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

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OFFICE OF
PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: NON-DIETARY EXPOSURE ASSESSMENT FOR THE APPLICATION OF ATRAZINE USING AN OPEN CAB VERSUS A CLOSED CAB TRACTOR (No HED Project Number)

TO: Jude Andresean
Special Review Branch
Special Review and Reregistration Division (H7505c)

FROM: Steven M. Knott
Environmental Chemistry Review Section
Non-Dietary Exposure Branch
Health Effects Division (H7509c)

Steven Knott

THRU: Michael P. Firestone, Ph.D., Section Head
Environmental Chemistry Review Section
Non-Dietary Exposure Branch
Health Effects Division (H7509c)

M P Firestone

Charles L. Trichilo, Ph.D., Chief
Non-Dietary Exposure Branch
Health Effects Division (H7509c)

C L Trichilo

A. INTRODUCTION

As per SRB's 19 July 1989 oral request, the assessment of atrazine exposure via a ground-boom applicator (Lunchick, EAB# 80077, January 6, 1988) has been expanded to include open cab and closed cab tractors.

B. CONCLUSION

NDEB has assessd applicator exposure to Atrazine for applicators within a closed cab versus on open cab tractor. The exposure estimates assume a 70 kg individual and have not been adjusted for dermal absorption. NDEB defers to Toxicology Branch 1-IRS the adjustment of the dermal exposure estimates for the dermal absorption of Atrazine. The results of the exposure assessment are as follows:

		Estimated Annual Exposure (mg/kg/yr)
CORN		
Grower	Open Cab/Open Pour	20
	Closed Cab/Open Pour	5.8
Commercial	Open Cab/Open Pour	290
	Open Cab/Closed Pour	133
	Closed Cab/Open Pour	165
	Closed Cab/Closed Pour	7.6
SORGHUM		
Grower	Open Cab/Open Pour	16
	Closed Cab/Open Pour	4.1

C. DETAILED CONSIDERATIONS

1.0 ASSESSMENT OF UNIT EXPOSURE

The triazine herbicide, Atrazine, has previously been the subject of an exposure assessment to estimate nondietary risk to mixer-loaders and applicators. In the original assessment (Lunchick, EAB # 80077, January 6, 1988), exposure was assessed for ground-boom applicators using the following studies:

Study	Replicates	Exposure (mg/hr)	Clothing
Abbott	18	40	Long-Sleeved Shirt, Long Pants
Maitlen	21	0.7	Short-Sleeved Shirt, Long Pants
Dubelman	12	0.93	Long-Sleeved Shirt, Long Pants
Wojeck	23	72	Long-Sleeved Shirt, Long Pants
Staiff	20	0.4	Short-Sleeved Shirt, Long Pants
Wolfe	7	9.4	Short-Sleeved Shirt, Long Pants

These data were integrated to produce a weighted geometric mean of 4.6 mg/hr, at an application rate of 1.0 lb ai/acre. From these data, it was estimated that, for corn, a grower doing his/her own application may be exposed to an average of 1.2 mg/kg/yr. If the grower also acts as the mixer-loader, his/her combined exposure would average 6.4 mg/kg/yr. For a commercial applicator treating corn, the applicator's annual exposure would be 11 mg/kg/yr and, if the applicator mixes or loads the pesticide, the annual exposure may be 170 mg/kg/yr for open pour, or 14 mg/kg/yr for closed pour systems.

Data from these studies were also used to estimate exposure from applying Atrazine to sorghum. The annual exposure was calculated to be 0.97 mg/kg/yr with a combined exposure of 4.6 mg/kg/yr.

A large range exists in the data from the original six studies (0.4 mg/hr - 72 mg/hr). This has been attributed to variability in equipment, weather conditions, and the personal habits of the applicator.

In an attempt to further refine NDEB's prior assessment, ground-boom applicator exposure has been reevaluated to distinguish exposure to applicators within an open cab from those within a closed cab. Only a few of the original six studies identify tractor cab type. These are listed below:

OPEN CAB

Study	Replicates	Exposure (mg/hr)	Clothing
Abbott	18	39.9	Long Sleeved Shirt, Long Pants
Wojeck	21	76.7	Long Sleeved Shirt, Long Pants

CLOSED CAB

Study	Replicates	Exposure (mg/hr)	Clothing
Wojeck	2	28.4	Long Sleeved Shirt, Long Pants
Dubelman	6	0.93	Long Sleeved Shirt, Long Pants

In the open cab exposure studies, the total of 39 replicates yields a weighted, geometric mean of 56.7 mg/hr. A geometric mean was calculated because the full data set, used in the original assessment (EAB # 80077) consisted of a broad range of values which in general, have been assumed to follow a log normal distribution. Although a data sub-set (closed cabs) of 2 data points has no true distribution, it is assumed to have the same frequency distribution as the parent data set. Therefore, the geometric rather than the arithmetic mean was calculated. The influence of weather conditions and the personal habits of the applicator can still be observed in the difference between the two studies (39.3 vs. 76.7).

