



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

7-26-90

JUL 26 1990

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

SUBJECT: Review of label protective clothing statements
submitted in response to requirements of the
Reregistration Guidance Document for Acephate (HED
Project #s 9-0849 and 48118)

TO: W.H. Miller/M. Mautz
Product Manager 16/3
Registration Division (H7505C)

FROM: Peg Perreault *Peg Perreault*
Field Studies and Special Projects Section
Non-Dietary Exposure Branch
Health Effects Division (H7509C)

THRU: Alan P. Nielsen, Chief *Al Nielsen*
Field Studies and Special Projects Section
Non-Dietary Exposure Branch
Health Effects Division (H7509C)

Charles L. Trichilo, Ph.D., Chief
Non-Dietary Exposure Branch
Health Effects Division (H7509C)

Please find below the NDEB review of

RD Record #: 229218, 229219, 229220, 229223, 229224, 229225,
229221

Caswell #: 2A

Date Received: 8/16/88 Review Time: 4 days

Deferral to: Biological Analysis Branch/BEAD
 Science Analysis and Coordination Branch
 X TB - Insecticide/Rodenticide Support Section
 TB - Herbicide/Fungicide/Antimicrobial Support
Section

1/10

1.0 INTRODUCTION

Chemical:

Common name: Acephate

Chemical name: O,S-Dimethyl acetylphosphoramidothioate

Registered uses/formulations:

Acephate is a systemic, broad spectrum, organophosphate insecticide registered for use on terrestrial food crops, terrestrial nonfood, forestry, indoor (both commercial and residential), and greenhouse sites. Acephate is formulated into soluble concentrate solids, soluble concentrate liquids, granulars, pressurized liquids, and an 85% cartridge. There are 23 products registered for use in the U.S.; these include 18 single active ingredient formulations and 5 multiple active ingredient formulations. Methods of application include aerial, ground, injection (into tree trunks), and dip treatment (seeds and ornamentals).

Background:

Chevron Chemical Company has submitted labels for seven products containing acephate as the active ingredient in response to requirements of the Reregistration Guidance Document for Acephate dated September, 1987. The Guidance Document imposed the use of protective clothing, including chemical resistant gloves, long-sleeved shirt, long-legged pants, shoes, and socks for mixer/loaders and applicators as an interim measure to reduce exposure until nondietary exposure data were submitted and evaluated. The required data have been submitted by Chevron and have been reviewed by NDEB/EAB (memo from M. Firestone dated 6/23/88). The NDEB/EAB review and exposure assessment (EAB review No. 80812) is attached as Appendix A. The registrant has now proposed (1) to remove the applicator protective clothing statement from the labels of each of the seven products, and (2) to remove the protective clothing statements for early reentry into treated areas and for overhead exposure from the labels of four of the products. These proposals are reviewed in Section 3 of this document.

2.0 CONCLUSIONS/RECOMMENDATIONS

Based on the available exposure data, NDEB does not accept the registrant's proposal to remove the applicator protective clothing statement required by the Reregistration Guidance Document for Acephate from the labels of Orthene 75S Soluble Powder, Orthene PCO Spray Concentrate, Orthene 80 Seed Protectant, Orthene Tree and Ornamental Spray, Orthene

Professional Roach Spray, and Orthene Tobacco Insect Spray. However, NDEB does accept the proposal to remove the applicator protective clothing statement from the label of Orthene Specialty Concentrate since this product is applied exclusively by air and dermal exposure to applicators (pilots) is expected to be minimal.

* In addition, NDEB accepts the registrant's proposal to remove the protective clothing statements for early reentry into treated areas and for overhead exposure from the labels of Orthene Specialty Concentrate, Orthene PCO Spray Concentrate, Orthene 80 Seed Protectant, and Orthene Professional Roach Spray since there are no reentry hazards or potential for overhead exposure from the use of these products.

