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OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

June 23, 2005

MEMORANDUM:

SUBJECT: Corrected Tau-Fluvalinate. Occupational and Residential Exposure Chapter of the Reregistration Eligibility Decision Document (RED).

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This memorandum and the accompanying attachments serve as the Occupational and Residential (ORE) chapter of the HED RED chapter for tau-fluvalinate. This memorandum has been revised in response to the "Thirty Day Period - Error Only Comment" letter submitted by the registrant and dated May 31, 2005. This document reflects current HED policy.

Cumulative risk assessment considering risks from other pesticides which have a common mechanism of toxicity is not addressed in this document.

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EPA Reg. Nos.: 2724-406; 2724-478; 2724-481; CA004002200; CA96001000; OR99004600.

Expo Sac Reviewers: Jack Arthur, Timothy Dole, Jeff Evans.

Attachments

cc: RF, SF, List B File, RRB3 File, C. Eiden

RDI: CM-2: Room 718 O: 305-7887: CAE 10/19/98: SAK 10/ /98

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1.0 Executive Summary

This document, prepared for utilization in EPA's development of the Tau-fluvalinate Reregistration Eligibility Decision, presents HED's results of its review of the potential human health effects of occupational and residential exposure to tau-fluvalinate.

Tau-fluvalinate, a type II class pyrethroid, is registered as a post-emergent insecticide/miticide for the control of various insects in beehives and in several non - agricultural settings.

An occupational and/or residential exposure assessment is required for an active ingredient if (1): certain toxicological criteria are triggered and (2): there is potential exposure to handlers (mixers, loader, applicators, etc.) during use or to persons entering treated sites after application is complete. These criteria have been met with tau-fluvalinate.

No toxicity endpoint was selected for dermal exposure to products containing *tau*-fluvalinate. Dermal exposure to products containing *tau*-fluvalinate is expected to be largely self-limiting due to the irritation that occurs as a result of the "pyrethroid reaction". The team determined (and the RARC agreed) that the issue of dermal exposure can be best addressed by labeling to avoid contact with skin and instructions to wash the affected area immediately following contact. Currently approved end-use product labels include adequate precautionary labeling. Therefore this document does not include a dermal exposure assessment for tau-fluvalinate and contains an assessment for inhalation exposure to tau-fluvalinate only. A Margin of Exposure (MOE) of 100 was determined by the Risk Assessment Team to be protective of occupational exposures to tau-fluvalinate.

HED evaluated 11 occupational handler scenarios for which short- and intermediate-term exposure to tau-fluvalinate may occur. Of these 11 possible exposure scenarios, 8 were assessed for short and intermediate-term exposures to tau-fluvalinate. All inhalation MOEs exceed 100 for all occupational scenarios assessed at either baseline or minimal PPE protection levels. The three use scenarios which were not assessed are: impregnated strips for beehives, greenhouse foggers, and cutflower dipping. The rationale for this decision is discussed in Section 4.1. Though the use of the tau-fluvalinate formulation as spot and perimeter treatment around structures and buildings may result in residential post-application exposures, these are expected to be minimal and also were not assessed. (*Tau*-fluvalinate - RARC1 (2/9/05)).

With the exception of greenhouse uses, post-application inhalation exposures are expected to be minimal and have not been assessed. In the case of greenhouses potential inhalation exposure is mitigated by the ventilation criteria required under the Worker Protection Standard (WPS).

2.0 Hazard Identification

The HED Risk Assessment Team evaluated tau-fluvalinate toxicity studies to determine acute toxicity categories and select endpoints for the risk assessment of exposures to this chemical.

2.1 Acute Toxicity Categories

Table 1.0 Acute Toxicity Profile - Tau-fluvalinate					
Guideline No.	Study Type	MRID(s) (Year)		Results	Toxicity Category
870.1100	Acute oral - rat	0094103		LD ₅₀ = 282 (218-365) mg/kg -males 261 (194-353) mg/kg - females.	II
870.1200	Acute dermal - rabbit	41597301 (1998)		LD ₅₀ > 2000 mg/kg	III
870.1300	Acute inhalation - rat			--Not applicable (1)--	
870.2400	Acute eye irritation -rabbit	00144622 (1984)		Slight conjunctival discharge observed one hour post instillation. Conjunctival swelling and redness noted for up to three days.	III
870.2500	Acute dermal irritation -rabbit	00144623 (1984)		PII = 0.8	IV*
870.2600	Skin sensitization - guinea pig	41889714 (1990)		Not a sensitizer.	Not applicable

*Study could not be verified since no MRID was located in the bibliography. The registrant needs to be asked to provide the original study report.

