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

OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

15 NOV 1989

MEMORANDUM

SUBJECT: REVIEW OF STUDY ESTIMATING RESIDENT EXPOSURE TO PROPOXUR FOLLOWING CRACK AND CREVICE TREATMENT
(HED Project No. 9-1936)

TO: Dennis Edwards
Product Manager 12
Registration Division (H7505C)

FROM: David Jaquith
Environmental Chemistry Review Section
Non-Dietary Exposure Branch
Health Effects Division (H7509C)

THRU: Michael Firestone, PhD., Section Head
Environmental Chemistry Review Section
Non-Dietary Exposure Branch
Health Effects Division (H7509C)

THRU: Charles L. Trichilo, PhD., Chief
Non-Dietary Exposure Branch
Health Effects Division (H7509C)

Please find below the NDEB review of ....

RD or SRRD Record #: 243739

Caswell #: 508

Date Received: 08/10/89 Review Time: 30 days

Deferral to: _____ Biological Analysis Branch/BEAD

_____ Science Analysis & Coordination Branch

_____ TB - Insecticide/Rodenticide Support Section

_____ TB - Herbicide/Fungicide/Antimicrobial Support Section

1.0 INTRODUCTION

In January 1985 NDEB/EAB conducted an exposure assessment for the insecticide propoxur (Baygon or 2-isoproxyphenyl N-methylcarbamate) (1). The assessment was derived from limited surrogate data obtained from the scientific literature. In December 1987 the Agency issued a Data-Call-In Notice (DCI) requiring data addressing the potential exposure of individuals to this material. Several possible exposure scenarios were included in the DCI. Among these scenarios addressed in the DCI was the potential exposures of residents of homes treated for pest control. Propoxur is commonly used in and around residences for insect control. The current submission (MRID No. 410547-03) is a study estimating the potential dermal and respiratory exposures of residents following crack and crevice treatment of the home.

2.0 CONCLUSIONS

NDEB has reviewed a study measuring the amounts of propoxur found on surfaces and in the air of residences following crack and crevice treatment with the insecticide. The study also measured the degree of transfer of the compound from treated surfaces to the skin. These data, along with several arbitrary assumptions, were used by the registrant and by NDEB to estimate the potential dermal and respiratory exposures of the inhabitants of these dwellings. Exposures were estimated for three age categories of residents, an infant (6-9 months), a 12 year old child, and an adult male. The estimates of exposure are presented in Table 1. The exposure assessment does not address potential oral exposure resulting from residues on the surfaces of kitchen items. There is no method currently available with which to estimate such exposure. There were also no data with which to estimate the potential oral exposure of infants to surface residues on toys, etc. While NDEB realizes that there will be an oral component contributing to the total exposure, this component cannot be quantified at this time.

The exposure tables provided by the registrant, presented in Appendix A, attempted to evaluate the effect of repeated treatment on exposure assuming daily application and accumulation of residues over time. The Agency believes that repeated crack and crevice treatment is unlikely to occur within such a short time and did not include the possibility of accumulation of residues in this assessment.

The dermal exposure of an individual will depend, not only on the levels of surface residues, but also on the surface area contacted. The registrant provided exposure estimates for a number of different scenarios in which the area contacted ranged from 5 to 50 square feet in a 4 hour interval. It was further assumed that exposure would occur over 50 percent of the body surface. NDEB notes that these are strictly arbitary assumptions and not based on available data. However, NDEB has no data with which to provide alternative scenarios and accepted these assumptions as reasonable.

Table 1. Estimates of Total Daily and Annual Exposure of Residents of Homes to Propoxur Following Crack and Crevice Treatment.

Age Category	Contact Area (ft^2)[1]	Exposure Time (hr/day)[2]	Daily Exposure		Annual Exposure		Total Exposure	
			Dermal (mg/kg/day)	Respiratory (mg/kg/day)	Dermal (mg/kg/yr)	Respiratory (mg/kg/yr)	(mg/kg/day)	(mg/kg/yr)
Infant	5	24	0.067	8.2×10^{-3}	25	3.0	0.08	28
	50	24	0.43	8.2×10^{-3}	1.6×10^{2}	3.0	0.44	1.6×10^{2}
12 Year old	5	15	0.013	1.7×10^{-3}	5	0.62	0.015	5.6
	50	15	0.053	1.7×10^{-3}	19	0.62	0.05	20
Adult	5	15	0.010	1.1×10^{-3}	3.6	0.40	0.014	4.0
	50	15	0.033	1.1×10^{-3}	12	0.40	0.034	12
LIFETIME DAILY AVG EXPOSURE[3]	5						0.020	
	50						0.071	

1 Area of treated surface contacted in a 4 hour period.

2 Infants, 12 year olds, and adults are assumed to spend 12, 8, and 6 hours at sleep (exposed to upholstery levels only).

