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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PREVENTION, PESTICIDES, AND TOXIC SUBSTANCES
WASHINGTON, D.C. 20460

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October 1, 1999

**MEMORANDUM**

SUBJECT: The ORE aspects of the HED Chapter of the Reregistration Eligibility Decision Document (RED) for Fenthion, Case #0290, PC Code 053301, DP Barcode D259765

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The Occupational and Residential aspects of the Human Health Assessment for the Reregistration Eligibility Decision (RED) document for fenthion is attached. The toxicology aspects of this chapter are based on the Hazard Identification Assessment Review Committee memo of June 2, 1999 and the memo revising the dermal absorption factor of September 15, 1999. The Agency also modified the risk assessment, as appropriate, based on comments received from the United States Department of Agriculture (dated May 27, 1999 and June 2, 1999) and the U.S. Department of Health and Human Services Centers For Disease Control and Prevention (dated May 20, 1999).

This chapter has been revised to incorporate the comments of the HED Risk Assessment SARC: to update the handler and post-application exposure scenarios; and also to include a revised risk assessment for both handlers and residential populations after mosquito adulticide applications.

18116

# Executive Summary

Fenthion [O.O-dimethyl O-(4-(methylthio)-m-tolyl) phosphorothioate], is a restricted-use organophosphate insecticide that is marketed in a variety of end-use products including liquid concentrates, ready-to-use solutions, treated articles (i.e., cattle ear tags); and granulars. Fenthion is primarily used as a mosquito control chemical, in agriculture on feed animals to control flies and cattle lice, and in aquaculture to control dragonfly larvae in ornamental fishponds. Mosquito control chemicals can be used as larvicides or adulticides. Larvicide applications are typically added directly to stagnant and other waters where breeding occurs. Adulticide applications are made in a manner that suspends as many small droplets in the air as possible since the efficacy of the chemical is dependent upon contacting the mosquitoes in flight. The principal use of fenthion for mosquito control is as an adulticide. Fenthion can be applied using a wide array of application equipment. Mosquito adulticide applications are made using either thermal or nonthermal fogging equipment. Most of these applications are completed with nonthermal fogging equipment on the ground or through aerial application. In agriculture, animals are treated by pour- or ladel-on methods. Aquaculture applications are completed using handheld equipment such as low pressure handwand sprayers and backpack sprayers. Mosquito control applications are completed at the discretion of mosquito control districts. Animal treatments are completed usually as needed and aquaculture applications are completed prior to stocking fishponds.

Because of the way that fenthion is applied, the Agency considered exposures to those who occupationally apply fenthion (i.e., referred to as handlers) and also to the general population in areas that have been subjected to mosquito control applications (i.e., referred to as residential post-application exposure). The Agency does not believe that there are individuals who are exposed after applications during the course of the employment (i.e., referred to as occupational post-application). Fenthion is also not available for sale to the general public. Therefore, the Agency also did not consider the exposures of people in the general public that would purchase and use it (i.e., referred to as homeowner handlers). No chemical-specific handler exposure data were submitted in support of the reregistration of fenthion. As a result, the Pesticide Handlers Exposure Database (PHED) was used to complete all occupational handler risk assessments. Available use and usage information were also included as appropriate (e.g., average application rates). The Agency evaluated post-application residential risks by first calculating the amount of fenthion that deposits in areas after mosquito control applications and then calculating the exposures of both adults and children (i.e., toddlers are the sentinel population) in those environments. The Agency used the Spray Drift Task Force model for predicting deposition from aerial applications (i.e., AgDRIFT) to determine how much material deposits in residential areas after aerial applications and published data to determine how much material deposits in residential areas after ground-fogger applications. After these values were determined, the risks for adults and toddlers were calculated using guidance included in the Agency's *Standard Operating Procedures For Residential Exposure Assessment* and guidance provided at the recent meeting of the FIFRA Science Advisory Panel on residential exposure issues.

The risk assessment has been revised to incorporate recent changes in the hazard parameters including a revision of the dermal absorption factor from 20 to 3 percent and to address concerns over the use of a human toxicity study versus use of an oral administration study conducted in primates (monkeys). The Agency considers the duration of exposure in its risk assessments. In this case, short-term ($\leq$7 days) and intermediate-term exposures (>7 days) were considered as the Agency believes that



29116

fenthion exposures can occur in these patterns. The Agency does not believe that longer term (or chronic) exposures occur. Toxicological endpoints are unchanged from the previous risk assessment. For short-term exposures, the Agency selected an endpoint of 0.07 mg/kg/day while an endpoint of 0.02 mg/kg/day was selected for intermediate-term risk assessment (the effect for both durations of exposure is the inhibition or lack thereof of plasma cholinesterase inhibition). Both of these endpoints were selected from the monkey study and are also closely reflected in the human data. These endpoints were used to assess risks from all routes of exposure by route-to-route extrapolation. The Agency defines risk concerns by comparing expressions of risk, otherwise referred to as *Margins of Exposure (MOEs)*, to uncertainty factors established by defining how closely the animal model upon which the endpoint is based relates to humans and the uncertainties associated with the selected endpoints. The Agency is currently grappling with the ethical issues associated with the use of human toxicity testing. For fenthion, the uncertainty factors for short-term assessments (30 or 100) have been defined based on whether human data is used to characterize the results of the monkey study (i.e., uncertainty factor of 30) or if just the monkey study is used for defining the uncertainty factor (i.e., uncertainty factor of 100). The available human toxicity study is not applicable to intermediate-term duration exposures and there is not a definitive NOAEL at this duration so the uncertainty factor for all of these assessments is 300.

The Agency has risk concerns over the use of fenthion, particularly for occupational handlers. The Agency evaluated exposures to occupational handlers in each of the three major markets for fenthion including mosquito control, feed animal treatments, and applications in aquaculture. For mosquito control adulticide applications, the Agency has concerns for loaders when using liquid formulations in preparation for mosquito adulticide applications of fenthion, in part, due to the very large acreages treated (lowest short-term MOE ~20). The Agency also has concerns for pilots and ground applicators during adulticide applications. For mosquito larvicide applications, the Agency has concerns for pilots during aerial application and for individuals completing ground applications. MOEs for loaders in these scenarios, however, exceeded the Agency's uncertainty factors. The Agency believes that the use of human flaggers is rare during mosquito control applications but completed an assessment for these individuals to account for other people that may be exposed in a similar manner (e.g., ground observers). The risks associated with these jobs exceeded each of the Agency's uncertainty factors during granular applications but not for liquid applications (i.e., the Agency has risk concerns for liquid applications). For the treatment of food animals, the Agency has concerns for the ladel-on and ear tag placement exposures due to a lack of data with which to complete the assessment. MOEs for the ready-to-use package exceeded each of the Agency's uncertainty factors. Additionally, the Agency has risk concerns for the use of fenthion in aquaculture.

Residential post-application exposure scenarios were also considered. There are no risk concerns over the exposures of adults as MOEs exceeded each of the Agency's uncertainty factors. Likewise, MOEs for toddlers after ground-based fogger applications, even when dermal and nondietary ingestion exposures were added together, exceeded each of the Agency's uncertainty factors. When fenthion is applied aerially, MOEs for short-term exposures exceed 30 even when dermal and nondietary ingestion exposures were added together to obtain total risks on the day of application. Total, short-term exposure, MOEs for aerial application did not exceed the uncertainty factor of 100 until 2 days after application at the average application rate and until 8 days after application at the maximum application rate. Intermediate-term MOEs were calculated by the Agency but are considered unlikely for several reasons. There are also risk concerns for toddlers based on this assessment for the aerial application method.



38116

## 1. Background Information

This memo was developed based on previous versions of the fenthion risk assessment and other information contained in the following documents:

- *United States Environmental Protection Agency. Guidelines for Exposure Assessment*: Federal Register Volume 57. Number 104 (Friday May 29. 1992).

- *United States Environmental Protection Agency. Draft Standard Operating Procedures (SOPs) For Residential Exposure Assessment* (December 11. 1997).

- *United States Environmental Protection Agency. Series 875 - Occupational and Residential Exposure Test Guidelines. Group B - Postapplication Exposure Monitoring Test Guidelines*: Version 5.4: (February 10. 1998).

- *United States Environmental Protection Agency. Exposure Factors Handbook.* EPA Report 600/P-95/002Fa. August. 1997.

- *Fenthion - Replacement of Human Study Used in Risk Assessments* Report of the Hazard Identification Assessment Review Committee (Dated June 2. 1999) From Jess Rowland (Co-chair) and Pauline Wagner (Co-chair) to Whang Phang (Branch Senior Scientist. RRB-1. Health Effects Division).

- *Fenthion - Dermal Absorption Factor* (Dated September 15. 1999) From Elizabeth Mendez (Toxicologist. RRB-1. Health Effects Division) to Jess Rowland (Co-chair) and Pauline Wagner (Co-chair) through Whang Phang (Branch Senior Scientist. RRB-1. Health Effects Division).

- *Fenthion: The ORE aspects of the HED Chapter of the Reregistration Eligibility Decision Document (RED). Case #0290. PC Code 053301*: Dated April 2. 1998: From Jeff Dawson (Chemist. OPP/HED/RRB-1) to William Hazel (Chemist. OPP/HED/RRB-1).

- Comments received from the United States Department of Agriculture (dated June 2. 1999).

- Comments received from the United States Department of Health and Human Services/Centers For Disease Control and Prevention (dated May 20. 1999).

- *AgDRIFT* Spray Drift Model. Version 1.03.

- *FSCBG* Spray Drift Model (used for informational purposes only).

- *Downwind Drift and Deposition of Malathion on Human Targets From Ground Ultra-Low Volume Mosquito Sprays*; Journal of the American Mosquito Control Association. Volume 9. Number 2: J.C. Moore. J.C. Dukes. J.R. Clark. J. Malone. C.F. Hallmon. and P.G. Hester: pp. 138-142: June. 1993.



4/16/16

- *Mass Recovery of Malathion in Simulated Open Field Mosquito Adulticide Tests*: Arch. Environ. Contam. Toxicol. 26: 473-477 (1994); N.S. Tietze, P.G. Hester, and K.R. Shaffer.

- *Mosquito (Diptera: Culcidae) Adulticide Drift into Wildlife Refuges of the Florida Keys*: Environmental Entomology, Vol. 21, No. 4: M.K. Hennessey, H.N. Nigg, and D.H. Habeck: pp. 714-721: August, 1992.

- Letter from James Dukes, Mosquito Adulticide Research Leader, Public Health Entomology Research and Education Center, Florida A&M University, 4000 Frankford Avenue, Panama City Florida 32405 to Teung Chen, USDA APHIS, Data Support, Policy and Program Development, 4700 River Road, Unit 152, Riverdale MD 20737. [Note: This letter contains deposition data for fenthion that has been used for risk characterization purposes.]

- *Methods For Assessing Dermal Absorption With Emphasis on Uptake From Contaminated Vegetation*, Toxicology and Industrial Health, Vol. 11, No. 1; P.R. Durkin, L. Rubin, J. Withey, and W. Meylan: pp. 63-79, 1995.

- *Environmental Monitoring Reports (1998) For the Boll Weevil Cooperative Eradication Program in (1) Texas and (2) Alabama, Arkansas, Lousianna, Mississippi, and Tennessee*, United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine, Prepared by the Environmental Monitoring Team.

- *Florida Mosquito Control: Conference on Urban Growth and its Impact on Future Mosquito Control Problems and Opportunities*, Florida Coordinating Council on Mosquito Control (1998).

- *Florida Mosquito Control: The state of the mission as defined by mosquito controllers, regulators, and environmental managers*, Florida Coordinating Council on Mosquito Control (1998).

- Personal communications between Michael K. Hennessey (EPA/BEAD) and the Lee County and Pasco Country Mosquito Abatement Districts.

- Letter from Lee County Mosquito Control District (George J. Wichterman) to the U.S. EPA CRM (William Wooge) dated August 21, 1996.

- *United States Environmental Protection Agency, Overview of Issues Related to the SOPs For Residential Exposure Assessment*, Presented to the FIFRA Science Advisory Panel on September 21, 1999 (8/5/99)

- *The Use of Aircraft in Agriculture/FAO Agricultural Development Paper No. 94*, N.B. Ackesson and W.E. Yates, Food and Agriculture Organization of the United Nations, 1974.

Several factors have altered the structure of the risk assessment since the last revision in April of 1998. Since the completion of the last assessment, the uncertainty factor for short-term exposures/risks has been reconsidered because it was based on a human toxicity study. The dermal absorption factor has also been revised from 20 to 3 percent. There have been many comments on the use of the AgDRIFT



5/16

model to predict spray drift. Additional comments and data that have been provided, focused on the drift issue, have been incorporated into the assessment for characterization purposes. The Rid-A-Bird use has also been removed from the fenthion label and all associated scenarios have accordingly been removed from the risk assessment. The Agency also added exposure scenarios to more completely address the SLN uses in aquaculture. Based on the results of the FIFRA SAP Meeting on residential exposure issues, the percent transferable amount was reduced from 20 to 5 percent of the fenthion deposited on the ground after mosquito control applications. Finally, additional routes and pathways have been considered in the risk assessment for post-application residential exposures. In the previous assessments, the Agency had a risk concern based solely on dermal exposures alone. The results of the current assessment indicate that the risks due to dermal exposures alone do not exceed the Agency's level of concern. Therefore, additional exposure scenarios were considered in order to define more representative total exposure levels for the exposed populations of concern. Specifically, the major revisions and modifications completed by the Agency in this document that differ from the April 1998 risk assessment include:

- Short- (≤7 days) and intermediate-term risks (>7 days) from dermal exposures to fenthion were calculated using two endpoints from a study completed in monkeys. The effect of concern for both durations of exposure is inhibition of plasma cholinesterase or lack thereof. In the monkey study, animals were monitored for plasma cholinesterase activity after one week of dosing. A dose of 0.07 mg/kg/day was selected as the endpoint of concern for short-term exposures since no plasma cholinesterase inhibition was seen during the first week of the study. The HIARC concluded that the human study should be considered supplemental data. Although this study is classified as supplemental, similar to the human studies completed for other organophosphates, the HIARC determined that the conventional MOE of 100 can be reduced based on the following reasons: (1) the lack of cholinesterase inhibition 24 hours after dosing in humans and 7 days in monkeys, (2) the acute NOAEL in monkeys (0.07 mg/kg/day) is supported by the marginal cholinesterase inhibition in humans (~8%) at the same dose, and (3) the NOAEL/LOAEL (0.02 mg/kg/day) is the threshold effect level in humans since some statistical significance was seen based on 5-12 percent plasma cholinesterase inhibition starting at one week of exposure. If the human study results are not considered, the uncertainty factor for short-term exposures remains at 100. A threshold NOAEL/LOAEL dose of 0.02 mg/kg/day from the monkey study was selected as the endpoint of concern for intermediate-term exposures. Again, the human study was also considered only as a source of supplemental information because of the duration of the study and the number of individuals dosed. There is also a concern for brain cholinesterase inhibition in animals at the same level (1.63 mg/kg/day) as plasma cholinesterase inhibition in animals as seen in the 90-day subchronic neurotoxicity study in rats. The HIARC concluded that a MOE of 300 is required based on the normal factors for inter- and intra-species extrapolation and due to the lack of a definitive NOAEL for intermediate-term exposures. Whether or not the human study results are considered has no bearing on the uncertainty factor associated with intermediate-term exposures.

- Inhalation risks in this assessment are calculated using the same oral administration monkey study as were the short- (0.07 mg/kg/day) and intermediate-term (0.02 mg/kg/day) dermal exposures. The endpoints and uncertainty factors are also the same as for the dermal exposures.



69116

- Nondietary ingestion risks in this assessment were calculated for post-application infant and toddlers exposures because the risks from dermal exposures did not exceed the Agency's level of concern in several scenarios.

- Post-application exposures for adults were calculated in this assessment based on the guidance provided in the Agency's *Standard Operating Procedures For Residential Exposure Assessment* rather than using a lower transfer coefficient of 10,000 $cm^2$ for a longer duration.

- Nondietary ingestion risks in this assessment are calculated using the same oral administration monkey study as with the short-term dermal and inhalation exposures (0.07 mg/kg/day). The uncertainty factors are also the same. This endpoint also serves as the basis for the acute RfD.

- Inconsistencies in unit exposure values and exposure scenarios noted in the previous risk assessment for handlers, were corrected. The 1998 risk assessment considered handler exposures using three different levels of personal protection including: baseline (applicators wearing long-pants and long-sleeved shirt); using maximum PPE (applicators at baseline with coveralls, gloves, and a respirator); and with the use of engineering controls (e.g., closed cabs, etc.). In this assessment, additional levels of personal protection were considered ranging from a baseline level of protection through the use of engineering controls in every aspect of the application process. Fenthion labels typically require the use of long-pants, long-sleeved shirts, double layer clothing, gloves, and respiratory protection (dust/mist masks with a protection factor of 5). In some cases, however, lower levels of personal protection are required such as when a closed loading system is used or for pilots/applicators in closed cabs.

- A risk/risk comparison for the public health aspects of this assessment was not completed (i.e., a comparison of the vector control versus the risks associated with the uses of fenthion was not completed).

- PHED data for mixer/loaders of liquids are extrapolated to model ready-to-use pour on applications to animals. Also, airblast application data are used to extrapolate to an applicator during ground ULV mosquito control applications.

- The use data included in the RED package for the counties in Florida need to be verified. Typical application rates for the postapplication exposure assessment have been derived from this information.

- The AgDRIFT model was used to predict deposition after aerial mosquito control applications. AgDRIFT is a product of the SDTF (Spray Drift Task Force) which is a FIFRA task force comprised of pesticide manufacturers, formed to address the spray drift issue. This has been done in cooperation with EFED and various ORD personnel involved in the development of the model through the CRADA agreement with industry. [Note: The SDTF is also preparing a position document on the use of AgDRIFT in human health risk assessments.]



79116

- Bayer is also a member of the Outdoor Residential Task Force which is generating data to refine the methods used for predicting exposures that occur as a result of contact with treated turf. The Agency's *Standard Operating Procedures For Residential Exposure Assessment* serve as the basis for this assessment in the interim.

- The percent dermal absorption value used in the risk calculations in this assessment was lowered from 20 to 3 percent.

- The default percentage used to estimate transferable residues of 20 percent of the deposited application rate was reduced to 5 percent of the deposited application rate based on the results of the September 21. 1999 FIFRA SAP meeting in which the panel concurred with an Agency proposal to reduce this value.

## 2. Occupational and Residential Exposure/Risk Characterization

This document addresses the exposures and risks associated with the use of the organophosphate insecticide, fenthion, that occur through non-dietary exposure. These exposures can occur as a result of applying fenthion or by entering areas that have been previously treated with fenthion. This chapter does not address possible fenthion exposures that occur through dietary intake of foods and water. Exposures can occur as a part of a job or through uses of fenthion around residences and in other areas that are frequented by the general public. Occupational and residential exposures are addressed separately in this document.

*Risk* is defined in the *U.S. EPA Guidelines for Exposure Assessment* (U.S. EPA, Federal Register Volume 57, Number 104, Friday May 29, 1992) as the probability of deleterious health or environmental effects. *Risk assessment* can be described as the process that defines the *risk*. The *risk assessment* process has four major components including: exposure assessment, hazard identification, evaluation of the dose response, and characterization of the calculated risk values. This document address the exposure assessment and risk characterization aspects of the process. The hazard identification and evaluation of dose response are addressed in separate documents.

Use patterns and available products are summarized in a manner appropriate for nondietary risk assessment in *Section 2a: Use Pattern and Available Product Summary For Exposure Assessment*. The exposure/risk assessments that have been completed for each handler and postapplication scenario, for which appropriate data exist, are included in *Section 2b: Occupational and Residential Exposure/Risk Assessment*. The characterization issues associated with, and a summary of the results of each assessment, are included in *Section 2c: Occupational and Residential Risk Characterization*.

### a. Use Pattern/Available Product Summary For Exposure Assessment

Fenthion products are described in this section. Additionally, available information that describes the manner in which fenthion products are applied is provided in this section (e.g., use categories/sites, application methods, and application rates). This section specifically includes a description of the available products that contain fenthion (*Section 2.a.i: Manufacturing- and End-Use Products*); the mode of action of fenthion and the pests that it is labeled to control (*Section 2.a.ii: Mode of Action and Targets Controlled*); a description of the crops/groupings and other areas on which fenthion can be used (*Section 2.a.iii: Registered Use Categories and Sites*); and a description of the manner in which fenthion can be applied (*Section 2.a.iv: Application Parameters*). All uses that have been deleted at this point will no longer be considered in this assessment (also see below for further information -- pet collars are an example).

#### *i. Manufacturing- and End-Use Products*

Fenthion [O,O-dimethyl O-(4-(methylthio)-m-tolyl) phosphorothioate], is a restricted-use organophosphate insecticide that is marketed in a variety of end-use products. Fenthion formulations include liquid concentrates, ready-to-use solutions, treated articles (i.e., cattle ear tags); and granulars. The following table summarizes all active formulations based on a review (1/7/98) of the *Office of Pesticide Programs -- Reference Files System(REFS)*, there are 13 active product labels. The



99116

distribution of these labels is as follows: 2 technical products, 8 Section 3 labels for end-use products, and 3 State and Local Need (SLN or 24C) labels. The following table summarizes all active labels:

| Formulation Type | Percent Active Ingredient | EPA Reg. Numbers |
|---|---|---|
| Manufacturing Use Products | 95 | 3125-137, 11556-36 |
| Liquid Concentrates | 7.6 & 95 | 3125-148, 11556-48, FL97000100, MO99000300, AR98000200 |
| Granulars | 1.0 & 2.0 | 5481-83, 5481-84, 5481-101 |
| Ready-to-Use | 3.0 & 20 | 11556-34, 11556-37 |
| Treated Articles (Ear Tags) | 20 | 11556-105 |

All products appear to be marketed solely for occupational use. There are no products apparently intended for sale to homeowners, for use in greenhouses, or that can be occupationally applied in indoor residential environments. The granular and liquid concentrate formulations that are intended for mosquito control applications can be used to treat residential areas. The 95 percent liquids are intended for neat, Ultra-Low-Volume applications to control mosquitoes (they are also sometimes used in thermal fog applications to control mosquitoes).

### *ii. Mode of Action and Targets Controlled*

Fenthion is an organophosphate insecticide used for the control of many types of pests including mosquitoes (Florida only), cattle lice, horn and face flies, and ticks. Given these parameters, fenthion applications can be described as belonging to one of the following categories: mosquito control (i.e., public health protection) and animal fly/tick control.

### *iii. Registered Use Categories and Sites*

An analysis of current fenthion uses was completed using available labels, the *Office of Pesticide Programs -- Label Use Information System, REFS*, and the recent *Quantitative Usage Analysis*. Fenthion is registered for use in a variety of occupational and homeowner/residential scenarios (i.e., mosquito control uses result in residential exposures). For reasons of clarity in the risk assessment, the use patterns have been described in a manner that delineates the occupational from homeowner/residential uses of fenthion.

Occupational populations are potentially exposed during direct animal treatments and while involved in mosquito control operations. The Agency does not believe that occupational exposures will also occur as a result of entering previously treated areas and performing a task that can lead to exposure because of the way that fenthion is used. The Agency also does not believe that homeowner handler exposures will occur because fenthion is not intended for sale in the residential market.



108116

Residential post-application exposures are, however, considered in this assessment because of the wide area applications that occur in residential areas to control mosquitoes. Exposures can occur during application to the following targets:

- ***Aquatic Non-Food Outdoor:*** ponds; swamps; marshes; salt-water sites; aquaria; and fountains (FL 97000100, MO99000300, and AR98000200).

- ***Residential Outdoor (includes mosquito adulticide uses):*** outdoor households; rural areas; urban areas; aerial/ULV; wide area; and households and domestic buildings (3125-148 & 5481-83/84/101).

- ***Indoor-Food:*** nonlactating and lactating dairy cattle; beef cattle; and swine (11556-34/37/48/105).

- ***Terrestrial Non-Food Crop (includes mosquito adulticide uses):*** general treatments; agricultural premises; and commercial, institutional, and industrial areas/premises (3125-148 & 5481-83/84/101).

### *iv. Application Parameters*

*Application Parameters* is a generic term that describes the factors that are considered in the development of a risk assessment in relation to how a chemical is applied, how much is applied, and how often it is applied. These parameters are generally defined by the physical nature of the use site, how a product is formulated (e.g., form and packaging), by the equipment used to make the application, and by the application rate required by the label. Fenthion is a broadspectrum insecticide and it can be used in a variety of markets. Therefore, the application parameters are quite varied. These parameters are presented below for each major market and specific crop/target (e.g., application rates and the equipment that can be used to make applications).

**Mosquito Control Applications:** Based on the use data available to the Agency, either aerial or ground-based ULV (Ultra-Low Volume) mosquito adulticide applications account for a vast majority of the mosquito control applications. Other allowable application scenarios based on current fenthion labels include the use of aerial thermal foggers for adulticide applications (used mostly in Lee County -- personal communication with Mike Hennessey, OPP/BEAD), ground-based applications of granulars as a larvicide, and aerial larvicide applications of granulars. Aerial ULV application rates specified on the label range from 0.05 to 0.10 lb ai/acre while the specified aerial thermal fogging application rate is 0.03 lb ai/acre (EPA Reg. 3125-148). The ground-based ULV maximum application rate is also 0.03 lb ai/A (EPA Reg. 3125-148). All applications of granular materials for mosquito control (includes aerial and ground-based) are at an application rate of 0.1 lb ai/A (EPA Regs. 5481-83/84/101). Aerial ULV applications require that between 0.66 and 1.3 oz formulation/A be applied while ground ULV application volumes range from 1.2 oz/minute to 3.6 oz/minute depending on the selected sprayer groundspeed (EPA Reg. 3125-148 specifies a 300 ft wide swath for ground ULV). Aerial thermal fogging applications require that 0.4 oz formulation/A be applied in conjunction with up to 0.8 quarts of fuel oil (EPA Reg. 3125-148). Granular applications require that from 5 to 10 pounds of formulated product be applied aerially or by ground for mosquito control depending upon the product selected (EPA Regs. 5481-83/84/101).

Data that document the actual quantities of fenthion used for mosquito control in various Florida counties (1993-1995) have been identified. These data are presented as they provide insight into typical fenthion use patterns. These data are summarized below:

- In Lee county, applications of fenthion were completed on 146 days over the 3 year period ranging from 1993 through 1995 (i.e., 1993 - 55 days; 1994 - 66 days; and 1995 - 25 days).

- In Lee county, applications of fenthion covered approximately 972.835 acres over the 3 year period ranging from 1993 through 1995 (i.e., 1993 - 401.290 acres; 1994 - 390.985 acres; and 1995 - 180.560 acres). Based on the number of treatment days for Lee County (1993-1995), the average number of acres per treatment day were 7296 A/day in 1993, 5924 A/day in 1994, 7222 A/day, and 6663A/day when all years were considered.

- In 1995, a total of 7.693 gallons of the 95 percent soluble concentrate formulation were applied covering 2.005.796 acres in 10 counties (includes major users such as Collier, Lee, Volusia, Dade, Hillsborough, Indian River, and Pasco). This volume of soluble concentrate, at 9.67 pounds active ingredient per gallon, contained 74.398 pounds of fenthion.

- In 1995, ground applications accounted for 21.4 percent of the total applied (i.e., 1622 gallons were applied in Dade, Hillsborough, Indian River and Pasco counties) while aerial applications accounted for the remaining 78.6 percent applied (i.e., 5955 gallons were applied in Collier, Lee, and Volusia counties). Ground applications accounted for 48.1 percent of the total acres treated (i.e., 965.177 acres mostly treated in Dade, Hillsborough, Indian River and Pasco) while aerial applications accounted for the remaining 51.9 percent applied (i.e., 1.040.619 acres treated in Collier, Duval, Lee, and Volusia).

- Based on the above data, average application rates (at 9.67 lb ai/gal.) for ground and aerial application methods, respectively, were calculated (aerial: 0.056 lb ai/acre and ground: 0.016 lb ai/acre). These average rates were considered in conjunction with the label maximum rates for these methods in order to provide for a more informed risk management decision. The maximum application rates for each method are 0.1 lb ai/acre for aerial and 0.03 lb ai/acre for ground applications (i.e., actual application rates were approximately 50 percent of the prescribed maximum for each technique). If one considers the overall use of fenthion, regardless of the application method, the average application rate is 0.37 lb ai/acre.

[Note: Some of the use and usage data provided above were considered in the April 1998 risk assessment. Since then, the Agency has identified the *Florida Coordinating Council on Mosquito Control's document entitled Florida Mosquito Control, The State of the Mission as defined by mosquito controllers, regulators, and environmental managers* as an additional source of information. This source



10/16/16

has been used if appropriate data are available as it is more up to date. Other sources of use information include personal communications between Mike Hennessey and Doug Wassmer of the Pasco County Florida Mosquito Abatement District (727-376-4568) and information provided by the Lee County Mosquito Control District (August. 1996 letter).]

**Direct Animal Treatments:** Applications for pest control on food animals (e.g., horn and face flies on cattle) can be made by pouring or otherwise directly ladelling solutions onto the backs of the target animals (i.e., ready-to-use or prepared aqueous application solutions). Impregnated ear tags are also used. Swine were not considered as the basis for this assessment because the applications rates were always higher for cattle. An average cattle weight of 600 pounds per animal served as the basis for this assessment. Application rates for the ready-to-use formulations on livestock range up to 0.089 oz (0.0014 lb ai)/100 lb on cattle (EPA Reg. 11556-37). Using the average cattle weight of 600 pounds per animal, the maximum application rate for the ready-to-use formulation is 0.0084 lb ai/animal (calculated using 2 lb ai/gallon in formulation). The label for the ladel-on specifies a dilution of 0.5 gallons formulation for every 4.5 gallons dilute solution prepared where each such dilution can treat up to 258 animals depending upon size. The maximum application rate for the ladel-on formulation, which equates to the use of 1 oz of dilute solution per 100 cattle pounds, is (0.00067 lb ai)/100 lb (EPA Reg. 11556-48). Again, using an average cattle weight of 600 pounds per animal, the application rate for the ladel-on formulation is 0.004 lb ai/animal (calculated using 0.77 lb ai/gallon in formulation). Each impregnated ear tag weighs 15 grams and contains 20 percent fenthion. Each animal is treated using two ear tags. As such, the application rate is 6 grams ai or 0.013 lb ai per animal.

[Note: Label information that stipulates the concentration of active ingredient per gallon (lb ai/gal) of formulation for the animal use and formulations was not available. These values were calculated by extrapolating from the available "percent active ingredient" values using the ratio of percent active ingredient to pounds ai per gallons for the liquid ULV mosquito control formulation.]

**Aquaculture Treatments:** Applications in aquaculture are intended for the control of larval dragonflies in commercially operated freshwater ponds. The use is only for ornamental or baitfish. Applications are made prior to stocking ornamental fish such as koi carp, goldfish, comets, shubunkins, fantails, and baitfish such as shiners and minnows. The only labels for this use are Section 24C (State and Local Need or SLN). The concentration of fenthion in each labelled product is 95 percent active ingredient. The material is diluted and applied by handheld equipment to obtain an even distribution in the treated ponds. For risk assessment purposes, the Agency has completed calculations using low pressure handwand and backpack sprayers as the method of application. The application rate is based on achieving a water concentration of 0.1 ppm. If a 5 acre pond that is 3 feet deep is treated, a total of 52.5 ounces of formulation in sufficient water to enable uniform application to the pond is needed to complete the application (i.e., ~4 pounds of active ingredient). Single applications are allowed 2 to 4 days prior to stocking.

### b. Occupational and Residential Exposure/Risk Assessment

The Agency has determined that there is a potential for exposure from handling fenthion products during the occupational application process (i.e., mixer/loaders, applicators, flaggers, and mixer/loader/applicators) and from entering residential areas previously treated with fenthion. The Agency has not identified any significant occupational postapplication or homeowner application



137116

scenarios. As such, exposure assessments have been completed for occupational handler and residential post-application scenarios. The exposure and risk assessments that have been completed are described in this section. All risk assessments are structured based on the toxicity of the chemical being considered. The toxicological endpoints that have been selected for fenthion are included in *Section 2.b.i: Toxicity Endpoints Used in the Exposure/Risk Assessment*. This assessment considers exposures to individuals during the application process (referred to as handlers) and also after application. A description of the occupational handler exposure scenarios that serve as the basis for this assessment are presented in *Section 2.b.ii: Handler Exposure Scenarios*. The mechanics of how the handler risk assessment was completed and the data used in that assessment are presented in *Section 2.b.iii: Handler Exposure and Risk Assessment*. A description of the residential post-application exposure scenarios that serve as the basis for this assessment are presented in *Section 2.b.iv: Post-Application Exposure Scenarios*. The mechanics of how the post-application risk assessment was completed and the data used in that assessment are presented in *Section 2.b.v: Post-Application Exposure and Risk Assessment*.

### *i. Toxicity Endpoints Used in the Exposure/Risk Assessment*

A series of toxicological endpoints were used to complete the handler and post-application risk assessments. The endpoints that were used to complete this assessment are summarized below (by applicable route and duration) in order to provide a quick reference to the occupational and residential risk assessments. The toxic effect associated with all endpoints is plasma cholinesterase inhibition or lack thereof.

- **Short-Term Dermal:** NOAEL of 0.07 mg/kg/day based on a lack of plasma cholinesterase inhibition at 1 week in a 2 year feeding study in monkeys (MRID 00147245):

- **Intermediate-Term Dermal (exposure durations >7 days):** 0.02 mg/kg/day based on a threshold NOAEL/ LOAEL from a 2 year feeding study in monkeys (MRID 00147245):

- **Dermal Absorption:** 3 percent based on a comparison of LOAELs in a rabbit developmental study (MRID 40462701) and a 21 day dermal toxicity study in rabbits (MRID 40329501):

- **Short-Term Inhalation:** NOAEL of 0.07 mg/kg/day based on a lack of plasma cholinesterase inhibition at 1 week in a 2 year feeding study in monkeys (MRID 00147245) [Note: Exposures were converted to an equivalent oral dose to complete this assessment.]:

- **Intermediate-Term Inhalation (exposure durations >7 days):** 0.02 mg/kg/day based on a threshold NOAEL/ LOAEL from a 2 year feeding study in monkeys (MRID 00147245) [Note: Exposures were converted to an equivalent oral dose to complete this assessment.]:

- **Inhalation Absorption:** 100 percent in lieu of any data to indicate otherwise:

- **Non-dietary ingestion:** NOAEL of 0.07 mg/kg/day based on a lack of plasma cholinesterase inhibition at 1 week in a 2 year feeding study in monkeys (MRID 00147245) [Note: This endpoint is also the basis of the acute RfD or reference dose.]:

- **Uncertainty Factors Applied to Short-Term Assessments:** a value of 30 is to be applied to all assessments when the overall factor considers the human toxicity study (MRID 00147246). the value would then account for inter-species extrapolation (3x) and intra-species variability (10x) and a value of 100 would be applied to all assessments when the overall factor does not consider the human toxicity study. the value would then account for inter-species extrapolation (10x) and intra-species variability (10x):

- **Uncertainty Factor Applied to Intermediate-Term Assessments:** a value of 300 is to be applied to all assessments. this value accounts for inter-species extrapolation (10x). intra-species variability (10x). and the lack of a definitive NOAEL in a critical study (3x): and

- **Cancer:** Database indicates that a quantitative calculation of cancer risks is not required.

