

OPP OFFICIAL RECORD  
HEALTH EFFECTS DIVISION  
SCIENTIFIC DATA REVIEWS  
EPA SERIES 361

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



OFFICE OF  
PREVENTION, PESTICIDES  
AND TOXIC SUBSTANCES

**MEMORANDUM**

**DATE:** 31 January 2007

**SUBJECT:** **Endosulfan.** The Health Effects Division's Review of California's Endosulfan Risk Characterization Draft Document (dated 12/05/2006)

<i>DP Number:</i>	D335812	<i>MRID:</i> None
<i>PC Code:</i>	079401	
<i>40 CFR:</i>	180.182	<i>Chemical Class:</i> Organochlorine insecticide

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The attached document entitled "*The Health Effects Division's Review of California's Endosulfan Risk Characterization Draft Document*" was generated to address the December 5, 2006 California Department of Pesticide Regulation (CDPR) endosulfan risk characterization document. The main focus of this memo is to discuss the differences between California's risk characterization draft document and the Agency's risk assessments for endosulfan (including the Reregistration Eligibility Decision (RED) which was completed in November of 2002 and the forthcoming 2007 risk assessment).

# Health Effects Division's Review of California's Endosulfan Risk Characterization Document

## I. Introduction

The following is HED's review of California's endosulfan risk characterization draft document dated December 5, 2006. The main focus of this review is to discuss the differences between California's risk characterization draft document and the EPA's 2002 RED and pending 2007 risk assessment. The major reason for the Agency's 2007 revision to the 2002 risk assessment is the completion and subsequent review by HED of a developmental neurotoxicity (DNT) study. Differences in the toxicological, dietary, and occupational portions of the risk assessments are discussed below.

## II. Toxicology

Table 1 below highlights the studies and endpoints used in the CDPR 2006 risk assessment as compared to the Agency's 2002 and current 2007 assessment. It is noted that the Agency's endosulfan assessment is currently under revision and changes after this memorandum are possible. A comparison of the risk assessments produced by CDPR in 2006 and the Agency in 2002 and currently in 2007 reveals two major differences in hazard assessment. The first difference is the lack of the use of the DNT study (Gilmore, 2006; MRID 46968301) in risk assessment by CDPR. The Agency is currently planning to use the DNT study for the dermal short- and intermediate-term scenarios. Furthermore, the established endpoints of the DNT study by CDPR differ from the identified endpoints by the Agency and are described briefly below. The second difference among the risk assessments is the critical study identified for the acute dietary assessment. CDPR used the developmental rabbit study (MRID 00094837) NOEL of 0.7 mg/kg/day, based on convulsions which were considered acute effects by CDPR. The Agency, however, established the salivation, convulsions, rapid breathing, and hyperactivity observed at 1.8 mg/kg/day to only occur on day 10 of gestation (not gestation day 6 as indicated by CDPR). Therefore the Agency relied on the acute neurotoxicity study (MRID 44403101) NOAEL of 1.5 mg/kg/day since convulsions were observed 8 hours after a single oral dose, thus making the endpoint more appropriate for the acute dietary assessment.

### *DNT- (Gilmore et al., 2006; MRID 46968301)*

The Agency recently received a developmental neurotoxicity study with endosulfan in wistar rats in December 2006. The study was reviewed and the findings then presented to the Developmental Neurotoxicity Committee on January 10, 2007. Based on the review of the study by the DNT Committee, the Committee concluded that there was no NOAEL for pups. The LOAEL of 3.74 mg/kg/day was the lowest dose tested (LDT), based on decreased pup weight [PND 11] and weight gain [PND 4-11], with delayed preputial separation in males receiving the MDT. For dams, the NOAEL is 3.74 mg/kg/day. The LOAEL for dams is 10.8 mg/kg/day, based on decreased body weight, food consumption

and food efficiency. This study is acceptable/guideline. The data evaluation record (DER) is currently being revised to reflect changes requested by the DNT Committee.

