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OFFICE OF PREVENTION,
PESTICIDES AND
TOXIC SUBSTANCES

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MEMORANDUM

SUBJECT: Evaluation of the Potential Exposure of Workers to Propanil During Mixing/Loading and Aerial Application to Rice Fields Using Simultaneous Dermal Dosimetry and Biological Monitoring Techniques, MRID No. 46147801 and 46075501, DP Bar Code: D310487

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The following is HED's response to the document submitted by the Propanil Task Force II which responded to HED's review of the "Evaluation of the Potential Exposure of Workers to Propanil During Mixing/Loading and Aerial Application to Rice Fields Using Simultaneous Dermal Dosimetry and Biological Monitoring Techniques" and the "Propanil Exposures and Risk Assessment Based on Data From an Aerial Application Study in Rice with Liquid Formulations."

The Propanil Task Force II (PTF II) responded to the review by the U.S. Environmental Protection Agency ("EPA" or "Agency") of the final reports from the "Evaluation of the Potential Exposure of Workers to Propanil During Mixing/Loading and Aerial Application to Rice Fields Using Simultaneous Dermal Dosimetry and Biological Monitoring Techniques" and the "Propanil Exposures and Risk Assessment Based on Data From an Aerial Application Study

in Rice with Liquid Formulations." This document is the response to the latest PTF II document.

1. **PTF II states**: *A quantitati e risk assessment based on the urine data from workers is not reliable or appropriate . . . Available data are not sufficient to quantify propanil exposure to humans based n urine levels of 3,4-DCA. Human pharmacokinetics data are necessary to provide a alid approach for quantification. [M]ost of the workers handled propanil on the da s prior to the study application day, the days following the study application or in som cases both time periods. These exposures, coupled with the lack of human pharmacokir etic data, make it impossible to validly use the urine DCA concentrations seen in the v orker study for assessing the risk of propanil to workers.*

   HED response: The burde is on the registrant to determine the suitability of biomarkers and the appropriate pharma okinetics. HED concurs that accurate documentation of propanil exposures to the ha ndlers on the days prior to the study application day, the days following the study applica on or in some cases both time periods – in addition to the lack of precise pharmacokir etic data – make the use of the biomonitoring data problematic.

2. **PTF II states**: *The objectiv of the Task Force study was to measure potential exposure to mixer/loaders and pilots rom propanil that was mixed/loaded and applied in a realistic and routine fashio . Achieving this objective allows exposure assessments to be performed in a way that det rmines an accurate risk to mixer/loaders and pilots handling propanil.*

   HED response: The PTF II submitted to EPA a proposed protocol for conducting the handler monitoring study ar d EPA approved the protocol. However, when the actual study was conducted, there were thirteen amendments and forty deviations to the study protocol. This contributed t o the Agency's difficulty in determining whether the study was performed in a manner hat would allow an accurate risk to be estimated for mixers/loaders and pilots ha ndling propanil.

3. **PTF II states**: *Propanil is m ost commonly applied at 3 to 4 lbs ai/Acre when grasses are actively growing in the 3-4- eaf stage approximately 15-25 days after planting. Higher rates of propanil at 4-6 lbs ai/Acre are sometimes used when grasses are in the 4-6-leaf stage about 20-30 days afte planting or for emergency or "rescue" operations for older tillering grasses about 30-4) days from planting.*

   HED response: The protoc ol submitted by the PTF II and approved by EPA stated that

the maximum labeled rate of 6 pounds active ingredient per acre would be applied. HED is concerned that the lower application rate factor would be expected to result in less residue being deposited on the outer dosimeter, thus likely underestimating exposure and risk.

4. **PTF II states**: *The loading of propanil products into a spray tank of an airplane occurs in two stages. Propanil is removed from the product drum using a siphoning device commonly called a "STAM" pipe. This is similar methodology to that represented by the data in PHED. Propanil is mixed with other products and water in the mix tank and the mixture is transferred to the airplane spray tank via a dry-lock connector that attaches to the airplane tank from the mix tank.*

HED response: HED concurs that the mixing/loading methodology described by the PTF II is similar to the methodology represented in PHED for mixing/loading liquid formulations using closed systems.

5. **PTF II states**: *[U]nder realistic conditions, it is not unusual for pilots to only apply propanil and mixer/loaders will only load propanil for an average of about 2 hours per day.*

HED response: The protocol submitted by the PTF II and approved by EPA stated that "all workers will perform their work tasks for a typical amount of time that represents an entire workday. One replicate will be an entire workday for each test subject. . . . The air sampling pump will operate for the entire monitoring replicate (estimated to be 6-12 hours)." However, the average duration of actual handling for each replicate in the study was only 2.2 hours for mixers/loaders and only 1.7 hours for pilots. HED is concerned that the reduced handling time would be expected to result in less time for the residue to penetrate the outer dosimeter, thus likely underestimating exposure and risk..

