Date: 21 May 1998

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MEMORANDUM

SUBJECT: OCCUPATIONAL AND RESIDENTIAL EXPOSURE ASSESSMENT AND RECOMMENDATIONS FOR THE REREGISTRATION ELIGIBILITY DECISION DOCUMENT FOR ETHYL PARATHION

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Please find attached the occupational and residential exposure assessment for Ethyl Parathion. This chapter uses a streamlined format.

DP Barcode: 240988

Pesticide Chemical Codes: 057501

EPA Reg Nos: 4787-16-67760; 4787-17; 4787-91

EPA MRID No.: N/A

PHED: Yes, Version 1.1

Ethyl Parathion

This is an abbreviated occupational exposure and risk assessment for ethyl parathion.

I. Hazard ID

Table 1 summarizes the critical toxicological information from the Ethyl Parathion Hazard ID memo dated 18 May 1998.

Table 1. Ethyl parathion hazard endpoints and uncertainty factors.

Route / Duration	NOEL (mg/kg/day)	Endpoint	Study	Uncertainty Factors	Comments
Short-term Dermal	0.025	Plasma and RBC ChE Inhibition	Acute Neurotoxicity Study in Rats (MRID 43117901)	Interspecies: 10x Intraspecies: 10x FQPA: None	100 percent dermal absorption assumed.
Short-term Inhalation				Interspecies: 10x Intraspecies: 10x FQPA: None	No inhalation study available. Exposure is converted to an oral equivalent dose, combined with the dermal dose, and compared to the oral endpoint.
Intermediate-term Dermal	0.0024	Plasma ChE Inhibition	6-month Oral Study in Dogs (MRID 41836601)	Intraspecies: 10x Intraspecies: 10x FQPA: None	100 percent dermal absorption assumed.
Intermediate-term Inhalation				Interspecies: 10x Intraspecies: 10x FQPA: None	No inhalation study available. See comments above.

Ethyl parathion is classified as a Group C (possible human) carcinogen. Based on the active ingredient, the acute oral and dermal toxicity are category I, acute inhalation toxicity is category II, primary eye and skin irritation data requirements were waived (based on acute toxicity). Ethyl parathion is not a dermal sensitizer.

II. Exposure Characterization

Ethyl parathion is an restricted use pesticide formulated solely as an emulsifiable concentrate (78 and 55 percent ai). The registrants entered into an agreement with EPA (57 FR 65061, December 13, 1991) to limit the use of ethyl parathion to nine crops (alfalfa, barley, canola, corn, cotton, soybeans, sorghum, sunflower, and wheat). There are no residential uses. The agreement also increased the handling restrictions to help prevent mixer/loader and

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applicator exposure. Occupational mixer/loaders must use closed mixing systems. The liquid ethyl parathion must be removed from its original shipping container and transferred to the mixing tank using hoses equipped with a dry-couple shut-off device that will minimize drips to not more than 2 ml per disconnect. An observer must be present during all mixing/loading activities in order to assist in the event of an accident.

The only application method permitted is by aircraft (by certified commercial applicators) and human flaggers are strictly prohibited. The pilot may not apply ethyl parathion if they have earlier in the day performed any mixing/loading activities.

No reentry is allow under any circumstances for the first 4 hours following the end of the application. Current labels state the restricted-entry period is 3 days (6 days for corn). Entry into the entry-restricted areas during this time is limited to workers scouting and irrigating the crop.

All workers entering a treated area under restricted reentry must wear PPE consisting of coveralls over long-sleeved shirts and long pants, chemical resistant boots and chemical resistant gloves. A crop that has been treated with parathion must be harvested by mechanical means only. Ethyl parathion is formulated with methyl parathion (EPA Reg No. 4787-19).

Routes of potential occupational exposure are dermal and inhalation. Occupational exposure durations are short- (1 to 7 days) and intermediate-term (1 week to several months). HED has not identified the potential for occupational chronic exposures.

III. Occupational Exposure and Risk Assessment

Application Rates: The registrant, Cheminova, is supporting the following crop-specific application rates for ethyl parathion (Table 2).

