Shaughnessy No: 109702

Date Out of EAB: MAR 2 4 1988

To: George LaRocca
Product Manager #15
Registration Division (TS-767C)

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

Michael Firestone

Thru: Paul F. Schuda, Chief
Exposure Assessment Branch
Hazard Evaluation Division (TS-769C)

Paul F. Schuda

Attached, please find the EAB review of:

Reg./File # : 10182-107, 10182-108

Chemical Name : Cypermethrin

Type Product : Termiticide

Product Name : Demon 2TC, Demon 3TC

Company Name : ICI Americas, Inc.

Purpose : Exposure Assessment

Date Received : 1/5/88 Action Code: _____

Date Completed: 3/21/88 EAB #(s): 80444-5

Monitoring study requested: X Total Reviewing Time: 2 days

Monitoring study voluntarily: _____

Deferrals to: _____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MAR 24 1988

MEMORANDUM

SUBJECT: Revised Exposure Assessment for Residents of Homes Treated with Cypermethrin for Subterranean Termite Control

FROM: David Jaquith
Special Review Section 2
Exposure Assessment Branch
Hazard Evaluation Division (TS-769C)

TO: George LaRocca
Product Manager #15
Registration Division (TS-767C)

THRU: Michael Firestone, Chief
Special Review Section 2
Exposure Assessment Branch
Hazard Evaluation Division (TS-769C)

THRU: Paul Schuda, Chief
Exposure Assessment Branch
Hazard Evaluation Division (TS-769C)

On 12 June 1987 EAB completed an estimate of the exposures of residents of homes treated with cypermethrin for subterranean termite control (attached). The estimate was based on the Ideal Gas Law and assumed that the air in these homes was saturated with the pyrethroid. The calculations also assumed that the ambient temperature was 20 degrees C, the vapor pressure was 1.4×10^{-9} mm Hg, and that an average 60 kg individual breathes 13149 L of household air per day. The daily exposure was calculated to be 6.7×10^{-3} ug per kg per day. EAB considered this theoretical estimate to be a worst-possible-case scenario and that indoor air would be unlikely to approach saturation.

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Toxicology Branch expressed concern that the vapor pressure would greatly increase if the temperature were elevated above 20 degrees C and that the potential exposure would then be underestimated. The Agency therefore required the submission of vapor pressure data at elevated temperatures. ICI Americas Incorporated, the registrant for Demon 2TC and 3TC termiticides containing cypermethrin, has submitted a published article in which the vapor pressure of cypermethrin was determined at temperatures of up to 97.7 degrees C using 2 methods, one conducted by ICI and the other by Shell International. The vapor pressures are presented in Tables 1 and 2 for the ICI method and the Shell technique, respectively. There was no statistical difference between the results of these 2 methods ($p<0.05$).

Table 1. Vapor Pressures of Cypermethrin as Measured by ICI, Inc.

Temperature (degrees C)	Vapor Pressure	
	Pascals	mm Hg
30	9.00×10^{-7}	6.75×10^{-9}
40	3.00×10^{-6}	2.25×10^{-8}
50	1.50×10^{-5}	1.13×10^{-7}
60	6.90×10^{-5}	5.18×10^{-7}
70	2.30×10^{-4}	1.73×10^{-6}
80	8.30×10^{-4}	6.23×10^{-6}

Table 2. Vapor Pressures of Cypermethrin as Measured by Shell International.

Temperature (degrees C)	Vapor Pressure	
	Pascals	mm Hg
62.9	1.64×10^{-4}	1.23×10^{-6}
72.5	6.50×10^{-4}	4.88×10^{-6}
73.0	6.94×10^{-4}	5.21×10^{-6}
76.7	9.21×10^{-4}	6.91×10^{-6}
90.6	5.05×10^{-3}	3.79×10^{-5}
97.6	1.14×10^{-2}	8.55×10^{-5}
97.7	1.12×10^{-2}	8.40×10^{-5}

The data from ICI yielded a regression equation of the form:

$$\ln P = B - (A/T)$$

where:

P = vapor pressure in Pascals
T = temperature in Kelvin
A = an empirical constant, 14.896
B = an empirical constant, 35.04

The coefficient of determination for this equation was 0.9988. The estimated vapor pressure of cypermethrin at 100 degrees F (37.78 degrees C) was 2.6×10^{-7} Pa (1.9×10^{-8} mm Hg). The airborne concentration of the termiticide would be:

$$PV = nRT$$

where:

P = vapor pressure of cypermethrin in atmospheres

$= 1.9 \times 10^{-8}$ mm Hg/(760 mm Hg/atm)

$= 2.50 \times 10^{-11}$ atm

V = 1 liter
T = temperature (K) = 37.78 + 273.15 = 311 K
R = universal gas constant = 0.08206 L atm/mol K
n = moles of cypermethrin per liter

$n = 9.79 \times 10^{-13}$ moles in 1 liter of air

The molecular weight of cypermethrin is 400 so the concentration in terms of ug per liter is:

Concentration (ug/L) = 9.79×10^{-13} moles/L x 400 x 10^6 ug/mole

$= 3.92 \times 10^{-4}$ ug/L

Using the same assumptions as those in EAB's previous review the daily exposures would be:

Exposure (ug/kg/day) = 13140 L/day x 3.71×10^{-4} ug/L x 1/60 kg bw

$= 8.6 \times 10^{-2}$ ug/kg/day

This estimate was conducted for situations where the temperature in the home is elevated. EAB realizes that such a high temperature is not likely to be a normal ambient temperature in an occupied home and considers this exposure to be conservative.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUN 12 1987

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

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	1.4×10^{-9} mm Hg @ 20°C
	Absolute Temperature	20°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:

$$pV = nRT$$

$$n = \frac{pV}{RT}$$

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

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

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

$$29 \text{ L/min} \times 60 \text{ min/hr} \times 5 \text{ hr/day} = 8700 \text{ L}$$
$$7.4 \text{ L/min} \times 60 \text{ min/hr} \times 10 \text{ hr/day} = 4440 \text{ L}$$
$$13140 \text{ L inhaled/day}$$

moles inhaled/day:

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

ug/day:

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

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

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
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