3.0 DETAILED CONSIDERATIONS

In response to requirements of the Reregistration Guidance Document for Acephate dated September, 1987, Chevron Chemical Company has submitted labels for the following products containing acephate as the active ingredient: Orthene 75S Soluble Powder (RD Record No. 229218); Orthene Specialty Concentrate (RD Record No. 229219); Orthene PCO Spray Concentrate (RD Record No. 229220); Orthene 80 Seed Protectant (RD Record No. 229223); Orthene Tree and Ornamental Spray (RD Record No. 229224); Orthene Professional Roach Spray (RD Record No. 229225); and Orthene Tobacco Insect Spray (RD Record No. 229221). The registrant has proposed (1) to remove the applicator protective clothing statement from the labels of all of these products, and (2) to remove the protective clothing statements for early reentry into treated areas and for overhead exposure from the labels of Orthene Specialty Concentrate, Orthene PCO Spray Concentrate, Orthene 80 Seed Protectant, and Orthene Professional Roach Spray. A discussion sheet and summary data on worker exposure to acephate and calculated Margins of Safety (MOS) were submitted to support the registrant's proposal to remove the applicator protective clothing statement from the labels.

The registrant's calculated MOS are based on a chronic NOEL (rat feeding study) of 250 $\mu\text{g/kg/day}$ and an ADI of 25 $\mu\text{g/kg/day}$ and were determined both for workers wearing gloves, trunks, and shoes and for workers wearing gloves, long-sleeved shirt, long-legged pants, shoes, and hat. In a recent memo from M. Firestone dated 6/23/88 (see Appendix A), NDEB concluded that approximately 65 to 99% of the dermal exposure to workers handling and/or applying acephate occurs to the hands, and that the proper use of protective gloves, as required by Reregistration Guidance Document, would reduce the exposure estimates two- to ten-fold. The MOS provided by the registrant are based on exposure data for workers wearing gloves and, as noted above, since most of the dermal exposure to mixer/loaders and applicators occurs to the hands, these MOS do not support the registrant's proposal to

remove the applicator protective clothing statement, which includes the use of chemical resistant gloves, from the labels of products containing acephate. In addition, the Toxicology Branch/IRS now considers brain ChE inhibition to be the end point of concern for acephate, and has established a NOEL of 0.004 mg/kg/day for brain ChE inhibition. The brain ChE NOEL (from a subchronic rat study) rather than the chronic NOEL should be used to calculate MOS for workers exposed to acephate.

With the exception of the label for Orthene Specialty Concentrate, NDEB does not accept the registrant's proposal to remove the applicator protective clothing statement from the labels that were submitted for products containing acephate as the active ingredient. NDEB agrees with the registrant's conclusion that since Orthene Specialty Concentrate is applied exclusively by air, there is no (or minimal) dermal exposure to applicators (pilots) during application and, thus, the applicator protective clothing statement may be removed from the label of this product.

In addition, NDEB agrees with the registrant's conclusion that there are no reentry hazards or potential for overhead exposure from the use of Orthene Specialty Concentrate, Orthene PCO Spray Concentrate, Orthene 80 Seed Protectant, and Orthene Professional Roach Spray. Therefore, NDEB accepts the registrant's proposal to remove the protective clothing statements for early reentry into treated areas and for overhead exposure from the labels of these four products.

Attachments: Appendix A

cc: Krystyna Locke/TB-1/IRS (H7509C)
Acephate File
Circulation
Correspondence File

APPENDIX A

Shaughnessy No: 103301

Date Out of EAB: 6/23/88

To: John Tice
Product Manager #16
Registration Division (TS-767C)

From: Michael P. Firestone, Chief *Michael P. Firestone*
Special Review Section #2
Exposure Assessment Branch/HED (TS-769C)

Thru: Paul F. Schuda, Chief *Paul F. Schuda*
Exposure Assessment Branch/HED (TS-769C)

Attached, please find the EAB review of:

Reg./File # : 223,409
Chemical Name : Acephate
Type Product : Insecticide
Product Name : Orthene
Company Name : Chevron
Purpose : Exposure Study

Date Received : 6/8/88 Action Code: 350

Date Completed: 6/23/88 EAB #(s): 80812

Monitoring study requested: X Total Reviewing Time: 10 days

Monitoring study volunteered:

Deferrals to:
 Ecological Effects Branch
 Residue Chemistry Branch
 Toxicology Branch

1.0 INTRODUCTION

The Guidance for the Reregistration of Pesticide Products Containing Acephate as the Active Ingredient document issued in September 1987 required the submission of nondietary exposure data for indoor residential and commercial indoor uses of acephate, outdoor home and commercial uses, greenhouse uses, and tobacco uses. These uses were selected due to lack of sufficient exposure data to permit the Agency to estimate the exposure to acephate. The required studies have been submitted by Chevron and have been evaluated by the Exposure Assessment Branch (EAB). In addition, the Benefits and Use Division (BUD) has provided EAB with the use information necessary to conduct the exposure assessment (Transmittal of Exposure Parameters for Various Acephate Use Sites, Memorandum from Yuen-Shaung Ng, May 27, 1988).

