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

JUN 4 1990

MEMORANDUM

OFFICE OF
PESTICIDES AND TOXIC
SUBSTANCES

SUBJECT: PRELIMINARY HUMAN NON-DIETARY EXPOSURE ASSESSMENT FOR HANDLERS OF GOAL 1.6E (OXYFLUORFEN) IN THE TREATMENT OF VARIOUS CROPS AND FALLOW LAND

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Please find below the NDEB review of.....

HED Project #: 9-1162

Reg File/Rec #:

Registration #:

Caswell #: 188AAA

Company Name:

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Monitoring Study Requested: Reviewing Time: 3 Weeks

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1.0 INTRODUCTION

Toxicology Branch-IRS has requested a human non-dietary exposure assessment for handlers, applicators and flaggers involved in the uses of Goal 2E which would be expected to result in the highest amount of worker exposure. NDEB has subsequently learned from the RD Product Manager that Goal 2E has not been actively marketed in the U.S. for some time because of the presence in the formulation of an inert ingredient which cannot be applied to food crops after the appearance of the edible portion. Goal 2E is a preemergence and postemergence herbicide used on a variety of crops. A similar product, Goal 1.6E, is used in the U.S. for essentially the same crops. BAB/BEAD has provided NDEB with use information for GOAL 1.6E only. The active ingredient in both products is oxyfluorfen which has the chemical name, 2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene. The toxicological effect of concern for oxyfluorfen is developmental toxicity (NOEL = 10 mg/kg/day), and the dermal penetration is assumed to be 100%. The exposure assessment requested is for actual daily dermal and inhalation exposure to the mixer/loader, applicator and flagger.

NDEB requested use information from BAB/BEAD and received data on Goal 1.6E only for the following uses: citrus (kumquat, tangerine, lemon, lime, mandarin orange, tangelo, grapefruit), corn, cotton, peppermint, spearmint, onion, artichokes, prune, almonds, apricot, cherry, fig, grape, nectarine, pear, pistachio, plum, peach, walnut and air application to fallow cotton land.

RE-ENTRY AND WORKER PROTECTION STATEMENTS

Do not enter treated areas without protective clothing until sprays have dried. Because certain states may require more restrictive re-entry intervals for various crops treated with this product, consult your state Department of Agriculture for further information. Do not apply this product in such a manner as to directly or through drift expose workers or other persons. The area being treated must be vacated by unprotected persons.

WARNING- Causes substantial but temporary eye injury and skin irritation. Do not get in eyes, on skin, or on clothing. Wear goggles or face shield. This material may be harmful if swallowed. Wash thoroughly with soap and water after handling. Remove contaminated clothing and wash before reuse.

2.0 CONCLUSIONS AND RECOMMENDATIONS

NDEB has made estimates of occupational exposure for various uses of Goal 1.6E (oxyfluorfen); these are given below. Only uses which were expected to be representative of higher levels of exposure were considered. NDEB notes that there are no

protective clothing restrictions nor engineering control requirements on the label for Goal 1.6E except for the statement: Wear goggles or face shield. Exposure data presented are not corrected for skin penetration.

(a) COTTON FALLOW BED (air application)

Two alternate scenarios are given for the mixing/loading task.

(1) Mixer/loader, dermal exposure (open pour, wearing gloves but not wearing protective clothing) = 190 mg/day.

(2) Mixer/loader, dermal exposure (closed system loading, wearing gloves but not wearing protective clothing) = 3.1 mg/day.

Aerial applicator (pilot) dermal exposure (no gloves or protective clothing) = 0.35 mg/day.

Flagger, dermal exposure (normal work clothes, not wearing gloves) = 1.9 mg/day.

For some of the following uses, different workers may perform mixer/loader and applicator tasks, BAB/BEAD (11). However, NDEB only has surrogate data for workers performing separate tasks, Staiff (2). Exposure values reported can only be expected to be preliminary approximations, and represent the total exposure for mixer/loader and applicator. Where these tasks are performed by different workers, exposure estimates for each worker will be less than the total reported. Exposure estimates are for workers not wearing gloves. Respiratory exposure is negligible compared to dermal exposure and is not estimated.

(b) CORN - Mixer/loader and applicator are the same person

Daily dermal exposure for the first application = 0.92 mg/day.
Daily dermal exposure for the second application =0.54 mg/day.