3 Assumes infant exposure during age 0-6, 12 year old exposure during age 7-17, and Adult exposure during age 18-70. The equation is:

LDAE = [(infant exp x 6) + (12 year old exp x 11) + (Adult exp x 53)]/70 yrs

Other assumptions used by the two parties differed in some cases and these differences are compared in Table 2. It must be emphasized that these exposure estimates are based largely on unsubstantiated assumptions that were judged reasonable by one or both of the parties involved. Should additional information become available, the estimated exposures may require refinement. Until such time the estimates of exposure are considered NDEB's best estimate of the average exposures of residents to propoxur after crack and crevice treatment of their homes.

3.0 DESCRIPTION OF STUDY

The study was conducted in conjunction with an applicator exposure study designed to measure the exposure of commercial pest control operators. A formulation of propoxur, BAYGON 70-WP, was applied as a 1.1 percent solution by weight, as specified by the label, to five homes in the Kansas City, Missouri area. The material was applied as a coarse spray to cracks, crevices, baseboards, and other hiding areas commonly treated for insect control using a hand held compression sprayer. An average of 1.2 ounces (0.7-1.8 oz) of active ingredient was applied to each house. Application took 20-34 minutes to complete.

Surface residues and air levels of propoxur were measured at intervals of up to 48 hours after treatment. Both transferrable and total surface residues were sampled. Five types of surfaces were evaluated. A total of 18 samples of each type of medium were placed in each room. The media were distributed in the rooms prior to the treatment. Triplicate samples of each medium were collected before treatment, immediately after application and at intervals of 6, 12, 24, and 48 hours post-application. In the kitchens, vinyl tile squares were placed on the floor and on counter tops. Aluminum foil squares were used to represent cooking utensils and ceramic saucers (26 in^2) were placed on counters or tables to represent tableware. The living rooms and bedrooms were sampled using squares of nylon carpet with a 1 cm nap placed on the floor and fabric squares located on the furniture. Each square used for wipe sampling had an area of 1 ft^2. Transferrable residues were determined by wiping one foot square areas of various media with gauze pads moistened with 1.9 ml of a pH 4 buffer solution to avoid basic decomposition of the compound. Additional 2 inch squares of the various media or additional saucers were placed adjacent to the dosimeters used for wipe sampling. These samples were used for total residue analysis. The squares were placed in wide-mouth jars and extracted with ethanol. The saucers were placed in zip-lock bags and wiped with gauze and ethanol. These gauze were then placed in wide-mouth jars. The jars were shaken for 30 minutes with a mechanical shaker after which the sampling media were removed. The jars were then stored on dry ice.

Airborne concentrations of propoxur were determined by drawing air, at a rate of 1 liter per minute, through sampling apparatus

Table 2. Comparison of Different Assumptions Used by Mobay Corporation and NDEB for the Estimation of Post-Application Exposure of Residents to Propoxur. Assumptions used by both parties are included in the text.

NDEB Assumptions	Mobay Assumptions
Dermal exposures were assumed to occur at a rate equal to the average of those for three different materials; vinyl tile, carpet, and upholstery material.	Five different scenarios were used to estimate exposure of infants and one for each of the other age groups. The scenarios assumed different times in each of the rooms.
The maximum geometric mean of all of the measured surface residues, from wipe samples taken between 6 and 48 hours, for a given material was used to represent that material. Residue levels from different rooms were pooled for each material.	Residues were assumed to be equal to the maximum arithmetic mean found on a material in a given room over the sampling interval.
Infant, 12 year old, and adult exposure times were assumed to be 24, 15, and 15 hours, respectively.	Contact for 4 hours was assumed.
During periods when the individual was assumed to be asleep levels found on upholstery were used to calculate dermal exposures. These intervals were 12 hours, 8 hours and 8 hours for infants, 12 year old children, and adults, respectively.	Not addressed.
Exposure occurs for 365 days per year.	Not addressed.
Dermal exposures are not corrected for dermal absorption.	Absorption was based on data from the public literature (2).

whose inlet was located 12 inches above the floor. The sampling tubes consisted of an initial 80 mg portion of XAD-4 resin, backed up by a second 40 mg portion. The personal sampling pumps were calibrated before and after the sampling interval and the mean used for calculation of sample volume. All sampling periods were at least one hour.

All samples were analyzed at the registrant's industrial hygiene laboratory in Pittsburgh, PA. The extracts were analyzed by high pressure liquid chromatography (HPLC) with a post-column derivatization unit and a fluorescence detector. The recoveries from the various types of samples and media are summarized in Table 3.

