EAB File

Shaughnessy No: 128857

Date Out of EAB: 4/22/88

To: Lois Rossi
Product Manager 21
Registration Division (TS-767C)

From: Michael P. Firestone, Chief
Special Review Section #2
Exposure Assessment Branch/HED (TS-769C)

Thru: Paul F. Schuda, Chief
Exposure Assessment Branch/HED (TS-769C)

Attached, please find the EAB review of:

Reg./File # : 214,087

Chemical Name : Myclobutanil

Type Product : Fungicide

Product Name :

Company Name : Rohm and Haas

Purpose : Exposure Assessment

Date Received : 2/8/88 Action Code: 111

Date Completed: 4/22/88 EAB #(s): 80379

Monitoring study requested: _____ Total Reviewing Time: 5 days

Monitoring study volunteered: X

Deferrals to: _____ Ecological Effects Branch

_____ Residue Chemistry Branch

_____ Toxicology Branch

1

REGISTRATION DIVISION DATA REVIEW RECORD

Confidential Business Information — Does Not Contain National Security Information (E.O. 12065) 4/6/21 HE

2/9/88

1. CHEMICAL NAME: MYCLOBUTANIL — MRID

2. IDENTIFYING NUMBER	3. ACTION CODE	~~4. ACCESSION~~ NUMBER
707-ERL	111	40489301
		40489302
		40489303
		40489304

TO BE COMPLETED BY PM

5. RECORD NUMBER: 214067
6. REFERENCE NUMBER: 1
7. DATE RECEIVED (EPA): 01/27/88
8. STATUTORY DUE DATE:
9. PRODUCT MANAGER (PM): ROSSI/SCHNAUBELT
10. PM TEAM NUMBER: 21

TO BE COMPLETED BY PCB

11. DATE SENT TO HED/TSS: 2-8-88
12. PRIORITY NUMBER: 42
13. PROJECTED RETURN DATE: 2-27-88

14. CHECK IF APPLICABLE

AH

- ☐ Public Health/Quarantine
- ☐ Minor Use
- ☐ Substitute Chemical
- ☐ Part of IPM
- ☒ Seasonal Concern
- ☐ Review Requires Less Than 4 Hours

15. INSTRUCTIONS TO REVIEWER

A. HED
- ☐ Total Assessment - 3(c)(5)
- ☐ Incremental Risk Assessment - 3(c)(7) and/or E.L. Johnson memo of May 12, 1977.

B. SPRD (Send Copy of Form to SPRD PM)
- ☐ Chemical Undergoing Active RPAR Review
- ☐ Chemical Undergoing Active Registration Standards Review

C. ☐ BFSD
D. ☐ TSS/RD
E. ☐ Other

F. INSTRUCTIONS

REVIEW WORKER EXPOSURE DATA SUBMITTED IN SUPPORT OF NEW CHEMICAL REGISTRATION. WILL THESE STUDIES SUPPORT OTHER FORMULATIONS (60 DF, 2EC, 40 W [LOOSE PACK])?

16. RELATED ACTIONS: SEE 5/29/87 MEMO FROM PAM HURLEY (TB) TO BOB HOLST RE REQUEST FOR EXPOSURE ANALYSIS. (COPY ATTACHED)

17. 3(c)(1)(D)
- ☐ Use Any or All Available Information
- ☐ Use Only Attached Data
- ☐ Use Only the Attached Data for Formulation and Any or All Available Information on the Technical or Manufacturing Chemical.

18. REVIEWS SENT TO
- ☐ TB
- ☐ EEB
- ☐ EF
- ☐ PL
- ☐ RCB
- ☒ EFB
- ☐ CH
- ☐ BFSD

19. To	TYPE OF REVIEW	NUMBER OF ACTIONS: Registration	Petition	EUP	SLN	Sec. 18	Inert	MNR. USE	Other
HED	TOXICOLOGY								
HED	ECOLOGICAL EFFECTS								
HED	RESIDUE CHEMISTRY								
HED	☒ ENVIRONMENTAL DATE								
RD/TSS	CHEMISTRY								
RD/TSS	EFFICACY								
RD/TSS	PRECAUTIONARY LABELING								
BFSD	ECONOMIC ANALYSIS								

20. ☒ Label Submitted with Application Attached
21. ☐ Confidential Statement of Formula
22. ☐ Representative Labels Showing Accepted Uses Attached
23. Date Returned to RD (to be completed by HED)
24. Include an Original and 4 (four) Copies of This Completed Form for Each Branch Checked for Review.