Table 2. Ethyl parathion crop-specific application rates.

Crop	Application Rate (lb ai / acre)
Alfalfa, Canola	0.5
Barley, Corn, Soybeans, Wheat	0.75
Cotton, Sorghum, Sunflower	1

As part of the Reregistration process, the crop-specific application rates on all labels should be amended to correspond to the above rates.

- *Submitted Studies:* HED is not aware of any additional studies submitted by the registrant since the ethyl parathion consent agreement in 1991.

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- *Handler Exposure Scenarios:* HED has identified three major exposure scenarios for the occupational handler: (1) mixing / loading liquids for aerial application; (2) applying sprays with fixed-wing aircraft; and (3) applying sprays with helicopter. Occupational handler short-term and intermediate-term dermal and inhalation exposures (developed using PHED Version 1.1 surrogate data) are presented in Table 6. Table 7 presents occupational handler short- and intermediate-term risks from ethyl parathion at baseline. Table 6 presents occupational handler short- and intermediate-term risks from ethyl parathion with maximum PPE and Table 9 presents occupational handler short- and intermediate-term risks from ethyl parathion with engineering controls. The formulae that were used in the exposure / risk calculations are documented in the table footnotes and the assumptions that were used are noted in Table 10.

- *Handler Exposure Scenario Results:* Results for the occupational handler scenarios are presented in Tables 7 through 9 and are summarized below in Table 3.

Table 3. Highest short- and intermediate-term MOE for each ethyl parathion exposure scenario.

Exposure Scenario	Restrictions / Risk Mitigation	Highest Total MOE	
		Short-Term	Intermediate-term
Mixing/loading liquids for aerial applications	Baseline	0.0035	0.00033
Mixing/loading liquids for aerial applications	Maximum PPE	0.59	0.056
Mixing/loading liquids for aerial applications	Engineering Controls	1.2	0.11
Applying sprays with fixed wing aircraft		2.0	0.19
Applying sprays with helicopter		5.3	0.5

- *Postapplication Exposure Scenarios:* One scenario has been selected to represent postapplication exposures to agricultural workers. This scenario, scouting in cotton, was selected to represent reasonable activities that would occur in the nine crops on ethyl parathion labels. The transfer coefficient (Tc) for scouting in early season cotton is estimated to be 1,000 cm^2/hr and to be 4,000 cm^2/hr for late season cotton. It is assumed that 20 percent of ethyl parathion is available as dislodgeable residues and that it dissipates at a rate of 10 percent per day. The dissipation rate used approximates reports in the open literature that ethyl parathion is degraded within weeks (Hazardous Substances Data Bank Retrieval, 1998).

  Because there are cases of early entry (scouting, irrigating) into restricted-entry areas wearing PPE, an additional analysis was conducted. Assuming the addition of PPE would result in a 90 percent protection factor, transfer coefficients were adjusted to 10 percent of the default values used above. The analysis was then conducted using transfer coefficients of 100 cm^2/hr for low crops and 400 cm^2/hr for high crops.

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- *Postapplication Exposure Scenario Results:* Table 4 provides results (i.e., day after treatment where MOE is greater than 100) for an occupational surrogate Restricted-Entry Interval (REI) calculation for scouting using standard default (1 hour in treated area, Tc = 1000 cm^2/hr; Intermediate-term NOEL = 0.0024 mg/kg/day). All of the calculated values are significantly longer than the label REIs of 3 days.

Table 4. Calculated Restricted-Entry Interval (REI) for each crop using surrogate data for transfer coefficients of 1,000 cm^2/hr for low crops.

Crop	Application Rate	REI (MOE greater than 100)
Alfalfa, Canola	0.5 lb ai / acre	62
Barley, Corn, Soybeans, Wheat	0.75 lb ai / acre	66
Cotton, Sorghum, Sunflower	1.0 lb ai / acre	69

See attached spreadsheets for calculations and formulae.

Table 5 provides results (i.e., day after treatment where MOE is greater than 100) for an occupational surrogate Restricted-Entry Interval (REI) calculation for scouting using PPE adjusted values (1 hour in treated area, Tc = 100 cm^2/hr; Intermediate-term NOEL = 0.0024 mg/kg/day). Again all of the calculated values are significantly longer than the label REIs of 3 days.