DETERMINATION OF TRANSFER COEFFICIENT

In addition to monitoring the residues of propoxur on household surfaces, the registrant conducted laboratory studies to measure the transfer of the insecticide from those surfaces to the skin. The resulting transfer coefficient was then used in the dermal exposure calculations. Pieces of vinyl tile, carpet, and upholstery fabric were treated with propoxur at the maximum label rate. After the surface had dried, wipe samples were taken from the treated media using gauze pads. Similar samples were taken using the bare hands of volunteers instead of the gauze pads. One factor that may possibly affect dermal exposure is effect of repeated contact of the skin with a treated surface. In order to evaluate this potential factor, the registrant investigated the effect of the ratio of the skin surface to the area contacted. Surface areas of 0.11, 9, and 18 ft^2 were sampled. Transfer coefficients, defined as the ratio of the residues obtained by hand wipe to those detected after wiping with a moistened gauze, were determined for each material (carpet, vinyl tile, and upholstery fabric) and for the different surface areas sampled. The ratios of skin surface to sample surface were 2, 0.024, and 0.012. The results of these investigations are presented in Table 4.

Correlations between the transfer coefficients and the ratios of skin surface area to area sampled were good. However, the selection of surface areas sampled (0.11, 9, and 18 ft^2) was such that it is not clear whether the relationship between skin surface and treated surface is linear or whether the correlation is artifactual due to the great disparity in the skin to surface area ratios (2, 0.024, and 0.012). Since only three varying surface areas, resulting in three ratios of skin surface to treated surface, were monitored, the registrant calculated an adjusted transfer coefficient by linear interpolation. This transfer coefficient was used to adjust the residues measured in the home by wipe sampling in order to estimate the amount of propoxur that would be transferred from contaminated surfaces to the skin. The interpolated estimates of the transfer coefficient for combinations of skin area and contacted surface area are presented in Table 5. In lieu of additional information,

NDEB accepted the linear interpolation as a reasonable first estimate. Sample calculations are presented in Appendix B.

CALCULATION OF EXPOSURES

Assumptions Used by the Registrant

In order to estimate the dermal exposure of residents to propoxur the registrant made a number of assumptions:

The body characteristic parameters used by the registrant for estimation of the exposure of residents are presented in Table 6. The registrant based the exposure calculations on the highest arithmetic mean residue found during the study for a given material in a given room. This value was multiplied by the interpolated transfer coefficient and the area of contact assumed in a 4 hour period to yield an estimate of exposure. The calculation was:

$$\text{Exposure (mg/4 hrs)} = \frac{(\text{ug/ft}^2) \times \text{Trans. Coeff.} \times \text{Area of Contact (ft}^2)}{1000 \text{ ug/mg}}$$

The registrant then made the assumption that the 50 percent of an individuals skin makes contact with a treated surface. Dermal exposures were calculated assuming that the area touched in a four hour period was assumed to be 5 or 50 ft^2. The registrant assumed 20 percent absorption, based on information found in the scientific literature (2). Other assumptions were made regarding the amount of time spent in various locations of the home. Copies of the resulting exposure tables, calculated by the registrant, are presented in Appendix A.

Assumptions Used by NDEB

The calculations performed by NDEB for exposure assessment were somewhat different from those used by the registrant. The reviewer found that there was no statistically significant difference in the residues found by wipe sampling a given material in different rooms (Kruskal-Wallace test, $p<0.05$). These data for a particular medium were then pooled to allow a more reliable estimate of the mean value. The data appeared to be lognormally distributed with relatively high values in a very few cases. Consequently, the geometric mean was used in the exposure calculations. The means of the pooled data for each material over time are presented in Table 7. There was no discernible pattern of decay of propoxur over the 48 hour sampling period for any of the materials tested. NDEB used a conservative approach and used the highest geometric mean found over the sampling period, excluding the transient high residues found immediately after treatment, for exposure calculations. The transfer coefficient was determined by linear interpolation although the linearity of the relationship between skin to surface area ratio and transfer coefficient has not been proven.

The arbitrary assumptions proposed by the registrant regarding skin surface areas, respiratory volumes, body weights, and areas contacted in a 4 hour period were also used by NDEB. However, NDEB made no assumptions of times spent in a specific location during active times of the day but rather assumed that contact times with carpet, vinyl tile flooring, and upholstery were equally divided. Adolescents and adults were assumed to be in the home 15 hours per day, 365 days per year. Infants were assumed to be in contact with one of these surfaces for 24 hours per day. NDEB further assumed that infants, 12 year old children, and adults spend 12, 8, and 6 hours asleep, respectively. During these sleeping hours the residents were assumed to be exposed to the levels found on upholstery. NDEB realizes that these assumptions may be somewhat simplistic but lacks sufficient data with which to refine them. Dermal exposure for a given interval was estimated using the following equation:

$$\text{Exposure (ug/kg)} = \frac{SR \times TC \times SA \times T}{BW \times 4}$$

where:

SR = Surface residues in ug/ft^2 as measured by wipe sample

TC = Transfer Coefficient

SA = Surface area Contacted in a 4 hour period in ft^2

T = Hours exposed

BW = Body weight in kg

Daily dermal exposures were calculated separately for active and sleep periods and were summed to yield daily exposures. The estimated dermal exposures for infants, 12 year old children, and adults are presented in Table 8.