(1) - The vapor pressure of technical tau-fluvalinate is < 1 x 10⁻⁷ torr at 25° C (i.e. is a viscous liquid). Refer to B. Greear memo dated 01/10/91 (HED Records Center Series 361 Science Review Files # 033573).

2.2 Toxicological Endpoints

As discussed in Section 1 of this document, significant toxicity from dermal exposure to tau-fluvalinate is not expected as in the typical "pyrethroid reaction", and therefore, no dose or endpoint was selected for dermal exposure. An inhalation endpoint (NOAEL) of 0.5 mg/kg/day based on rat chronic feeding study was selected for inhalation exposure assessment (all durations). End-Use Products (EUPs) have the potential for inhalation exposures under greenhouse uses. However, label language on these EUPs and Worker Protection Standard (WPS) criteria provide protection and are expected to mitigate these exposures. A greenhouse

fogger/mist exposure study is being required as confirmatory data. HED classifies tau-fluvalinate as not likely to be carcinogenic to humans.

Table 4.4. Summary of Toxicological Doses and Endpoints for Tau-fluvalinate for Use in Human Risk Assessments			
Exposure Scenario	Dose Used in Risk Assessment, UF	Special FQPA SF* and Level of Concern for Risk Assessment	Study and Toxicological Effects
Acute Dietary (females 13-49)	No selection. No evidence that there is significant toxicity following a single exposure.		
Acute Dietary (general population)	NOAEL = 0.5 mg/kg/day. UF = 100 aRfD = 0.005 mg/kg/day	1X aPAD = aPAD/FQPA SF aPAD = 0.005/1 = 0.005 mg/kg/day	LOAEL = 1 mg/kg/day. Clinical signs in the rat chronic feeding study coupled with a LOAEL of 2 mg/kg/day based on excessive grooming and bulging eyes in the subchronic neurotoxicity study.
Chronic Dietary (all populations)	NOAEL = 0.5 mg/kg/day UF = 100 cRfD = 0.005 mg/kg/day	1X cPAD = cRfD/FQPA SF cPAD = 0.005/1 = 0.005 mg/kg/day	LOAEL = 1 mg/kg/day. Clinical signs in the rat chronic feeding study coupled with a LOAEL of 2 mg/kg/day based on excessive grooming and bulging eyes in the subchronic neurotoxicity study.
Incidental Oral - all durations.	No selection since there are no residential, recreational or institutional uses likely to result in incidental oral exposure to tau-fluvalinate. As per e-mail from K. Rothwell (February 4, 2005) there is no residential turf use.		
Dermal - all intervals	No endpoint selection. Dermal exposure should be self-limiting because of the dermal reactions resulting from contact with product. The issue of dermal exposure can be best addressed by labeling to avoid contact with skin and instructions to wash the affected area immediately following contact.		
Inhalation - all intervals Short-Term (1 - 30 days)	NOAEL = 0.5 mg/kg/day.	1X MOE = 100	LOAEL = 1 mg/kg/day. Clinical signs in the rat chronic feeding study coupled with a LOAEL of 2 mg/kg/day based on excessive grooming and bulging eyes in the subchronic neurotoxicity study.
Cancer (oral, dermal, inhalation)	Classification: tau-fluvalinate has not been reviewed by CARC or HIARC for carcinogenicity classification. However, since no evidence of carcinogenicity was seen in rat and mouse carcinogenicity studies with tau-fluvalinate, and the available mutagenicity/genetic toxicity data base do not indicate a concern, tau-fluvalinate may be classified as "not likely to be a human carcinogen".		