### *ii. Handler Exposure Scenarios*

Exposure scenarios can be thought of as ways of categorizing the kinds of exposures that occur related to the use of a chemical. The use of scenarios as a basis for exposure assessment is very common as described in the *U.S. EPA Guidelines For Exposure Assessment* (U.S. EPA: Federal Register Volume 57. Number 104: May 29. 1992). The purpose of this section is to describe the exposure scenarios that were used by the Agency in the assessment for fenthion handlers and to explain how the scenarios were defined. Information from the current labels. use and usage information. toxicology data. and exposure data were all key components in the developing the exposure scenarios.

The Agency uses the term "Handlers" to describe those individuals who are involved in the pesticide application process. The agency believes that there are distinct job functions or tasks related to applications and that exposures can vary depending on the specifics of each task. Job requirements (e.g.. amount of chemical to be used in an application). the kinds of equipment used. the crop or target being treated. and the circumstances of the user (e.g.. the level of protection used by an applicator) can cause exposure levels to differ in a manner specific to each scenario.

The Agency uses a concept known as *unit exposure* as the basis for the scenarios used to assess handler exposures to pesticides. *Unit exposures* numerically represent the exposures one would receive related to an application. They are generally presented as (mg active ingredient exposure/pounds of active ingredient handled). The Agency has developed a series of unit exposures that are unique for each scenario typically considered in our assessments (i.e.. there are different unit exposures for different types of application equipment. job functions. and levels of protection). The *unit exposure* concept has been established in the scientific literature and also through various exposure monitoring guidelines published by the U.S. EPA and international organizations such as Health Canada and OECD (Organization For Economic Cooperation and Development). The concept of unit exposures can be illustrated by the following example. If an individual makes an application using a groundboom sprayer with either 10 pounds of chemical A or 10 pounds of chemical B using the same application equipment and protective measures. the exposures to chemicals A and B would be similar. The unit exposure in both cases would be 1/10th of the total exposure (measured in milligrams) received during the application of either chemical A or chemical B (i.e.. milligrams on the skin after applying 10 pounds of active ingredient divided by 10 pounds of active ingredient applied).



15 9/16

The first step in the handler risk assessment process is to identify the kinds of individuals that are likely to be exposed to fenthion during the application process. In order to do this in a consistent manner, the Agency has developed a series of general descriptions for tasks that are associated with pesticide applications. Common tasks (as an example) can include: preparation of dilute, water-based spray solutions for application; transferring or loading dilute spray solutions into sprayers for application; and making applications with specific types of equipment such as a groundboom or airblast sprayer. The Agency also considers whether or not individuals use pesticides as part of their employment (referred to as occupational risk assessments) or if they are individuals who purchase and use pesticide products in and around their residences (referred to as homeowners). Tasks associated with pesticide use (i.e., for "handlers") can generally be categorized using one of the following terms:

- **Occupational Mixer/loaders:** these individuals perform tasks in preparation for an application. For example, they would prepare dilute spray solutions and/or load/transfer solid materials (e.g., granulars) or spray solutions into application equipment such as an aircraft prior to application.

- **Occupational Applicators:** these individuals operate application equipment during the release of a pesticide product into the environment. These individuals can make applications using equipment such as aircraft or containers holding ready-to-use liquids.

- **Occupational Mixer/loader/applicators:** these individuals are involved in the entire pesticide application process (i.e., they do all job functions related to a pesticide application event). These individuals would prepare a dilute spray solution and then also apply the solution. The Agency always considers some exposures to be mixer/loader/applicator exposures because of the equipment used and the logistics associated with such applications. For example, if one uses a small handheld device such as a 1 gallon low pressure handwand sprayer it is anticipated that one individual will mix a spray solution and then apply the solution because of labor and logistical considerations.

- **Occupational Flaggers:** these individuals guide aerial applicators during the release of a pesticide product onto an intended target. [Note: Flagger exposures/risks are included in this document but are not considered to be a very likely scenario by the Agency.]

There are individuals who use fenthion that fit into each of the job function categories described above. Therefore, the fenthion risk assessment for handlers contains exposure scenarios in each category. There are currently no products containing fenthion that are marketed for sale to homeowners. As such, no exposure/risk analysis was completed for homeowner applicator scenarios.

The next step in the risk assessment process is to define what kinds of equipment, packaging, and formulation types (as well as other kinds of factors that can vary in specific assessments) can be used by individuals when making fenthion applications. For mosquito control purposes, fenthion can be used as an adulticide (i.e., to contact and kill adult mosquitoes in flight) and as a larvicide (i.e., to contact and kill developing larvae in breeding areas such as stagnant water). The predominant use is as an adulticide. Mosquito adulticide applications are completed using Ultra-low volume application methods (ULV) with a 95 percent active ingredient formulation intended for that purpose. Adulticide applications are made by ground and by air (both fixed wing and helicopters) using cold aerosol generators or thermal fog methods. Cold aerosol generators are the predominant method. "Thermal foggers were developed

largely from smoke generators built principally for concealing military maneuvers. The insecticide is mixed into a fog oil, usually #2 diesel or a light petroleum distillate, which is injected into a heated, often double walled nozzle. This mixture is then vaporized by heat, which may be in excess of 1000°F. A source of forced air drives this vapor out of the nozzle where the outside cooler air condenses it into a visible fog with droplets ranging from 0.5 to 1.5 $\mu$m" (Florida Coordination Council on Mosquito Control, 1998). Cold aerosol generators or foggers are similar in that they create small droplets except that they create these droplets using smaller size nozzles that are placed in a manner that shears the spray into small droplets needed for these kinds of applications. There are also other methods in use such as rotary atomizers, ultrasonic, and electrostatic nozzles. Larvicide applications of fenthion were also considered in this assessment because the labels still exist even though they are thought to be very rare. The Agency believes that these applications are completed using granular formulations and that the applications can be made by air or using a ground-based granular spreader. It is not clear how fenthion is packaged and transferred into application equipment. Therefore, the Agency has considered both open and closed-system loading in this assessment.

Fenthion can be also be occupationally applied to animals in agriculture (cattle and swine), as a pour-on using a ready-to-use liquid or by ladelling a prepared solution onto the backs of the animals, in order to control a variety of pests. The ladel-on applications are made by diluting a soluble concentrate formulation and then applying it to the animal. It is not clear how fenthion is packaged for either type of application or how the ladel-on formulations are diluted.

In very limited circumstances, fenthion can also be used in aquaculture to treat ponds prior to adding ornamental fish. In these types of applications, a soluble concentrate formulation is diluted and then added to the treated area using a backpack sprayer or a low pressure handwand sprayer. These applications generally require a small amount of liquid spray solution to uniformly treat a pond. It is not clear how fenthion is packaged and transferred into application equipment.

Next, assessors must understand how exposures to fenthion occur (i.e., frequency and duration) and how the patterns of these occurrences can cause the effects of the chemical to differ (referred to as dose response). Wherever possible, use and usage data determine the appropriateness of certain types of risk assessments (e.g., a chronic risk assessment is not warranted for fenthion because chronic duration exposure patterns do not occur). Other parameters are also defined from use and usage data such as application rates and application frequency. The Agency always completes risk assessments using maximum application rates for each scenario because what is possible under the label (the legal means of controlling pesticide use) must be evaluated, for complete stewardship, in order to ensure there are no concerns for each specific use. Additionally, whenever the Agency has additional information such as typical application rates, as in this case, it uses the information to further evaluate the overall risks associated with the use of the chemical in order to allow for a more informed risk management decision. In this case, average application rates (considered to be the same as typical rates for the purposes of this assessment) for mosquito control applications were integrated into the assessment.

A chemical can produce different effects based on how long a person is exposed, how frequently exposures occur, and the level of exposure. It is likely that fenthion exposures can occur in a variety of patterns. The Agency believes that occupational fenthion exposures can occur over a single day or up to weeks at a time even though each application target is generally treated only once or twice per season. Intermittent exposures over several weeks are also anticipated. Some applicators may apply fenthion



179/16

over a period of weeks in periods of heavy pest infestation (e.g., heavy use need mosquito season). The Agency classifies exposures of one week or less as short-term exposures and exposures of 1 week to several months as intermediate-term exposures. The Agency completes both short- and intermediate-term assessments for occupational scenarios in essentially all cases because these kinds of exposures are likely and acceptable use and usage data are not available to justify deleting intermediate-term assessments. For fenthion, the agency has selected two sets of toxicological endpoints to separately address short- and intermediate-term duration exposures. The endpoints were selected from the same monkey study. In this study, no effects were seen for short-term duration exposures (i.e., the NOAEL for this exposure duration was selected as the endpoint for risk assessment). Effects were noted, however, for intermediate-term duration exposures. Based on the data, a NOAEL could not be determined for this duration. As a result, the Agency selected the threshold NOAEL/LOAEL from the study for use in the risk assessment (i.e., a time-dependent dose-response was observed in the monkey study that was incorporated into the selection of the endpoints).

The toxicology database for fenthion indicates that the monkey study is the most appropriate source of endpoints for various durations of exposure (as discussed above) and also for differing routes of exposure. The toxicity of chemicals can vary based on the route of exposure or how a chemical enters the body. For example, exposures to the skin can result in a different toxic effect and/or severity of reaction than exposures via inhalation. The monkey study involved the oral administration of fenthion to the test animals. As such, the endpoints derived from the monkey study were used in all risk assessments in conjunction with a dermal absorption factor (i.e., 3 percent) to account for the permeability of the skin and an absorption factor of 100 percent to assess inhalation exposures. As per Agency policy, risks from nondietary ingestion exposures were calculated using the NOAEL from the monkey study which also serves as the basis for the acute RfD (reference dose) used for the dietary risk assessment. [Note: The actual endpoints selected and how they are applied in the risk assessment has been previously presented above in *Section 2.b.i: Toxicity Endpoints Used in the Exposure/Risk Assessment.*]

Occupational handler exposure assessments are completed by the Agency using different levels of personal protection. The Agency typically evaluates all exposures with minimal protection and then adds additional protective measures using a tiered approach to obtain an appropriate MOE or until all options are exhausted (i.e., going from minimal to maximum levels of protection). The lowest tier is represented by the baseline exposure scenario followed by increasing the levels of personal protection represented by personal protective equipment or PPE (e.g., gloves, extra clothing, and respirators) and engineering controls (e.g., closed cabs and closed loading systems). This approach is always used by the Agency in order to be able to define label language using a risk-based approach and not based on generic requirements for label language. In addition, the minimal level of adequate protection for a chemical is generally considered by the Agency to be the most practical option for risk reduction (i.e., over-burdensome risk mitigation measures are not considered a practical alternative for regulatory action). For fenthion, four distinct levels of dermal protection were considered in the assessment to account for the use of standard work clothing (long-pants and long-sleeved shirt), standard work clothing with a pair of gloves, standard work clothing with a pair of chemical-resistant gloves and an additional layer of clothing such as coveralls, and the use of engineering controls. Additionally, four levels of respiratory protection were considered in the assessment to account for no respiratory protection, the use of dust/mist PF 5 and air purifying PF 10 respirators (PF = protection factor), and the use of engineering controls. [Note: The manner in which these calculations have been completed allow for flexibility in

determining final protective measures -- see Section 2.c for further details.] The levels of protection that formed the basis for the calculations in this assessment include:

- **Baseline:** Represents typical work clothing or a long-sleeved shirt and long pants with no respiratory protection. No chemical-resistant gloves are included in this scenario.

- **Minimum Personal Protective Equipment (PPE):** Represents the baseline scenario with the use of chemical-resistant gloves and a dust/mist respirator with a protection factor of 5.

- **Maximum Personal Protective Equipment (PPE):** Represents the baseline scenario with the use of an additional layer of clothing (e.g., a pair of coveralls), chemical-resistant gloves, and an air purifying respirator with a protection factor of 10.

- **Engineering Controls:** Represents the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods which have no known devices that can be used to reliably and routinely lower the exposures for these methods.

HED has determined that exposure to pesticide handlers is likely during the occupational use of fenthion in a variety environments including agriculture, commercial/industrial premises, and in public health scenarios (e.g., occupational applications in residential environments). There are no apparent homeowner handler or application scenarios. The anticipated use patterns and current labeling indicate 11 major occupational exposure scenarios based on the types of equipment and techniques that can potentially be used to make fenthion applications. These 11 scenarios serve as the basis for the quantitative exposure/risk assessment developed for occupational handlers. These scenarios include (the scenario numbers correspond to the tables of risk calculations included in the occupational risk calculation aspects of the appendices):

(1a) mixing/loading liquids for mosquito control fixed-wing aerial applications:
(1b) mixing/loading liquids for mosquito control ground-fogger applications:
(2) loading granular materials for mosquito control fixed-wing aerial applications;
(3) applying liquids using aerial equipment (includes both ULV and thermal fogger) for mosquito control applications:
(4) applying liquids using ULV ground-fogger equipment for mosquito control:
(5) applying granulars using aerial equipment for mosquito control applications:
(6) applying the ready-to-use solutions to livestock (cattle and swine):
(7) applying cattle ear tags:
(8) mixing/loading/applying liquids to livestock via ladeling:
(9) loading/applying granulars for ground-based mosquito larvicide control applications:
(10) mixing/loading/applying liquids for aquaculture using low pressure handwand sprayers:
(11) mixing/loading/applying liquids for aquaculture using backpack sprayers:
(12) flagging during aerial application of liquids: and
(13) flagging during aerial application of granulars.

[Note: Helicopters are a plausible application method for aerial ULV fenthion applications. However, given the poor quality of the PHED data for helicopters, the aerial fixed wing scenario is used as the basis for assessing the aerial ULV application scenario. Flagger exposure scenarios were also included in this chapter even though the Agency believes that the use of flaggers is unlikely in typical mosquito applications. All scenarios were assessed at each appropriate level of personal protection described above and using both typical (if available) and maximum application rates.]

### iii. Handler Exposure and Risk Assessment

The Agency considers how chemical exposures occur (the frequency and duration) and also how chemicals enter the body (because the toxic effects can be different), as described in Section 2.b.ii above, when developing risk assessments. To evaluate all of these types of risk concerns, the Agency has completed two distinct risk assessments for fenthion handlers including:

- Short-term Duration; and
- Intermediate-term Duration (>7 days).

Exposure levels have been calculated in a manner that accounts for the method of application, the level of personal protection used during application, and the amount of chemical handled in an application (i.e., proportional to application rate and the amount treated per day). Both daily dermal and daily inhalation exposures have been calculated for each type of assessment completed. Risks were calculated individually for each route of exposure then added together to obtain an overall risk estimate.

In all cases, daily dermal exposure levels were calculated. Daily dermal exposures were calculated using the following formula:

Daily Dermal Exposure (mg ai/day) = Unit Exposure (mg ai/lb ai) x Appl. Rate (lb ai/A) x Daily Acres Treated (A/day)

Where:

**Daily Dermal Exposure** = Amount deposited on the surface of the skin that is available for dermal absorption, also referred to as potential dose (mg ai/day);
**Unit Exposure** = Normalized exposure value derived from May 1997 PHED Surrogate Exposure Table, no chemical-specific handler data were available for this assessment (mg ai/pound ai applied);
**Appl. Rate** = Normalized application rate based on a logical treatment unit such as acres or on a per animal basis, a maximum value is generally used (lb ai/A or lb ai/animal); and
**Daily Acres Treated** = Normalized application area based on a logical unit treatment such as acres or numbers of animals (A/day or animals/day).

Daily dermal dose (i.e., a biologically appropriate and available dose resulting from dermal exposure) was then calculated by normalizing the daily dermal exposure value by body weight and accounting for dermal absorption. For adult handlers using fenthion, a body weight of 70 kg was used for all exposure scenarios because the toxic effect (cholinesterase inhibition) is not sex-specific. Additionally, a dermal absorption factor of 3 percent was used for all calculations. Daily dermal dose was calculated using the following formula:

$$Daily\ Dose\left(\frac{mg\ ai}{kg\ day}\right) \quad Daily\ Exposure\left(\frac{mg\ ai}{day}\right) \times \left(\frac{Absorption Factor(\%\ 100)}{Body\ Weight\ (kg)}\right)$$

Where:

**Daily Dose** = the amount of absorbed dose received from exposure to a pesticide in a given scenario (mg pesticide active ingredient kg body weight day);
**Daily Exposure** = the amount of dermal (on the skin) or inhalation (inhaled) exposure calculated above (mg pesticide active ingredient day);
**Absorption Factor** = a measure of the flux or amount of chemical that crosses a biological boundary (% of the total available); and
**Body Weight** = body weight determined to represent the population of interest in a risk assessment (kg).

[Note: The U.S. EPA Exposure Assessment Guidelines (EPA. 1992) define potential dose (i.e., same value as exposure in this case) as the amount of a chemical at the absorption barrier. Additionally, absorbed dose is defined as the amount of a chemical that has been absorbed and is available for interaction with biologically significant receptors.]

The next step was to calculate the daily inhalation dose for handlers. The process used was similar to that used to calculate the daily dermal dose to handlers. Daily inhalation exposure levels were presented as (ug/lb ai) values in the *PHED Surrogate Exposure Table* of May 1997 (i.e., these values are based on an inhalation rate of 29 liters/minute and an 8 hour exposure interval). Once the unit exposure value is presented in this form and converted to (mg/lb ai), the calculations essentially mirror those presented above for the dermal route using a value of 100 percent absorption (i.e., a daily inhalation dose is calculated in mg/kg/day).

The handler exposure assessments do not include any dietary or drinking water inputs. They also do not include any dose attributable to nondietary ingestion (e.g., hand-to-mouth activity).

Risks were calculated in a non-probabilistic manner using the Margin of Exposure (MOE) which is a ratio of the calculated exposure to the toxic endpoint of concern. The endpoints used to complete the calculations for both short- and intermediate-term exposures were defined from the monkey feeding study. The daily dose values in the equation represent route-specific values. [Note: See Section 2.b.i for more details about the specific endpoints used in each assessment.] MOEs were calculated using the formula below:

$$MOE = \frac{Endpoint\left(\frac{mg}{kg/day}\right)}{Daily\ Dose\left(\frac{mg}{kg/day}\right)}$$

Where:

**MOE** = margin of exposure or value used by the Agency to represent noncancer risk or how close a chemical exposure is to being a concern (unitless):



2/9/16

**Daily Dose** = the amount as potential dose (for the dermal calculations) or absorbed dose (for inhalation or nondietary ingestion calculations) received from exposure to a pesticide in a given scenario (mg pesticide active ingredient kg body weight day); and
**Endpoint** = dose level in a toxicity study, where no observed adverse effects occur (NOAEL) or the lowest dose at which an effect occurred (LOAEL) in the study (mg pesticide active ingredient kg body weight day).

MOEs were added together in order to consider total risks to handlers given the toxic effect (cholinesterase inhibition) for each route of exposure (e.g., to the skin and being inhaled) is the same. The equation the Agency uses to add MOEs together is presented below:

$$MOE_{total} = 1/((1/MOE_a) + (1/MOE_b) + .... (1/MOE_n))$$

Where:

$MOE_a$, $MOE_b$, and $MOE_n$ represent MOEs for each exposure route of concern

A margin of exposure (MOE) uncertainty factor of 100 is considered an appropriate risk level for both the short- and intermediate-term exposures to fenthion when only animal toxicity data are considered in the assessment. A human toxicity study has been completed for fenthion. If these data are also considered in the assessment, the uncertainty factor is reduced to 30 for short-term duration exposures. These factors apply to all routes of exposure.

All occupational handler exposure and risk calculations are presented in the tables contained in *Appendix A: Occupational Handler Exposure and Risk Assessment For Fenthion.* Table 1 contains information that can be used to describe the exposure data used in the analysis. The origin of each unit exposure value is presented along with information pertaining to the quality of the data used to calculate each value. The assessment of data quality is based on the number of observations and the available quality control data. The quality control data are assessed based on Agency guidelines and a grading criteria established by the Pesticide Handlers Exposure Database task force. Other exposure factors (i.e., descriptions of each scenario, application rates, and acres treated), unit exposure values at varying levels of mitigation (such as personal protection), and toxicological parameters used in the assessment are presented in Table 2. The calculation of baseline exposures (mg/day), dose levels, and the resulting Margins of Exposure (MOEs) for short- and all intermediate-term exposures are presented in Table 3. Tables 4, 5, and 6 contain similar calculations for increased levels of personal protection. Values calculated for the use of additional mitigation in the form of minimum personal protective equipment are presented in Table 4 (single layer clothing with gloves and a PF 5 respirator) while values calculated for the use of additional mitigation in the form of maximum personal protective equipment (double layer clothing with gloves and a PF 10 respirator) are presented in Table 5. Table 6 contains values that reflect the use of appropriate engineering controls. Tables 7 through 10 in Appendix A present summary results of the assessment that are also discussed in more detail in the section 2.c of this document.

The factors described in the exposure calculation above are discussed below. These factors include: unit exposures; application rate; acres treated per day; and frequency of application.



227116

Chemical-specific exposure data for pesticide handling activities were not submitted to the Agency in support of the reregistration of fenthion. It is the policy of the Agency to use data from the *Pesticide Handlers Exposure Database (PHED) Version 1.1* to assess handler exposures for regulatory actions when chemical-specific monitoring data are not available.

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

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

Once the data for a given exposure scenario have been selected, the data are normalized (i.e., divided by) by the amount of pesticide handled,resulting in standard unit exposures (milligrams of exposure per pound of active ingredient handled). Following normalization, the data are statistically summarized. The distribution of exposure values for each body part (e.g., chest upper arm) is categorized as normal, lognormal, or "other" (i.e., neither normal nor lognormal). A central tendency value is then selected from the distribution of the exposure values for each body part. These values are the arithmetic mean for normal distributions, the geometric mean for lognormal distributions, and the median for all "other" distributions. Once selected, the central tendency values for each body part are composited into a "best fit" exposure value representing the entire body. The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. It should also be noted that distributional analyses of the data contained in PHED are not done for the risk assessment process because the available data do not lend themselves to this kind of analysis.

To add consistency to the values produced from this system and to ensure quality control, the PHED Task Force has evaluated all data within the system and has developed a set of grading criteria to characterize the quality of the original study data. The assessment of data quality is based on the number of observations and the available quality control data. These evaluation criteria and the caveats specific to each exposure scenario are summarized in Appendix A/Table 1. While data from PHED provide the best available information on handler exposures, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases. The Agency has developed a series of tables of standard unit exposure values (i.e., representing the "best fit" for each dataset) for many occupational scenarios that can be utilized to ensure consistency in exposure assessments.

In addition to PHED, the application rate and daily amount treated (usually acres per day) are also key elements in the calculation of handler exposures. A range of application rates, derived from fenthion labeling and usage information, serves as the basis for this assessment. Maximum application

rates range from 0.03 to 0.10 lb ai/acre for mosquito control applications (allowable maximum depends upon method of application). Animal and aquaculture maximum use rates are defined based on the size of the animal or of the ponds. For these scenarios, the Agency defined a likely maximum based on estimates of what is likely to be treated (i.e., cattle and pond size were defined for risk assessment purposes). Wherever available, both maximum and average application rates are used in each assessment.

The amount treated per day, usually expressed as the number of acres treated per day, is another critical factor in the exposure calculations for handlers. The Agency typically uses acres treated per day values that are thought to represent 8 solid hours of application work for specific types of application equipment. The Agency has used the same default values for acres treated per day for several years. These values were based on data included in PHED, consideration of agricultural engineering principles, and use and usage information. Through NAFTA (North American Free Trade Agreement) auspices, there is currently an initiative underway to harmonize the acres treated per day values used for the purposes of risk assessment. The values currently used by the Agency are similar or equivalent to those being discussed in the NAFTA working group. The actual values, specific to each scenario in the risk assessment, are presented below.

In addition to the information presented above, the following assumptions and factors were used in order to complete this exposure assessment:

- An average occupational work day interval represents 8 hours per workday. The definition of a workday has been used by the Agency to define the number of acres that could be treated based on the application method and application site. Residential (homeowner) workday durations are defined based on how much can be treated in a single home or yard (i.e., a residential applicator workday has not been made equivalent to 8 hours of work). The values used by the Agency to represent the amount of acres that can be treated in a day (or application volumes as appropriate) for each scenario include:

  (1a) mixing/loading liquids for mosquito control fixed-wing aerial applications to 7500 acres per day (see further explanation below);
  (1b) mixing/loading liquids for mosquito control ground-fogger applications to 3000 acres per day (see further explanation below);
  (2) loading granular materials for mosquito control fixed-wing aerial applications to 80 or 800 acres per day (see further explanation below);
  (3) applying liquids using aerial equipment (includes both ULV and thermal fogger) for mosquito control applications to 7500 acres per day (see further explanation below);
  (4) applying liquids using ULV ground-fogger equipment for mosquito control to 3000 acres per day (see further explanation below);
  (5) applying granulars using aerial equipment for mosquito control applications to 80 or 800 acres per day (see further explanation below);
  (6) applying the ready-to-use solutions to livestock (cattle and swine) to 200 animals per day;
  (7) applying cattle ear tags to 200 animals per day;
  (8) mixing/loading/applying liquids to livestock via ladeling to 200 animals per day;
  (9) loading/applying granulars for ground-based mosquito larvicide control applications to 5 acres per day;



2/8/16

(10) mixing loading/applying liquids for aquaculture using low pressure handwand sprayers to a single 2.5 or 5 acre pond per day;
(11) mixing/loading/applying liquids for aquaculture using backpack sprayers to a single 2.5 or 5 acre pond per day;
(12) flagging during aerial application of liquids to 7500 acres per day (see further explanation below); and
(13) flagging during aerial application of granulars to 80 or 800 acres per day (see further explanation below).

- Daily areas (as appropriate) to be treated were defined for each handler scenario. The Agency typically uses a maximum of 1200 acres per day for assessing risks to aerial applicators in agricultural scenarios. Mosquito control applications, however, are distinctly different from the typical agricultural scenario. For the liquid malaria control formulation, it appears that aerial applications will be ULV (Ultra-Low Volume) or thermal fog (i.e., for the purposes of this handler assessment, they are treated as the same technique -- thermal fog is almost a nonexistent application method even though it remains on the Baytex label). Similarly, ground-based applications are anticipated to be ULV. According to *The Use of Aircraft in Agriculture* (Ackeson and Yates, FAO/UN 1974), the number of acres treated using aerial ULV techniques can reach as high as 5000 acres per hour for fixed-wing aircraft and 1500 acres per hour for helicopters. The average number of acres per day that were treated by air in Florida was defined as 6600 acres per day using 1993 to 1995 data (probably including fixed-wing aircraft and helicopters). Since the exposure scenarios of concern are short- or intermediate-term, a value of 7500 acres per day was selected for the aerial application of liquids exposure scenario. Likewise, for ground-based ULV applications, the techniques and number of acres that can be treated per day are distinctly different from typical agricultural scenarios. Based on the liquid mosquito control label application parameters, approximately 3000 acres per day can be treated (i.e., 3.6 oz of 95% ULV liquid per minute at 15 mph, 6 hours per day -- note this is approximately only 10 gallons of formulation). *The Use of Aircraft in Agriculture* also indicated that the hopper capacity of a 600 horsepower biplane with a ram air-type granular spreader is 2000 pounds. Since this is a very common aircraft, HED estimated that 200 acres can be treated per load (based on the use of the 1 percent ai formulation and 10 pounds product per acre). The Agency also estimates that a pilot can apply 4 hopperfulls in a single day and therefore treat 800 acres.

- The animal assessments were based on cattle since they are larger than swine and the unit application rates (i.e., amount of chemical per 100 pounds animal weight) were higher for cattle. Treated cattle were assumed to weigh 600 pounds. The average cattle weight was determined based on an assessment of cattle weight gain during the finishing process (i.e., a 600 pound animal is early on in the finishing process which would correspond to the use of a fly and cattle lice control chemical).

- As indicated above, the Agency has developed a series of unit exposures that can be used in risk assessments for different application equipment and varying levels of protection. Due to a lack of empirical, scenario-specific data, unit exposures are sometimes calculated using generic protection factors that are intended to represent the protectiveness of various risk mitigation options (i.e., the use of PPE or Personal Protective Equipment and engineering controls). PPE



25/116

protection factors include those representing layers of clothing (50%), chemical-resistant gloves (90%), and respiratory protection (80 to 90% depending upon mitigation selected). Engineering controls are generally assigned a protection factor of 98 percent. Engineering controls may include closed mixing/loading systems for liquids, closed cabs/cockpits, and closed gravity fed loading systems for granulars. Adjustments to exposure values using protection factors are made using the following equation and are completed only in lieu of scenario-specific monitoring data (PF = Protection Factor expressed as a percent reduction):

PF Adjusted Exposure = (1-(PF/100)) * (Nonadjusted Exposure Value)

Baseline occupational assessments unit exposures are typically calculated based on empirical data that is reflective of the scenario. In other words, the empirical data in PHED used to generate exposure values are generally monitoring data that were generated from individuals wearing clothing similar to the occupational baseline (long pants and long-sleeved shirt.

- No scenario-specific data are available to the Agency with which to assess the cattle pour-on uses. As such, the Agency has used data for the open mixing of liquids to calculate the exposures for this scenario because it appears to be the best data available with which to assess this scenario. The Agency did not use these data for the ladel-on scenario because that process also involves additional activities that are not thought to be represented by the mixing/loading data for liquids.

- Average body weight of an adult handler is 70 kg. This body weight is used in all assessments since the endpoints of concern are not sex-specific (i.e., the cholinesterase inhibition could be assumed to occur in males or females).

- All handler calculations were completed using typical (if available) and maximum labeled application rates for each scenario.

### *vi. Post-Application Exposure Scenarios*

The Agency is concerned about exposures one could receive in the workplace or in other areas that are frequented by the general population, including residences. The purpose of this section of the document is to explain how post-application exposure scenarios were developed for each setting where fenthion use can lead to post-application exposures. Exposure scenarios can be thought of as ways of categorizing the kinds of exposures that occur related to the use of a chemical. The use of scenarios as a basis for exposure assessment is very common as described in the *U.S. EPA Guidelines For Exposure Assessment* (U.S. EPA: Federal Register Volume 57, Number 104: May 29, 1992). Fenthion can be used in mosquito control operations that involve wide area adulticide applications to residential areas. As a result, individuals can be exposed by entering previously treated areas and engaging in activities that could contribute to exposure. [Note: Direct animal treatments in agriculture or uses in aquaculture are not thought to lead to significant post-application exposures. Additionally, the Agency does not believe that the larvicide uses of fenthion will contribute to residential exposures. Hence, these scenarios are not considered further in the post-application residential risk assessment.]



K8/16

The Agency uses the term "post-application" to describe those individuals who can be exposed to pesticides after entering areas previously treated with pesticides and performing certain job tasks or activities (also often referred to as reentry exposure). As with the handler risk assessment scenarios described above in Section 2.b.ii. the Agency believes that there are activities that may lead to exposures particularly after wide area applications for mosquito control (e.g., children playing outdoors in previously treated areas). The Agency also believes that the resulting exposures can vary depending upon the specifics of each task or activity and the levels of chemical residue available in the environment. The duration of activity of the individual can also cause exposure levels to differ in a manner specific to each setting considered.

The agency uses a concept known as the *transfer coefficient* to numerically represent the post-application exposures one would receive (i.e., generally presented as $cm^2$/hour). The transfer coefficient concept has been established in the scientific literature and through various exposure monitoring guidelines published by the U.S. EPA and international organizations such as Health Canada and OECD (Organization For Economic Cooperation and Development). The establishment of transfer coefficients also forms the basis of the work of the Agricultural Reentry Task Force (ARTF) and the Outdoor Residential Exposure Task Force (ORETF), of which, the Bayer Chemical Company is a member. The transfer coefficient is essentially a measure of the contact with a treated surface one would have while doing a task or activity. These values are defined by calculating the ratio of an exposure for a given task or activity to the amount of pesticide on leaves (or other surfaces) that can rub off on the skin resulting in an exposure. For post-application exposures, the amounts that can rub off on the skin are measured using techniques that specifically determine the amount of residues on treated leaves or other surfaces such as turf (referred to as transferable residues) rather than the total residues contained both on the surface and absorbed into treated leaves. Transfer coefficients can be illustrated by the following example. Consider two lawns where the amount of chemical on treated turf that can rub off on the skin is the same. One lawn has been treated with chemical A while the other field has been treated in a similar manner with chemical B. If a child plays on either treated lawn, the exposures the individual would receive would be similar (given that each child played the same way). The transfer coefficient would also be similar for each lawn and chemical because the ratio of exposure to residue would be the same. If the same children would do another activity on those lawns, the exposures would be different as would the resulting transfer coefficients because the activity that resulted in the exposures is different.

Like the handler risk assessment process, the first step in the post-application risk assessment process is to identify the kinds of individuals that are likely to be exposed to fenthion after application. In order to do this in a consistent manner, the Agency has developed a series of general descriptions for tasks or activities that are associated with post-application exposures. The Agency also considers whether or not individuals are exposed to pesticides as part of their employment (referred to as occupational risk assessments) or if they are individuals who are exposed to pesticide products in and around their residences or other areas frequented by the general public (referred to residential risk assessments). Tasks or activities associated with fenthion post-application exposures can be categorized using one of the following terms:

- **Residential (homeowner) Adults:** these individuals are members of the general population that are exposed to chemicals by engaging in activities at their residences and also in areas not limited to their residence (e.g., golf courses or parks) previously treated with a pesticide. These kinds of exposures are attributable to a variety of activities and usually addressed by the Agency in risk assessments by considering a representative activity that results in a conservative exposure calculation.

- **Residential Children:** children are members of the general population that are exposed to chemicals by engaging in activities in areas not limited to their residence (e.g., parks) previously treated with a pesticide. These kinds of exposures are attributable to a variety of activities and usually addressed by the Agency in risk assessments by considering a representative activity that results in a conservative exposure calculation. Toddlers have been selected as a sentinel exposure population for the assessment.

There are individuals who are potentially exposed to fenthion that fit into each of the categories described above. Therefore, the fenthion post-application exposure/risk assessment contains exposure scenarios in each category described above. Mosquito control applications are the basis as the post-application concern is for residential settings and the general population. Animal uses, by definition, are generally not a postapplication nondietary exposure concern for the Agency. There are currently no products containing fenthion for which the Agency believes that occupational post-application exposures would be of concern.

The basis for this assessment is to evaluate dermal and nondietary ingestion exposures on treated turf (i.e., assessment for adults considered dermal exposures only). This exposure scenario has been selected because it is likely that people will spend time outdoors following mosquito control adulticide applications in contact with treated turf. The next step in the risk assessment process is to define how and when chemicals are applied in order to determine the level of transferable residues to which individuals could be exposed over time. Wherever available, use and usage data are incorporated in the process to define values such as application rates and application frequency. The Agency always completes risk assessments using maximum application rates for each scenario because what is possible under the label (the legal means of controlling pesticide use) must be evaluated, for complete stewardship, in order to ensure the Agency has no concerns for each specific use. Additionally, whenever the Agency has additional information, such as typical application rates or application frequency, it uses the information to further evaluate the overall risks associated with the use of the chemical. In order to define the amount of transferable residues to which individuals can be exposed, the Agency relies on chemical- and target-specific studies as described in the Agency guidelines for exposure data collection (*Series 875, Occupational and Residential Exposure Test Guidelines: Group B - Postapplication Exposure Monitoring Test Guidelines*). The Agency has also developed a standard modeling approach that can also be used to predict transferable residues over time in lieu of chemical- and scenario-specific dissipation data (best described in the Agency's *SOPs For Residential Exposure Assessment*). The standard modeling approach from the Residential SOPs was used to predict the



28816

amount of transferable residues available on treated turf because no chemical- and scenario-specific data were available to complete this assessment. Special considerations were also given to the methods of application in this assessment in order to account for the fact that the objective of a mosquito control adulticide application (to create smaller droplets) is antithetical to a normal agricultural application of a pesticide (to minimize drift).

