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

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

NOV 9 1990

MEMORANDUM

SUBJECT: POTENTIAL RISK MITIGATION MEASURES FOR COTTON WORKERS EXPOSED TO ARSENIC ACID

TO: Janet Auerbach Product Manager 60
Special Review Branch
Special Review and Reregistration Division (H7508C)

FROM: Arthur O. Schlosser, Chemist Arthur O. Schlosser
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THRU: Curt Lunchick, Acting Head Steven Knott for
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THRU: Charles L. Trichilo, Ph.D., Chief
Occupational and Residential Exposure Branch/HED
(H7509C)

Please find below the OREB review of.....

HED Project #: HED-0-1990

Reg File/Rec #: _____

Registration #: _____

Caswell #: 056

Company Name: _____

Date Received: 11/09/90 Action Code: _____

Monitoring Study Requested: _____ Reviewing Time: 3 Days

1/7

2

(1) INTRODUCTION

This is in response to your memo of September 27, 1990 in which Special Review Branch, SRRD, requested that OREB evaluate potential risk mitigation measures for workers associated with the application of arsenic acid to cotton. Measures to be considered are: (1) use of closed loading systems, (2) use of closed cab application equipment with air filtration systems, (3) improved container design, (4) protective clothing, (5) restriction on the amount of active ingredient handled or acreage treated.

(2) CONCLUSIONS/RECOMMENDATIONS

(A) Use of closed loading systems.

Data on dermal and respiratory exposure and risk for open and closed loading systems are presented in the JUL 18, 1989 memo entitled: Oncogenic Risk Assessment for Inorganic Arsenic. For inhalation exposure, OREB has no separate data for open and closed systems. Therefore, a single value was used for both scenarios. For Example, inhalation exposure for a grower mixing and loading for 5 applications per year was reported as 0.018 mg/yr for both open and closed systems. However, enough data does exist to allow refinement of the dermal exposure values for open and closed mixing and loading scenarios. For example, the grower described above would be exposed to 920 mg/yr and 15 mg/yr from open and closed loading respectively.

(B) Use of closed cab application equipment with air filtration systems.

OREB does not have data on which to base a reliable estimate of the potential for the mitigation of exposure and risk associated with the use of closed cabs for application of arsenic acid. While the use of closed cabs for application is expected to reduce exposure, this is not demonstrated by an analysis of applicator exposure data currently available and made for the bromoxynil special review by C. Lunchick (1). A statement from this document follows: As with the enclosed tractor cab option, insufficient data points are available to enable an adequate quantification of the exposure reductions which would be associated with these equipment types.

(C) Improved container design.

OREB does not have useful data on exposure mitigation from the use of improved container design. Efforts to mitigate exposure through the use of improved container design are discussed in the document on bromoxynil by C. Lunchick (1). Relevant statements from this document follow: HED believes that use of the new "no-glug" container will yield a reduction in mixer/loader exposure. Mixer/loader exposure occurs primarily from splashing of the liquid during pouring, dripping of the liquid on the container, and

2

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contact of the mixer/loader with the contaminated surface of the spray tank. The new container is expected to reduce the first two sources, but may have little effect on the third source..... HED does not believe the new container will yield exposure reductions as uniform or as great as the exposure reductions obtained by the use of closed loading systems. However, OREB cannot make any conclusions until the container design has been thoroughly reviewed.

(D) Protective clothing.

Since inhalation exposure results in the highest estimated levels of risk, the use of effective respirators could result in the most significant mitigation of exposure, 10 X or less, as indicated in Federal Register Proposed Rules (2). However, OREB does not believe that the recommended use of respirators would be practical. This is because of cost of quantitative fitting (or individual tailoring) of the respirators. In addition, there may be a problem with compliance because of the failure of the workers to use the respirators. Revised estimates of exposure and risk for the use of respirators and protective clothing (PC) are given below.