UF = uncertainty factor, FQPA SF = Special FQPA safety factor, NOAEL = no observed adverse effect level, LOAEL = lowest observed adverse effect level, PAD = population adjusted dose (a = acute, c = chronic) RfD = reference dose, MOE = margin of exposure, LOC = level of concern, NA = Not Applicable

* Refer to Section 4.5

3.0 Incident Reports

Databases for the OPP Incident Data System (IDS), Poison Control Centers, the California Department of Pesticide Regulation, the National Pesticide Telecommunications Network (NPTN) and the National Institute of Occupational Safety and Health's Sentinel Event Notification System for Occupational Risks (NIOSH SENSOR) were consulted for incident data involving the insecticidal active ingredient tau-fluvalinate.

From the available incident data it is apparent that tau-fluvalinate exposure can lead to mild or moderate irritation of eyes and skin. Commonly reported systemic effects include nausea and breathing difficulty. Compared to incident data available for all other pesticides however, tau-fluvalinate in general was as likely to cause minor symptoms as other pesticides but was much less likely to cause serious effects requiring hospitalization or critical care than other pesticides in the database.

4.0 Occupational Exposure and Risk Estimates

4.1 Formulations & Use Patterns

Tau-fluvalinate is registered as a post-emergent insecticide/miticide for the control of a variety of insects in various outdoor or greenhouse settings. There are 3 EPA registered products: a technical grade for formulating end-use products, one liquid formulations and the impregnated plastic strips used for beehives. There are also three Special Local Needs (SLN) 24(C) products. Tau-fluvalinate is mostly produced as a liquid formulation. Tau-fluvalinate through the amount used annually in the U.S. is considered to be a low-volume use pesticide. The single food-use, beehives comprises a relatively low percentage of insecticidal use of tau-fluvalinate in the United States. (Refer to the Confidential Appendix: "Tau-Fluvalinate: Summary of Uses and Potential for Human, Non-Occupational Exposure.", contained in the Risk Assessment document - S. Stanton.) The non-food uses, which embody the liquid formulations, include field and container-grown ornamentals, commercial greenhouses, indoor ornamentals, carrots and the brassica crop group grown for seed (24(C)), foliage and flower cuttings (dip treatment). The residential uses include perimeter treatments/outside surfaces, ant mound treatments (spot application).

4.2 Crops and/or Use Sites

Table 3 lists the use patterns, rates, methods and size of area treated for tau-fluvalinate applications.

Table 3. Use Patterns, Rates, Methods & Acreage for Tau-Fluvalinate Application

Crop or Treated Area	Max. Application Rate (lbs ai/acre; lbs./gallon)	Application Method	Application Formulation	Area or Acreage
bee hives	10.25 % a.i./strip	placement	impregnated	5 combs
carrots/brassica	0.15	aerial/ground-boom	liquid	350/80 acres
outdoor/indoor ornamentals	0.0016 lbs ai/gal.	low pressure handwand	liquid	40 gal./day
outdoor perimeter treatments (structures, buildings, etc)	0.0016 lbs ai/gal	high pressure handwand	liquid	1000 gal./day
greenhouses	0.0016 lbs ai/gal	high pressure handwand	liquid	1000 gal./day
greenhouse fog treatment	0.0016 lbs ai/gal	fogger	liquid	1000 gal./day
cut flowers/cuttings	0.0008	dip	liquid	1000 gal./day
ant mounds	0.0016 lbs ai/gal	low pressure handwand	liquid	40 gal./day

Of these scenarios, HED evaluated carrots/brassica, outdoor/indoor ornamentals, outdoor perimeter treatments (structures, buildings, etc), greenhouses and ant mounds for occupational inhalation exposures. In the case of the treated strips used in beehives, an outdoor use, HED believes that exposure to the tau-fluvalinate impregnated in the strips will be minimal due to the low vapor pressure (10^{-7} Torr). In the case of cut flowers/cuttings, HED feels that the high pressure handwand greenhouse scenario would be a comparable protective estimate of exposure to tau-fluvalinate through this use. In the case of greenhouse fog treatments, HED does not have a database with which to estimate possible tau-fluvalinate exposures through this use.