EPA Form 8570-13 (Rev. 11-81) PREVIOUS EDITIONS ARE OBSOLETE.

3

1.0 INTRODUCTION

The Registration Division (RD) has requested the Exposure Assessment Branch (EAB) to conduct an exposure assessment for handlers of myclobutanil. Myclobutanil is a fungicide that Rohm & Haas is seeking to register. The proposed myclobutanil products are as follows:

For apples and grapes:	Rally 60DF Fungicide, a dry flowable
	Rally 40W Fungicide, a wettable powder
	Rally 40W Agricultural Fungicide, a water-soluble packaged wettable powder
	Nova 40W Agricultural Fungicide, a water-soluble packaged wettable powder
For perennial grasses grown for seed:	Systhane 40W Fungicide, a wettable powder
	Systhane 2E Fungicide, an emulsifiable concentrate.

As part of the registration application, Rohm & Haas has submitted an exposure study in which Rally 40W Agricultural Fungicide was applied to grapes.

2.0 EVALUATION OF ROHM & HAAS EXPOSURE STUDY

Rohm & Haas has submitted an applicator study ("Applicator Exposure Study of Myclobutanil on Grapes," Zogorski, W.J. III, Rohm & Haas Report No. 31S-87-14, November 24, 1987, 1296 pages) in which dermal and inhalation exposure was monitored during mixing/loading and application of myclobutanil to grapes by airblast sprayers. Rohm & Haas also conducted biological monitoring of the workers to assess the internal dosage of myclobutanil and its metabolites.

2.1 METHODOLOGY

Rally 40W, a wettable powder formulation in 4-oz water-soluble bags that contain 40% myclobutanil, was applied to grapes at 0.125 lb ai/acre. A total of six applications were monitored in the central valley of California. Two applications were made at each of three locations. Each application involved the monitoring of a mixer/loader and an applicator, who were separate individuals. Trials 1, 2, 5, and 6 involved the application of

Rally 40W by airblast to 6.4 acres/trial and required 0.8 lb ai. Trials 3 and 4 involved the application of Rally 40W to 9.6 acres/trial and required 1.2 lb ai.

The passive dosimetry pads for monitoring dermal exposure consisted of an outer layer of 4" x 4" sterile gauze sponge followed by a 4" x 4" alpha-cellulose pad, aluminium foil, and filter paper backing sealed together with tape. Hand exposure inside chemical resistant gloves was monitored by using cotton undertaker gloves. The passive dosimetry patches were placed outside the clothing on a hat, both shoulders, upper chest and back, both forearms, thighs, and shins. These outer patches represent dermal exposure to uncovered skin surfaces. A second set of patches was placed under the pants, shirt, and hat on either the underwear or skin. These inner patches, intended to monitor dermal exposure to areas of the body covered by clothing, were placed in the same area as the outer patches but not directly under the outer patches. The chemical-resistant gloves were rinsed with alcohol to represent potential exposure to unprotected hands.

Inhalation exposure was monitored using modified half-face respirators as described by Durham and Wolfe. Preextracted filter pads were placed over the pesticide cartridge. An inverted polyethylene funnel with the neck removed was placed over the cartridge and collection pad to avoid direct drift.

Urine samples were collected for the biological monitoring portion of the study. Workers were provided with 100-ml medical urine sample containers. Samples were collected 24 hours prior to handling Rally and for 48 hours postexposure. From the samples, a preexposure, 24-hour sample, 48-hour sample, and a composite from all samples were analyzed for myclobutanil and its known metabolites. It is unclear from the report whether total urine output during the 48 hours was collected or if spot sampling was performed. Regardless, the urine data were reported as ug myclobutanil/ml urine rather than back calculated to total internal dosage of myclobutanil.

2.2 ANALYTICAL CHEMISTRY

Prestudy analyses of the dosimeters, liquid matrices, and urine were conducted to determine background levels of myclobutanil. Laboratory fortification of the dosimeters and liquid matrices was also done. The dosimeter pads were fortified at 0.1, 0.5, and 1.0 ug/sample. The percent recovery ranged from 98 to 119 percent. The cotton gloves had a recovery of 85 percent at a 0.1 ug fortification and 109 percent at the 0.5 ug fortification level. The alcohol washes for the chemical-resistant gloves were fortified at 10 and 20 ug and had recoveries of 79 to 102 percent. A recovery of 100 percent was determined for the respirator pad fortified at 0.05 ug, and the respirator pad fortified at 0.10 ug had myclobutanil recovered at 87 percent. The face swabs were

fortified at 0.1, 0.5, and 1.0 ug and the recoveries ranged from 85 to 110 percent. Laboratory fortified samples were also analyzed for storage stability over 54 days. Test results indicated that myclobutanil was stable on the collection matrices over 54 days of frozen storage.

