OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

Note to Reader

Background: As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply. EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, If unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

Note: This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket (RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

Jack E. Housenger, Acting Director
Special Review and Reregistration Division

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

OFFICE OF
PREVENTION, PESTICIDES AND
TOXIC SUBSTANCES

October 28, 1999

MEMORANDUM

SUBJECT: **Dicrotophos** (Chemical No: 035201; List A, Reregistration Case No. 0145).
HED Revision to Risk Assessment for Reregistration Eligibility Document (RED.)
DP Barcode: D260602; MRID: None.

FROM: David E. Hrdy, Biologist
Reregistration Branch IV
Health Effects Division (7509C)

THROUGH: Susan V. Hummel, Branch Senior Scientist
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TO: Michael Nieves/Stephanie Willett, Chemical Review Managers
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Attached is a revision of Health Effects Division's (HED's) risk assessment of dicrotophos for purposes of issuing a Reregistration Eligibility Decision (RED) Document for this active ingredient. Cumulative risk assessment considering risks from other pesticides or chemical compounds having a common mechanism of toxicity is not addressed in this document. This risk assessment document updates the August 20, 1999 version by addressing the factual errors provided by the Amvac. A separate memo specifically addresses each item in the registrant's *Comments on the Dicrotophos Risk Assessment* communication to SRRD (D260060, D. Hrdy) pertaining to the HED risk assessment. The disciplinary science chapters and other supporting documents for the Dicrotophos RED are included as attachments as follows:

Report of the Hazard Identification Assessment Review Committee. W. Greear (June 8, 1999)
Report of the FQPA Safety Factor Committee. B. Tarplee/J. Rowland (August 6, 1998)
Product & Residue Chemistry Chapter. G. Otakie (June 8, 1999, D241592)
Occupational and Residential Exposure Assessment. T. Leighton (August 16, 1999, D258491)
Dietary Exposure and Risk Estimates for Reregistration. D. Hrdy (August 20, 1999)
Incident Report. M. Spann and J. Blondell, Ph.D (July 9, 1998, D247490)
Environmental Fate and Effects Water EECs. K. McCormack (November 4, 1998)

RDI: BRSrSci: SVHummel

1.0 Executive Summary

The Health Effects Division (HED) has conducted a human health assessment for the active ingredient dicrotophos (dimethyl phosphate of 3-hydroxy-N,N-dimethyl-cis-crotonamide) for the purpose of making a reregistration eligibility decision. In conducting its assessment, HED evaluated the toxicology, residue chemistry, and exposure data bases for dicrotophos and determined that the data are adequate to support a reregistration eligibility decision. HED assessed acute and chronic (non-cancer) dietary risks and occupational risks. There are no residential/homeowner uses of dicrotophos.

Dicrotophos is a contact, systemic acaricide/insecticide registered for use on cotton [40 CFR §180.299]. The only dicrotophos end-use formulation currently registered is a water-miscible formulation (Bidrin®) which may be applied foliarly to established cotton plants. At this time products containing dicrotophos are intended for occupational use only. It is classified as Restricted Use and may be purchased and used only by certified applicators or persons under their direct supervision.

<u>Hazard Identification</u>

Dicrotophos is an organophosphate (OP) insecticide; its mode of toxic action is via the inhibition of cholinesterase (ChE) activity. In all studies in which ChE was measured, the Lowest Observed Adverse Effect Level (LOAEL) was based on plasma, red blood cell (RBC) or brain ChE inhibition. In some studies, including both short-term and chronic administration, all three effects were seen at the LOAEL. Dicrotophos is a potent cholinesterase inhibitor to rodents, rabbits and dogs at very low doses. Female rats are more sensitive than males in acute oral studies. The rat is also more sensitive than the mouse in both acute and chronic studies.

Dicrotophos is acutely toxic to rats by the oral and dermal routes of exposure. No inhalation data are available. Primary eye and skin irritation fall into Toxicity Categories II and IV, respectively. Dicrotophos is a strong dermal sensitizer. Evidence of ChE inhibition was observed in several of the studies, however there was no evidence of alterations in structural neuropathological (gross and histopathology) parameters. In a subchronic neurotoxicity study in rat, decreases in body weight and food consumption, and cholinesterase inhibition were observed.

There was no evidence of prenatal developmental toxicity or increased fetal susceptibility in rats or rabbits. In the 2-generation reproduction study, there was a decrease in the number of second generation pups/litter indicating reproductive toxicity. Offspring effects were not seen. Therefore, the developmental neurotoxicity study (with extended postnatal treatment) is not required.

The core toxicity study requirements, as well as additional environmental fate/effects, residue, drift and re-entry data were imposed in a subsequent Data Call-In (issued in 1991), while further DCIs imposed human incident data requirements (1993), as well as worker exposure requirement

(1995). Much of the available toxicology data do not satisfy current FIFRA Test Guideline requirements.

Based on the tumors in the mouse, a majority of the Cancer Assessment Review Committee (CARC) concluded that there is “Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential” because the evidence from animal data is suggestive of carcinogenicity, which raises a concern for carcinogenic effects but is judged not sufficient for a conclusion as to human carcinogenic potential. Such evidence includes evidence only in a single study. A cancer assessment was not required.

The FQPA Safety Factor Committee recommended that the FQPA safety factor of **10x** was **retained** for acute and chronic endpoints solely because of the inadequacy of the toxicology data base which precluded an evaluation of potential enhanced susceptibility to infants and children.

<u>Drinking Water Exposure</u>

Using the PRZM-EXAMS model and available environmental fate data for parent dicrotophos, EFED calculated the following Tier 2 Estimated Environmental Concentrations (EECs) for residues of dicrotophos in surface water as follows: Acute or peak EECs: 21 ppb and Chronic (yearly upper 10^{th} percentile) EECs: 0.6 ppb. Using the SCI-GROW model, EFED calculated the following EEC for dicrotophos in ground water: Dicrotophos: 0.005 ppb

<u>Non-Occupational Exposure And Risk Assessments</u>

HED conducted acute and chronic dietary (food) exposure analyses using the Dietary Exposure Evaluation Model ($DEEM^{TM}$). In the acute dietary assessment, exposure was compared to the acute Population Adjusted Dose (aPAD) based on the acute reference dose (RfD) reflecting retention of a 10x FQPA Safety Factor. In the chronic dietary assessment, exposure was compared to the chronic PAD based on the chronic RfD also reflecting retention of a 10x FQPA Safety Factor. HED considers dietary residue contributions greater than 100% of the PAD to be of concern. The acute and chronic analyses (Tier 3 for each analysis) are refined estimates using anticipated residues from field trial data, and percent of crop treated data from Biological Economic Analysis Division (BEAD). No monitoring data from USDA’s Pesticide Data Program (PDP) or FDA’s Surveillance Monitoring program were available for dicrotophos.

Acute dietary exposures (mg/kg/day) estimates at the 99.9 percentile were below HED’s level of concern for all subpopulations. The subgroup with the highest estimated exposure was children 1-6 yrs. Their exposure was estimated at 0.000004 mg/kg/day resulting in a risk estimate of 9% of the acute population adjusted dose (aPAD.) The general U.S. Population’s acute dietary exposure and risk estimates were 0.000002 mg/kg/day and 4% of the aPAD, respectively.

Chronic dietary exposures (mg/kg/day) estimates are below HED’s level of concern for all subpopulations. The subgroup with the highest estimated exposure was children 1-6 yrs their estimated exposure was 0.000001 mg/kg/day resulting in a risk estimate of 9.2% of the chronic population adjusted dose (cPAD.) The general U.S. Population's chronic dietary exposure and risk estimates were <0.000001 mg/kg/day and 4% of the cPAD, respectively.

Based on the above-calculated acute exposure from food, HED has calculated the acute Drinking Water Level of Comparison ($DWLOC_{acute}$) for acute dietary exposures to dicrotophos. The DWLOC is the concentration in drinking water which, when combined or aggregated with exposures through food, would result in an aggregate exposure which is acceptable. In other words, it is the theoretical concentration of a pesticide in drinking water which would be an acceptable upper limit in light of the total aggregate exposure to that pesticide through all pathways. If model-based estimated concentrations in ground and surface waters are less than the $DWLOC_{acute}$, OPP can conclude with reasonable certainty that aggregate exposure through food and drinking water do not exceed HED's level of concern.

HED's calculated $DWLOC_{acute}$ is 0.46 ppb (based on the most highly exposed subgroup, children 1-6). Enviromental Fate and Effects Division's (EFED's) model-based estimates for maximum concentrations in surface and ground water are 21 ppb and 0.005 ppb, respectively. Since the model-based estimate for concentrations in surface water (21 ppb) exceeds HED $DWLOC_{acute}$ of 0.46 ppm, HED cannot conclude that residues of dicrotophos in food and surface water result in levels of aggregate exposure below HED's level of concern. *Note: that model estimates for dicrotophos in ground water are below $DWLOC_{acute}$, therefore, HED concludes that with reasonable certainty that aggregate exposure to dicrotophos through food and ground water will not result in unacceptable exposure and risk.

Based on the above-calculated chronic exposure from food, HED has also calculated the chronic Drinking Water Level of Comparison ($DWLOC_{chronic}$) for chronic dietary exposures to dicrotophos.

HED's calculated $DWLOC_{chronic}$ is 0.01 ppb (based on the most exposed subgroup, children 1-6). EFED's model-based estimates for average concentrations of dicrotophos in surface and ground water are 0.6 ppb and 0.005 ppb, respectively. Since the model-based estimate for concentrations in surface water (0.6 ppb) exceeds HED's $DWLOC_{chronic}$ of 0.01 ppb, HED cannot conclude that residues of dicrotophos in food and surface water result in levels of aggregate exposure below HED's level of concern. *Note: that model estimates for dicrotophos in ground water are below $DWLOC_{chronic}$, therefore, HED concludes that with reasonable certainty that aggregate exposure to dicrotophos through food and ground water will not result in unacceptable exposure and risk.

