



D-13921 ^{SD} methazole

LA/TI
ml

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

OCT 19 1992

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: EVALUATION OF REGISTRANT EXPOSURE ASSESSMENT FOR
METHAZOLE

FROM: David Jaquith
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David Jaquith

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THRU: Steve Knott, Acting Head
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Larry Dorsey

Please find below the OREB review of

DP Barcode: N/A Pesticide Chemical Code:

EPA Reg. No.:

Deferral to:

PHED: Yes

*memo: 11 pages
attachment: 10 pages*

I. INTRODUCTION

A. Background

OREB has been requested to review an exposure assessment submitted by Sandoz Agro, Inc. for workers using the herbicide methazole on cotton. Methazole is marketed as a water dispersible granular formulation containing 75 percent active ingredient under the name Probe. The material is registered for use on cotton only and is applied using ground equipment. Both pre-emergent and post-emergent applications are allowed, using either broadcast or banded application techniques. The maximum total application rate of Probe is 2.0 pounds per acre (1.5 lb ai per year). Workers are required to wear protective clothing and protective gloves while handling this pesticide. Exposure is estimated to occur for 2-3 days per application to a typical 250 acre cotton farm, separated by an interval of several weeks. Sandoz Agro, Inc., the sole registrant for this material, has requested a voluntary cancellation of this material because of toxicological concerns. The company wishes to use the existing stocks of this compound.

B. Purpose

OREB has previously calculated exposure estimates for methazole in a memorandum dated August 4, 1992 (1). These daily exposures were derived from data available in the Pesticide Handlers Exposure Database (PHED), Version 1.01, dated May 13, 1992. The assumptions used in subsetting the database as well as the exposure scenarios are contained in OREB's previous review which is attached as Appendix A. The resulting dermal exposures from this assessment, normalized by pounds of active ingredient handled were 0.016 mg for applicators and 0.20 mg for mixer/loaders. The corresponding respiratory exposures were 0.00049 mg and 0.0027 mg, respectively. **Note that these are unit exposures only, not the daily exposures used for hazard assessment.**

II. DETAILED CONSIDERATIONS

The registrant has submitted two separate assessments of handler exposure, one based on three surrogate studies found in the literature (2,3,4), and a second derived from PHED using different assumptions.

A. Assessment derived from surrogate data from the scientific literature:

CITATION: Atallah, Y.H., W.P. Cahill, and D.M. Whitacre (1982) Exposure of Pesticide Applicators and Support Personnel to O-Ethyl-O-(4-Nitrophenyl) Phenylphosphonothioate (EPN). Arch. Environm. Contam. Toxicol. Vol. 11, 219-225.

Dermal and respiratory exposures of workers during mixing/loading, application or flagging operations were monitored during application of O-Ethyl-O-(4-Nitrophenyl) Phenylphosphonothioate (EPN) to cotton. Applications were conducted using ground boom or aerial equipment. Dermal exposure of the body was monitored using denim patches attached outside the clothing at various locations. Hand exposure was measured by hand rinse. Respiratory exposure was estimated by drawing measured amounts of air through silica gel sampling tubes attached to the worker near the breathing zone.

The study consisted of four separate tests:

- Test I** Three pilots, one loader, and one flagger were monitored for EPN exposure. Open pour mixing/loading was used to transfer the insecticide into a nurse tank.
- Test II** Two ground boom applicators, spraying their own fields with their own equipment were monitored.
- Tests III/IV** A pilot, mixer/loader and flagger were monitored.

The exposures of individual body areas were not reported. The estimates of exposure, calculated by Sandoz for methazole using values from this study, are presented in Table 1. Sample calculations were not provided.

Table 1. Estimates of Exposure to Methazole Provided by Sandoz Using Data From Atallah, Y.H., W.P. Cahill, and D.M. Whitacre (1982)

Exposure of Pesticide Applicators and Support Personnel to O-Ethyl- O-(4-Nitrophenyl) Phenylphosphonothioate (EPN). Arch. Environm. Contam. Toxicol. Vol. 11, 219-225. Sample calculations were not provided.