Field fortification of the dosimeters, cotton gloves, chemical-resistant glove washes, respirator pads, and face swabs were conducted during each trial. Each monitoring device was fortified with 15 ug of Rally 40W and subjected to the same environmental conditions and handling that the study dosimeters were. The recoveries ranged from 89 percent with the glove washes to 96 percent with the face swabs.

Spray solutions were analyzed during each trial to determine the concentration of myclobutanil in the solution and hence the actual application rate. Aliquots of 10 mL were removed for the analysis. The nominal application rate was 0.125 lb ai/acre. The application rates as determined by the spray solution analyses were as follows:

Trial Nos.	1	2	3	4	5	6
Appl. Rate (lb ai/acre)	0.076	0.130	0.134	0.126	0.124	0.110

The actual application rates will be used by EAB to determine the pounds of active ingredient sprayed.

The dosimeter extracts were analyzed for myclobutanil residues by a Varian 3400 GLC gas chromatograph equipped with a thermionic detector. Urine residues were analyzed using a HP 5890 gas chromatograph with an electron capture detector. The limits of detection were 0.025 ug/sample for all dosimeters except the protective glove wash, which was 0.050 ug/wash. The limit of detection for the urine samples was 0.01 ppm (0.1 ug/10 g urine). EAB will use 50 percent of the limit of detection to calculate exposure to samples containing myclobutanil residues that were below the detection limit.

2.3 MIXER/LOADER AND APPLICATOR EXPOSURE TO MYCLOBUTANIL

EAB calculated exposure to the mixer/loaders and applicators using three scenarios. The first scenario estimates total potential exposure which is the exposure to the exposed skin or the clothing. Total potential exposure was calculated using only the outer monitoring devices (Table 1). The second scenario assumes the use of long pants, short-sleeve shirt, and no protective gloves. It must be emphasized that this scenario is being calculated upon the request of RD (memorandum from L. Rossi to M. Firestone, Myclobutanil Exposure Assessment, February 29, 1988) to estimate exposure without protective clothing. The exposure was calculated using the outer monitoring dosimeters to represent exposed skin

and the inner monitoring dosimeters to estimate exposure to body areas covered by the clothing. The exposure for this scenario would be indicative of the exposure resulting from not wearing the label-required clothing (Table 2). The third scenario assumes the use of label-required clothing. The mixer/loader and applicator are assumed to be wearing long pants, long-sleeve shirt, chemical-resistant gloves, and eye goggles (Table 3). EAB considers this protective clothing requirement to be reasonable.

Based on the amount of active ingredient handled by the mixer/loaders and on the exposure received during the mixer/loading process, the exposure to mixer/loaders handling myclobutanil as a water-soluble package wettable powder is as follows:

	Exposure (ug/lb ai)						
	R-1	R-2	R-3	R-4	R-5	R-6	Mean
Total Potential Exposure	14	420	27	33	178	71	124
Long Pants/Short-Sleeve Shirt	14	389	25	33	179	24	111
Long Pants/Long-Sleeve Shirt/Gloves	4.4	4.8	3.2	3.2	7.4	5.1	4.7

Not suprisingly, the factor that had the greatest influence on reducing the exposure to mixer/loaders was the use of protective gloves.

Applicator exposure was also estimated on a ug/lb ai basis. The pounds of active ingredient sprayed by the applicators were determined by multiplying the acres sprayed by the pounds ai sprayed per acre as determined from the spray tank solution analysis. Therefore, it was assumed that 0.49 lb ai was sprayed during the first replicate and that 0.83, 1.3, 1.2, 0.79, and 0.70 lb ai were sprayed during the second through sixth replicates, respectively. Based on these amounts of myclobutanil sprayed and the applicator exposure per replicate, the exposure to airblast applicators was as follows:

	Exposure (ug/lb ai)						
	R-1	R-2	R-3	R-4	R-5	R-6	Mean
Total Potential Exposure	2570	1100	208	163	1100	733	979
Long Pants/Short-Sleeve Shirt	435	125	42	36	200	101	157
Long Pants/Long-Sleeve Shirt/Gloves	29	16	7.7	5.0	97	14	28

The biological monitoring data were not suitable to permit EAB to estimate the internal dosage of myclobutanil. Supporting pharmacokinetic data were not provided. These data are essential in determining if urine was collected for a sufficient period of time, the metabolites of myclobutanil that are excreted, and what percentage of internal myclobutanil is excreted in the urine. The urine data were presented in the Rohm & Haas report as ug myclobutanil/mL urine. No data were provided on the total quantity of urine excreted; therefore, the total quantity of myclobutanil excreted could not be calculated.

3.0 MYCLOBUTANIL USE INFORMATION

The Science Support Branch/Benefits and Use Division (SSB/BUD) provided estimated use data for myclobutanil use on grapes, apples, and grasses, assuming that the product's registrations are granted (Use Exposure Report for Myclobutanil, J. Dean Hansen, March 31, 1988). Myclobutanil will most likely be applied to apples by airblast at 0.06 to 0.51 lb ai/acre at 200 to 600 gal spray/acre. The average apple orchard is 20 acres. A total of 1.2 to 10.2 lb ai will be handled to treat the 20 acres. Typically, the trees will be sprayed at 7- to 10-day intervals from early spring to late summer which would permit 14 applications/yr. The total lb of ai handled in a year would be 16.8 to 40.0 lb ai/yr. The 40 lb ai/yr is based on a label maximum application of 2.0 lb ai/acre/season.

Grapes are predicted to be treated with myclobutanil at 0.075 to 0.125 lb ai/acre. Airblast sprayers would apply 50 or more gallons of spray per acre and can treat up to 50 acres in a day. A total of 3.75 to 6.25 lb ai would be handled daily to treat 50 acres. The grapes would be sprayed 5 to 10 times at 14- to 21-day intervals from early spring to summer with a maximum application of 0.6 lb ai/acre/season. During a season a grower would handle 18.75 to 30 lb ai.

Myclobutanil is expected to be applied to grasses grown for seed at 0.1 to 0.2 lb ai/acre by ground-boom sprayer or by air. Unlike the grape and apple uses where the wettable powder formulation is expected to predominate, the emulsifiable concentrate is expected to be the formulation of choice for grass use. A total of 120 acres could be treated daily which would require 12 to 24 lb ai. The grass could be sprayed 4 to 8 times in a year with a label maximum rate of 0.78 lb ai/acre/season. The amount of myclobutanil handled annually would be 48 to 93.6 lb ai.

4.0 NONDIETARY EXPOSURE TO MYCLOBUTANIL

The exposure data from the Rohm & Haas study permitted EAB to estimate exposure to mixer/loaders and applicators handling wettable powder formulations packaged in water-soluble bags and spraying by airblast sprayer. Mixer/loaders handling the

wettable powder formulations that are not packaged in water-soluble bags will receive greater exposures. When the dry flowable and liquid formulations of myclobutanil are used, the mixer/loader exposures will differ from that produced by the water-soluble packaged wettable powders. EAB cannot quantify this difference but the direction and magnitude of the difference will depend on the use or nonuse of closed loading systems. The different formulations should have minimal impact on the applicator exposure. The ground-boom applicator is expected to receive a lower exposure than an airblast applicator for each pound of myclobutanil sprayed.

4.1 APPLES

The exposure to mixer/loaders and applicators applying myclobutanil as Rally 40W in water-soluble bags is presented below. The exposure estimates assume a 70-kg individual and are not adjusted for the dermal or inhalation absorption of myclobutanil.

Daily Mixer/Loader Exposure:

Total Potential: 124 ug/lb ai x 10.2 lb ai/day x 1/70 kg = 18 ug/kg/day

Short-Sleeve Shirt/Long Pants: 111 ug/lb ai x 10.2 lb ai/day x 1/70 = 16 ug/kg/day

Label-Required Clothing: 4.7 ug/lb ai x 10.2 lb ai/day x 1/70 kg = 0.68 ug/kg/day

Daily Airblast Applicator Exposure:

Total Potential: 979 ug/lb ai x 10.2 lb ai/day x 1/70 kg = 143 ug/kg/day

Short-Sleeve Shirt/Long Pants: 157 ug/lb ai x 10.2 lb ai/day x 1/70 kg = 23 ug/kg/day