<u>Aggregate (Food, Water and Residential) Exposure and Risk Estimate</u>

Aggregate risk is estimated by combining dietary (food and water) and residential exposures. Dicrotophos has no uses that could result in residential exposure, therefore, the aggregate risk estimate will be based on the dietary exposure from food and water only, for the most highly exposed population subgroups and the general population. Details concerning the assumptions used in deriving exposure estimates and risk characterizations were discussed previously in this document.

Occupational Exposure Summary and Characterization of Risk

There are no residential or non-occupational uses for dicrotophos; therefore residential exposures are not likely, nor are residential postapplication exposures expected. There is potential for spray drift during aerial application, however, HED does not currently have an approved method of assessing this scenario. Incident data do not indicate that spray drift is a problem.

Margins of exposures (MOEs) for occupational exposure risk assessments: The target MOE is 1000 for both dermal and inhalation exposure risk assessments and includes the conventional factor of 100 and an additional factor of 10 for the use of a LOAEL for all risk assessments.

No chemical-specific handler data are available. Surrogate data from the Pesticide Handlers Exposure Database (PHED) were used to estimate the exposures. The data in PHED for the typical agricultural scenarios assessed (i.e., aerial and groundboom) are representative of the cotton use. Since the toxicological endpoints for occupational risk assessments are LOAELs less than 1 mg/kg and the margin of exposure is required to be 1,000 or greater, only engineering control risk mitigation is assessed for dicrotophos handlers. The results of the short-term handler total risks indicate that 7 of the 24 scenarios calculated have MOEs greater than 1,000. MOEs ranged from 42 to 5,500. The results of the intermediate-term handler total risks indicate that none of the 24 scenarios calculated have MOEs greater than 1,000. MOEs ranged from 3 to 440.

Chemical-specific dislodgeable foliar residue (DFR) data were submitted in support of the postapplication assessment. However, worker reentry exposure data were not available, and therefore, transfer coefficients were estimated using HED standard values for scouting and hoeing activities. The results of the postapplication assessment indicate that MOEs are greater than 1,000 for short-term “late-season” scouting at day 12 and day 21 for the intermediate-term duration. The MOEs are greater than 1,000 for the short-term “early-season” scouting and hoeing on day 1 and day 10 for the intermediate-term duration.

The handler and postapplication assessments are believed to be reasonable high end representations of dicrotophos uses. There are, however, many uncertainties in these assessments. The uncertainties include but are not limited to the following:

- exposure of an intermediate-term duration to assess all uses;
- extrapolating exposure and DFR data by the amount of active ingredient handled or applied; and
- application timing in comparison to actual potential postapplication exposure scenarios.

These uncertainties are inherent in most pesticide exposure assessments. The conservative nature of the assessments, however, is believed to be protective of the handlers.

Conclusions

It should be noted that the combination of safety factors limits the degree of certainty with which the following conclusions can be drawn. The current 10,000 fold factor (including a 10x for inter-species, a 10x for intra-species, a 10x from HIARC because the endpoints used were from LOAELs and a 10x FQPA safety factor was retained for women and children subpopulations because of the inadequacy of the toxicology data base) resulted in PADs and MOEs that generated significantly smaller allowances for drinking water calculations and greater differences between calculated occupational risks and acceptable MOEs.

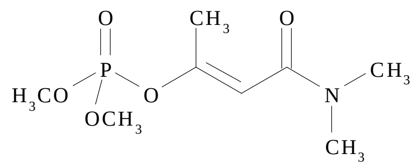
The anticipated residues used in the dietary assessment were not from monitoring data, rather from field trials. Therefore, it was assumed that the application rate was 1x with the shortest allowable pre-harvest interval (i.e. the maximum label rate.) This results in residues reflective at the farmgate, not the dinner plate. Field trial residues do not consider degradation and removal of residues through transport, distribution, washing, cooking, and peeling. Therefore, the dietary exposure estimates are conservative, upper bound estimates.

Dicrotophos has no uses that would legally result in residential exposure, therefore, the aggregate risk estimate was based on the dietary exposure from food and water only, for the most highly exposed population subgroups and the general population as appropriate.

Comparing the acute and chronic surface water EECs to the $DWLOC_{acute}$ and $DWLOC_{chronic}$, respectively, HED cannot conclude that residues of dicrotophos in food and surface water result in levels of aggregate exposure below HED's level of concern. *Note: that model estimates for dicrotophos in ground water are below both $DWLOC_{acute}$ and $DWLOC_{chronic}$, therefore, HED concludes that with reasonable certainty that aggregate exposure to dicrotophos through food and ground water will not result in unacceptable exposure and risk.

Short-term occupational handler total risks resulted in 17 of the 24 scenarios that have MOEs lower than 1,000. MOEs ranged from 42 to 5,500. All of the 24 intermediate-term occupational handler total risks scenarios resulted in MOEs below 1,000. MOEs ranged from 3 to 440. MOEs are greater than 1,000 for short-term “late-season” scouting at day 12 and day 21 for the intermediate-term duration. The MOEs are greater than 1,000 for the short-term “early-season” scouting and hoeing on day 1 and day 10 for the intermediate-term duration.

2.0 Physical/Chemical Properties Characterization



Empirical Formula:	$C_8H_{16}NO_5P$
Molecular Weight:	237.21
CAS Registry No.:	141-66-2
PC Code:	035201

Dicrotophos is a mixture of the E- and Z-isomers in which the E-isomer is pesticidally active. Technical dicrotophos is a yellow to dark amber liquid at room temperature with a boiling point of 111-112° C at 0.022 mm Hg (399° C at 760 mm Hg), density of 1.19-1.22 g/mL at 20 C, octanol/water partition coefficient (K_{ow} of PAI) of 2.445 (E-isomer) and 0.000481 (Z-isomer), and vapor pressure of 2.2 x 10^{-5} mm Hg at 20° C and/or 2.9 mPa at 20° C. Dicrotophos is miscible (mixable in all proportions) with water, acetone, alcohol, acetonitrile, chloroform, methylene chloride, and xylene. Dicrotophos is only slightly soluble in kerosene and diesel fuel.

3.0 HAZARD CHARACTERIZATION

3.1 Hazard Profile

Dicrotophos is an organophosphate (OP) insecticide whose mode of toxic action is the inhibition of cholinesterase (ChE). In all studies in which ChE was measured, the Lowest Observed Adverse Effect Level (LOAEL) was based on plasma, RBC and brain ChE inhibition. In some studies, including both short-term and chronic administration, all three effects were seen at the LOAEL. Dicrotophos is a potent ChE inhibitor at very low doses to rodents, rabbits and dogs. Female rats are more sensitive than males in acute oral studies. The rat is also more sensitive than the mouse in both acute and chronic studies.

Dicrotophos is acutely toxic to rats by the oral and dermal routes of exposure. No inhalation data are available. Primary eye and skin irritation fall into Toxicity Categories II and IV, respectively. Dicrotophos is a strong dermal sensitizer. ChE inhibition was observed in several of the studies, however there was no evidence of alterations in structural neuropathological (gross and histopathology) measurements. A subchronic neurotoxicity study was conducted in rat in which dicrotophos produced decreases in body weight and food consumption, and cholinesterase inhibition.

There was no evidence of prenatal developmental toxicity or increased quantitative or qualitative fetal susceptibility in rats. The developmental toxicity study in rabbits is classified unacceptable. In the 2-generation reproduction study, there was a decrease in the number of second generation pups/litter indicating reproductive toxicity. Offspring effects were not seen. A DCI for a developmental neurotoxicity study (with extended postnatal treatment) has been issued.

Data Gaps include:

- Developmental Toxicity -Rabbit *(HED Doc #013049, dated 16 December 1998.)*
- 21-Day Dermal - Rabbit *(HED Doc #008034, dated 16 July 1999.)*
- 90-Day Feeding Study - Rat *(HED Doc # 002181, MRID # 00066334.)*

Table 1. ACUTE TOXICITY of Dicrotophos.

Guideline No.	Study Type	MRID #(S).	Results	Toxicity Category
81-1	Acute Oral	00261098 /43893901	M/F LD_{50} = 11/8 mg/kg	I
81-2	Acute Dermal	00261098	M/F LD_{50} 876/476 = mg/kg	II
81-4	Primary Eye Irritation	00261098	Lesions reversed by 14 days	II
81-5	Primary Skin Irritation	00261098	No irritation	IV
81-6	Dermal Sensitization	00261098	Strong sensitizer	-

3.2 FQPA Considerations

For **Dicrotophos** the FQPA safety factor was **retained** because of the inadequacy of the toxicology data base which precluded complete evaluation of potential enhanced susceptibility to infants and children.

3.3 Dose Response Assessment

Table 2. The doses and toxicological endpoints selected for various exposure scenarios are summarized below.

EXPOSURE SCENARIO	DOSE	ENDPOINT	STUDY
Acute Dietary	LOAEL= 0.5 mg/kg/day UF = 1000 FQPA=10	The value of 0.5 mg/kg was recommended for the endpoint because at this level plasma, RBC and brain ChE on day 1 was observed (a NOAEL was not established).	Acute Neurotoxicity -Rat
	Acute RfD = 0.0005 mg/kg **aPAD = 0.00005 mg/kg/day**		
Chronic Dietary	LOAEL= 0.02 mg/kg/day UF = 1000 FQPA=10	The value of 0.02 mg/kg was recommended for the endpoint because at this level plasma, RBC and brain ChE in both sexes was observed (a NOAEL was not established).	Chronic Toxicity -Rat
		Chronic RfD = 0.00002 mg/kg/day **cPAD = 0.000002 mg/kg/day**	
Short-Term* (Dermal)	LOAEL= 0.5 mg/kg/day MOE=1000	The value of 0.5 mg/kg was recommended for the endpoint because at this level plasma, RBC and brain Che on day 1 was observed (a NOAEL was not established).	Acute Neurotoxicity -Rat
Intermediate-Term* (Dermal)	LOAEL= 0.04 mg/kg/day MOE=1000	The value of 0.04 mg/kg was recommended for the endpoint because at this level plasma, RBC and brain Che in both sexes was observed (a NOAEL was not established).	Subchronic Neurotoxicity -Rat
Long-Term (Dermal)	LOAEL= 0.04 mg/kg/day MOE=1000	The value of 0.04 mg/kg was recommended for the endpoint because at this level plasma, RBC and brain Che in both sexes was observed (a NOAEL was not established).	Subchronic Neurotoxicity -Rat
Inhalation* Short- Intermediate- Long-	LOAEL= 0.5 mg/kg/day 0.04 mg/kg/day 0.02 mg/kg/day	The values were recommended for the endpoint because at this level plasma, RBC and/or brain Che was observed (a NOAEL was not established).	Acute Neurotoxicity - Rat; Subchronic Neurotoxicity-Rat; Chronic Toxicity-Rat

* Since an oral LOAEL was selected a 15 % dermal and 100 % inhalation absorption rates should be used for risk assessments. Also a MOE of 1000 is required for occupational exposure.