Defining the activities that could lead to exposures related to the use of the chemical is also a critical aspect of the process. Generally, this can be a difficult aspect of the risk assessment process in that many activities are plausible and dynamics of the population of interest constantly change. As such, the Agency currently uses scenarios that represent many activities related to the populations of concern to calculate exposures. The Agency considered both low exposure (e.g., light yard and garden work) and high exposure (e.g., heavy yardwork) activities for adults in the assessment. In order to consider the risks to children, guidance from the Agency's *SOPs For Residential Exposure Assessment* was used to address the exposures of children from treated turf.

Next, assessors must understand how exposures to fenthion occur (i.e., frequency and duration) and how the patterns of these occurrences can alter the effects of the chemical in the population after being exposed (referred to as dose response). The Agency believes that fenthion exposures can occur over a single day or up to weeks at a time even though mosquito control applications within a given area are likely only a couple of times per season. This is supported by the length of time fenthion residues take to decline using the standard dissipation model. Typically, the Agency conducts separate assessments for exposures that are one week or less, and also for periods greater than one week up to several months. The Agency classifies these as short-term exposures (one-week or less) and intermediate-term exposures (seven days to several months), respectively. Long-term or chronic exposures (essentially every working day over a year) can also occur for some chemicals. However, no long-term exposures are associated with the use of fenthion. These classifications are the basis for selecting toxicological endpoints for chemicals and are generally included in each risk assessment. A chemical can have different effects based on how long or how often a person is exposed. The toxicity of chemicals can also vary based on how a person is exposed. The toxicology database for fenthion indicates that the Agency needs to separately consider exposures to the skin and exposures via inhalation because the effects and the dose levels at which effects occur differ based on whether it gets on skin or it is inhaled. The Agency has selected both short- and intermediate-term endpoints from the same monkey study. A NOAEL has been selected as the short-term endpoint while a threshold NOAEL/LOAEL has been selected for the intermediate-term endpoint. A dermal absorption factor has been applied to these endpoints for all calculations (i.e., 3 percent). Inhalation exposures are minimal in outdoor post-application scenarios because of the low vapor pressure and because existing empirical data have also generally shown post-application inhalation exposures to be negligible. As such, inhalation exposures are not considered in the post-application assessment. Hand-to-mouth exposures are also considered in this assessment because toddlers are anticipated to engage in mouthing behaviors.

An administrative approach is used by the Agency to reduce occupational post-application risks and is referred to as the *Restricted Entry Interval* or REI. The REI is a measure of the time it takes for residue levels to decline to a point that entry into a previously treated area and engaging in a task or activity would not result in exposures that exceed the Agency's level of concern. REIs are generally established in the risk assessment process on a chemical-, crop-, and activity-specific basis. REIs are not considered a viable regulatory tool for reducing exposures and risks in the residential environment (i.e.,



2/9/16

for the general population). Therefore, for chemicals used in the residential environment or any other areas where the general population can be exposed, regulatory risk management currently considers the risks associated with a chemical on the day it is applied or as part of an aggregate exposure assessment should the single day risks be of no concern.

Based on the anticipated fenthion use patterns and current labeling, four major post-application exposure scenarios were modeled using a surrogate approach for each application method (i.e., aerial and ground ULV). Two of these scenarios are assessments of exposure to adults while the remaining two scenarios were assessments of exposures to toddlers. These assessments were based on the guidance provided in the *Draft: Series 875-Occupational and Residential Exposure Test Guidelines, Group B-Postapplication Exposure Monitoring Test Guidelines (7/24/97 Version)* and the *Draft: Standard Operating Procedures (SOPs) for Residential Exposure Assessment (12/11/97 Version)*. The four scenarios assessed for each application method include:

(1) adults involved in a high exposure activity (e.g., heavy yard work) at the typical Florida mosquito control application rate;

(2) adults involved in a high exposure activity (e.g., heavy yard work) at the label maximum mosquito control application rate;

(3) toddlers involved in a high exposure activity (e.g., rolling/playing on lawn) at the typical Florida mosquito control application rate; and

(4) toddlers involved in a high exposure activity (e.g., rolling/playing on lawn) at the label maximum mosquito control application rate.

[Note: The dose levels calculated for adults and children are for use in the residential risk assessment and for the purposes of calculating aggregate risks that also considers exposure from dietary intake of food and water.]

### *v. Post-Application Exposure and Risk Assessment*

As described above, the Agency considers how chemical exposures occur including how chemicals enter the body (because the toxic effects can be different) such as absorption through the skin or by being inhaled; both of these kinds of exposures are typically considered for handlers. However, in this post-application assessment, the Agency has focused on the predominant exposure pathways which are thought to be exposures to the skin (i.e., dermal) and exposures from the mouthing behaviors of children. Inhalation exposures were also considered but are thought to be negligible because of the dilution that occurs outdoors, the low application rates for aerial and ground applications, and the historical exposure data that indicate inhalation exposure in these circumstances are minimal.

No chemical- or scenario-specific data for fenthion were available with which to complete the assessment. As a result, the post-application risk assessment for fenthion has been developed using the

standard Agency approach for modeling transferable residue decline over time. Additionally, the Agency has also considered the specialized nature of adulticide mosquito control applications by developing a deposition factor that accounts for the intentional amount of drift created in typical mosquito adulticide applications as opposed to common agricultural applications.

The calculations used to estimate *Daily Dermal Dose* and noncancer *MOE*s for the post-application scenarios are similar to those described above for the handler scenarios. The only significant differences are (1) the manner in which the *Daily Dermal Dose* is calculated using transfer coefficients, transferable residue levels, and accounting for the dissipation of fenthion over time; (2) inhalation exposures were not calculated for the postapplication scenarios (i.e., *Total Daily Dose* in the MOE calculation only represents dose levels resulting from dermal exposures because inhalation exposures historically have been shown to account for a negligible percentage of the overall body burden); and (3) non-dietary ingestion exposures were calculated for subpopulations where the behavior can be anticipated with relative certainty along with a calculation of associated dose from dermal exposure (i.e., toddlers after contact with treated turf).

**Step 1: Calculation of Transferable Residue Levels**

The first step in the post-application risk assessment was to calculate transferable residue (TR) values using the generic approach for predicting application day concentrations and modeling dissipation over time commonly used by the Agency. Additionally, the Agency used the AgDRIFT model and published data to account for specialized aspects of mosquito control applications when calculating application day concentrations.

Application day transferable residue levels (TR) were calculated by considering several factors including the application rate, how much material is actually deposited on the ground during mosquito control applications, and the percentage of transferability of material from turf. This risk assessment calculated dose values attributable to both dermal and hand-to-mouth exposures. The transferable residue percentage value for each type of exposure differs based on current Agency policy. The following equation was used to calculate the application day TR values:

$$TR_{APP\ DAY}\ (\mu g/cm^2) = (AR\ (lb\ ai/acre) * TRAN\ (\%/100) * DEP\ (\%/100) * 4.54E8\ (\mu g/lb)) / (43560\ (ft^2/acre) * 929\ (cm^2/ft^2))$$

Where:

| | | |
|---|---|---|
| **$TR_{APP.\ DAY}$** | = | transferable residue level on the day of application ($\mu g/cm^2$); |
| **AR** | = | application rate (lb ai/acre); |
| **TRAN** | = | transferable residue percentage or amount of deposited material available as transferable residue immediately after application - differs for dermal and hand-to-mouth exposures (%); and |
| **DEP** | = | deposited residues or percentage of applied material actually deposited on turf - accounts for mosquitocide application methods (%). |

[Note: Exposures that evaluate residential postapplication risks over a range of application rates were calculated using the average application rate for seven Florida counties in 1995 and the maximum label application rate for each application method.]



3/8/16

The Agency is also concerned about exposures on days subsequent to application. No chemical-specific data were available that measured fenthion transferable residue concentrations over time on turf. As such, the Agency used the standard approach for calculating dissipation over time in lieu of data. The following equation was used to calculate dissipation of transferable residues over time:

$$TR_{(t)}\ (\mu g/cm^2) = TR_{APP\ DAY}\ (\mu g/cm^2) * (1-D)^t$$

Where:

| | | |
|---|---|---|
| $TR_{APP.\ DAY}$ | = | transferable residue level on the day of application ($\mu g/cm^2$); |
| $TR_{(t)}$ | = | transferable residue at time$_{(t)}$ ($\mu g/cm^2$); |
| D | = | fraction of residue that dissipates daily (% 100); and |
| t | = | post application interval on which transferable residues are being assessed (days after application). |

In lieu of chemical-specific transferable residue monitoring data, the Agency uses the above equations to calculate transferable residue levels based on information from the label such as maximum application rates, use and usage information (e.g., average application rates), and factors used to determine the amount of residues available for uptake from treated surfaces (i.e., the transferability factor). In this assessment the Agency has used the maximum and average (treated as typical rates for this assessment) application rates for both aerial and ground based applications of mosquito adulticides. The maximum application rates for aerial and ground-based methods are 0.1 and 0.03 lb ai/acre, respectively. The average application rates for aerial and ground-based methods are 0.05 and 0.016 lb ai/acre, respectively. Two transferability factors were used for the calculations to estimate the amount available for uptake to the skin (5% of deposited) and the amount available for non-dietary ingestion (20% of deposited). The transferability value is higher for non-dietary ingestion exposures because children's hands may be wet or sticky therefore transferring more of the deposited residues. The dissipation of fenthion residues is also modeled using the standard approach based on a rate of 10 percent dissipation per day. Calculations were carried out to 30 days after application because the environmental fate data for fenthion indicate that residues in various media have half-lives of several days or weeks and no chemical-specific turf transferable residue data were available. The major difference between these calculations of transferable residues and the those normally completed by the Agency in lieu of data is that a factor that accounts for the amount deposited based on the application method has also been added because of the unique nature of mosquito adulticide applications.

With few notable exceptions such as public health scenarios (e.g., mosquito control), the general intent during most pesticide applications is to confine the deposition of applied chemicals to specific target areas such as agricultural fields and to minimize or eliminate off-target drift. Economic concerns, health concerns, environmental concerns, and efficacy are the generally recognized rationale for limiting off-target drift. Pesticide applicators can control deposition patterns through the use of specific types of equipment, the use of surfactants and spray additives, and by controlling application parameters. Several application parameters can potentially impact deposition patterns of liquid-form pesticides in the environment during application (e.g., nozzle size, application pressure, vehicle configuration and speed, meteorological conditions including environmental stability, and physical-chemical characteristics of the formulation). As indicated above, wide area (ULV) mosquito adulticide applications serve as the basis for this assessment. The general intent of these types of applications is antithetical to most pesticide

applications in that spray drift is generally not inhibited but promoted in order to broaden the effective treatment area and ensure that the resulting droplets stay aloft for as long as possible. In fact, the efficacy of mosquito adulticide compounds is based on droplets contacting in-flight mosquitos. As a result, these significant agricultural engineering differences were considered by the Agency in developing this risk assessment.

The following deposition rates presented as a percentage of the application rate served as the basis of the postapplication exposure calculations completed by the Agency:

- Ground-based ULV = 5 percent of application rate, and
- Aerial ULV = 11.5 percent of application rate.

The rationale and methods used for deriving these deposition values are presented in Appendix B of this document. In summary, the model developed by the Spray Drift Task Force, AgDRIFT, was used to calculate the value for aerial ULV applications and a published paper was used to define the value for ground-based applications. The calculated transferable residue values are presented in Appendix C/Tables 1 and 2 for aerial and ground-based application methods, respectively.

**Step 2: Calculation of Risks Resulting From Dermal Exposures**

The next step in the risk assessment process was to calculate dermal exposure values (remembering that inhalation exposures are not assessed for these scenarios) on each post-application day after application. These calculations were completed using the following equation (see equation D2-20 from *Series 875-Occupational and Residential Test Guidelines: Group B-Postapplication Exposure Monitoring Test Guidelines* and *Residential SOP 2.2: Postapplication Dermal Potential Doses From Pesticide Residues On Turf*):

$$DE_{(t)}\ (mg/day) = (TR_{(t)}\ (\mu g/cm^2) \times TC\ (cm^2/hr) \times Hr/Day)/1000\ (\mu g/mg)$$

Where:

| | | |
|---|---|---|
| **DE** | = | dermal exposure at time (t) attributable for activity in a previously treated area (mg/day); |
| **TR** | = | transferable residue at time$_t$ ($\mu g/cm^2$); |
| **TC** | = | transfer coefficient ($cm^2$/hour); and |
| **Hr** | = | exposure duration (hours). |

As indicated above, the transferable residue represents the amount of chemical on treated surfaces that can rub off on one's skin. The transfer coefficient is a value that represents the exposure one receives while performing a specific task or activity in an area previously treated with a pesticide. Exposure duration values represent the amount of time that individuals are expected to spend engaged in a job task or activity.

In addition to the TR values calculated above and presented in Appendix C, transfer coefficients and duration of exposure are also key elements in the calculation of post-application exposures and risks.

Risks have been calculated in this assessment for only residential exposure scenarios. In the Agency's *SOPs For Residential Exposure Assessment*, dermal exposures are calculated based on the Jazzercize exposure model developed by Ross and Krieger. This model uses a routine that involves high levels of contact with treated surfaces during a short duration, intense activity. This activity does not, however, directly relate to the activities of individuals during the course of their lives as the level of intensity and contact would not be anticipated for the general population in a situation that would contribute to exposure. Given this information and based on the discussions at the September 1999 meeting of the FIFRA Science Advisory Panel, the Agency has used the Jazzercize model to represent the amount of contact/exposure one would receive over longer intervals. The Agency believes that 20 minutes of Jazzercize, in exposure terms, is equivalent to approximately 1 hour of intense activity that would lead to exposure. The U.S. EPA *Exposure Factors Handbook* indicates that children and adults spend approximately 2 hours per day outdoors in a residential setting. Therefore, the Agency has used 40 minutes of Jazzercize to represent 2 hours of dermal exposure to both adults and toddlers.

The activities that were selected as the basis for the risk assessment are represented by the following transfer coefficients (the corresponding exposure scenario numbers are also presented for clarity). To reiterate, transfer coefficients are a measure of the amount of contact that an individual would have with a treated surface while engaged in specific activities. In this assessment, only residential, post-application dermal exposures were considered. It is not scientifically possible to determine what individuals do on a daily basis from a microactivity perspective that contributes to exposure. Therefore, given the scientific state of the art, the Agency has used the Jazzercize macroactivity model to represent the activities of adults and toddlers that contribute to exposure. The transfer coefficients that were developed using Jazzercize were completed using adults in the studies. The Agency had scaled the adult values down to toddler-sized individuals using allometric scaling based on the ratio of adult skin surface area to the surface area of toddlers. The transfer coefficients used in the risk assessment are presented below:

- **Transfer Coefficient = 43560 $cm^2$/hour used in Residential Scenarios 1&2:** for adults involved in a high exposure activity such heavy yardwork; and

- **Transfer Coefficient = 8700 $cm^2$/hour used in Residential Scenarios 3&4:** for toddlers involved in a high exposure activity such as heavy play.

Daily dermal dose (i.e., a biologically appropriate and available dose resulting from dermal exposure) was then calculated by normalizing the daily dermal exposure value by body weight and accounting for dermal absorption as appropriate. A body weight of 70 kg for adults was used for all exposure scenarios because the toxic effect (cholinesterase inhibition) is not sex-specific. The value used for all toddler calculations was 15 kg. Additionally, a dermal absorption factor of 3 percent was used for all calculations. Daily dose attributable to dermal exposure was calculated using the following formula:

$$Daily\ Dose\left(\frac{mg\ ai}{kg\cdot day}\right) = Daily\ Exposure\left(\frac{mg\ ai}{day}\right) \times \left(\frac{Absorption Factor(\%\ 100)}{Body\ Weight\ (kg)}\right)$$

Where:

**Daily Dose** = the amount as absorbed dose received from exposure to a pesticide in a given scenario (mg pesticide active ingredient kg body weight day):
**Daily Exposure** = the amount of dermal (on the skin) or nondietary ingestion (from mouthing behaviors of children) exposure calculated above (mg pesticide active ingredient day):
**Absorption Factor** = a measure of the flux or amount of chemical that crosses a biological boundary (% of the total available): and
**Body Weight** = body weight determined to represent the population of interest in a risk assessment (kg).

[Note: The U.S. EPA Exposure Assessment Guidelines (EPA. 1992) define potential dose as the amount of a chemical at the absorption barrier. Additionally, absorbed dose is defined as the amount of a chemical that has been absorbed and is available for interaction with biologically significant receptors.]

Risks were calculated in a non-probabilistic manner using the Margin of Exposure (MOE) which is a ratio of the toxic endpoint of concern to the calculated exposure. Short-term MOEs (for exposure durations ≤7 days) attributable to dermal exposure were calculated using the NOAEL from the monkey feeding study while intermediate-term MOEs (for exposure durations > 7 days) were calculated using the threshold NOAEL/LOAEL from the same study. [Note: See Section 2.b.i for more details about the specific endpoints used in each assessment.] One other aspect of the calculations that should be considered is that all intermediate-term calculations in this assessment were completed using a monthly average dose value which is a more appropriate comparison with the toxicological endpoint. Values were amortized over a month to account for a reasonable period of dissipation. MOEs were calculated using the formula below:

$$MOE = \frac{Endpoint\left(\frac{mg}{kg/day}\right)}{Daily\ Dose\left(\frac{mg}{kg/day}\right)}$$

Where:

**MOE** = margin of exposure or value used by the Agency to represent noncancer risk or how close a chemical exposure is to being a concern as determined by the associated uncertainty factor (unitless):
**Daily Dose** = the absorbed dose received from exposure to a pesticide in a given scenario (mg pesticide active ingredient kg body weight day): and
**Endpoint** = dose level in a toxicity study where no observed adverse effects occur (NOAEL) or the lowest dose at which an effect occurred (LOAEL) in the study (mg pesticide active ingredient kg body weight day).

The calculated MOEs from dermal exposure are presented in Appendix C/Tables 3 through 6. Table 3 contains the dermal dose for adults after aerial application. Table 4 contains the dermal dose for adults after ground-based application. Table 5 contains the dermal dose for toddlers after aerial application. Table 6 contains the dermal dose for toddlers after ground-based application.

**Step 3: Calculation of Risks Resulting From Toddler Mouthing Behavior**

The *Food Quality Protection Act (FQPA)* requires that the Agency aggregate (or add together) exposures that can occur in a variety of ways to a chemical. The assessments described above, focused only on the dermal exposures of adults and toddlers on treated turf engaged in various activities. FQPA also requires the Agency to focus on other exposures for any population that significantly contributes to

the overall burden of the exposed population. For the purposes of this assessment, the Agency does not believe that there are other significant pathways of exposure for adults engaged in activities on treated turf. However, the Agency does believe that there are several exposure pathways through which toddlers can be exposed because of mouthing behaviors.

The Agency has developed a document that is used by exposure assessors called the *SOPs For Residential Exposure Assessments* that was completed in December, 1997. This document contains guidance for considering children's exposures from mouthing behavior. All nondietary exposures were calculated using guidance from this document. Specifically, the kinds of nondietary exposures that were considered in this assessment include the following:

- ***Dose from hand to mouth activity calculated using SOP 2.3.2:*** *Postapplication potential dose among toddlers from incidental nondietary ingestion of pesticide residues on residential lawns from hand-to-mouth transfer* (i.e., those residues that end up in the mouth from a child touching surfaces then putting their hands in their mouth);

- ***Dose from object to mouth activity calculated using SOP 2.3.3:*** *Postapplication potential dose among toddlers from the ingestion of pesticide treated turfgrass* (i.e., residues that end up in the mouth after a child actively mouths turf a handful of turf or other object); and

- ***Dose from soil ingestion activity calculated using SOP 2.3.4:*** *Postapplication potential dose among toddlers from incidental ingestion of soil from Pesticide Treated Residential Areas* (i.e., residues that end up in the mouth after a child ingests soils from a treated area).

The following illustrates the approach used to calculate exposures that are attributable to a child touching treated turf and then putting their hands in their mouth (SOP 2.3.2):

$$D = (TR \times SA \times Freq \times Hr \times (1mg/1000\mu g))$$

where:

| | | |
|---|---|---|
| **D** | = | dose from hand-to-mouth activity (mg/day); |
| **TR(t)** | = | transferable residue at time$_{(t)}$ ($\mu$g/cm$^2$); |
| **SA** | = | surface area of the hands (cm$^2$); |
| **Freq** | = | frequency of hand-to-mouth events (events/hour); and |
| **Hr** | = | exposure duration (hours). |

As indicated above, the transferable residue represents the amount of chemical on the surfaces of treated leaves that can rub off on one's skin. The transferable residue levels that have been used in the nondietary ingestion assessment are based on a transferability factor of 20 percent instead of the 5 percent used in the calculation of dermal exposure above. The TR values are presented in Appendix C/Tables 1 and 2. The surface area for hands used (20 cm$^2$) represents the palmar surface area of three fingers. The frequency of ingestion events represents the 90th percentile of that activity monitored in a videography measure of children's activity completed by (U.S. EPA, 1999). The time spent outdoors (2 hours/day) is referenced directly from the *SOPs For Residential Exposure Assessment.* The 2 hour duration value is also a recommended value from the *U.S. EPA Exposure Factors Handbook* (U.S. EPA,

1997). This model for hand-to-mouth dose is based on the premise that **the residues on the hands are completely transferred from the hands to the mouth**, and **that all of the transferable residues available on the treated turf transfer to the child's hand each time they exhibit this behavior.**

The following illustrates the basics of the approach, used to calculate exposures that are attributable to children's object-to-mouth behavior (i.e., mouthing treated turf as described in SOP 2.3.3):

$$D = (TR \times IgR \times (1mg/1000\mu g))$$

where:

| | | |
|---|---|---|
| **D** | = | dose from mouthing activity (mg/day); |
| **TTR(t)** | = | transferable residue at time$_{(t)}$ ($\mu$g/cm$^2$); and |
| **IgR** | = | ingestion rate for mouthing of grass per day (cm$^2$/day). |

As indicated above, the turf transferable residue represents the amount of chemical on the surfaces of treated leaves that can rub off on one's skin or, as in this case, that can transfer from mouthing of turf. The transferable residue levels that have been used in the nondietary ingestion assessment are based on a transferability factor of 20 percent instead of the 5 percent used in the calculation of dermal exposure above. The TR values are presented in Appendix C/Tables 1 and 2. The time spent outdoors (2 hours/day) is referenced directly from the *SOPs For Residential Exposure Assessment*. The 2 hour duration value is also a recommended value from the *U.S. EPA Exposure Factors Handbook* (U.S. EPA, 1997). The ingestion rate used (25 cm$^2$/day) assumes that over the course of the exposure duration, the child will mouth this much turf. Turf has been selected as the generic "object" for this assessment. This model for a mouthing behavior dose is based on the premise that a **child will grab a handful of turf, mouth it and remove and ingest all transferable residues, and then remove it from their mouth** as described in the *SOPs For Residential Exposure Assessment*. The surface area of (25 cm$^2$/day) is thought to approximate a handful of turf that is mouthed.

The following illustrates the basics of the approach, used to calculate exposures that are attributable to children's ingestion of soil from treated areas (SOP 2.3.4):

$$D = (SR \times IgR \times (1\ g/1E6\ \mu g))$$

where:

| | | |
|---|---|---|
| **D** | = | dose from mouthing activity (mg/day): |
| **SR(t)** | = | soil residue at time$_{(t)}$ (ppm); and |
| **IgR** | = | soil ingestion rate (mg/day). |

The soil residue represents the amount of chemical in the top centimeter of surface soil converted to a weight/weight concentration using the density of soil. The ingestion rate represents the amount of soil that a typical child might ingest on a daily basis. All of the chemical residues in the soil are available for consumption because any soil in the top 1cm layer can be ingested. The soil concentration

values are presented in Appendix C/Tables 1 and 2. The daily soil ingestion rate (100 mg/day) is referenced directly from the *SOPs For Residential Exposure Assessment.* This value is also a recommended value from the *U.S. EPA Exposure Factors Handbook* (U.S. EPA. 1997).

The nondietary ingestion exposure levels were normalized by the body weight of a toddler (15 kg) as was done in the dermal risk calculations above. Risks are also presented for nondietary ingestion exposures by calculating MOE values. MOEs are were calculated using the same equation that was used above for the risks attributable to dermal exposure. In fact. the toxicological endpoints used in these calculations were the same as from the monkey study used in both the short- and intermediate-term dermal assessments (0.07 and 0.02 mg/kg/day).

The results of the nondietary exposure calculations are presented in Appendix C. Tables 1 and 2 contain the residue transferable and soil residue levels that serve as the basis for the assessment resulting from aerial and ground applications of fenthion. respectively. Risks attributable to hand-to-mouth behavior are presented in tables 7 and 8 for aerial and ground applications. respectively. Likewise. risks attributable to object-to-mouth behavior are presented in tables 9 and 10 for aerial and ground applications. respectively. Tables 11 and 12 present the risks calculated for soil ingestion after aerial and ground applications. respectively.

**Step 4: Calculation of Total Risks For Toddlers**

The FQPA requires the Agency to consider a variety of exposure routes and pathways and then to add these exposures together in order to more accurately define the overall risks associated with the use of a chemical. Typically the Agency has not added exposures if risks were a concern for a single pathway. In this case. however. the Agency has added the exposures for toddlers to obtain risk estimates that include dermal exposure. exposures from mouthing behaviors (hands and objects). and exposures from soil ingestion.

Risks were first calculated for individual pathways as described above and then added together (or aggregated). MOEs were added together in order to consider total risks to toddlers given the toxic effect (cholinesterase inhibition) for each route of exposure (e.g.. to the skin and being inhaled) is the same. The equation the Agency uses to add MOEs together is presented below:

$$MOE_{total} = 1 ((1 MOE_a) - (1 MOE_b) - .... (1 MOE_n))$$

Where:

$MOE_a$. $MOE_b$. and $MOE_n$ represent MOEs for each exposure route of concern

A margin of exposure (MOE) uncertainty factor of 100 is considered an appropriate risk level for short-term exposures when only animal toxicity data are considered in the assessment. A human toxicity study has been completed for fenthion. If these data are also considered in the assessment. the uncertainty factor is reduced to 30 for short-term duration exposures. The uncertainty factor required for intermediate-term assessments is 300. The human study is not considered appropriate for characterization of intermediate-term risks s because of the duration. These factors apply to all routes of exposure. Total risk values are also presented in Appendix C. Table 13 presents the total risks associated with aerial applications while Table 14 presents the total risks for ground-based applications.

**Assumptions and Factors**

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

- These assessments were based on the guidance provided, as appropriate, in the *Draft: Series 875-Occupational and Residential Exposure Test Guidelines, Group B-Postapplication Exposure Monitoring Test Guidelines (7/24/97 Version)* and the *Draft: Standard Operating Procedures (SOPs) for Residential Exposure Assessment (12/11/97 Version).* Several of the assumptions and factors used in the exposure assessment are described in that document. [Note: The Agency presented proposed revisions of this document before the FIFRA Science Advisory Panel in September of this year. The proposed revisions presented to the panel have been used as the basis for this risk assessment.] For example, the SOP document addressed hand-to-mouth exposures using the following information: surface area for hands used (350 $cm^2$) is the median surface area for a toddler (age 3 years), the time spent outdoors (2 hours/day) and frequency of events (1.56 events/hour). The proposed revisions use a lower surface area of 20 $cm^2$ to represent only a portion of the hands and a higher frequency of contact (20 times per hour based on videography data discussed in U.S. EPA, 1999).

- The average body weight of an adult used in all assessments is 70 kg because the NOAELs used for the short- and intermediate-term assessments are based on a endpoint appropriate to both male and female populations. The average body weight for toddlers used in all assessments is 15 kg based on the *SOPs For Residential Exposure Assessment*.

- Both the short-term and intermediate-term endpoints served as the basis for this assessment as HED believes that exposure patterns meet both criteria. For the short-term assessment, single day exposures calculated to reflect both deposition and residue dissipation rates were compared to the endpoint in order to calculate MOE values (i.e., daily dose levels were compared directly to the endpoint of 0.07 mg/kg/day). For the intermediate-term risk assessment, repetitive area applications for mosquito control are thought to occur along with routine outdoor activity during mosquito season providing opportunity for exposure. However, it is believed that most repetitive applications will not occur on subsequent days for the extended period that would trigger an intermediate-term MOE calculated using the peak dose level (i.e., on the day of application). By definition, intermediate-term biological effects are not triggered until sustained exposure at the endpoint dose levels occur. Based on this premise, MOEs for the intermediate-term assessment were calculated using a dose level that was derived by taking the average of the dose levels from applications occurring on a monthly basis (i.e., longer durations were not selected as the interval as the Agency believes applications will occur on a more frequent basis). This approach should also coincide well with actual mosquito control application management practices. Based on the use data available from Lee County Florida, the maximum number of annual treatment days was

66 which is approximately once per week. Considering this information, it is therefore unlikely that the same residential areas will be treated in a manner that does not allow for residue dissipation over time. In other words, sustained maximum application day dose levels are unlikely based on the available data that detail specific management practices and the Agency has used a monthly average dose level for comparison to the intermediate-term endpoint of 0.02 mg/kg/day for calculation of MOEs.

- Due to a lack of chemical-specific transferable residue data (TR), a surrogate approach has been used to predict transferable residue levels over time as specified in the residential SOPs. Deposition rates of 11.5 percent of the application rate for aerial ULV and 5 percent of the application rate for ground-based ULV applications are assumed as described above. Availability of deposited residues after application day are assumed to be 5 or 20 percent of the deposition rate (depending upon how used in the assessment) and these available residues are assumed to decline at a rate of 10 percent per day. No chemical-specific dissipation data were available. The environmental fate data included in the EFED database were reviewed on 3/16/98 and the aerobic soil half-life was reported as 24 hours for the parent and 72 hours for total residues. The aerobic aquatic half-life was also reported in the range of 7 to 14 days. These values support the use of the surrogate Residential SOP-type dissipation model that has been utilized for fenthion.

- Deposition from aerial and ground-based ULV applications is assumed to be uniform throughout the drift zone even though AgDRIFT indicates minor fluctuations in the region of interest and the empirical data for ground applications also indicates some variation. The deposition region of interest has been defined as the region immediately adjacent to the treatment area out to a reasonable model approximated limit (i.e., for aerial -- about 2000 feet, ground -- about 500 feet). This deposition region is considered to be representative of a residential environment for the purposes of the risk assessment.

- The average body weight for adults used in all assessments is 70 kg based on current HED policy. This body weight is used in the intermediate-term assessment, since the endpoint of concern is not sex-specific. The average body weight for toddlers used in all assessments is 15 kg based on the residential SOPs.

- Calculations were completed using the maximum application rates for ground-based and aerial applications (i.e., 0.03 and 0.10 lb ai/A, respectively). Additionally, calculations were completed using the average Lee County, Florida application rates (i.e., 0.016 and 0.050 lb ai/A, respectively). The overall application rate, regardless of application method, in Florida appears to be 0.037 lb ai/acre. This value has also been used in the assessment for risk characterization purposes.

- Due to a lack of scenario-specific exposure data, HED has calculated unit exposure values for adults using a surrogate dermal transfer coefficient based on the use of the Jazzercize protocol. As was proposed to the FIFRA Science Advisory Panel in September, 1999 the Agency has used the Jazzercize value to represent adult exposures. This should be considered by the fact that the Agency also proposed that the Jazzercize protocol is a very intense, high contact activity. As such, for exposure assessment purposes, the Agency has used 20 minutes of Jazzercize to represent each hour of activities that contribute to dermal exposure. Based on the residential

SOPs. a transfer coefficient of 8,700 $cm^2$/hour was used to calculate dermal exposures for toddlers. This value is also based on the Jazzercize transfer coefficient that has been allometrically scaled based on a proportion of adult to toddler skin surface areas.

### c. Occupational and Residential Risk Assessment/Characterization

#### *i. General Risk Characterization Considerations*

Several issues must be considered that pertain to the quality of the assessment and when interpreting the results of the occupational handler and residential postapplication risk assessment. These include:

- Bayer Chemical Company is a member of the ongoing *Outdoor Residential Exposure Taskforce (ORETF).* As such, studies are to be completed to enable the Agency to better evaluate residential exposures in the future due to contact with treated turf (i.e., to generate appropriate activity pattern and transfer coefficient data).

- The *SOPs For Residential Exposure Assessment* and the changes proposed before the FIFRA Science Advisory Panel in September, 1999 have served as the basis for this risk assessment. The Jazzercize protocol has served as the basis for the dermal risk assessment. Significant proposed recent changes, however, include modifying the duration to which the Jazzercize data are applied (i.e., 20 minutes of Jazzercize is equivalent to 1 hour of intense activity that would lead to exposure) and modifying the hand-to-mouth model inputs (changes from 1.56 events per hour to 20 events per hour and the surface area ingested per event).

- The AgDRIFT model was used to calculate the deposition pattern for fenthion after aerial ULV applications for mosquito control. No proprietary data (e.g., droplet spectrum or physical property) from the Spray Drift Task Force (SDTF) were used in this assessment. Bayer is a member of the SDTF and may refine the AgDRIFT input parameters if data were generated for the Baytex ULV product. Additionally, AgDRIFT was recently presented before the FIFRA Science Advisory Panel. Modifications to the model are possible as a result of the SAP comments. These modifications, however, are anticipated not to significantly alter the results of this assessment given that without the model, the Agency would likely use a much more conservative estimate of deposition (e.g., treating mosquito control applications similar to typical agricultural applications by 100 percent of the application rate is deposited on the turf in residential areas where mosquito control applications occur).

- The deposition patterns for the aerial and ground-based ULV mosquito control adulticide applications were calculated/estimated using the best data/tools available to the Agency. The ground-based deposition percentage (5 % of total applied is deposited) was excerpted from a study that used malathion and typical ground-based fogging/application equipment under conditions similar to what would be expected for an application of fenthion for similar purposes (all available data support the 5 percent value used for ground-based fogging equipment including Moore *et al.* 1993; Hennessey *et al.* 1992; and Tietze *et al.* 1994). The deposition percentage (11.5 % of total applied is deposited) predicted with the AGDRIFT model is also consistent with the levels that would be expected for similar applications. Data generated by



4/19/16

Dukes *et al.* 1999 also support that the 11.5 percent deposition value is consistent with what would be anticipated after an aerial ULV application of fenthion. Further analysis using AgDRIFT by the United States Department of Agriculture (USDA) also support the results of the analysis completed by the Agency. The USDA has also supplied data from Boll Weevil monitoring programs in Texas and other southern states where malathion was applied. The deposition values noted in these reports, given all of the uncertainties associated with the application equipment/parameters and conditions, also support the deposition values calculated using the AgDRIFT model (USDA, 1998).