This exposure assessment has been expedited as per the request of the Registration Division Director (E. Tinsworth memorandum to A. Barton, HED Director dated May 10, 1988).

2.0 EXPOSURE TO HOMEOWNERS DURING OUTDOOR USE OF ACEPHATE

Chevron submitted an exposure study entitled "Potential Exposure to Acephate During Home Use of Orthene Systemic Insect Control" which was evaluated by EAB (Lunchick, C., EAB #80536, May 16, 1988). The inhalation exposure was below detection limits which would have provided an exposure of 0.15 mg/lb ai or 0.03% of the dermal exposure. Dermal exposure for homeowners applying acephate to ornamentals by hose-end sprayer were 480 mg/lb ai to 450 mg/lb ai depending on the clothing worn. Clothing scenarios varied as to shorts or long pants and long- or short-sleeved shirts. Hand exposure accounted for over 90% of the dermal exposure and should homeowners properly wear protective gloves, as required by the registration standard, the exposure would be reduced approximately five-fold. The Orthene used at the time of the study did not require protective gloves, and the exposure assessment will reflect that use.

BUD estimated that a homeowner would treat 600 square feet a day and may spray 15 times during the year to treat 9000 square feet. The total time required to fill the hose-end sprayer with acephate and treat 600 square feet is 41 min/day. A total of 0.42 fl oz ai are required to treat 600 square feet and 6.35 fl oz ai are required to treat 9000 square feet. Assuming one gallon weighs eight pounds, the weight of active ingredient in 0.42 fl oz and 6.35 fl oz is 0.026 lbs and 0.40 lbs ai, respectively. The daily exposure to a 70 kg homeowner using a hose-end sprayer to apply acephate is $(450 \text{ mg/lb ai} \times 0.026 \text{ lb ai/day} \times 1/70 \text{ kg})$ 0.17 mg/kg/day and $(450 \text{ mg/lb ai} \times 0.40 \text{ lb ai/yr} \times 1/70 \text{ kg})$ 2.6 mg/kg/yr.

3.0 EXPOSURE TO MIXER/LOADER/APPLICATORS DURING GREENHOUSE USE OF ACEPHATE

A surrogate study in which Sumagic PGR was applied by pressure hand-held sprayer to greenhouse ornamentals was submitted by Chevron. Individuals wearing long pants and long-sleeved shirts but not protective gloves were determined by EAB (Lunchick, C., EAB #80537, May 26, 1988) to receive a dermal exposure of 160 mg/lb ai during mixing/loading and application. Airborne levels of Sumagic were below the detection limit and, therefore, inhalation exposure would be insignificant. The reregistration guidance document requires acephate labels to be revised to require the use of protective gloves during use. The 160 mg/lb ai estimate would overestimate exposure for individuals complying with the revised labeling. EAB cannot quantify the reduction in dermal exposure from the use of gloves because many of the dosimeters were below the detection limit and, therefore, a substantial portion of the 160 mg/lb ai exposure estimate is based on 50% of the detection limit.

The BUD use information assumed a 40 ft x 500 ft greenhouse with 14,000 square feet of benches. It was assumed that acephate would be applied at 10.5 oz Orthene 75S/100 gallons water (0.49 lb ai/100 gal) and that 35 gallons would treat 14,000 square feet to runoff.

Based on these assumptions, a total of 2.76 oz or 0.17 lb ai are used daily. Yearly use assumed acephate is applied weekly over a 42-week period requiring 115.76 oz ai or 7.2 lb ai. It is unlikely that acephate would be the sole insecticide used weekly due to the fear of resistance among the insect population. The daily exposure to a 70 kg individual mixing/loading and applying acephate in a greenhouse is estimated to be (160 mg/lb ai x 0.17 lb ai/day x 1/70 kg) 0.34 mg/kg/day. The annual exposure to the individual would be (160 mg/lb ai x 7.2 lbs ai/yr x 1/70 kg) 16 mg/kg/yr.