INHALATION EXPOSURE AND POTENTIAL RISKS FROM VARIOUS USES OF ARSENIC ASSUMING USE OF RESPIRATOR GIVING 10X MITIGATION***

ARSENIC ACID AS A COTTON DESICCANT

	ANNUAL EXPOSURE MG/YR		RISK**	
	Coastal Bend & Blackland	High Rolling Plains	Coastal Bend & Blacklands	High Rolling Plains
GROUND APPLICATION:				
GROWER [days/yr]	[5]	[10]		
M/L (open)*	0.018	0.035	$5.2X10^{-6}$	$1.0X10^{-5}$
M/L (closed)*	0.018	0.035	$5.2X10^{-6}$	$1.0X10^{-5}$
Applicator	0.73	1.5	$2.1X10^{-4}$	$4.4X10^{-4}$
M/L/A (open)*	0.75	1.5	$2.2X10^{-4}$	$4.4X10^{-4}$
M/L/A (closed)*	0.75	1.5	$2.2X10^{-4}$	$4.4X10^{-4}$
COMMERCIAL [days/yr]	[36]	[20]		
M/L (open)*	0.5	0.28	$1.4X10^{-4}$	$8.1X10^{-5}$
M/L (closed)*	0.5	0.28	$1.4X10^{-4}$	$8.1X10^{-5}$
Applicator	6.2	3.4	$1.8X10^{-3}$	$9.9\ 10^{-4}$
AERIAL: {days/yr]	[6]	[25]		
M/L (open)*	0.18	0.75	$5.2X10^{-5}$	$2.2X10^{-4}$
M/L (closed)*	0.18	0.75	$5.2X10^{-5}$	$2.2X10^{-4}$
Applicator	0.07	0.27	$2.0X10^{-5}$	$7.8X10^{-5}$

3
4

OTHER USES ON COTTON

	[days/yr]	MG/YR	RISK
STRIPPING			
CLOSED CAB	[100]	0.02	$5.8X10^{-6}$
OPEN TRACTOR	[15]	0.03	$8.7X10^{-6}$
GINNING	[100]	0.81	$2.4x10^{-4}$
COTTON TRASH DISPOSAL	[100]	0.58	$1.7x10^{-4}$

* Values for M/L (open pour) and M/L (closed loading) are identical since OREB does not have data for each scenario. The value estimated is based on data in which the loading system is unspecified.

** Risk Calculation assumes a 100% inhalation absorption value and Q1* of 15 $(mg/kg/d)^{-1}$ for inhalation exposure.

*** Mitigation of 10X is the maximum that can be expected with a half face mask (2).

Sample Calculation-
Unmitigated exposure - Grower M/L (open pour) = 0.18 mg/yr
Mitigation with respirator = 0.18 mg/yr X 0.1 = 0.018 mg/yr