The 2006 assessment by CDPR indicated the DNT study (Gilmore et al., 2006) was reviewed and determined that there was no increase in neurotoxicity in rats receiving endosulfan treatment in diets during pre- and post-natal development. The maternal NOEL is < 3.74 mg/kg/day, based on lower mean body weights (5-6%) and lower food consumption (12%) at 3.74 mg/kg/day. The developmental NOEL is <3.74 mg/kg/day, based on lower mean body weights (8% on post-partum day 11 of offspring). The developmental neurotoxicity NOEL is 29.8 mg/kg/day, based on the lack of a neurologically-related effect noted in the offspring at the highest dose tested.

Table 1. Comparison of Toxicological Data for Endosulfan

Exposure Scenario		CDPR 2006	EPA 2002	EPA 2007
Acute Dietary (general population including infants and children)	PoD, UF	NOEL = 0.7 mg/kg/day UF = 100 FQPA = 10	NOAEL = 1.5 mg/kg/day UF = 100 FQPA = 10x	NOAEL = 1.5 mg/kg/day UF = 100 FQPA = N/A, currently under review
	Level of Concern for Risk Assessment with UFs	aRfD = 0.007 mg/kg/day aPAD = 0.0007 mg/kg/day	aRfD = 0.015 mg/kg/day aPAD = 0.0015 mg/kg/day	aRfD = 0.015 mg/kg/day aPAD = N/A mg/kg/day
	Critical Study and Endpoints	Developmental- Rabbit LOEL- 1.8 mg/kg/day, based on abortions, death, convulsions, neurotoxicity; signs began on GD6	Acute Neurotoxicity-rats LOAEL= 3 mg/kg/day; based on increased incidence of convulsions seen in female rats within 8 hours after dosing.	Acute Neurotoxicity-rats LOAEL= 3 mg/kg/day; based on increased incidence of convulsions seen in female rats within 8 hours after dosing.
Chronic Dietary (all populations)	Reference	Nye, 1981	MRID 44403101	MRID 44403101
	PoD, UF	NOAEL = 0.57 mg/kg/day UF = 100 FQPA = 10	NOAEL = 0.6 mg/kg/day UF = 100 FQPA = 10x	NOAEL = 0.6 mg/kg/day UF = 100 FQPA = N/A, currently under review

Exposure Scenario		CDPR 2006	EPA 2002	EPA 2007
Dermal Short (1-30 days) and Intermediate-term (1-6 mos)	Level of Concern for Risk Assessment with UFs	cRfD = 0.0057 mg/kg/day cPAD = 0.00057 mg/kg/day	cRfD = 0.006 mg/kg/day cPAD = 0.0006 mg/kg/day	cRfD = 0.006 mg/kg/day cPAD = N/A mg/kg/day
	Critical Study and Endpoints	Chronic dog (capsule)- LOEL= 2.09 mg/kg/day, based on premature termination, neurotoxic effects, decreased body weight gain and food consumption	Chronic/Cancer rats- LOAEL = 2.9 mg/kg/day, based on reduced body weight gain, increased incidences of marked progressive glomerulonephrosis & blood vessel aneurysms in male rats.	Chronic/Cancer rats- LOAEL = 2.9 mg/kg/day, based on reduced body weight gain, increased incidences of marked progressive glomerulonephrosis & blood vessel aneurysms in male rats.
	Reference	Brunk, 1989	MRID 41099502	MRID 41099502
	PoD, UF	Seasonal (1 week to 1 year) 45% dermal absorption (Craine, 1988)	NOAEL = 12 mg/kg/day 45% absorption	NOAEL = 1.2 mg/kg/day 45% dermal absorption
Level of Concern (LOC) and Margins of Exposure (MOE)	Level of Concern (LOC) and Margins of Exposure (MOE)		Occupational LOC MOE = 100	Occupational LOC MOE = 100
	Critical Study and Endpoints		21-Day Dermal-Rat LOAEL = 27 mg/kg/day, based on mortality in females	Co-critical studies: 2-Gen Reproductive toxicity – rat

