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DATE: November 13, 2008

SUBJECT: EXPOSURE SCOPING DOCUMENT FOR ESFENVALERATE

Attached is an exposure scoping document for registered pesticide products containing esfenvalerate as an active ingredient. All actively registered labels (currently a total of 79) were reviewed, as well as pesticide use date, pesticide illness data, and other pertinent information. Based on this information, this document is intended to lay the groundwork for the risk assessment process. The information in this document may be used for the development of an exposure assessment document for esfenvalerate.

If you have any comments or questions, please contact me.

Attachment

HSM-08009

EXPOSURE SCOPING DOCUMENT FOR PESTICIDE PRODUCTS THAT CONTAIN ESFENVALERATE

By

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November 13, 2008

Worker Health and Safety Branch
Department of Pesticide Regulation
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SUMMARY

Esfenvalerate is a synthetic pyrethroid insecticide, which is used to control a wide range of arthropod pests in agricultural, commercial, residential, and industrial settings. It has both contact and stomach poison action. Esfenvalerate is a mixture of four stereoisomers. It has replaced the compound fenvalerate (to which it is almost identical) for use in the United States. Much of the data for fenvalerate is applicable to esfenvalerate because the two compounds contain the same components. The only difference is the relative proportions of four isomers. Esfenvalerate contains a much higher percentage (84% compared to 22% for fenvalerate) of the S,S-isomer, the most insecticidally active isomer. Esfenvalerate requires lower application rates than fenvalerate, is chronically less toxic, and is considered a more powerful insecticide. Esfenvalerate trade names include Asana XL, Halmark, and Sumi-alfa. DuPont Agricultural Products is the basic producer of esfenvalerate.

Esfenvalerate is used as an insecticide on vegetable crops, fruit trees, nut crops, lawns, and gardens. It is also used for structural pest control on residential, commercial, and industrial sites. The reported use of esfenvalerate in California averaged 33,583 pounds per year from 2002 to 2006. The major use crops were almonds, peaches, tomatoes, corn (human consumption), artichokes, walnuts, and prunes.

Reported illnesses that were associated with esfenvalerate indicated a total of 48 incidents from 2002 to 2006 in California. Illness incidents were associated with both agricultural and non-agricultural uses, involving mostly pesticide handlers, bystanders, and residents. The symptoms of illnesses included itching and burning skin (which was worsened by sweating and washing), dizziness, eye irritation, nausea, vomiting, headache, difficulty breathing, and nose and throat irritation.

Based on the information on the product labels, exposure scenarios were proposed for occupational and non-occupational handler activities. Exposure scenarios were also proposed for fieldworkers, residents, and others who may be exposed to post-application residues of esfenvalerate. The information in this document may be used for the development of an exposure assessment document for esfenvalerate.

PURPOSE

The Department of Pesticide Regulation (DPR) identified esfenvalerate as having potential adverse health effects in studies of sufficient quality to warrant risk characterization (DPR, 2007). During the risk assessment process, DPR evaluates the significance of the adverse effects associated with use and determines if further action is needed to mitigate unacceptable adverse effects.

REGULATORY HISTORY/STATUS

Esfenvalerate was first registered in California about 1988 (Berliner *et al*., 1988). As of July 15, 2008, there are 79 esfenvalerate products registered in California (DPR, 2008a). Twelve products have the signal word "Warning" and oral toxicity category II on the product label. The other 67 product labels have the signal word "Caution" on the label. Esfenvalerate products for agricultural use are federally restricted use pesticides because of esfenvalerate's toxicity to fish and aquatic organisms.