6. **PTF II states**: *Early season application of propanil was chosen in order to meet the protocol requirement of finding mixer/loaders and pilots who did not have previous exposure to propanil in 2003.*

HED response: See #4 for HED comments regarding use of maximum application rate. HED also notes the study did not meet the protocol requirement of finding mixer/loaders and pilots who did not have previous exposure to propanil in 2003 (see #2).

7. **PTF II states**: *Field scient sts waited for propanil orders from growers and for wind conditions to be favorable b efore performing each replicate of the study.*

HED response: HED has n o concerns with this approach.

8. **PTF II states**: *The "outer dosimeter" worn by mixer/loaders and pilots was a 100% cotton long sleeve shirt and 100% cotton long pants.*

HED response: HED agree s that the "outer dosimeter" was a cotton long sleeve shirt and 100% cotton long pants, an not a cotton coverall.

9. **PTF II states**: *The Task Fo rce proposes an alternative method to calculate the potential dermal exposure to the mixe r/loaders wearing the chemical-resistant apron. The proposed method to recalcu ate the dermal exposure to propanil mixer/loaders uses a penetration factor of 10%. Average penetration factors ranging from 2-27% percent have been observed in studi s since 1981 (References 1-4). Thus, a reasonable average penetration factor to use for subsequent calculations would be 10% for the upper and lower arms as well as the ba ck of the legs of the mixer/loader.*

HED response: The standa d operating procedure in HED is to use a penetration factor of 50% when estimating the reduction in exposure provided by an additional layer of protections. HED routinely applies this 50% penetration factor to PHED data to estimate the additional protection off ered by wearing coveralls over a long-sleeve shirt and long pants. HED notes that the G uidance Manual for Selecting Protective Clothing for Agricultural Pesticide Oper tions (EPA publication number 736-B-94-001) that summarizes literature on pe sonal protective equipment, including body protection states: "The amount of penetration was not linear with applied volume, rather the percent penetration increased with t ie amount applied. A fabric that provided relatively high penetration resistance at one volume did not necessarily provide a relatively high resistance at a different volu me. There seems to be an absorbency capacity threshold beyond which the penetratio n resistance of some fabrics drops off dramatically. This behavior must be borne in m ind when reviewing penetration data in which different volumes are applied. The c apacity threshold may account for apparent discrepancies in data reported from different researchers (p. 70)."

10. **PTF II states**: *This 10% pe netration factor is a conservative estimate of penetration since the front top of the thi hs down to the ankle of the mixer/loader were covered by the chemical resistant apron wo rn by the mixer/loader test subjects in this study. This*

covered area of the body would result in much less than 10% penetration through the front thigh and calf areas of the legs.

HED response: Even though the apron worn in the study apparently covered the mixer/loader down to his/her ankles, the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170) defines a chemical-resistant apron as "an apron that is made of chemical-resistant material and that covers the front of the body from mid-chest to the knees." Therefore, HED cannot assume that a mixer/loader would be completely covered in the front down to the ankles. Furthermore, the measured residues on the lower leg were likely reduced since the mixers/loaders wore "full rubber boots" in the study.

11. **PTF II states**: *The Task Force's proposed method of calculation of exposure to the mixer/loaders in this study is as follows:*

    a. *The residues of propanil on the legs and arms of the outer dosimeter long-sleeved cotton shirt and long cotton pants are summed. The sum is then multiplied by 0.1 to achieve the residue amounts given a 10% penetration factor for the cotton garments.*

    b. *The corrected residue on the arms and legs of the mixer/loader are then added to the residues of propanil on the t-shirt and brief as well as to the residues in the handwash. This sum is then added to the head, face and neck residues derived from the head patch data to provide a total dermal body exposure for the worker.*

HED response: HED concurs with the Propanil Task Force II's proposed method of calculation of exposure to mixers/loaders, except HED applied a 0.5 (i.e., 50%) factor to the summed residues on the legs and arms of the outer dosimeter.

12. **PTF II states**: *Only workers wearing chemical-resistant aprons are considered when using this alternative method of calculating exposure. The four workers wearing the Tyvek coverall were excluded from the data set since the Tyvek coverall would produce in theory an artificially low residue on the outer dosimeter shirt and pants, rendering the arms and leg data from the shirt and pants outer dosimeter useless.*

HED response: HED concurs in excluding the four mixers/loaders wearing Tyvek coveralls over the outer dosimeter from the calculations of dermal exposure. However, HED included the measured inhalation exposures of those four handlers, since the Tyvek coverall should have no effect on the inhalation exposures.