Exposure Scenario		CDPR 2006	EPA 2002	EPA 2007
Dermal Long-term (> 6 months)				LOAEL = 6.2, based on decreased body weight DNT- rat: LOAEL = 3.74, based on decreased pup weight; NOAEL not established.
	Reference		MRID 00146841/00147744 MRID 00146841	MRID 00148264 MRID 46968301
	PoD, UF		NOAEL = 12 mg/kg/day 45% absorption	NOAEL = 12 mg/kg/day 45% absorption
Inhalation Short (1-30 days) and Intermediate term (1 - 6 months)	Level of Concern (LOC) and absorption rate		Occupational LOC MOE = 100	Occupational LOC MOE = 100
	Critical Study and Endpoints		21-Day Dermal-Rat LOAEL= 27 mg/kg/day, based on mortality in females	21-Day Dermal-Rat LOAEL= 27 mg/kg/day, based on mortality in females
	Reference		MRID 00146841/00147744 MRID 00146841	MRID 00146841/00147744 MRID 00146841
Inhalation Short (1-30 days) and Intermediate term (1 - 6 months)	PoD, UF		NOAEL = 0.2 (0.001 mg/L)	NOAEL = 0.2 (0.001 mg/L)
	Level of Concern (LOC) and absorption rate		MOE = 100 100% absorption	MOE = 100 100% absorption

Exposure Scenario		CDPR 2006	EPA 2002	EPA 2007
Inhalation Long-term (> 6 months)	Critical Study and Endpoints		21-Day inhalation -rats LOAEL= 0.002 mg/L, based on ↓ body weight gains, ↓ leukocyte counts (M), and ↑ creatinine values (F); 0.4 mg/kg/day	21-Day inhalation -rats LOAEL= 0.002 mg/L, based on ↓ body weight gains, ↓ leukocyte counts (M), and ↑ creatinine values (F); 0.4 mg/kg/day
	Reference		MRID 00147183 MRID 41667501	MRID 00147183 MRID 41667501
	PoD, UF			
	Level of Concern (LOC) and absorption rate			
	Critical Study and Endpoints			
Cancer	Reference		None Established	None Established
	Classification	Not oncogenic Not genotoxic	Group E- Evidence of non-carcinogenicity for humans	Group E- Evidence of non-carcinogenicity for humans
	Statistical Analysis	none	Q1* not calculated	Q1* not calculated

### III. Dietary Assessment

HED has the following comments on the dietary portion of the CDPR endosulfan characterization document. It is important to note that the original CDPR dietary assessment is from 1998. There is an addendum dated September 2006 that addresses the need for a complete revision of the 1998 dietary assessment. A complete reassessment was not conducted. Comparisons will be made between the 1998 CDPR assessment (and addendum) and the 2002 HED dietary assessment. The 2002 HED dietary assessment is likely to change in the near future based upon review of additional submitted data.

- HED does not usually present screening level assessments if a more refined assessment has been done. HED only presents the more refined assessment. The CDPR assessment includes data that has been refined (with percent crop treated and PDP monitoring data) as well as a general screening assessment assuming 100% crop treated and tolerance level residues.
- HED used an acute endpoint of 1.5 mg/kg/day (with an uncertainty factor of 100 and a FQPA safety factor of 10) and a chronic endpoint of 0.6 mg/kg/day (with an uncertainty factor of 100 and a FQPA safety factor of 10). CDPR used an acute endpoint of 0.7 mg/kg/day and a 0.57 mg/kg/day chronic endpoint. There is also mention of a NOEL of 0.25 mg/kg/day used as a chronic endpoint. This is referred to in Appendix A (original 1996 dietary assessment).
- Neither assessment included consumption data for drinking water.
- The CDPR assessment discusses populations upon which HED does not normally base regulatory decisions on.
- The CDPR assessment discusses acute exposures at the 95<sup>th</sup> percentile. HED typically bases regulatory decisions on the 99.9<sup>th</sup> percentile.
- The CDPR dietary assessment from 1998 used the TAS, Inc EX<sup>TM</sup> acute and chronic dietary exposure software (TAS, 1996). The 2002 HED dietary exposure assessment used the DEEM<sup>TM</sup> dietary exposure model. The dietary modeling software program is important to determine if the recipes and age groupings are the same as those used by HED. In other words, an assessment done with a program other than DEEM cannot be directly compared to an assessment done with DEEM. The results could vary based upon this fact. Both HED and CDPR now use the DEEM-FCID<sup>TM</sup> modeling software. Also, the DEEM<sup>TM</sup> food recipe libraries may well differ from those used by the TAS, Inc EX<sup>TM</sup> software.
- The TAS, Inc EX<sup>TM</sup> acute and chronic dietary exposure software analyzes acute exposure, seasonal exposure for California workers, chronic exposure (1 year), and lifetime exposure (oncogenic). Since DPR had no oncogenic exposure factor for endosulfan, a lifetime dietary exposure was not performed. HED conducts acute and chronic (lifetime - age 0 to 85 years) dietary exposure assessments.