Spray drift is always a potential (postapplication) source of exposure to residents nearby to spraying operations. This is particularly the case with aerial application, but, to a lesser extent, could also be a potential source of exposure from the ground application method employed for tau-fluvalinate. The Agency has been working with the Spray Drift Task Force, EPA Regional Offices and State Lead Agencies for pesticide regulation and other parties to develop the best spray drift management practices. The Agency is now requiring interim mitigation measures for aerial applications that must be placed on product labels/labeling. The Agency has completed its evaluation of the new data base submitted by the Spray Drift Task Force, a membership of U.S. pesticide registrants, and is developing a policy on how to appropriately apply the data and the AgDRIFT computer model to its risk assessments for pesticides applied by air, orchard airblast and ground hydraulic methods. After the policy is in place, the Agency may impose further refinements in spray drift management practices to reduce off-target drift and risks associated with aerial as well as other application types where appropriate.

4.3 Occupational Handler Exposure Scenarios

The following 8 occupational handler exposure scenarios were evaluated for short and intermediate term inhalation exposures to tau-fluvalinate:

1. Mix/load: Liquids for Aerial to Support Application on carrots/brassica,
2. Application: Aerial Spray Application on carrots/brassica,
3. Application: Groundboom Spray Application on carrots/brassica,
4. Flagger: Aerial on carrots/brassica
5. Mix/load/application on non-agricultural outdoor areas, structures, buildings etc. (high pressure handwand),
6. Mix/load/application for greenhouses (high pressure handwand),
7. Mix/load/application for outdoor ornamentals (low pressure handwand),
8. Mix/load/application for ant mounds (low pressure handwand).

The potential handler exposures associated with these scenarios are assessed in this RED chapter using the toxicological endpoints and uncertainty factors associated with the active ingredient as outlined in **Section 2** of this document.

Note that all of the tau-fluvalinate labels require handlers to wear long-sleeved shirt and pants, chemical resistant gloves, shoes and socks as well as NIOSH approved respirators for outdoor and indoor uses at all times. In addition the label also includes precautionary language concerning symptoms expected from exposures to the chemical: "Sensitive individuals may temporarily experience an itching, burning or tingling sensation, with or without a rash. These symptoms will usually subside without requiring medical treatment. Avoid hand or sleeve-to-face contact. Prior to exposure or after washing, an application of corn oil to exposed skin may reduce these symptoms. Certain persons may be sensitive to Mavrik Aquaflo's fine spray particles." (EPA Reg. No. 2724 -478).

4.4 Occupational Handlers Exposure Estimates

Because no chemical specific data and/or studies were submitted in support of the reregistration process for this chemical, PHED V1.1 has been used to assess the exposure scenarios for tau-fluvalinate. 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 individuals (i.e., 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 has 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 handler assessments encompass all of the major uses of tau-fluvalinate being supported throughout the country. The assumptions used in calculating exposures and risks are listed below:

- *Application Rates:* The application rates are the maximum allowable that were identified on the available product labels for each use assessed in this document.
- *Acreage Treated:* The daily acres treated are HED standard values (EXPO SAC policy 9.1).
- *Unit Exposures:* The unit exposure values calculated by PHED generally range from the geometric mean to the median of the selected data set. To add consistency and quality control to the values produced from this system, 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. While data from PHED provides 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.

- *Amount Handled*: Based on the daily acres treated.
- *Personal Protective Equipment (PPE)*: HED calculated MOEs for the baseline, minimum PPE, PPE1 PPE2 and PPE with engineering controls for each occupational exposure scenario under the following assumptions:

All Scenarios: All occupational handlers are wearing footwear (socks plus shoes or boots), foot exposure is not traditionally monitored, and therefore, a 100 percent protection factor is implied..

Baseline Attire: All handlers are wearing long-sleeved shirts, long pants, no gloves, and no respirator.

Minimum PPE (PPE 1): All handlers are wearing long-sleeved shirts, long pants, gloves, and no respirator.

PPE 2: All handlers are wearing long-sleeved shirts, long pants, gloves and a PF5 respirator (dust/mist respirator with a protection factor of 5).

Engineering Controls: Represents the use of an appropriate engineering control such as a closed tractor cab or closed loading system for granulars or liquids.

Potential **daily inhalation exposure** is calculated using the following formula:

$$\text{Daily Inhalation Exposure (mg ai/day)} = \text{Inhalation Unit Exposure (mg ai/lb ai)} \times \text{Application Rate (lb ai/acre or gallon)} \times \text{Daily amount Treated (acres or gallons)}$$

The inhalation daily doses were calculated using the following formulas:

$$\text{Daily Inhalation dose (mg/kg/day)} = \text{daily Inhalation exposure(mg ai/day)/body weight(kg)} \times 100\%$$

(where body weight = 70kg.)