The related risk-unmitigated = 5.2×10^{-5}
Risk related-mitigated = 5.2×10^{-6}

DERMAL EXPOSURE AND POTENTIAL RISKS FROM VARIOUS USES OF ARSENIC ACID AS A COTTON DESICCANT

	ANNUAL EXPOSURE MG/YR		RISK*	
	Coastal Bend & Blackland	High Rolling Plains	Coastal Bend & Blacklands	High Rolling Plains
GROUND APPLICATION:				
GROWER [days/yr]	[5]	[10]		
M/L (open)	920	1840	$2.9X10^{-5}$	$5.9X10^{-5}$
(open+PC)**	460	910	$1.4X10^{-5}$	$2.9X10^{-5}$
M/L (closed)	15	30	$4.8X10^{-7}$	$9.6X10^{-7}$
(closed+PC)**	9.1	18	$2.9X10^{-7}$	$5.8X10^{-7}$
Applicator	400	800	$1.3X10^{-5}$	$2.6X10^{-5}$
(with PC)	61	120	$2.0X10^{-6}$	$4.0X10^{-6}$
M/L/A (open)	1300	2700	$4.2X10^{-5}$	$8.6X10^{-5}$
(both with PC)	520	1000	$1.6X10^{-5}$	$3.3X10^{-5}$
M/L/A (closed)	420	830	$1.3X10^{-5}$	$2.7X10^{-5}$
(both with PC)	70	140	$2.3X10^{-6}$	$4.6X10^{-6}$
COMMERCIAL [days/yr]	[36]	[20]		
M/L (open)	27000	15000	$8.6X10^{-4}$	$4.8X10^{-4}$
(open+PC)	13000	7400	$4.3X10^{-4}$	$2.4X10^{-4}$
M/L (closed)	450	250	$1.4X10^{-5}$	$8.0X10^{-6}$
(closed+PC)	270	150	$8.5X10^{-6}$	$4.9X10^{-6}$
Applicator	3500	1900	$1.1X10^{-4}$	$6.1X10^{-5}$
(with PC)	530	290	$1.7X10^{-5}$	$9.3X10^{-6}$
AERIAL: [days/yr]	[6]	[25]		
M/L (open)	8800	37000	$2.8X10^{-4}$	$1.2X10^{-3}$
(open+PC)	4400	18000	$1.4X10^{-4}$	$5.9X10^{-4}$
M/L (closed)	146	610	$4.7X10^{-6}$	$6.2X10^{-5}$
(closed+PC)	89	370	$2.9X10^{-6}$	$3.8X10^{-5}$
Applicator	22	92	$7.0X10^{-7}$	$2.9X10^{-6}$

OTHER USES ON COTTON

	[days/yr]	MG/YR	RISK
STRIPPING			
CLOSED CAB	[100]	UNKNOWN	
OPEN TRACTOR	[15]	UNKNOWN	
GINNING	[100]	UNKNOWN	
COTTON TRASH DISPOSAL	[100]	UNKNOWN	

* Risk Calculation assumes a 0.1% (0.001) dermal absorption value and Q1* of 1.65 $(mg/kg/d)^{-1}$ for dermal exposure.

** PC (Protective Clothing)- Assumes complete protection to torso and limbs and gloves that provide 90% protection to hands. This can be considered to be the maximum achievable.

Sample Calculations -

OREB Surrogate Data factors-
M/L open pour = 0.93 mg/lb
M/L open pour - protective clothing and gloves = 0.43 mg/lb
M/L closed loading = 0.015 mg/lb
M/L closed loading - protective clothing and gloves = 0.0091 mg/lb
Applicator normal work clothes = 4.6 mg/hr
Applicator - protective clothing and gloves = 0.70 mg/hr

To calculate (M/L open pour) to (M/L open pour + PC) multiply by 0.43/0.93 = 0.495 e.g. M/L open pour - 920 mg/yr X 0.495 = 460 mg/yr.
The same factor is used to convert the risk.

To calculate (M/L closed pour) to (M/L closed pour + PC) multiply by 0.0091/0.015 = 0.607 e.g., M/L closed pour - 15 mg/yr X 0.607 = 9.1 mg/yr. The same factor is used to convert the risk.

To calculate (Applicator) to (Applicator with PC) multiply by 0.70/4.6 = 0.152 e.g., Applicator - 400 mg/yr X 0.152 = 61 mg/yr. The same factor is used to convert the risk.

(E) Restriction on the amount of active ingredient handled or acreage treated.

These restrictions would be expected to mitigate exposure linearly based on pounds of A.I. handled. However, OREB defers to the Office of Compliance Monitoring to determine if this option is practical. To reduce exposure by an order of magnitude may require

reductions in acreage treated and/or lbs. of A.I. handled that are not practical or enforceable.

REFERENCES

(1) Exposure Analysis for Proposed Bromoxynil Label Restrictions and Requirements. Curt Lunchick OREB/HEB.

(2) Table I-Respiratory Protection for Cadmium. Federal Register/ Vol. 55, No. 25/ Tuesday, February 6, 1990/ Proposed Rules

Attachments (3)

cc: A. Schlosser/OREB (H7509C)
Taylor/TOX-HFS (H7509C)
Miller/RD (H7505C)
L. Dorsey/SACB (H7509C)
L.Kutney/SACB (H7509C)
Chemical File/Arsenic
Correspondence
Circulation