- The CDPR assessment and the most recent HED risk assessment completed (Endosulfan RED, 2002) both used the same Continuing Survey of Food Intake by Individuals (CSFII) consumption database from 1989-1992. There is a newer database that is currently in use by both HED and DPR (CSFII 1994-1996 and 1998). This newer consumption database will be used in the event the upcoming HED endosulfan risk assessment conducts quantitative dietary risk calculations.
- The CDPR assessment used residue data from the following sources: DPR monitoring program (1993-1995), registrant field residue trials, USDA 1994 or 1996 PDP monitoring program, or USDA 1995 FSIS residue monitoring program. A US EPA tolerance level was only used as the exposure value for sugarcane and its processed commodities. The 2002 HED assessment used a combination of data from PDP, FDA, and registrant field trials. HED typically uses the most recent 5 years of monitoring data and the assessments are supposed to be updated using anticipated residues every 5 years.
- For the reasons listed in the draft document, HED agrees with the CDPR conclusion regarding the 2006 dietary addendum being sufficient when combined with the prior 1998 DPR dietary exposure assessment. With the nine tolerances canceled or proposed for cancellation by the registrant and 5 tolerances revoked by the Agency (72 uses decreased to 58), decreased maximum application rates for a number of commodities, along with the fact that the FQPA safety factor is likely to be reduced, it is highly unlikely that dietary risks will exceed the Agency's level of concern. This same rationale will likely be used in conducting the forthcoming 2007 HED dietary risk assessment.

#### **IV. Occupational/Residential Assessment**

HED has the following comments on the Occupational and Residential endosulfan characterization document. Tables 2 and 3 below highlight the differences in occupational handler exposure parameters and occupational postapplication exposure parameters, respectively, used in the CDPR 2006 risk assessment as compared to the Agency's 2007 forthcoming risk assessment. Some differences include:

- The duration measured- CDPR measured short-term (1-7 days), seasonal (1 week to 1 year), and annual. HED measured short-term (1-30 days), and intermediate-term (1-6 months);
- CDPR uses PHED, but adjusts the values. For short-term exposure, CDPR applies an upper confidence limit factor on the 95th percentile. The UCL multiplier is 5 for replicates of  $\geq 20$  and is 4 for replicates  $< 20$ . For seasonal and annual exposure, CDPR applies an upper confidence limit factor to the arithmetic mean. The UCL multiplier is 1 if the replicates are  $> 15$ . HED uses central tendency estimates and does not adjust PHED values;
- CDPR assessed the worse-case (highest transfer coefficient) for major crop groupings and HED assessed all crops and all transfer coefficients applicable to each crop;
- CDPR assessed public exposure to ambient air and to bystanders estimating the concentration of endosulfan in the air and uptake of endosulfan from the air. HED typically does not assess this exposure scenario unless specifically triggered by physical properties, use pattern, and/or incident data; and
- CDPR assessed swimmer exposure using the Swimmodel. HED does not assess this exposure scenario unless a pesticide is directly applied to a body of water or swimming pool.