- No chemical-specific pesticide handler exposure data were submitted. As a result, all analyses were completed using data from PHED. Some of the data used from PHED were poor quality (see Appendix A/Table 1). The extrapolation to the very high acreage estimates used in this assessment for the aerial mosquito control applications should also be considered because the PHED data were generated in studies for lower acreage exposure scenarios (i.e., the extrapolation likely over-predicts exposures but is based on the best available data). Other extrapolations were needed as well to complete this assessment (e.g., no exposure data were available for applicators using the ground-based ULV application equipment). As such, the Agency used exposure data, believed to be similar for calculating the risks associated with the scenario (e.g., using airblast data to calculate risks for applicators using ground-based ULV application equipment). See Appendix A/Table 1 for specific details of each dataset used in the handler risk assessment.

- No chemical-specific transferable residue or post-application exposure data were submitted. As a result, all analyses were completed using surrogate data and assumptions related to the behavior of the chemical in the environment (e.g., amount of transferable residues available and dissipation of transferable residues on turf). These inputs incorporated the latest discussion before the FIFRA Science Advisory Panel that indicated that the percent transferability could be reduced from 20 to 5 percent when calculating dermal exposures. The dissipation of fenthion residues over time was also modeled using the standard approach when data are not available (i.e., a dissipation rate of 10 percent per day). Calculations were carried out to 30 days after application because the environmental fate data for fenthion indicate that residues in various media have half-lives of several days or weeks and no chemical-specific turf transferable residue data were available. The result of the use of this model is that intermediate-term risks have been calculated but are considered to be relatively unlikely because of the uncertainties associated with the transferability/dissipation model.

- The use of thermal foggers is an allowable practice in mosquito control applications. However, for risk assessment purposes, the all handler assessments for "aerial" wide area application methods are also intended to address the use of thermal fog methods (i.e., exposure data cannot differentiate between these two methods). Additionally, the post-application residential assessment, modeled using parameters from nonthermal aerial and ground applications is also intended to address risks associated with thermal fogger applications.

- Flagger scenarios were included in the assessment even though the Agency believes that it is unlikely that flaggers will be used to identify flight paths in aerial mosquito control applications. There are, however, other individuals involved in these types of applications that may have similar exposures such as ground crews and spotters.



4/28/16

- Several generic protection factors were used to calculate handler exposures. The protection factors used for clothing layers and gloves have not been completely evaluated by HED. The key element being evaluated by HED is the factor for clothing. The value used for respiratory protection is based on the *NIOSH Respirator Decision Logic* and the value for gloves is in the range that OSHA and NIOSH often use.

- Exposure factors used to calculate daily exposures to handlers are based on the applicable data if available. Otherwise, values are based on the best professional judgement of Agency assessors due to a lack of pertinent data and assumptions such as the number of animals treated per day or the number of gallons spray solution prepared and applied for handheld equipment types. The recent draft NAFTA exposure factor summary (e.g., acres/day/equipment type) was also consulted. These factors are believed to represent reasonable to conservative estimates for calculating exposures. In some cases, a range of values has been considered to allow for a more informed risk management decision (e.g., aerial larvicide application acreages and aquaculture acreages).

- The Agency normally completes both short- and intermediate-term occupational risk assessments. Short- and intermediate-term residential post-application assessments are also completed if the data indicate that residues are persistent thereby resulting in an opportunity for prolonged (i.e., intermediate-term) exposures. For handlers, the rationale behind this approach is that an insufficient use and usage dataset is available to establish that intermediate-term exposures do not occur and, for many situations with fenthion, the Agency was able to develop several plausible scenarios for which intermediate-term exposures can occur (e.g., data from Lee County mosquito control district indicate that application events occur 50 to 60 times per year).

- The Agency always considers the maximum application rates allowed by labels in its risk assessments in order to be able to consider what is legally possible based on the label in order to ensure proper stewardship. If more information is available concerning the use patterns of the chemical, the Agency tries to incorporate it into the risk assessment process. Average application rates, used to represent typical application rates for the purposes of this analysis, were available. The results of this analysis indicate that in most cases, average application rates differ from maximum application rates on average by a factor of two to four. The Agency used these rates in the assessment. However, the impact on the calculated risks is small because there is little difference between the average and maximum application rates.

- The calculation of hand-to-mouth doses may be based on conservative exposure factors such as infinite replenishment on a treated surface, low levels of residue dissipation, maximum hand surface area contacted, and quantitative transfer processes.

- Toddler post-application exposures were aggregated together to calculate total risk values representing dermal exposure, exposures from mouthing behaviors, and exposures from soil ingestion. The inputs and approaches used to calculate the exposures for each scenario are thought by the Agency to each result in conservative estimates of exposure keeping in mind that the intent of the *SOPs For Residential Exposure Assessment* is to provide a screening level tool for calculating residential exposures. Consideration should be given this observation when



93 8 1/6

interpreting the results of the toddler post-application risk assessment because adding together individual exposure values that are thought to be conservative results in a very conservative estimate of exposure (U.S. EPA, 1992) given that the probability for all events to occur simultaneously in the manner modeled is unlikely.

- The aquaculture applications (all SLN labels) are thought to occur in a relatively few facilities in the country.

- The larvicide mosquito control labels have been considered in this assessment even though the last recorded application of that manner was in 1996 (personal communication between Jeff Dawson and Mike Hennessey EPA/BEAD).

Refinement of the ORE exposure and risk assessment calculations presented in this chapter is possible if the issues presented above are addressed by the registrant or if more refined approaches and data become available.

### *ii. Occupational Handler Risk Summary*

In this current assessment for fenthion, risks for handlers were assessed using the same endpoints for both dermal and inhalation exposures. The resulting risks (MOE values) were then added in order to obtain an overall risk for each applicator that accounted for both dermal and inhalation exposures for each exposure duration considered. Dermal and inhalation risks are mitigated using different types of protective equipment such that it may be acceptable to add a pair of gloves and not a respirator, and vice versa. All of the risk calculations for occupational handlers completed in this assessment are included in Appendix A. The specifics of each of table included in Appendix A are described below as well as a summary of the risks for each exposure scenario.

- **Table 1: Sources of Exposure Data Used in the Occupational Fenthion Handler Exposure and Risk Calculations** Describes the sources of the exposure data used in all of the occupational handler calculations.

- **Table 2: Input Parameters For Fenthion Occupational Handler Exposure and Risk Calculations** Presents the exposure values and other exposure factors used in the occupational handler noncancer risk assessments.

- **Table 3: Fenthion Occupational Handler Exposure and Risk Calculations At The Baseline Protection Level** Represents typical work clothing or a long-sleeved shirt and long pants with no respiratory protection. No chemical-resistant gloves are included in this scenario. Therefore, some scenarios have no baseline dermal exposure assessments (see notes on Table 2). [Note: The calculations from this table have been used to develop the summary in Tables 7, 8, 9, and 10.]

- **Table 4: Fenthion Occupational Handler Exposure and Risk Calculations At The Minimum PPE Protection Levels** Represents the baseline scenario with the use of chemical-resistant gloves and PF 5 respirators. [Note: The calculations from this table have been used to develop the summary in Tables 7, 8, 9, and 10.]

- **Table 5: Fenthion Occupational Handler Exposure and Risk Calculations At The Maximum PPE Protection Levels** Represents the baseline scenario with the use of an additional layer of clothing (e.g., a pair of coveralls), chemical-resistant gloves, and, in some cases, a PF 10 respirator. [Note: The calculations from this table have been used to develop the summary in Tables 7, 8, 9, and 10.]

- **Table 6: Fenthion Occupational Handler Exposure and Risk Calculations At The Engineering Control Protection Levels** Represents the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids. Engineering controls are not applicable to handheld application methods there are no known devices that can be used to routinely lower the exposures for these methods. [Note: The calculations from this table have been used to develop the summary in Tables 7, 8, 9, and 10.]

- **Table 7: Fenthion MOEs Attributable to Dermal Exposure** Summarizes all MOEs calculated for dermal exposures at each level of personal protection (i.e., baseline through engineering controls). [Note: See tables 3 through 6 for calculations of specific MOE values.]

- **Table 8: Fenthion MOEs Attributable to Inhalation Exposure** Summarizes all MOEs calculated for inhalation exposures at each level of personal protection (i.e., baseline through engineering controls). [Note: See tables 3 through 6 for calculations of specific MOE values.]

- **Table 9: Fenthion MOEs Attributable to Combined Short-Term Dermal and Inhalation Exposures** Presents combined dermal and inhalation MOEs with each possible combination of dermal and respiratory protection considered in this assessment. Only exposure durations < 7 days are included in this table. [Note: See tables 3 through 6 for calculations of specific MOE values.]

- **Table 10: Fenthion MOEs Attributable to Combined Intermediate-Term Dermal and Inhalation Exposures** Presents combined dermal and inhalation MOEs with each possible combination of dermal and respiratory protection considered in this assessment. Only exposure durations of >7 days are included in this table. [Note: See tables 3 through 6 for calculations of specific MOE values.]

Tables 1 through 6 of Appendix A illustrate how the calculations were performed to define the risks (i.e., MOEs) for fenthion handlers. The exposure data and exposure factors represent the best sources of data currently available to the Agency for completing these kinds of assessments. For example, maximum application rates were derived directly from fenthion labels. The recent use and usage information was also used to define average application rates as well as the annual frequency of application rates per crop. Exposure factors (e.g., body weight, amount treated per day, protection factors, etc.) are all standard values that have been used by the Agency over several years and are derived from peer reviewed sources whenever possible (e.g., Exposure Factors Handbook) and the PHED unit exposure values are the best available estimates of exposure. Some PHED unit exposure values are high quality while others represent low quality, but the best available, data. Tables 7 and 8 provide summaries of the MOE values calculated for each route of exposure, dermal and inhalation, respectively.

in the risk assessment. Tables 9 and 10 provide the information that are the key to interpreting the overall results of the risk assessment because they contain the overall risks calculated using several combinations of personal protection for each exposure duration considered (e.g., short-term MOEs are presented in Table 9).

The risks are summarized based on the specific markets for fenthion use and the lowest level of personal protection that does not exceed the Agency's level of concern as established by the appropriate uncertainty factor. Two different uncertainty factors, 30 or 100, have been applied to the short-term risk estimates to ascertain whether or not the exposure scenario exceeds the Agency's level of concern. Two uncertainty factors are considered in this assessment because of the human toxicity study issue. A human toxicity study has been completed for fenthion and the Agency is awaiting the decision from the Science Advisory Board on the ethical issues surrounding the use of human data. If the Agency opts to consider the human toxicity study in the decision making process, the uncertainty factor of 30 will be the standard that establishes the Agency's level of concern. If the Agency opts to consider only animal toxicity data and does not opt to consider the human toxicity data, an uncertainty factor of 100 will be the standard that establishes the Agency's level of concern for short-term exposures. The human toxicity study is not an issue when intermediate-term exposures are considered. An uncertainty factor of 300 has been used to establish the Agency's level of concern for all intermediate-term exposures.

**For Occupational Uses During Wide Area Mosquito Adulticide ULV Applications:**

**(1a)** **mixing/loading liquids for mosquito control fixed-wing aerial applications:** The maximum application rate is 0.10 lb ai per acre. The average (treated as typical for this assessment) application rate 0.056 lb ai/acre. When short-term dermal and inhalation exposures were combined, the MOE is 19 at the maximum application rate even with the use of engineering controls and exceeds 30 (is 34) at the average application rate with engineering controls. MOEs never exceeded 100 for short-term exposures at either application rate even with the use of engineering controls. When intermediate-term exposures were considered, the MOE is 5.5 at the maximum application rate and 9.8 at the average application rate even when engineering controls are considered (i.e., intermediate-term MOEs never exceeded 300 even with the use of engineering controls). Since the Agency cannot eliminate the possibility of intermediate-term exposures, the Agency has a risk concern over the exposures of individuals who load aircraft for wide area aerial mosquito control applications.

**(1b)** **mixing/loading liquids for mosquito control ground-fogger applications:** The maximum application rate is 0.03 lb ai per acre. The average (treated as typical for this assessment) application rate 0.016 lb ai/acre. When short-term dermal and inhalation exposures were combined, the MOE exceeds 30 (is 59) at the maximum application rate when gloves and a PF 5 respirator are used with long pants and a long-sleeved shirt. At the average application rate, MOEs exceeded 30 (is 54) when gloves are used with long pants and long-sleeved shirts. Engineering controls are required for the MOE to exceed 100 (is 160) at the maximum application rate for short-term exposures. When short-term exposures at the average application rate is considered, the MOE exceeds 100 (is 110) when gloves and a PF 5 respirator are used with long pants and a long-sleeved shirt. When intermediate-term exposures are considered, the MOE is 45 at the maximum application rate and 86 at the average application rate even with engineering controls (i.e., MOEs for intermediate-term exposures never exceeded 300). Since the



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Agency cannot eliminate the possibility of intermediate-term exposures, the Agency has a risk concern over the exposures of individuals who load ground-based foggers for wide area aerial mosquito control applications.

(3) **applying liquids using aerial equipment (includes both ULV and thermal fogger) for mosquito control applications:** The maximum application rate is 0.10 lb ai per acre. The average (treated as typical for this assessment) application rate 0.056 lb ai/acre. When short-term dermal and inhalation exposures were combined, the MOE is 30 at the maximum application rate with the use of engineering controls and exceeds 30 (is 54) at the average application rate with engineering controls. MOEs for short-term exposures never exceeded 100. When intermediate-term exposures were considered, the MOE is 8.6 at the maximum application rate and 15 at the average application rate even with engineering controls (i.e., MOEs for intermediate-term exposures never exceeded 300). Since the Agency cannot eliminate the possibility of intermediate-term exposures, the Agency has a risk concern over the exposures of pilots who fly aircraft during wide area aerial mosquito control applications. The only plausible exposure scenario is the use of closed cabs which was considered in this assessment.

(4) **applying liquids using ULV ground-fogger equipment for mosquito control:** The maximum application rate is 0.03 lb ai per acre. The average (treated as typical for this assessment) application rate 0.016 lb ai/acre. When short-term dermal and inhalation exposures were combined, the MOE exceeds 30 (is 53) at the maximum application rate when engineering controls are used. When short-term exposures at the average application rate are considered, the MOE exceeds 30 (is 100) when engineering controls are used. The MOE only exceeds 100 (is 100) if engineering controls are considered for short-term exposures at the average application rate. Short-term MOEs are less than 100 at the maximum application rate. When intermediate-term exposures were considered, the MOE is 15 at the maximum application rate and 29 at the average application rate even with engineering controls (i.e., MOEs for intermediate-term exposures never exceeded 300). Since the Agency cannot eliminate the possibility of intermediate-term exposures, the Agency has a risk concern over the exposures of applicators who use ground-based application equipment during wide area aerial mosquito control applications.

(12) **flagging during aerial application of liquids:** The maximum application rate is 0.10 lb ai per acre. The average (treated as typical for this assessment) application rate 0.056 lb ai/acre. When short-term dermal and inhalation exposures were combined, the MOE exceeds 30 (is 480) at the maximum application rate when engineering controls are used. At the average application rate, short-term MOEs exceeded 30 (is 32) when gloves, a PF10 respirator, and double layer clothing are used. Engineering controls are required for the MOE to exceed 100 (is 480) at the maximum application rate and the average application rate (is 858) for short-term exposures. When intermediate-term exposures are considered, MOEs never exceeded 300 at the maximum (is 137) and at the average application rates (is 245) even with the use of engineering controls. Since the Agency cannot eliminate the possibility of intermediate-term exposures, the Agency has a risk concern over the exposures of pilots who fly aircraft during wide area aerial mosquito control applications. [Note: The Agency has included this scenario in the assessment even though the Agency believes that it is not a common practice. The practice, however, is not precluded by current fenthion labeling.]



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For Occupational Uses During Mosquito Larvicide Applications:

(2) **loading granular materials for mosquito control fixed-wing aerial applications:** The maximum application rate is 0.10 lb ai per acre. The average (overall rate for Florida treated as typical for this assessment) application rate 0.056 lb ai/acre. When short-term dermal and inhalation exposures were combined, the MOE exceeds 30 (is 31 for 800 acres and 314 for 80 acres) at the maximum application rate at the baseline level of clothing (long pants and long-sleeved shirts). Likewise, when short-term dermal and inhalation exposures were combined, the MOE exceeds 30 (is 56 for 800 acres and 560 for 80 acres) at the average application rate at the baseline level of clothing (long pants and long-sleeved shirts). Short-term MOEs exceed 100 at the maximum (is 112) and typical (is 200) application rates when 800 acres are treated if single layer clothing, gloves, and a PF5 respirator are used. Likewise, short-term MOEs exceed 100 at the maximum (is 314) and typical (is 560) application rates when 80 acres are treated if single layer clothing, gloves, and a PF5 respirator are used. When intermediate-term exposures were considered, the MOE exceeds 300 (is 448) at the maximum application rate if engineering controls are used and 800 acres are treated. When 80 acres are treated at the maximum rate, the MOE exceeds 300 (is 320) if single layer clothing, gloves, and a PF5 respirator are used. For intermediate-term exposures at the typical application rate, the MOE exceeds 300 (is 800) when 800 acres are treated and engineering controls are used. When 80 acres are treated at the typical application rate, the MOE exceeds 300 (is 571) if the baseline level clothing, gloves, and a PF5 respirator are used. MOEs for all exposure parameters considered do not exceed the Agency's level of concern for individuals who load aircraft for the aerial application larvicide applications of fenthion. The Agency considered a range of acreages in the assessment to provide for a more informed risk management decision as this use of fenthion is not a common practice and no information are available about typical daily application acreages.

(5) **applying granulars using aerial equipment for mosquito control** The maximum application rate is 0.10 lb ai per acre. The average (treated as typical for this assessment) application rate 0.056 lb ai/acre. When short-term dermal and inhalation exposures were combined, MOEs exceed 30 (is 45 for 800 acres and 453 for 80 acres treated) at the maximum application rate with the use of engineering controls. Likewise, MOEs for short-term exposures exceed 30 (is 81 for 800 acres and 810 for 80 acres treated) at the typical application rate with the use of engineering controls. Combined short-term MOEs do not exceed 100 when 800 acres are treated, even with the use of engineering controls, at the maximum (is 45) and the typical application rates (is 81). However, combined short-term MOEs exceed 100 when 80 acres are treated, with the use of engineering controls, at the maximum (is 453) and the typical application rate (is 810). Combined intermediate-term MOEs do not exceed 300 when 800 acres are treated, even with the use of engineering controls, at the maximum (is 13) and the typical application rates (is 23). Likewise, combined intermediate-term MOEs do not exceed 300 when 80 acres are treated, with the use of engineering controls, at the maximum (is 130) and the typical application rates (is 231). The Agency has risk concerns for applications at the high acreage value of 800 acres per day when exposures are short-term in nature and also has concerns over high and lower acreage applications when intermediate-term exposures are considered. The Agency considered a range of acreages to provide for a more informed risk management decision as this use of fenthion is not a common practice and no information are available about typical daily application acreages. The only plausible exposure scenario is the use of closed cabs which was used in this assessment.



4/8/16

(9) **loading/applying granulars for ground-based mosquito larvicide control applications:** The maximum application rate is 0.1 lb ai/acre. MOEs for combined dermal and inhalation exposures exceed 30 (is 34) when single layer clothing, gloves, and a PF5 respirator are used. Short-term MOEs do not exceed 100 (is 55) even if the maximum level of personal protection is considered in the assessment. When intermediate-term dermal and inhalation exposures were combined, MOEs do not exceed 300 (is 16) even if the maximum levels of personal protection are applied. Since the Agency cannot eliminate the possibility of intermediate-term exposures, the Agency has a risk concern over the exposures of applicators who use ground-based application equipment during mosquito control larvicide applications.

(13) **flagging during aerial application of granulars:** The maximum application rate is 0.10 lb ai per acre. The average (treated as typical for this assessment) application rate 0.056 lb ai/acre. When short-term dermal and inhalation exposures were combined, MOEs exceeded both uncertainty factors of concern, 30 and 100, at the maximum application rate with the baseline level of clothing (is 262) and at the average application (is 467) with the baseline level of clothing. When intermediate-term exposures are considered, MOEs exceeded 300 at the maximum application rate (is 389) with the use of double layer clothing, gloves, and a PF 10 respirator. At the typical application rate, MOEs exceeded 300 with the use of double layer clothing, gloves, and a PF 5 respirator. MOEs for all exposure parameters considered do not exceed the Agency's level of concern for individuals who direct aircraft (flag) during the aerial application of granulars for mosquito larvicide control. [Note: The Agency has included this scenario in the assessment even though the Agency believes that it is not a common practice. The practice, however, is not precluded by current fenthion labeling.]

**For Occupational Uses During Applications To Feed Animals in Agriculture:**

(6) **applying the ready-to-use solutions to livestock (cattle and swine):** The maximum application rate is 0.0084 lb ai/animal. When short-term dermal and inhalation exposures were combined, MOEs exceeded 30 (is 33) at the maximum application rate when the baseline level of clothing is used. Likewise, combined short-term MOEs exceeded 100 (is 1543) if single layer clothing and gloves are used (respiratory protection is not needed). MOEs for combined intermediate-term dermal and inhalation exposures exceed 300 (is 441) if single layer clothing and gloves are used (respiratory protection is not needed). MOEs for all exposure parameters considered do not exceed the Agency's level of concern for individuals who complete ground-based application of granulars for mosquito larvicide control.

(7) **applying cattle ear tags:** A quantitative risk assessment was completed for this scenario because appropriate exposure data were not available.

(8) **mixing/loading/applying liquids to livestock via ladeling:** A quantitative risk assessment was completed for this scenario because appropriate exposure data were not available.



4/9/116

**For Occupational Uses During Aquaculture Applications:**

(10) **mixing/loading/applying liquids for aquaculture using low pressure handwand sprayers:** The application rate is intended to achieve a concentration of 0.1 ppm in the treated ponds. This rate is achieved by adding, for example, 52.5 liquid ounces (of a 95% ai liquid) to a 5 acre pond that is 3 feet deep. Using a pond with this depth, the equivalent application rate is 0.8 lb ai/acre. When dermal and inhalation exposures are combined, short-term MOEs exceed 30 (is 65) if single layer clothing, gloves, and a PF5 respirator are used if a 5 acre pond is treated. If a 2.5 acre pond is treated, short-term MOEs exceed 30 (is 57) if single layer clothing and gloves (no respirator) are used. If a 5 acre pond is treated, MOEs for combined short-term dermal and inhalation exposures never exceed 100 even if the highest level of personal protection is considered (double layer clothing, gloves, and PF10 respirator). If a 2.5 acre pond is treated, MOEs for combined short-term dermal and inhalation exposures exceed 100 (is 130) if single layer clothing, gloves, and PF5 respirator are used. MOEs for combined intermediate-term dermal and inhalation exposures never exceeded 300 (is 35 for 5 acre pond and 50 for 2.5 acre pond) even if the highest level of personal protection is used regardless of pond size. The Agency has risk concerns over the use of fenthion in aquaculture when applied using low pressure handwand sprayers for both short- and intermediate-term duration exposures.

(11) **mixing/loading/applying liquids for aquaculture using backpack sprayers:** The application rate is intended to achieve a concentration of 0.1 ppm in the treated ponds. This rate is achieved by adding, for example, 52.5 liquid ounces (of a 95% ai liquid) to a 5 acre pond that is 3 feet deep. Using a pond with this depth, the equivalent application rate is 0.8 lb ai/acre. When dermal and inhalation exposures are combined, short-term MOEs never exceed 30 (is 24) even if the maximum level of personal protection is considered (double layer clothing, gloves, and PF10 respirator). If a 2.5 acre pond is treated, short-term MOEs exceed 30 (is 30) if single layer clothing, gloves, and a PF5 respirator are used. MOEs for combined short-term dermal and inhalation exposures never exceed 100 even if the highest level of personal protection is considered (double layer clothing, gloves, and PF10 respirator) regardless of the pond size considered (is 24 for 5 acres and 48 for 2.5 acres). MOEs for combined intermediate-term dermal and inhalation exposures never exceeded 300 (is 7 for 5 acre pond and 14 for 2.5 acre pond) even if the highest level of personal protection is used regardless of pond size. The Agency has risk concerns over the use of fenthion in aquaculture when applied using backpack sprayers for both short- and intermediate-term duration exposures.

### *iii. Total Risks to Residential Handlers*

Risks for residential handlers were not assessed as no fenthion products are labelled for homeowner use.



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### *iv. Occupational Risks From Postapplication Exposures*

Occupational postapplication risks were not assessed as the Agency believes there are no applicable fenthion product use patterns. Mosquito control applications are addressed in the residential postapplication risk assessment summarized below and animal (fly and tick) control applications are not considered an occupational postapplication risk assessment requirement by the Agency.

### *v. Residential Risks From Postapplication Exposures*

The use of a Restricted Entry Interval (REI) is not an appropriate method of risk mitigation for residential use chemicals and, essentially, for all exposure scenarios where there is the potential for unrestricted general population exposures. As a result, the approach used to evaluate residential risks is to consider exposures immediately after application as these represent higher exposures and risks which are a concern for acutely toxic compounds like the organophosphates.

The Agency developed exposure scenarios in this residential postapplication risk assessment to evaluate exposures to children and adults after both aerial and ground-based wide area mosquito control applications. Different application methods were considered in the assessment because they deposit different amounts of material in surrounding areas and the application rates (both allowable maximum and average) are different for each method (i.e., resulting in different levels of exposure). Risks to adults were assessed only via dermal exposures as outdoor post-application inhalation exposures have been historically shown to be minimal and in this case the outdoor dilution factor is expected to also minimize the potential for inhalation exposure. Adults are expected to have minimal hand-to-mouth activity that would contribute to nondietary ingestion exposure. Dermal as well as nondietary ingestion exposures to toddlers, however, were considered in this assessment to obtain total risk estimates for aggregation purposes as toddlers are likely to be exposed from playing on treated lawns and from routine mouthing behaviors. Toddlers were selected as the sentinel population for this assessment because their exposures are expected to be higher than other children because they are more mobile than younger children and they have a greater propensity for mouthing behaviors than older children. In this assessment, the Agency considered hand-to-mouth behavior, object-to-mouth behavior, and soil ingestion. All residential post-application risk calculations completed for adults and children are presented in Appendix C of this document. The specifics of each table included in Appendix C are described below:

- **Table 1 : Ambient Residue Levels Resulting From the Aerial ULV Application of Fenthion** Presents the amount of residues deposited on turf in treatment areas after aerial applications, the amount available for dermal exposure (TTR or turf transferable residues for dermal exposure), the amount available for nondietary ingestion exposure (TTR or turf transferable residue levels for nondietary ingestion exposure), and soil concentrations for calculating exposures due to soil ingestion.

- **Table 2 : Ambient Residue Levels Resulting From Ground Fogger Applications of Fenthion** Presents the amount of residues deposited on turf in treatment areas after ground fogger applications, the amount available for dermal exposure (TTR or turf transferable residues for dermal exposure), the amount available for nondietary ingestion exposure (TTR or turf transferable residue levels for nondietary ingestion exposure), and soil concentrations for calculating exposures due to soil ingestion.



5/9/16

- **Table 3: MOEs Attributable To Dermal Exposure For Adults On Turf Treated With Fenthion Using Aerial ULV Equipment** Presents the MOEs that were calculated for the post-application dermal exposures of adults involved in outdoor activities after aerial mosquito control treatments. Daily and also monthly average exposures/MOEs are presented.

- **Table 4: MOEs Attributable To Dermal Exposure For Adults On Turf Treated With Fenthion Using Ground-Based Foggers** Presents the MOEs that were calculated for the post-application dermal exposures of adults involved in outdoor activities after ground-based mosquito control treatments. Daily and also monthly average exposures/MOEs are presented.

- **Table 5: MOEs Attributable To Dermal Exposure For Toddlers On Turf Treated With Fenthion Using Aerial ULV Equipment** Presents the MOEs that were calculated for the post-application dermal exposures of toddlers involved in outdoor activities after aerial mosquito control treatments. Daily and also monthly average exposures/MOEs are presented.

- **Table 6: MOEs Attributable To Dermal Exposure For Toddlers On Turf Treated With Fenthion Using Ground-Based Foggers** Presents the MOEs that were calculated for the post-application dermal exposures of toddlers involved in outdoor activities after ground-based mosquito control treatments. Daily and also monthly average exposures/MOEs are presented.

- **Table 7: MOEs Attributable To Toddler Hand-To-Mouth Behavior On Turf Treated With Fenthion Using Aerial ULV Equipment** Presents the MOEs that were calculated for the post-application nondietary ingestion exposures of toddlers due to hand-to-mouth activity after contact with turf treated by aerial ULV equipment as described in the Agency's *SOPs For Residential Exposure Assessment* and based on the discussions at the recent FIFRA Science Advisory Panel meeting on residential exposure issues. Daily and also monthly average exposures/MOEs are presented.

- **Table 8: MOEs Attributable To Toddler Hand-To-Mouth Behavior On Turf Treated With Fenthion Using Ground-Based Foggers** Presents the MOEs that were calculated for the post-application nondietary ingestion exposures of toddlers due to hand-to-mouth activity after contact with turf treated by ground foggers as described in the Agency's *SOPs For Residential Exposure Assessment* and based on the discussions at the recent FIFRA Science Advisory Panel meeting on residential exposure issues. Daily and also monthly average exposures/MOEs are presented.

- **Table 9: MOEs Attributable To Toddler Object-To-Mouth Behavior On Turf Treated With Fenthion Using Aerial ULV Equipment** Presents the MOEs that were calculated for the post-application nondietary ingestion exposures of toddlers due to object-to-mouth activity after contact with turf treated by aerial ULV equipment as described in the Agency's *SOPs For Residential Exposure Assessment* and based on the discussions at the recent FIFRA Science Advisory Panel meeting on residential exposure issues. Daily and also monthly average exposures/MOEs are presented.



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- **Table 10: MOEs Attributable To Toddler Object-To-Mouth Behavior On Turf Treated With Fenthion Using Ground-Based Foggers** Presents the MOEs that were calculated for the post-application nondietary ingestion exposures of toddlers due to object-to-mouth activity after contact with turf treated by ground foggers as described in the Agency's *SOPs For Residential Exposure Assessment* and based on the discussions at the recent FIFRA Science Advisory Panel meeting on residential exposure issues. Daily and also monthly average exposures/MOEs are presented.

- **Table 11: MOEs Attributable To Toddler Soil Ingestion In Areas Treated With Fenthion Using Aerial ULV Equipment** Presents the MOEs that were calculated for the post-application nondietary ingestion exposures of toddlers due to soil ingestion after contact with exposed soil treated by aerial ULV equipment as described in the Agency's *SOPs For Residential Exposure Assessment* and based on the discussions at the recent FIFRA Science Advisory Panel meeting on residential exposure issues. Daily and also monthly average exposures/MOEs are presented.

- **Table 12: MOEs Attributable To Toddler Hand-To-Mouth Behavior On Turf Treated With Fenthion Using Ground-Based Foggers** Presents the MOEs that were calculated for the post-application nondietary ingestion exposures of toddlers due to soil ingestion after contact with exposed soil treated by ground foggers as described in the Agency's *SOPs For Residential Exposure Assessment* and based on the discussions at the recent FIFRA Science Advisory Panel meeting on residential exposure issues. Daily and also monthly average exposures/MOEs are presented.

- **Table 13: Total MOEs Attributable To Toddler Exposures In Areas Previously Treated With Fenthion Using Aerial ULV Equipment** Presents the MOEs that were calculated for defining total exposures that included post-application nondietary ingestion exposures due to hand-to-mouth activity after contact with treated surfaces (turf and soil) and dermal exposures after contact with treated turf. Daily and also monthly average MOEs are presented.

- **Table 14: Total MOEs Attributable To Toddler Exposures In Areas Previously Treated With Fenthion Using Ground-Based Foggers** Presents the MOEs that were calculated for defining total exposures that included post-application nondietary ingestion exposures due to hand-to-mouth activity after contact with treated surfaces (turf and soil) and dermal exposures after contact with treated turf. Daily and also monthly average MOEs are presented.

As indicated above, the use of an REI as a mitigation tool in residential settings is not considered appropriate by the Agency because it is not believed that an administrative mitigation measure like the REI is applicable to the general public. Therefore, the approach used by the Agency to manage the risks of chemicals used in the residential environment attributable to post-application short-term exposures is to determine if their use is acceptable on the day of application. The MOEs (where applicable adult scenarios are considered) are presented below for each type of exposure considered. MOE values are presented for the day of application and the specific day after application, if achieved within 30 days after application (i.e., the interval where retreatment is likely), where the Agency would have no concerns over the use of fenthion. These values (time when a noncancer MOE exceeds 30 or 100 as two uncertainty factors are applied to this scenario) are presented below:



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- **Adults On Aerial ULV Treated Turf:** $Day_0$ MOE = 871 at the maximum application rate and $Day_0$ MOE = 1.556 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Adults On Ground Fogger Treated Turf:** $Day_0$ MOE = 6.681 at the maximum application rate and $Day_0$ MOE = 12.527 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Dermal Exposure of Toddlers On Aerial ULV Treated Turf:** $Day_0$ MOE = 935 at the maximum application rate and $Day_0$ MOE = 1.670 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Dermal Exposure of Toddlers On Ground Fogger Treated Turf:** $Day_0$ MOE = 7.168 at the maximum application rate and $Day_0$ MOE = 13.440 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Hand-To-Mouth Exposure of Toddlers On Aerial ULV Treated Turf:** At the maximum application rate, the $Day_0$ MOE = 51 (i.e., exceeds the uncertainty factor of 30) on the day of application. Likewise, the $Day_0$ MOE = 91 (i.e., exceeds the uncertainty factor of 30) at the average application rate on the day of application. The MOE does not exceed 100 (is 106) until 7 days after application at the maximum application rate and does not exceed 100 (is 101) until the day after application at the average application rate.

- **Hand-To-Mouth Exposure of Toddlers On Ground Fogger Treated Turf:** $Day_0$ MOE = 390 at the maximum application rate and $Day_0$ MOE = 731 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Object-To-Mouth Exposure of Toddlers On Aerial ULV Treated Turf:** $Day_0$ MOE = 1.628 at the maximum application rate and $Day_0$ MOE = 2.907 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Object-To-Mouth Exposure of Toddlers On Ground Fogger Treated Turf:** $Day_0$ MOE = 12.479 at the maximum application rate and $Day_0$ MOE = 23.398 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Soil Ingestion Exposure of Toddlers On Aerial ULV Treated Turf:** $Day_0$ MOE = 121.469 at the maximum application rate and $Day_0$ MOE = 216.908 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.



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- **Soil Ingestion Exposure of Toddlers On Ground Fogger Treated Turf:** $Day_0$ MOE = 931,260 at the maximum application rate and $Day_0$ MOE = 1,746,113 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

- **Total Exposure of Toddlers On Aerial ULV Treated Turf:** At the maximum application rate, the $Day_0$ MOE = 47 (i.e., exceeds the uncertainty factor of 30) on the day of application. Likewise, the $Day_0$ MOE = 84 (i.e., exceeds the uncertainty factor of 30) at the average application rate on the day of application. The MOE does not exceed 100 (is 109) until 8 days after application at the maximum application rate and does not exceed 100 (is 103) until two days after application at the average application rate.

- **Total Exposure of Toddlers On Ground Fogger Treated Turf:** $Day_0$ MOE = 359 at the maximum application rate and $Day_0$ MOE = 673 at the average (used as typical for this assessment) application rate. Therefore, both uncertainty factors (30 and 100) are exceeded on the day of application.