13. **PTF II states**: *When total dermal and inhalation exposures are normalized against pounds handled the resultant geometric means are: 1.30 ug/lb ai for dermal and 0.0065 ug/lb ai for inhalation.*

HED response: Using the same dermal and inhalation exposure values presented in the table in the PTF II response HED calculates a dermal exposure (geometric mean) of 1.2 µg per pound active ingredient handled and an inhalation exposure (geometric mean) of 0.0054 µg per pound active ingredient handled.

14. **PTF II states**: *Exposure and risk for mixer/loaders was recalculated based on the proposed method using a default penetration factor rather than a calculated one and only those workers who did not wear Tyvek. MOEs are acceptable for mixer/loaders who load for as many as 1200 acres a day.*

HED response: HED also calculated exposures and risks to mixers/loaders using the same methodology as the Propanil Task Force II, but using a dermal penetration value of 50%, rather than 10%, and also using slightly different data. The dermal data differed between HED and the PTF II in several ways:

- HED included mixer/loader replicate 21 in the calculations, but PTF II did not,
- the Head Patch data differed because HED adjusted for a field recovery of 73% versus the 83% field recovery adjustment used by the PTF II, and
- for replicate 27, HED used 576 pounds active ingredient handled per day as listed in the study (page 69), however PTF II used 1676 pounds active ingredient handled per day.

The inhalation data differed between HED and the PTF II, since HED used all the inhalation exposure values for the mixers/loaders (including those wearing Tyvek suits), whereas the PTF II used the inhalation exposure values for the mixers/loaders who were not wearing Tyvek suits.

Using HED's calculations and normalizing exposure by pounds active ingredient handled, the unit exposure value for dermal is 2.89 µg/lb ai handled and for inhalation is 0.0061 µg/lb ai handled.

HED used the propanil-specific unit exposure values from the PTF II study to estimate exposure and risks to mixer/loaders supporting aerial applications to rice (see Table 1). At the 6 lb ai/A application rate, the risks exceeded HED's level of concern (i.e., the MOEs were less than 300) when treating 1200 and 3200 acres per day. Risks were below

HED's level of concern (i.e., the MOEs were greater than 300) when treating 500 and 350 acres per day. At the 3 lb ai/A application rate, the risks exceeded HED's level of concern (i.e., the MOEs were less than 300) when treating 3200 acres per day. Risks at the 3 lb ai/A rate were below HED's level of concern (i.e., the MOEs were greater than 300) when treating 1200, 500, and 350 acres per day.

15. **PTF II states**: *The workers monitored in this study did work appropriate times and handled appropriate amounts of material. Recreating Scenarios 6 [closed mixing/loading liquid formulations] and 7 [applying sprays with enclosed cockpits] from the "PHED SURROGATE EXPOSURE GUIDE" (August, 1998) allows one to look at the amounts of material handled for both the mixer/loader and the pilot as well as the acres treated by the pilot. As can be seen from the . . . data, the Geometric Mean, Average, Median and Minimum Pounds Handled for the propanil study all exceed those same values for the data in PHED.*

HED response: HED believes it is irrelevant that the mixer/loader replicates for closed mixing/loading of liquid formulations in PHED involved handling of less active ingredient than in the propanil-specific study. The maximum number of pounds active ingredient applied to an acre varies widely among pesticide active ingredients and, as long as the studies in PHED reflect the maximum label application rate *for that active ingredient*, the results would appropriately reflect mixer/loader exposure. HED's position is that the PTF II propanil study could underestimate exposure to propanil due to the relatively short exposure times and the use of a maximum application rate that averaged slightly less than half of the maximum labeled application rate.

16. **PTF II states**: *Further, the hours worked [in the PTF II propanil-specific study] is consistent with PHED and likewise supports that the propanil data from the Study are superior to PHED with its pounds handled.*

HED response: HED notes that the mixer/loader (without Tyvek) hours worked in the PFT II study are significantly lower than mixer/loader hours worked in PHED. Using the geometric mean, the study hours represent only approximately 3/4 of the PHED hours and using the average, the study hours represent only approximately 2/3 of the PHED hours. Furthermore, HED notes that the acres treated in the PTF II study is consistently lower using the geometric mean, average, and median acres treated. Furthermore, PHED is a database made up of replicates of individual workcycles across studies and is not intended to represent the duration of a typical workday. The PTF II propanil-specific study protocol specified that the study would represent a typical work day.