DPR placed certain products containing pyrethroids, including esfenvalerate, into reevaluation on August 31, 2006. The reevaluation was based on monitoring surveys and toxicity studies, which revealed the widespread presence of synthetic pyrethroid residues in the sediment of both agricultural and urban dominated California waterways at levels toxic to *Hyalella azteca*. Scientist commonly use *Hyalella azteca*, an aquatic crustacean, as an indicator of environmental health and water quality in streams, lakes, and other bodies of water. There was a high correlation between concentrations of pyrethroids and observed toxicity. Findings further indicate that the unique physical, chemical, and toxicological properties of pyrethroids contribute to their propensity to accumulate in sediment at toxic levels. Registrants were required by DPR to submit environmental fate data, sediment data, and information and data relating to the reduction or elimination of offsite movement of pyrethroid residues. These studies may include aerobic and anaerobic aquatic California sediment half-life (metabolism) studies, acute and chronic sediment toxicity studies on *Chironomus tentans* and *Hyallela azteca*, sediment analytical methods, and monitoring in areas appropriate to certain use patterns. Once all of the required studies are submitted, DPR will evaluate these studies as part of the reevaluation process (DPR, 2008d).

The California regulatory status for esfenvalerate is summarized below.

Table 1. California Regulatory Status for Esfenvalerate

	Restricted Material	**Toxic Air Contaminant**	**Groundwater Protection List**	**Proposition 65 List**
Yes / No	No	No	No	No
Law	FAC Division 7, Chapter 3, Article 1.5, Section 14001	FAC Division 7, Chapter 3, Article 1.5, Section 14021(b)	FAC Division 7, Chapter 2, Article 15, Section 13141	Health & Safety Code, Section 25249.5
Regulation	3 CCR, Section 6400	3 CCR, Section 6860	3 CCR, Section 6800	27 CCR, Section 25000 to 27001

FAC: California Food and Agricultural Code
HSC: California Health and Safety Code
CCR: California Code of Regulations

SUMMARY OF EXISTING DOCUMENTS

Reregistration Eligibility Document (RED): As of July 15, 2008, a RED document for esfenvalerate is not available from the United States Environmental Protection Agency (U.S. EPA), (U.S. EPA, 2008).

Report of Food Quality Protection Act (FQPA) Tolerance Reassessment Progress: The initial tolerance decision for esfenvalerate was made in 1998. In 2004, a new assessment was completed indicating that dietary risks are below U.S. EPA's level of concern. However, both the acute and chronic population adjusted doses are close enough to U.S. EPA's level of concern that changes in use patterns have the potential to increase residue to levels that could be of concern. A new risk assessment will be conducted in 2008 using the most recent data (U.S. EPA, 2008a).

PESTICIDE USE AND SALES

The available California pesticide use reports for the past five years (2002-2006) indicate an average annual use of 33,583 pounds (lbs) of the active ingredient (AI) esfenvalerate (DPR, 2008). The average annual amount of esfenvalerate sold in the same period was 56,836 lbs. The major use crops were almonds, peaches, tomatoes, corn (human consumption), artichokes, walnuts, and prunes (Table 2).

It is important to note that reported uses are those reported by licensed applicators and agricultural applicators. Esfenvalerate has numerous products registered in California that may be used by homeowners and people other than licensed applicators. In addition to pesticide use data, California collects pesticide sales data (DPR, 2008b), mainly for collection of a mill assessment fee. While the reported use and reported sales data do not match each year (sold does not necessarily means applied), the averages over several years can provide some information on the amount of the pesticide used by those other than licensed applicators and agricultural applicators.

Monthly (or seasonal) uses of esfenvalerate were obtained from the California Pesticide Information Portal (CalPIP) (DPR, 2008c). The average seasonal uses of esfenvalerate from 2002 to 2006 are shown in Figure 2. The highest monthly use was in January and July, totaling about 22% and 18% of the total annual use, respectively. The top five counties with the highest use of esfenvalerate (2002-2006) are shown in Table 3. The average annual use in these five counties totaled 16,780 lbs of esfenvalerate, which accounted for 44.18% of the average total annual use in California during the same period.

California pesticide use reports show that esfenvalerate has agricultural and non-agricultural uses, and is used both indoors and outdoors. In agriculture, it was applied to field crops, vegetable crops, fruit crops, tree nut crops, and to Christmas tree plantings, conifer plantations, conifer seed orchards, forest tree nurseries, and non-cropland (excluding public lands such as forest, parks, or recreational areas).