(c) COTTON (ground application) - Mixer/loader and applicator are not the same person

Daily dermal exposure from treatment of 146 acres on first day = 0.84 mg/day.

Dermal exposure resulting from treatment of typical farm (1.7 days) = 1.5 mg.

(d) TREEFRUIT/NUT/VINE (Dormant Application)

1. ALMOND - Mixer/loader and applicator are not the same person

Daily dermal exposure from treatment of 33 acres = 4.0 mg/day.

Dermal exposure resulting from treatment of typical orchard (1.9 days) = 7.6 mg.

2. PISTACHIO - Mixer/loader and applicator are not the same person

Daily dermal exposure from treatment of 14 acres = 4.4 mg/day.

Dermal exposure resulting from treatment of typical orchard (4.9 days) = 22 mg.

3. FIG - Mixer/loader and applicator are not the same person

Daily dermal exposure from treatment of 28 acres = 3.5 mg/day.

Dermal exposure resulting from treatment of a typical orchard (1.6 days) = 5.5 mg.

4. GRAPES - Mixer/loader and applicator are not the same person

Daily dermal exposure from treatment of 14 acres = 3.3 mg/day.

Dermal exposure resulting from treatment of a typical farm (5.1 days) = 17 mg.

(e) ARTICHOKES (GLOBE) - Mixer/loader and applicator are not the same person

Daily dermal exposure for the first application to 83 acres = 2.6 mg/day.

Dermal exposure resulting from treating a typical farm in 2.5 days (first application) = 6.4 mg

Daily dermal exposure for the second application to 83 acres = 2.6 mg/day.

Dermal exposure resulting from treating a typical farm in 2.5 days (for second application) = 6.4 mg

(f) MINT (PEPPERMINT) - Mixer/loader and applicator are not the same person

Daily dermal exposure from treatment of 105 acres = 1.5 mg/day.

(g) PEPPERMINT/SPEARMINT - Mixer/loader and applicator are not the same person

Daily dermal exposure from treatment of 99 acres = 3.6 mg/day.

(h) GRAPEFRUIT (FL,LA,TX) - Mixer/loader and applicator are not the same person

Daily dermal exposure for the first application from treatment of 14.3 acres (first day) = 5.5 mg/day.

Dermal exposure resulting from treating a typical orchard in 1.6 days = 8.8 mg.

Identical exposure would result from the second application at 2.0 lbs ai/acre.

(i) LIME (FL,LA,TX) - Mixer/loader and applicator are not the same person

Daily dermal exposure for the first application from treatment of 14.3 acres (first day) = 5.5 mg/day.

Dermal exposure resulting from treating a typical orchard in 1.4 days = 7.7 mg.

Identical exposure would result from the second application at 2.0 lbs ai/acre.

(j) LEMON (FL,LA,TX) - Mixer/loader and applicator are not the same person

Daily dermal exposure for the first application from treatment of 14.3 acres (first day) = 5.5 mg/day.

Dermal exposure resulting from treating a typical orchard in 5.0 days = 28 mg.

Identical exposure would result from the second application at 2.0 lbs ai/acre.

NDEB recommends that chemical resistant gloves be worn during mixing and loading of products containing oxyfluorfen. If more accurate exposure data are needed, the registrant should be required to provide the results of supporting field studies. Study protocols should submitted to NDEB for approval before field work is initiated.

3.0 DETAILED CONSIDERATIONS

GENERAL ASSUMPTIONS

(1) There are no chemical specific data for any of the uses of products containing oxyfluorfen. NDEB will use surrogate data for the application of paraquat in orchards at 35 psi by tractor-mounted low-boom sprayer to estimate exposure, Staiff (1975) (2).

(2) The surrogate data are for a single worker wearing short-sleeved, open-necked shirts, no gloves or hats, with clothing worn giving protection to the area covered. The same worker performs both mixer/loader and applicator tasks. The data indicate a mean unit dermal exposure of 0.40 mg/hour (application rate of 1.0 lb ai/acre) based on 20 trials. Mean respiratory exposure is reported as less than 0.001 mg/hour.

(3) Use information provided by BAB/BEAD (11), indicates that a different worker performs mixer/loader and application tasks for many of the uses considered. In the surrogate data used for this assessment, Staiff (1975) (2), the mixer/loader and applicator are the same person and separate data are not provided for each type of task. Therefore, in cases where mixing/loading and application are performed by different workers the exposure to either worker will be lower than the value reported for a single worker.