	Minimum	$\mu\text{g}/8$ hrs Maximum	Mean	$\mu\text{g}/\text{kg}/\text{day}$ for an 8 hour day
Ground Applicators				
Respiratory	11.5	67.6	40	0.57
Dermal	2100	12900	7500	107.14
Total	2111.5	12967.6	7540	107.7
Mixer/Loaders				
Respiratory	10.5	18.3	15.2	0.027
Dermal	830	14700	6300	11.25
Total	840.5	14718.3	6315.2	11.3

CITATION: Putnam, A.R., M.D. Willis, L.K. Binning, and P.F. Boldt (1983). Exposure of Pesticide Applicators to Nitrofen: Influence of Formulation, Handling Systems, and Protective Garments. Jour. Agric. Food Chem. Vol. 31, 645-650.

Exposures of 10 cooperators were monitored during mixing/loading or application of the herbicide nitrofen. Either a wettable powder (50% active ingredient) or an emulsifiable concentrate (25% active ingredient) were used. Both open pour and closed loading systems were tested in the case of the emulsifiable concentrate. Workers wore protective coveralls (with a Teflon layer sandwiched between 2 rip stop nylon layers), rubber gloves, boots, and an air purifying helmet. One applicator used an air purifying closed cab tractor. Dermal exposure was monitored by attaching gauze pads, both inside and outside of the coverall or helmet, on the chest, lower leg, forearm, and head. Hand exposure was monitored using gauze

pads attached inside and outside the protective gloves with elastic bands. Inhalation exposure was estimated by drawing air through XAD-4 resin tubes. The estimates of exposure, calculated by Sandoz for methazole using values from this study, are presented in Table 2. Sample calculations were not provided.

Table 2. Estimates of Exposure to Methazole Provided by Sandoz Using Data From Putnam, A.R., M.D. Willis, L.K. Binning, and P.F. Boldt (1983) Exposure of Pesticide Applicators to Nitrofen: Influence of Formulation, Handling Systems, and Protective Garments. Jour. Agric. Food Chem. Vol. 31, 645-650. Exposures are based on a 5-hour work day (1 hour mixing/loading, 4 hours applying). Workers wore protective coveralls and helmets.

	Formulating and Handling		
	EC Closed	EC Open	Wettable Powder
Respiratory: Inside Helmet	11	20	208
Dermal: Inside Garment	215	228	327
Total	226	248	535
Exposure ($\mu\text{g}/\text{kg}/\text{day}$)	3.2	3.54	7.64

CITATION: Sutherland, J.A., W.J. King, H.M. Dobson, W.R. Ingram, M.R. Attique, and W. Sanjrani (1990) Effect of Application Volume and Method on Spray Operator Contamination by Insecticide During Cotton Spraying. Crop Protection, Vol 9, 343-350.

Worker exposures to pesticides were estimated, using a fluorescent tracer technique, during treatment of cotton in Pakistan. The study addressed applicator exposure only. Applications were conducted using knapsack sprayers, a mistblower, spinning-disc apparatus, and an electrostatic sprayer. Several different spray volumes were used. Workers wore disposable polyolefin (Tyvek®) coveralls, cloths to protect the face, and shoes. Gloves were not worn. Fluorescent tracer was added to the spray mix at a nominal level of 1 percent. Suits were stored at 28 °C until analysis. Each suit was photographed under UV light prior to analysis. The suits were then cut into sections and analyzed for the dye. Hand exposure was not monitored. The exposure estimates, calculated by the

registrant using data from this study are presented in Table 3. Sample calculations were not provided.

Table 3. Estimates of Exposure to Methazole Provided by Sandoz Using Data From Sutherland, J.A., W.J. King, H.M. Dobson, W.R. Ingram, M.R. Attique, and W. Sanjrani (1990) Effect of Application Volume and Method on Spray Operator Contamination by Insecticide During Cotton Spraying. Crop Protection, Vol 9, 343-350.

	$\mu\text{g/hr}$	$\mu\text{g/8 hr day}$	$\mu\text{g/kg/day}$
	325	2600	37
	256	2048	29
	350	2800	40
	797	6376	91
Average Unprotected	432	3456	49
Average Protected (90% Protection)	43	346	5

B. Registrants Assessment Using PHED

The registrant conducted separate PHED exposure estimates for applicators and mixer/loaders.

Clothing: long pants, long sleeves, no gloves
Respiration Rate = 29 liters per minute

Mixer/loader:

The mixer/loader subset, PROBE.MLOD, was created from the master PHED mixer/loader file MXLD.FILE. The dataset was subsetted by the parameter dry flowable formulation and open pouring, yielding 16 replicates. Protective coveralls over no clothing was selected to determine worker exposures. All data came from a single study. Total dermal exposure, using the best fit composite value, was 93 μg per pound active handled. The geometric mean respiratory exposure was 0.78 μg per pound active. Total exposure was 94 μg per pound active ingredient handled. A copy of the summary statistics, generated by OREB to confirm the registrants unit exposure, is presented in Appendix B.