Label-Required Clothing: 28 ug/lb ai x 10.2 lb ai/day x 1/70 kg = 4.1 ug/kg/day

Combined Daily Exposure

Total Potential: 18 ug/kg/day + 143 ug/kg/day = 161 ug/kg/day

Short-Sleeve Shirt/Long Pants: 16 ug/kg/day + 23 ug/kg/day = 39 ug/kg/day

Label-Required Clothing: 0.68 ug/kg/day + 4.1 ug/kg/day = 4.8 ug/kg/day

Annual Mixer/Loader Exposure

Total Potential: 125 ug/lb ai x 40.0 lb ai/yr x 1/70 kg = 71 ug/kg/yr

Short-Sleeve Shirt/Long Pants: 111 ug/lb ai x 40.0 lb ai/yr x 1/70 kg = 63 ug/kg/yr

Label-Required Clothing: 4.7 ug/lb ai x 40.0 lb ai/yr x 1/70 kg = 2.7 ug/kg/yr

5

Annual Airblast Application Exposure:

Total Potential: 979 ug/lb ai x 40.0 lb ai/yr x 1/70 kg = 559 ug/kg/yr

Short-Sleeve Shirt/Long Pants: 157 ug/lb ai x 40.0 lb ai/yr x 1/70 kg = 90 ug/kg/yr

Label-Required Clothing: 28 ug/lb ai x 40.0 lb ai/yr x 1/70 kg = 16 ug/kg/yr

Combined Annual Exposure:

Total Potential: 71 ug/kg/yr + 559 ug/kg/yr = 630 ug/kg/yr

Short-Sleeve Shirt/Long Pants: 63 ug/kg/yr + 90 ug/kg/yr = 153 ug/kg/yr

Label-Required Clothing: 2.7 ug/kg/yr + 16 ug/kg/yr = 19 ug/kg/yr

4.2 GRAPES

An estimation of exposure similar to that done for apples is presented as follows:

Daily Mixer/Loader Exposure:

Total Potential Exposure: 124 ug/lb ai x 6.25 lb ai/day x 1/70 kg = 11 ug/kg/day

Short-Sleeve Shirt/Long Pants: 111 ug/lb ai x 6.25 lb ai/day x 1/70 kg = 9.9 ug/kg/day

Label-Required Clothing: 4.7 ug/lb ai x 6.25 lb ai/day x 1/70 kg = 0.42 ug/kg/day

Daily Airblast Applicator Exposure:

Total Potential Exposure: 979 ug/lb ai x 6.25 lb ai/day x 1/70 kg = 87 ug/kg/day

Short-Sleeve Shirt/Long Pants: 157 ug/lb ai x 6.25 lb ai/day x 1/70 kg = 14 ug/kg/day

Label-Required Clothing: 28 ug/lb ai x 6.25 lb ai/day x 1/70 kg = 2.5 ug/kg/day

Combined Daily Exposure

Total Potential Exposure: 11 ug/kg/day + 87 ug/kg/day = 98 ug/kg/day

Short-Sleeve Shirt/Long Pants: 9.9 ug/kg/day + 14 ug/kg/day = 24 ug/kg/day

Label-Required Clothing: 0.42 ug/kg/day + 2.5 ug/kg/day = 2.9 ug/kg/day

Annual Mixer/Loader Exposure

Total Potential Exposure: 124 ug/lb ai x 30 lb ai/yr x 1/70 kg = 53 ug/kg/yr

Short-Sleeve Shirt/Long Pants: 111 ug/lb ai x 30 lb ai/yr x 1/70 kg = 48 ug/kg/yr

Label-Required Clothing: 4.7 ug/lb ai x 30 lb ai/yr x 1/70 kg = 2.0 ug/kg/yr

Annual Airblast Applicator Exposure

Total Potential Exposure: 979 ug/lb ai x 30 lb ai/yr x 1/70 kg = 420 ug/kg/yr

Short-Sleeve Shirt/Long Pants: 157 ug/lb ai x 30 lb ai/yr x 1/70 kg = 67 ug/kg/yr

Label-Required Clothing: 28 ug/lb ai x 30 lb ai/yr x 1/70 kg = 12 ug/kg/yr

Combined Annual Exposure:

Total Potential Exposure: 53 ug/kg/yr + 420 ug/kg/yr = 473 ug/kg/yr

Short-Sleeve Shirt/Long Pants: 48 ug/kg/yr + 67 ug/kg/yr = 115 ug/kg/yr

Label-Required Clothing: 2.0 ug/kg/yr + 12 ug/kg/yr = 14 ug/kg/yr

4.3 GRASS GROWN FOR SEED

Unlike grapes and apples, myclobutanil is applied to grass by ground-boom equipment, and the main formulation is expected to be the liquid 2 EC. The myclobutanil exposure study submitted by Rohm & Haas provided data only for the wettable powder in water-soluble bags formulation and for application by airblast spray. Although EAB has surrogate ground-boom data, the application rates in the surrogate studies were greater than 1.0 lb ai/acre. Myclobutanil would be applied to grass at 0.1 to 0.2 lb ai/acre. Based on the large difference in application rates between myclobutanil and the surrogate data base and the absence of appropriate exposure data in the Rohm & Haas study, EAB will defer estimating mixer/loader and applicator exposure to myclobutanil applied to grass.

5.0 CONCLUSIONS

Rohm & Haas is seeking to register myclobutanil for use as a fungicide on grapes, apples, and grass grown for seed. The registrant has submitted an exposure study in which mixer/loader and applicator exposure to the water-soluble packaged wettable powder formulation (Rally 40W Agricultural Fungicide) was monitored during airblast application to grapes. Daily and annual exposures were estimated based on the exposure study data and use information provided by SSB/BUD. The exposure estimates are based on use of

a wettable powder in water-soluble packaging and maximum application rates. The exposure estimates have not been adjusted for the dermal absorption of myclobutanil.

The total potential exposure to an individual mixing/loading and airblast applying myclobutanil is estimated to be 161 ug/kg/day and 630 ug/kg/yr for apples and 98 ug/kg/day and 473 ug/kg/yr for grapes.

The exposure to an individual mixing/loading and airblast applying myclobutanil while wearing long pants, short-sleeve shirt, and no protective gloves is estimated to be 39 ug/kg/day and 153 ug/kg/yr for apples and 24 ug/kg/day and 115 ug/kg/yr for grapes. This level of clothing is not sufficient to comply with the proposed myclobutanil clothing requirements.

The exposure to an individual mixing/loading and airblast applying myclobutanil while wearing the label-required long pants, long-sleeve shirt, and protective gloves is estimated to be 4.8 ug/kg/ day and 19 ug/kg/yr for apples and 2.9 ug/kg/day and 14 ug/kg/yr for grapes.

Insufficent data were submitted to permit estimating exposure during the use of myclobutanil on grass or for apples, grapes, and grass with formulations other than the water-soluble packaged wettable powder. Use of Rally 40W would yield higher exposures than those provided above because the wettable powder would not be in water-soluble bags.

Curt Lunchick
Special Review Section
Exposure Assessment Branch
Hazard Evaluation Division (TS-769C)

Table 1. Total Potential Exposure

I. APPLICATORS

Body Area	Exposure (ug) Repl. 1	Repl. 2	Repl. 3	Repl. 4	Repl. 5	Repl. 6
Face	0.73	0.65	0.93	0.45	0.013	0.14
Front of neck	4.0	6.1	1.7	0.38	1.3	1.9
Back of neck	3.6	2.6	0.65	0.19	3.8	0.91
Chest	94	145	41	8.9	32	44
Back	116	84	21	6.1	123	29
Upper arms	285	78	12	34	59	64
Forearms	59	26	9.7	19	45	36
Thighs	507	280	72	87	545	301
Shins	52	227	78	20	18	10
Hands	140	65	34	19	36	25
Inhalation	0.013	0.060	0.034	0.36	1.1	0.63
Total	1261	914	271	195	864	513

II. MIXER/LOADERS

Body Area	Exposure (ug) Repl. 1	Repl. 2	Repl. 3	Repl. 4	Repl. 5	Repl. 6
Face	0.013	0.013	0.013	0.013	0.013	0.013
Front of neck	0.029	0.21	0.029	0.029	0.029	0.029
Back of neck	0.021	0.12	0.021	0.021	0.021	0.021
Chest	0.69	4.9	0.69	0.69	0.69	0.69
Back	0.69	4.0	0.69	0.69	0.69	0.69
Upper arms	0.57	6.0	0.57	0.57	1.5	0.57
Forearms	0.24	1.6	0.24	0.24	0.24	0.24
Thighs	0.75	9.9	0.75	0.75	0.75	11
Shins	0.46	2.9	3.0	0.46	0.46	28
Hands	7.5	306	26	35	137	15
Inhalation	0.013	0.071	0.013	0.36	1.1	0.63
Total	11	336	32	39	142	57