Postapplication monitoring of Sumagic showed nondetectable airborne levels at 4 hours and 1, 2, and 4 days postapplication. The relationship of vapor pressures between Sumagic and acephate would partially determine if the Sumagic observations are indicative of postapplication airborne levels of acephate. Ventilation rates in the greenhouse also are important in affecting the airborne concentration of a pesticide after application. The air exchange in the Sumagic study greenhouse was 16,000 cfm.

4.0 EXPOSURE FROM PCO'S TREATMENT OF RESIDENTIAL SITES

EAB evaluated the PCO exposure study submitted by Chevron in response to the reregistration guidance document and estimated that the dermal exposure to a PCO treating a residential site was 160 mg/lb ai (Lunchick, C., EAB #80477, May 5, 1988). The estimate is for a PCO mixing/loading and applying acephate by hand-held sprayer to baseboards and cabinets. The estimate is based on a PCO wearing long pants, long-sleeved shirts, and no protective gloves. Gloves were not worn during the exposure study and the hands of the PCO accounted for 74 to 98% (average = 91%) of the dermal exposure. The reregistration guidance document requires the acephate labels to be revised to include the use of protective gloves. Assuming that properly worn protective gloves reduce hand exposure by 90%, the use of the gloves would reduce dermal exposure by approximately 80% or five-fold.

The use estimates provided by BUD assume that 252 feet are sprayed in a house and 228 feet are sprayed in an apartment. Using a spray dilution of 1.0 oz/gal water, a total of 0.18 oz ai are used per home and 0.12 oz ai are used per apartment. Based on 16 homes or 24 apartments treated daily with acephate, the PCO would handle 2.88 oz ai or 0.18 lb ai daily. Maximum yearly use estimates assume the PCO sprays 220 days/year using only acephate. This is very unlikely so that the assumption that a PCO uses 633.6 oz ai or 39.6 lb ai/yr is a maximal overestimate of usage. Based on these use estimates, the exposure to a 70 kg PCO treating residential units is 0.41 mg/kg/day and 91 mg/kg/yr.

Inhalation exposure for all residential PCOs was below the detection limit. All postapplication air samples (4 hrs, 1, 2, and 4 days) were below the detection limit. Based on the detection limit of 2.0 ug and 240 l drawn through the sampling tube during the 4-hour sampling period, the air levels did not exceed 0.008 ug/l. Assuming a 70 kg resident spends 24 hours in a treated room of which 18 hours is at rest and 6 hours is at light work, the inhalation exposure for this resident would not exceed $[(18 \text{ hrs} \times 60 \text{ min/hr} \times 7.4 \text{ l/min} + 6 \text{ hrs} \times 60 \text{ min/hr} \times 29 \text{ l/min}) \times 0.008 \text{ ug/l} \times 1/70 \text{ kg}]$ 2.1 ug/kg/day.

5.0 EXPOSURE FROM PCO TREATMENT OF COMMERCIAL SITES

The dermal exposure to PCOs treating commercial sites was similar to residential site exposure and was 170 mg/lb ai (Lunchick, C., EAB #80477, May 5, 1988). The dermal exposure estimate assumed the PCO wore long pants, long-sleeved shirt, and no protective gloves. As was observed with residential site treatments, the hands accounted for the majority of the dermal exposure (77 to 99%, average = 94%). The proper use of protective gloves by PCOs

would reduce dermal exposure about 80% or five-fold, assuming that the gloves reduce hand exposure 90%. The reregistration guidance document requires acephate labels to be revised to include the use of protective gloves. Inhalation exposure was below detectable levels for eight of the nine commercial PCOs. The inhalation exposure to the PCO was calculated to be 2.8 mg/lb ai.