To support the assessments presented above in which short-term exposures were calculated, the Agency also calculated post-application MOEs using 30 day time-weighted averages. The uncertainty factor for this scenario is 300. The reason for completing this type of calculation is that it is possible for individuals to be exposed over an extended duration even though the Agency believes that these exposure scenarios are unlikely for several reasons (e.g., use of dissipation model/lack of data). These MOEs are summarized in the following table:

| Population | Application Method | Application Rate | MOEs For Each Pathway Considered (based on monthly average exposures) | | | | |
|---|---|---|---|---|---|---|---|
| | | | Dermal Exposures On Turf | Hand-to-Mouth From On Turf | Object-to-Mouth From On Turf | Soil Ingestion | Total From Mosquito Control Use |
| Adults | Aerial ULV | Average | 1,433 | N/A | N/A | N/A | N/A |
| Toddlers | | | 1,537 | 84 | 2,677 | 199,739 | 77 |
| Adults | | Maximum | 802 | N/A | N/A | N/A | N/A |
| Toddlers | | | 861 | 47 | 1,499 | 111,854 | 43 |
| Adults | Ground Fogger | Average | 11,535 | N/A | N/A | N/A | N/A |
| Toddlers | | | 12,377 | 673 | 21,546 | 1,607,902 | 620 |
| Adults | | Maximum | 6,152 | N/A | N/A | N/A | N/A |
| Toddlers | | | 6,601 | 359 | 11,491 | 857,548 | 331 |



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### *vi. Incident reports*

The incident report completed for this assessment is not included in this document. The report has been developed under a separate memo by Dr. Jerome Blondell of the Office of Pesticide Programs. This report as well as the results of this risk assessment are considered in the overall risk assessment for fenthion.

### *vii. Worker Monitoring Program Results*

The results of 3 worker monitoring programs were submitted to the Agency for consideration in this risk assessment. In each of these programs, plasma cholinesterase activity was monitored in worker populations using various chemicals that can inhibit the activity of the enzyme. One set of data was submitted to the Agency by the Lee County Mosquito Control District in Florida. The other two sets of data were included in the Boll Weevil Cooperative Eradication Program Environmental Monitoring Reports submitted by the USDA (USDA, 1998).

The Agency reviewed these data and determined that their utility was limited for several reasons including:

- Representativeness of the monitored individuals to other member of the same job category has not been established.

- Complete occupational exposure history to organophosphate pesticides is not known. A detailed description of how, when, and for how long the pesticide was handled/applied prior to sample collection is not provided. Information such as percent active ingredient, formulation, dilution factors, concentrations of all impurities, inerts or other added ingredients is not known.

- Complete non-occupational exposure history to other cholinesterase inhibiting chemicals is not known. Examples of other chemicals are organophosphates used in and around the home.

- Baseline plasma and red blood cell cholinesterase levels were not established for each individual. Comparisons between a given individual's plasma cholinesterase level and a reference population mean value is uninformative.

- The health histories of subjects are not known. Confounding variables such as smoking status, diet or medication use or other exposures are not addressed. Further, the subjects were not assessed for possible clinical signs (symptoms of cholinergic effects) following pesticide activity such as a self-reporting questionnaires and more quantifiable measures (e.g., blood pressure, heart rate).

- Malathion appeared to be the principal chemical for Boll Weevil control. Malathion significantly differs from fenthion in a number of ways toxicologically which would suggest that the pharmacokinetic/pharmacodynamic properties are different making a direct comparison between the two chemicals inappropriate (e.g., structure activity relationship is different as malathion is a phosphorodithioate whereas fenthion is a phosphorothioate).

### *viii. Overall risk summary*

The Agency has risk concerns over the use of fenthion, particularly for occupational handlers. The Agency evaluated exposures to occupational handlers in each of the three major markets for fenthion including mosquito control, feed animal treatments, and applications in aquaculture. For mosquito control adulticide applications, the Agency has concerns for loaders when using liquid formulations in preparation for mosquito adulticide applications of fenthion, in part, due to the very large acreages treated (lowest short-term MOE ~20). The Agency also has concerns for pilots and ground applicators during adulticide applications. For mosquito larvicide applications, the Agency has concerns for pilots during aerial application and for individuals completing ground applications. MOEs for loaders in these scenarios, however, exceeded the Agency's uncertainty factors. The Agency believes that the use of human flaggers is rare during mosquito control applications but completed an assessment for these individuals to account for other people that may be exposed in a similar manner (e.g., ground observers). The risks associated with these jobs exceeded each of the Agency's uncertainty factors during granular applications but not for liquid applications (i.e., the Agency has risk concerns for liquid applications). For the treatment of food animals, the Agency has concerns for the ladel-on and ear tag placement exposures due to a lack of data with which to complete the assessment. MOEs for the ready-to-use package exceeded each of the Agency's uncertainty factors. Additionally, the Agency has risk concerns for the use of fenthion in aquaculture.

Residential post-application exposure scenarios were also considered. There are no risk concerns over the exposures of adults as MOEs exceeded each of the Agency's uncertainty factors. Likewise, MOEs for toddlers after ground-based fogger applications, even when dermal and nondietary ingestion exposures were added together, exceeded each of the Agency's uncertainty factors. When fenthion is applied aerially, MOEs for short-term exposures exceed 30 even when dermal and nondietary ingestion exposures were added together to obtain total risks on the day of application. Total, short-term exposure, MOEs for aerial application did not exceed the uncertainty factor of 100 until 2 days after application at the average application rate and until 8 days after application at the maximum application rate. Intermediate-term MOEs were calculated by the Agency but are considered unlikely for several reasons. There are also risk concerns for toddlers based on this assessment for the aerial application method.

# APPENDIX A

# OCCUPATIONAL HANDLER RISK ASSESSMENT FOR FENTHION

| Appendix A/Table 1: Exposure Scenario Descriptions For Occupational Fenthion Handlers | | | |
|---|---|---|---|
| Scen. No. | Exposure Scenarios | Data Source | Comments[b] |
| | | Mixer/Loaders | |
| 1a/1b | Mixing/Loading Liquids for Mosquito Applications Using Both Ground-Based and Aerial Spray Equipment | PHED V1.1 (May 1997 Surrogate Table) | **Baseline:** Hand, dermal, and inhalation are acceptable grades. Hand – 53 replicates; dermal - 71 to 121 replicates; and inhalation – 85 replicates High confidence in dermal/hand and inhalation data. No protection factors were needed to define any unit exposure value.<br><br>**PPE:** The same dermal and inhalation data are used as for the baseline coupled with a 50% protection factor to account for an additional layer of clothing and a 90% protection factor to account for the use of a respirator. A protection factor was not required for the hand assessment. Hands acceptable grades. Hands – 59 replicates. High confidence in hand data.<br><br>**Engineering Control:** Hand and inhalation – acceptable grades; and dermal – ABC grade. Dermal = 30 to 36 replicates; hand - 31 replicates, and inhalation - 27 replicates. High confidence in hand and inhalation data. Medium confidence in dermal data. No protection factors were used for this assessment. |
| 2 | Loading Granulars for Mosquito Control Aerial Applications | PHED V1.1 (May 1997 Surrogate Table) | **Baseline:** Inhalation data are acceptable grade. Hand data are all grade. Dermal data are ABC grade. Hand = 10 replicates; dermal - 33 to 78 replicates; and inhalation - 58 replicates. High confidence in inhalation data. Low confidence in dermal/hand data. No protection factors were needed to define any unit exposure value.<br><br>**PPE:** The same inhalation data are used as for the baseline coupled with a 90% protection factor to account for the use of a respirator. A protection factor was not required for the hand or dermal assessments. Hands – acceptable grade and dermal = ABC grade. Hands – 45 replicates and dermal 12 to 59 replicates. Low confidence in hand/dermal data.<br><br>**Engineering Controls:** The same dermal, inhalation, and hand data are used as for the baseline coupled with a 90% protection factor to account for the use of an engineering control (i.e., sitting in a vehicle). |
| | | Applicators | |
| 3 | Applying Liquids Using Fixed-Wing Aerial Equipment (includes ULV and thermal fogger) for Mosquito Control | PHED V1.1 (May 1997 Surrogate Table) | **Baseline:** Not feasible.<br><br>**PPE:** Not feasible.<br><br>**Engineering Control:** Dermal and inhalation – ABC grade; and hand – acceptable grade. Dermal – 24 to 48 replicates; hand - 34 replicates, and inhalation – 23 replicates. Medium confidence in dermal/hand and inhalation data. No protection factors were required to define any unit exposure value. |

| Appendix A/Table F: Exposure Scenario Descriptions For Occupational Fenthion Handlers | | | |
|---|---|---|---|
| Scen. No. | Exposure Scenarios | Data Source | Comments[b,c] |
| 4 | Applying Liquids Using ULV Ground Equipment For Mosquito Control | PHED V1.1 (May 1997 Surrogate Table) | **No empirical data are available for this scenario, instead, airblast application data were used. This assessment must be considered only for use as a rangefinder using extremely low confidence data because of the extrapolation that has been completed. See the risk characterization discussion presented in Section 4b. For information purposes only, a summary of the airblast data are presented below.**<br><br>**Baseline:** Dermal and inhalation – acceptable grades; and hand – ABC grade. Dermal = 31 to 48 replicates; hands = 31 replicates; and inhalation 47 replicates. High confidence in dermal and inhalation data. Medium confidence in hand data. No protection factors were required to define any unit exposure value.<br><br>**PPE:** The same dermal and inhalation data are used as for the baseline coupled with a 50% protection factor to account for an additional layer of clothing and a 90% protection factor to account for the use of a respirator. A protection factor was not required for the hand assessment. Hands acceptable grades. Hands 18 replicates. High confidence in hand data.<br><br>**Engineering Control:** Dermal and hand – acceptable grades; and inhalation – ABC grade. Dermal = 20 to 30 replicates; hand = 20 replicates, and inhalation = 9 replicates. High confidence in dermal/hand data and low confidence in inhalation data. No protection factors were required to define any unit exposure value. |
| 5 | Applying Granulars for Mosquito Control Aerial Applications | PHED V1.1 (May 1997 Surrogate Table) | **Baseline:** Not feasible.<br><br>**PPE:** Not feasible.<br><br>**Engineering Control:** Dermal C grade; hand and inhalation – all grade. Dermal = 9 to 13 replicates; hand = 4 replicates; and inhalation 13 replicates. Low confidence in all data. A 50% protection factor was used to account for a layer of clothing as the only data available were for a total deposition scenario. |
| 6 | RTU Solution on Livestock | See 1a/1b above | **No empirical data are available for this scenario, instead, open mixing/loading of liquids data were used. This assessment must be considered only for use as a rangefinder using extremely low confidence data because of the extrapolation that has been completed. See the risk characterization discussion presented in Section 4b. For information purposes only, a summary of the mixer/loader data are presented above (see scenario 1a/1b).** |
| 7 | Cattle Ear Tags | No data | No data |

| Appendix A/Table F: Exposure Scenario Descriptions For Occupational Fenthion Handlers | | | |
|---|---|---|---|
| Scen. No. | Exposure Scenarios | Data Source | Comments[b,c] |
| | | Mixer/Loader/Applicator | |
| 8 | Ladeling on Pigs, Cattle with dipper | No data | No data |
| 9 | Loading/Applying Granulars for Ground-Based Mosquito Control Applications | PHED V1.1 (May 1997 Surrogate Table) | **HED does not anticipate that ground-based applications of fenthion will be a common practice. In fact, HED has based this assessment on the premise that any ground-based mosquito control scenarios will be spot treatments. No empirical data are available for this scenario, instead, "belly-grinder" loader/applicator data are the basis for this assessment. This assessment must be considered only for use as a rangefinder using extremely low confidence data because of the extrapolation that has been completed. See the risk characterization discussion presented in Section 4b. For information purposes only, a summary of the "belly-grinder" data are presented below.**<br><br>**Baseline:** Dermal and hand ABC grade. Inhalation data are acceptable grade. Dermal = 29 to 45 replicates; hand = 23 replicates; and inhalation 40 replicates. High confidence in inhalation data. Medium confidence in dermal/hand data. No protection factors were required to define any unit exposure value.<br><br>**PPE:** The same dermal and inhalation data are used as for the baseline coupled with a 50% protection factor to account for an additional layer of clothing and a 90% protection factor to account for the use of a respirator. A protection factor was not required for the hand assessment. Hands ABC grade. Hands = 15 replicates. Medium confidence in hand data. |
| 10 | Mixing/applying liquids for aquaculture with a low pressure handwand sprayer | PHED V1.1 (May 1997 Surrogate Table) | **Baseline:** Dermal (9 to 80 replicates) and inhalation (80 replicates) exposure values are based on ABC grade data. Hand (70 replicates) exposure value is based on all grade data. Low confidence in the unit exposure value. No protection factors were needed to define the unit exposure value<br><br>**PPE:** Dermal (16 replicates) and inhalation (16 replicates) exposure values are based on ABC grade data. Hand (15 replicates) exposure value is based on acceptable grade data. Medium confidence in the unit exposure value. A 50% protection factor was applied to account for the use of an additional layer of clothing and a 5-fold protection factor to account for the use of a dust/mist respirator<br><br>**Engineering Controls:** Not considered plausible for this assessment. |
| 11 | Mixing/applying liquids for aquaculture with a backpack sprayer | PHED V1.1 (May 1997 Surrogate Table) | **Baseline:** Dermal (9 to 11 replicates) and inhalation (11 replicates) exposure values are based on acceptable grade data. Hand data (11 replicates) exposure value is based on ABC grade data. Low confidence in the unit exposure value. No protection factors were needed to define the unit exposure value. Empirical data include the use of chemical-resistant gloves.<br><br>**PPE:** The same dermal, inhalation, and hand data are used as for the baseline coupled with a 50% protection factor to account for the use of an additional layer of clothing and a 5-fold protection factor to account for the use of a dust/mist respirator. Low confidence in the unit exposure value<br><br>**Engineering Controls:** Not considered plausible for this assessment. |

| Appendix A/Table 1: Exposure Scenario Descriptions For Occupational Fenthion Handlers | | | |
|---|---|---|---|
| Scen. No. | Exposure Scenarios | Data Source | Comments[b,c] |
| | | Flaggers | |
| 12 | Flagging For Applications of Liquids Using Aerial Equipment (includes ULV and thermal fogger) During Mosquito Applications | PHED V1.1 (May 1997 Surrogate Table) | **Baseline:** Dermal, hand, and inhalation data are acceptable grade. Dermal 18 to 28 replicates; hand = 30 replicates; and inhalation 28 replicates High confidence in all data. No protection factors were required to define any unit exposure value.<br><br>**PPE:** The same dermal and inhalation data are used as for the baseline coupled with a 50% protection factor to account for an additional layer of clothing and a 90% protection factor to account for the use of a respirator. A protection factor was not required for the hand assessment. Hands acceptable grades. Hands 6 replicates. Low confidence in hand data.<br><br>**Engineering Controls:** The same dermal, inhalation, and hand data are used as for the baseline coupled with a 90% protection factor to account for the use of an engineering control (i.e., sitting in a vehicle). |
| 13 | Flagging for Applications of Granulars Using Aerial Equipment During Mosquito Control Applications | PHED V1.1 (May 1997 Surrogate Table) | **The baseline for this scenario is total deposition data. The surrogate exposure tables specifically warns not to extrapolate from this data.**<br><br>**Baseline:** Dermal = ABC grade, hand all grade, and inhalation - E grade. Dermal = 16 to 20 replicates; hand = 4 replicates; and inhalation - 4 replicates. Low confidence in all data. No protection factors were required to define any unit exposure value. |

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

b All handler exposure assessments in this document are based on the "Best Available" data as defined by the PHED SOP for meeting Subdivision U Guidelines (i.e., completing exposure assessments). Best available grades are assigned to data as follows: matrices with A and B grade data (i.e., Acceptable Grade Data) and a minimum of 15 replicates. If not available, then grades A, B and C data and a minimum of 15 replicates. If not available, then all data regardless of the quality (i.e., All Grade Data) and number of replicates. High quality data with a protection factor take precedence over low quality data with no protection factor. Generic data confidence categories are assigned as follows:

| | |
|---|---|
| High | grades A and B and 15 or more replicates per body part |
| Medium | grades A, B, and C and 15 or more replicates per body part |
| Low | grades A, B, C, D and L or any combination of grades with less than 15 replicates |

c PHED grading criteria do not reflect overall quality of the reliability of the assessment. Sources of the exposure factors should also be considered in the risk management decision.

APPENDIX A/TABLE 2: INPUT PARAMETERS FOR FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS

| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | UNIT EXPOSURES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | BASELINE | | MIN PPE | | MAX PPE | | ENG CONTROLS | | |
| | | | RATE | ACRES OR GALLONS | Dermal (mg/lb ai) | Inhalation (ug/lb ai) | Dermal (mg/lb ai) | Inhalation (ug/lb ai) | Dermal (mg/lb ai) | Inhalation (ug/lb ai) | Dermal (mg/lb ai) | Glove Use | Inhalation (ug/lb ai) |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 2.9 | 1.2 | 0.023 | 0.24 | 0.017 | 0.12 | 0.0086 | Yes | 0.083 |
| | | Mosquito Adulticide | 0.056 | 7500 | 2.9 | 1.2 | 0.023 | 0.24 | 0.017 | 0.12 | 0.0086 | Yes | 0.083 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 2.9 | 1.2 | 0.023 | 0.24 | 0.017 | 0.12 | 0.0086 | Yes | 0.083 |
| | | Mosquito Adulticide | 0.016 | 3000 | 2.9 | 1.2 | 0.023 | 0.24 | 0.017 | 0.12 | 0.0086 | Yes | 0.083 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 0.0084 | 1.7 | 0.0069 | 0.34 | 0.0034 | 0.17 | 0 | No | 0.034 |
| | | Mosquito Larvicide | 0.056 | 800 | 0.0084 | 1.7 | 0.0069 | 0.34 | 0.0034 | 0.17 | 0 | No | 0.034 |
| | | Mosquito Larvicide | 0.1 | 80 | 0.0084 | 1.7 | 0.0069 | 0.34 | 0.0034 | 0.17 | 0 | No | 0.034 |
| | | Mosquito Larvicide | 0.056 | 80 | 0.0084 | 1.7 | 0.0069 | 0.34 | 0.0034 | 0.17 | 0 | No | 0.034 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 0.005 | No | 0.068 |
| | | Mosquito Adulticide | 0.056 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 0.005 | No | 0.068 |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 0.36 | 4.5 | 0.24 | 0.9 | 0.22 | 0.45 | 0.019 | Yes | 0.45 |
| | | Mosquito Adulticide | 0.016 | 3000 | 0.36 | 4.5 | 0.24 | 0.9 | 0.22 | 0.45 | 0.019 | Yes | 0.45 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 0.0017 | No | 1.3 |
| | | Mosquito Larvicide | 0.056 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 0.0017 | No | 1.3 |
| | | Mosquito Larvicide | 0.1 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 0.0017 | No | 1.3 |
| | | Mosquito Larvicide | 0.056 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 0.0017 | No | 1.3 |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.008 | 200 | 2.9 | 1.2 | 0.023 | 0.24 | 0.017 | 0.12 | Not Feasible | NA | Not Feasible |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | Not Feasible | NA | Not Feasible |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | | |
| 8 | Label On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | Not Feasible | NA | Not Feasible |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 10 | 62 | 9.3 | 12.4 | 5.71 | 6.2 | Not Feasible | NA | Not Feasible |

APPENDIX A/TABLE 2: INPUT PARAMETERS FOR FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS

| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | UNIT EXPOSURES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | BASELINE | | MIN PPE | | MAX PPE | | ENG CONTROLS | | |
| | | | RATE | ACRES OR GALLONS | Dermal (mg/lb ai) | Inhalation (ug/lb ai) | Dermal (mg/lb ai) | Inhalation (ug/lb ai) | Dermal (mg/lb ai) | Inhalation (ug/lb ai) | Dermal (mg/lb ai) | Glove Use | Inhalation (ug/lb ai) |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 100 | 30 | 0.43 | 6 | 0.37 | 3 | Not Feasible | NA | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 100 | 30 | 0.43 | 6 | 0.37 | 3 | Not Feasible | NA | Not Feasible |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | No Data | 30 | 2.5 | 6 | 1.6 | 3 | Not Feasible | NA | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | No Data | 30 | 2.5 | 6 | 1.6 | 3 | Not Feasible | NA | Not Feasible |
| | | FLAGGERS | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 0.011 | 0.35 | 0.012 | 0.07 | 0.011 | 0.035 | 0 | No | 0.007 |
| | | Mosquito Adulticide | 0.056 | 7500 | 0.011 | 0.35 | 0.012 | 0.07 | 0.011 | 0.035 | 0 | No | 0.007 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 0.0028 | 0.15 | 0.0016 | 0.03 | 0.001 | 0.015 | 0 | No | 0.003 |
| | | Mosquito Larvicide | 0.056 | 800 | 0.0028 | 0.15 | 0.0016 | 0.03 | 0.001 | 0.015 | 0 | No | 0.003 |

| APPENDIX A/TABLE 3: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT THE BASELINE PROTECTION LEVEL | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT. (mg/day) | DERMAL (mg/day) | INHALAT. (mg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER TERM |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 2.2e+03 | 9.0e-01 | 9.3e-01 | 1.3e-02 | 0.08 | 0.02 | 5.44 | 1.56 | 0.07 | 0.02 |
| | | Mosquito Adulticide | 0.037 | 7500 | 1.2e+03 | 5.0e-01 | 5.2e-01 | 7.2e-03 | 0.13 | 0.04 | 9.72 | 2.78 | 0 13 | 0.04 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 2.6e+02 | 1.1e-01 | 1.1e-01 | 1.5e-03 | 0.63 | 0.18 | 45.37 | 12.96 | 0.62 | 0.18 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.4e+02 | 5.8e-02 | 6.0e-02 | 8.2e-04 | 1.17 | 0.34 | 85.07 | 24.31 | 1.16 | 0.33 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 6.7e-01 | 1.4e-01 | 2.9e-04 | 1.9e-03 | 243.06 | 69.44 | 36.03 | 10.29 | 31.38 | 8.97 |
| | | Mosquito Larvicide | 0.037 | 800 | 3.8e-01 | 7.6e 02 | 1.6e-04 | 1.1e-03 | 434.03 | 124.01 | 64.34 | 18.38 | 56.03 | 16.01 |
| | | Mosquito Larvicide | 0.1 | 80 | 6.7e-02 | 1.4e-02 | 2.9e-05 | 1.9e-04 | 2430.56 | 694.44 | 360.29 | 102.94 | 313.78 | 89.65 |
| | | Mosquito Larvicide | 0.037 | 80 | 3.8e-02 | 7.6e-03 | 1.6e-05 | 1.1e-04 | 4340.28 | 1240.08 | 643.38 | 183.82 | 560.32 | 160.09 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible |
| | | Mosquito Adulticide | 0.037 | 7500 | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 3.2e+01 | 4.1e-01 | 1.4e-02 | 5.8e-03 | 5.04 | 1.44 | 12.10 | 3.46 | 3.56 | 1.02 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.7e+01 | 2.2e-01 | 7.4e-03 | 3.1e-03 | 9.45 | 2.70 | 22.69 | 6.48 | 6.67 | 1.91 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible |
| | | Mosquito Larvicide | 0.037 | 800 | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible |
| | | Mosquito Larvicide | 0.1 | 80 | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible |
| | | Mosquito Larvicide | 0.037 | 80 | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible | Not feasible |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.008 | 200 | 4.9e+00 | 2.0e-03 | 2.1e-03 | 2.9e-05 | 33.52 | 9.58 | 2430.56 | 694.44 | 33.07 | 9.45 |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | | | |
| 8 | Ladel On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |

| APPENDIX A/TABLE 3: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT THE BASELINE PROTECTION LEVEL | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT. (mg/day) | DERMAL (mg/day) | INHALAT. (mg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER TERM |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 5.0e+00 | 3.1e-02 | 2.1e 03 | 4.4e-04 | 32.67 | 9.33 | 158.06 | 45.16 | 27.07 | 7 73 |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 4.0e+02 | 1.2e 01 | 1.7e-01 | 1.7e-03 | 0.41 | 0.12 | 40.83 | 11.67 | 0.40 | 0 12 |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 2.0e+02 | 6.0e-02 | 8.6e-02 | 8.6e-04 | 0.82 | 0.23 | 81.67 | 23.33 | 0.81 | 0.23 |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | No Data | 1.2e-01 | No Data | 1.7e-03 | No Data | No Data | 40.83 | 11.67 | No Data | No Data |
| | | Dragonfly Larvicide | 0.8 | 2.5 | No Data | 6.0e-02 | No Data | 8.6e-04 | No Data | No Data | 81.67 | 23.33 | No Data | No Data |
| FLAGGERS | | | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 8.3e+00 | 2.6e-01 | 3.5e-03 | 3.8e-03 | 19.80 | 5.66 | 18.67 | 5.33 | 9.61 | 2.75 |
| | | Mosquito Adulticide | 0.037 | 7500 | 4.6e+00 | 1.5e-01 | 2.0e-03 | 2.1e-03 | 35.35 | 10.10 | 33.33 | 9.52 | 17.16 | 4.90 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 2.2e-01 | 1.2e-02 | 9.6e-05 | 1.7e-04 | 729.17 | 208.33 | 408.33 | 116.67 | 261.75 | 74.79 |
| | | Mosquito Larvicide | 0.037 | 800 | 1.3e-01 | 6.7e-03 | 5.4e-05 | 9.6e-05 | 1302.08 | 372.02 | 729.17 | 208.33 | 467.41 | 133.55 |

| APPENDIX A/TABLE 4: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT MINIMUM PPE PROTECTION LEVELS (Gloves & PF 5 Respirators) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT (mg/day) | DERMAL (mg/kg/day) | INHALAT. (mg/kg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER TERM |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 1.7e+01 | 1.8e-01 | 7.4e-03 | 2.6e-03 | 9.5 | 2.7 | 27.2 | 7.8 | 7.0 | 2.0 |
| | | Mosquito Adulticide | 0.037 | 7500 | 9.7e+00 | 1.0e-01 | 4.1e-03 | 1.4e-03 | 16.9 | 4.8 | 48.6 | 13.9 | 12.5 | 3.6 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 2.1e+00 | 2.2e-02 | 8.9e-04 | 3.1e-04 | 78.9 | 22.5 | 226.9 | 64.8 | 58.5 | 16.7 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.1e+00 | 1.2e-02 | 4.7e-04 | 1.6e-04 | 147.9 | 42.3 | 425.3 | 121.5 | 109.8 | 31.4 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 5.5e-01 | 2.7e-02 | 2.4e-04 | 3.9e-04 | 295.9 | 84.5 | 180.1 | 51.5 | 112.0 | 32.0 |
| | | Mosquito Larvicide | 0.037 | 800 | 3.1e-01 | 1.5e 02 | 1.3e-04 | 2.2e-04 | 528.4 | 151.0 | 321.7 | 91.9 | 200.0 | 57.1 |
| | | Mosquito Larvicide | 0.1 | 80 | 5.5e-02 | 2.7e-03 | 2.4e-05 | 3.9e-05 | 2958.9 | 845.4 | 1801.5 | 514.7 | 1119.7 | 319.9 |
| | | Mosquito Larvicide | 0.037 | 80 | 3.1e-02 | 1.5e-03 | 1.3e-05 | 2.2e-05 | 5283.8 | 1509.7 | 3216.9 | 919.1 | 1999.5 | 571.3 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Adulticide | 0.037 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 2.2e+01 | 8.1e-02 | 9.3e 03 | 1.2e-03 | 7.6 | 2.2 | 60.5 | 17.3 | 6.7 | 1.9 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.2e+01 | 4.3e-02 | 4.9e-03 | 6.2e-04 | 14.2 | 4.1 | 113.4 | 32.4 | 12.6 | 3.6 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Larvicide | 0.037 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Larvicide | 0.1 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Larvicide | 0.037 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.0084 | 200 | 3.9e-02 | 4.0e-04 | 1.7e-05 | 5.8e-06 | 4227.1 | 1207.7 | 12152.8 | 3472.2 | 3136.2 | 896.1 |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |

| APPENDIX A/TABLE 4: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT MINIMUM PPE PROTECTION LEVELS (Gloves & PF 5 Respirators) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT. (mg/day) | DERMAL (mg/kg/day) | INHALAT. (mg/kg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER TERM |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | | | |
| 8 | Ladel On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 4.7e+00 | 6.2e-03 | 2.0e-03 | 8.9e-05 | 35.1 | 10.0 | 790.3 | 225.8 | 33.6 | 9.6 |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 1.7e+00 | 2.4e-02 | 7.4e-04 | 3.4e-04 | 95.0 | 27.1 | 204.2 | 58.3 | 64.8 | 18.5 |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 8.6e-01 | 1.2e-02 | 3.7e-04 | 1.7e-04 | 189.9 | 54.3 | 408.3 | 116.7 | 129.6 | 37.0 |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 1.0e+01 | 2.4e-02 | 4.3e-03 | 3.4e-04 | 16.3 | 4.7 | 204.2 | 58.3 | 15.1 | 4.3 |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 5.0e+00 | 1.2e-02 | 2.1e-03 | 1.7e-04 | 32.7 | 9.3 | 408.3 | 116.7 | 30.2 | 8.6 |
| FLAGGERS | | | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 9.0e+00 | 5.3e-02 | 3.9e-03 | 7.5e-04 | 18.1 | 5.2 | 93.3 | 26.7 | 15.2 | 4.3 |
| | | Mosquito Adulticide | 0.037 | 7500 | 5.0e+00 | 2.9e-02 | 2.2e-03 | 4.2e-04 | 32.4 | 9.3 | 166.7 | 47.6 | 27.1 | 7.8 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 1.3e-01 | 2.4e-03 | 5.5e-05 | 3.4e-05 | 1276.0 | 364.6 | 2041.7 | 583.3 | 785.3 | 224.4 |
| | | Mosquito Larvicide | 0.037 | 800 | 7.2e-02 | 1.3e-03 | 3.1e-05 | 1.9e-05 | 2278.6 | 651.0 | 3645.8 | 1041.7 | 1402.2 | 400.6 |

APPENDIX A/TABLE 5: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT MAXIMUM PPE PROTECTION LEVELS

| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT. (mg/day) | DERMAL (mg/kg/day) | INHALAT. (mg/kg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 1.3e+01 | 9.0e-02 | 5.5e-03 | 1.3e-03 | 12.8 | 3.7 | 54.4 | 15.6 | 10.4 | 3.0 |
| | | Mosquito Adulticide | 0.037 | 7500 | 7.1e+00 | 5.0e-02 | 3.1e-03 | 7.2e-04 | 22.9 | 6.5 | 97.2 | 27.8 | 18.5 | 5.3 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 1.5e+00 | 1.1e-02 | 6.6e-04 | 1.5e-04 | 106.8 | 30.5 | 453.7 | 129 6 | 86.4 | 24.7 |
| | | Mosquito Adulticide | 0.016 | 3000 | 8.2e 01 | 5.8e 03 | 3.5e-04 | 8.2e-05 | 200.2 | 57.2 | 850.7 | 243.1 | 162.0 | 46.3 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 2.7e-01 | 1.4e-02 | 1.2e-04 | 1.9e-04 | 600.5 | 171.6 | 360.3 | 102.9 | 225.2 | 64.3 |
| | | Mosquito Larvicide | 0.037 | 800 | 1.5e-01 | 7.6e-03 | 6.5e-05 | 1.1e-04 | 1072.3 | 306.4 | 643.4 | 183.8 | 402.1 | 114.9 |
| | | Mosquito Larvicide | 0.1 | 80 | 2.7e-02 | 1.4e-03 | 1.2e-05 | 1.9e-05 | 6004.9 | 1715.7 | 3602.9 | 1029.4 | 2251.8 | 643.4 |
| | | Mosquito Larvicide | 0.037 | 80 | 1.5e 02 | 7.6e-04 | 6.5e-06 | 1.1e-05 | 10723.0 | 3063.7 | 6433.8 | 1838.2 | 4021.1 | 1148.9 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Adulticide | 0.037 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 2.0e+01 | 4.1e-02 | 8.5e 03 | 5.8e-04 | 8.2 | 2.4 | 121.0 | 34.6 | 7.7 | 2.2 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.1e+01 | 2.2e-02 | 4.5e-03 | 3.1e-04 | 15.5 | 4.4 | 226.9 | 64.8 | 14.5 | 4.1 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Larvicide | 0.037 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Larvicide | 0.1 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Mosquito Larvicide | 0.037 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.008 | 200 | 2.9e-02 | 2.0e-04 | 1.2e-05 | 2.9e-06 | 5719.0 | 1634.0 | 24305.6 | 6944.4 | 4629.6 | 1322.8 |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |

| APPENDIX A/TABLE 5: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT MAXIMUM PPE PROTECTION LEVELS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT. (mg/day) | DERMAL (mg/kg/day) | INHALAT. (mg/kg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | | | |
| 8 | Label On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data | No Data |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 2.9e+00 | 3.1e-03 | 1.2e-03 | 4.4e-05 | 57.2 | 16.3 | 1580.6 | 451.6 | 55.2 | 15.8 |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 1.5e+00 | 1.2e-02 | 6.3e-04 | 1.7e-04 | 110.4 | 31.5 | 408.3 | 116.7 | 86.9 | 24.8 |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 7.4e-01 | 6.0e-03 | 3.2e-04 | 8.6e-05 | 220.7 | 63.1 | 816.7 | 233.3 | 173.8 | 49.6 |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 6.4e+00 | 1.2e-02 | 2.7e-03 | 1.7e-04 | 25.5 | 7.3 | 408.3 | 116.7 | 24.0 | 6.9 |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 3.2e+00 | 6.0e-03 | 1.4e-03 | 8.6e-05 | 51.0 | 14.6 | 816.7 | 233.3 | 48.0 | 13.7 |
| FLAGGERS | | | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 8.3e+00 | 2.6e-02 | 3.5e-03 | 3.8e-04 | 19.8 | 5.7 | 186.7 | 53.3 | 17.9 | 5.1 |
| | | Mosquito Adulticide | 0.037 | 7500 | 4.6e+00 | 1.5e-02 | 2.0e-03 | 2.1e-04 | 35.4 | 10.1 | 333.3 | 95.2 | 32.0 | 9.1 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 8.0e-02 | 1.2e-03 | 3.4e-05 | 1.7e-05 | 2041.7 | 583.3 | 4083.3 | 1166.7 | 1361.1 | 388.9 |
| | | Mosquito Larvicide | 0.037 | 800 | 4.5e-02 | 6.7e-04 | 1.9e-05 | 9.6e-06 | 3645.8 | 1041.7 | 7291.7 | 2083.3 | 2430.6 | 694.4 |

