of the Pesticide Assessment Guidelines. The calculations are listed below.

GIVEN: Vapor Pressure $1.4 \times 10^{-9}$ mm Hg @ 20°C
Absolute Temperature $20^\circ C + 273.15 = 293.15$ K
Universal Gas Constant $0.08206$ L·atm/mol·K
Formula Weight of Cypermethrin $400$ g/mol
IDEAL GAS LAW: \[ pV = nRT \] where 
- \( p \) = pressure 
- \( V \) = volume 
- \( n \) = number of moles 
- \( R \) = universal gas constant 
- \( T \) = absolute temperature

Assuming a volume of 1 L:

\[ pV = nRT \]

\[ n = \frac{pV}{RT} \]

\[ n = \frac{(1.4 \times 10^{-9} \text{ mm Hg}) \times (1 \text{ atm/760 mm Hg}) \times (1 \text{ L})}{(0.08206 \text{ L atm/mol K}) \times (293.15 \text{ K})} \]

\[ n = 7.7 \times 10^{-14} \text{ mol cypermethrin/L} \]

Assuming a 15 hr day, 5 hr at light work (29 L/min) and 10 hr at rest (7.4 L/min):

\[ 29 \text{ L/min} \times 60 \text{ min/hr} \times 5 \text{ hr/day} = 8700 \text{ L} \]

\[ 7.4 \text{ L/min} \times 60 \text{ min/hr} \times 10 \text{ hr/day} = 4440 \text{ L} \]

\[ \frac{13140 \text{ L inhaled/day}}{13140 \text{ L inhaled/day}} \]

moles inhaled/day:

\[ 7.7 \times 10^{-14} \text{ mol/L} \times 13140 \text{ L/day} = 1.0 \times 10^{-9} \text{ mol/day} \]

\[ \text{ug/day:} \]

\[ (400 \text{ g/mol}) \times (1 \times 10^6 \text{ ug/g}) = 4.00 \times 10^8 \text{ ug/mol} \]

\[ (4.00 \times 10^8 \text{ ug/mol}) \times (1.0 \times 10^{-9} \text{ mol/day}) = 4.0 \times 10^{-1} \text{ ug/day} \]

\[ \text{ug/kg/day:} \]

\[ \frac{4.0 \times 10^{-1} \text{ ug/day}}{60 \text{ kg individual}} = 6.7 \times 10^{-3} \text{ ug/kg/day} \]

It should be noted that the utility of this theoretical approach will vary from compound to compound. The more toxic chemicals, such as organophosphates, will likely yield unacceptable risks when saturation of the indoor air is assumed.
It must be emphasized that this is a worst-possible-case scenario and that indoor air is not likely to approach saturation with the material. This theoretical exposure assessment should allow Toxicology Branch to estimate risks from this compound. If the risks are acceptable, EAB sees no reason to request an exposure monitoring study for cypermethrin applied as a termiticide.

Karen E. Warkentien
Special Review Section
Exposure Assessment Branch
Hazard Evaluation Division (TS-769C)
Keren, IGL please calciate the saturation exposure at 25°C. 

\[ \text{VP} = 18 \text{ Torr} \]
TO: Karen

☑ YOU WERE CALLED BY
☑ YOU WERE VISITED BY

BEFORE (Organization)

☑ PLEASE PHONE ▶
☑ FTS
☑ AUTOVON

☑ WILL CALL AGAIN
☑ IS WAITING TO SEE YOU
☑ RETURNED YOUR CALL
☑ WISHES AN APPOINTMENT

MESSAGE

1.4 \times 10^{-9} \text{ mm Hg} \ @ \ 20^\circ C

RECEIVED BY

DATE

TIME

12 JUNE 97

2:17
MEMORANDUM

SUBJECT: Homeowner Inhalation Exposure for Cypermethrin

THRU: Michael P. Firestone, Ph.D., Acting Chief
       Special Review Section
       Exposure Assessment Branch
       Hazard Evaluation Division (TS-7690)

TO: George LaRocca, PM #15
    Registration Division (TS-7670)

EAB has been asked to provide an exposure estimate for homeowners exposed to cypermethrin applied as a termicide. In
order to expedite the process of exposure assessment and permit the need for such a long and expensive study,
EAB has calculated a theoretical maximum exposure based on the vapor pressure for cypermethrin provided by the registrant. (This value was provided by Barbara Karmuski of ICY Americas, 11 June 1987.)

\[
\begin{align*}
V_p &= 1.1 \times 10^{-9} \text{ mm Hg @ } 20^\circ C \\
R &= 293.15 \text{ K} \\
F_W &= 0.08206 \text{ L atm / mol K} \\
P &= 400 \text{ g/l m}^{-1} \text{ K}
\end{align*}
\]
\[ pV = nRT \]

\[ n = \frac{pV}{RT} \]

\[ n = \frac{(1.9 \times 10^{-9} \text{ mol} \cdot \text{atm}) \times (1 \text{ atm} / 760 \text{ mmHg}) \times 1}{(0.08206 \text{ L} \cdot \text{atm} / \text{mol} \cdot \text{K}) \times (293.15 \text{ K})} \]

\[ n = 7.7 \times 10^{-14} \text{ mol} / \text{L} \]

\[ \ell \text{ inhaled} / \text{ day} = 13140 \ell / \text{ day} \]

\[ \text{miles inhaled} / \text{ day} \]

\[ 7.7 \times 10^{-14} \text{ mol} / \text{L} \times 13140 \ell / \text{ day} = 1.0 \times 10^{-9} \text{ mol/\ell} \]

\[ 400 \text{ ell} / \text{ day} \times (1 \times 10^{-6} \text{ ell} / \ell) = 4.00 \times 10^{-8} \text{ ell} / \text{ day} \]

\[ 400 \times 10^{-8} \text{ ell} / \text{ day} \times 1.0 \times 10^{-9} \text{ mol} / \ell = 4.0 \times 10^{-17} \text{ mol/\ell} \]

\[ 4.0 \times 10^{-17} \text{ mol/\ell} \times 1.0 \times 10^{16} \ell / \text{ day} = 4.0 \times 10^{-1} \text{ mol/\ell} \]
<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>12.0 x 2 = 24</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>1.0 x 19 = 19</td>
<td></td>
</tr>
<tr>
<td>Cl</td>
<td>35.5 x 2 = 71</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>14.0 x 1 = 14</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>16.0 x 2 = 32</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>400</td>
</tr>
</tbody>
</table>