In the closed cab exposure study, the total of 8 replicates yields a weighted geometric mean of 2.2 mg/hr. Again, the range in data (0.93 vs. 28.4) indicates some variability in the factors discussed above.

Other equipment factors such as boom length, shielded booms and tractor size and design will also influence applicator exposure. The surrogate data do not contain sufficient identified replications of these subsets to quantify these effects on exposure.

2.0 ANNUAL NONDIETARY EXPOSURE TO ATRAZINE, CORN

Use information, discussed below, was obtained from a SSB/BUD (now BAB/BEAD) memorandum dated December 11, 1987. Atrazine is applied to corn at 2.0 lb ai/acre. A grower will handle 390 lb ai in treating 195 acres annually. The required spray time is 8.9 hours. The commercial applicator will treat 6000 acres annually, over an 80 hour period. The mixer-loader will handle 12000 lb of Atrazine.

The annual grower exposure, when atrazine is applied to corn is as follows:

Mixer-Loader Open Pour — 0.93 mg/lb x 390 lb/yr x 1/70 kg = 5.2 mg/kg/yr

Ground-Boom Applicators

- Open cab — 56.7 mg/hr x 2 x 8.9 hr/yr x 1/70 kg = 14 mg/kg/yr
- Closed cab — 2.2 mg/yr x 2 x 8.9 hr/yr x 1/70 kg = 0.56 mg/kg/yr

Combined

- Open cab — 5.2 mg/kg/yr + 14.4 mg/kg/yr = 20 mg/kg/yr
- Closed cab — 5.2 mg/kg/yr + 0.56 mg/kg/yr = 5.8 mg/kg/yr

If the commercial mixer-loader open pours Atrazine, the annual exposure is estimated to be 160 mg/kg/yr (0.93 mg/lb ai x 12000 lb/yr x 1/70 kg). If the mixer-loader uses a closed loading system, the annual exposure would be reduced to 2.6 mg/kg/yr (0.015 mg/lb ai x 12000 lb/yr x 1/70 kg). The annual commercial applicator exposure is as follows:

Ground-Boom applicator

Open cab - 56.7 mg/hr x 2 x 80 hr/yr x 1/70 kg = 130 mg/kg/yr

Closed cab - 2.2 mg/hr x 2 x 80 hr/yr x 1/70 kg = 5.0 mg/kg/yr

Combined exposure

Open cab/open pour - 160 mg/kg/yr + 130 mg/kg/yr = 290 mg/kg/yr

Open cab/closed pour - 2.6 mg/kg/yr + 130 mg/kg/yr = 133 mg/kg/yr

Closed cab/open pour - 5.0 mg/kg/yr + 160 mg/kg/yr = 165 mg/kg/yr

Closed cab/closed pour - 5.0 mg/kg/yr +2.6 mg/kg/yr = 7.6 mg/kg/yr

4.0 GROUND-BOOM APPLICATOR EXPOSURE, SORGHUM

The assessment of the ground-boom application of Atrazine to sorghum has also been further divided into an assessment of open cab versus closed cab exposure. Use information obtained from a BAB/BEAD memorandum dated July 3, 1989, indicated that 135 acres would be the typical annual acreage treated and would require 7.4 hours, spread over two days. Based on the average application rate of 2 lb ai/acre, a mixer-loader would handle 270 lb ai/yr.

Surrogate data was used in the assessment of the application of Atrazine to corn. Using these data, the dermal exposure to mixer-loaders wearing long pants, long-sleeved shirts and chemical resistant goggles, was estimated to be 0.93 mg/lb ai for open pour loading. For the ground boom applicator in an open cab, dermal exposure was estimated to average 56.7 mg/hr at an application rate of 1 lb ai/acre. For the ground boom applicator in a closed cab, dermal exposure was estimated to average 2.2 mg/hr. The applicator is assumed to be wearing long pants and long sleeved shirts. Inhalation exposure is negligible compared to dermal exposure. These data can be applied to sorghum as follows:

Annual dermal exposure during mixing and loading:
0.93 mg/lb ai x 270 lb ai/yr x 1/70 kg = 3.6 mg/kg/yr

The annual exposure to applicator in an open cab:
56.7 mg/hr x 2 x 7.4 hrs/yr x 1/70 kg = 12 mg/kg/yr

The annual exposure to applicator in a closed cab:
2.2 mg/hr x 2 x 7.4 hrs/yr x 1/70 kg = 0.46 mg/kg/yr

Typically, the private farmer will do both the mixing-loading and application of Atrazine to sorghum. The combined annual exposure to an applicator in an open cab would be 16 mg/kg/yr. That for an applicator in a closed cab would be 4.1 mg/kg/yr.

cc: SACB
Circulation
Correspondence File
Atrazine File

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