Acute Reference Dose (RfD)
A rat acute neurotoxicity resulted in an LOAEL of 0.5 mg/kg based on the plasma, RBC or brain ChE observed on Day 1 (a NOAEL was not established). This dose is appropriate since the effects were observed on Day 1 following a single dose. Also, an additional Uncertainty Factor (UF) of 10 was applied for the use of a LOAEL for risk assessment. A UF of 10 (as opposed to a 3 x) is needed because of the severity of the effects seen at the lowest dose tested following a single dose. Uncertainty Factor (UF): 1000 (10 x for inter-species extrapolation, 10 x for intra-species variability and 10 x for lack of a NOAEL)

$$\textbf{Acute RfD} = \frac{0.5\ \text{mg/kg}}{1000} = \mathbf{0.0005\ mg/kg}. \quad \textit{Acute PAD} = \frac{\text{RfD}}{\text{FQPA Safety factor (10)}} = \textit{0.00005 mg/kg}$$

Chronic RfD
A rat combined chronic toxicity carcinogenicity resulted in an LOAEL of 0.02 mg/kg based on was

recommended for the endpoint because at this level the plasma, RBC or brain ChE in both sexes was observed (a NOAEL was not established). An additional Uncertainty Factor of 10 was applied for the use of a LOAEL for risk assessment. A UF of 10 (as opposed to 3X) is needed because of the use of a LOAEL and because significant ChE was observed in the acute and subchronic neurotoxicity studies.

Chronic RfD = $\frac{0.02 \text{ mg/kg/day}}{1000}$ = **0.00002 mg/kg/day** *Chronic PAD* = $\frac{\text{RfD}}{\text{FQPA SF (10)}}$ = *0.000002 mg/kg*

<u>Occupational/Residential Exposure Endpoints</u>

There are no residential uses. Therefore, doses and toxicology endpoints were selected only for occupational exposure risk assessments.

Dermal Absorption

Dermal Absorption Factor: 15 %. A well-conducted, acceptable guideline study was conducted with monocrotophos that indicated a dermal absorption of 15 %. It is reasonable to conclude that because structure activity relationship is so similar between dicrotophos and monocrotophos that dermal absorption is also similar.

Short-Term Dermal - (1-7 days)

In a rat neurotoxicity study an oral LOAEL of 0.5 mg/kg/day based on the plasma, RBC or brain ChE was observed on Day 1. (See acute reference dose.) This dose/endpoint/study was selected due to the lack of a 21-day dermal toxicity study. Also, the effects observed in this study after a single dose is appropriate for risk assessment for this exposure period of concern (i.e., 1-7 days). Since an oral LOAEL was selected a dermal absorption factor of 15 % should be used for this risk assessment.

Intermediate-Term Dermal (7 Days to Several Months)

In a rat subchronic oral neurotoxicity feeding study an oral LOAEL of 0.04 mg/kg based on the plasma, erythrocyte or brain ChE in both sexes was observed. Cholinesterase inhibition was observed in all 3 compartments (plasma, erythrocyte and brain). The effects (cholinesterase inhibition) are consistent with those observed in the rat chronic toxicity/carcinogenicity study only the effects were expressed at 13 weeks and are, therefore, applicable for intermediate- and long-term exposures. Since an oral LOAEL was selected, a 15 % dermal absorption factor should be used for risk assessments.

Long-Term Dermal (Several Months to Life-Time)

In a rat subchronic neurotoxicity an oral LOAEL of 0.04 mg/kg/day based on the plasma, erythrocyte or brain ChE in both sexes was observed. Cholinesterase inhibition was observed in all 3 compartments (plasma, erythrocyte and brain). The effects (cholinesterase inhibition) are consistent with those observed in the rat chronic toxicity/carcinogenicity study only the effects were expressed at 13 weeks and are, therefore, applicable for intermediate- and long-term exposures. Since an oral LOAEL was selected, a 15 % dermal absorption factor should be selected.

Inhalation Exposure (Any Time Period).

Due to the lack of an acceptable inhalation study, oral LOAELs were selected as the appropriate endpoints. One hundred percent absorption was assumed.

Carcinogenicity:
The CARC determined that dicrotophos was not carcinogenic to male and female CD-1 rats and considered the dosing to be adequate and not excessive in both sexes at 25 ppm based on clinical signs indicative of cholinesterase inhibition and effects on hematological parameters including elevated white blood cell counts (up to 142% of the control value in males and 179% in females) and mild leukocytosis at 25 ppm in both sexes and decreased survival of animals at 50 ppm.

Based on the occurrence of tumors in the mouse study, three members of the Committee considered that the "Data are inadequate for an assessment of human carcinogenic potential" because of a lack of pertinent or useful data or the existing evidence is conflicting e.g., some evidence is suggestive of carcinogenic effects, but other equally pertinent evidence does not confirm a concern.   No new study in mice was requested. However, the majority of the CARC concluded that there is "Suggestive evidence of carcinogenicity, but not sufficient to assess human carcinogenic potential" because the evidence from animal data is suggestive of carcinogenicity, which raises a concern for carcinogenic effects but is judged not sufficient for a conclusion as to human carcinogenic potential. Such evidence includes evidence only in a single study.

3.5 Endocrine Disrupter effects

The Food Quality Protection Act (FQPA; 1996) requires that EPA develop a screening program to determine whether certain substances (including all pesticides and inerts) "may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or such other endocrine effect..." The Agency is currently working with the interested stake holders, including other government agencies, public interest groups, and industry and research scientists in developing a screening and testing program and a priority setting scheme to implement this program. Congress has allowed 3 years from the passage of FQPA to implement this program. At that time, dicrotophos may require further testing for endocrine effects.

4.0 EXPOSURE ASSESSMENT

4.1 Summary of Registered Uses

Dicrotophos (dimethyl phosphate of 3-hydroxy-N,N-dimethyl-cis-crotonamide) is a contact, systemic acaricide/insecticide registered for use on cotton. The reregistration of dicrotophos is being supported by Amvac Chemical Corporation, the basic producer. Dicrotophos end-use products are marketed in the United States under the trade name Bidrin®; the only dicrotophos end-use formulation currently registered is a water-miscible formulation which may be applied foliarly to established cotton plants.

A specimen label for an 82% a.i. water miscible insecticide formulation of dicrotophos (Product name = Bidrin® 8, EPA Reg. No. 352-466, 2.0 lbs ai/qt) permits the use on cotton for the control of aphids, thrips, spider mites, cotton fleahoppers, grasshoppers, boll weevils, stinkbugs, black fleahoppers, plant bugs (lygus), saltmarsh caterpillars, and leaf perforators. Described below is the proposed use pattern.

Label directions for dicrotophos permit early season, ground application at a maximal rate of 0.2 lb ai/A/application. For mid and late season applications, a maximum application rate of 0.5 lb ai/A/application is permitted. Application may be repeated, up to a total of 3 times per season. Application of this product through irrigation systems is prohibited. There is a general 30 day PHI for harvest. Grazing of livestock is prohibited.

4.2 Dietary Exposure

4.2.1 Food Exposure

a. Dietary Exposure (Food Sources)

Tolerances are currently established and expressed in terms of dicrotophos (Dimethyl phosphate of 3-hydroxy-N,N-dimethyl-cis crotonamide) in or on the raw agricultural commodities **cottonseed** (0.05 ppm) and pecans (0.05 ppm) [40 CFR §180.299]. The tolerance expression and dietary risk assessment for dicrotophos should be expressed in terms of the combined residues of dicrotophos and its metabolite monocrotophos (calculated as dicrotophos).

Nature of the Residue in Plants and Animals

The nature of the residue in livestock and poultry is adequately understood. Animal metabolism studies were conducted in poultry and ruminants. The majority of ^{14}C-residues (78-100%) in the goat were characterized or identified. Neither dicrotophos or monocrotophos were detected in eggs and poultry tissues, or milk and ruminant tissues. The metabolites found in animals are structurally similar to those found in cotton. HED concluded that tolerances are not required for livestock commodities.

The nature of residue in cotton is understood. The residues of concern are dicrotophos and monocrotophos.

Residue Analytical Methods

The recommended change in tolerance expression requires that an appropriate enforcement method be available to determine all dicrotophos residues of concern in/on plant commodities. For the purpose of reregistration, adequate methods are available for the enforcement of plant commodity tolerances. Analytical methods for determination of dicrotophos residues of concern in animal commodities are not needed because tolerances are not needed for eggs, milk, and edible livestock tissues. The Pesticide Analytical Manual (PAM) Volume II (Section 180.299) lists two GLC methods (designated as Methods A and B) with KCl thermionic detection. Both of these methods detect residues of dicrotophos and monocrotophos, but not other cholinesterase-inhibiting metabolites. A later method used for the field trials has completed a successful independent laboratory validation and Agency validation is pending.

Multiresidue Methods
The reregistration requirements for multiresidue method testing are fulfilled. The 2/97 FDA PESTDATA database (PAM Volume I, Appendix I) indicates that dicrotophos is completely recovered (>80%) using Multiresidue Methods Section 302 (Luke Method; Protocol D) but is not recovered using Multiresidue Methods Section 303 (Mills, Onley, Gaither Method; Protocol E, nonfatty foods).