Table 5. Calculated Restricted-Entry Interval (REI) for each crop using surrogate data for transfer coefficients of 100 cm^2/hr for low crops.

Crop	Application Rate	REI (MOE greater than 100)
Alfalfa, Canola	0.5 lb ai / acre	40
Barley, Corn, Soybeans, Wheat	0.75 lb ai / acre	44
Cotton, Sorghum, Sunflower	1.0 lb ai / acre	47

See attached spreadsheets for calculations and formulae.

As a simple check on these default values, a study submitted in 1987 that was used to set the re-entry intervals was re-examined (MRID 401399-03 Ethyl Parathion: Proposal for Reentry Interval for Cotton). This study reports a dislodgeable foliar residue value for the combined parathion and paraoxon residues at or below 0.06 µg per cm^2 at 72 hours (3 days) post treatment. Using this value in the formula on the attached spreadsheet and the current intermediate dermal endpoint, the calculated MOEs are 3 for scouting early season cotton and 1 for late season cotton assuming that the scout (without PPE) spends 1 hour per day in the treated area. Assuming that the scout wears PPE which reduces the transfer coefficents by 90 percent (to 100 and 400 respectively), the calculated MOEs are 28 for scouting early season cotton and 7 for late season cotton.

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IV. Residential Exposure Assessment

- *Residential Handler Exposure:* There are no residential uses of ethyl parathion.

- *Residential Postapplication Exposure:* All labels include language concerning the maintenance of a buffer zone of 100 feet from buildings, public roads, or bodies of water to minimize the exposure via spray drift to bystanders. However, without actual exposure data, or validated modeling results, HED remains concerned that the existing buffer zones may not be not adequately protective and would not prevent ethyl parathion exposure to bystanders. The registrant is a member of the Spray Drift Task Force and HED reserves the decision concerning the magnitude of bystander spray drift exposure and the required buffer zone until data from the task force are evaluated.

V. Incident Data

Based on a recent review of ethyl parathion poisoning data (1992-1996) following the consent agreement, the following poisoning incidents have been reported (memo from Jerome Blondell (HED) to Jonathan Becker (HED), dated March 30, 1998):

- Incident Data System (IDS) includes two incidents, one from Minnesota and one from South Dakota. Both were related to spray drift exposure. Systemic / health effects were not reported.
- California reported six incidents involving ethyl parathion in 1992 and no incidents from 1993 through 1996. Three incidents involved drift from a plum orchard related to misuse. The three other incidents related to handlers cleaning or working on spray rigs.

VI. Conclusions

Based on the above occupational exposure and risk assessment, HED concludes:

- The use of risk mitigation measures for occupational handlers (i.e., maximum PPE and engineering controls) will not result in MOEs greater than 100 at the application rates supported by the registrant.

- Calculated REIs for the occupational postapplication assessment range from 62 to 69 days for default values and from 40 to 47 days for reentry using maximum PPE. These intervals are substantially greater than the label restricted-entry period of 3 days.

- In the absence of exposure data, or validated modeling results, HED cannot verify that the buffer zone of 100 feet is adequately protective to bystanders. Because the registrant is a member of the Spray Drift Task Force, HED reserves the decision concerning the magnitude of bystander spray drift exposure and the required buffer zone until data from the task force are evaluated.

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VII. Summary

Ethyl parathion, formulated only as an emulsifiable concentrate, is a restricted use pesticide used as an insecticide on 9 crops. The Agency and the registrant entered into a consent agreement in 1991 that placed numerous restrictions on the mixing, loading, and application of ethyl parathion. Further, constraints were placed on the restricted entry interval, such as limiting the time spent by workers in a treated area to 1 hour per 24 hour period and requiring additional PPE.