CALCULATION OF RESPIRATORY EXPOSURES

The arithmetic and geometric mean air concentrations of propoxur, tabulated by room and sampling interval are presented in Table 9. Propoxur levels in basement air were significantly higher than those found in other rooms of the homes. There was no significant change in the concentrations measured at the different sampling intervals (Analysis of Variance, $p<0.05$). Since it is unknown how much time an individual would spend in a particular room, the data for all rooms were pooled to yield an average air concentration to which a resident would be exposed. The resulting grand mean was 5.1 ug/m^3. The registrant assumed the respiratory rates presented in Table 6. NDEB found these estimates to be acceptable

and used them for respiratory exposure calculations. The daily respiratory exposure calculation is:

$$\text{Daily Respiratory Exposure (mg/kg)} = \frac{\text{Conc. (ug/m}^3\text{) x Resp. Rate (m}^3\text{/hr) x hrs/day}}{\text{BW (kg) x 1000 ug/mg}}$$

For example, a 7.5 kg infant with a respiratory rate of 0.5 m^3/hr would have a respiratory exposure of:

$$\text{Daily Respiratory Exposure (mg/kg/day)} = \frac{(5.1\ \text{ug/m}^3)\ \text{x}\ 0.5\ \text{m}^3\text{/hr}\ \text{x}\ 24\ \text{hrs/day}}{7.5\ \text{kg x 1000 ug/mg}}$$

(concentration; rate; time expos.; body weight)

$$= 8.16 \times 10^{-3}\ \text{mg/kg/day}$$

$$= 8.16\ \text{ug/kg/day}$$

The estimated daily and annual respiratory exposures of residents to propoxur are presented in Table 10.

cc: Circulation
Correspondence
Linda Kutney/SACB
Propoxur file
SRRB
TB-IRS

Table 3. Summary of Data for Recovery of Propoxur from Various Types of Media and at Different Intervals.

Sampling Medium	Type of Sample	Spike Level (ug)	Day	Recovery (percent)	No. of Samples
Gauze pad	Stability	1.0	0	92.3	7
			20	87.0	7
			134	99.8	7
XAD-4 Resin	Stability	1.0	0	81.5	7
			15	39.8	7
			19	75.8	4
			20	73.4	7
			20	69.4	4
			85	71.8	5
			130	96.2	7
XAD-4 Resin	Collection Efficiency	1.0		88.8	7
Vinyl Patch	Stability	1.0	0	114.0	7
			12	107.0	7
			27	90.6	7
			111	79.6	7
Vinyl Patch	Desorption Efficiency	5000		95.8	7
Ceramic Plate	Stability	2.0	0	102.0	2
			69	138.0	2
			104	107.0	2
Ceramic Plate	Desorption Efficiency	50		103.0	7
Carpet Patch	Stability	3.0	0	90.0	2
			13	109.0	2
			26	107.0	2
			86	117.0	2
			113	85.0	2
Carpet Patch	Desorption Efficiency	45		101.0	7
Cloth Patch	Stability	1.0	0	138.0	2
			20	105.0	2
			53	107.0	2
			111	115.0	2

Table 3. (Continued). Summary of Data for Recovery of Propoxur from Various Types of Media and at Different Intervals.

Sampling Medium	Type of Sample	Spike Level (ug)	Day	Recovery (percent)	No. of Samples
Cloth Patch	Desorption Efficiency	45		91.7	7
Aluminum Foil	Stability	1.0	0	83.7	2
			12	107.0	2
			27	76.4	2
			53	76.5	2
			111	129.0	2

Table 4. Results of Experiments to Determine the Transfer Coefficient for Propoxur Applied to Various Surfaces.

Sampling Medium	Area Wiped (ft)	Gauze Pad		Hands		Transfer Coefficient	Skin SA/ Sample SA
		ug collected	ug/ft^2	ug collected	ug/ft^2		
Vinyl tile	0.11	2846	25873	3575	32500	1.26	2.0
	9.00	134130	14903	51300	5700	0.38	0.024
	18.00	169155	9398	59370	3298	0.35	0.012
Carpet	0.11	295	2682	1838	16709	6.23	2.0
	9.00	7233	804	1780	198	0.25	0.024
	18.00	14480	804	3472	193	0.24	0.012
Fabric	0.11	589	5355	1451	13191	2.46	2.0
	9.00	9099	1011	1207	134	0.13	0.024
	18.00	19886	1105	2317	129	0.12	0.012

Table 5. Interpolated Transfer Coefficients for Individuals in Contact with Surfaces Following Treatment with Propoxur.

Age Category	Area (ft^2)		Skin/Cont Ratio	Transfer Coefficient (Interpolated)		
	Skin[1]	Contacted		Vinyl Tile	Carpet	Upholstery
Infant (6-9 months)	4.80	5	0.48	0.57	1.63	0.67
		50	0.048	0.39	0.32	0.16
12 Year old Child	14.80	5	1.48	0.98	4.66	1.85
		50	0.15	0.43	0.63	0.28
Adult	21.00	5	2.10	1.24	6.53	2.58
		50	0.21	0.46	0.81	0.35

[1] Exposure is assumed to occur over 50 percent of this area.