**Table 2. Comparison of Occupational Handler Data for Endosulfan**

<b>OCCUPATIONAL HANDLER EXPOSURE DATA</b>	<b>CDPR ASSESSMENT – 2006</b>	<b>HED ASSESSMENT</b>
Dermal absorption	47.3%	45%
Body Weight	70 kg	60 kg for dermal; 70 kg for inhalation
Duration Assessed	Short-term, Seasonal, Annual	Short- and Intermediate-Term
Unit Exposure Value Source	<p>PHED, except:</p> <ul style="list-style-type: none"> <li>• Carbaryl handler study for airblast application</li> <li>• Rags-E for dermal and Swimodel for inhalation for dip application</li> </ul>	<p>PHED plus:</p> <ul style="list-style-type: none"> <li>• ORETF for handgun, and low-pressure handwand scenarios</li> <li>• Carbaryl for airblast application</li> <li>• Malathion for closed system mixing/loading to support aerial application</li> </ul>
PHED Unit Exposure Value Adjustments	<p>Adjusts PHED values:</p> <ul style="list-style-type: none"> <li>• Short-term applies an upper confidence limit factor on the 95<sup>th</sup> percentile – the UCL multiplier is 5 for replicates <math>\geq 20</math> and the UCL is 4 for replicates <math>&lt; 20</math></li> <li>• Seasonal and Annual applies an upper confidence limit factor to the arithmetic mean – the multiplier is 1 if the replicates are <math>&gt; 15</math></li> </ul>	Does not adjust PHED values – uses central tendency estimates
Airblast (Carbaryl) Unit Exposure Value Adjustments	Adjusts carbaryl airblast unit exposures as described for PHED adjustments above	Uses geometric mean unit exposure values from the carbaryl airblast study
Mixing/Loading Liquids	Assumes closed system (CA requirement) plus baseline attire, chemical-resistant gloves, chemical-resistant apron, and respirator	Assesses baseline attire through engineering controls. As per the WPS, assumes baseline attire, chemical-resistant gloves, and chemical-resistant apron (but no respirator) when closed mix/load systems are used
Mixing/Loading Wettable Powder	Assesses both wettable powder and water-soluble packaging scenarios plus baseline attire, chemical-resistant gloves, chemical-resistant apron, and respirator	Assesses wettable powder with baseline attire and the addition of PPE, including gloves, double layer, and respirator. As per the WPS, applicators using wettable powders in water-soluble packaging are assessed with baseline attire, chemical-resistant gloves, and chemical-resistant apron (but no respirator).

<b>OCCUPATIONAL HANDLER EXPOSURE DATA</b>	<b>CDPR ASSESSMENT – 2006</b>	<b>HED ASSESSMENT</b>
Aerial Application	Assesses open cockpit with baseline attire plus respirator	Only assesses enclosed cockpit with baseline attire.
Groundboom Application	Assesses open cab with baseline attire plus gloves plus respirator	Assesses open and enclosed cab and assesses baseline attire and addition of PPE, including gloves, double layer, and respirator. As per the WPS, applicators using enclosed cabs are assessed with baseline attire.
Airblast Application	Uses carbaryl-specific data for open cab with baseline attire, gloves, chemical-resistant headgear, and respirator	Uses PHED and carbaryl-specific data. For PHED: assesses open and enclosed cab and assesses baseline attire and addition of PPE, including gloves, double layer, and respirator. As per the WPS, applicators using enclosed cabs are assessed with baseline attire. For carbaryl, assumes same attire as CDPR.
Flaggers	Assumes baseline attire plus gloves	Assesses open and enclosed cab and assesses baseline attire and addition of PPE, including gloves, double layer, and respirator. As per the WPS, applicators using enclosed cabs are assessed with baseline attire.
Mixer/Loader/Applicators (backpack, low-pressure handwand, high-pressure handwand and handgun applications)	Assume baseline attire plus gloves plus respirator	Assesses baseline attire and addition of PPE, including gloves, double layer, and respirator.
Mixer/Loader/Applicators (dip applications)	Assumes closed system for mixing/loading and assumes all handlers wearing baseline attire plus gloves plus respirator. Amount handled per day is not specified	Assesses open-system mixing/loading with baseline attire and addition of PPE, including gloves, double layer, and respirator. As per the WPS, assesses closed-system mixing/loading with baseline attire plus gloves and apron. No data for applying dips. Assumes 100 gallon/day.
Worse-Case Scenario Selection: Aerial	<ul style="list-style-type: none"> <li>Max application rate of 2.5 lb ai/A (for tree nuts) and 350 acres treated per day</li> </ul>	<ul style="list-style-type: none"> <li>High acreage: max application rate of 1.5 lb ai/A (for cotton and sorghum) and 1200 acres treated per day;</li> <li>Typical acreage: max current application rate of 3 lb ai/A (tree fruit and nuts) and max proposed application rate of 2.5 lb ai/A (tree fruit) and 350 acres</li> </ul>