17. **PTF II states**: *Data from the National Agricultural Aviation Association's survey in 2004 show that the average flying time for airplanes in aerial application scenarios on a given day is 3-4 hours. In the present study, mixing loading times ranged from 0.37 to 5.3 hours (median = 2.33 hours) and application times ranged from 0.68 to 3.82 hours (median = 1.59 hours). These mixer/loader and pilot replicate times are not extremely different from the data gathered by the National Agricultural Aviation Association in a survey performed in 2004 with aerial applicators throughout the US (Reference 5). It is concluded that the times that workers handled propanil during this study were realistic and routine.*

HED response: HED notes that in the PTF II study, the mixer/loader times and the application times were both significantly less than the *average* flying time for aerial applications found in the NAAA survey. HED further notes that the PTF II study, which is supposed to represent realistic and routine exposure times for aerial applications to rice, resulted in application to a *maximum* of 480 acres per day.

18. **PTF II states**: *The worker exposure study with propanil involving passive dosimetry was conducted according to typical current use practices followed in the rice industry. The amounts of product mixed and applied and the exposure times for mixer/loaders and pilots were typical of propanil uses and more representative of propanil uses than the data currently in PHED for the liquid mixer/loader and aerial applicator scenarios. There were no special considerations made regarding either the clothing or PPE worn by mixer/loaders or pilots and the procedures for mixing and transferal of propanil to and from mixing tanks and to airplanes were consistent with industry standards. Because of the consistency in rice industry procedures and practices, the dosimetry data are considered valid measures of worker exposure.*

HED response: HED's long standing policy is that chemical-specific data can be used instead of PHED data, *provided* that the chemical-specific data are equal to or higher quality than the PHED data. HED has many concerns with the PTF II study, including the use of the typical application rate, rather than maximum and the relatively short exposure times. In addition, OPPTS Series 875, Occupational and Residential Exposure Test Guidelines, Group A: 875.1200 (dermal exposure-indoor handler), and 875.1400 (inhalation exposure-indoor handler) clearly require a *minimum* of 15 replicates for each exposure scenario. The PTF II is proposing to eliminate 4 mixer/loader replicates (due to wearing Tyvek suits over the "outer" dosimeter) and another replicate was eliminated (because the handler mixed loaded and applied). That leaves only 10 replicates for the mixer/loader exposure scenario. PHED scenario 6 (closed system mixing/loading using liquid formulations) has 16 to 22 replicates for the dermal (non-hands) data, 31 replicates for the hands data, and 27 replicates for the inhalation data. This PHED scenario is rated as High Confidence. The PTF II study would be rated as low confidence for the dermal data due to the lack of replicates.

Table 1. Propanil Mixer/Loader Engineering Control Exposures and Risk

Exposure Scenario	Crop or Target	Application Rate (lb ai/acre)	Area Treated Daily (acres)	Engineering Control Unit Exposures		Engineering Control Dose (mg/kg/day)		Engineering Control MOE (Level of Concern = 300)		
				Dermal (mg/lb ai)	Inhalation (µg/lb ai)	Dermal	Inhalation	Dermal	Inhalation	Combined Dermal + Inhalation
Mixing/Loading Liquid Concentrates for Aerial Applications	Rice (PHED data)	6	3200	0.0086	0.083	0.47	0.023	19	400	**18**
	Rice (Propanil Dosimetry Data)		3200	0.0029	0.0061	0.18	0.0017	50	5400	**56**
	Rice (PHED data)		1200	0.0086	0.083	0.18	0.0085	51	1100	**49**
	Rice (Propanil Dosimetry Data)		1200	0.0029	0.0061	0.068	0.00063	130	14000	**150**
	Rice (PHED data)		500	0.0086	0.083	0.074	0.0036	120	2500	**110**
	Rice (Propanil Dosimetry Data)		500	0.0020	0.0061	0.028	0.00026	320	35000	360
	Rice (PHED data)		350	0.0086	0.083	0.052	0.0025	170	3600	**160**
	Rice (Propanil Dosimetry Data)		350	0.0029	0.0061	0.02	0.00018	460	49000	510
Mixing/Loading Liquid Concentrates for Aerial Applications	Rice (PHED data)	3	3200	0.0086	0.083	0.24	0.011	38	790	**36**
	Rice (Propanil Dosimetry Data)		3200	0.0029	0.0061	0.09	0.00083	100	11000	**110**
	Rice (PHED data)		1200	0.0086	0.083	0.088	0.0043	100	2100	**95**
	Rice (Propanil Dosimetry Data)		1200	0.0029	0.0061	0.034	0.00031	270	29000	300
	Rice (PHED data)		500	0.0086	0.083	0.037	0.0018	240	5100	**230**
	Rice (Propanil Dosimetry Data)		500	0.0029	0.0061	0.014	0.00013	640	69000	720
	Rice (PHED data)		350	0.0086	0.083	0.026	0.0012	350	7200	330
	Rice (Propanil Dosimetry Data)		350	0.0029	0.0061	0.0099	0.000091	910	99000	990

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