4.5 Occupational Handlers Risk Estimates

Using the exposure scenarios identified in the exposure section, HED calculated the potential inhalation risk to persons from tau-fluvalinate handler exposures using MOEs.

The MOEs were calculated using the following formulas:

$$\text{Inhalation MOE} = \text{Inhalation NOAEL(mg/kg/day)}/\text{Daily Inhalation Dose (mg/kg/day)}$$

Margins of exposure (MOEs) were calculated for handlers for short-term (up to 1 month) and intermediate-term (1 to 6 months) durations.

The results of the inhalation handler risk estimates for short and intermediate-term exposure durations to tau-fluvalinate are summarized in tables 4,5, 6 & 7.

All inhalation MOES exceed the target MOPE of 100 at all protection levels: baseline, PPE 1, PPE 2 and with engineering controls.

A screening level estimate for dermal exposures using NOAEL of 100 mg/kg/day from a 21-day dermal toxicity study (rabbit) revealed that all scenarios exceed the target MOE of 100 at baseline protection levels.

Table 4. Fluralinate Short & Intermediate Term Baseline Table

Exposure Scenario (Scenario #)	Inhalation Unit Exposure (Ug/lb ai) ¹	Crop ²	Application Rate ³	Daily Area Treated ⁴	Inhalation Dose (mg/kg/day) ⁵	Inhalation MOE ⁶
Mixer/Loader						
Mixing/Loading Liquids for Aerial application (1)	1.2	Carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.0009	560
Applicator						
Sprays for Aerial application (2)	Not Applicable (see engineering controls)	carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	Not Applicable (see engineering controls)	Not Applicable (see engineering controls)
Sprays for Groundboom Application (3)	0.74	carrots & brassica crop group grown for seed	0.15 lb ai per acre	80 acres per day	0.00013	3900
Flagger						
Flagging for Sprays application (4)	0.35	Carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.00026	1900
Mixer/Loader/App						
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (5)	120	non-agricultural areas; non-residential/industrial outdoor areas; buildings, structures.	0.0016 lb ai per gallon	1000 Gallons per day	0.0027	180
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (6)	120	greenhouses	0.0016 lb ai per gallon	1000 Gallons per day	0.0027	180
Mixing/Loading/Applying Liquids for Low Pressure Handwand application (7)	30	outdoor ornamentals	0.0016 lb ai per gallon	40 Gallons per day	0.000027	18000
Mixing/Loading/Applying Liquids for Low Pressure Handwand application (8)	30	ant mounds	0.0016 lb ai per gallon	40 Gallons per day	0.000027	18000

¹Baseline inhalation unit exposures represent no respirator. Values are reported in the PHED Surrogate Exposure Guide dated August 1998 or are from data submitted by the Outdoor Residential Exposure Task Force dated May 2000.

²Crops and use patterns are from product labeling & LUIS Report.

³Application rates are based on maximum values found in various sources including LUIS and various labels. In most scenarios, a range of maximum application rates is used to represent the range of rates for different crops/sites/uses. Most application rates upon which the analysis is based are presented as lb ai/A. In some cases, the application rate is based on applying a solution at concentrations specified by the label (i.e., presented as lb ai/gallon).

⁴Amount treated is based on the area or gallons that can be reasonably applied in a single day for each exposure scenario of concern based on the application method and formulation/packaging type. (Standard EPA/OPP/HED values).

⁵ Inhalation dose (mg/kg/day) = [unit exposure (ug/lb ai) * 0.001 mg/ug unit conversion * Inhalation absorption (100%) * Application rate (lb ai/acre or lb ai/gallon) * Daily area treated (acres or gallons)] / Body weight (70 kg).

⁶Inhalation MOE = 0.5 mg/kg/day (oral NOAEL) / Daily Inhalation Dose. Target Inhalation MOE is 100.