Applicator:

Applicator exposure was estimated using the subset PROBE.APPL created from the applicator file APPL.FILE. Tractor drawn ground boom was selected yielding a subset containing 83 records. Emulsifiable concentrates, aqueous suspensions, solutions and wettable powders were included. After comparing the results of this subset to others generated by the registrant it was judged that formulation type, quality grade (dermal or inhalation), application rate and spray rate had no appreciable effect on exposure. Dermal and respiratory exposures were 27 μg and 0.67 μg per pound of active ingredient handled, respectively. A copy of the summary statistics, generated by OREB to confirm the registrants unit exposure, is presented in Appendix C.

III. CONCLUSIONS

OREB has examined the registrant's exposure assessments for the use of methazole on cotton, both an assessment derived from literature data and one using the Pesticide Handlers Exposure Database (PHED). The literature assessment was based on three studies of worker exposure. Each study has its own individual weaknesses. The registrant indicates that the mixer/loader exposures from these surrogate studies should be used because the PHED estimate is obtained from one study and that a typical container is completely emptied during mixing/loading, minimizing repeat contact. OREB notes that there are more replicates in this single study than in all three literature studies combined and that there is no indication that exposures are less when a container is completely emptied. Appreciable exposure could occur from contact with contaminated equipment rather than the container itself. It is OREBs opinion that none of these studies, either individually or in concert, provides as reliable an estimate of exposure to workers as that derived from PHED.

The registrant has also provided an exposure assessment obtained from PHED. While OREB was able to confirm the summary statistics provided by the registrant (see Appendices B and C), there were some differences between OREBs original assessments and those of the registrant. The differences between OREBs original assessment and those of the registrant are summarized in Table 4.

Preliminary information provided to OREB indicated that methazole (PROBE) was a wettable powder formulation. Recent information shows that it is a water dispersible granular formulation which is synonymous with a dry flowable. OREB accepts the registrants PHED assessment for the unit exposure for mixer/loaders handling a dry flowable formulation. This

assessment reduces the estimate of total mixer/loader exposure from 198 μg to 94 μg per pound of active ingredient handled.

The registrant provided PHED estimates of applicator exposure assuming that applicators wear long sleeve shirts, long pants, and no gloves. The label (5) requires individuals handling methazole to "wear impervious gloves and protective clothing when handling". OREB considers an applicator to be a pesticide handler as indicated in the Worker Protection Standards (6). Therefore, applicators as well as mixer/loaders must wear the required protective equipment. OREBs estimate of unit exposure for applicators (17 μg per pound active applied) assumed the use of this equipment. The registrants estimate was based on the assumption of normal work clothing and yielded a value of 27 μg per pound active applied. OREB continues to use the values obtained using the label required clothing for purposes of exposure assessment and emphasizes that such clothing must be worn during application.

Table 4. Comparison of OREB and Sandoz Estimates of Unit Exposure to Workers Applying Methazole.

Worker Category	Original OREB Estimate ($\mu\text{g}/\text{lb ai}$)	Registrant Estimate ($\mu\text{g}/\text{lb ai}$)	Revised OREB Estimate ($\mu\text{g}/\text{lb ai}$)	Reasons for difference/change
Mixer/loader	196	94	94	Difference in formulation category; wettable powders were originally selected by OREB, dry flowable judged to be more appropriate.
Applicator	16	27	16	No change in OREB estimate; registrant estimate did not include the label required protective clothing.
Total	212	121	110	See above.

The registrant has also proposed several label changes intended to reduce the potential exposures of these workers. These proposals and some toxicological considerations were submitted to the Agency in a letter dated September 23, 1992 (7). This review will only address those relating to exposure issues. Toxicological considerations are beyond the purview of OREB and need to be addressed by Toxicology Branch. The registrant also presented application parameters which should be evaluated by BEAD. Until changes are indicated OREB will continue to use the use parameters (areas treated, equipment, etc.) provided by BEAD and referenced in OREBs earlier assessment (1).

