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OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Estimates of Exposure for Fortress (Chlorethoxyfos).

FROM: Charles Lewis *Chuck Lewis*
Special Review and Registration Section II

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THRU: Mark I. Dow, Ph.D., Section Head *Mark I. Dow*
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Health Effects Division (7509C)

The Occupational and Residential Exposure Branch (OREB) has been requested by the Risk Characterization and Analysis Branch (RCAB) to provide estimates of exposure for two E.I. du Pont de Nemours and Company products, Fortress® 5G (SmartBox™) and Fortress® 2.5G. The exposure estimates are attached.

DP Barcode: None

Pesticide Chemical Code: 129006

EPA Reg. No.: 352-LLG

PHED: No



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I. INTRODUCTION:

A. Background:

As stated in the OREB review of May 11, 1995, the exposure study submitted by DuPont (MRID 425592-22) satisfies the Subdivision U guideline requirements for the Fortress® 5G product tested during the study. However, in a meeting with the registrant on July 26, 1995, OREB was informed that the Fortress® 5G product tested was a prototype and therefore different than the current Fortress® 2.5G product. OREB has estimated exposure to loaders and applicators of Fortress® 2.5G based on the exposure data contained in the previously submitted DuPont study. OREB has assumed that the exposure potential from the current Fortress® 2.5G product is the same as for the product tested during the study. Currently, no exposure data are available for Fortress® 5G applied with the SmartBox™.

Current estimates of exposure for Fortress® 2.5G assume loaders will wear long-sleeved shirt, long pants, waterproof gloves, shoes plus socks, coveralls, protective eyewear¹ and an organic vapor (OV) respirator.

Loaders working with the SmartBox™ must wear long-sleeved shirt, long pants, waterproof gloves, shoes plus socks, protective eyewear, and an OV respirator.

Applicators of both Fortress® 2.5G and Fortress® 5G (SmartBox™) must wear long-sleeved shirt, long pants, and shoes plus socks while operating a closed cab tractor. For either formulation, if the applicator exits the cab to make a repair or adjustment to the planter, the following PPE must be worn: waterproof gloves, coveralls, and protective eyewear. After completing the repairs/adjustments, but before reentering the cab, this PPE must be removed and placed in a chemical resistant bag. The bag must not be placed in the cab.

As currently labelled, Fortress® 5G (SmartBox™) is applied differently than that of the original Fortress® 5G formulation used for the exposure study. As a result, the PPE requirements may be more restrictive than might have been required if the exposure study had been conducted using the new technology

¹ The use of eye protection while handling Fortress® 5G (SmartBox™) and Fortress® 2.5G is not required by WPS based on the current toxicity values for the products (Tox Cat. III for Eye Irritation). However, the labels for both of these products require use of eye protection. OREB does not currently have data that would permit the quantification of the degree of protection provided by this additional PPE.

(SmartBox™). On the other hand, as mentioned above, the formulation used during the original exposure study was a prototype and different from that of the current products. As a result, the additional PPE required for the Fortress® 5G (SmartBox™) product are prudent until the data outlined later in this review are provided by the registrant.

The new closed loading system for the SmartBox™ should theoretically result in minimal exposure to the handler. However, OREB does not have data to verify this assumption. OREB believes that until data are provided for the closed system, this additional PPE is required.

TABLE 1 contains the unit of exposure values generated from the DuPont exposure study (MRID 425592-22). OREB has relied on these values in developing its estimates of exposure for Fortress® 2.5G.

TABLE 1. Unit of exposure values ($\mu\text{g}/\text{lb}$ ai handled) from the E.I. du Pont de Nemours and Company exposure study (MRID 425592-22) for loaders and applicators of Fortress® 5G.					
Task	Area sampled ($\mu\text{g}/\text{lb}$ ai handled)				
	Air Filters	Hands	Face/neck	T-shirt/tights	Total
Loading	2.4	0.2	0.7	1.5	4.8
Application	0.6	0.1	0.2	2.0	2.9

II. DETAILED CONSIDERATIONS:

A. Bag head-space exposure (2.5G).

During OREB's review of data collected in the exposure study submitted by DuPont, it was noted that for the loader component, inhalation exposure was 50% of total exposure. However, the exposure value for hands was only 4% of total exposure. Normally, one would expect insignificant exposure from inhalation and a much higher exposure level for hands. Apparently, since the product is being used as a fumigant (vapor pressure 1.7×10^{-3}), significant volatilization of the formulation was occurring. This volatilization is apparent from the data obtained from the air sampling devices worn by the loaders.