[2] See Appendix B for calculation of Interpolated Transfer Coefficient.

Table 6. Body Characteristic Parameters Used by the Registrant for Estimation of Residents to Propoxur Applied as a Crack and Crevice Treatment.

Age Category	Body Weight (kg)	Surface Area (ft^2)	Respiratory Volume (m^3/hr)
Infant (6-9 months)	7.5	4.8	0.5
12 Year old Child	40.5	14.8	0.9
Adult	70	21	1.0

Table 7. Mean Surface Wipe Residues of Propoxur On Surfaces Following Crack and Crevice Treatment. Means were calculated using pooled data from the Kitchens, Bedrooms, and Basements.

Material Sampled	Sampling Interval	Residues (ug/sq ft) Arithmetic Mean	Geometric Mean
Vinyl Tile	Immediately After Treatment	2649	288
	6 Hours	1979	57
	12 Hours	5851	41
	24 Hours	3287	165
	48 Hours	2707	101
Carpet	Immediately After Treatment	21	7.6
	6 Hours	8.0	3.1
	12 Hours	9.8	3.6
	24 Hours	2.8	1.3
	48 Hours	1.1	0.66
Upholstery	Immediately After Treatment	1.2	0.96
	6 Hours	0.94	0.64
	12 Hours	1.2	0.79
	24 Hours	0.70	0.48
	48 Hours	0.74	0.52

Table 8. Estimated Dermal Exposures of Residents After Crack and Crevice Treatment of Homes.

Age Category	ft^2 of Contact	Hours Exposed per Day		Dermal Exposure					
				mg per hr		Daily	Annual	Daily	Annual
		active	at sleep[2]	Active	Sleep	(mg/day)	(mg/yr)	(mg/kg/day)	(mg/kg/yr)
Infant	5	24	12	0.04	6.67×10^{-4}	0.51	1.8×10^{2}	0.067	25
	50	24	12	0.27	1.55×10^{-3}	3.26	1.2×10^{3}	0.435	159
12 Year old	5	15	8	0.07	1.85×10^{-3}	0.54	2.0×10^{2}	0.013	5
	50	15	8	0.30	2.74×10^{-3}	2.15	7.8×10^{2}	0.053	19
Adult	5	15	8	0.10	2.59×10^{-3}	0.88	3.2×10^{2}	0.010	4.0
	50	15	8	0.32	3.47×10^{-3}	2.94	1.1×10^{3}	0.033	12

1 ft^2 of contact in a 4 hour period.

2 Residents are assumed to be dermally to exposed upholstery residues only during this period.

Table 9. Air Concentrations of Propoxur in Various Rooms of Homes Following Crack and Crevice Treatment. All values are expressed as ug/m^3.

No.	Room	Sampling Interval: Immediately After	6 Hours	12 Hours	24 Hours	48 Hours
1	Basement	0.47	0.72	2.00	0.53	1.60
2	Basement	10.20	9.40	8.40	11.60	5.80
3	Basement	12.20	9.70	6.30	7.50	5.30
4	Basement	14.40	14.40	13.00	10.60	12.90
5	Basement	25.80	26.20	29.60	25.50	14.70
Arithmetic Mean		11.15 ug/m^3				
Geometric Mean		7.18 ug/m^3				
1	Bathroom	0.79	1.04	1.40	0.53	1.00
2	Bathroom	2.60	3.40	1.80	1.30	1.20
3	Bathroom	5.40	3.60	18.20	4.50	7.40
4	Bathroom	6.10	7.20	5.80	8.60	3.40
5	Bathroom	6.10	4.20	4.70	3.00	4.80
Arithmetic Mean		4.32 ug/m^3				
Geometric Mean		3.12 ug/m^3				
1	Bedroom	0.80	8.40	1.90	0.96	1.40
2	Bedroom	0.96	0.60	0.62	1.10	0.98
3	Bedroom	1.50	2.60	1.30	0.76	1.80
4	Bedroom	2.10	1.40	1.10	0.49	0.66
5	Bedroom	4.80	5.50	4.40	2.60	3.80
Arithmetic Mean		2.10 ug/m^3				
Geometric Mean		1.55 ug/m^3				
1	Kitchen	2.50	0.64	3.40	0.69	1.60
2	Kitchen	3.40	4.70	1.80	3.40	4.00
3	Kitchen	5.60	5.40	3.80	4.00	2.40
4	Kitchen	6.90	6.40	8.00	6.40	4.50
5	Kitchen	10.50	8.80	11.70	5.20	9.40
Arithmetic Mean		5.01 ug/m^3				
Geometric Mean		4.03 ug/m^3				
1	Living Room	0.70	0.67	2.20	0.81	1.40
2	Living Room	2.40	2.10	2.60	1.60	0.87
3	Living Room	2.50	3.30	1.20	2.00	1.80
4	Living Room	3.60	4.00	1.90	3.00	2.60
5	Living Room	6.80	6.80	7.20	4.60	8.00
Arithmetic Mean		2.99 ug/m^3				
Geometric Mean		2.35 ug/m3				

Grand Mean Mean of all samples = 5.1 ug/m_3

Table 10. Estimated Respiratory Exposures of Residents to Propoxur Following Crack and Crevice Treatment of the Home.