The registrant proposed a label change to reduce the maximum application rate to 0.25 pounds of active ingredient per acre, which they believe to be the maximum application rate in the major market area. The registrant further states that the classification as a wettable granular instead of a wettable powder, post-directed spray, respirators, and eye protection would further limit exposure. The changes produced by altering the classification of the Probe® formulation to water dispersible granular (dry flowable) have been discussed above. Since respiratory exposure was only a very small component of total exposure, the addition of respirators would have only minimal effect on the MOEs for this compound. Similarly, the use of eye protection (unspecified), while helping to protect the worker from spills and other incidences, has little effect (maximum of approximately 17 percent for mixer/loaders) on the total exposure, protecting only the area covered by goggles or face shield.

The registrant has proposed a label change of the maximum label application rate to 0.25 pounds of active ingredient per acre (0.33 lb product per acre) coupled with a post-emergent directed spray. The combination of these proposed parameters with the unit exposure values presented in Table 4, would yield the daily exposures presented in Table 5.

Table 5. Revised Estimates of Dermal and Respiratory Exposures of Workers Applying Methazole to Cotton Using Ground Equipment. Exposures were derived from Pesticide Handlers Exposure Database (PHED), Version 1.01, dated May 13, 1992. Protective clothing and gloves are assumed. The formulation is considered to be a dry flowable. Values in **Boldface reflect proposed label changes.**

Application Type	Application Rate	Applicator Exposure		M/L Exposure		Combined		
		Dermal	Respiratory	Dermal	Respiratory	Dermal	Respiratory	Total
Broadcast-Preemergent	1.0	0.042	0.00130	0.25	0.0021	0.288	0.0030	0.29
	1.5	0.063	0.00194	0.37	0.0031	0.432	0.0050	0.44
Banded - Preemergent	0.33	0.017	0.00053	0.10	0.0008	0.118	0.0014	0.12
	0.50	0.026	0.00080	0.15	0.0013	0.178	0.0021	0.18
Broadcast-Postemergent	0.50	0.014	0.00043	0.08	0.0007	0.097	0.0011	0.10
	0.75	0.021	0.00065	0.12	0.0010	0.145	0.0017	0.15
	1.5	0.043	0.00130	0.25	0.0021	0.290	0.0034	0.29
Banded-Postemergent	0.17	0.003	0.00010	0.02	0.0002	0.023	0.0003	0.02
	0.25	0.005	0.00015	0.03	0.0002	0.034	0.0004	0.03
	0.50	0.010	0.00031	0.06	0.0005	0.069	0.0008	0.07

IV. REFERENCES

- 1) Memorandum from D. Jaquith (OREB) to K. Bouve (PMSD) titled "Exposure Assessment for Methazole on Cotton", dated August 4, 1992.
- 2) Atallah, Y.H., W.P. Cahill, and D.M. Whitacre (1982) Exposure of Pesticide Applicators and Support Personnel to O-Ethyl-O-(4-Nitrophenyl) Phenylphosphonothioate (EPN).
- 3) Putnam, A.R., M.D. Willis, L.K. Binning, and P.F. Boldt (1983) Exposure of Pesticide Applicators to Nitrofen: Influence of Formulation, Handling Systems, and Protective Garments. Jour. Agric. Food Chem. Vol. 31, 645-650.
- 4) Sutherland, J.A., W.J. King, H.M. Dobson, W.R. Ingram, M.R. Attique, and W. Sanjrani (1990) Effect of Application Volume and Method on Spray Operator Contamination by Insecticide During Cotton Spraying. Crop Protection, Vol 9, 343-350.
- 5) Label for PROBE[®] Herbicide, EPA Reg. No. 55947-23, accepted 23 April 1992.
- 6) Worker Protection Standard, Hazard Information, Hand Labor Tasks on Cut Flowers and Ferns Exception; Final Rule, and Proposed Rules. 40 CFR Parts 156 and 170, published August 21, 1992.
- 7) Letter from C. Keefer (Sandoz) to J. Housenger (SRB) dated September 23, 1992.

cc: D. Jaquith/OREB
Correspondence File
Chemical file/Methazole
Circulation

APPENDIX A.