Because of the volatile nature of chlorethoxyfos, Toxicology Branch has expressed a concern for handlers being subjected to high concentrations of active ingredient when bags are

opened (24 bags would be required for treatment of 180 acres²). Based on the results of the exposure study, it would appear that some portion of the chemical collected by the personal air samplers was most likely from bag head-space. Unfortunately, OREB has no way of determining what portion of the inhalation exposure occurred during the other tasks performed during loading.

OREB feels it is imperative that a loader wear an approved organic vapor respirator during the loading process. Use of a dust/mist respirator would not provide the protection afforded by an OV respirator. Use of an OV respirator could reduce inhalation exposure by 90% (OREB Science Peer Review, April 4, 1994).

B. Cross contamination.

1. Loaders

The clothing scenario proposed by OREB for handlers should provide adequate protection during loading. However, OREB is very concerned about the potential contamination of the tractor cab following loading of the 2.5G product. PPE contaminated with chlorethoxyfos during loading could contaminate the cab. Data from the submitted study seem to indicate that this phenomena could occur. Therefore, loaders must remove the waterproof gloves, protective eyewear, OV respirator, and coveralls prior to entering the cab. The PPE that are removed must not be used again until properly cleaned.

Based on the type of equipment that DuPont has described as typical, OREB has assumed that one loading operation will be required per day³. Therefore, only one set of PPE would be required per day.

² The 2.5G formulation will be marketed in 50 pound bags. DuPont has estimated that 180 acres will be treated per day (Using information provided by Dr. Yuen-shaung Ng, Biological and Economic Analysis Division (BEAD), OREB has confirmed this estimate). Therefore, at an application rate of 6.5 lb product per acre, 24 bags would be opened during the loading process (6.5 lb 2.5G/A x 180 A ÷ 50 lb 2.5G/bag = 23.4 bags).

³ Use of a 16 row planter having insecticide boxes holding 70 pounds product would permit the operator to treat for approximately eight hours. OREB typically assumes an eight hour work day when estimating exposure from pesticides applied with ground equipment.

2. Applicators.

After entering the cab, if the applicator exits the cab to make a repair or adjustment to the planter, a set of coveralls, protective eyewear, and waterproof gloves are to be used other than that used during the loading process. Upon completion of the task, the PPE must be removed and stored in a chemical resistant bag outside the tractor prior to reentering the cab. OREB believes that this precaution could reduce exposure once the applicator has reentered the cab.

C. Fortress® 5G (Smartbox™) Exposure Study.

To answer the questions concerning potential inhalation exposure to workers during loading and application, a Subdivision U guideline exposure study is required for Fortress® 5G applied using the Smartbox™ system. The study must be conducted as outlined in Subdivision U and special consideration of the following issues in the design of the study protocol are needed.

1). Chlorethoxyfos concentrations, in the air and dermal exposure to loaders, during the transfer of the 5G product using the Smartbox™ system.

The original exposure study was conducted with Fortress® 5G loaded into conventional planter equipment. OREB can use this information to estimate exposure to loaders of Fortress® 2.5G formulation. Unfortunately, no data are available for Fortress® 5G when used in the Smartbox™. OREB is aware that the system should result in reduced dermal and inhalation exposure, however, since the product is volatile, there is a potential for exposure when material is transferred into the delivery system. Workers wearing a personal air sampler during this process could provide the information necessary to justify removal of an OV respirator requirement.

2). Chlorethoxyfos concentration inside the tractor cab during application of the 5G product.

Currently, there is no way for OREB to ascertain from the submitted study, when exposure is occurring during application. Workers wearing a personal air sampler as well as a separate air sampler located in the cab could provide this needed information.

D. Fortress® 2.5G Estimates of Exposure.

TABLE 2 contains the estimates of exposure, expressed as $\mu\text{g}/\text{kg bw}/\text{day}$, for loaders and applicators of Fortress® 2.5G. These values are based on DuPont's exposure study.

TABLE 2. Inhalation and dermal estimates of exposure ($\mu\text{g}/\text{kg bw}/\text{day}$) for loaders and applicators of Fortress® 2.5G.		
Task	Routes of Exposure ($\mu\text{g}/\text{kg bw}/\text{day}$)	
	Inhalation	Dermal
Loading	0.10	0.50
Application	0.25	0.48

E. Fortress® 5G (Smartbox™) Estimates of Exposure.

As indicated earlier, OREB does not have exposure data specific for Fortress® 5G when loaded and applied using the new Smartbox™ technology. However, based on several factors, OREB feels that this system of handling Fortress® 5G, could reduce worker exposure, particularly during the loading process.