Age Category	Body Weight (kg)	Respiratory Volume (m^3/hr)	Time Exposed (hr/day)	Respiratory Exposure Daily (mg/kg/day)	Annual (mg/kg/yr)
Infant	7.5	0.5	24	8.2×10^{-3}	3.0
12 Year old	40.5	0.9	15	1.7×10^{-3}	0.62
Adult	70	1.0	15	1.1×10^{-3}	0.40

REFERENCES

1) Memorandum from C. Lunchick (EAB) to J. Ellenberger and B. Zendzian (TB) titled "Exposure Assessment for Propoxur (Baygon)", dated 8 January 1985.

2) Feldmann, R.J. and H.I. Maibach (1974) Percutaneous Penetration of Some Pesticides and Herbicides in Man. Toxicology and Applied Pharmacology 28:126-132.

APPENDIX A - Photocopies of of Dermal exposure rates calculated by Mobay Corporation (Mobay Report No. 99102, MRID No. 410547-03) for individuals in homes following crack and crevice treatment with propoxur.

Tables 21, 22, 23, 24, 25, 26, 28, and 29 from original report.

Table 21. Infants, Dermal Dose Rate, ug/kg/hr

Exposure Scenario 1: 4 hr contact with 5 ft² of living room carpet.

From Table 20: Dermal exposure = 49 ug; oral exposure = 5.2 ug

Exposure Day	0-4 hr	4-8 hr	8-12 hr	12-24 hr	24-48 hr	48-72 hr	72-96 hr	96-120 hr
1	0.023	0.046	0.078	0.035	0.0061	0.0015	0.0013	0.0018
2	0.023	0.046	0.078	0.035	0.0061	0.0015	0.0013	0.0018
	0.0061	0.0061	0.0061	0.0061	0.0015	0.0013	0.0018	-
	0.029	0.052	0.084	0.041	0.0076	0.0028	0.0031	
3	0.023	0.046	0.078	0.035	0.0061	0.0015	0.0013	0.0018
	0.0076	0.0076	0.0076	0.0076	0.0028	0.0031	-	-
	0.031	0.054	0.086	0.043	0.0089	0.0046		
4	0.023	0.046	0.078	0.035	0.0061	0.0015	0.0013	0.0018
	0.0089	0.0089	0.0089	0.0089	0.0046	-	-	-
	0.032	0.055	0.087	0.044	0.011			

Oral Dose Rate = $\frac{5.2 \text{ ug}}{(7.5 \text{ kg})(4 \text{ hr})}$ = 0.17 ug/kg/hr.

Inhalation Dose Rate = (5.8 ug/m³)(0.5 m³ /hr)/(7.5kg)

= 0.39 ug/kg/hr

Table 22. Infants, Dermal Dose Rate, ug/kg/hr

Exposure Scenario 2: 4 hr contact with 50 ft² of living room carpet

From Table 20: Dermal exposure = 99 ug; oral exposure = 10 ug

Exposure Day	0-4 hr	4-8 hr	8-12 hr	12-24 hr	24-48 hr	48-72 hr	72-96 hr	96-120 hr
1	0.046	0.093	0.16	0.072	0.012	0.0030	0.0026	0.0037
2	0.046	0.093	0.16	0.072	0.012	0.0030	0.0016	0.0037
	0.012	0.012	0.012	0.012	0.030	0.0026	0.0037	-
	0.058	0.10	0.17	0.084	0.015	0.0056	0.0063	
3	0.046	0.093	0.16	0.072	0.012	0.0030	0.0026	0.0037
	0.015	0.015	0.015	0.015	0.0056	0.0063	-	-
	0.061	0.11	0.18	0.087	0.018	0.0093		
4	0.046	0.093	0.16	0.072	0.012	0.0030	0.0026	0.0037
	0.018	0.018	0.018	0.018	0.0093	-	-	-
	0.064	0.11	0.18	0.09	0.021			

Oral Dose Rate = $\frac{10 \text{ ug}}{(7.5 \text{ kg})(4 \text{ hr})}$ = 0.33 ug/kg/hr

Inhalation Dose Rate = (5.8 ug/m³)(0.5 m³ /hr)/(7.5 kg)

= 0.39 ug/kg/hr

Table 23. Infants, Dermal Dose Rate, ug/kg/hr

Exposure Scenario 3: 4 hr contact with 5 ft² of living room, bedroom, basement. 1/2 with living room, 1/4 with bedroom, 1/4 with basement.