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

AUG 4 1992

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: EXPOSURE ASSESSMENT FOR METHAZOLE ON COTTON

TO: Kathryn S. Bouve
Special Projects and Coordination Staff
Program Management and Support Division (H7502C)

FROM: David Jaquith
Special Review and Registration Section I
Occupational and Residential Exposure Branch
Health Effects Division (H7509C) *D. Jaquith*

THRU: Steve Knott, Acting Section Head
Special Review and Registration Section I
Occupational and Residential Exposure Branch
Health Effects Division (H7509C) *Steve Knott*

THRU: Larry Dorsey, Acting Chief
Occupational and Residential Exposure Branch
Health Effects Division (H7509C) *Larry Dorsey*

Please find below the OREB review of

HED Project #: _____

RD or SRRD Record #: _____

Caswell #: _____

Date Received: 07/28/92 Review Time: 2 days

Date Returned: 7/31/92

Deferral to: _____ Biological Analysis Branch/BEAD

_____ Science Coordination Branch

_____ TB -I

_____ TB -II

1.0 INTRODUCTION

OREB has been requested to estimate potential dermal and respiratory exposures of workers to methazole. Methazole is a wettable powder formulation containing 75 percent active ingredient and is marketed under the name PROBE. The formulation is registered for use on cotton only and is applied using ground equipment. The product is applied for both preemergent and post emergent weed control with a maximum total application of 1.5 lb active ingredient per year. The registrant for this material, Sandoz Agro Inc., has requested voluntary cancellation of this registration because of toxicological concerns and requests the ability to use existing stocks of material.

Workers using methazole are required to wear protective clothing and impervious gloves while handling the pesticide. OREB has estimated exposures using surrogate data contained in the Pesticide Handlers Exposure Database (PHED), Version 1.01, dated May 13, 1992.

2.0 CONCLUSIONS

OREB has estimated exposures for applicators, mixer/loaders, and mixer/loader/applicators to the herbicide methazole. The daily exposures were derived from data available in the Pesticide Handlers Exposure Database (PHED), Version 1.01, dated 5/13/92. These estimated exposures are presented in Table 1. Exposure is likely to occur in 2-3 day intervals separated by several weeks.

3.0 CALCULATION OF EXPOSURES

3.1 Use Parameters

OREB has obtained use parameters for the use of methazole on cotton from BEAD and an earlier assessment for azodrin use on cotton. The following use information was used in these assessments:

- 1) An average cotton farm consists of 250 acres.
- 2) Preemergent application is either by broadcast or band application. Broadcast application is typically 1.0 to 1.5 lb ai per acre. Band application is at a rate approximately one third of the broadcast rate.
- 3) Postemergent application is at rates of 0.5, 0.75, or 1.5 lb ai per acre. Band application is again at a rate of about one third of the broadcast rate.

Table 1. Estimated Dermal and Respiratory Exposures of Workers Applying Methazole to Cotton Using Ground Equipment. Exposures were derived from Pesticide Handlers Exposure Database (PHED), Version 1.01, dated May 13, 1992. Protective clothing and gloves are assumed.

Application Type	lb ai/A	Applicator Exposure (mg/kg/day)				M/L Exposure (mg/kg/day)				Combined (mg/kg/day)			
		Dermal	Resp.	Total		Dermal	Resp.	Total		Dermal	Resp.	Total	
Broadcast- Preemergent	1.0	0.042	0.00130	0.044	0.53	0.0071	0.536	0.571	0.0084	0.58			
	1.5	0.063	0.00194	0.065	0.79	0.0107	0.804	0.856	0.0126	0.87			
Banded - Preemergent	0.33	0.017	0.00053	0.018	0.22	0.0029	0.219	0.233	0.0034	0.24			
	0.50	0.026	0.00080	0.027	0.33	0.0044	0.332	0.353	0.0052	0.36			
Broadcast- Postemergent	0.50	0.014	0.00043	0.015	0.18	0.0024	0.180	0.191	0.0028	0.19			
	0.75	0.021	0.00065	0.022	0.27	0.0036	0.269	0.287	0.0042	0.29			
Banded- Postemergent	1.5	0.043	0.00130	0.044	0.53	0.0072	0.539	0.574	0.0085	0.58			
	0.17	0.003	0.00010	0.004	0.04	0.0006	0.043	0.046	0.0007	0.05			
	0.25	0.005	0.00015	0.005	0.06	0.0008	0.064	0.068	0.0010	0.07			
	0.50	0.010	0.00031	0.010	0.13	0.0017	0.127	0.136	0.0020	0.14			