(4) Respiratory exposure will be insignificant compared to dermal exposure (<0.001/0.4) and, therefore, will not be included in the exposure estimations.

(5) Exposure assessments will not be made for all the uses of Goal 1.6E, but only for representative uses which are expected to result in higher levels of exposure.

(6) There are no clothing restrictions on the Goal 1.6E label except for the statement: Wear goggles or face shield.

(7) Exposure estimates have not been corrected for skin penetration.

3.1 CORN - Mixer/loader and applicator are the same person

(1) Label directions recommend: spray at the base of the corn plant and uniformly over the entire row surface....Spray should contact only the lower 3 to 8 inches of the corn stalk and any leaves in the zone.

(2) For typical/average exposure, first application is assumed to be 0.66 lb ai/acre and second application is assumed to be 0.40 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical field will be 46.6 acres and the time required for mixing/loading and application would be 3.5 hours.

CALCULATION OF EXPOSURE

Daily dermal exposure for the first application = 0.40 mg/hour (unit dermal exposure) x 3.5 hours worked per day x 0.66 (adjustment for application rate) = 0.92 mg/day.

Daily dermal exposure for the second application = 0.40 mg/hour (unit dermal exposure) x 3.5 hours worked per day x 0.40 (adjustment for application rate) = 0.54 mg/day.

3.2 COTTON (GROUND APPLICATION) - Mixer/loader and applicator are not the same person

(1) Label directions recommend: spray at the base of the corn plant and uniformly over the entire row surface.

Southern cotton - Goal 1.6E herbicide must be applied using rigid precision ground spray equipment. The use of spray shields is recommended to avoid spray contact with cotton foliage. Use bench lifters or shields if excessive spray contact on larger cotton plants cannot be avoided by the directed spray.
Western cotton - Use bench lifters and shields if excessive spray contact to the cotton plant cannot be avoided.

(2) For typical/average exposure application is assumed to be 0.25 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical farm will be 256 acres and 146 acres can be treated in one day. The time required for mixing/loading and application for one day's treatment would be 8.4 hours (for 146 acres) and 6.3 hours for 110 acres on the second day.

CALCULATION OF EXPOSURE

Daily dermal exposure to treat 146 acres on the first day = 0.40 mg/hour (unit dermal exposure) x 8.4 hours worked x 0.25 (adjustment for application rate) = 0.84 mg/day.

Dermal exposure resulting from the treatment of a typical farm of 256 acres by a single worker = 256/146 x 0.84 = 1.5 mg.

3.3 TREEFRUIT/NUT/VINE (DORMANT APPLICATION)

(a) ALMOND - Mixer/loader and applicator are not the same person

(1) Label directions recommend: Direct spray toward the base of tree or vines. Avoid direct plant contact.

(2) For typical/average exposure application is assumed to be 1.6 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical orchard will be 63.0 acres and that 33 acres can be treated in one day. The time required for mixing/loading and application would be 6.3 hours for 33 acres and 5.7 hours for the remaining 30 acres.

CALCULATION OF EXPOSURE

Daily dermal exposure for the first day = 0.40 mg/hour (unit dermal exposure) x 6.3 hours worked per day x 1.6 (adjustment for application rate) = 4.0 mg/day.

Dermal exposure resulting from the treatment of a typical orchard of 63 acres = 63/33 x 4.0 mg/day = 7.6 mg.

(b) PISTACHIO - Mixer/loader and applicator are not the same person

(1) Label directions recommend: Direct spray toward the base of tree or vines. Avoid direct plant contact.

(2) For typical/average exposure application rate is assumed to be 1.6 lb ai/acre (AZ,CA).

(3) Data provided by BAB/BEAD (1) indicate that the typical orchard will be 68.9 acres and that 14 acres can be treated in one day. The time required for mixing/loading and application would be 6.8 hours for 14 acres. It would take 4.9 days to treat the typical orchard of 68.9 acres.

CALCULATION OF EXPOSURE

Daily dermal exposure = 0.40 mg/hour (unit dermal exposure) x 6.8 hours worked per day x 1.6 (adjustment for application rate) = 4.4 mg/day.

Dermal exposure to a single worker treating a typical farm = 4.4 mg/day x 4.9 days = 22 mg.