BUD estimated that PCOs will treat commercial sites at 0.10 oz/gallon spray by hand-held sprayer. Treating a commercial kitchen site of 2479 ft in a hotel would require 0.12 oz ai. Treating 45 guest rooms would require 0.54 oz ai and treating the hotel's dining room would require 0.22 oz ai. One hotel could be treated in a day and would require 0.88 oz ai or 0.055 lb ai/day. Assuming one 70 kg PCO treats the entire hotel, the dermal exposure would be 0.13 mg/kg/day (170 mg/lb ai x 0.055 lb ai/day x 1/70 kg). Inhalation exposure generally would not exceed 0.0022 mg/kg/day (2.8 mg/lb ai x 0.055 lb ai/day x 1/70 kg). BUD did not provide annual use estimates; however, if one uses the upper limit assumption of 220 days/yr using only acephate, the annual exposures to the PCO are 29 mg/kg/yr for dermal exposure and 0.48 mg/kg/yr for inhalation exposure. As with the residential uses, it is extremely unlikely that a PCO will actually treat 220 days/yr with acephate.

The postapplication air concentration of acephate at the commercial sites did not exceed 0.015 ug/l which occurred at 4 hours postapplication. Assuming a worker is exposed 8 hours per day and has a respiratory volume of 29 l/min, the daily exposure would not exceed (29 l/min x 60 min/hr x 8 hr/day x 1/70 x 0.015 ug/l) 3.0 ug/kg/day. If the commercial site is treated weekly with acephate, the annual respiratory exposure would be 150 ug/kg/yr for workers at the commercial site.

6.0 EXPOSURE TO MIXER/LOADER/APPLICATORS DURING FOLIAR GROUND BOOM APPLICATION TO TOBACCO

EAB shall use surrogate data to estimate the exposure to mixer/loaders and applicators applying Orthene Tobacco Insect Spray to tobacco by ground boom. Chevron submitted a surrogate exposure study in which captafol was applied to wheat. The study was rejected by EAB (Nelson, H., EAB# 80535, June 17, 1988) due to inconsistencies and ambiguities in reported amounts of captafol handled during the sampling period. EAB will use its surrogate data in place of the captafol study.

Everhart, L.P. and Holt, R.F. (Potential Benlate Fungicide Exposure During Mixer/Loader Operations, Crop Harvest, and Home Use, J. Agric. Food Chem., 30:222-227) measured the exposure to mixer/loaders handling Benlate, a wettable powder containing 50 percent benomyl. Orthene Tobacco Insect Spray is a 75 percent ai

soluble powder. Dermal exposure was measured using surgical gauze pads and cotton undertaker's gloves for the hands. The exposure was as follows and is adjusted to include the use of long-sleeved shirts and protective gloves:

Body Area	Exposure (mg)*							
	Repl. 1	Repl. 2	Repl. 5	Repl. 6	Repl. 7	Repl. 8	Repl. 9	Repl. 10
Forearms	0.075	0.58	1.6	3.8	0.19	0.73	0.42	1.4
Face	0.026	0.29	2.9	7.8	1.4	1.4	1.4	1.1
Back of Neck	0.004	0.017	0.11	0.035	0.004	0.42	0.23	0.14
Back	0.014	0.053	0.36	0.11	0.014	1.3	0.75	0.46
Front of Neck	0.006	0.033	0.57	0.71	0.051	0.12	0.51	0.23
Chest	0.014	0.078	1.3	1.7	0.12	0.27	1.2	0.53
Hands	0.32	0.37	1.1	1.0	0.23	1.7	0.47	4.5
	0.459	1.42	7.94	15.2	2.01	5.94	4.98	8.36
lb ai	18.5	18.5	20	23.5	12.5	20	30	30
Exposure mg/lb ai	0.025	0.077	0.40	0.64	0.16	0.30	0.17	0.28

*Data from Tables I and III, body surface areas from Subdivision U, Exposure Assessment Guidelines.

The mean exposure for the eight replicates is 0.26 mg/lb ai. Mean respiratory exposure was 4.4 ug/lb ai.