1. Loading

Use of Fortress® 2.5G in a conventional planter will require a loader to open 24 bags of product. Based on the exposure study, 50% of total exposure reported during the loading process was from the air sampler. The remainder of the exposure was apparently from dermal exposure. Use of an OV respirator could reduce loader exposure by 90% (inhalation route).

Use of the Smartbox™ does not require loaders to open bags of product. According to DuPont, the loader only has to place the transfer box containing the formulation, obtained from the Dealer, on the Smartbox™ unit mounted on the planter. After the box has been attached and is in place, product is transferred into the lower unit. Theoretically, the loader should not come in contact with any of the product. This system should reduce loader dermal and inhalation exposure. However, since exposure to organic vapors is a concern, until the registrant provides inhalation data for workers involved with this task, an OV respirator will be required for workers loading Fortress® 5G (Smartbox™). In addition, a complete loader/applicator exposure study, based on Subdivision U Guidelines, is required for Fortress® 5G (Smartbox™).

2. Application.

For the exposure study previously conducted using conventional planters, applicators wore coveralls during the entire application period. Repairs and adjustments to equipment necessitated that the applicator exit the cab and make adjustments. In some instances, hoppers were clogged with foreign materials requiring the applicator to remove them by hand. Other problems involved clogged planters. Consequently, workers may have become contaminated outside the cab and then contaminated the inside of the tractor after reentering. OREB feels that by requiring removal of coveralls, protective eyewear, and waterproof gloves after making repairs or adjustments, but before reentering the cab when applying the 2.5G product, problems with cross contamination should be reduced.

Use of the Smartbox™ should negate the need for an applicator to unclog hoppers. Planters will undoubtedly need adjustments during application, however, the chance for exposure should be less than that of the 2.5G product. In addition, applicators must wear coveralls, protective eyewear, and waterproof gloves while outside the cab making adjustments or repairs to the planter. This PPE will be removed prior to reentering the cab, thereby reducing potential contamination of the cab.

F. PPE Requirements.

TABLE 3 contains the PPE requirements for both Fortress® 2.5G and Fortress® 5G (SmartBox™). These requirements are based on the DuPont exposure study conducted on Fortress® 5G (open loading, conventional planter).

TABLE 3. PPE requirements for Fortress® 2.5G and Fortress® 5G (SmartBox™) applied from a closed cab tractor.		
Task	Formulation	
	Fortress® 2.5G	Fortress® 5G (SmartBox™)
Loading	Coveralls, long-sleeved shirt, long pants, shoes plus socks, waterproof gloves, protective eyewear, and OV respirator.	Long-sleeved shirt, long pants, shoes plus socks, waterproof gloves, protective eyewear, and OV respirator.
Application (In cab)	Long-sleeved shirt, long pants, and shoes plus socks.	Long-sleeved shirt, long pants, and shoes plus socks.
Application (Outside cab)	Coveralls, long-sleeved shirt, long pants, shoe plus socks, waterproof gloves, and protective eyewear.	Coveralls, long-sleeved shirt, long pants, shoe plus socks, waterproof gloves, and protective eyewear.

G. Calculations

Lbs ai/day

Application rate 0.1625 lb ai/A (from MRID 435503-06) x 180 acres treated per day with ground equipment (from meeting with DuPont August 8, 1995) = 29.25 lb ai/day.

Estimates of Exposure

Fortress® 2.5G

Loaders - Dermal

2.4 µg/lb ai applied (open loading, wearing long-sleeved shirt, long pants, coveralls, waterproof gloves, and shoes plus socks) x 50% (dermal absorption⁴) x 29.25 lb ai/day ÷ 70 kg bw = 0.5014 µg ai/kg bw/day.

Loaders - Inhalation

0.24 µg/lb ai applied (open loading, 90% reduction of reported value based on **loader wearing OV respirator**) x 29.25 lb ai/day ÷ 70 kg bw = 0.10029 µg ai/kg bw/day.

Applicators - Dermal

2.3 µg/lb ai applied (closed cab, applicator wearing long-sleeved shirt, long pants, coveralls, waterproof gloves, and shoes plus socks) x 50% (dermal absorption) x 29.25 lb ai/day ÷ 70 kg bw = 0.4805 µg ai/kg bw/day.

Applicators - Inhalation

0.6 µg/lb ai applied (closed cab, applicator **not wearing OV respirator**) X 29.25 lb ai/day ÷ 70 kg bw = 0.25071 µg ai/kg bw/day.

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Correspondence File
Chemical File (129006)

⁴ Personal communication, K. Baetcke, TB/HED, August 10, 1995.