Monocrotophos is completely recovered (>80%) using Multiresidue Methods Section 302 (Luke Method; Protocol D) but is not recovered using method Sections 303 (Mills, Onley, and Gaither Method; Protocol E for nonfatty food) and 304 (Mills method; Protocol E for fatty food).

Storage Stability Data
The reregistration requirements for storage stability data are satisfied. The total storage intervals between harvest and analysis of samples from previously evaluated cotton field and processing studies were ~5 months. Recently submitted storage stability data indicate that fortified residues of dicrotophos and monocrotophos are stable during frozen storage (<-20 ±5 C) for at least 6 months in/on undelinted cottonseed, cotton gin trash, and cottonseed processed commodities. These storage stability data are adequate to support the storage intervals and conditions of samples collected from the cottonseed field and processing studies.

Crop Field Trials
The submitted field trial data of dicrotophos residues in/on cottonseed and cotton gin byproducts are adequate. Treatment of crops and timing of applications adequately reflected label directions. Applications were made using ground equipment, with application volume of 14.9 to 20.9 gallons per acre. Application rates ranged from 0.24-0.26 lb ai/A (~1x the maximum label rate) for the early season application and from 0.48-0.53 lb ai/A (~1x the maximum label rate) for the mid and late season application. No unusual or adverse conditions existed following application of dicrotophos. Time from treatment to sampling ranged from 28 to 36 days (PHI).

For undelinted cottonseed, combined residues of dicrotophos and monocrotophos ranged from <0.02 ppm (non-detectable) to 0.13 ppm. Based on the existing dicrotophos and monocrotophos residues from the cotton field trials, the existing dicrotophos tolerance of 0.05 ppm is too low. The recommended tolerance for combined dicrotophos regulated residues (dicrotophos and monocrotophos) in/on cottonseed is 0.2 ppm. For cotton gin byproducts, combined residues of dicrotophos and monocrotophos ranged from 0.12 ppm to 1.8 ppm. There is no existing tolerance established for dicrotophos in/on cotton gin byproducts. HED recommends that the tolerance for regulated residues of dicrotophos in/on cotton gin byproducts be established at 2.0 ppm.

Processed Food/Feed
HED has evaluated residue data pertaining to the potential for concentration of dicrotophos residues of concern in the processed commodities of cotton. The cotton processing data indicate that dicrotophos and monocrotophos residues did not concentrate in hulls, meal, and refined oil processed from cottonseed bearing detectable dicrotophos residues and nondetectable monocrotophos residues. Tolerances are, therefore, not required for the processed commodities of cotton.

Meat, Milk, Poultry, Eggs
The reregistration requirements for studies pertaining to magnitude of the residue in milk, eggs, and tissues of animals are waived. Based on the results of dicrotophos animal metabolism studies, there is no reasonable expectation of residues in milk, eggs, and tissues of animals [Category 3 of 40 CFR §180.6(a)] when dicrotophos is applied according to registered use directions. Therefore, tolerances for residues of dicrotophos in animal commodities need not be proposed.

Confined Accumulation in Rotational Crops
The reregistration requirements for confined/field rotational crop studies are fulfilled. The available confined rotational crop data indicate that the metabolism of dicrotophos in rotational crops is similar to that in primary plants. Because no residues of dicrotophos or monocrotophos were detected in any rotational crop commodity at any plant back interval, no field rotational crop studies are required. In addition, no rotational crop tolerances or restrictions need be established.

CODEX Harmonization
The Codex Alimentarius Commission has not established or proposed maximum residue limits (MRLs) for residues of dicrotophos. Therefore, there are no issues regarding compatibility of U.S. tolerances with Codex MRLs.

4.2.2 Water

Dietary Exposure (Drinking Water Source)

Surface Water Estimates
Using the PRZM-EXAMS model and available environmental fate data for parent dicrotophos, EFED calculated the following Tier 2 Estimated Environmental Concentrations (EECs) for residues of dicrotophos in surface water as follows: acute or peak EECs of 21 ppb and Chronic (yearly upper 10^{th} percentile) EECs of 0.6 ppb

The major route of dissipation for dicrotophos in the environment is microbial-mediated degradation in soil. Dicrotophos may also move into surface water through runoff if sufficient rainfall occurs close to the time of application.

The USGS Organic Geochemistry Research Group conducted a regional water-quality study in the Missippi Embayment from January-December 1996. Dicrotophos was the most frequently detected insecticide and was found in 35% of the surface water samples (60 samples were taken) at a median concentration of 0.1 µg/L and at a maximum (90^{th} percentile) concentration of 0.2 µg/L.

Laboratory studies showed that abiotic hydrolysis rates were pH-dependent (alkaline-catalyzed), and followed first-order kinetics. The calculated half-lives for dicrotophos in sterile aqueous solutions at pH 5, 7, and 9 were 117, 72, and 28 days, respectively. The estimated half-life values at pH 5 and 7 exceed the length of the study (28 days). The calculated half-life for the aqueous photolysis study was 48 days at pH 7. In the soil surface photolysis study, 80% of the applied parent was recovered in both the light and dark controls after 30 days of exposure. Laboratory soil metabolism studies showed that dicrotophos degraded rapidly under aerobic and anaerobic conditions. Under aerobic conditions, the soil half-life of dicrotophos was 2.7 days in a Hanford sandy loam soil (pH 5.7). Under anaerobic conditions, dicrotophos degraded with a half-life of 7 days in a Hanford sandy loam soil. Supplemental soil TLC studies showed that aged dicrotophos was highly mobile in sandy soil and of intermediate mobility in sandy loam soil. In supplemental terrestrial field studies in Mississippi and Georgia, dicrotophos dissipated with a half-life of 2.2 days.

Groundwater Estimates

Using the SCI-GROW model, EFED calculated the following EEC for dicrotophos in ground water:
Dicrotophos: 0.005 ppb

Drinking Water Model Characterization: Input Data and Assumptions for Models

Surface Water: EFED used Tier 2 PRZM-EXAMS to calculate refined EECs. The Pesticide Root Zone Model (PRZM, version 3.1) simulates pesticides in field runoff, while the Exposure Analysis Modeling System (EXAMS, version 2.97-5) simulates pesticide fate and transport in an aquatic environment (one hectare body of water, two meters deep. Using a cotton scenario, dicrotophos was modeled at 0.5 lb ai/A application from three 5-day interval treatments) aerial application to southern Mississippi Valley silty uplands. The soil was Loring silt loam (Hydrological Soil Group - HSG:C), and the meteorological file was MET134.MET, using 36 years of weather data from 1948 to 1983.

Ground Water: Ground water calculations for parent dicrotophos were based on the SCI-GROW model (Screening Concentrations in Ground Water), which is a model for estimating concentrations of pesticides in ground water under "worst case" conditions. SCI-GROW provides a screening concentration or an estimate of likely ground water concentration if the pesticide is used at the maximum allowed label rate in areas with ground water that is exceptionally vulnerable to contamination. In most cases, a majority of the use area will have ground water that is less vulnerable to contamination than the areas used to derive the SCI-GROW estimate.

The SCI-GROW model is based on normalized ground water concentrations from ground water monitoring studies, environmental fate properties (aerobic soil half-lives and organic carbon partitioning coefficients - K_{oc}'s) and application rates. The model is based on permeable soils that are vulnerable to leaching and that overlay shallow ground water (10-30 feet).

c. Dietary Risk Assessment And Characterization (Food Sources)

Chronic Dietary Exposure

The chronic dietary exposure analysis was conducted using the DEEM™ software (D. E. Hrdy, 08/20/99). This analysis is based on consumption data obtained from respondents in the USDA 1989-91 Continuing Surveys for Food Intake by Individuals (CFSII). Cottonseed residue data from crop field trials were averaged resulting in 0.04 ppm. The estimated average percent crop treated data provided by BEAD of 8% was included in the calculation by using a second adjustment factor in DEEM. The resulting exposure for the general US population was <*0.000001* mg/kg/day. The percent of cPAD occupied is provided for the US population and most highly exposed subpopulation, children 1-6 years of age, in table 4.

Table 4. Chronic Dietary (Food) Exposure Estimate and Percent of Acute RfD Occupied (Tier 3 Exposure Analysis using 11% crop treated and avg. field trial residues).

Population Subgroup	Chronic Dietary (Food) Exposure (mg/kg/day)	Percent of Chronic PAD
U.S. Population	*<0.000001*	*4%*
Children 1-6 years old	*0.000001*	*9%*

Acute Dietary Exposure

An acute dietary exposure analysis was conducted for dicrotophos using the DEEM™ software (D. E. Hrdy, 08/20/99). This analysis is based on consumption data obtained from respondents in the USDA 1989-91 Continuing Surveys for Food Intake by Individuals (CFSII). Since the only commodity with registered use of dicrotophos (cotton) is considered to be blended, residues from crop field trials were averaged resulting in 0.04 ppm. The estimated maximum percent crop treated data provided by BEAD of 11% was included in the calculation by using a second adjustment factor in DEEM™. The percent of aPAD occupied and level of exposure for the US population and the most highly exposed subpopulation, children 1-6 years of age, are provided in table 5.

Table 5. Acute Dietary (Food) Exposure Estimate and Percent of Acute RfD Occupied at the 99.9th Percentile (Tier 3 Exposure Analysis Using 11% crop treated and avg. field trial residues).

Population Subgroup	Acute Dietary (Food) Exposure (mg/kg/day)	Percent of Acute RfD
US Population	*0.000002*	*4%*
Children 1-6 years old	*0.000004*	<9%

Water Exposure and Risk Estimates

Based on the chronic and acute dietary exposure estimates presented in Tables 4 and 5, drinking water levels of comparison (DWLOC) were calculated using the formulas presented below. A human health DWLOC is the concentration of a pesticide in drinking water which would result in an unacceptable aggregate risk, after factoring in all food exposures and other non-occupational exposures for which OPP has reliable data.