- 4) While BEAD reports that 250 acres can be treated in one day if wide booms are used, the tables indicate that a 45 foot boom is more likely and this number was used for these assessments. Postemergent application must be conducted at a lower speed to prevent crop damage. Acres treated per day were obtained from a computerized database program written by BEAD personnel. The following parameters were used:

a) Preemergent - Broadcast

Tank Capacity = 250 gal.
Swath width = 45 ft.
Finished Spray = 30 gal/A
Run length = 250 ft
Water station = 200 yd
Refill time = 2.5 min.
Speed 5.0 mph
The acreage treated per day under these conditions is 185.

b) Preemergent - Banded

Tank Capacity = 250 gal.
Swath width = 45 ft.
Finished Spray = 30 gal/A
Run length = 250 ft
Water station = 200 yd
Refill time = 2.5 min.
Speed 2.0 mph
The acreage treated per day under these conditions is 229

c) Postemergent - Broadcast

Tank Capacity = 250 gal.
Swath width = 45 ft.
Finished Spray = 30 gal/A
Run length = 250 ft
Water station = 200 yd
Refill time = 2.5 min.
Speed 3.0 mph
The acreage treated per day under these conditions is 124.

d) Postemergent - Banded

Tank Capacity = 250 gal.
Swath width = 45 ft.
Finished Spray = 30 gal/A
Run length = 250 ft
Water station = 200 yd
Refill time = 2.5 min.
Speed 2.0 mph
The acreage treated per day under these conditions is 88.

These parameters indicate that a typical 250 acre farm will take about 2-3 days per treatment. The label allows only one preemergent application so these treatments would likely be several weeks apart. The total amounts of active ingredient, applied per day are presented in Table 2. OREB notes that different combinations may be used under certain conditions and these should be considered typical amounts only.

Table 2. Amounts of Methazole Applied to Cotton Using Ground Equipment Under Different Application Rates and Application Types.

Application Type	Application Rate (lb ai/A)	Acres per day	Amount Handled per day (lbs ai)
Broadcast-Preemergent	1.0	185	185
	1.5	185	278
Banded - Preemergent	0.33	229	76
	0.50	229	115
Broadcast-Postemergent	0.50	124	62
	0.75	124	93
	1.5	124	186
Banded-Postemergent	0.17	88	15
	0.25	88	22
	0.50	88	44

3.2 Exposure Parameters

In order to estimate exposures of these workers a number of additional exposure parameters were necessary:

- 1) An average worker weighs 70 kg and has a respiratory volume of 25 liters per minute while mixing/loading or application.
- 2) The same worker performs both the mixing/loading and application tasks.
- 3) Growers apply methazole themselves. Commercial application is minimal.
- 4) Workers wear the label required protective clothing and impervious gloves.
- 5) The label does not specify a cab type so no attempt was made to isolate this factor.

Unit exposures were obtained from the Pesticide Handlers Exposure Database (PHED), Version 1.01, dated 5/13/92. The following subsets and factors were used.

Applicators:

The APPL.FILE was subsetted for ground Boom tractor drawn or ground boom truck drawn, yielding 111 records. No cab type was selected. No attempt was made to adjust for quality assurance grade. Combined dermal and respiratory exposures were selected, normalized by pounds active ingredient handled. Respiratory volume was 25 liters per minute. Protective category was overalls over no additional clothing, with gloves. Actual and estimated head patches were used. A copy of the printout for this subset and the resulting exposures is presented in Appendix A.

Mixer/loaders:

Subset PROBEWP.MLOD was created from MIXLD.FILE and contained 41 records. Wettable powders were selected. No attempt was made to adjust for quality assurance grade. Combined dermal and respiratory exposures were selected, normalized by pounds active ingredient handled. Respiratory volume was 25 liters per minute. Protective category was overalls over no additional clothing, with gloves. Actual and estimated head patches were used. A copy of the printout for this subset and the resulting exposures is presented in Appendix B. The mixer/loader/applicator file (MLAP.FILE) contained insufficient data to use for this assessment.