| APPENDIX A/TABLE 6: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT ENGINEERING CONTROL PROTECTION LEVELS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT. (mg/day) | DERMAL (mg/kg/day) | INHALAT. (mg/kg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 6.5e+00 | 6.2e-02 | 2.8e-03 | 8.9e-04 | 25.3 | 7.2 | 78.7 | 22.5 | 19.2 | 5.5 |
| | | Mosquito Adulticide | 0.037 | 7500 | 3.6e+00 | 3.5e-02 | 1.5e-03 | 5.0e-04 | 45.2 | 12.9 | 140.6 | 40.2 | 34.2 | 9.8 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 7.7e-01 | 7.5e-03 | 3.3e-04 | 1.1e-04 | 211.0 | 60.3 | 656.0 | 187.4 | 159.7 | 45.6 |
| | | Mosquito Adulticide | 0.016 | 3000 | 4.1e-01 | 4.0e-03 | 1.8e-04 | 5.7e-05 | 395.7 | 113.0 | 1229.9 | 351.4 | 299.4 | 85.5 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 1.3e-02 | 2.7e-03 | 5.8e-06 | 3.9e-05 | 12152.8 | 3472.2 | 1801.5 | 514.7 | 1568.9 | 448.3 |
| | | Mosquito Larvicide | 0.037 | 800 | 7.5e-03 | 1.5e-03 | 3.2e-06 | 2.2e-05 | 21701.4 | 6200.4 | 3216.9 | 919.1 | 2801.6 | 800.5 |
| | | Mosquito Larvicide | 0.1 | 80 | 1.3e-03 | 2.7e-04 | 5.8e-07 | 3.9e-06 | 121527.8 | 34722.2 | 18014.7 | 5147.1 | 15689.0 | 4482.6 |
| | | Mosquito Larvicide | 0.037 | 80 | 7.5e-04 | 1.5e-04 | 3.2e-07 | 2.2e-06 | 217013.9 | 62004.0 | 32169.1 | 9191.2 | 28016.1 | 8004.6 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 3.8e+00 | 5.1e-02 | 1.6e-03 | 7.3e-04 | 43.6 | 12.4 | 96.1 | 27.5 | 30.0 | 8.6 |
| | | Mosquito Adulticide | 0.037 | 7500 | 2.1e+00 | 2.9e-02 | 9.0e-04 | 4.1e-04 | 77.8 | 22.2 | 171.6 | 49.0 | 53.5 | 15.3 |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 1.7e+00 | 4.1e-02 | 7.3e-04 | 5.8e-04 | 95.5 | 27.3 | 121.0 | 34.6 | 53.4 | 15.3 |
| | | Mosquito Adulticide | 0.016 | 3000 | 9.1e-01 | 2.2e-02 | 3.9e-04 | 3.1e-04 | 179.1 | 51.2 | 226.9 | 64.8 | 100.1 | 28.6 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 1.4e-01 | 1.0e-01 | 5.8e-05 | 1.5e-03 | 1201.0 | 343.1 | 47.1 | 13.5 | 45.3 | 13.0 |
| | | Mosquito Larvicide | 0.037 | 800 | 7.6e-02 | 5.8e-02 | 3.3e-05 | 8.3e-04 | 2144.6 | 612.7 | 84.1 | 24.0 | 81.0 | 23.1 |
| | | Mosquito Larvicide | 0.1 | 80 | 1.4e-02 | 1.0e-02 | 5.8e-06 | 1.5e-04 | 12009.8 | 3431.4 | 471.2 | 134.6 | 453.4 | 129.5 |
| | | Mosquito Larvicide | 0.037 | 80 | 7.6e-03 | 5.8e-03 | 3.3e-06 | 8.3e-05 | 21446.1 | 6127.5 | 841.3 | 240.4 | 809.6 | 231.3 |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.008 | 200 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |

| APPENDIX A/TABLE 6: FENTHION HANDLER EXPOSURE AND RISK CALCULATIONS AT ENGINEERING CONTROL PROTECTION LEVELS | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DAILY EXPOSURE | | ABSORBED DAILY DOSE | | DERMAL MOEs | | INHALATION MOEs | | COMBINED MOEs | |
| | | | RATE | ACRES OR GALLONS | DERMAL (mg/day) | INHALAT. (mg/day) | DERMAL (mg/kg/day) | INHALAT. (mg/kg/day) | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM | SHORT TERM | INTER. TERM |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | | | |
| 8 | Label On For Livestock | Fly Control | 0.004 | 200 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible |
| FLAGGERS | | | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 1.7e-01 | 5.3e-03 | 7.1e-05 | 7.5e-05 | 989.9 | 282.8 | 933.3 | 266.7 | 480.4 | 137.3 |
| | | Mosquito Adulticide | 0.037 | 7500 | 9.2e-02 | 2.9e-03 | 4.0e-05 | 4.2e-05 | 1767.7 | 505.1 | 1666.7 | 476.2 | 857.8 | 245.1 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 4.5e-03 | 2.4e-04 | 1.9e-06 | 3.4e-06 | 36458.3 | 10416.7 | 20416.7 | 5833.3 | 13087.6 | 3739.3 |
| | | Mosquito Larvicide | 0.037 | 800 | 2.5e-03 | 1.3e-04 | 1.1e-06 | 1.9e-06 | 65104.2 | 18601.2 | 36458.3 | 10416.7 | 23370.7 | 6677.4 |

| APPENDIX A/TABLE 7: FENTHION MOEs ATTRIBUTABLE TO DERMAL EXPOSURE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DERMAL MOEs FOR VARYING LEVELS OF PROTECTION | | | | | | | |
| | | | RATE | ACRES OR GALLONS | FOR SHORT-TERM EXPOSURES | | | | FOR INTERMEDIATE-TERM EXPOSURES | | | |
| | | | | | BASELINE | MINIMUM PPE (SINGLE LAYER & GLOVES) | MAXIMUM PPE (DOUBLE LAYER & GLOVES) | ENG. CONTROLS | BASELINE | MINIMUM PPE (SINGLE LAYER & GLOVES) | MAXIMUM PPE (DOUBLE LAYER & GLOVES) | ENG. CONTROLS |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 0.1 | 9.5 | 12.8 | 25.3 | 0.02 | 2.7 | 3.7 | 7.2 |
| | | Mosquito Adulticide | 0.056 | 7500 | 0.1 | 16.9 | 22.9 | 45.2 | 0.04 | 4.8 | 6.5 | 12.9 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 0.6 | 78.9 | 106.8 | 211.0 | 0.18 | 22.5 | 30.5 | 60.3 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.2 | 147.9 | 200.2 | 395.7 | 0.34 | 42.3 | 57.2 | 113.0 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 243.1 | 295.9 | 600.5 | 12152.8 | 69.44 | 84.5 | 171.6 | 3472.2 |
| | | Mosquito Larvicide | 0.056 | 800 | 434.0 | 528.4 | 1072.3 | 21701.4 | 124.01 | 151.0 | 306.4 | 6200.4 |
| | | Mosquito Larvicide | 0.1 | 80 | 2430.6 | 2958.9 | 6004.9 | 121527.8 | 694.44 | 845.4 | 1715.7 | 34722.2 |
| | | Mosquito Larvicide | 0.056 | 80 | 4340.3 | 5283.8 | 10723.0 | 217013.9 | 1240.08 | 1509.7 | 3063.7 | 62004.0 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not feasible | Not Feasible | Not Feasible | 43.6 | Not feasible | Not Feasible | Not Feasible | 12.4 |
| | | Mosquito Adulticide | 0.056 | 7500 | Not feasible | Not Feasible | Not Feasible | 77.8 | Not feasible | Not Feasible | Not Feasible | 22.2 |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 5.0 | 7.6 | 8.2 | 95.5 | 1.44 | 2.2 | 2.4 | 27.3 |
| | | Mosquito Adulticide | 0.016 | 3000 | 9.5 | 14.2 | 15.5 | 179.1 | 2.70 | 4.1 | 4.4 | 51.2 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not feasible | Not Feasible | Not Feasible | 1201.0 | Not feasible | Not Feasible | Not Feasible | 343.1 |
| | | Mosquito Larvicide | 0.056 | 800 | Not feasible | Not Feasible | Not Feasible | 2144.6 | Not feasible | Not Feasible | Not Feasible | 612.7 |
| | | Mosquito Larvicide | 0.1 | 80 | Not feasible | Not Feasible | Not Feasible | 12009.8 | Not feasible | Not Feasible | Not Feasible | 3431.4 |
| | | Mosquito Larvicide | 0.056 | 80 | Not feasible | Not Feasible | Not Feasible | 21446.1 | Not feasible | Not Feasible | Not Feasible | 6127.5 |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.008 | 200 | 33.5 | 4227.1 | 5719.0 | Not Feasible | 9.58 | 1207.7 | 1634.0 | Not Feasible |

| APPENDIX A/TABLE 7: FENTHION MOEs ATTRIBUTABLE TO DERMAL EXPOSURE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | DERMAL MOEs FOR VARYING LEVELS OF PROTECTION | | | | | | | |
| | | | RATE | ACRES OR GALLONS | FOR SHORT-TERM EXPOSURES | | | | FOR INTERMEDIATE-TERM EXPOSURES | | | |
| | | | | | BASELINE | MINIMUM PPE (SINGLE LAYER & GLOVES) | MAXIMUM PPE (DOUBLE LAYER & GLOVES) | ENG. CONTROLS | BASELINE | MINIMUM PPE (SINGLE LAYER & GLOVES) | MAXIMUM PPE (DOUBLE LAYER & GLOVES) | ENG. CONTROLS |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | Not Feasible | No Data | No Data | No Data | Not Feasible |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | |
| 8 | Label On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | Not Feasible | No Data | No Data | No Data | Not Feasible |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 32.7 | 35.1 | 57.2 | Not Feasible | 9.33 | 10.0 | 16.3 | Not Feasible |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 0.4 | 95.0 | 110.4 | Not Feasible | 0.12 | 27.1 | 31.5 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 0.8 | 189.9 | 220.7 | Not Feasible | 0.23 | 54.3 | 63.1 | Not Feasible |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | No Data | 16.3 | 25.5 | Not Feasible | No Data | 4.7 | 7.3 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | No Data | 32.7 | 51.0 | Not Feasible | No Data | 9.3 | 14.6 | Not Feasible |
| FLAGGERS | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 19.8 | 18.1 | 19.8 | 989.9 | 5.66 | 5.2 | 5.7 | 282.8 |
| | | Mosquito Adulticide | 0.056 | 7500 | 35.4 | 32.4 | 35.4 | 1767.7 | 10.10 | 9.3 | 10.1 | 505.1 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 729.2 | 1276.0 | 2041.7 | 36458.3 | 208.33 | 364.6 | 583.3 | 10416.7 |
| | | Mosquito Larvicide | 0.056 | 800 | 1302.1 | 2278.6 | 3645.8 | 65104.2 | 372.02 | 651.0 | 1041.7 | 18601.2 |



7921/6

| APPENDIX A/TABLE 8. FENTHION MOEs ATTRIBUTABLE TO INHALATION EXPOSURE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | INHALATION MOEs FOR VARYING LEVELS OF PROTECTION | | | | | | | |
| | | | | | SHORT TERM EXPOSURE DURATIONS | | | | INTERMEDIATE-TERM EXPOSURE DURATIONS | | | |
| | | | RATE | ACRES OR GALLONS | BASELINE | PF 5 RESPIRATOR | PF 10 RESPIRATOR | ENG. CONTROLS | BASELINE | PF 5 RESPIRATOR | PF 10 RESPIRATOR | ENG. CONTROLS |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 5.4 | 27.2 | 54.4 | 78.7 | 1.6 | 7.8 | 15.6 | 22.5 |
| | | Mosquito Adulticide | 0.056 | 7500 | 9.7 | 48.6 | 97.2 | 140.6 | 2.8 | 13.9 | 27.8 | 40.2 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 45.4 | 226.9 | 453.7 | 656.0 | 13.0 | 64.8 | 129.6 | 187.4 |
| | | Mosquito Adulticide | 0.016 | 3000 | 85.1 | 425.3 | 850.7 | 1229.9 | 24.3 | 121.5 | 243.1 | 351.4 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 36.0 | 180.1 | 360.3 | 1801.5 | 10.3 | 51.5 | 102.9 | 514.7 |
| | | Mosquito Larvicide | 0.056 | 800 | 64.3 | 321.7 | 643.4 | 3216.9 | 18.4 | 91.9 | 183.8 | 919.1 |
| | | Mosquito Larvicide | 0.1 | 80 | 360.3 | 1801.5 | 3602.9 | 18014.7 | 102.9 | 514.7 | 1029.4 | 5147.1 |
| | | Mosquito Larvicide | 0.056 | 80 | 643.4 | 3216.9 | 6433.8 | 32169.1 | 183.8 | 919.1 | 1838.2 | 9191.2 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not feasible | Not Feasible | Not Feasible | 96.1 | Not feasible | Not Feasible | Not Feasible | 27.5 |
| | | Mosquito Adulticide | 0.056 | 7500 | Not feasible | Not Feasible | Not Feasible | 171.6 | Not feasible | Not Feasible | Not Feasible | 49.0 |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 12.1 | 60.5 | 121.0 | 121.0 | 3.5 | 17.3 | 34.6 | 34.6 |
| | | Mosquito Adulticide | 0.016 | 3000 | 22.7 | 113.4 | 226.9 | 226.9 | 6.5 | 32.4 | 64.8 | 64.8 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not feasible | Not Feasible | Not Feasible | 47.1 | Not feasible | Not Feasible | Not Feasible | 13.5 |
| | | Mosquito Larvicide | 0.056 | 800 | Not feasible | Not Feasible | Not Feasible | 84.1 | Not feasible | Not Feasible | Not Feasible | 24.0 |
| | | Mosquito Larvicide | 0.1 | 80 | Not feasible | Not Feasible | Not Feasible | 471.2 | Not feasible | Not Feasible | Not Feasible | 134.6 |
| | | Mosquito Larvicide | 0.056 | 80 | Not feasible | Not Feasible | Not Feasible | 841.3 | Not feasible | Not Feasible | Not Feasible | 240.4 |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.008 | 200 | 2430.6 | 12152.8 | 24305.6 | Not Feasible | 694.4 | 3472.2 | 6944.4 | Not Feasible |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | Not Feasible | No Data | No Data | No Data | Not Feasible |

| APPENDIX A/TABLE 8: FENTHION MOEs ATTRIBUTABLE TO INHALATION EXPOSURE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | INHALATION MOEs FOR VARYING LEVELS OF PROTECTION | | | | | | | |
| | | | | | SHORT-TERM EXPOSURE DURATIONS | | | | INTERMEDIATE-TERM EXPOSURE DURATIONS | | | |
| | | | RATE | ACRES OR GALLONS | BASELINE | PF 5 RESPIRATOR | PF 10 RESPIRATOR | ENG. CONTROLS | BASELINE | PF 5 RESPIRATOR | PF 10 RESPIRATOR | ENG. CONTROLS |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | |
| 8 | Label On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | Not Feasible | No Data | No Data | No Data | Not Feasible |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 158.1 | 790.3 | 1580.6 | Not Feasible | 45.2 | 225.8 | 451.6 | Not Feasible |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 40.8 | 204.2 | 408.3 | Not Feasible | 11.7 | 58.3 | 116.7 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 81.7 | 408.3 | 816.7 | Not Feasible | 23.3 | 116.7 | 233.3 | Not Feasible |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 40.8 | 204.2 | 408.3 | Not Feasible | 11.7 | 58.3 | 116.7 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 81.7 | 408.3 | 816.7 | Not Feasible | 23.3 | 116.7 | 233.3 | Not Feasible |
| FLAGGERS | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 18.7 | 93.3 | 186.7 | 933.3 | 5.3 | 26.7 | 53.3 | 266.7 |
| | | Mosquito Adulticide | 0.056 | 7500 | 33.3 | 166.7 | 333.3 | 1666.7 | 9.5 | 47.6 | 95.2 | 476.2 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 408.3 | 2041.7 | 4083.3 | 20416.7 | 116.7 | 583.3 | 1166.7 | 5833.3 |
| | | Mosquito Larvicide | 0.056 | 800 | 729.2 | 3645.8 | 7291.7 | 36458.3 | 208.3 | 1041.7 | 2083.3 | 10416.7 |

APPENDIX A/TABLE 9: FENTHION MOEs ATTRIBUTABLE TO COMBINED SHORT TERM DERMAL AND INHALATION EXPOSURES

| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | SUMMARY MOEs FOR COMBINATIONS OF DERMAL AND INHALATION PROTECTIVE MEASURES | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | RATE | ACRES OR GALLONS | BASELINE (TABLE 2) | SINGLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 &3) | SINGLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLE 3) | SINGLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 & 4) | DOUBLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLE 4) | ENG CONTROLS (TABLE 5) |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 0.1 | 3.5 | 7.0 | 8.1 | 3.8 | 8.7 | 10.4 | 19.2 |
| | | Mosquito Adulticide | 0.056 | 7500 | 0.1 | 6.2 | 12.5 | 14.4 | 6.8 | 15.6 | 18.5 | 34.2 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 0.6 | 28.8 | 58.5 | 67.2 | 31.8 | 72.6 | 86.4 | 159.7 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.2 | 54.0 | 109.8 | 126.0 | 59.7 | 136.1 | 162.0 | 299.4 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 31.4 | 32.1 | 112.0 | 162.5 | 34.0 | 138.6 | 225.2 | 1568.9 |
| | | Mosquito Larvicide | 0.056 | 800 | 56.0 | 57.4 | 200.0 | 290.1 | 60.7 | 247.5 | 402.1 | 2801.6 |
| | | Mosquito Larvicide | 0.1 | 80 | 313.8 | 321.2 | 1119.7 | 1624.7 | 339.9 | 1385.7 | 2251.8 | 15689.0 |
| | | Mosquito Larvicide | 0.056 | 80 | 560.3 | 573.5 | 1999.5 | 2901.2 | 607.0 | 2474.5 | 4021.1 | 28016.1 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 30.0 |
| | | Mosquito Adulticide | 0.056 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 53.5 |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 3.6 | 4.7 | 6.7 | 7.1 | 4.9 | 7.3 | 7.7 | 53.4 |
| | | Mosquito Adulticide | 0.016 | 3000 | 6.7 | 8.7 | 12.6 | 13.3 | 9.2 | 13.6 | 14.5 | 100.1 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 45.3 |
| | | Mosquito Larvicide | 0.056 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 81.0 |
| | | Mosquito Larvicide | 0.1 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 453.4 |
| | | Mosquito Larvicide | 0.056 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 809.6 |

| APPENDIX A/TABLE 9: FENTHION MOES ATTRIBUTABLE TO COMBINED SHORT-TERM DERMAL AND INHALATION EXPOSURES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | SUMMARY MOES FOR COMBINATIONS OF DERMAL AND INHALATION PROTECTIVE MEASURES | | | | | | | |
| | | | RATE | ACRES OR GALLONS | BASELINE (TABLE 2) | SINGLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 &3) | SINGLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLE 3) | SINGLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 & 4) | DOUBLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLE 4) | ENG CONTROLS (TABLE 5) |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.008 | 200 | 33.1 | 1543.2 | 3136.2 | 3600.8 | 1705.7 | 3888.9 | 4629.6 | Not Feasible |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | Not Feasible |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | |
| 8 | Label On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | Not Feasible |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 27.1 | 28.7 | 33.6 | 34.4 | 42.0 | 53.3 | 55.2 | Not Feasible |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 0.4 | 28.6 | 64.8 | 77.0 | 29.8 | 71.6 | 86.9 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 0.8 | 57.1 | 129.6 | 154.1 | 59.6 | 143.3 | 173.8 | Not Feasible |
| 11 | Backpack Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | No Data | 11.7 | 15.1 | 15.7 | 15.7 | 22.7 | 24.0 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | No Data | 23.3 | 30.2 | 31.4 | 31.4 | 45.4 | 48.0 | Not Feasible |
| FLAGGERS | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 9.6 | 9.2 | 15.2 | 16.5 | 9.6 | 16.3 | 17.9 | 480.4 |
| | | Mosquito Adulticide | 0.056 | 7500 | 17.2 | 16.4 | 27.1 | 29.5 | 17.2 | 29.2 | 32.0 | 857 8 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 261.8 | 309.3 | 785.3 | 972.2 | 340.3 | 1020.8 | 1361.1 | 13087 6 |
| | | Mosquito Larvicide | 0.056 | 800 | 467.4 | 552.4 | 1402.2 | 1736.1 | 607.6 | 1822.9 | 2430.6 | 23370.7 |

| APPENDIX A/TABLE 10: FENTHION MOEs ATTRIBUTABLE TO COMBINED INTERMEDIATE-TERM DERMAL AND INHALATION EXPOSURES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | SUMMARY MOEs FOR COMBINATIONS OF DERMAL AND INHALATION PROTECTIVE MEASURES | | | | | | | |
| | | | RATE | ACRES OR GALLONS | BASELINE (TABLE 2) | SINGLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 &3) | SINGLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLE 3) | SINGLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 & 4) | DOUBLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLE 4) | ENG. CONTROLS (TABLE 5) |
| OCCUPATIONAL MIXER/LOADERS | | | | | | | | | | | | |
| 1a | Mixing/loading Liquids for Aerial Application | Mosquito Adulticide | 0.1 | 7500 | 0.02 | 1.0 | 2.0 | 2.3 | 1.1 | 2.5 | 3.0 | 5 5 |
| | | Mosquito Adulticide | 0.056 | 7500 | 0.04 | 1.8 | 3.6 | 4.1 | 1.9 | 4.4 | 5.3 | 9 8 |
| 1b | Mixing/loading Liquids for Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 0.18 | 8.2 | 16.7 | 19.2 | 9.1 | 20.7 | 24.7 | 45.6 |
| | | Mosquito Adulticide | 0.016 | 3000 | 0.33 | 15.4 | 31.4 | 36.0 | 17.1 | 38.9 | 46.3 | 85.5 |
| 2 | Loading Granulars for Aerial Application | Mosquito Larvicide | 0.1 | 800 | 8.97 | 9.2 | 32.0 | 46.4 | 9.7 | 39.6 | 64.3 | 448.3 |
| | | Mosquito Larvicide | 0.056 | 800 | 16.01 | 16.4 | 57.1 | 82.9 | 17.3 | 70.7 | 114.9 | 800.5 |
| | | Mosquito Larvicide | 0.1 | 80 | 89.65 | 91.8 | 319.9 | 464.2 | 97.1 | 395.9 | 643.4 | 4482 6 |
| | | Mosquito Larvicide | 0.056 | 80 | 160.09 | 163.9 | 571.3 | 828.9 | 173.4 | 707.0 | 1148.9 | 8004.6 |
| OCCUPATIONAL APPLICATORS | | | | | | | | | | | | |
| 3 | Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 8 6 |
| | | Mosquito Adulticide | 0.056 | 7500 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 15.3 |
| 4 | Ground Fogger Application | Mosquito Adulticide | 0.03 | 3000 | 1.02 | 1.3 | 1.9 | 2.0 | 1.4 | 2.1 | 2.2 | 15.3 |
| | | Mosquito Adulticide | 0.016 | 3000 | 1.91 | 2.5 | 3.6 | 3.8 | 2.6 | 3.9 | 4.1 | 28.6 |
| 5 | Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 13 0 |
| | | Mosquito Larvicide | 0.056 | 800 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 23 1 |
| | | Mosquito Larvicide | 0.1 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 129.5 |
| | | Mosquito Larvicide | 0.056 | 80 | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | Not Feasible | 231 3 |

| APPENDIX A/TABLE 10: FENTHION MOES ATTRIBUTABLE TO COMBINED INTERMEDIATE-TERM DERMAL AND INHALATION EXPOSURES | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SCEN. | SCEN. DESCRIPTOR | CROP TYPE OR TARGET | EXPOSURE FACTORS | | SUMMARY MOES FOR COMBINATIONS OF DERMAL AND INHALATION PROTECTIVE MEASURES | | | | | | | |
| | | | RATE | ACRES OR GALLONS | BASELINE (TABLE 2) | SINGLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 &3) | SINGLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLE 3) | SINGLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & NO RESPIRATOR (TABLES 2 & 4) | DOUBLE LAYER, GLOVES & PF 5 RESPIRATOR (TABLES 3 & 4) | DOUBLE LAYER, GLOVES & PF 10 RESPIRATOR (TABLE 4) | ENG CONTROLS (TABLE 5) |
| 6 | Ready-to-Use Package For Livestock | Fly Control | 0.0084 | 200 | 9.45 | 440.9 | 896.1 | 1028.8 | 487.3 | 1111.1 | 1322.8 | Not Feasible |
| 7 | Ear Tags For Cattle | Fly Control | 0.013 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | Not Feasible |
| OCCUPATIONAL MIXER/LOADER/APPLICATORS | | | | | | | | | | | | |
| 8 | Ladel On For Livestock | Fly Control | 0.004 | 200 | No Data | No Data | No Data | No Data | No Data | No Data | No Data | Not Feasible |
| 9 | Ground-based Granular Application | Mosquito Larvicide | 0.1 | 5 | 7.73 | 8.2 | 9.6 | 9.8 | 12.0 | 15.2 | 15.8 | Not Feasible |
| 10 | Low Pressure Handwand Application of 95% Liquid | Dragonfly Larvicide | 0.8 | 5 | 0.12 | 8.2 | 18.5 | 22.0 | 8.5 | 20.5 | 24.8 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | 0.23 | 16.3 | 37.0 | 44.0 | 17.0 | 40.9 | 49.6 | Not Feasible |
| 11 | Backpack Application of 95% Liqnd | Dragonfly Larvicide | 0.8 | 5 | No Data | 3.3 | 4.3 | 4.5 | 4.5 | 6.5 | 6.9 | Not Feasible |
| | | Dragonfly Larvicide | 0.8 | 2.5 | No Data | 6.7 | 8.6 | 9.0 | 9.0 | 13.0 | 13.7 | Not Feasible |
| FLAGGERS | | | | | | | | | | | | |
| 12 | Flagging For Aerial Application of Liquid Sprays | Mosquito Adulticide | 0.1 | 7500 | 2.75 | 2.6 | 4.3 | 4.7 | 2.7 | 4.7 | 5.1 | 137 3 |
| | | Mosquito Adulticide | 0.056 | 7500 | 4.90 | 4.7 | 7.8 | 8.4 | 4.9 | 8.3 | 9.1 | 245 1 |
| 13 | Flagging For Aerial Application of Granulars | Mosquito Larvicide | 0.1 | 800 | 74.79 | 88.4 | 224.4 | 277.8 | 97.2 | 291.7 | 388.9 | 3739 3 |
| | | Mosquito Larvicide | 0.056 | 800 | 133.55 | 157.8 | 400.6 | 496.0 | 173.6 | 520.8 | 694.4 | 6677 4 |



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# APPENDIX B

# RATIONALE FOR SELECTION OF DEPOSITION PERCENTAGE VALUES FOR AERIAL AND GROUND-BASED MOSQUITO ADULTICIDE APPLICATIONS

**Background Information:** One of the predominant uses of fenthion is for the control of mosquitos in regions of the country where there are public health concerns over disease transmission. Fenthion, intended for use in public health applications, is marketed as an Ultra Low Volume (ULV) liquid and in various granular formulations. Based on a January 1998 search of REFs, the currently available ULV liquid formulations include EPA Reg. Numbers 3125-148 and FL97000100 (i.e., Baytex, 95% active ingredient). Likewise, the currently available granular formulations include EPA Reg. Numbers 5481-83,-84, and -101 (Duratex, 1 or 2% active ingredient).

According to the use information available to The Agency it appears that the major application method for fenthion is through ground-based and aerial ULV liquid applications and not through aerial thermal fogging techniques or applications of the granular formulations. As a result, the fenthion postapplication exposure/risk assessment has been completed for the use scenarios described on the Baytex ULV liquid label (EPA Reg. No. 3125-148) and no other label. [Note: The aerial thermal fog application is not considered here because of concerns over environmental releases of the fuel oil component (personal communication between Jeff Dawson and Randy Dominy of EPA Region 4/Atlanta, Georgia).]

The maximum application rates specified on the Baytex label are 0.1 lb ai/acre for aerial ULV applications and 0.03 lb ai/acre for ground-based ULV applications. The Baytex label also stipulated other application parameter requirements that impact deposition patterns which were considered by The Agency in the development of this exposure/risk assessment. The critical label statements used in the development of this exposure/risk assessment include:

- "Spray droplets should have a median droplet size range from 5 to 20 $\mu$m with a Mass Median Diameter (MMD) not to exceed 15 $\mu$m. Droplets 45 $\mu$m or larger may cause permanent damage to automobile paint finishes."

- For aerial ULV applications, "No more than 5 percent of the droplets should exceed 80 MMD."

**Agricultural Engineering Considerations:** With few notable exceptions such as public health scenarios (e.g., mosquito control), the general intent during most pesticide applications is to confine the deposition of applied chemicals to specific target areas such as agricultural fields. Economic concerns, health concerns, environmental concerns, and efficacy are the generally recognized rationale for limiting off-target deposition. Pesticide applicators can control deposition patterns through the use of specific types of equipment and by controlling application parameters. Several application parameters can potentially impact deposition patterns of liquid-form pesticides in the environment during application (e.g., nozzle size, application pressure, vehicle configuration and speed, meteorological conditions including environmental stability, and physical-chemical characteristics of the formulation).

As indicated above, ULV mosquito control applications serve as the basis for this assessment. The general intent of these types of applications is antithetical to most pesticide applications in that spray drift is generally not inhibited but promoted in order to broaden the effective treatment area and ensure that the resulting droplets stay aloft for as long as possible. In fact, the efficacy of mosquito adulticide



8/2/16

compounds is based on droplets contacting in-flight mosquitos. As a result, there are significant agricultural engineering differences that were considered by The Agency in this assessment. These include:

- Release heights for mosquito control aerial ULV applications are typically 100 to 500 feet (or even higher) as opposed to most typical agricultural aerial applications where the release height is generally as low as the pilot can go (i.e., often 10 feet or less). Release height can significantly impact spray drift (i.e., the higher the release, the longer to time of impact with target area, and the more potential for drift). A release height of 300 feet was used in this assessment (i.e., the upper limit application height allowed in the *AgDRIFT* model).

- Nozzle configurations are such that extremely small droplets are released as opposed to typical aerial applications (i.e., Baytex label specifies MMD of 15 $\mu$m while the values for most agricultural applications are 100 $\mu$m or more).

- Larger aircraft are generally used to make malaria control applications. For example, Lee County Florida, one of the largest Florida mosquito abatement districts, has a fleet of Douglas DC3s and Huey Helicopters (based on personal communication between Randy Dominy of EPA Region 4 and Jeff Dawson). The DC3 is a much larger aircraft than the common agricultural application fixed-wing aircraft (e.g., Air Tractor AT401). These differences are significant when predicting deposition and were addressed in the Agency calculation of deposition after an aerial ULV application. The DC3 was used as the basis for all AgDRIFT calculations completed by The Agency.

- The Baytex label specifies that only 1.3 fluid ounces of formulation should be applied per acre by air and that the ground-based flow rate should range from 1.2 to 3.6 ounces per minute based on sprayer groundspeed. The aerial scenario significantly differs from agricultural aerial applications (even most ag label ULV applications) because there is no diluent (i.e., water) and the volume per acre is much less. Most ag ULV applications typically apply approximately 1 gallon per acre of finished spray solution. The use of neat formulation impacts spray drift because of changes in surface tension of the droplets (i.e., this effects evaporation rate and hence deposition).

**Predictive Tools and Data:** The Agency has used state-of-the-art tools in order to calculate deposition rates resulting from ground-based and aerial ULV applications as well as to calculate the postapplication dermal exposures that result from entry into areas previously treated with fenthion using these techniques. The Agency did not calculate airborne concentrations and complete an inhalation based risk assessment because of several issues including the magnitude of the inhalation endpoint for fenthion, the infinite dilution that is anticipated in an outdoor application, and based on the very low application rate. Additionally, The Agency did not consider postapplication nondietary exposure in this assessment, given the conservative nature of the calculations, for the dermal route based on the use of the Residential SOPs for calculating dermal exposure from deposition (i.e., based on a Jazzercise bounding estimate of dermal exposure).

The first aspect of this exposure/risk assessment required the calculation of realistic deposition rates from the aerial and ground-based ULV applications of fenthion. The Agency could have taken a

very simplistic approach of assigning the application rate as the deposition after an application. However, The Agency did not utilize this approach given the current state of knowledge pertaining to spray drift and recent industry and agency efforts in this area (i.e., this approach would generally be considered as unrealistic given the intent of mosquito control applications). There are a number of predictive tools and open literature articles that pertain to this technical area. Given that ground-based and aerial ULV applications are allowable, models and data were identified to support a human health exposure/risk assessment for each scenario. [Note: The Agency recognizes that there are potential issues with the selection and use of these models in this assessment. As such, the use of each model for completing this exposure/risk assessment is appropriately characterized (see below).]

- **Aerial ULV:** In order to calculate deposition from aerial ULV applications, The Agency used *AgDRIFT* (V 1.03 -- June 1997) which is the model that was developed as a result of the efforts of the *Spray Drift Task Force (SDTF)*. The SDTF is a coalition of 38 pesticide registrants whose primary objectives were to develop a comprehensive database of off-target drift information in support of pesticide registrations and an appropriate model system. This model was selected based on the consensus of several experts in the spray drift area because it represents the current state-of-the-art. The Agency discussed the issue of model selection with several experts in the spray drift community prior to selecting *AgDRIFT* (e.g., Sandra L. Bird, U.S. EPA; Steven G. Perry, U.S. EPA; Milton E. Teske, Continuum Dynamics; Pat Skyler, U.S. Forest Service; Arnet Jones, U.S. EPA; and Harold Thistle, U.S. Forest Service). The Agency considered using the *USDA Forest Service Cramer-Barry-Grim Model* (commonly referred to as *FSCBG*). *FSCBG* was developed through support from the U.S. Forest Service, in cooperation with the U.S. Army, and has been in existence for over 20 years in various iterations. Actual support and development of *FSCBG* was completed by Continuum Dynamics, Inc. located in Princeton, New Jersey under the technical direction of Milton E. Teske. However, it was decided that *AgDRIFT* should be used because it is based on essentially the same algorithms as *FSCBG* (personal communication with Milton E. Teske of Contiuum Dynamics), it has undergone extensive validation by the *SDTF*, and it is very user-friendly compared to *FSCBG*.

  *AgDRIFT* is a *Microsoft Windows*-based personal computer program that is provided to the U.S. Environmental Protection Agency's Office of Pesticide Programs as a product of the Cooperative Research and Development Agreement (CRADA) between EPA's Office of Research and Development and the *SDTF*. *AgDRIFT* predicts the motion of spray material released from aircraft, including the mean position of the material and the position variance about the mean as a result of turbulent fluctuations. *AgDRIFT* enhancements include a significant solution speed increase, an in-memory computation of deposition and flux as the solution proceeds, and extensive validation based on 180 separate aerial treatments performed during field trials in 1992 and 1993 by the SDTF.

  **Ground ULV:** In contrast to the aerial ULV scenario, the data available to predict deposition patterns and resulting exposures from ground-based ULV malaria applications are limited. In fact, The Agency utilized two published journal articles and a preliminary model developed for the Environmental Fate and Effects Division of OPP by EPA's Office of Research and Development as the basis of this effort. These documents include:



84/2/11

*Mass Recovery of Malathion in Simulated Open Field Mosquito Adulticide Tests*: N.S. Tietze, P.G. Hester, and K.R. Shaffer; Archives of Environmental Contamination and Toxicology; 26: 473-477 (1994). [Note: This document was used as the primary source of deposition rates resulting from ground-based ULV mosquito applications.]

*Downwind Drift and Deposition of Malathion on Human Targets From Ground Ultra-Low Volume Mosquito Sprays*: J.C. Moore, J.C. Dukes, J.R. Clark, J. Malone, C.F. Hallmon, and P.G. Hester; Journal of the American Mosquito Control Association; Vol. 9, No. 2 (June, 1993).[Note: This document was used as the primary source of deposition rates resulting from ground-based ULV mosquito applications and as a confirmatory source of exposure data.]

*Modeling of Deposition From Mosquito Adulticide Applications*: S.G. Perry and W.B. Petersen of EPA/ORD for Arnet Jones of EPA/OPP (February 7, 1995). [Note: This is an internal document that has not been peer reviewed. It was used only for confirmatory purposes in this exposure/risk assessment.]