From Table 20: Dermal exposure = 120 ug; oral exposure = 12 ug

Exposure Day	0-4 hr	4-8 hr	8-12 hr	12-24 hr	24-48 hr	48-72 hr	72-96 hr	96-120 hr
1	0.056	0.11	0.19	0.087	0.015	0.0037	0.0032	0.0045
2	0.056	0.11	0.19	0.087	0.015	0.0037	0.0032	0.0045
	0.015	0.015	0.015	0.015	0.0037	0.0032	0.0045	-
	0.071	0.12	0.20	0.10	0.019	0.0069	0.0077	
3	0.056	0.11	0.19	0.087	0.015	0.0037	0.0032	0.0045
	0.019	0.019	0.019	0.019	0.0069	0.0077	-	-
	0.075	0.13	0.21	0.11	0.022	0.011		
4	0.056	0.11	0.19	0.087	0.015	0.0037		
	0.0069	0.0069	0.0069	0.0069	0.011	-		
	0.063	0.12	0.20	0.094	0.026			

$$\text{Oral Dose Rate} = \frac{12 \text{ ug}}{(7.5 \text{ kg})(4 \text{ hr})} = 0.4 \text{ ug/kg/hr}$$

Inhalation Dose Rate = (5.8 ug/m³)(0.5 m³ /hr)/7.5 kg)

= 0.39 ug/kg/hr

Table 24. Infants, Dermal Dose Rate, ug/kg/hr

Exposure Scenario 4: 4 hr contact with 50 ft^2 of living room, bedroom, basement. 1/2 with living room, 1/4 with bedroom, 1/4 with basement

From Table 20: Dermal exposure = 240 ug; oral exposure = 26 ug

Exposure Day	0-4 hr	4-8 hr	8-12 hr	12-24 hr	24-48 hr	48-72 hr	72-96 hr	96-120 hr
1	0.11	0.22	0.38	0.17	0.030	0.0074	0.0064	0.0090
2	0.11	0.22	0.38	0.17	0.030	0.0074	0.0064	0.0090
	0.030	0.030	0.030	0.030	0.0074	0.0064	0.0090	-
	0.14	0.25	0.41	0.20	0.037	0.014	0.015	
3	0.11	0.22	0.38	0.17	0.030	0.0074	0.0064	0.0090
	0.037	0.037	0.037	0.037	0.014	0.015	-	-
	0.15	0.26	0.42	0.21	0.044	0.022		
4	0.11	0.22	0.38	0.17	0.030	0.0074	0.0064	0.0090
	0.044	0.044	0.044	0.044	0.022	-	-	-
	0.15	0.26	0.42	0.21	0.052			

Oral Dose Rate = $\frac{26 \text{ ug}}{(7.5 \text{ kg})(4 \text{ hr})}$ = 0.87 ug/kg/hr

Inhalation Dose Rate = (5.8 ug/m^3)(0.5 m^3 /hr)/7.5 kg)

= 0.39 ug/kg/hr

Table 25. Infants, Dermal Dose Rate, ug/kg/hr

Exposure Scenario 5: 4 hr contact with 5 ft² of living room, bedroom, kitchen. 1/2 with living room, 1/4 with bedroom, 1/4 with kitchen.

From Table 20: Dermal exposure = 4730 ug; oral exposure = 500 ug

Exposure Day	0-4 hr	4-8 hr	8-12 hr	12-24 hr	24-48 hr	48-72 hr	72-96 hr	96-120 hr
1	2.2	4.4	7.6	3.4	0.59	0.14	0.13	0.18
2	2.2	4.4	7.6	3.4	0.59	0.14	0.13	0.18
	0.59	0.59	0.59	0.59	0.14	0.13	0.18	-
	2.8	5.0	8.2	4.0	0.73	0.27	0.31	
3	2.2	4.4	7.6	3.4	0.59	0.14	0.13	0.18
	0.73	0.73	0.73	0.73	0.27	0.31	-	-
	2.9	5.1	8.3	4.1	0.86	0.45		
4	2.2	4.4	7.6	3.4	0.59	0.14	0.13	0.18
	0.86	0.86	0.86	0.86	0.45	-	-	-
	3.1	5.3	8.5	4.3	1.0			

$$\text{Oral Dose Rate} = \frac{500 \text{ ug}}{(7.5 \text{ kg})\ (4 \text{ hr})} = 16.7 \text{ ug/kg/hr}$$

Inhalation Dose Rate = $(5.8 \text{ ug/m}^3)(0.5 \text{ m}^3/\text{hr})/(7.5 \text{ kg})$

= 0.39 ug/kg/hr

Table 26. Infants, Dermal Dose Rate, ug/kg/hr

Exposure Scenario 6: 4 hr contact with 50 ft² of living room, bedroom, kitchen. 1/2 with living room, 1/4 with bedroom, 1/4 with kitchen