OCCUPATIONAL HANDLER EXPOSURE DATA	CDPR ASSESSMENT – 2006	HED ASSESSMENT
Worse-Case Scenario Selection: Groundboom	<ul style="list-style-type: none"> <li>Max application rate of 2.0 lb ai/A (strawberry, pineapple, and crucifer) and 80 acres treated per day</li> </ul>	<p>treated per day</p> <ul style="list-style-type: none"> <li>High acreage: max application rate of 1.5 lb ai/A (for cotton and sorghum) and 1200 acres treated per day;</li> <li>Typical acreage: max current application rate of 2.0 lb ai/A (same as CA plus vegetables grown for seed) and 80 acres treated per day</li> </ul>
Worse-Case Scenario Selection: Airblast	Max application rate of 2.5 lb ai/A (tree nuts) and 40 acres treated per day	Max current application rate of 3 lb ai/A (tree fruit and nuts) and max proposed application rate of 2.5 lb ai/A (tree fruit) and 40 acres treated per day
Worse-Case Scenario Selection: Backpack and Low-Pressure Handwand	Max application rate of 0.01 lb ai/gal (macadamia nuts) and 40 gallons per day	Max application rate of 0.025 lb ai/gal (postharvest bark treatment to apricots, nectarines, peaches, SE States only) and 40 gallons per day
Worse-Case Scenario Selection: Handgun and High-Pressure Handwand	Max application rate of 0.01 lb ai/gal (macadamia nuts) and 1000 gallons per day (does not assess handgun)	Max application rate of 0.025 lb ai/gal (postharvest bark treatment to apricots, nectarines, peaches, SE States only) and 1000 gallons per day
Worse-Case Scenario Selection: Dip	Max application rate of 0.05 lb ai/gal (nursery stock dip) and no gallons per day given	Max application rate of 0.05 lb ai/gal (nursery stock dip) and 100 gallons per day

**Table 3. Comparison of Postapplication Exposure Data for Endosulfan**

<b>OCCUPATIONAL POSTAPPLICATION EXPOSURE DATA</b>	<b>CDPR ASSESSMENT – 2006</b>	<b>HED ASSESSMENT</b>
Dermal absorption	47.3%	45%
Body Weight	70 kg	60 kg for dermal; 70 kg for inhalation
Duration Assessed	Short-term, Seasonal, Annual	Short- and Intermediate-Term
Short-Term Assumptions	Assumes entry after 2-day REI expires for all activities, except harvesting; Assumes entry after PHI for harvesting	Assesses all days following application (starting 12 hours after application) until MOE is 100 or greater; Does not consider PHI in calculations, since these are based on dietary considerations and can change without affecting the REI
Personal Protective Equipment	No PPE after REI expires	No PPE after REI expires
Exposure Route Assessed	Dermal only	Dermal only
DFR Data Used	Used endosulfan-specific DFR data from grape, lettuce, melons, and peaches, but doesn't state which DFR data were used to represent which crops	Used endosulfan-specific DFR data from grape, lettuce, melons, and peaches
Crop Scenarios Assessed	Assesses worse-case (highest transfer coefficient) for major crop groupings	Assesses all crops and all transfer coefficients applicable to each crop
Scenario: Almond, Thinning	TC of 1500 cm <sup>2</sup> /hour	Worse-case TC of 2500 cm <sup>2</sup> /hour (represents hand harvesting, hand pruning)
Scenario: Broccoli, Hand Harvesting	TC of 5000 cm <sup>2</sup> /hour	Worse-case TC of 5000 cm <sup>2</sup> /hour (represents hand harvesting, irrigating, hand pruning)
Scenario: Broccoli, Scouting	TC of 4,000 cm <sup>2</sup> /hour	Worse-case TC of 4,000 cm <sup>2</sup> /hour (represents scouting)
Scenario: Citrus, Thinning	TC of 3,000 cm <sup>2</sup> /hour	Worse-case TC of 400 cm <sup>2</sup> /hour (represents all tasks – nonbearing citrus only)
Scenario: Sweet Corn, Hand Harvesting	TC of 17,000 cm <sup>2</sup> /hour	Worse-case TC of 17,000 cm <sup>2</sup> /hour (represents detasselling, hand harvesting)
Scenario: Cotton, Scouting	TC of 2,000 cm <sup>2</sup> /hour	Worse-case TC of 2,500 cm <sup>2</sup> /hour (represents hand harvesting; TC of 1,500 cm <sup>2</sup> /hour (represents irrigating, scouting, hand weeding)
Scenario: Cucumber, Hand Harvesting	TC of 2,500 cm <sup>2</sup> /hour	Worse-case TC of 2,500 cm <sup>2</sup> /hour (represents hand harvesting, hand pruning, thinning)