Based on HED's occupational exposure and risk assessment, the MOEs for ethyl parathion are much less than 100 for all handler scenarios. Restricted entry intervals are calculated to be greater than 40 days for scouts wearing PPE and spending 1 hour per day in the treated area. These estimates are based on default values expected to be found in typical agricultural settings where ethyl parathion is being used.

cc: Richard Griffin (OPP/HED/RRB2)
OREB Files

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Table 6: Occupational Handler Short- and Intermediate-term Dermal and Inhalation Exposures to Ethyl Parathion at Baseline.

Exposure Scenario (Scenario #)	Baseline Dermal Unit Exposure (mg/lb ai)[a]	Baseline Inhalation Unit Exposure (µg/lb ai)[b]	Crop	Range of Application Rates (lb ai/acre)[c]	Daily Acres Treated[d]	Daily Dermal Exposure (mg/day)[e]	Daily Inhalation Exposure (mg/day)[f]
Mixer/Loader Exposure							
Mixing/loading liquids for aerial application (1)	2.9	1.2	Alfalfa, Canola	0.5	350	510	0.21
			Barley, Corn, Soybeans, Wheat	0.75		760	0.32
			Cotton, Sorghum, Sunflower	1		1000	0.42
Applicator Exposure							
Applying sprays with fixed wing aircraft (2)	See engineering controls.	See engineering controls.	Alfalfa, Canola	0.5	350	See engineering controls.	See engineering controls.
			Barley, Corn, Soybeans, Wheat	0.75		See engineering controls.	See engineering controls.
			Cotton, Sorghum, Sunflower	1		See engineering controls.	See engineering controls.
Applying sprays with helicopter (3)	See engineering controls.	See engineering controls.	Alfalfa, Canola	0.5		See engineering controls.	See engineering controls.
			Barley, Corn, Soybeans, Wheat	0.75		See engineering controls.	See engineering controls.
			Cotton, Sorghum, Sunflower	1		See engineering controls.	See engineering controls.
Flagger Exposure							
Human flaggers are explicitly prohibited.	---	---	---	---	---	---	---

a Baseline dermal unit exposure represents long pants, long sleeved shirt, no gloves, open mixing/loading, open cab tractor.
b Baseline inhalation exposure represents no respirator.
c Application rates are the maximum single application rates provided by Cheminova in support of ethyl parathion tolerances for the 9 registered crops.
d Daily acres treated values are based on EPA HED estimates of acreage that could be treated in a single day for each exposure scenario of concern.
e Daily dermal exposure (mg/day) = Unit exposure (mg/lb ai) * Appl. rate (lb ai/acre) * Acres treated.
f Daily inhalation exposure (mg/day)= Unit exposure (µg/lb ai) * (1mg/1000 µg) Unit conversion * Application rate (lb ai/A) * Acres treated.

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Table 7: Occupational Handler Short-term and Intermediate-term Risks from Ethyl Parathion at Baseline.

Exposure Scenario (Scenario #)	Crop	Baseline Dermal			Baseline Inhalation			Baseline Total		
		Daily Dose (mg/kg/day)[a]	Short-term MOE[b]	Intermediate-term MOE[c]	Daily Dose (mg/kg/day)[d]	Short-term MOE[e]	Intermediate-term MOE[f]	Daily Dose (mg/kg/day)[g]	Short-term MOE[h]	Intermediate-term MOE[i]
Mixer/Loader Exposure										
Mixing/loading liquids for aerial application (1)	Alfalfa, Canola	7.3	0.0035	0.00033	0.003	8.3	0.8	7.3	0.0035	0.00033
	Barley, Corn, Soybeans, Wheat	11	0.0023	0.00022	0.0045	5.6	0.53	11	0.0023	0.00022
	Cotton, Sorghum, Sunflower	15	0.0017	0.00017	0.006	4.2	0.4	15	0.0017	0.00017
Applicator Exposure										
Applying sprays with fixed wing aircraft (2)	Alfalfa, Canola	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.
	Barley, Corn, Soybeans, Wheat	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.
	Cotton, Sorghum, Sunflower	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.
Applying sprays with helicopter (3)	Alfalfa, Canola	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.
	Barley, Corn, Soybeans, Wheat	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.
	Cotton, Sorghum, Sunflower	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.	See engineering controls.