To estimate the dermal exposure to ground boom applicators, EAB reviewed six studies available in the published literature. The estimated dermal exposure for ground boom applicators applying 1.0 lb ai/A while wearing the described clothing is presented below:

Study	Replicates	Exposure (mg/hr)	Clothing
Abbott	18	40	long-sleeved shirt, long pants
Maitlen	21	0.7	short-sleeved shirt, long pants
Dubelman	12	0.93	long-sleeved shirt long pants
Wojeck	23	72	long-sleeved shirt, long pants
Staiff	20	0.4	short-sleeved shirt, long pants
Wolfe	7	9.4	short-sleeved shirt, long pants

The total of 101 replicates yielded a weighted geometric mean exposure of 4.6 mg/hr. The large range of 0.4 to 72 mg/hr around this geometric mean reflects the wide range of exposure that can occur to applicators during ground boom application. Tractor-type and boom equipment can greatly affect exposure. Enclosed cabs provide a physical barrier between the applicator and spray. Wojeck found that shielding the boom yielded lower exposures. Wind can blow spray drift across the applicator and increase exposure. It is reasonable to assume that depending on equipment used, weather conditions, and the personal habits of the applicator, the exposure received during any given application can fall anywhere within this range of 0.4 and 72 mg/hr. Inhalation exposure during ground boom application is approximately 1 percent of the dermal exposure.

BUD estimated that foliar spraying to tobacco will occur at 0.33 to 1.0 lb ai/A. The average acreage of tobacco that is treated is 5 acres. Based on an average application rate of 0.5 lb ai/A and 5 acres/farm, a private grower will handle 2.5 lb ai/day and require 25 minutes/day to treat the 5 acres. Three applications are likely during the growing season which would require the handling of 7.5 lb ai/yr

and 75 minutes of actual spray time annually. Based on these use parameters, the exposure to a tobacco farmer applying acephate is as follows:

Daily dermal mixer/loader: $0.26 \text{ mg/lb ai} \times 2.5 \text{ lb ai/day} \times 1/70 \text{ kg} = 0.0093 \text{ mg/kg/day}$

Daily dermal applicator: $4.6 \text{ mg/hr} \times 0.5 \times 0.42 \text{ hrs/day} \times 1/70 \text{ kg} = 0.014 \text{ mg/kg/day}$

Combined daily dermal exposure: $0.0093 \text{ mg/kg/day} + 0.014 \text{ mg/kg/day} = 0.023 \text{ mg/kg/day}$

Daily respiratory M/L: $4.4 \text{ ug/lb ai} \times 2.5 \text{ lb ai/day} \times 1/70 \text{ kg} = 0.16 \text{ ug/kg/day}$

Daily respiratory applicator: $0.014 \text{ mg/kg/day} \times 1\% = 0.14 \text{ ug/kg/day}$

Combined daily respiratory: $0.16 \text{ ug/kg/day} + 0.14 \text{ ug/kg/day} = 0.30 \text{ ug/kg/day}$

Annual dermal M/L: $0.0093 \text{ mg/kg/day} \times 3 \text{ days/yr} = 0.028 \text{ ug/kg/yr}$

Annual dermal applicator: $0.014 \text{ mg/kg/day} \times 3 \text{ days/yr} = 0.042 \text{ mg/kg/yr}$

Combined annual dermal exposure: $0.028 \text{ mg/kg/yr} + 0.042 \text{ mg/kg/yr} = 0.070 \text{ mg/kg/yr}$

Annual respiratory M/L: $0.16 \text{ ug/kg/day} \times 3 \text{ days/yr} = 0.48 \text{ ug/kg/yr}$

Annual respiratory applicator: $0.14 \text{ ug/kg/day} \times 3 \text{ days/yr} = 0.42 \text{ ug/kg/yr}$

Combined annual respiratory: $0.48 \text{ ug/kg/yr} + 0.42 \text{ ug/kg/yr} = 0.90 \text{ ug/kg/yr}$

7.0 EXPOSURE TO MIXER/LOADER/APPLICATORS DURING TRANSPLANT TOBACCO GROUND BOOM APPLICATION

According to BUD, acephate is applied to transplant beds by ground boom application at an application rate of 1.0 lb ai/A. The exposure scenario is similar to that used in Section 6.0 and, therefore, the same surrogate data will be used. Because of the spacing of the transplant tobacco beds, the ground speed of the tractor is 1.5 mph, rather than the 5.0 mph likely with foliar spraying. Both scenarios are based on 5 acres of tobacco, but the slower tractor speed in the transplant beds and other changes

in application technique mean that the applicator will require 41 minutes to treat 5 acres at 1.0 lb ai/A, rather than the 25 minutes required to foliar treat 5 acres at 0.5 lb ai/A. EAB believes that exposure during similar applications is more dependent on pounds active ingredient handled, rather than time. The transplant tobacco applicator will spray 5.0 lb ai during the 41 minutes while the foliar applicator sprayed 2.5 lbs ai during 25 minutes. The daily exposure to the applicator will, therefore, be twice that received by the foliar spray applicator, based on the handling of twice the amount of acephate. One application to bedding plants is made during the growing season. The daily/annual exposure estimates are as follows:

Dermal M/L: $0.26 \text{ mg/lb ai} \times 5.0 \text{ lbs ai/day or year} \times 1/70 \text{ kg} = 0.019 \text{ mg/kg/day or year}$

Dermal Applicator: $0.014 \text{ mg.kg based on } 2.5 \text{ lbs ai} \times 2 = 0.028 \text{ mg/kg/day or year}$

Combined Dermal: $0.019 \text{ mg/kg/day or year} + 0.028 \text{ mg/kg/day or year} = 0.047 \text{ mg/kg/day or year}$

Respiratory M/L: $4.4 \text{ ug/lb ai} \times 5.0 \text{ lb ai/day or year} \times 1/70 \text{ kg} = 0.31 \text{ ug/kg/day or year}$

Respiratory Applicator: $0.028 \text{ mg/kg/day or year} \times 1\% = 0.28 \text{ ug/kg/day or year}$

Combined Respiratory: $0.31 \text{ ug/kg/day or year} + 0.28 \text{ ug/kg/day or year} = 0.59 \text{ ug/kg/day or year}$

8.0 EXPOSURE TO MIXER/LOADER/APPLICATORS DURING GROUND BOOM APPLICATION OF ACEPHATE TO TURF GRASS

EAB has evaluated exposure data submitted by Chevron in which Orthene 75S Soluble Powder was applied to golf courses by ground boom (Schlosser, A., EAB #80538, May 23, 1988). Orthene 75S is a soluble powder containing 75% acephate as the active ingredient. The exposure to individuals wearing long pants and long-sleeved shirts was as follows:

Dermal Mixer/Loader: 4.13 mg/lb ai
 Dermal Applicator: 0.34 mg/lb ai
 Combined Dermal: 4.48 mg/lb ai
 Inhalation Mixer/Loader: 2.8 ug/lb ai
 Inhalation Applicator: 2.1 ug/lb ai
 Combined Inhalation: 4.9 ug/lb ai

The dermal exposure estimates assumed that protective gloves are not worn. The reregistration guidance document requires acephate labels to be revised to include the use of protective gloves for mixer/loaders and applicators. Hand exposure in the Chevron study accounted for 98% of the mixer/loader dermal exposure and 68% of the applicator dermal exposure. Assuming that gloves reduce hand exposure 90%, proper use of protective gloves would reduce mixer/loader dermal exposure 88% and applicator dermal exposure 61%.

Orthene 75S is applied to turf grass at 0.5 to 2.4 oz/1000 ft² by ground boom. Use information provided by BUD indicates that 6.5 acres/day on a golf course may be treated requiring 213.75 oz ai or 13 lbs ai/day. Golf course fairways average 48 acres and receive two insecticide applications annually; greens average 3.5 acres and require four applications annually, and tees average 2.5 acres and are treated once. The total acreage treated annually is, therefore, $[(48 \times 2) + (3.5 \times 4) + 2.5]$ 112.5 acres. Since 6 acres are treated daily, a total of 17 days are required annually to apply insecticides to golf course turf grass.

Based on the above parameters, turf grass application exposure to acephate exposure is estimated as follows:

Dermal

Daily Exposure:

$$\begin{array}{l} \text{M/L} \quad 4.13 \text{ mg/lb ai} \times 13 \text{ lbs ai/day} \times 1/70 \text{ kg} = \\ \quad \quad 0.77 \text{ mg/kg day} \end{array}$$

$$\begin{array}{l} \text{Applicator} \quad 0.34 \text{ mg/lb ai} \times 13 \text{ lbs ai/day} \times 1/70 \text{ kg} = \\ \quad \quad 0.063 \text{ mg/kg/day} \end{array}$$

$$\begin{array}{l} \text{Combined} \quad 0.77 \text{ mg/kg/day} + 0.063 \text{ mg/kg/day} = \\ \quad \quad 0.83 \text{ mg/kg/day} \end{array}$$