Table 2. Exposure to Mixer/Loaders and Applicators Wearing Short-Sleeve Shirts and Long Pants

I. APPLICATORS

Body Area	Exposure (ug) Repl. 1	Repl. 2	Repl. 3	Repl. 4	Repl. 5	Repl. 6
Face	0.73	0.65	0.93	0.45	0.013	0.14
Front of neck	4.0	6.1	1.7	0.38	1.3	1.9
Back of neck	3.6	2.6	0.65	0.19	3.8	0.91
Chest	0.69	0.69	2.3	0.69	19	3.7
Back	0.69	0.69	0.69	0.69	43	0.69
Upper arms	2.3	0.57	0.77	0.65	7.4	0.57
Forearms	59	26	9.7	19	45	36
Thighs	1.1	0.75	1.9	0.75	0.75	0.75
Shins	0.46	0.46	0.99	0.46	0.46	0.46
Hands	140	65	34	19	36	25
Inhalation	0.013	0.060	0.034	0.36	1.1	0.63
Total	213	104	54	43	158	71

II. MIXER/LOADERS

Body Area	Exposure (ug) Repl. 1	Repl. 2	Repl. 3	Repl. 4	Repl. 5	Repl. 6
Face	0.013	0.013	0.013	0.013	0.013	0.013
Front of neck	0.029	0.21	0.029	0.029	0.029	0.029
Back of neck	0.021	0.12	0.021	0.021	0.021	0.021
Chest	0.69	0.69	0.69	0.69	0.69	0.69
Back	0.69	0.69	0.69	0.69	0.69	0.69
Upper arms	0.57	0.57	0.57	0.57	0.57	0.57
Forearms	0.24	1.6	0.24	0.24	0.24	0.24
Thighs	0.75	0.75	0.75	0.75	2.1	0.75
Shins	0.46	0.46	0.77	0.46	0.46	0.46
Hands	7.5	306	26	35	137	15
Inhalation	0.013	0.071	0.013	0.36	1.1	0.63
Total	11	311	30	39	143	19

Table 3. Exposure to Mixer/Loaders and Applicators Wearing Label-Required Clothing

I. APPLICATORS

Body Area	Exposure (ug) Repl. 1	Repl. 2	Repl. 3	Repl. 4	Repl. 5	Repl. 6
Face	0.73	0.65	0.93	0.45	0.013	0.14
Front of neck	4.0	6.1	1.7	0.38	1.3	1.9
Back of neck	3.6	2.6	0.65	0.19	3.8	0.91
Chest	0.69	0.69	2.3	0.69	19	3.7
Back	0.69	0.69	0.69	0.69	43	0.69
Upper arms	2.3	0.57	0.77	0.65	7.4	0.57
Forearms	0.40	0.24	0.40	0.31	0.24	0.24
Thighs	1.1	0.75	1.9	0.75	0.75	0.75
Shins	0.46	0.46	0.99	0.46	0.46	0.46
Hands	0.013	0.045	0.070	1.1	0.013	0.013
Inhalation	0.013	0.060	0.034	0.36	1.1	0.63
Total	14	13	10	6.0	77	10

II. MIXER/LOADERS

Body Area	Exposure (ug) Repl. 1	Repl. 2	Repl. 3	Repl. 4	Repl. 5	Repl. 6
Face	0.013	0.013	0.013	0.013	0.013	0.013
Front of neck	0.029	0.21	0.029	0.029	0.029	0.029
Back of neck	0.021	0.12	0.021	0.021	0.021	0.021
Chest	0.69	0.69	0.69	0.69	0.69	0.69
Back	0.69	0.69	0.69	0.69	0.69	0.69
Upper arms	0.57	0.57	0.57	0.57	0.57	0.57
Forearms	0.24	0.24	0.24	0.24	0.24	0.24
Thighs	0.75	0.75	0.75	0.75	2.1	0.75
Shins	0.46	0.46	0.77	0.46	0.46	0.46
Hands	0.013	0.013	0.013	0.013	0.013	0.013
Inhalation	0.013	0.071	0.013	0.36	1.1	0.63
Total	3.5	3.8	3.8	3.8	5.9	4.1