Exposure Scenario (Scenario #)	Crop	Baseline Dermal			Baseline Inhalation			Baseline Total		
		Daily Dose (mg/kg/day)[a]	Short-term MOE[b]	Intermediate-term MOE[c]	Daily Dose (mg/kg/day)[d]	Short-term MOE[e]	Intermediate-term MOE[f]	Daily Dose (mg/kg/day)[g]	Short-term MOE[h]	Intermediate-term MOE[i]
Flagger Exposure										
Human flaggers are explicitly prohibited.	---	---	---	---	---	---	---	---	---	---

a Baseline dermal daily dose (mg/kg/day) = Daily dermal exposure (mg/kg) / Body weight (70 kg).
b Baseline dermal short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Baseline dermal daily dose (mg/kg/day).
c Baseline dermal intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Baseline dermal daily dose (mg/kg/day).
d Baseline inhalation daily dose (mg/kg/day) =Daily inhalation exposure (mg/kg) / Body weight (70 kg).
e Baseline inhalation short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Baseline inhalation daily dose (mg/kg/day).
f Baseline inhalation intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Baseline inhalation daily dose (mg/kg/day).
g Baseline total daily dose (mg/kg/day) = Baseline dermal daily dose (mg/kg/day) + Baseline inhalation daily dose (mg/kg/day).
h Baseline total short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Baseline total daily dose (mg/kg/day).
i Baseline total intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Baseline total daily dose (mg/kg/day).

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Table 8: Occupational Handler Short-term and Intermediate-term Risks from Ethyl Parathion with Maximum PPE

Exposure Scenario (Scenario #)	Crop	Dermal - Maximum PPE				Inhalation - Maximum PPE				Total - Maximum PPE		
		Unit Exposure (mg/lb ai) [a]	Daily Dose (mg/kg/day) [b]	Short-term MOE [c]	Int.-term MOE [d]	Unit Exposure (mg/lb ai) [a]	Daily Dose (mg/kg/day) [f]	Short-term MOE [g]	Int.-term MOE [h]	Daily Dose (mg/kg/day) [i]	Short-term MOE [j]	Int.-term MOE [k]
Mixer/Loader Exposure												
Mixing/ loading liquids for aerial application (1)	Alfalfa, Canola	0.017	0.043	0.59	0/056	1.2E-04	0.0003	83	8	0.043	0.59	0.056
	Barley, Corn, Soybeans, Wheat		0.064	0.39	0.038		0.00045	56	5	0.064	0.39	0.037
	Cotton, Sorghum, Sunflower		0.085	0.29	0.028		0.0006	42	4	0.086	0.29	0.028
Applicator Exposure												
Applying sprays with a fixed-wing aircraft (2)	Alfalfa, Canola	See eng. controls.	See eng. controls	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.
	Barley, Corn, Soybeans, Wheat		See eng. controls.	See eng. controls.	See eng. controls.		See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.
	Cotton, Sorghum, Sunflower		See eng. controls.	See eng. controls.	See eng. controls.		See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.
Applying sprays with a helicopter (3)	Alfalfa, Canola	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.
	Barley, Corn, Soybeans, Wheat		See eng. controls.	See eng. controls.	See eng. controls.		See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.
	Cotton, Sorghum, Sunflower		See eng. controls.	See eng. controls.	See eng. controls.		See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.	See eng. controls.

Exposure Scenario (Scenario #)	Crop	Dermal - Maximum PPE				Inhalation - Maximum PPE				Total - Maximum PPE		
		Unit Exposure (mg/lb ai) [a]	Daily Dose (mg/kg/day) [b]	Short-term MOE [c]	Int.-term MOE [d]	Unit Exposure (mg/lb ai) [e]	Daily Dose (mg/kg/day) [f]	Short-term MOE [g]	Int.-term MOE [h]	Daily Dose (mg/kg/day) [i]	Short-term MOE [j]	Int.-term MOE [k]
Flagger Exposure												
Human flaggers are explicitly prohibited.	---	---	---	---	---	---	---	---	---		---	---

[a] Maximum PPE dermal unit exposure (mg/day) represent coveralls over long pants, long sleeved shirt, chemical-resistant gloves.