Annual Exposure:

$$\text{M/L} \quad 0.77 \text{ mg/kg/day} \times 17 \text{ days/yr} = 13 \text{ mg/kg/yr}$$

$$\text{Applicator} \quad 0.063 \text{ mg/kg/day} \times 17 \text{ days/yr} = 1.1 \text{ mg/kg/yr}$$

$$\text{Combined} \quad 0.83 \text{ mg/kg/day} \times 17 \text{ days/yr} = 14 \text{ mg/kg/yr}$$

Inhalation

Daily Exposure:

$$\begin{array}{l} \text{M/L} \quad 2.8 \text{ ug/lb ai} \times 13 \text{ lbs ai/day} \times 1/70 = \\ \quad \quad 0.52 \text{ ug/kg/yr} \end{array}$$

$$\text{Applicator } 2.1 \text{ ug/lb ai} \times 13 \text{ lb ai/day} \times 1/70 = 0.39 \text{ ug/kg/day}$$

$$\text{Combined } 0.52 \text{ mg/kg/day} + 0.39 \text{ ug/kg/day} = 0.91 \text{ ug/kg/day}$$

Annual:

$$\text{M/L } 0.52 \text{ ug/kg/day} \times 17 \text{ days/yr} = 8.8 \text{ ug/kg/yr}$$

$$\text{Applicator } 0.39 \text{ ug/kg/day} \times 17 \text{ days/yr} = 6.6 \text{ ug/kg/yr}$$

$$\text{Combined } 0.91 \text{ ug/kg/day} \times 17 \text{ days/yr} = 15 \text{ ug/kg/yr}$$

9.0 CONCLUSIONS

Based on exposure data submitted by Chevron and surrogate data reviewed by the EAB, nondietary exposure to acephate has been calculated. The annual exposure estimates assumes that all insecticide applications are with acephate. Because of resistance concerns and market penetration of acephate, it is unlikely that PCOs, farmers, and turf grass applicators will rely solely on acephate and, therefore, the annual estimates should be considered maximal. The exposure estimates, with the exception of tobacco, assume the use of long-sleeved shirts and long pants, but no protective gloves. Current acephate labels do not require the gloves. The proper use of protective gloves, as required by the reregistration guidance document, will greatly reduce dermal exposure. Based on the evaluated data which indicated that approximately 65 to 99% of the dermal exposure occurred to the hands, the gloves would reduce the exposure estimates two- to ten-fold. This exposure reduction estimates assume the proper use of protective gloves reduces hand exposure 90%.

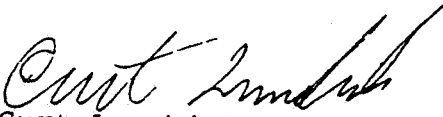
EAB estimates that the daily and annual exposures to acephate are as follows:

Use	Daily Exposure (mg/kg/day)		Annual Exposure (mg/kg/year)	
	Dermal	Inhalation	Dermal	Inhalation
Homeowner	0.17	(a)	2.6	(a)
Greenhouse	0.34	(a)	16	(a)
(Ornamental)	0.41	(a)	91	(a)
Residential PCO	0.13	0.002	29	(a)
Commercial PCO	0.023	3.0×10^{-4}	0.070	0.48
Tobacco-Foliar	0.047	5.9×10^{-4}	0.047	9.0×10^{-4}
Tobacco-Transplant	0.83	9.1×10^{-4}	14	5.9×10^{-4}
Turf grass				0.015

(a) Below the limit of detection

The above estimates assume a 70 kg individual and are not adjusted for dermal and inhalation absorption of acephate.

Postapplication monitoring of acephate in the greenhouse and indoor sites indicated that residues were low or nondetectable. Postapplication air levels of acephate will depend to a large degree on the air exchange rate in the greenhouse. Home air levels of acephate 4 hours to 4 days after application did not exceed 0.008 ug/l based on the detection limit. The highest air levels of acephate in a commercial site occurred 4 hours after application and was 0.015 ug/l. Based on an 8-hour work day, the postapplication inhalation exposure to individuals at the work site would be 3.0 ug/kg/day on the day of treatment.


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Exposure Assessment Branch/HED (TS-769C)