The results provided by PHED for applicators and mixer/loaders are presented in Appendices A and B, respectively. It must be noted that the replicates used for these estimates were not selected on the bases of quality assurance score and that the number of available data points is minimal for certain body areas. The resulting unit dermal exposure values 16.1404 $\mu\text{g}/\text{lb ai}$ (0.016 mg/lb ai) for applicators and 195.7771 $\mu\text{g}/\text{lb ai}$ (0.20 mg/lb ai) for mixer/loaders. The corresponding respiratory exposures were 0.491 $\mu\text{g}/\text{lb ai}$ (0.00049 mg/lb ai) and 2.6977 $\mu\text{g}/\text{lb ai}$ (0.0027 mg/lb ai) for applicators and mixer/loaders, respectively. Total applicator exposure, as derived by PHED, was 16.6314 μg per pound active ingredient applied (0.016 mg/lb ai). In the case of the mixer/loaders, the total exposure was 198.4748 μg per pound active ingredient handled (0.20 mg/lb ai). **These numbers are composites derived by summing the best estimate of central tendency for each body area and inhalation exposure.** In the cases where the distribution of a body area was normal, the arithmetic mean was used. Where the distribution of an exposure source was lognormal or unknown (other) the geometric mean or median were used, respectively. It must be noted that, in cases where sample sizes are small the determination of the appropriate distribution cannot be reliably ascertained and the estimates must be used cautiously. The estimates of total daily exposure for mixer/loaders and applicators applying methazole are presented in Table 1.

Appendix A. Exposure Statistics for Applicators Applying Methazole to Cotton Using Ground Boom Equipment. Obtained from the Pesticide Handlers Exposure Database (PHED), Version 1.01, dated 5/13/92.

SUMMARY STATISTICS FOR CALCULATED DERMAL EXPOSURES

SCENARIO: Protective overall over no clothing, gloves		MICROGRAMS PER LB AI SPRAYED				Obs.
PATCH	DISTRIB.	Mean	Coef of Var	Geo. Mean		
LOCATION	TYPE	Median				
HEAD (ALL)	Lognormal	3.51	220.9774	3.2635		105
NECK.FRONT	Lognormal	.36	238.4405	.3608		103
NECK.BACK	Lognormal	.154	233.486	.2303		102
UPPER ARMS	Other	.582	228.8233	1.6244		16
CHEST	Lognormal	1.5975	139.1049	1.6924		16
BACK	Lognormal	1.775	246.7903	2.8475		19
FOREARMS	Lognormal	.6655	319.7481	.8009		20
THIGHS	Lognormal	.573	47.1379	.5402		2
LOWER LEGS	Lognormal	1.666	123.359	1.3326		21
FEET						0
HANDS	Lognormal	7.742	114.1313	4.4902		18
TOTAL DERM:	16.1404	18.625	174.7579	17.1828		
INHALATION:	Other	.491	227.1592	.5532		108
COMBINED:	16.6314	19.116	178.441	17.736		

95% C.I. on Mean: Dermal: [-2970.6567, 3320.1725]

95% C.I. on Geo. Mean: Inhalation: [.009, 33.8257]

Inhalation Rate : 25 Liters/Minute

Data File: APPLICATOR

Number of Records: 111

Subset Name: PROBE.APPL

Appendix B. Exposure Statistics for Mixer/loaders Handling a Wettable Powder Formulation of Methazole to Cotton Using Ground Boom Equipment. Obtained from the Pesticide Handlers Exposure Database (PHED), Version 1.01, dated 5/13/92.

SUMMARY STATISTICS FOR CALCULATED DERMAL EXPOSURES

SCENARIO: Protective overall over no clothing, gloves		MICROGRAMS PER LB AI MIXED				Obs.
PATCH	DISTRIB.	Mean	Coef of Var	Geo. Mean		
LOCATION	TYPE	Median				
HEAD (ALL)	Lognormal	52.26	65.31	94.0289	22.9793	39
NECK.FRONT	Normal	9.165	10.6708	92.9537	3.8922	39
NECK.BACK	Normal	3.025	4.6056	118.8054	1.3032	39
UPPER ARMS	Lognormal	18.333	127.6035	140.0647	29.2713	8
CHEST	Lognormal	13.49	68.515	185.5086	20.6539	5
BACK	Lognormal	12.78	154.6025	157.03	33.4495	6
FOREARMS	Lognormal	13.189	19.0373	71.4508	14.7038	9
THIGHS	Lognormal	17.572	26.6636	52.9448	23.872	5
LOWER LEGS	Lognormal	4.76	8.7465	106.1659	6.1847	4
FEET						0
HANDS	Lognormal	29.4489	40.0501	77.5958	29.3862	8
TOTAL DERM:	195.7771	174.0229	525.8049		185.6961	
INHALATION:	Lognormal	3.1922	36.6771	276.4136	2.6977	41
COMBINED:	198.4748	177.2151	562.482		188.3938	