[b] Maximum PPE dermal daily dose (mg/kg/day) = [Maximum PPE dermal unit exposure (mg/lb ai) * Appl. rate (lb ai/acre) * Acres treated] / Body weight (70 kg

[c] Maximum PPE dermal short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Maximum PPE dermal daily dose (mg/kg/day).

[d] Maximum PPE dermal intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Maximum PPE dermal daily dose (mg/kg/day).

[e] Maximum PPE inhalation unit exposure (ug/lb ai) represent organic vapor respirator.

[f] Maximum PPE inhalation daily dose (mg/kg/day) = [Maximum PPE inhalation unit exposure (mg/lb ai) * Appl. rate (lb ai/acre) * Acres treated] / Body weight (70 kg).

[g] Maximum PPE inhalation short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Maximum PPE inhalation daily dose (mg/kg/day).

[h] Maximum PPE inhalation intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Maximum PPE inhalation daily dose (mg/kg/day).

[i] Maximum PPE total daily dose (mg/kg/day) = Maximum PPE dermal daily dose (mg/kg/day) + Maximum PPE inhalation daily dose (mg/kg/day).

[j] Maximum PPE total short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Maximum PPE total daily dose (mg/kg/day).

[k] Maximum PPE total intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Maximum PPE total daily dose (mg/kg/day).

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Table 9: Occupational Handler Short-term and Intermediate-term Risks from Ethyl Parathion with Engineering Controls

Exposure Scenario (Scenario #)	Crop	Dermal - Engineering Controls				Inhalation - Engineering Controls				Total - Eng. Controls		
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Short-term MOE[c]	Int.-term MOE[d]	Unit Exposure (mg/lb ai)[e]	Daily Dose (mg/kg/day)[f]	Short-term MOE[g]	Int.-term MOE[h]	Daily Dose (mg/kg/day)[i]	Short-term MOE[j]	Int.-term MOE[k]
Mixer/Loader Exposure												
Mixing/ loading liquids for aerial application (1)	Alfalfa, Canola	0.0086	0.022	1.2	0.11	8.3E-05	0.00021	120	12	0.022	1.15	0.11
	Barley, Corn, Soybeans, Wheat		0.032	0.78	0.07		0.00031	80	8	0.033	0.77	0.074
	Cotton, Sorghum, Sunflower		0.043	0.58	0.06		0.00042	60	6	0.043	0.58	0.055
Applicator Exposure												
Applying sprays with a fixed-wing aircraft (2)	Alfalfa, Canola	0.005	0.013	2.0	0.19	6.8E--05	0.00017	150	14	0.013	2.0	0.19
	Barley, Corn, Soybeans, Wheat		0.019	1.3	0.13		0.00026	98	9	0.019	1.3	0.13
	Cotton, Sorghum, Sunflower		0.025	1.0	0.096		0.00034	74	7	0.025	0.99	0.095
Applying sprays with helicopter (3)	Alfalfa, Canola	0.0019	0.0048	5.3	0.51	1.8E-06	4.5E-06	5600	530	0.0048	5.3	0.50
	Barley, Corn, Soybeans, Wheat		0.0071	3.5	0.34		6.8E-06	3700	360	0.0071	3.5	0.34
	Cotton, Sorghum, Sunflower		0.0095	2.6	0.25		9.0E-06	2800	270	0.0095	2.6	0.25

Exposure Scenario (Scenario #)	Crop	Dermal - Engineering Controls				Inhalation - Engineering Controls				Total - Eng. Controls		
		Unit Exposure (mg/lb ai)[a]	Daily Dose (mg/kg/day)[b]	Short-term MOE[c]	Int.-term MOE[d]	Unit Exposure (mg/lb ai)[e]	Daily Dose (mg/kg/day)[f]	Short-term MOE[g]	Int.-term MOE[h]	Daily Dose (mg/kg/day)[i]	Short-term MOE[j]	Int.-term MOE[k]
Flagger Exposure												
Human flaggers are explicitly prohibited.	---	---	---	---	---	---	---	---	---		---	---

a Engineering Controls dermal unit exposure (mg/day) represent long pants, long sleeved shirt, no gloves in an enclosed cab or cockpit..