[acute water exposure (mg/kg/day) x (body weight kg)]

$$\mathbf{DWLOC_{acute}} = \frac{}{[\text{water consumption (L/day)} \times 10^{-3}\ \text{mg}/\mu\text{g}]}$$

where acute water exposure (mg/kg/day) = aPAD (0.000005) - acute food exposure (mg/kg/day)

(i.e. children 1-6 = $\frac{0.000046 \times 10}{1 \times 0.001}$ = 0.46 ppb)

where acute water exposure (mg/kg/day) = [aPAD (0.00005mg/kg/day)- (acute food exposure) (mg/kg/day)]
(i.e. 0.00005mg/kg/day - 0.000004mg/kg/day = 0.000046 mg/kg/day)

$$\mathbf{DWLOC_{chronic}} = \frac{[\text{chronic water exposure (mg/kg/day)} \times \text{(body weight kg)}]}{[\text{water consumption (L/day)} \times 10^{-3}\ \text{mg}/\mu\text{g}]}$$

(i.e. children 1-6 = $\frac{0.000001 \times 10}{1 \times 0.001}$ = 0.01 ppb)

where chronic water exposure (mg/kg/day) = [cPAD (0.000002 mg/kg/day)- (chronic food exposure) (mg/kg/day)]
(i.e. 0.000002 mg/kg/day - 0.000001 mg/kg/day = 0.000001 mg/kg/day)

The Agency's default body weights and consumption values used to calculate DWLOCs are as follows: 70 kg/2L/day (adult male), 60 kg/2L/day (adult female) and 10 kg/1L/day (child).

Acute DWLOC

Based on the above-calculated acute exposure from food, HED has calculated the acute Drinking Water Level of Comparison ($DWLOC_{acute}$) for acute exposures to dicrotophos. The DWLOC is the concentration in drinking water which, when combined or aggregated with exposures through food, would result in an aggregate exposure which is just acceptable. In other words, it is the theoretical concentration of a pesticide in drinking water which would be an acceptable upper limit in light of the total aggregate exposure to that pesticide through all pathways. If model-based estimated concentrations in ground and surface waters are less than the $DWLOC_{acute}$, OPP can conclude with reasonable certainty that aggregate exposures through food and drinking water do not exceed HED's level of concern.

HED's calculated $DWLOC_{acute}$ is 0.46 ppb (based on the most highly exposed subgroup, children 1-6). Enviromental Fate and Effects Division's (EFED's) model-based estimates for maximum concentrations in surface and ground water are 21 ppb and 0.005 ppb, respectively. Since the model-based estimate for concentrations in surface water (21 ppb) exceeds HED $DWLOC_{acute}$ of 0.46 ppb, HED cannot conclude that residues of dicrotophos in food and surface water result in levels of aggregate exposure below HED's level of concern. *Note: that model estimates for dicrotophos in ground water are below $DWLOC_{acute}$, therefore, HED concludes that with reasonable certainty that aggregate exposure to dicrotophos through food and ground water will not result in unacceptable exposure and risk.

Chronic DWLOC

Based on the above-calculated chronic exposure from food, HED has also calculated the chronic Drinking Water Level of Comparison ($DWLOC_{chronic}$) for chronic exposures to dicrotophos.

HED's calculated $DWLOC_{chronic}$ is 0.01 ppb (based on the most exposed subgroup, children 1-6). EFED's model-based estimates for average concentrations of dicrotophos in surface and ground water are 0.6 ppb and 0.005 ppb, respectively. Since the model-based estimate for concentrations in surface water (0.6 ppb) exceeds HED's $DWLOC_{chronic}$ of 0.01 ppb, HED cannot conclude that residues of dicrotophos in food and surface water result in levels of aggregate exposure below HED's level of concern. *Note: that model estimates for dicrotophos in ground water are below $DWLOC_{chronic}$, therefore, HED concludes that with reasonable certainty that aggregate exposure to dicrotophos through food and ground water will not result in unacceptable exposure and risk.

4.3 Occupational Exposure

At this time products containing dicrotophos are intended for occupational use only. It is classified as Restricted Use and may be purchased and used only by certified applicators or persons under their direct supervision.

Dicrotophos (3-hydroxy-N, N-dimethyl-cis-crotonamide, dimethyl phosphate) is a contact and systemic organophosphate insecticide. It is formulated as a:

- technical product with 85 percent active ingredient,
- liquid (isopropyl alcohol based) formulation with 82 percent active ingredient (EPA Reg. No. 5481-448).

Currently, dicrotophos is registered for occupational-use on cotton (application rates range from 0.1 to 0.5 pounds active ingredient per acre).

Dicrotophos is applied during early, middle, and late season to cotton using aerial or groundboom equipment.

4.3.1 Handler

<u>EXPOSURE/RISK ASSESSMENT/CHARACTERIZATION</u>

Occupational Exposures and Risks

4.3.1.1 <u>Handler Exposures & Risks</u>

EPA has determined that there are potential exposures to mixers, loaders, applicators, or other handlers during usual use-patterns associated with dicrotophos. Based on the use patterns, 5 major exposure scenarios were identified for dicrotophos:

- (1a) mixing/loading liquid formulation to support aerial applications,
- (1b) mixing/loading liquid formulation to support groundboom applications,
- (2) applying spray with aircraft,
- (3) applying spray with groundboom equipment, and
- (4) flagging for aerial spray applications.

4.3.1.2 Handler Exposure Scenarios -- Data and Assumptions

Chemical-specific data for assessing human exposures during pesticide handling activities were not submitted to the Agency in support of the (re) registration of dicrotophos. It is the policy of the HED to use data from the Pesticide Handlers Exposure Database (PHED) Version 1.1 to assess handler exposures for regulatory actions when chemical-specific monitoring data are not available.

PHED was designed by a task force of representatives from the U.S. EPA, Health Canada, the California Department of Pesticide regulation, and member companies of the American Crop Protection Association. PHED is a software system consisting of two parts -- a database of measured exposure values for workers involved in the handling of pesticides under actual field conditions and a set of computer algorithms used to subset and statistically summarize the selected data. Currently, the database contains values for over 1,700 monitored individuals (i.e., replicates).

Users select criteria to subset the PHED database to reflect the exposure scenario being evaluated. The subsetting algorithms in PHED are based on the central assumption that the magnitude of handler exposures to pesticides are primarily a function of activity (e.g., mixing/loading, applying), formulation type (e.g., wettable powders, granular), application method (e.g., aerial, groundboom), and clothing scenarios (e.g., gloves, double layer clothing).

Once the data for a given exposure scenario have been selected, the data are normalized (i.e., divided by) by the amount of pesticide handled resulting in standard unit exposures (milligrams of exposure per pound of active ingredient handled). Following normalization, the data are statistically summarized. The distribution of exposure values for each body part (e.g., chest upper arm) is categorized as normal, lognormal, or "other" (i.e., neither normal nor lognormal). A central tendency value is then selected from the distribution of the exposure values for each body part. These values are the arithmetic mean for normal distributions, the geometric mean for lognormal distributions, and the median for all "other" distributions. Once selected, the central tendency values for each body part are composited into a "best fit" exposure value representing the entire body.

The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. To add consistency and quality control to the values produced from this system, the PHED Task Force has evaluated all data within the system and has developed a set of grading criteria to characterize the quality of the original study data. The assessment of data quality is based on the number of observations and the available quality control data. These evaluation criteria and the caveats specific to each exposure scenario are summarized in Table 6. While data from PHED provide the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases. HED has developed a series of tables of standard unit exposure values for many occupational scenarios that can be utilized to ensure consistency in exposure assessments.

4.3.1.3 Assumptions Used in Handler Exposure Calculations

The following assumptions and factors were used in order to complete this exposure assessment:

- Average body weight of an adult handler is 70 kg.
- Average work day interval represents an 8 hour workday (e.g., the acres treated or volume of spray solution prepared in a typical day).

- Daily acres to be treated in each scenario include:
  - -- Aerial applications, including flaggers: 350 and 1,200 acres per day as a range-finder, since cotton is typically cultivated on large acreages, and
  - -- Groundboom applications: 80 acres per day.
- Calculations are completed at the application rates for early- and late-season cotton applications as specified by the dicrotophos label to bracket risk levels associated with the various application rates. No use-data were provided by the registrant concerning the actual "typical" application rates that are commonly used for dicrotophos.

4.3.1.4 Handler Exposure and Risk Estimates

Usually handler exposure assessments are completed by EPA using a baseline exposure scenario and, if required, increasing levels of risk mitigation (PPE and engineering controls) to achieve an appropriate margin of exposure or cancer risk. The baseline scenario generally represents a handler wearing long pants, a long-sleeved shirt, and no chemical-resistant gloves. However, since the toxicological endpoints for occupational risk assessments are LOAELs less than 1 mg/kg and the margin of exposure is required to be 1,000 or greater, **only engineering control risk mitigation** is assessed for dicrotophos. Table 7 presents the exposure and risk assessment calculations for occupational handlers of dicrotophos using the short-term endpoints for dermal, inhalation, and total exposures. Table 8 presents the exposure and risk calculations for occupational handlers of dicrotophos using the intermediate-term endpoints for dermal, inhalation, and total exposures. Risks are assessed for dermal exposures and inhalation exposures and, since the endpoint of concern is cholinesterase inhibition for both the dermal and inhalation routes (an oral endpoint is used as a surrogate for both), risks are also assessed for combined total exposures. In lieu of route-specific data, an oral LOAEL was selected as the short- and intermediate-term endpoints for occupational dermal and inhalation exposures and 15 percent and 100 percent absorption is used for the dermal and inhalation routes of exposure, respectively.