From Table 20: Dermal exposure = 31600 ug; oral exposure = 3400 ug

Exposure Day	0-4 hr	4-8 hr	8-12 hr	12-24 hr	24-48 hr	48-72 hr	72-96 hr	96-120 hr
1	14.8	29.7	51.	23.	3.9	0.97	0.84	1.2
2	14.8	29.7	51.	23.	3.9	0.97	0.84	1.2
	3.9	3.9	3.9	3.9	0.97	0.84	1.2	-
	19.	34.	55.	27.	4.9	1.8	2.0	-
3	14.8	29.7	51.	23.	3.9	0.97	0.84	1.2
	4.9	4.9	4.9	4.9	1.8	2.0	-	-
	20.	35.	56.	28.	5.7	3.0		
4	14.8	29.7	51.	23.	3.9	0.97	0.84	1.2
	5.7	5.7	5.7	5.7	3.0	-	-	-
	20.	35.	57.	29.	6.9			

Oral Dose Rate = $\frac{3400 \text{ ug}}{(7.5 \text{ kg})(4 \text{ hr})}$ = 113 ug/kg/hr

Inhalation Dose Rate = (5.8 ug/m³)(0.5 m³/hr)/7.5 kg)

= 0.39 ug/kg/hr

Table 28 12-yr-old Dermal Exposure

ft^2 contact	Skin Area/ Surface Area	Surface mat'l	Skin/Gauze Transfer Ratio (Interpolated)	Surface	Max Loading ug/ft^2	Dermal exp., mg
5	$\frac{7.4}{5.0} = 1.5$	vinyl	1.0	K. floor	7130	36
				Bath floor	5029	25
1	$\frac{0.22}{1} = 0.22$	vinyl	0.47	K. counter	5497	2.6
50	$\frac{7.4}{50} = 0.15$	vinyl	0.44	K. floor	7130	157
				Bath floor	5029	111
5	1.5	carpet	4.7	LR floor	6.7	0.157
				BdR floor	13	0.30
				Bsmt floor	39	0.92
50	0.15	carpet	0.63	LR floor	6.7	0.21
				BdR floor	13	0.41
				Bsmt floor	39	1.2
5	1.5	fabric	1.9	LR	1.3	0.012
				BdR	1.3	0.012

Table 29. 12-yr-olds, Dermal Dose Rate, ug/kg/hr

Exposure Scenario : 4 hr contact with 50 ft^2 of living room, bedroom, kitchen (1/2 with living room, 1/4 with bedroom, 1/4 with kitchen) + 1 ft^2 of kitchen counter.

From Table 28: 42000 ug dermal exposure

Exposure Day	0-4 hr	4-8 hr	8-12 hr	12-24 hr	24-48 hr	48-72 hr	72-96 hr	96-120 hr
1	3.6	7.3	12.5	5.6	0.96	0.24	0.21	0.29
2	3.6	7.3	12.5	5.6	0.96	0.24	0.21	0.29
	0.96	0.96	0.96	0.96	0.24	0.21	0.29	-
	4.6	8.3	13	6.6	1.2	0.45	0.50	
3	3.6	7.3	12.5	5.6	0.96	0.24	0.21	0.29
	1.2	1.2	1.2	1.2	0.45	0.50	-	-
	4.8	8.5	14	6.8	1.4	0.74		
4	3.6	7.3	12.5	5.6	0.96	0.24	0.21	0.29
	1.4	1.4	1.4	1.4	0.74	-	-	-
	5.0	8.7	14	7.0	1.7	-	-	-

Inhalation DR = $\frac{(5.8\ ug/m^3)(0.9\ m^3/hr)}{40.5\ kg}$ = 0.13 ug/kg/hr

Total DR = Dermal + Inhalation = 14 ug/kg/hr + 0.13 ug/kg/hr = 14 ug/kg/hr

Acceptable DR/Total DR = (300 ug/kg/hr)/(14 ug/kg/hr) = 21

Appendix B. Calculation of Interpolated Transfer Coefficients for Propoxur on Household Surfaces.

The interpolated transfer coefficient was calculated by the following equation:

$$ITC = (R - S^2)/(S^1 - S^2) \times TC^1 + [1 - (R - S^2)/(S^1 - S^2)] \times TC^2$$

where:

ITC = Interpolated Transfer Coefficient

R = Skin Surface to Contact Surface Ratio

S^1 = Skin Surface to Contact Surface Ratio When
Area of Sampling = 0.11 ft^2
For the transfer Coefficient Study = 2.0

S^2 = Skin Surface to Contact Surface Ratio When
Area of Sampling = 9 ft^2
For the transfer Coefficient Study = 2.0

TC^1 = Observed Transfer Coefficient at Ratio S^1

For example, if an infant with an exposed body area of 2.4 ft^2 (50 percent of total body area) contacts 5 ft^2 of treated vinyl surface:

$R = 2.4\ ft^2/5\ ft^2 = 0.48$

$S^1 = 2.0$

$S^2 = 0.024$

$TC^1 = 1.2$ (From Table X.)

$TC^2 = 0.38$ (From Table X.)

$$ITC = [(0.48-0.024)/(2-0.024)] \times 1.2 + [1-(0.48-0.024)/(2-0.024)] \times 0.38$$

$$= 0.57$$