**Determination of Deposition Rates:** Deposition rates were determined for both aerial and ground-based ULV application methods as a percentage of the nominal application rate (i.e., how much of the target application rate actually deposited on outdoor surfaces such as turf). Both maximum and average application rates (calculated using 1993-1995 Lee County Florida data) served as the basis for this assessment. The rates used for aerial ULV application method were 0.1 lb ai/acre (the label maximum) while the average Lee County Florida rate used was 0.056 lb ai/acre. Likewise, the rates used for ground-based ULV applications was 0.03 lb ai/acre (the label maximum) while the average Lee County Florida rate used was 0.016 lb ai/acre.

As indicated above, *AgDRIFT V 1.03* was used to calculate the deposition rate from aerial ULV applications. The following inputs were used as the basis of the *AgDRIFT* calculations:

- **AgDRIFT Model Tier:** 3.

- **Droplet Size Distribution:** $D_{v0.1}$ = 7.14 $\mu$m; $D_{v0.5}$ = 17.06 $\mu$m; $D_{v0.9}$ = 70 $\mu$m; and <141 $\mu$m = 98 percent (developed to reflect droplet spectrum requirements of Baytex label). **[Note: The droplet distribution was developed based on the Baytex label. No proprietary SDTF data were used in the completion of this assessment.]**

- **Spray Material:** User-defined option (oil option). Inputs include: nonvolatile rate 2.5 lb per acre, specific gravity 1.2 (calculated based on approximately 10 pounds per gallon), spray rate 0.25 gallons/acre, active ingredient application rate (0.1 lb ai/acre), and evaporation rate (1 $\mu m^2$/deg C/sec). [Note: Several of these parameters do not exactly coincide with the Baytex label but were used because the Baytex label inputs exceeded the allowable input parameters. These differences are not expected to significantly effect the AgDRIFT results because a nonvolatile oil was selected, hence the critical input is the active ingredient application rate. Additionally, **no proprietary SDTF physical property data were used in the completion of this assessment.** ]



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- **Aircraft:** User-defined option (fixed-wing option). Inputs include: Douglas DC3, wingspan: 94.6 ft (semispan 47.28 ft), typical application airspeed: 228 mph, weight: 21397 pounds, planform area: 1009.63 $ft^2$, propeller RPM: 2550, propeller radius: 5.81 feet, engine vertical distance: -4.003 feet, and engine forward distance: 20.01 feet. [Note: DC3-specific inputs were obtained from the *FSCBG (V4)* aircraft library.]

- **Nozzles:** User-defined option. Inputs include number of nozzles: 60, vertical distance of nozzles from wing: -2.66 feet, horizontal distance from wing: -0.82 feet, and horizontal distance limit: 75 percent.

- **Meteorology:** Inputs were not changed from Tier 3 recommendations of wind speed: 2 mph, wind direction: -90 degrees (perpendicular to flight path), temperature: 86°F, and relative humidity: 50 percent.

- **Control:** Inputs were altered from the Tier 3 recommendations. The parameters that were used included a spray release height of 300 feet, 20 spray lines (aircraft passes) in each application event, a swath width of 500 feet, and a swath displacement based on the aircraft centerline.

- **Advanced Settings:** Inputs were not changed from Tier 3 recommendations of wind speed height (2 meters), maximum compute time (600 seconds), maximum downwind distance (795 meters), vortex decay rate (0.56 m/s), aircraft drag coefficient (0.1), propeller efficiency (0.8), and ambient pressure (1013 mb).

AgDRIFT is capable of producing a variety of useful outputs. The key for The Agency in this assessment was to determine from the model what percentage of the application volume remained aloft and what percentage of the resulting droplets deposited on the surfaces in the treatment area as well as downwind from the treatment area. AgDRIFT is generally intended to calculate deposition rates in areas that are downwind from the treatment area (i.e., presented from the border of the treatment area to areas of interest downwind). The Agency has used the values at the border of the treatment area to represent the deposition rate within the treated area. It is clear from the results that from the edge of the treatment area to 2000 feet downwind, approximately 11.5 percent of the theoretical application is deposited. This value is intuitively consistent with what one might suspect would occur considering the agricultural engineering parameters associated with mosquito applications.

As indicated above, two published journal articles served as the basis for predicting deposition rates, as a percentage of the application rate, after ground-based ULV application for mosquito control (i.e., Tietze, *et al*, 1994 and Moore, *et al*, 1993). Both of these studies were completed using ULV formulations of malathion (91 and 95 percent). The Agency anticipates that the "behavior" of these formulations in the referenced studies would not be significantly different from the Baytex 95 percent ULV formulation because the physical-chemical properties of the malathion formulations would be expected to be similar to that of the Baytex formulation (i.e., The Agency believes the malathion formulations to be acceptable surrogates for Baytex in this analysis).

In the study conducted by Moore, *et al* both human exposure and deposition was quantified over 5 separate application events. A 91 percent formulation of malathion was applied in April and May of



86 9116

1989 in the early evening (a time of day for relative atmospheric stability). A Leco HD ULV cold aerosol generator (Lowndes Engineering Company, Valdosta Georgia) was used to make each application. The application parameters included a fluid flow rate of 4.3 fluid ounces per minute, a vehicle groundspeed of 10 mph, and a nominal application rate of 0.05 lb ai/acre (i.e., equates to a deposition rate of 0.51 $\mu g/cm^2$). Deposition was monitored at three locations downwind from the treatment area (i.e., 15.2m, 30.4m, and 91.2m). For the events considered in the deposition calculations, "average amounts of malathion deposited on ground level at 15.2, 30.4, and 91.2 m were not significantly different." The percentage of the application rate reported to have deposited ranged from 1 to 14 percent. The mean deposition value for all measurements was 4.3 percent (n=35, CV=98).

In the study conducted by Tietze, *et al* only deposition was quantified over 6 separate application events (i.e., one event was not included in deposition calculations "due to negative air stability"). The application parameters were similar to that used by Moore *et al*. A 95 percent formulation of malathion was applied from May to August of 1993. A Leco 1600 ULV cold aerosol generator (Lowndes Engineering Company, Valdosta Georgia) was also used to make each application. The application parameters included a fluid flow rate of 4.3 fluid ounces per minute, a vehicle groundspeed of 10 mph, and a nominal application rate of 0.057 lb ai/acre (i.e., equates to a deposition rate of 0.58 $\mu g/cm^2$). Deposition was monitored at four locations downwind from the treatment area (i.e., 5 m, 25 m, 100 m and 500 m). For the events considered in the deposition calculations, "malathion mass deposited differed significantly between the 500 m site and the three closer sites ($df = 3$; F-value = 3.42; $P<0.05$)." The percentage of the application rate reported to have deposited (not including 500 m samples which were much less) ranged up to 5.8 percent. The mean deposition value for all measurements was 3.8 percent.

Considering the data that are available in the Tietze *et al* and Moore *et al* papers, an off-target deposition rate of 5 percent was used by The Agency to evaluate ground-based ULV applications. A value slightly higher than the mean values for both studies was selected because of the variability in the data and the limited number of datapoints. It should be noted that this value is also consistent with the draft modeling assessment for ground-ULV approaches completed by S.T. Perry and W.B. Petersen of EPA's Office of Research and Development (i.e., within a factor of 5). Perry and Petersen used "the INPUFF Lagrangian puff model" as the basis for their assessment (Petersen and Lavdas, 1986: *INPUFF 2.0 - A Multiple Source Gaussian Puff Dispersion Algorithm. User's Guide*, EPA/600/8-86/024). Depending on the scenario selected from this document, deposition rates ranged from approximately 2.5 percent deposition 450 m downwind to 15 to 20 percent deposition **immediately adjacent** to the treatment zone.

The following deposition rates presented as a percentage of the application rate served as the basis of the postapplication exposure calculations completed by The Agency:

- Ground-based ULV = 5 percent of application rate, and
- Aerial ULV = 11.5 percent of application rate.



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# APPENDIX C

# RESIDENTIAL POST-APPLICATION RISK ASSESSMENT FOR FENTHION



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| APPENDIX C/TABLE 1: AMBIENT RESIDUE LEVELS RESULTING FROM THE AERIAL ULV APPLICATION OF FENTHION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAT | RESIDUE DEPOSITION (ug/cm2) | | TTR FOR DERMAL EXPOSURE (ug/cm2) | | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.0723 | 0.1290 | 0.0036 | 0.0065 | 0.0145 | 0.0258 | 0.0484 | 0.0864 |
| 1 | 0.0650 | 0.1161 | 0.0033 | 0.0058 | 0.0130 | 0.0232 | 0.0436 | 0.0778 |
| 2 | 0.0585 | 0.1045 | 0.0029 | 0.0052 | 0.0117 | 0.0209 | 0.0392 | 0.0700 |
| 3 | 0.0527 | 0.0941 | 0.0026 | 0.0047 | 0.0105 | 0.0188 | 0.0353 | 0.0630 |
| 4 | 0.0474 | 0.0846 | 0.0024 | 0.0042 | 0.0095 | 0.0169 | 0.0318 | 0.0567 |
| 5 | 0.0427 | 0.0762 | 0.0021 | 0.0038 | 0.0085 | 0.0152 | 0.0286 | 0.0510 |
| 6 | 0.0384 | 0.0686 | 0.0019 | 0.0034 | 0.0077 | 0.0137 | 0.0257 | 0.0459 |
| 7 | 0.0346 | 0.0617 | 0.0017 | 0.0031 | 0.0069 | 0.0123 | 0.0232 | 0.0413 |
| 8 | 0.0311 | 0.0555 | 0.0016 | 0.0028 | 0.0062 | 0.0111 | 0.0208 | 0.0372 |
| 9 | 0.0280 | 0.0500 | 0.0014 | 0.0025 | 0.0056 | 0.0100 | 0.0188 | 0.0335 |
| 10 | 0.0252 | 0.0450 | 0.0013 | 0.0022 | 0.0050 | 0.0090 | 0.0169 | 0.0301 |
| 11 | 0.0227 | 0.0405 | 0.0011 | 0.0020 | 0.0045 | 0.0081 | 0.0152 | 0.0271 |
| 12 | 0.0204 | 0.0364 | 0.0010 | 0.0018 | 0.0041 | 0.0073 | 0.0137 | 0.0244 |
| 13 | 0.0184 | 0.0328 | 0.0009 | 0.0016 | 0.0037 | 0.0066 | 0.0123 | 0.0220 |
| 14 | 0.0165 | 0.0295 | 0.0008 | 0.0015 | 0.0033 | 0.0059 | 0.0111 | 0.0198 |
| 15 | 0.0149 | 0.0266 | 0.0007 | 0.0013 | 0.0030 | 0.0053 | 0.0100 | 0.0178 |
| 16 | 0.0134 | 0.0239 | 0.0007 | 0.0012 | 0.0027 | 0.0048 | 0.0090 | 0.0160 |
| 17 | 0.0120 | 0.0215 | 0.0006 | 0.0011 | 0.0024 | 0.0043 | 0.0081 | 0.0144 |
| 18 | 0.0108 | 0.0194 | 0.0005 | 0.0010 | 0.0022 | 0.0039 | 0.0073 | 0.0130 |
| 19 | 0.0098 | 0.0174 | 0.0005 | 0.0009 | 0.0020 | 0.0035 | 0.0065 | 0.0117 |
| 20 | 0.0088 | 0.0157 | 0.0004 | 0.0008 | 0.0018 | 0.0031 | 0.0059 | 0.0105 |
| 21 | 0.0079 | 0.0141 | 0.0004 | 0.0007 | 0.0016 | 0.0028 | 0.0053 | 0.0095 |
| 22 | 0.0071 | 0.0127 | 0.0004 | 0.0006 | 0.0014 | 0.0025 | 0.0048 | 0.0085 |
| 23 | 0.0064 | 0.0114 | 0.0003 | 0.0006 | 0.0013 | 0.0023 | 0.0043 | 0.0077 |
| 24 | 0.0058 | 0.0103 | 0.0003 | 0.0005 | 0.0012 | 0.0021 | 0.0039 | 0.0069 |

| APPENDIX C/TABLE 1: AMBIENT RESIDUE LEVELS RESULTING FROM THE AERIAL ULV APPLICATION OF FENTHION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAT | RESIDUE DEPOSITION (ug/cm2) | | TTR FOR DERMAL EXPOSURE (ug/cm2) | | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.0052 | 0.0093 | 0.0003 | 0.0005 | 0.0010 | 0.0019 | 0.0035 | 0.0062 |
| 26 | 0.0047 | 0.0083 | 0.0002 | 0.0004 | 0.0009 | 0.0017 | 0.0031 | 0.0056 |
| 27 | 0.0042 | 0.0075 | 0.0002 | 0.0004 | 0.0008 | 0.0015 | 0.0028 | 0.0050 |
| 28 | 0.0038 | 0.0068 | 0.0002 | 0.0003 | 0.0008 | 0.0014 | 0.0025 | 0.0045 |
| 29 | 0.0034 | 0.0061 | 0.0002 | 0.0003 | 0.0007 | 0.0012 | 0.0023 | 0.0041 |
| 30 | 0.0031 | 0.0055 | 0.0002 | 0.0003 | 0.0006 | 0.0011 | 0.0021 | 0.0037 |
| AVG. | 0.0224 | 0.0400 | 0.0011 | 0.0020 | 0.0045 | 0.0080 | 0.0150 | 0.0268 |

| APPENDIX C/TABLE 2: AMBIENT RESIDUE LEVELS RESULTING FROM GROUND FOGGER APPLICATIONS OF FENTHION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAT | RESIDUE DEPOSITION (ug/cm2) | | TTR FOR DERMAL EXPOSURE (ug/cm2) | | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.008975 | 0.016828 | 0.000449 | 0.000841 | 0.001795 | 0.003366 | 0.0060 | 0.0113 |
| 1 | 0.008078 | 0.015146 | 0.000404 | 0.000757 | 0.001616 | 0.003029 | 0.0054 | 0.0101 |
| 2 | 0.007270 | 0.013631 | 0.000363 | 0.000682 | 0.001454 | 0.002726 | 0.0049 | 0.0091 |
| 3 | 0.006543 | 0.012268 | 0.000327 | 0.000613 | 0.001309 | 0.002454 | 0.0044 | 0.0082 |
| 4 | 0.005889 | 0.011041 | 0.000294 | 0.000552 | 0.001178 | 0.002208 | 0.0039 | 0.0074 |
| 5 | 0.005300 | 0.009937 | 0.000265 | 0.000497 | 0.001060 | 0.001987 | 0.0036 | 0.0067 |
| 6 | 0.004770 | 0.008943 | 0.000238 | 0.000447 | 0.000954 | 0.001789 | 0.0032 | 0.0060 |
| 7 | 0.004293 | 0.008049 | 0.000215 | 0.000402 | 0.000859 | 0.001610 | 0.0029 | 0.0054 |
| 8 | 0.003864 | 0.007244 | 0.000193 | 0.000362 | 0.000773 | 0.001449 | 0.0026 | 0.0049 |
| 9 | 0.003477 | 0.006520 | 0.000174 | 0.000326 | 0.000695 | 0.001304 | 0.0023 | 0.0044 |
| 10 | 0.003129 | 0.005868 | 0.000156 | 0.000293 | 0.000626 | 0.001174 | 0.0021 | 0.0039 |
| 11 | 0.002817 | 0.005281 | 0.000141 | 0.000264 | 0.000563 | 0.001056 | 0.0019 | 0.0035 |
| 12 | 0.002535 | 0.004753 | 0.000127 | 0.000238 | 0.000507 | 0.000951 | 0.0017 | 0.0032 |
| 13 | 0.002281 | 0.004278 | 0.000114 | 0.000214 | 0.000456 | 0.000856 | 0.0015 | 0.0029 |
| 14 | 0.002053 | 0.003850 | 0.000103 | 0.000192 | 0.000411 | 0.000770 | 0.0014 | 0.0026 |
| 15 | 0.001848 | 0.003465 | 0.000092 | 0.000173 | 0.000370 | 0.000693 | 0.0012 | 0.0023 |
| 16 | 0.001663 | 0.003118 | 0.000083 | 0.000156 | 0.000333 | 0.000624 | 0.0011 | 0.0021 |
| 17 | 0.001497 | 0.002807 | 0.000075 | 0.000140 | 0.000299 | 0.000561 | 0.0010 | 0.0019 |
| 18 | 0.001347 | 0.002526 | 0.000067 | 0.000126 | 0.000269 | 0.000505 | 0.0009 | 0.0017 |
| 19 | 0.001212 | 0.002273 | 0.000061 | 0.000114 | 0.000242 | 0.000455 | 0.0008 | 0.0015 |
| 20 | 0.001091 | 0.002046 | 0.000055 | 0.000102 | 0.000218 | 0.000409 | 0.0007 | 0.0014 |
| 21 | 0.000982 | 0.001841 | 0.000049 | 0.000092 | 0.000196 | 0.000368 | 0.0007 | 0.0012 |
| 22 | 0.000884 | 0.001657 | 0.000044 | 0.000083 | 0.000177 | 0.000331 | 0.0006 | 0.0011 |
| 23 | 0.000795 | 0.001491 | 0.000040 | 0.000075 | 0.000159 | 0.000298 | 0.0005 | 0.0010 |
| 24 | 0.000716 | 0.001342 | 0.000036 | 0.000067 | 0.000143 | 0.000268 | 0.0005 | 0.0009 |

| APPENDIX C/TABLE 2: AMBIENT RESIDUE LEVELS RESULTING FROM GROUND FOGGER APPLICATIONS OF FENTHION | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| DAT | RESIDUE DEPOSITION (ug/cm2) | | TTR FOR DERMAL EXPOSURE (ug/cm2) | | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.000644 | 0.001208 | 0.000032 | 0.000060 | 0.000129 | 0.000242 | 0.0004 | 0.0008 |
| 26 | 0.000580 | 0.001087 | 0.000029 | 0.000054 | 0.000116 | 0.000217 | 0.0004 | 0.0007 |
| 27 | 0.000522 | 0.000979 | 0.000026 | 0.000049 | 0.000104 | 0.000196 | 0.0004 | 0.0007 |
| 28 | 0.000470 | 0.000881 | 0.000023 | 0.000044 | 0.000094 | 0.000176 | 0.0003 | 0.0006 |
| 29 | 0.000423 | 0.000793 | 0.000021 | 0.000040 | 0.000085 | 0.000159 | 0.0003 | 0.0005 |
| 30 | 0.000380 | 0.000713 | 0.000019 | 0.000036 | 0.000076 | 0.000143 | 0.0003 | 0.0005 |
| AVG. | 0.002785 | 0.005221 | 0.000139 | 0.000261 | 0.000557 | 0.001044 | 0.0019 | 0.0035 |

| APPENDIX C/TABLE 3: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR ADULTS ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | HIGH EXPOSURE ACTIVITY ADULT DOSE (mg/kg/day) | | HIGH EXPOSURE ACTIVITY MOE | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.00361 | 0.00645 | 4.50e-05 | 8.03e-05 | 1556 | 871 |
| 1 | 0.00325 | 0.00581 | 4.05e-05 | 7.23e-05 | 1729 | 968 |
| 2 | 0.00293 | 0.00523 | 3.64e-05 | 6.51e-05 | 1921 | 1076 |
| 3 | 0.00263 | 0.00470 | 3.28e-05 | 5.86e-05 | 2135 | 1195 |
| 4 | 0.00237 | 0.00423 | 2.95e-05 | 5.27e-05 | 2372 | 1328 |
| 5 | 0.00213 | 0.00381 | 2.66e-05 | 4.74e-05 | 2635 | 1476 |
| 6 | 0.00192 | 0.00343 | 2.39e-05 | 4.27e-05 | 2928 | 1640 |
| 7 | 0.00173 | 0.00309 | 2.15e-05 | 3.84e-05 | 3254 | 1822 |
| 8 | 0.00156 | 0.00278 | 1.94e-05 | 3.46e-05 | 3615 | 2024 |
| 9 | 0.00140 | 0.00250 | 1.74e-05 | 3.11e-05 | 4017 | 2249 |
| 10 | 0.00126 | 0.00225 | 1.57e-05 | 2.80e-05 | 4463 | 2499 |
| 11 | 0.00113 | 0.00202 | 1.41e-05 | 2.52e-05 | 4959 | 2777 |
| 12 | 0.00102 | 0.00182 | 1.27e-05 | 2.27e-05 | 5510 | 3086 |
| 13 | 0.00092 | 0.00164 | 1.14e-05 | 2.04e-05 | 6122 | 3428 |
| 14 | 0.00083 | 0.00148 | 1.03e-05 | 1.84e-05 | 6802 | 3809 |
| 15 | 0.00074 | 0.00133 | 9.26e-06 | 1.65e-05 | 7558 | 4233 |
| 16 | 0.00067 | 0.00120 | 8.34e-06 | 1.49e-05 | 8398 | 4703 |
| 17 | 0.00060 | 0.00108 | 7.50e-06 | 1.34e-05 | 9331 | 5225 |
| 18 | 0.00054 | 0.00097 | 6.75e-06 | 1.21e-05 | 10368 | 5806 |
| 19 | 0.00049 | 0.00087 | 6.08e-06 | 1.09e-05 | 11520 | 6451 |
| 20 | 0.00044 | 0.00078 | 5.47e-06 | 9.77e-06 | 12800 | 7168 |
| 21 | 0.00040 | 0.00071 | 4.92e-06 | 8.79e-06 | 14222 | 7964 |
| 22 | 0.00036 | 0.00064 | 4.43e-06 | 7.91e-06 | 15802 | 8849 |
| 23 | 0.00032 | 0.00057 | 3.99e-06 | 7.12e-06 | 17558 | 9832 |
| 24 | 0.00029 | 0.00051 | 3.59e-06 | 6.41e-06 | 19509 | 10925 |

| APPENDIX C/TABLE 3: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR ADULTS ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | HIGH EXPOSURE ACTIVITY ADULT DOSE (mg/kg/day) | | HIGH EXPOSURE ACTIVITY MOE | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.00026 | 0.00046 | 3.23e-06 | 5.77e-06 | 21677 | 12139 |
| 26 | 0.00023 | 0.00042 | 2.91e-06 | 5.19e-06 | 24085 | 13488 |
| 27 | 0.00021 | 0.00038 | 2.62e-06 | 4.67e-06 | 26761 | 14986 |
| 28 | 0.00019 | 0.00034 | 2.35e-06 | 4.20e-06 | 29735 | 16651 |
| 29 | 0.00017 | 0.00030 | 2.12e-06 | 3.78e-06 | 33038 | 18502 |
| 30 | 0.00015 | 0.00027 | 1.91e-06 | 3.41e-06 | 36709 | 20557 |
| AVG. | 0.00112 | 0.00200 | 1.40e-05 | 2.49e-05 | 1433 | 802 |

| APPENDIX C/TABLE 4: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR ADULTS ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | HIGH EXPOSURE ACTIVITY ADULT DOSE (mg/kg/day) | | HIGH EXPOSURE ACTIVITY MOE | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.000449 | 0.000841 | 5.59e-06 | 1.05e-05 | 12527 | 6681 |
| 1 | 0.000404 | 0.000757 | 5.03e-06 | 9.43e-06 | 13919 | 7423 |
| 2 | 0.000363 | 0.000682 | 4.53e-06 | 8.49e-06 | 15465 | 8248 |
| 3 | 0.000327 | 0.000613 | 4.07e-06 | 7.64e-06 | 17184 | 9165 |
| 4 | 0.000294 | 0.000552 | 3.67e-06 | 6.87e-06 | 19093 | 10183 |
| 5 | 0.000265 | 0.000497 | 3.30e-06 | 6.19e-06 | 21215 | 11314 |
| 6 | 0.000238 | 0.000447 | 2.97e-06 | 5.57e-06 | 23572 | 12572 |
| 7 | 0.000215 | 0.000402 | 2.67e-06 | 5.01e-06 | 26191 | 13969 |
| 8 | 0.000193 | 0.000362 | 2.41e-06 | 4.51e-06 | 29101 | 15521 |
| 9 | 0.000174 | 0.000326 | 2.16e-06 | 4.06e-06 | 32335 | 17245 |
| 10 | 0.000156 | 0.000293 | 1.95e-06 | 3.65e-06 | 35927 | 19161 |
| 11 | 0.000141 | 0.000264 | 1.75e-06 | 3.29e-06 | 39919 | 21290 |
| 12 | 0.000127 | 0.000238 | 1.58e-06 | 2.96e-06 | 44355 | 23656 |
| 13 | 0.000114 | 0.000214 | 1.42e-06 | 2.66e-06 | 49283 | 26284 |
| 14 | 0.000103 | 0.000192 | 1.28e-06 | 2.40e-06 | 54759 | 29205 |
| 15 | 0.000092 | 0.000173 | 1.15e-06 | 2.16e-06 | 60843 | 32450 |
| 16 | 0.000083 | 0.000156 | 1.04e-06 | 1.94e-06 | 67603 | 36055 |
| 17 | 0.000075 | 0.000140 | 9.32e-07 | 1.75e-06 | 75115 | 40061 |
| 18 | 0.000067 | 0.000126 | 8.39e-07 | 1.57e-06 | 83461 | 44513 |
| 19 | 0.000061 | 0.000114 | 7.55e-07 | 1.42e-06 | 92734 | 49458 |
| 20 | 0.000055 | 0.000102 | 6.79e-07 | 1.27e-06 | 103038 | 54954 |
| 21 | 0.000049 | 0.000092 | 6.11e-07 | 1.15e-06 | 114487 | 61060 |
| 22 | 0.000044 | 0.000083 | 5.50e-07 | 1.03e-06 | 127208 | 67844 |
| 23 | 0.000040 | 0.000075 | 4.95e-07 | 9.29e-07 | 141342 | 75382 |
| 24 | 0.000036 | 0.000067 | 4.46e-07 | 8.36e-07 | 157047 | 83758 |

| APPENDIX C/TABLE 4: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR ADULTS ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | HIGH EXPOSURE ACTIVITY ADULT DOSE (mg/kg/day) | | HIGH EXPOSURE ACTIVITY MOE | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.000032 | 0.000060 | 4.01e-07 | 7.52e-07 | 174496 | 93065 |
| 26 | 0.000029 | 0.000054 | 3.61e-07 | 6.77e-07 | 193885 | 103405 |
| 27 | 0.000026 | 0.000049 | 3.25e-07 | 6.09e-07 | 215427 | 114895 |
| 28 | 0.000023 | 0.000044 | 2.92e-07 | 5.48e-07 | 239364 | 127661 |
| 29 | 0.000021 | 0.000040 | 2.63e-07 | 4.94e-07 | 265960 | 141845 |
| 30 | 0.000019 | 0.000036 | 2.37e-07 | 4.44e-07 | 295511 | 157606 |
| AVG. | 0.000139 | 0.000261 | 1.73e-06 | 3.25e-06 | 11535 | 6152 |

| APPENDIX C/TABLE 5: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR TODDLERS ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | DERMAL DOSE FOR TODDLERS (mg/kg/day) | | TODDLER DERMAL EXPOSURE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.00361 | 0.00645 | 4.19e-05 | 7.49e-05 | 1670 | 935 |
| 1 | 0.00325 | 0.00581 | 3.77e-05 | 6.74e-05 | 1855 | 1039 |
| 2 | 0.00293 | 0.00523 | 3.40e-05 | 6.06e-05 | 2061 | 1154 |
| 3 | 0.00263 | 0.00470 | 3.06e-05 | 5.46e-05 | 2290 | 1283 |
| 4 | 0.00237 | 0.00423 | 2.75e-05 | 4.91e-05 | 2545 | 1425 |
| 5 | 0.00213 | 0.00381 | 2.48e-05 | 4.42e-05 | 2827 | 1583 |
| 6 | 0.00192 | 0.00343 | 2.23e-05 | 3.98e-05 | 3142 | 1759 |
| 7 | 0.00173 | 0.00309 | 2.01e-05 | 3.58e-05 | 3491 | 1955 |
| 8 | 0.00156 | 0.00278 | 1.80e-05 | 3.22e-05 | 3879 | 2172 |
| 9 | 0.00140 | 0.00250 | 1.62e-05 | 2.90e-05 | 4310 | 2413 |
| 10 | 0.00126 | 0.00225 | 1.46e-05 | 2.61e-05 | 4788 | 2681 |
| 11 | 0.00113 | 0.00202 | 1.32e-05 | 2.35e-05 | 5320 | 2979 |
| 12 | 0.00102 | 0.00182 | 1.18e-05 | 2.11e-05 | 5912 | 3310 |
| 13 | 0.00092 | 0.00164 | 1.07e-05 | 1.90e-05 | 6568 | 3678 |
| 14 | 0.00083 | 0.00148 | 9.59e-06 | 1.71e-05 | 7298 | 4087 |
| 15 | 0.00074 | 0.00133 | 8.63e-06 | 1.54e-05 | 8109 | 4541 |
| 16 | 0.00067 | 0.00120 | 7.77e-06 | 1.39e-05 | 9010 | 5046 |
| 17 | 0.00060 | 0.00108 | 6.99e-06 | 1.25e-05 | 10011 | 5606 |
| 18 | 0.00054 | 0.00097 | 6.29e-06 | 1.12e-05 | 11124 | 6229 |
| 19 | 0.00049 | 0.00087 | 5.66e-06 | 1.01e-05 | 12360 | 6921 |
| 20 | 0.00044 | 0.00078 | 5.10e-06 | 9.10e-06 | 13733 | 7690 |
| 21 | 0.00040 | 0.00071 | 4.59e-06 | 8.19e-06 | 15259 | 8545 |
| 22 | 0.00036 | 0.00064 | 4.13e-06 | 7.37e-06 | 16954 | 9494 |
| 23 | 0.00032 | 0.00057 | 3.72e-06 | 6.64e-06 | 18838 | 10549 |
| 24 | 0.00029 | 0.00051 | 3.34e-06 | 5.97e-06 | 20931 | 11721 |

| APPENDIX C/TABLE 5: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR TODDLERS ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | DERMAL DOSE FOR TODDLERS (mg/kg/day) | | TODDLER DERMAL EXPOSURE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.00026 | 0.00046 | 3.01e-06 | 5.37e-06 | 23257 | 13024 |
| 26 | 0.00023 | 0.00042 | 2.71e-06 | 4.84e-06 | 25841 | 14471 |
| 27 | 0.00021 | 0.00038 | 2.44e-06 | 4.35e-06 | 28712 | 16079 |
| 28 | 0.00019 | 0.00034 | 2.19e-06 | 3.92e-06 | 31902 | 17865 |
| 29 | 0.00017 | 0.00030 | 1.97e-06 | 3.53e-06 | 35447 | 19850 |
| 30 | 0.00015 | 0.00027 | 1.78e-06 | 3.17e-06 | 39386 | 22056 |
| AVG. | 0.00112 | 0.00200 | 1.30e-05 | 2.32e-05 | 1537 | 861 |

| APPENDIX C/TABLE 6: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR TODDLERS ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | DERMAL DOSE FOR TODDLERS (mg/kg/day) | | TODDLER DERMAL EXPOSURE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.000449 | 0.000841 | 5.21e-06 | 9.77e-06 | 13440 | 7168 |
| 1 | 0.000404 | 0.000757 | 4.69e-06 | 8.79e-06 | 14934 | 7965 |
| 2 | 0.000363 | 0.000682 | 4.22e-06 | 7.91e-06 | 16593 | 8850 |
| 3 | 0.000327 | 0.000613 | 3.80e-06 | 7.12e-06 | 18437 | 9833 |
| 4 | 0.000294 | 0.000552 | 3.42e-06 | 6.41e-06 | 20485 | 10925 |
| 5 | 0.000265 | 0.000497 | 3.08e-06 | 5.77e-06 | 22761 | 12139 |
| 6 | 0.000238 | 0.000447 | 2.77e-06 | 5.19e-06 | 25290 | 13488 |
| 7 | 0.000215 | 0.000402 | 2.49e-06 | 4.67e-06 | 28100 | 14987 |
| 8 | 0.000193 | 0.000362 | 2.24e-06 | 4.20e-06 | 31223 | 16652 |
| 9 | 0.000174 | 0.000326 | 2.02e-06 | 3.78e-06 | 34692 | 18502 |
| 10 | 0.000156 | 0.000293 | 1.82e-06 | 3.41e-06 | 38547 | 20558 |
| 11 | 0.000141 | 0.000264 | 1.63e-06 | 3.06e-06 | 42830 | 22842 |
| 12 | 0.000127 | 0.000238 | 1.47e-06 | 2.76e-06 | 47588 | 25380 |
| 13 | 0.000114 | 0.000214 | 1.32e-06 | 2.48e-06 | 52876 | 28200 |
| 14 | 0.000103 | 0.000192 | 1.19e-06 | 2.23e-06 | 58751 | 31334 |
| 15 | 0.000092 | 0.000173 | 1.07e-06 | 2.01e-06 | 65279 | 34815 |
| 16 | 0.000083 | 0.000156 | 9.65e-07 | 1.81e-06 | 72532 | 38684 |
| 17 | 0.000075 | 0.000140 | 8.69e-07 | 1.63e-06 | 80591 | 42982 |
| 18 | 0.000067 | 0.000126 | 7.82e-07 | 1.47e-06 | 89546 | 47758 |
| 19 | 0.000061 | 0.000114 | 7.04e-07 | 1.32e-06 | 99495 | 53064 |
| 20 | 0.000055 | 0.000102 | 6.33e-07 | 1.19e-06 | 110550 | 58960 |
| 21 | 0.000049 | 0.000092 | 5.70e-07 | 1.07e-06 | 122834 | 65511 |
| 22 | 0.000044 | 0.000083 | 5.13e-07 | 9.62e-07 | 136482 | 72790 |
| 23 | 0.000040 | 0.000075 | 4.62e-07 | 8.66e-07 | 151647 | 80878 |
| 24 | 0.000036 | 0.000067 | 4.15e-07 | 7.79e-07 | 168496 | 89865 |

| APPENDIX C/TABLE 6: MOES ATTRIBUTABLE TO DERMAL EXPOSURE FOR TODDLERS ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR DERMAL EXPOSURE (ug/cm2) | | DERMAL DOSE FOR TODDLERS (mg/kg/day) | | TODDLER DERMAL EXPOSURE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.000032 | 0.000060 | 3.74e-07 | 7.01e-07 | 187218 | 99850 |
| 26 | 0.000029 | 0.000054 | 3.37e-07 | 6.31e-07 | 208020 | 110944 |
| 27 | 0.000026 | 0.000049 | 3.03e-07 | 5.68e-07 | 231134 | 123271 |
| 28 | 0.000023 | 0.000044 | 2.73e-07 | 5.11e-07 | 256815 | 136968 |
| 29 | 0.000021 | 0.000040 | 2.45e-07 | 4.60e-07 | 285350 | 152187 |
| 30 | 0.000019 | 0.000036 | 2.21e-07 | 4.14e-07 | 317056 | 169096 |
| AVG. | 0.000139 | 0.000261 | 1.62e-06 | 3.03e-06 | 12377 | 6601 |