(c) FIG - Mixer/loader and applicator are not the same person

(1) Label directions recommend: Direct spray toward the base of tree or vines. Avoid direct plant contact.

(2) For typical/average exposure application rate is assumed to be 1.6 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical orchard will be 43.6 acres and that 28 acres can be treated in

one day. The time required for mixing/loading and application would be 5.4 hours for 28 acres and 3.0 hours for the remaining 15.6 acres.

CALCULATION OF EXPOSURE

Daily dermal exposure for the first day = 0.40 mg/hour (unit dermal exposure) x 5.4 hours worked per day x 1.6 (adjustment for application rate) = 3.5 mg/day.

Dermal exposure resulting from the treatment of a typical orchard of 43.6 acres = 43.6/28 x 3.5 mg/day = 5.4 mg.

(d) GRAPE - Mixer/loader and applicator are not the same person

(1) Label directions recommend: Direct spray toward the base of vines. Avoid direct plant contact.....Use a low pressure sprayer equipped with a breakaway boom and flat fan nozzles. An off center (OC) nozzle positioned at the end of the boom may be desired.

(2) For typical/average exposure application is assumed to be 1.2 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical farm in California/Arizona will be 71.8 acres and that 14 acres can be treated in one day. The time required for mixing/loading and application would be 6.8 hours for 14 acres. Therefore, the time required for a single worker to treat 71.8 acres would be 5.1 days.

CALCULATION OF EXPOSURE

Daily dermal exposure = 0.40 mg/hour (unit dermal exposure) x 6.8 hours worked per day x 1.2 (adjustment for application rate) = 3.3 mg/day.

Dermal exposure resulting from the treatment of a typical farm of 71.8 acres by one worker = 5.1 days x 3.3 mg/day = 17 mg.

3.4 ARTICHOKES (GLOBE) - Mixer/loader and applicator are not the same person

(1) Label directions recommend: herbicide should be directed toward the winter ditch, levees or flat rows between the artichoke rows.

(2) For typical/average exposure, first application is assumed to be 1.00 lb ai/acre and second application is assumed to be 1.00 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical farm

will be 204 acres and the time required for mixing/loading and application would be 6.4 hours to treat 83 acres in one day. Therefore, 2.5 days would be required for a single worker to treat a typical farm.

CALCULATION OF EXPOSURE

Daily dermal exposure for the first application = 0.40 mg/hour (unit dermal exposure) x 6.4 hours worked per day x 1.0 (adjustment for application rate) = 2.6 mg/day.

Dermal exposure to a single worker treating a typical farm (for first application) = 2.6 mg/day x 2.47 days (to treat 204 acres) = 6.4 mg
Identical exposure would result from the second application at 1.0 lbs ai/acre.

3.5 MINT (PEPPERMINT) - Mixer/loader and applicator are not the same person

(1) For typical/average exposure application is assumed to be 0.60 lb ai/acre.

(2) Data provided by BAB/BEAD (1) indicate that the typical field will be 105 acres and the time required for mixing/loading and application would be 6.1 hours.

CALCULATION OF EXPOSURE

Daily dermal exposure = 0.40 mg/hour (unit dermal exposure) x 6.1 hours worked per day x 0.60 (adjustment for application rate) = 1.5 mg/day.

3.6 PEPPERMINT/SPEARMINT - Mixer/loader and applicator are not the same person

(1) For typical/average exposure, application is assumed to be 1.50 lb ai/acre.

(2) Data provided by BAB/BEAD (1) indicate that the typical field will be 99 acres and the time required for mixing/loading and application would be 6.0 hours.

CALCULATION OF EXPOSURE

Daily dermal exposure = 0.40 mg/hour (unit dermal exposure) x 6.0 hours worked per day x 1.5 (adjustment for application rate) = 3.6 mg/day.

3.7 CITRUS non-bearing: All states - Arizona, California, Florida, Louisiana and Texas.

GOAL 1.6E herbicide should be directed to the soil and base of the trees. Avoid direct spray contact on the citrus foliage. Use a low-pressure sprayer equipped with a breakaway boom and flat fan nozzles. An off center (OC) nozzle positioned at the end of the boom may be desired.

(a) GRAPEFRUIT (FL,LA,TX) - Mixer/loader and applicator are not the same person

(1) Label directions recommend: Direct spray toward the base of tree.