OCCUPATIONAL POSTAPPLICATION EXPOSURE DATA	CDPR ASSESSMENT – 2006	HED ASSESSMENT
Scenario: Grape, Cane Turning	TC of 10,000 cm <sup>2</sup> /hour	Worse-case TC of 10,000 cm <sup>2</sup> /hour (represents girdling, cane turning, tying)
Scenario: Lettuce, Scouting	TC 1,500 of cm <sup>2</sup> /hour	Worse-case TC 2,500 of cm <sup>2</sup> /hour (represents Hand harvesting); TC 1,500 of cm <sup>2</sup> /hour (represents scouting and irrigating)
Scenario: Ornamental Plants, Hand Harvesting	TC of 400 cm <sup>2</sup> /hour	Worse-case TC of 400 cm <sup>2</sup> /hour (represents all tasks, except harvesting flowers or foliage grown for cutting)
Scenario: Ornamental Cut Flowers, Hand Harvesting	TC of 7,000 cm <sup>2</sup> /hour	Worse-case TC of 5,100 cm <sup>2</sup> /hour (represents harvesting flowers or foliage grown for cutting – short-term endpoint)
Scenario: Peach, Thinning	TC of 3,000 cm <sup>2</sup> /hour	Worse-case TC of 3,000 cm <sup>2</sup> /hour (represents peach thinning)
Scenario: Potato, Scouting	TC of 1,500 cm <sup>2</sup> /hour	Worse-case TC of 1,500 cm <sup>2</sup> /hour (represents irrigating, scouting)
Scenario: Strawberry, Hand Harvesting	TC of 1,500 cm <sup>2</sup> /hour	Worse-case TC of 1,500 cm <sup>2</sup> /hour (represents hand harvesting, hand pruning, pinching, training)
Scenario: Tomato, Hand Harvesting	TC of 1,000 cm <sup>2</sup> /hour	Worse-case TC of 1,000 cm <sup>2</sup> /hour (represents (hand harvesting, hand pruning, staking thinning, training, tying)
Scenario: Public Exposure to Ambient Air and to Bystanders	Estimated concentration of endosulfan in air and uptake of endosulfan from air	Not assessed
Scenario: Swimmer Exposure	Estimated swimmer exposure using the Swimmodel	Not assessed

## References

1. DP Barcode: D272431  
Subject: Endosulfan: HED Risk Assessment for the Endosulfan Reregistration Eligibility Decision (RED) Document.  
From: D. Locke  
To: R. Dumas  
Dated: 01/31/2001  
MRID(s): None
  
2. DP Barcode: D327215 [DRAFT]  
Subject: A Developmental Neurotoxicity Study with Technical Grade Endosulfan in Wistar Rats. Project Number: 201563  
From: J. Facey  
To: N/A  
Dated: January 2007 [DRAFT]  
MRID(s): 46968301
  
3. DP Barcode: D281201  
Subject: Endosulfan. Anticipated Residues, and Revised Acute and Chronic Dietary Exposure Analysis.  
From: S. Kinard  
To: D. Locke  
Dated: 02/28/2002  
MRID(s): None
  
4. DP Barcode: D327222 [DRAFT]  
Subject: Endosulfan: Occupational and Residential Exposure Assessment for the Reregistration Eligibility Decision Document.  
From: S. Recore  
To: T. Perry  
Dated: February 2007 [DRAFT]  
MRID(s): None



13544

# R139831

**Chemical:** Endosulfan

**PC Code:**  
079401

**HED File Code:** 14000 Risk Reviews

**Memo Date:** 1/31/2007

**File ID:** DPD335812

**Accession #:** 000-00-0117

**HED Records Reference Center**  
2/7/2007