Table 5. Tau-Fluvalinate Short & Intermediate - Term PPE 1 (Single Layer Protection, Gloves, No Respirator) Table

Exposure Scenario (Scenario #)	Inhalation Unit Exposure (Ug/lb ai) ¹	Crop ²	Application Rate ³	Daily Area Treated ⁴	Inhalation Dose (mg/kg/day) ⁵	Inhalation MOE ⁶
Mixer/Loader						
Mixing/Loading Liquids for Aerial application (1)	1.2	Carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.0009	560
Applicator						
Sprays for Aerial application (2)	Not Applicable (see engineering controls)	carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	Not Applicable (see engineering controls)	Not Applicable (see engineering controls)
Sprays for Groundboom Application (3)	0.74	carrots & brassica crop group grown for seed	0.15 lb ai per acre	80 Acres per day	0.00013	3900
Flagger						
Flagging for Sprays application (4)	0.35	Carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.00026	1900
Mixer/Loader/App						
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (5)	120	non-agricultural areas; non-residential/industrial outdoor areas; buildings, structures.	0.0016 lb ai per gallon	1000 Gallons per day	0.0027	180
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (6)	120	greenhouses	0.0016 lb ai per gallon	1000 Gallons per day	0.0027	180
Mixing/Loading/Applying Liquids for Low Pressure Handwand application (7)	30	outdoor ornamentals	0.0016 lb ai per gallon	40 Gallons per day	0.000027	18000
Mixing/Loading/Applying Liquids for Low Pressure Handwand application (8)	30	ant mounds	0.0016 lb ai per gallon	40 Gallons per day	0.000027	18000

¹PPE1 inhalation unit exposures represent no respirator. Values are reported in the PHED Surrogate Exposure Guide dated August 1998 or are from data submitted by the Outdoor Residential Exposure Task Force dated May 2000.

²Crops and use patterns are from product labeling & LUIS Report.

³Application rates are based on maximum values found in various sources including LUIS and various labels. Most application rates upon which the analysis is based are presented as lb ai/A. In some cases, the application rate is based on applying a solution at concentrations specified by the label (i.e., presented as lb ai/gallon).

⁴Amount treated is based on the area or gallons that can be reasonably applied in a single day for each exposure scenario of concern based on the application method and formulation/packaging type. (Standard EPA/OPP/HED values).

⁵Inhalation dose (mg/kg/day) = [unit exposure (ug/lb ai) * 0.001 mg/ g unit conversion * Inhalation absorption (100%) * Application rate (lb ai/acre or lb ai/gallon) * Daily area treated (acres or gallons)] / Body weight (70 kg).

⁶Inhalation MOE = 0.5 mg/kg/day (oral NOAEL) / Daily Inhalation Dose. Target Inhalation MOE is 100.

Table 6. Tau-Fluvalinate Shot & Intermediate - Term PPE 2 (Single Layer Protection, Gloves, PF5 Respirator) Table

Exposure Scenario (Scenario #)	Inhalation Unit Exposure (Ug/lb ai) ¹	Crop ²	Application Rate ²	Daily Area Treated ²	Inhalation Dose (mg/kg/day) ⁵	Inhalation MOE ⁴
Mixer/Loader						
Mixing/Loading Liquids for Aerial application (1)	0.24	Carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.00018	2800
Applicator						
Sprays for Aerial application (2)	Not Applicable (see engineering controls)	carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	Not Applicable (see engineering controls)	Not Applicable (see engineering controls)
Sprays for Groundboom Application (3)	0.15	carrots & brassica crop group grown for seed	0.15 lb ai per acre	80 Acres per day	0.000026	19000
Flagger						
Flagging for Sprays application (4)	0.07	Carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.000053	9500
Mixer/Loader/App						
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (5)	24	non-agricultural areas; non-residential/industrial outdoor areas; buildings, structures.	0.0016 lb ai per gallon	1000 Gallons per day	0.00055	910
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (6)	24	greenhouses	0.0016 lb ai per gallon	1000 Gallons per day	0.00055	910
Mixing/Loading/Applying Liquids for Low Pressure Handwand application (7)	6	outdoor ornamentals	0.0016 lb ai per gallon	40 Gallons per day	0.0000055	91000
Mixing/Loading/Applying Liquids for Low Pressure Handwand application (8)	6	ant mounds	0.0016 lb ai per gallon	40 Gallons per day	0.0000055	91000

¹PPE2 inhalation unit exposures represent a dust/mist respirator with a protection factor of 5. Values are reported in the PHED Surrogate Exposure Guide dated August 1998 or are from data submitted by the Outdoor Residential Exposure Task Force dated May 2000.