Almonds, peaches, tomatoes, corn (human consumption), artichokes, walnuts, and prunes were the major use crops constituting 23.7, 10.0, 9.1, 8.4, 6.4, 5.0, and 4.1 percent of the total reported uses, respectively (Table 2).

Table 2. Pesticide Use for Esfenvalerate for 2002 to 2006 in California

	2002	2003	2004	2005	2006	Average	% of Total AI [a] Applied
Total Applied (pounds)	30,763	33,840	32,112	33,301	37,899	33,583	----
Total Sold (pounds)	43,478	53,580	57,221	49,671	80,229	56,836	----
SITE (total pounds)							
Almonds	5,196	6,713	8,090	8,142	11,642	7,957	23.7
Peach	3,838	3,158	3,477	3,145	3,101	3,344	10.0
Tomato [b]	2,820	3,921	3,307	2,545	2,719	3,062	9.1
Corn (human consumption)	3,768	2,963	2,271	2,317	2,847	2,833	8.4
Artichoke	2,159	1,988	1,860	2,402	2,335	2,149	6.4
Walnuts	1,273	1,543	1,298	1,810	2,546	1,694	5.0
Prunes	1,270	1,416	1,146	1,557	1,506	1,379	4.1
Others [c]	10,439	12,137	10,663	11,384	11,201	11,165	33.2
Total	30,763	33,839	32,112	33,302	37,897	------	100

[a] AI is active ingredient
[b] Includes processing tomatoes
[c] Includes all other application use sites reported

Figure 1. Total Pounds of Esfenvalerate Use per Year in California for 2002-2006

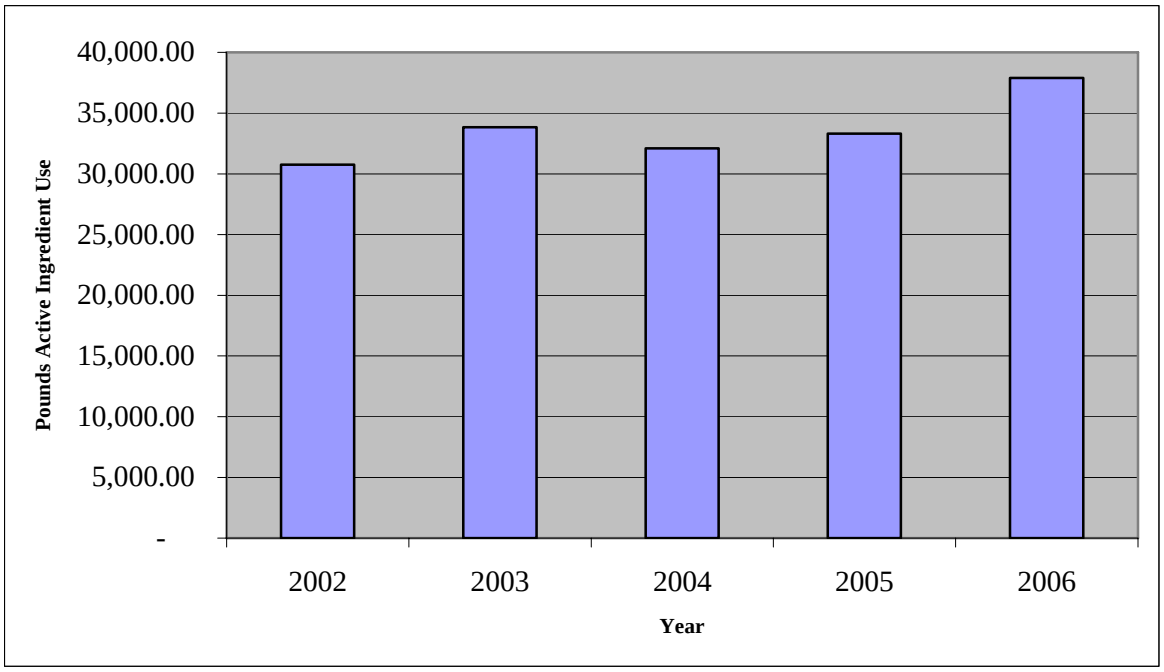

Figure 2. Average Pounds and the Corresponding Percentage of Seasonal Use of Esfenvalerate in California for 2002-2006