Potential daily inhalation exposure was calculated using the following formula:

$$Daily\ Inhalation\ Exposure\left(\frac{mg\ ai}{day}\right) = Unit\ Exposure\left(\frac{\mu g\ ai}{lb\ ai}\right)\ x\ Conversion\ Factor\left(\frac{1 mg}{1{,}000\ \mu g}\right)\ x\ Use\ Rate\left(\frac{lb\ ai}{A}\right)\ x\ Daily\ Acres\ Treated\left(\frac{A}{day}\right)$$

Potential daily dermal exposure was calculated using the following formula:

$$Daily\ Dermal\ Exposure\left(\frac{mg\ ai}{day}\right) = Unit\ Exposure\left(\frac{mg\ ai}{lb\ ai}\right)\ x\ Use\ Rate\left(\frac{lb\ ai}{A}\right)\ x\ Daily\ Acres\ Treated\left(\frac{A}{day}\right)$$

The daily dermal and inhalation doses and total doses were calculated using a 70 kg body weight using the following formulas:

$$Daily\ Inhalation\ Dose\left(\frac{mg\ ai}{kg/day}\right) = Daily\ Inhalation\ Exposure\left(\frac{mg\ ai}{day}\right)\ x\left(\frac{1}{Body\ Weight\ (kg)}\right)$$

100 percent inhalation absorption was assumed in this calculation.

$$Daily\ Dermal\ Dose\left(\frac{mg\ ai}{Kg/Day}\right) = Daily\ Dermal\ Exposure\left(\frac{mg\ ai}{Day}\right)\ x\ \left(\frac{1}{Body\ Weight\ (Kg)}\right)\ x\ Dermal\ Absorption\ Factor\ (0.15)$$

15 percent dermal absorption was assumed in this calculation.

Handler exposure assessments were completed by EPA using an engineering control exposure scenario -- the maximum risk mitigation possible for the use scenarios examined. The short- and intermediate-term risks for dermal, inhalation, and total exposures are calculated as follows:

$$MOE = \frac{LOAEL}{DailyDose(dermal,inhalation,total)}$$

4.3.1.5 Summary of Risk Concerns for Handlers

Risk concerns for handlers: Tables 7 and 8 present estimates of occupational dermal, inhalation, and total risks from handling dicrotophos when engineering controls are used. An MOE of 1,000 for both the dermal and inhalation routes is considered adequate for the handler risk assessment. Results from these tables indicate:

DERMAL

- *Short-term dermal risk*: using the short-term dermal endpoint, MOEs range between 45 and 5,800 with 7 of the 24 MOEs calculated greater than 1,000; and

- *Intermediate-term dermal risk*: using the intermediate-term dermal endpoint, all MOEs are lower than 1,000, ranging between 4 and 470;

INHALATION

- *Short-term inhalation risk:* using the short-term inhalation end-point, all but two MOEs are greater than 1,000 (range 700 to 100,000). The two exceptions include mixing/loading and applying liquid formulation at the maximum rate for aerial applications; and

- *Intermediate-term inhalation risk:* using the intermediate-term inhalation endpoint, MOEs are greater than 1,000 (range 56 to 8,100) for 7 of the 24 calculated MOEs.

TOTAL

- *Short-term Total risk*: when combining the short-term dermal risks with the inhalation risks, MOEs are greater than 1,000 for 7 of the 24 calculated MOEs (ranging between 42 and 5,500); and
- *Intermediate-term Total risk*: when combining the intermediate-term dermal risks with the inhalation risks, none of the MOEs are greater than 1,000 (MOEs ranging between 3 and 440).

Data Gaps: There were no chemical-specific exposure data available to evaluate handler exposure to dicrotophos. In lieu of such data, data from the Pesticide Handler Exposure Database (V1.1) were used.

Data Quality and Confidence in Assessment: Several issues must be considered when interpreting the occupational exposure risk assessment. These include:

- All handler assessments were completed using “medium to high quality” PHED data;

- No generic protection factors were needed to calculate handler exposures.

4.3.2 Postapplication

4.3.2.1 Postapplication Exposure Scenarios

EPA has determined that there are potential postapplication exposures to individuals entering treated cotton fields for the purpose of:

- hoeing (workers), and
- scouting/crop-advising (handlers) both in the early season and late season.

Postapplication risks are mitigated for crop advisors/scouts using entry restrictions, not restricted-entry intervals. Since, under the Worker Protection Standard for Agricultural Pesticides (40 CFR Part 170), crop advisors/scouts are defined as handlers, the Agency can permit such persons to enter treated areas to perform scouting tasks, provided they are using required personal protective equipment. Postapplication requirements for crop advisors/scouts for dicrotophos are based on the individual and averaged residue measurements from a foliar dislodgeable residue (DFR) study conducted in two geographical areas (Texas, and Mississippi) (see Tables 9 and 10).

Postapplication risks are mitigated for workers using a restricted-entry interval (REI). In general, the REI is established based on the number of days following application that must elapse before the pesticide residues dissipate to a level where estimated worker MOE’s equal or exceed 1,000 while wearing baseline attire (i.e., long-sleeve shirt, long pants, shoes, and socks). Under the Worker Protection Standard for Agricultural Pesticides (WPS) -- 40 CFR Part 170, entry to perform routine hand labor tasks is prohibited during an REI and personal protective equipment cannot be considered as a risk reduction measure in establishing the REI. REI requirements for dicrotophos are based on the individual and averaged residue measurements from a foliar dislodgeable residue (DFR) study conducted in two geographical areas (Texas, and Mississippi) (see Table 10).

4.3.2.2 Data Source Descriptions for Scenarios Considered

The registrant submitted postapplication dicrotophos exposure data in response to the data requested by the Agency during Phase 4 of the reregistration process. One foliar dissipation (dislodgeable residue) study was submitted for dicrotophos.

4.3.2.3 Assumptions Used in Postapplication Exposure Calculations

The assumptions used in the calculations for occupational postapplication risks include the following items:

- Daily exposure is assumed to occur for 8 hours per day
- The median body weight of 70 kg is used, representing a typical adult.

4.3.2.4 Postapplication Exposure and Risk Estimates

The postapplication risks from dicrotophos has been assessed using dicrotophos-specific regression data and standard values for transfer coefficients.

Daily Absorbed Doses were calculated as follows:

$$Dose\ (mg/kg/day) = \frac{(DFR\ (\mu g/cm^2)\ x\ Tc\ (cm^2/hr)\ x\ CF \left(\frac{1\ mg}{1{,}000\ \mu g}\right)\ x\ Abs\ x\ ED\ (hrs/day))}{BW}$$

Where:

DFR	=	daily DFR (μg/cm^2)
Tc	=	transfer coefficient; 4,000 cm^2/hr for late season scouting; and 1,000 cm^2/hr for early season scouting and hoeing
CF	=	conversion factor (i.e., 1 mg/1,000 μg)
Abs	=	15 percent dermal absorption
ED	=	exposure duration; 8 hours worked per day for scouting and hoeing
BW	=	body weight (70 kg)

Short- and intermediate-term MOEs were calculated as follows:

$$Short\text{-}term\ MOE = \frac{Short\text{-}term\ LOAEL}{Dose}$$

$$Intermediate\text{-}term\ MOE = \frac{Intermediate\text{-}term\ LOAEL}{Dose}$$

Where:

Short-term LOAEL	=	0.5 mg/kg/day[1]
Intermediate-term LOAEL	=	0.04 mg/kg/day[1]
Dose	=	calculated absorbed dermal dose

Table 9 presents the short- and intermediate-term dermal MOEs for the late season scouting scenario and Table 10 presents the short- and intermediate-term dermal MOEs for early season scouting and hoeing.

Table 9 indicates that for <u>late season</u> scouting activities, the margin of exposure (MOE) for:

- short-term postapplication exposures exceeds 1,000 at day 12 using the combined (averaged) DFRs for the two sites; and

- intermediate-term postapplication exposures exceeds 1,000 at day 21 for the combined (averaged) DFRs for the two sites.

Table 10 indicates that for <u>early season</u> scouting and hoeing activities, the margin of exposure for:

- short-term postapplication exposures exceeds 1,000 at day 1 for the combined (averaged) DFRs for the two sites; and

- intermediate-term postapplication exposures exceeds 1,000 at day 10 for the combined (averaged) DFRs for the two sites.

Table 6: Occupational Exposure Scenario Descriptions for the Use of Dicrotophos

Exposure Scenario (Number)	Data Source	Standard Assumptions[a] (8-hr work day)	Comments[b]
Mixer/Loader Descriptors			
Mixing/Loading Liquid Formulations (1a, 1b)	PHED V1.1	Eight-hour work day; Mixing/loading to support aerial application of between 350 acres and 1200 acres per day; Mixing/loading to support groundboom application of 80 acres per day	**Engineering Controls:** Hands, dermal, and inhalation = AB grades. Hands = 31 replicates; Dermal= 16 to 22; and Inhalation = 27 replicates. High confidence in hands/dermal, and inhalation data. No protection factor was needed to define the unit exposure value.
Applicator Descriptors			
Applying Sprays with Aircraft (2)	PHED V1.1	Eight-hour work day and aerial application of between 350 acres and 1200 acres per day	**Engineering Controls:** Hands = AB grade, dermal and inhalation = ABC grade. Hands= 34 replicates, dermal = 24 to 48 replicates, and inhalation = 23 replicates. Medium confidence in hands, dermal, and inhalation data. No protection factor was needed to define the unit exposure value.
Applying Sprays with a Groundboom Sprayer (3)	PHED V1.1	Eight-hour work day and groundboom application of 80 acres per day	**Engineering Controls:** Hands and dermal = ABC grade, inhalation = AB grade. Hands = 16 replicates, dermal = 20-31 replicates, inhalation = 16 replicates. Medium confidence in hands and dermal data, and high confidence in inhalation data. No protection factor was needed to define the unit exposure value.
Flagger Descriptors			
Flagging Aerial Spray Applications (4)	PHED V1.1	Eight-hour work day and flagging to support aerial application of between 350 acres and 1200 acres per day	**Engineering Controls**: Enclosed groundboom data are used as a surrogate for engineering controls for flaggers. Dermal and hands = ABC grades; Inhalation = AB grades. Dermal = 20 to 31 replicates; Hands = 16 replicates; and Inhalation = 16 replicates. Medium confidence in dermal and hands data. High confidence in inhalation data. No protection factor was needed to define the unit exposure value.

a Standard Assumptions based on an 8-hour work day as estimated by HED. BEAD data were not available.