95% C.I. on Mean: Dermal: [-7638.1896, 8689.7994]
 95% C.I. on Geo. Mean: Inhalation: [.0177, 411.1736]

Inhalation Rate : 25 Liters/Minute Number of Records: 41

Data File: MIXER/LOADER Subset Name: PROBEWP.MLOD

Appendix B. Unit Exposure Summary Statistics for Mixer/loaders Using Dry Flowable Formulations, Calculated using the Pesticide Handlers Exposure Database (PHED) Version 1.01, dated 5/13/92. Statistics were generated by OREB to confirm results submitted by the registrant.

SUMMARY STATISTICS FOR CALCULATED DERMAL EXPOSURES

SCENARIO: Protective overall over no clothing, gloves

PATCH LOCATION	DISTRIB. TYPE	Median	MICROGRAMS PER LB AI MIXED			Obs.
			Mean	Coef of Var	Geo. Mean	
HEAD (ALL)	Lognormal	16.575	35.7906	109.9166	17.5482	16
NECK.FRONT	Lognormal	8.055	13.9106	102.7059	5.8389	16
NECK.BACK	Lognormal	.5665	3.8954	152.6005	1.1169	16
UPPER ARMS	Lognormal	5.82	7.6751	122.0349	5.7753	16
CHEST	Lognormal	7.1	9.0525	56.739	8.0221	16
BACK	Lognormal	5.325	5.6578	29.4726	5.3841	16
FOREARMS	Lognormal	2.42	3.5317	74.0267	2.8683	16
THIGHS	Lognormal	21.01	143.7991	232.209	31.365	16
LOWER LEGS	Other	4.76	27.1469	246.6433	8.3813	16
FEET						0
HANDS	Lognormal	10.6667	11.1217	30.8631	10.5675	16
TOTAL DERM:	93.2463	82.2982	261.5814		96.8676	
INHALATION:	Lognormal	.7332	1.1954	113.7862	.7752	16
COMBINED:	94.0215	83.0314	262.7768		97.6428	

95% C.I. on Mean: Dermal: [-5059.0451, 5582.2079]
 95% C.I. on Geo. Mean: Inhalation: [.1209, 4.9721]
 Inhalation Rate : 29 Liters/Minute
 Data File: MIXER/LOADER
 Number of Records: 16
 Subset Name: PROBE.WDG.MLOD

Appendix C. Unit Exposure Summary Statistics for Applicators Using Ground Boom Equipment, Calculated using the Pesticide Handlers Exposure Database (PHED) Version 1.01, dated 5/13/92. Statistics were generated by OREB to confirm results submitted by the registrant.

SUMMARY STATISTICS FOR CALCULATED DERMAL EXPOSURES

SCENARIO: Long pants, long sleeves, no gloves		MICROGRAMS PER LB AI SPRAYED				Obs.
PATCH	DISTRIB.	Mean	Coef of Var	Geo.	Mean	Obs.
LOCATION	TYPE	Median				
HEAD (ALL)	Lognormal	7.02	188.6086	5.4023	5.4023	77
NECK.FRONT	Lognormal	.705	205.934	.5523	.5523	75
NECK.BACK	Lognormal	.3905	199.368	.3761	.3761	74
UPPER ARMS	Other	.291	0	.291	.291	6
CHEST	Other	.71	205.7953	1.621	1.621	39
BACK	Other	2.13	181.4676	1.9108	1.9108	24
FOREARMS	Lognormal	.726	151.5618	.8094	.8094	14
THIGHS	Other	.382	165.5202	.5749	.5749	14
LOWER LEGS	Other	.238	232.805	.4201	.4201	14
FEET						0
HANDS	Lognormal	20.8676	224.686	15.6989	15.6989	60
TOTAL DERM:	26.59	33.4601	129.3517	27.6568	27.6568	
INHALATION:	Other	.6664	196.7911	1.1602	1.1602	80
COMBINED:	27.2564	34.1265	134.9299	28.817	28.817	

95% C.I. on Mean: Dermal: [-1258.7391, 1517.4425]

95% C.I. on Geo. Mean: Inhalation: [.033, 40.8102]

Inhalation Rate : 29 Liters/Minute

Data File: APPLICATOR

Number of Records: 83
Subset Name: PROBE.JSCF.APPL