(2) For typical/average exposure, first application is assumed to be 2.0 lb ai/acre and second application is assumed to be 2.0 lb ai/acre.
(3) Data provided by BAB/BEAD (1) indicate that the typical orchard will be 22.7 acres and that 14.3 acres can be treated in one day. The time required for mixing/loading and application would be 6.9 hours for 14.3 acres. The time required to treat the typical orchard would be 1.6 days. There are two applications at 2.0 lbs ai/acre per season.

CALCULATION OF EXPOSURE

Daily dermal exposure for the first application (first day) = 0.40 mg/hour (unit dermal exposure) x 6.9 hours worked per day x 2.0 (adjustment for application rate) = 5.5 mg/day.

Dermal exposure to a single worker treating a typical orchard (first application) = 5.5 mg/day x 1.6 days = 8.8 mg.

Identical exposure would result from the second application at 2.0 lbs ai/acre.

(b) LIME (FL,LA,TX) - Mixer/loader and applicator are not the same person

(1) Label directions recommend: Direct spray toward the base of tree.

(2) For typical/average exposure, first application is assumed to be 2.0 lb ai/acre and second application is assumed to be 2.0 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical orchard will be 20.2 acres and that 14.3 acres can be treated in one day. The time required for mixing/loading and application would be 6.9 hours for 14.3 acres. The time required to treat the typical orchard would be 1.4 days. There are two applications at 2.0 lbs ai/acre per season.

CALCULATION OF EXPOSURE

Daily dermal exposure for the first application (first day) = 0.40 mg/hour (unit dermal exposure) x 6.9 hours worked per day x 2.0 (adjustment for application rate) = 5.5 mg/day.

Dermal exposure to a single worker treating a typical orchard (first application) = 5.5 mg/day x 1.4 days = 7.7 mg.

Identical exposure would result from the second application at 2.0 lbs ai/acre.

(c) LEMON (FL,LA,TX) - Mixer/loader and applicator are not the same person

(1) Label directions recommend: Direct spray toward the base of tree.

(2) For typical/average exposure, first application is assumed to be 2.0 lb ai/acre and second application is assumed to be 2.0 lb ai/acre.

(3) Data provided by BAB/BEAD (1) indicate that the typical orchard will be 71.4 acres and that 14.3 acres can be treated in one day. The time required for mixing/loading and application would be 6.9 hours for 14.3 acres. The time required to treat the typical orchard would be 5.0 days. There are two applications at 2.0 lbs ai/acre per season.

CALCULATION OF EXPOSURE

Daily dermal exposure for the first application (first day) = 0.40 mg/hour (unit dermal exposure) x 6.9 hours worked per day x 2.0 (adjustment for application rate) = 5.5 mg/day.

Dermal exposure to a single worker treating a typical orchard (first application) = 5.5 mg/day x 5.0 days = 28 mg.

Identical exposure would result from the second application at 2.0 lbs ai/acre.

3.8 COTTON FALLOW BED (AIR APPLICATION) - Mixer/loader and applicator are not the same person

(1) Label directions recommend: GOAL 1.6E herbicide should be applied using swirljet or hollow cone nozzles and a spray pressure less than 40 psi to deliver a minimum spray volume of 10 gallons of water per acre.... Application should be at a height of 6 to 10 feet above the soil surface. It is suggested that the nozzle on the spray booms should not be placed any closer to the wing or rotor tips than 1/4 of the span; this will minimize the formation of spray or wingtip vortice roll. Nozzles should be

spaced and positioned to produce a uniform spray pattern and to minimize or eliminate the formation of droplets 100 microns or less in diameter.

(2) For typical/average exposure application is assumed to be 0.5 lb ai/acre.

(3) Data provided by BAB/BEAD (4) indicate that a typical field will be 414 acres and it can be treated in one day by aerial application. The time required to treat the typical field will be 29 minutes treatment time plus 44 minutes turning time (1.2 hours).

(4) Data in Abbott (3) indicate that unit dermal exposure to a mixer/loader (wearing long sleeve shirt and long pants, 50% protection and protective gloves, 90% protection) would be 0.93 mg/lb ai (open pour). Data in Dubelman (5) and Peoples (6) indicate dermal exposure of 0.015 mg/lb ai in a closed loading situation for mixer/loaders having generally similar clothing protection.