10/8/16

| APPENDIX C/TABLE 7: MOES ATTRIBUTABLE TO TODDLER HAND-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | HAND-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER HAND-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.01445 | 0.02580 | 7.71e-04 | 1.38e-03 | 91 | 51 |
| 1 | 0.01301 | 0.02322 | 6.94e-04 | 1.24e-03 | 101 | 57 |
| 2 | 0.01170 | 0.02090 | 6.24e-04 | 1.11e-03 | 112 | 63 |
| 3 | 0.01053 | 0.01881 | 5.62e-04 | 1.00e-03 | 125 | 70 |
| 4 | 0.00948 | 0.01693 | 5.06e-04 | 9.03e-04 | 138 | 78 |
| 5 | 0.00853 | 0.01524 | 4.55e-04 | 8.13e-04 | 154 | 86 |
| 6 | 0.00768 | 0.01371 | 4.10e-04 | 7.31e-04 | 171 | 96 |
| 7 | 0.00691 | 0.01234 | 3.69e-04 | 6.58e-04 | 190 | 106 |
| 8 | 0.00622 | 0.01111 | 3.32e-04 | 5.92e-04 | 211 | 118 |
| 9 | 0.00560 | 0.01000 | 2.99e-04 | 5.33e-04 | 234 | 131 |
| 10 | 0.00504 | 0.00900 | 2.69e-04 | 4.80e-04 | 260 | 146 |
| 11 | 0.00453 | 0.00810 | 2.42e-04 | 4.32e-04 | 289 | 162 |
| 12 | 0.00408 | 0.00729 | 2.18e-04 | 3.89e-04 | 322 | 180 |
| 13 | 0.00367 | 0.00656 | 1.96e-04 | 3.50e-04 | 357 | 200 |
| 14 | 0.00331 | 0.00590 | 1.76e-04 | 3.15e-04 | 397 | 222 |
| 15 | 0.00298 | 0.00531 | 1.59e-04 | 2.83e-04 | 441 | 247 |
| 16 | 0.00268 | 0.00478 | 1.43e-04 | 2.55e-04 | 490 | 274 |
| 17 | 0.00241 | 0.00430 | 1.29e-04 | 2.30e-04 | 545 | 305 |
| 18 | 0.00217 | 0.00387 | 1.16e-04 | 2.07e-04 | 605 | 339 |
| 19 | 0.00195 | 0.00349 | 1.04e-04 | 1.86e-04 | 672 | 377 |
| 20 | 0.00176 | 0.00314 | 9.37e-05 | 1.67e-04 | 747 | 418 |
| 21 | 0.00158 | 0.00282 | 8.43e-05 | 1.51e-04 | 830 | 465 |
| 22 | 0.00142 | 0.00254 | 7.59e-05 | 1.36e-04 | 922 | 517 |
| 23 | 0.00128 | 0.00229 | 6.83e-05 | 1.22e-04 | 1025 | 574 |
| 24 | 0.00115 | 0.00206 | 6.15e-05 | 1.10e-04 | 1139 | 638 |

| APPENDIX C/TABLE 7: MOES ATTRIBUTABLE TO TODDLER HAND-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | HAND-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER HAND-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.00104 | 0.00185 | 5.53e-05 | 9.88e-05 | 1265 | 709 |
| 26 | 0.00093 | 0.00167 | 4.98e-05 | 8.89e-05 | 1406 | 787 |
| 27 | 0.00084 | 0.00150 | 4.48e-05 | 8.00e-05 | 1562 | 875 |
| 28 | 0.00076 | 0.00135 | 4.03e-05 | 7.20e-05 | 1736 | 972 |
| 29 | 0.00068 | 0.00122 | 3.63e-05 | 6.48e-05 | 1928 | 1080 |
| 30 | 0.00061 | 0.00109 | 3.27e-05 | 5.83e-05 | 2143 | 1200 |
| AVG. | 0.00448 | 0.00801 | 2.39e-04 | 4.27e-04 | 84 | 47 |

| APPENDIX C/TABLE 8: MOES ATTRIBUTABLE TO TODDLER HAND-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | HAND-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER HAND-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.00180 | 0.00337 | 9.57e-05 | 1.80e-04 | 731 | 390 |
| 1 | 0.00162 | 0.00303 | 8.62e-05 | 1.62e-04 | 812 | 433 |
| 2 | 0.00145 | 0.00273 | 7.75e-05 | 1.45e-04 | 903 | 481 |
| 3 | 0.00131 | 0.00245 | 6.98e-05 | 1.31e-04 | 1003 | 535 |
| 4 | 0.00118 | 0.00221 | 6.28e-05 | 1.18e-04 | 1114 | 594 |
| 5 | 0.00106 | 0.00199 | 5.65e-05 | 1.06e-04 | 1238 | 660 |
| 6 | 0.00095 | 0.00179 | 5.09e-05 | 9.54e-05 | 1376 | 734 |
| 7 | 0.00086 | 0.00161 | 4.58e-05 | 8.59e-05 | 1529 | 815 |
| 8 | 0.00077 | 0.00145 | 4.12e-05 | 7.73e-05 | 1699 | 906 |
| 9 | 0.00070 | 0.00130 | 3.71e-05 | 6.95e-05 | 1887 | 1007 |
| 10 | 0.00063 | 0.00117 | 3.34e-05 | 6.26e-05 | 2097 | 1118 |
| 11 | 0.00056 | 0.00106 | 3.00e-05 | 5.63e-05 | 2330 | 1243 |
| 12 | 0.00051 | 0.00095 | 2.70e-05 | 5.07e-05 | 2589 | 1381 |
| 13 | 0.00046 | 0.00086 | 2.43e-05 | 4.56e-05 | 2877 | 1534 |
| 14 | 0.00041 | 0.00077 | 2.19e-05 | 4.11e-05 | 3196 | 1705 |
| 15 | 0.00037 | 0.00069 | 1.97e-05 | 3.70e-05 | 3551 | 1894 |
| 16 | 0.00033 | 0.00062 | 1.77e-05 | 3.33e-05 | 3946 | 2104 |
| 17 | 0.00030 | 0.00056 | 1.60e-05 | 2.99e-05 | 4384 | 2338 |
| 18 | 0.00027 | 0.00051 | 1.44e-05 | 2.69e-05 | 4871 | 2598 |
| 19 | 0.00024 | 0.00045 | 1.29e-05 | 2.42e-05 | 5413 | 2887 |
| 20 | 0.00022 | 0.00041 | 1.16e-05 | 2.18e-05 | 6014 | 3208 |
| 21 | 0.00020 | 0.00037 | 1.05e-05 | 1.96e-05 | 6682 | 3564 |
| 22 | 0.00018 | 0.00033 | 9.43e-06 | 1.77e-05 | 7425 | 3960 |
| 23 | 0.00016 | 0.00030 | 8.48e-06 | 1.59e-05 | 8250 | 4400 |
| 24 | 0.00014 | 0.00027 | 7.64e-06 | 1.43e-05 | 9167 | 4889 |

| APPENDIX C/TABLE 8: MOES ATTRIBUTABLE TO TODDLER HAND-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | HAND-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER HAND-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.00013 | 0.00024 | 6.87e-06 | 1.29e-05 | 10185 | 5432 |
| 26 | 0.00012 | 0.00022 | 6.19e-06 | 1.16e-05 | 11317 | 6036 |
| 27 | 0.00010 | 0.00020 | 5.57e-06 | 1.04e-05 | 12574 | 6706 |
| 28 | 0.00009 | 0.00018 | 5.01e-06 | 9.39e-06 | 13971 | 7451 |
| 29 | 0.00008 | 0.00016 | 4.51e-06 | 8.45e-06 | 15524 | 8279 |
| 30 | 0.00008 | 0.00014 | 4.06e-06 | 7.61e-06 | 17249 | 9199 |
| AVG. | 0.00056 | 0.00104 | 2.97e-05 | 5.57e-05 | 673 | 359 |

9/1/16

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| APPENDIX C/TABLE 9: MOES ATTRIBUTABLE TO TODDLER OBJECT-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | OBJECT-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER OBJECT-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.01445 | 0.02580 | 2.41e-05 | 4.30e-05 | 2907 | 1628 |
| 1 | 0.01301 | 0.02322 | 2.17e-05 | 3.87e-05 | 3230 | 1809 |
| 2 | 0.01170 | 0.02090 | 1.95e-05 | 3.48e-05 | 3588 | 2009 |
| 3 | 0.01053 | 0.01881 | 1.76e-05 | 3.14e-05 | 3987 | 2233 |
| 4 | 0.00948 | 0.01693 | 1.58e-05 | 2.82e-05 | 4430 | 2481 |
| 5 | 0.00853 | 0.01524 | 1.42e-05 | 2.54e-05 | 4922 | 2756 |
| 6 | 0.00768 | 0.01371 | 1.28e-05 | 2.29e-05 | 5469 | 3063 |
| 7 | 0.00691 | 0.01234 | 1.15e-05 | 2.06e-05 | 6077 | 3403 |
| 8 | 0.00622 | 0.01111 | 1.04e-05 | 1.85e-05 | 6752 | 3781 |
| 9 | 0.00560 | 0.01000 | 9.33e-06 | 1.67e-05 | 7502 | 4201 |
| 10 | 0.00504 | 0.00900 | 8.40e-06 | 1.50e-05 | 8336 | 4668 |
| 11 | 0.00453 | 0.00810 | 7.56e-06 | 1.35e-05 | 9262 | 5187 |
| 12 | 0.00408 | 0.00729 | 6.80e-06 | 1.21e-05 | 10291 | 5763 |
| 13 | 0.00367 | 0.00656 | 6.12e-06 | 1.09e-05 | 11435 | 6403 |
| 14 | 0.00331 | 0.00590 | 5.51e-06 | 9.84e-06 | 12705 | 7115 |
| 15 | 0.00298 | 0.00531 | 4.96e-06 | 8.85e-06 | 14117 | 7906 |
| 16 | 0.00268 | 0.00478 | 4.46e-06 | 7.97e-06 | 15686 | 8784 |
| 17 | 0.00241 | 0.00430 | 4.02e-06 | 7.17e-06 | 17428 | 9760 |
| 18 | 0.00217 | 0.00387 | 3.61e-06 | 6.46e-06 | 19365 | 10844 |
| 19 | 0.00195 | 0.00349 | 3.25e-06 | 5.81e-06 | 21517 | 12049 |
| 20 | 0.00176 | 0.00314 | 2.93e-06 | 5.23e-06 | 23907 | 13388 |
| 21 | 0.00158 | 0.00282 | 2.64e-06 | 4.71e-06 | 26564 | 14876 |
| 22 | 0.00142 | 0.00254 | 2.37e-06 | 4.24e-06 | 29515 | 16529 |
| 23 | 0.00128 | 0.00229 | 2.13e-06 | 3.81e-06 | 32795 | 18365 |
| 24 | 0.00115 | 0.00206 | 1.92e-06 | 3.43e-06 | 36439 | 20406 |

| APPENDIX C/TABLE 9: MOES ATTRIBUTABLE TO TODDLER OBJECT-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | OBJECT-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER OBJECT-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.00104 | 0.00185 | 1.73e-06 | 3.09e-06 | 40487 | 22673 |
| 26 | 0.00093 | 0.00167 | 1.56e-06 | 2.78e-06 | 44986 | 25192 |
| 27 | 0.00084 | 0.00150 | 1.40e-06 | 2.50e-06 | 49984 | 27991 |
| 28 | 0.00076 | 0.00135 | 1.26e-06 | 2.25e-06 | 55538 | 31101 |
| 29 | 0.00068 | 0.00122 | 1.13e-06 | 2.03e-06 | 61709 | 34557 |
| 30 | 0.00061 | 0.00109 | 1.02e-06 | 1.82e-06 | 68566 | 38397 |
| AVG. | 0.00448 | 0.00801 | 7.47e-06 | 1.33e-05 | 2677 | 1499 |

10/29/96

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| APPENDIX C/TABLE 10: MOES ATTRIBUTABLE TO TODDLER OBJECT-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | OBJECT-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER OBJECT-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.00180 | 0.00337 | 2.99e-06 | 5.61e-06 | 23398 | 12479 |
| 1 | 0.00162 | 0.00303 | 2.69e-06 | 5.05e-06 | 25998 | 13865 |
| 2 | 0.00145 | 0.00273 | 2.42e-06 | 4.54e-06 | 28886 | 15406 |
| 3 | 0.00131 | 0.00245 | 2.18e-06 | 4.09e-06 | 32096 | 17118 |
| 4 | 0.00118 | 0.00221 | 1.96e-06 | 3.68e-06 | 35662 | 19020 |
| 5 | 0.00106 | 0.00199 | 1.77e-06 | 3.31e-06 | 39625 | 21133 |
| 6 | 0.00095 | 0.00179 | 1.59e-06 | 2.98e-06 | 44027 | 23481 |
| 7 | 0.00086 | 0.00161 | 1.43e-06 | 2.68e-06 | 48919 | 26090 |
| 8 | 0.00077 | 0.00145 | 1.29e-06 | 2.41e-06 | 54355 | 28989 |
| 9 | 0.00070 | 0.00130 | 1.16e-06 | 2.17e-06 | 60394 | 32210 |
| 10 | 0.00063 | 0.00117 | 1.04e-06 | 1.96e-06 | 67105 | 35789 |
| 11 | 0.00056 | 0.00106 | 9.39e-07 | 1.76e-06 | 74561 | 39766 |
| 12 | 0.00051 | 0.00095 | 8.45e-07 | 1.58e-06 | 82845 | 44184 |
| 13 | 0.00046 | 0.00086 | 7.60e-07 | 1.43e-06 | 92050 | 49093 |
| 14 | 0.00041 | 0.00077 | 6.84e-07 | 1.28e-06 | 102278 | 54548 |
| 15 | 0.00037 | 0.00069 | 6.16e-07 | 1.15e-06 | 113642 | 60609 |
| 16 | 0.00033 | 0.00062 | 5.54e-07 | 1.04e-06 | 126269 | 67343 |
| 17 | 0.00030 | 0.00056 | 4.99e-07 | 9.36e-07 | 140299 | 74826 |
| 18 | 0.00027 | 0.00051 | 4.49e-07 | 8.42e-07 | 155888 | 83140 |
| 19 | 0.00024 | 0.00045 | 4.04e-07 | 7.58e-07 | 173209 | 92378 |
| 20 | 0.00022 | 0.00041 | 3.64e-07 | 6.82e-07 | 192454 | 102642 |
| 21 | 0.00020 | 0.00037 | 3.27e-07 | 6.14e-07 | 213838 | 114047 |
| 22 | 0.00018 | 0.00033 | 2.95e-07 | 5.52e-07 | 237597 | 126719 |
| 23 | 0.00016 | 0.00030 | 2.65e-07 | 4.97e-07 | 263997 | 140799 |
| 24 | 0.00014 | 0.00027 | 2.39e-07 | 4.47e-07 | 293330 | 156443 |

| APPENDIX C/TABLE 10: MOES ATTRIBUTABLE TO TODDLER OBJECT-TO-MOUTH BEHAVIOR ON TURF TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | TTR FOR NONDIETARY INGESTION EXPOSURE (ug/cm2) | | OBJECT-TO-MOUTH DOSE FOR TODDLERS (mg/kg/day) | | TODDLER OBJECT-TO-MOUTH MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.00013 | 0.00024 | 2.15e-07 | 4.03e-07 | 325922 | 173825 |
| 26 | 0.00012 | 0.00022 | 1.93e-07 | 3.62e-07 | 362136 | 193139 |
| 27 | 0.00010 | 0.00020 | 1.74e-07 | 3.26e-07 | 402373 | 214599 |
| 28 | 0.00009 | 0.00018 | 1.57e-07 | 2.94e-07 | 447082 | 238444 |
| 29 | 0.00008 | 0.00016 | 1.41e-07 | 2.64e-07 | 496757 | 264937 |
| 30 | 0.00008 | 0.00014 | 1.27e-07 | 2.38e-07 | 551953 | 294375 |
| AVG. | 0.00056 | 0.00104 | 9.28e-07 | 1.74e-06 | 21546 | 11491 |

9/12/96

| APPENDIX C/TABLE 11: MOES ATTA[illegible] TABLE TO TODDLER SOIL INGESTION IN AREAS TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | | SOIL INGESTION DOSE FOR TODDLERS (mg/kg/day) | | TODDLER SOIL INGESTION MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.0484 | 0.0864 | 3.23e-07 | 5.76e-07 | 216908 | 121469 |
| 1 | 0.0436 | 0.0778 | 2.90e-07 | 5.19e-07 | 241009 | 134965 |
| 2 | 0.0392 | 0.0700 | 2.61e-07 | 4.67e-07 | 267788 | 149961 |
| 3 | 0.0353 | 0.0630 | 2.35e-07 | 4.20e-07 | 297542 | 166624 |
| 4 | 0.0318 | 0.0567 | 2.12e-07 | 3.78e-07 | 330603 | 185137 |
| 5 | 0.0286 | 0.0510 | 1.91e-07 | 3.40e-07 | 367336 | 205708 |
| 6 | 0.0257 | 0.0459 | 1.72e-07 | 3.06e-07 | 408151 | 228565 |
| 7 | 0.0232 | 0.0413 | 1.54e-07 | 2.76e-07 | 453502 | 253961 |
| 8 | 0.0208 | 0.0372 | 1.39e-07 | 2.48e-07 | 503891 | 282179 |
| 9 | 0.0188 | 0.0335 | 1.25e-07 | 2.23e-07 | 559878 | 313532 |
| 10 | 0.0169 | 0.0301 | 1.13e-07 | 2.01e-07 | 622087 | 348369 |
| 11 | 0.0152 | 0.0271 | 1.01e-07 | 1.81e-07 | 691208 | 387076 |
| 12 | 0.0137 | 0.0244 | 9.11e-08 | 1.63e-07 | 768009 | 430085 |
| 13 | 0.0123 | 0.0220 | 8.20e-08 | 1.46e-07 | 853343 | 477872 |
| 14 | 0.0111 | 0.0198 | 7.38e-08 | 1.32e-07 | 948159 | 530969 |
| 15 | 0.0100 | 0.0178 | 6.64e-08 | 1.19e-07 | 1053510 | 589966 |
| 16 | 0.0090 | 0.0160 | 5.98e-08 | 1.07e-07 | 1170567 | 655517 |
| 17 | 0.0081 | 0.0144 | 5.38e-08 | 9.61e-08 | 1300630 | 728353 |
| 18 | 0.0073 | 0.0130 | 4.84e-08 | 8.65e-08 | 1445144 | 809281 |
| 19 | 0.0065 | 0.0117 | 4.36e-08 | 7.78e-08 | 1605716 | 899201 |
| 20 | 0.0059 | 0.0105 | 3.92e-08 | 7.01e-08 | 1784129 | 999112 |
| 21 | 0.0053 | 0.0095 | 3.53e-08 | 6.31e-08 | 1982365 | 1110125 |
| 22 | 0.0048 | 0.0085 | 3.18e-08 | 5.68e-08 | 2202628 | 1233472 |
| 23 | 0.0043 | 0.0077 | 2.86e-08 | 5.11e-08 | 2447364 | 1370524 |
| 24 | 0.0039 | 0.0069 | 2.57e-08 | 4.60e-08 | 2719294 | 1522805 |

| APPENDIX C/TABLE 11: MOES ATTRIBUTABLE TO TODDLER SOIL INGESTION IN AREAS TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | |
|---|---|---|---|---|---|---|
| DAT | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | | SOIL INGESTION DOSE FOR TODDLERS (mg/kg/day) | | TODDLER SOIL INGESTION MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.0035 | 0.0062 | 2.32e-08 | 4.14e-08 | 3021438 | 1692005 |
| 26 | 0.0031 | 0.0056 | 2.09e-08 | 3.72e-08 | 3357153 | 1880006 |
| 27 | 0.0028 | 0.0050 | 1.88e-08 | 3.35e-08 | 3730170 | 2088895 |
| 28 | 0.0025 | 0.0045 | 1.69e-08 | 3.02e-08 | 4144633 | 2320995 |
| 29 | 0.0023 | 0.0041 | 1.52e-08 | 2.71e-08 | 4605148 | 2578883 |
| 30 | 0.0021 | 0.0037 | 1.37e-08 | 2.44e-08 | 5116831 | 2865425 |
| AVG. | 0.0150 | 0.0268 | 1.00e-07 | 1.79e-07 | 199739 | 111854 |

9/16/11

| APPENDIX C/TABLE 12: MOES ATTRIBUTABLE TO TODDLER SOIL INGESTION IN AREAS TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | | SOIL INGESTION DOSE FOR TODDLERS (mg/kg/day) | | TODDLER SOIL INGESTION MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 0.00601 | 0.01128 | 4.01e-08 | 7.52e-08 | 1746113 | 931260 |
| 1 | 0.00541 | 0.01015 | 3.61e-08 | 6.77e-08 | 1940125 | 1034733 |
| 2 | 0.00487 | 0.00913 | 3.25e-08 | 6.09e-08 | 2155695 | 1149704 |
| 3 | 0.00438 | 0.00822 | 2.92e-08 | 5.48e-08 | 2395216 | 1277449 |
| 4 | 0.00395 | 0.00740 | 2.63e-08 | 4.93e-08 | 2661351 | 1419387 |
| 5 | 0.00355 | 0.00666 | 2.37e-08 | 4.44e-08 | 2957057 | 1577097 |
| 6 | 0.00320 | 0.00599 | 2.13e-08 | 3.99e-08 | 3285619 | 1752330 |
| 7 | 0.00288 | 0.00539 | 1.92e-08 | 3.60e-08 | 3650688 | 1947033 |
| 8 | 0.00259 | 0.00485 | 1.73e-08 | 3.24e-08 | 4056320 | 2163370 |
| 9 | 0.00233 | 0.00437 | 1.55e-08 | 2.91e-08 | 4507022 | 2403745 |
| 10 | 0.00210 | 0.00393 | 1.40e-08 | 2.62e-08 | 5007802 | 2670828 |
| 11 | 0.00189 | 0.00354 | 1.26e-08 | 2.36e-08 | 5564224 | 2967586 |
| 12 | 0.00170 | 0.00318 | 1.13e-08 | 2.12e-08 | 6182472 | 3297318 |
| 13 | 0.00153 | 0.00287 | 1.02e-08 | 1.91e-08 | 6869413 | 3663687 |
| 14 | 0.00138 | 0.00258 | 9.17e-09 | 1.72e-08 | 7632681 | 4070763 |
| 15 | 0.00124 | 0.00232 | 8.25e-09 | 1.55e-08 | 8480757 | 4523070 |
| 16 | 0.00111 | 0.00209 | 7.43e-09 | 1.39e-08 | 9423063 | 5025634 |
| 17 | 0.00100 | 0.00188 | 6.69e-09 | 1.25e-08 | 10470070 | 5584037 |
| 18 | 0.00090 | 0.00169 | 6.02e-09 | 1.13e-08 | 11633411 | 6204486 |
| 19 | 0.00081 | 0.00152 | 5.42e-09 | 1.02e-08 | 12926012 | 6893873 |
| 20 | 0.00073 | 0.00137 | 4.87e-09 | 9.14e-09 | 14362236 | 7659859 |
| 21 | 0.00066 | 0.00123 | 4.39e-09 | 8.22e-09 | 15958040 | 8510955 |
| 22 | 0.00059 | 0.00111 | 3.95e-09 | 7.40e-09 | 17731155 | 9456616 |
| 23 | 0.00053 | 0.00100 | 3.55e-09 | 6.66e-09 | 19701284 | 10507351 |
| 24 | 0.00048 | 0.00090 | 3.20e-09 | 6.00e-09 | 21890315 | 11674835 |

| APPENDIX C/TABLE 12: MOES ATTRIBUTABLE TO TODDLER SOIL INGESTION IN AREAS TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | |
|---|---|---|---|---|---|---|
| DAT | [SOIL] FOR NONDIETARY INGESTION EXPOSURE (ppm) | | SOIL INGESTION DOSE FOR TODDLERS (mg/kg/day) | | TODDLER SOIL INGESTION MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 0.00043 | 0.00081 | 2.88e-09 | 5.40e-09 | 24322572 | 12972039 |
| 26 | 0.00039 | 0.00073 | 2.59e-09 | 4.86e-09 | 27025080 | 14413376 |
| 27 | 0.00035 | 0.00066 | 2.33e-09 | 4.37e-09 | 30027867 | 16014863 |
| 28 | 0.00031 | 0.00059 | 2.10e-09 | 3.93e-09 | 33364297 | 17794292 |
| 29 | 0.00028 | 0.00053 | 1.89e-09 | 3.54e-09 | 37071441 | 19771435 |
| 30 | 0.00025 | 0.00048 | 1.70e-09 | 3.19e-09 | 41190490 | 21968261 |
| AVG. | 0.00187 | 0.00350 | 1.24e-08 | 2.33e-08 | 1607902 | 857548 |

| APPENDIX C/TABLE 13: AGGREGATE MOES ATTRIBUTABLE TO TODDLER EXPOSURES IN AREAS PREVIOUSLY TREATED WITH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DAT | TODDLER DERMAL EXPOSURE MOES | | TODDLER HAND-TO-MOUTH MOES | | TODDLER OBJECT-TO-MOUTH MOES | | TODDLER SOIL INGESTION MOES | | TODDLER AGGREGATE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 1670 | 935 | 91 | 51 | 2907 | 1628 | 216908 | 121469 | 83.6 | 46.8 |
| 1 | 1855 | 1039 | 101 | 57 | 3230 | 1809 | 241009 | 134965 | 92.9 | 52.0 |
| 2 | 2061 | 1154 | 112 | 63 | 3588 | 2009 | 267788 | 149961 | 103.3 | 57.8 |
| 3 | 2290 | 1283 | 125 | 70 | 3987 | 2233 | 297542 | 166624 | 114.7 | 64.2 |
| 4 | 2545 | 1425 | 138 | 78 | 4430 | 2481 | 330603 | 185137 | 127.5 | 71.4 |
| 5 | 2827 | 1583 | 154 | 86 | 4922 | 2756 | 367336 | 205708 | 141.6 | 79.3 |
| 6 | 3142 | 1759 | 171 | 96 | 5469 | 3063 | 408151 | 228565 | 157.4 | 88.1 |
| 7 | 3491 | 1955 | 190 | 106 | 6077 | 3403 | 453502 | 253961 | 174.9 | 97.9 |
| 8 | 3879 | 2172 | 211 | 118 | 6752 | 3781 | 503891 | 282179 | 194.3 | 108.8 |
| 9 | 4310 | 2413 | 234 | 131 | 7502 | 4201 | 559878 | 313532 | 215.9 | 120.9 |
| 10 | 4788 | 2681 | 260 | 146 | 8336 | 4668 | 622087 | 348369 | 239.9 | 134.3 |
| 11 | 5320 | 2979 | 289 | 162 | 9262 | 5187 | 691208 | 387076 | 266.5 | 149.2 |
| 12 | 5912 | 3310 | 322 | 180 | 10291 | 5763 | 768009 | 430085 | 296.1 | 165.8 |
| 13 | 6568 | 3678 | 357 | 200 | 11435 | 6403 | 853343 | 477872 | 329.0 | 184.3 |
| 14 | 7298 | 4087 | 397 | 222 | 12705 | 7115 | 948159 | 530969 | 365.6 | 204.7 |
| 15 | 8109 | 4541 | 441 | 247 | 14117 | 7906 | 1053510 | 589966 | 406.2 | 227.5 |
| 16 | 9010 | 5046 | 490 | 274 | 15686 | 8784 | 1170567 | 655517 | 451.3 | 252.7 |
| 17 | 10011 | 5606 | 545 | 305 | 17428 | 9760 | 1300630 | 728353 | 501.5 | 280.8 |
| 18 | 11124 | 6229 | 605 | 339 | 19365 | 10844 | 1445144 | 809281 | 557.2 | 312.0 |
| 19 | 12360 | 6921 | 672 | 377 | 21517 | 12049 | 1605716 | 899201 | 619.1 | 346.7 |
| 20 | 13733 | 7690 | 747 | 418 | 23907 | 13388 | 1784129 | 999112 | 687.9 | 385.2 |
| 21 | 15259 | 8545 | 830 | 465 | 26564 | 14876 | 1982365 | 1110125 | 764.3 | 428.0 |
| 22 | 16954 | 9494 | 922 | 517 | 29515 | 16529 | 2202628 | 1233472 | 849.3 | 475.6 |
| 23 | 18838 | 10549 | 1025 | 574 | 32795 | 18365 | 2447364 | 1370524 | 943.6 | 528.4 |
| 24 | 20931 | 11721 | 1139 | 638 | 36439 | 20406 | 2719294 | 1522805 | 1048.5 | 587.1 |

| APPENDIX C/TABLE 13: AGGREGATE MOES ATTRIBUTABLE TO TODDLER EXPOSURES IN AREAS PREVIOUSLY TREATED WETH FENTHION USING AERIAL ULV EQUIPMENT | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DAT | TODDLER DERMAL EXPOSURE MOES | | TODDLER HAND-TO-MOUTH MOES | | TODDLER OBJECT-TO-MOUTH MOES | | TODDLER SOIL INGESTION MOES | | TODDLER AGGREGATE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 23257 | 13024 | 1265 | 709 | 40487 | 22673 | 3021438 | 1692005 | 1165.0 | 652.4 |
| 26 | 25841 | 14471 | 1406 | 787 | 44986 | 25192 | 3357153 | 1880006 | 1294.4 | 724.9 |
| 27 | 28712 | 16079 | 1562 | 875 | 49984 | 27991 | 3730170 | 2088895 | 1438.2 | 805.4 |
| 28 | 31902 | 17865 | 1736 | 972 | 55538 | 31101 | 4144633 | 2320995 | 1598.0 | 894.9 |
| 29 | 35447 | 19850 | 1928 | 1080 | 61709 | 34557 | 4605148 | 2578883 | 1775.6 | 994.3 |
| 30 | 39386 | 22056 | 2143 | 1200 | 68566 | 38397 | 5116831 | 2865425 | 1972.9 | 1104.8 |
| AVG. | 1537 | 861 | 84 | 47 | 2677 | 1499 | 199739 | 111854 | 77.0 | 43.1 |

1152 llc

| APPENDIX C/TABLE 14: AGGREGATE MOES ATTRIBUTABLE TO TODDLER EXPOSURES IN AREAS PREVIOUSLY TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DAT | TODDLER DERMAL EXPOSURE MOES | | TODDLER HAND-TO-MOUTH MOES | | TODDLER OBJECT-TO-MOUTH MOES | | TODDLER SOIL INGESTION MOES | | TODDLER AGGREGATE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 0 | 13440 | 7168 | 731 | 390 | 23398 | 12479 | 1746113 | 931260 | 673.2 | 359.1 |
| 1 | 14934 | 7965 | 812 | 433 | 25998 | 13865 | 1940125 | 1034733 | 748.0 | 399.0 |
| 2 | 16593 | 8850 | 903 | 481 | 28886 | 15406 | 2155695 | 1149704 | 831.2 | 443.3 |
| 3 | 18437 | 9833 | 1003 | 535 | 32096 | 17118 | 2395216 | 1277449 | 923.5 | 492.5 |
| 4 | 20485 | 10925 | 1114 | 594 | 35662 | 19020 | 2661351 | 1419387 | 1026.1 | 547.3 |
| 5 | 22761 | 12139 | 1238 | 660 | 39625 | 21133 | 2957057 | 1577097 | 1140.1 | 608.1 |
| 6 | 25290 | 13488 | 1376 | 734 | 44027 | 23481 | 3285619 | 1752330 | 1266.8 | 675.6 |
| 7 | 28100 | 14987 | 1529 | 815 | 48919 | 26090 | 3650688 | 1947033 | 1407.6 | 750.7 |
| 8 | 31223 | 16652 | 1699 | 906 | 54355 | 28989 | 4056320 | 2163370 | 1564.0 | 834.1 |
| 9 | 34692 | 18502 | 1887 | 1007 | 60394 | 32210 | 4507022 | 2403745 | 1737.7 | 926.8 |
| 10 | 38547 | 20558 | 2097 | 1118 | 67105 | 35789 | 5007802 | 2670828 | 1930.8 | 1029.8 |
| 11 | 42830 | 22842 | 2330 | 1243 | 74561 | 39766 | 5564224 | 2967586 | 2145.4 | 1144.2 |
| 12 | 47588 | 25380 | 2589 | 1381 | 82845 | 44184 | 6182472 | 3297318 | 2383.7 | 1271.3 |
| 13 | 52876 | 28200 | 2877 | 1534 | 92050 | 49093 | 6869413 | 3663687 | 2648.6 | 1412.6 |
| 14 | 58751 | 31334 | 3196 | 1705 | 102278 | 54548 | 7632681 | 4070763 | 2942.9 | 1569.5 |
| 15 | 65279 | 34815 | 3551 | 1894 | 113642 | 60609 | 8480757 | 4523070 | 3269.9 | 1743.9 |
| 16 | 72532 | 38684 | 3946 | 2104 | 126269 | 67343 | 9423063 | 5025634 | 3633.2 | 1937.7 |
| 17 | 80591 | 42982 | 4384 | 2338 | 140299 | 74826 | 10470070 | 5584037 | 4036.9 | 2153.0 |
| 18 | 89546 | 47758 | 4871 | 2598 | 155888 | 83140 | 11633411 | 6204486 | 4485.4 | 2392.2 |
| 19 | 99495 | 53064 | 5413 | 2887 | 173209 | 92378 | 12926012 | 6893873 | 4983.8 | 2658.0 |
| 20 | 110550 | 58960 | 6014 | 3208 | 192454 | 102642 | 14362236 | 7659859 | 5537.6 | 2953.4 |
| 21 | 122834 | 65511 | 6682 | 3564 | 213838 | 114047 | 15958040 | 8510955 | 6152.8 | 3281.5 |
| 22 | 136482 | 72790 | 7425 | 3960 | 237597 | 126719 | 17731155 | 9456616 | 6836.5 | 3646.1 |
| 23 | 151647 | 80878 | 8250 | 4400 | 263997 | 140799 | 19701284 | 10507351 | 7596.1 | 4051.3 |
| 24 | 168496 | 89865 | 9167 | 4889 | 293330 | 156443 | 21890315 | 11674835 | 8440.1 | 4501.4 |

| APPENDIX C/TABLE 14: AGGREGATE MOES ATTRIBUTABLE TO TODDLER EXPOSURES IN AREAS PREVIOUSLY TREATED WITH FENTHION USING GROUND-BASED FOGGERS | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| DAT | TODDLER DERMAL EXPOSURE MOES | | TODDLER HAND-TO-MOUTH MOES | | TODDLER OBJECT-TO-MOUTH MOES | | TODDLER SOIL INGESTION MOES | | TODDLER AGGREGATE MOES | |
| | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE | AVERAGE APPL. RATE | MAXIMUM APPL. RATE |
| 25 | 187218 | 99850 | 10185 | 5432 | 325922 | 173825 | 24322572 | 12972039 | 9377.9 | 5001.6 |
| 26 | 208020 | 110944 | 11317 | 6036 | 362136 | 193139 | 27025080 | 14413376 | 10419.9 | 5557.3 |
| 27 | 231134 | 123271 | 12574 | 6706 | 402373 | 214599 | 30027867 | 16014863 | 11577.7 | 6174.8 |
| 28 | 256815 | 136968 | 13971 | 7451 | 447082 | 238444 | 33364297 | 17794292 | 12864.1 | 6860.8 |
| 29 | 285350 | 152187 | 15524 | 8279 | 496757 | 264937 | 37071441 | 19771435 | 14293.4 | 7623.2 |
| 30 | 317056 | 169096 | 17249 | 9199 | 551953 | 294375 | 41190490 | 21968261 | 15881.6 | 8470.2 |
| AVG. | 12377 | 6601 | 673 | 359 | 21546 | 11491 | 1607902 | 857548 | 619.9 | 330.6 |