b "Best Available" grades are defined by HED SOP for meeting Subdivision U Guidelines. Best available grades are assigned as follows: matrices with grades A and B data <u>and</u> a minimum of 15 replicates; if not available, then grades A, B and C data and a minimum of 15 replicates; if not available, then all data regardless of the quality and number of replicates. Data confidence are assigned as follows:
High = grades A and B and 15 or more replicates per body part
Medium = grades A, B, and C and 15 or more replicates per body part
Low = grades A, B, C, D and E <u>or</u> any combination of grades with less than 15 replicates

Table 7. Short-Term Dermal, Inhalation, and Total MOEs for Dicrotophos with Engineering Control Mitigation

Exposure Scenario (Scenario #)	Engineering Controls Dermal Unit Exposure[a] (mg/lb ai)	Engineering Controls Inhalation Unit Exposure[b] (μg/lb ai)	Application Rate[c] (lb ai/A)	Amount Handled per Day[d]	Engineering Controls Dermal[e,h]		Engineering Controls Inhalation[f,h]		Engineering Controls Total[g,h]	
					Daily Dose[e] (mg/kg/day)	MOE[f] (target 1,000)	Daily Dose[g] (mg/kg/day)	MOE[h] (target 1,000)	Daily Dose[i] (mg/kg/day)	MOE[j] (target 1,000
Mixer/Loader Exposure										
Mixing/Loading Liquid Formulations for Aerial Application (1a)	0.0086	0.083	0.1	350 Acres	6.5E-04	780	4.2E-05	12,000	6.9E-04	730
			0.2		1.3E-03	390	8.3E-05	6,000	1.4E-03	360
			0.5		3.2E-03	160	2.1E-04	2,400	3.4E-03	150
			0.1	1,200 Acres	2.2E-03	230	1.4E-04	3,500	2.4E-03	210
			0.2		4.4E-03	110	2.8E-04	1,800	4.7E-03	110
			0.5		1.1E-02	45	7.1E-04	700	1.2E-02	42
Mixing/Loading Liquid Formulations for Groundboom Application (1b)			0.1	80 Acres	1.5E-04	3,400	9.5E-06	53,000	1.6E-04	3,200
			0.2		2.9E-04	1,700	1.9E-05	27,000	3.1E-04	1,600
			0.5		7.4E-04	680	4.7E-05	11,000	7.8E-04	640
Applicator										
Applying Spray with Aircraft (2)	0.005	0.068	0.1	350 Acres	3.8E-04	1,300	3.4E-05	15,000	4.1E-04	1,200
			0.2		7.5E-04	670	6.8E-05	7,400	8.2E-04	610
			0.5		1.9E-03	270	1.7E-04	2,900	2.0E-03	240
			0.1	1,200 Acres	1.3E-03	390	1.2E-04	4,300	1.4E-03	360
			0.2		2.6E-03	190	1.2E-04	2,100	2.8E-03	180
			0.5		6.4E-03	78	5.8E-04	860	7.0E-03	71
Applying Spray with a Groundboom Sprayer (3)	0.005	0.043	0.1	80 Acres	9.0E-05	5,800	4.9E-06	100,000	9.1E-05	5,500
			0.2		1.7E-04	2,900	9.8E-06	51,000	1.8E-04	2,800
			0.5		4.3E-04	1,200	2.5E-05	20,000	4.5E-04	1,100

Table 7. Short-Term Dermal, Inhalation, and Total MOEs for Dicrotophos with Engineering Control Mitigation (continued)

Exposure Scenario (Scenario #)	Engineering Controls Dermal Unit Exposure[a] (mg/lb ai)	Engineering Controls Inhalation Unit Exposure[b] (μg/lb ai)	Application Rate[c] (lb ai/A)	Amount Handled per Day[d]	Engineering Controls Dermal[e,h]		Engineering Controls Inhalation[f,h]		Engineering Controls Total[g,h]	
					Daily Dose[e] (mg/kg/day)	MOE[f] (target 1,000)	Daily Dose[g] (mg/kg/day)	MOE[h] (target 1,000)	Daily Dose[i] (mg/kg/day)	MOE[j] (target 1,000
Flagger Exposure										
Flagging Aerial Spray Applications (4)	0.005	0.043	0.1	350 Acres	38E-04	1,300	2.2E-05	23,000	4.0E-04	1,300
			0.2		7.5E-04	670	4.3E-05	12,000	7.9E-04	630
			0.5		1.9E-03	270	1.1E-04	4,700	2.0E-03	250
			0.1	1,200 Acres	1.3E-03	390	7.4E-05	6,800	1.4E-03	370
			0.2		2.6E-03	190	1.5E-04	3,400	2.7E-03	180
			0.5		6.4E-03	78	3.7E-04	1,400	6.8E-03	74

Footnotes:

a Dermal unit exposure values from PHED V1.1 Surrogate Exposure Guide dated August 1998.
b Inhalation unit exposure values from PHED V1.1 Surrogate Exposure Guide dated August 1998.
c Application rate taken from dicrotophos label (EPA 5481-448).
d Amount handled per day values are EPA estimates of acreage treated.
e Dermal daily dose (mg/kg/day) = [daily unit exposure (mg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x 0.15 dermal absorption factor] / body weight (70 kg).
f Dermal MOE = LOAEL (0.5 mg/kg) / daily dose (mg/kg/day).
g Inhalation daily dose (mg/kg/day) = [inhalation unit exposure (μg/lb ai) x application rate (lb ai/A) x amount handled per day (acres) x conversion factor (1 mg/1,000 μg) x 1 inhalation absorption factor] / body weight (70 kg).
h Inhalation MOE = LOAEL (0.5 mg/kg) / daily dose (mg/kg/day).
I Total daily dose = dermal daily dose (mg/kg/day) + inhalation daily dose (mg/kg/day).
j Total MOE = LOAEL (0.5 mg/kg) / total daily dose (mg/kg/day).

Table 8. Intermediate-Term Dermal, Inhalation, and Total MOEs for Dicrotophos with Engineering Control Mitigation

Exposure Scenario (Scenario #)	Engineering Control Dermal Unit Exposure[a] (mg/lb ai)	Engineering Control Inhalation Unit Exposure[b] (μg/lb ai)	Application Rate[c] (lb ai/A)	Amount Handled per Day[d]	Engineering Controls Dermal[e,h]		Engineering Controls Inhalation[f,h]		Engineering Controls Total[g,h]	
					Daily Dose[e] (mg/kg/day)	MOE[f]	Daily Dose[g] (mg/kg/day)	MOE[h]	Daily Dose[i] (mg/kg/day)	MOE[j]
Mixer/Loader Exposure										
Mixing/Loading Liquid Formulations for Aerial Application (1a)	0.0086	0.083	0.1	350 Acres	6.5E-04	62	4.2E-05	960	6.9E-04	58
			0.2		1.3E-03	31	8.3E-05	480	1.4E-03	29
			0.5		3.2E-03	12	2.1E-04	190	3.4E-03	12
			0.1	1,200 Acres	2.2E-03	18	1.4E-04	280	2.4E-03	17
			0.2		4.4E-03	9	2.8E-04	140	4.7E-03	8.5
			0.5		1.1E-02	3.6	7.1E-04	56	1.2E-02	3.4
Mixing/Loading Liquid Formulations for Groundboom Application (1b)			0.1	80 Acres	1.5E-04	270	9.5E-06	4,200	1.6E-04	250
			0.2		2.9E-04	140	1.9E-05	2,100	3.1E-04	130
			0.5		7.4E-04	54	4.7E-05	840	7.8E-04	51
Applicator Exposure										
Applying Spray with Aircraft (2)	0.005	0.068	0.1	350 Acres	3.8E-04	110	3.4E-05	1,200	4.1E-04	98
			0.2		7.5E-04	53	6.8E-05	590	8.1E-04	49
			0.5		1.9E-03	21	1.7E-04	240	2.0E-03	20
			0.1	1,200 Acres	1.3E-03	31	1.2E-04	340	1.4E-03	29
			0.2		2.6E-03	16	2.3E-04	170	2.8E-03	14
			0.5		6.4E-03	6.2	5.8E-04	69	7.0E-03	5.7
Applying Spray with a Groundboom Sprayer (3)	0.005	0.043	0.1	80 Acres	8.6E-05	470	4.9E-06	8,100	9.1E-05	440
			0.2		1.7E-04	230	9.8E-06	4,100	1.8E-04	220
			0.5		4.3E-04	93	2.5E-05	1,600	4.5E-04	88

Exposure Scenario (Scenario #)	Engineering Control Dermal Unit Exposure[a] (mg/lb ai)	Engineering Control Inhalation Unit Exposure[b] (μg/lb ai)	Application Rate[c] (lb ai/A)	Amount Handled per Day[d]	Engineering Controls Dermal[e,h]		Engineering Controls Inhalation[f,h]		Engineering Controls Total[g,h]	
					Daily Dose[e] (mg/kg/day)	MOE[f]	Daily Dose[g] (mg/kg/day)	MOE[h]	Daily Dose[i] (mg/kg/day)	MOE[j]
Flagger Exposure										
Flagging Aerial Spray Applications (4)	0.005	0.043	0.1	350 Acres	3.8E-04	110	2.2E-05	1.900	4.0E-04	100
			0.2		7.5E-04	53	4.3E-05	930	7.9E-04	50
			0.5		1.9E-03	21	1.1E-04	370	2.0E-03	20
			0.1	1,200 Acres	1.3E-03	31	7.4E-05	540	1.4E-03	29
			0.2		2.6E-03	16	1.5E-04	270	2.7E-03	15
			0.5		6.4E-03	6.2	3.7E-04	110	6.8E-03	5.9

Footnotes:

Note: Engineering control mitigation:
- 1a, b single layer clothing, chemical resistant gloves, closed mixing
- 2 single layer clothing, no gloves, enclosed cockpit
- 3, 4 single layer clothing, no gloves, enclosed cab

a Dermal unit exposure values from PHED V1.1 dated August 1998.
b Inhalation unit exposure values from PHED V1.1 dated August 1998.
c Application rate taken from dicrotophos label (EPA 5481-448).
d Amount handled per day values are EPA estimates of acreage treated.
e Dermal daily dose (mg/kg/day) = [daily unit exposure(mg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x 0.15 dermal absorption fraction] / body weight (70 kg).
f Dermal MOE = LOAEL (0.04 mg/kg) / daily dose (mg/kg/day).
g Inhalation daily dose (mg/kg/day) = [inhalation unit exposure (μg/lb ai) x application rate (lb ai/acre) x amount handled per day (acres) x conversion factor (1 mg/1,000 μg) x 1 inhalation absorption fraction] / body weight (70 kg).
h Inhalation MOE = LOAEL (0.04 mg/kg) / daily dose (mg/kg/day).
I Total daily dose = dermal daily dose (mg/kg/day) + inhalation daily dose (mg/kg/day).
j Total MOE = LOAEL (0.04 mg/kg) / total daily dose (mg/kg/day).