(5) Unit dermal exposure to the applicator (pilot) is estimated to be 0.58 mg/hour based on an application rate of 1.0 lbs ai/acre [(Lavy (7), Maddy (8), Peoples (6), Mumma (9) and Atallah (10)].

(6) Unit dermal exposure to the flagger (if used) is estimated to be 3.2 mg/hour based on an application rate of 1.0 lbs ai/acre [(Maddy (8), Peoples (6) and Atallah (10)].

(7) NDEB does not have suitable surrogate data on which to base an estimate of respiratory exposure to mixer/loaders handling liquid formulations.

(8) A respiratory unit exposure of 0.018 mg/hour (based on an application rate of 1.0 lbs ai/acre) for air applicators (pilots) is indicated from exposure data found in Lavy (7), Maddy (8), Peoples (6), Mumma (9) and Atallah (10).

(9) A respiratory unit exposure of 0.18 mg/hour for flaggers is indicated from data found in Maddy (8), Peoples (6), Atallah (10) and Lavy (7).

CALCULATION OF EXPOSURE

Daily dermal exposure to the mixer/loader (open pour, wearing protective gloves but not wearing protective clothing) = 414 acres treated per day x 0.5 mg/lb ai handled x 0.93 mg/lb ai handled = 193 mg/day.

Daily dermal exposure to the mixer/loader (closed loading, wearing protective gloves but not wearing protective clothing) =

414 acres treated per day x 0.5 mg/lb ai handled x 0.015 mg/lb ai handled = 3.1 mg/day.

Daily dermal exposure to the applicator (pilot) = 0.58 mg/hour unit dermal exposure x 1.2 hours application time x 0.5 adjustment for application rate = 0.35 mg/day.

Daily dermal exposure to the flagger, if used (long-sleeved shirt and long pants, standing in the open and attempting to remain upwind of the spraying) = 3.2 mg/hour unit dermal exposure x 1.2 hours application time x 0.5 adjustment for application rate = 1.9 mg/day.

Daily respiratory exposure to an aerial applicator (pilot) = 0.018 mg/hour (unit exposure) x 1.2 hours application time x 0.5 adjustment = 0.011 mg/day. This is considered not significant compared to dermal exposure.

Daily respiratory exposure to a flagger (if used) = 0.18 mg/hour (unit exposure) x 1.2 hours application time x 0.5 adjustment = 0.11 mg/day. This is considered not significant compared to dermal exposure.

REFERENCES:

(1) Projected Parameters and Data for Application Exposure From Applying Oxyfluorfen to Grapefruit, Tangelo, Mandarin Orange, Lime, Lemon, Prunes, Tangerines, Walnut, Peach, Plum, Pistachio, Pear, Nectarine, Grape, Fig, Cherry, Apricot, Almonds, Kumquat, Almonds, Artichokes, Onions, Mint, Peppermint/Spearmint, Cotton and Corn (Ground Application). B. Schneider, BAB/BEAD.

(2) Staiff, D.C., et al. (1975), Exposure to the Herbicide Paraquat, Bull. Environ. Contam. Toxicol. 14 (3):334-340.

(3) Abbott Ian M., Bonsall, Chester, Hart and TurnbullI. Worker Exposure to a Herbicide Applied With Ground Sprayers in the United Kingdom. AM. Ind. Hyg. Assoc. J. 48(2):167-175 (1987).

(4) Projected parameters and data for application exposure for applying Goal 1.6E to cotton fallow bed (Air application) B. Schneider (4/27/90).

(5) Dubelman S., R. Lauer, D.D. Arras, and S.A. Adams (1982) Operator Exposure Measurements during Application of the Herbicide Diallate. J. Agric. Food Chem. 30(3):528-532.

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(8) Maddy, K.T. et al. (1982) Monitoring of Potential Occupational Exposure of Mixer/Loaders, Pilots, and Flaggers During Application of Phosdrin (Mevinphos) in Imperial County in 1981. Report HS-889. California Department of Food and Agriculture. 21 January 1982.

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(10) Atallah, Y.H., Cahill, W.P., and Whitacre, D.M. (1982) "Exposure of Pesticide Applicators and Support Personnel to O-

ethyl O-(4-nitrophenyl) phenyl phosphonothioate (EPN)," Arch. Environm. Contam. Toxicol. 11:219-225.

(11) Memorandum from Bernard Schneider, BAB/BEAD: Mixer Loader Information for Oxyfluorfen. Received May 23,1990.

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