²Crops and use patterns are from product labeling & LUIS Report.

³Application rates are based on maximum values found in various sources including LUIS and various labels. In most scenarios, a range of maximum application rates is used to represent the range of rates for different crops/sites/uses. Most application rates upon which the analysis is based are presented as lb ai/A. In some cases, the application rate is based on applying a solution at concentrations specified by the label (i.e., presented as lb ai/gallon).

⁴Amount treated is based on the area or gallons that can be reasonably applied in a single day for each exposure scenario of concern based on the application method and formulation/packaging type. (Standard EPA/OPP/HED values).

⁵Inhalation dose (mg/kg/day) = [unit exposure (ug/lb ai) * 0.001 mg/g unit conversion * Inhalation absorption (100%) * Application rate (lb ai/acre or lb ai/gallon) * Daily area treated (acres or gallons)] / Body weight (70 kg).

⁶Inhalation MOE = 0.5 mg/kg/day (oral NOAEL) / Daily Inhalation Dose. Target Inhalation MOE is 100.

Table 7. Tau-Fluvalinate Shot & Intermediate - Term Exposure with Engineering Controls

Exposure Scenario (Scenario #)	Inhalation Unit Exposure (Ug/lb ai) ¹	Crop ²	Application Rate ³	Daily Area Treated ⁴	Inhalation Dose (mg/kg/day) ⁵	Inhalation MOE ⁶
Mixer/Loader						
Mixing/Loading Liquids for Aerial application (1)	0.083	carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.000062	8000
Applicator						
Sprays for Aerial application (2)	0.068	carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.000051	9800
Sprays for Groundboom Application (3)	0.43	carrots & brassica crop group grown for seed	0.15 lb ai per acre	80 Acres per day	0.0000074	68000
Flagger						
Flagging for Sprays application (4)	0.07	carrots & brassica crop group grown for seed	0.15 lb ai per acre	350 Acres per day	0.0000053	95000
Mixer/Loader/App						
Mixing/Loading/Applying Liquids for High-Pressure HandWand (5)	Not Applicable (NA)	non-agricultural areas; non-residential/industrial outdoor areas; buildings, structures	0.0016 lb ai per gallon	1000 Gallons per day	Data not available	Data not available
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (6)	NA	greenhouses	0.0016 lb ai per gallon	1000 Gallons per day	Data not available	Data not available
Mixing/Loading/Applying Liquids for High-Pressure HandWand application (7)	NA	outdoor ornamentals	0.0016 lb ai per gallon	40 Gallons per day	Data not available	Data not available
Mixing/Loading/Applying Liquids for Low Pressure Handwand application (8)	NA	ant mounds	0.0016 lb ai per gallon	40 Gallons per day	Data not available	Data not available

¹Engineering controls inhalation unit exposures represent no respirator. Values are reported in the PHED Surrogate Exposure Guide dated August 1998 or are from data submitted by the Outdoor Residential Exposure Task Force dated May 2000.

²Crops and use patterns are from product labeling & LUIS Report.

³Application rates are based on maximum values found in various sources including LUIS and various labels. In most scenarios, a range of maximum application rates is used to represent the range of rates for different crops/sites/uses. Most application rates upon which the analysis is based are presented as lb ai/A. In some cases, the application rate is based on applying a solution at concentrations specified by the label (i.e., presented as lb ai/gallon).

⁴Amount treated is based on the area or gallons that can be reasonably applied in a single day for each exposure scenario of concern based on the application method and formulation/packaging type. (Standard EPA/OPP/HED values).

⁵Inhalation dose (mg/kg/day) = [unit exposure (ug/lb ai) * 0.001 mg/ g unit conversion * Inhalation absorption (100%) * Application rate (lb ai/acre or lb ai/gallon) * Daily area treated (acres or gallons)] / Body weight (70 kg).

⁶Inhalation MOE = 0.5 mg/kg/day (oral NOAEL) / Daily Inhalation Dose. Target Inhalation MOE is 100.

5.0 Recommendations for Refining Risk Estimates - Data Gaps

Occupational exposure data for greenhouse fogger scenarios under the OPPTS guideline 875.2500; Part B - Chapter 8 - "Inhalation Exposure".



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