Table 9. Estimates of Postapplication Exposure/Risk to Late-Season Scouts (TC = 4,000 cm^2/hr) Following Applications of Dicrotophos to Cotton (0.5 lb ai/acre)

DAT[a]	TEXAS				MISSISSIPPI				COMBINED SITE DATA			
	DFR at 0.5 lb ai/A[b]	Dermal Dose Late-Season[c]	Short-Term MOE[d]	Intermediate-Term MOE[e]	DFR at 0.5 lb ai/A[b]	Dermal Dose Late-Season[c]	Short-Term MOE[d]	Intermediate-Term MOE[e]	DFR at 0.5 lb ai/A[b]	Dermal Dose Late-Season[c]	Short-Term MOE[d]	Intermediate-Term MOE[e]
0	3.2E-01	2.2E-02	23	1.8	1.4E-01	9.4E-03	53	4.2	1.7E-01	1.2E-02	42	3.4
1	2.4E-01	1.6E-02	31	2.5	8.6E-02	5.9E-03	85	6.8	1.3E-01	9.0E-03	56	4.5
2	1.8E-01	1.2E-02	41	3.3	5.4E-02	3.7E-03	140	11	9.9E-02	6.8E-03	74	5.9
3	1.3E-01	8.9E-03	56	4.5	3.3E-02	2.3E-03	220	17	7.5E-02	5.1E-03	98	7.8
4	9.7E-02	6.6E-03	75	6.0	2.1E-02	1.4E-03	350	28	5.6E-02	3.9E-03	130	10
5	7.2E-02	4.9E-03	100	8.1	1.3E-02	8.9E-04	560	45	4.3E-02	2.9E-03	170	14
6	5.3E-02	3.6E-03	140	11	8.1E-03	5.6E-04	900	72	3.2E-02	2.2E-03	230	18
7	3.9E-02	2.7E-03	180	15	5.1E-03	3.5E-04	1400	120	2.4E-02	1.7E-03	300	24
8	2.9E-02	2.0E-03	250	20	3.2E-03	2.2E-04	NA	180	1.8E-02	1.3E-03	400	32
9	2.2E-02	1.5E-03	340	27	2.0E-03	1.4E-04	NA	300	1.4E-02	9.5E-04	520	42
10	1.6E-02	1.1E-03	450	36	1.2E-03	8.4E-05	NA	470	1.1E-02	7.2E-04	690	56
11	1.2E-02	8.2E-04	610	49	7.7E-04	5.3E-05	NA	760	7.9E-03	5.4E-04	920	74
12	8.9E-03	6.1E-04	820	66	4.8E-04	3.3E-05	NA	1200	6.0E-03	4.1E-04	1200	97
13	6.6E-03	4.5E-04	1100	89	3.0E-04	2.1E-05	NA	1900	4.5E-03	3.1E-04	1600	130
14	4.9E-03	3.3E-04	1500	120	NA	NA	NA	NA	3.4E-03	2.3E-04	NA	170
15	3.6E-03	2.5E-04	NA	160	NA	NA	NA	NA	2.6E-03	1.8E-04	NA	230
16	2.7E-03	1.8E-04	NA	220	NA	NA	NA	NA	2.0E-03	1.3E-04	NA	300
17	2.0E-03	1.4E-04	NA	293	NA	NA	NA	NA	1.5E-03	1.0E-04	NA	400
18	1.5E-03	1.0E-04	NA	400	NA	NA	NA	NA	1.1E-03	7.7E-05	NA	520
19	1.1E-03	7.5E-05	NA	530	NA	NA	NA	NA	8.4E-04	5.8E-05	NA	690
20	8.1E-04	5.6E-05	NA	720	NA	NA	NA	NA	6.4E-04	4.4E-05	NA	920
21	6.0E-04	4.1E-05	NA	970	NA	NA	NA	NA	4.8E-04	3.3E-05	NA	1200
22	4.5E-04	3.1E-05	NA	1300	NA	NA	NA	NA	3.6E-04	2.5E-05	NA	1600
23	2.5E-04	1.7E-05	NA	2400	NA	NA	NA	NA	2.7E-04	1.9E-05	NA	2100

a DAT = days after application
b DFR ($\mu g/cm^2$) = DFR data from MRID No. 447310-02, which was conducted using an application rate of 0.5 lb ai/acre.
c Dermal Dose = DFR ($\mu g/cm^2$) x transfer coefficient (4,000 cm^2/hr) x exposure time (8 hrs) x dermal absorption factor (0.15) x conversion factor (1 mg/1,000 μg) / body weight (70 kg).
d Short-term MOE = LOAEL (0.5 mg/kg) / dermal dose (mg/kg/day).
e Intermediate-term MOE = LOAEL (0.04 mg/kg) / dermal dose (mg/kg/day).

Table 10. Estimates of Postapplication Exposure and Risk to Early-Season Scouts and Hoers (TC = 1,000 cm^2/hr) Following Applications of Dicrotophos to Cotton (0.1 lb ai/acre)

DATA	TEXAS				MISSISSIPPI				COMBINED SITE DATA			
	DFR at 0.1 lb ai/A[b]	Dermal Dose Early-Season[c]	Short-Term MOE[d]	Intermediate-Term MOE[e]	DFR at 0.1 lb ai/A[b]	Dermal Dose Early-Season[c]	Short-Term MOE[d]	Intermediate-Term MOE[e]	DFR at 0.1 lb ai/A[b]	Dermal Dose Early-Season[c]	Short-Term MOE[d]	Intermediate-Term MOE[e]
0	6.4E-02	1.1E-03	460	37	2.8E-02	4.7E-04	1100	85	3.5E-02	5.9E-04	840	67
1	4.7E-02	8.1E-04	620	49	1.7E-02	2.9E-04	1700	140	2.6E-02	4.5E-04	1100	89
2	3.5E-02	6.0E-04	830	66	1.1E-02	1.8E-04	NA	220	2.0E-02	3.4E-04	NA	120
3	2.6E-02	4.5E-04	1100	89	6.7E-03	1.1E-04	NA	350	1.5E-02	2.6E-04	NA	160
4	1.9E-02	3.3E-04	1500	120	4.2E-03	7.1E-05	NA	560	1.1E-02	1.9E-04	NA	200
5	1.4E-02	2.5E-04	NA	160	2.6E-03	4.5E-05	NA	900	8.5E-03	1.5E-04	NA	270
6	1.1E-02	1.8E-04	NA	220	1.6E-03	2.8E-05	NA	1400	6.4E-03	1.1E-04	NA	360
7	7.9E-03	1.4E-04	NA	300	NA	NA	NA	NA	4.9E-03	8.4E-05	NA	480
8	5.9E-03	1.0E-04	NA	400	NA	NA	NA	NA	3.7E-03	6.3E-05	NA	630
9	4.3E-03	7.4E-05	NA	540	NA	NA	NA	NA	2.8E-03	4.8E-05	NA	840
10	3.2E-03	5.5E-05	NA	720	NA	NA	NA	NA	2.1E-03	3.6E-05	NA	1100
11	2.4E-03	4.1E-05	NA	980	NA	NA	NA	NA	1.6E-03	2.7E-05	NA	1500
12	1.8E-03	3.0E-05	NA	1300	NA	NA	NA	NA	NA	NA	NA	NA
13	1.3E-04	2.3E-05	NA	1800	NA	NA	NA	NA	NA	NA	NA	NA

a DAT = days after application
b DFR ($\mu g/cm^2$) = DFR data from MRID No. 447310-01, to account for reduced application rate of 0.1 lb ai/acre.
c Dermal Dose = DFR ($\mu g/cm^2$) x transfer coefficient (1,000 cm^2/hr) x exposure time (8 hrs) x dermal absorption factor (0.15) x conversion factor (1 mg/1,000 μg) / body weight (70 kg).
d Short-term MOE = LOAEL (0.5 mg/kg) / dermal dose (mg/kg/day).
e Intermediate-term MOE = LOAEL (0.04 mg/kg) / dermal dose (mg/kg/day).

4.4 Residential Exposure

There are no registered uses that would result in residential exposure.

5.0 AGGREGATE RISK ASSESSMENTS AND RISK CHARACTERIZATION

Aggregate risk is estimated by combining dietary (food and water) and residential exposures. Dicrotophos has no uses that could result in residential exposure, therefore, the aggregate risk estimate will be based on the dietary exposure from food and water only, for the most highly exposed population subgroups and the general population as appropriate. Details concerning the assumptions used in deriving exposure estimates and risk characterizations were discussed previously in this document.

6.0 DATA NEEDS

Developmental Toxicity -Rabbit *(HED Doc #013049, dated 16 December 1998.)*
21-Day Dermal - Rabbit *(HED Doc #008034, dated 16 July 1999.)*
90-Day Feeding Study - Rat *(HED Doc # 002181, MRID # 00066334.)*

There were no chemical-specific exposure data available to evaluate handler exposure to dicrotophos. In lieu of such data, data from the Pesticide Handler Exposure Database (V1.1) were used.

SignOff Date:	10/28/99
DP Barcode:	D260602
HED DOC Number:	013817
Toxicology Branch:	RRB4