b Engineering Controls dermal daily dose (mg/kg/day) = [Engineering Controls dermal unit exposure (mg/lb ai) * Appl. rate (lb ai/acre) * Acres treated] / Body weight (70 kg).

c Engineering Controls dermal short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Engineering Controls dermal daily dose (mg/kg/day).

d Engineering Controls dermal intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Engineering Controls dermal daily dose (mg/kg/day).

e Engineering Controls inhalation unit exposure (ug/lb ai) represent enclosed cab or cockpit.

f Engineering Controls inhalation daily dose (mg/kg/day) = [Engineering Controls inhalation unit exposure (mg/lb ai) * Appl. rate (lb ai/acre) * Acres treated] / Body weight (70 kg).

g Engineering Controls inhalation short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Engineering Controls inhalation daily dose (mg/kg/day).

h Engineering Controls inhalation intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Engineering Controls inhalation daily dose (mg/kg/day).

i Engineering Controls total daily dose (mg/kg/day) = Engineering Controls dermal daily dose (mg/kg/day) + Engineering Controls inhalation daily dose (mg/kg/day).

j Engineering Controls total short-term MOE = Short-term NOEL (0.025 mg/kg/day) / Engineering Controls total daily dose (mg/kg/day).

k Engineering Controls total intermediate-term MOE = Intermediate-term NOEL (0.0025 mg/kg/day) / Engineering Controls total daily dose (mg/kg/day).

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Table 10: Occupational Exposure Scenario Descriptions for the Use of Ethyl Parathion

Exposure Scenario (Number)	Data Source	Standard Assumptions [a] (8-hr work day)	Comments[b]
Mixer/Loader Exposure			
Mixing/Loading Liquid Formulations (1)	PHED V1.1	350 acres	**Baseline:** "Best Available" grades: Hands, dermal, and inhalation based on acceptable grades. Dermal = 72 to 122 replicates; hands = 53 replicates; and inhalation= 85 replicates. High confidence in all data. **PPE:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades. Dermal = 72 to 122 replicates; hands = 59 replicates; and inhalation = 85 replicates. High confidence in all data. **Engineering Controls:** "Best Available" grades: Hands, dermal, and inhalation = acceptable grades; Dermal = 16 to 22 replicates; hands = 31 replicates; and inhalation = 27 replicates. High confidence in all data. PHED data were used for baseline, no protection factors (PFs) were necessary. A 50% PF was added to simulate coveralls for PPE. An 90% PF was used for PPE for inhalation to represent an organic vapor respirator. Engineering Controls data were monitored with chemical resistant gloves.
Applicator Exposure			
Applying Sprays with a Fixed-wing Aircraft (2)	PHED V1.1	350 acres	**Baseline:** Enclosed cockpit considered to be an engineering control. **Engineering controls:** "Best Available" grades: Dermal and inhalation = ABC grades; and hands = acceptable grades. Dermal = 24 to 48 replicates; hands = 34 replicates; and inhalation = 23 replicates. Medium confidence in all data. PHED data were used for baseline, no PFs were necessary.
Applying Sprays with a Helicopter (3)	PHED V1.1	350 acres	**Baseline:** Enclosed cockpit considered to be an engineering control. **Engineering Controls:** "Best Available" grades: Dermal and hands = ABC grades; and inhalation = acceptable grades. Dermal = 3 replicates; hands = 1 replicates; and inhalation = 3 replicates. Low confidence in all data. PHED data were used for baseline, no PFs were necessary.

Exposure Scenario (Number)	Data Source	Standard Assumptions [a] (8-hr work day)	Comments [b]
Flagger Exposure			
Human Flaggers are explicitly prohibited on all labels.	---	---	

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

[b] "Best Available" grades are defined by EPA SOP for meeting Subdivision U Guidelines. Acceptable grades are matrices with grades A and B data. Data confidence are assigned as follows:

High = grades A and B and 15 or more replicates
Medium = grades A, B, and C and 15 or more replicates
Low = grades A, B, C, D, and E or any combination of grades with less than 15 replicates.