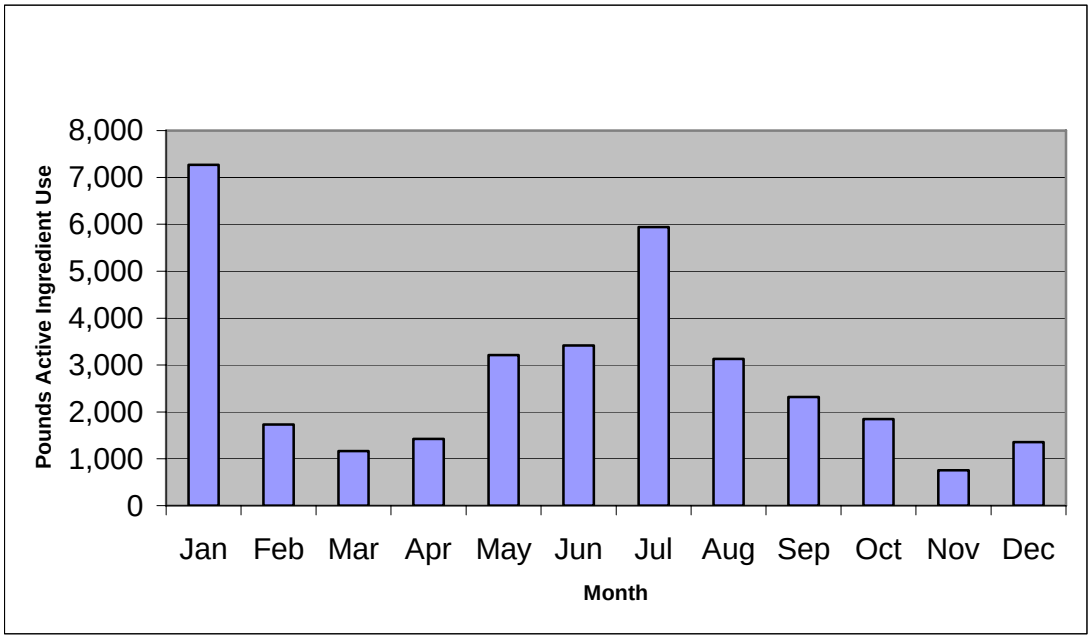

Table 3. Top Five Counties with the Highest Use of Esfenvalerate in California for 2002-2006

COUNTY	AVERAGE (POUNDS OF ACTIVE INGREDIENT)	% AVERAGE TOTAL ANNUAL USE
Fresno	5,257	13.84
Imperial	2,492	6.56
Monterey	3,116	8.20
San Joaquin	2,977	7.84
Stanislaus	2,939	7.74
TOTAL	16,780	44.18

FORMULATIONS AND USES

Esfenvalerate has a variety of agricultural and non-agricultural uses, and can be used indoors or outdoors. The bulk of the products registered in California are for indoor/outdoor residential, commercial, institutional and industrial pest control. The product Dupont Asana® XL is additionally registered for a special local need [24(c) Registration Label] for the control of grasshoppers and crickets on forest sites in California (EPA Special Local Need Number CA-990022). Esfenvalerate products are manufactured in several formulations (Table 4).

Table 4. Esfenvalerate Formulations [a] Registered in California

FORMULATION TYPE	NUMBER OF PRODUCTS	CONCENTRATION RANGE (%)	SIGNAL WORD
PL/S/F	45	0.025 - 0.10	Caution/Warning
Micro	3	0.025 – 9.36	Caution
EC	13	0.425 – 8.40	Caution/Warning
S/L (Ready-To-Use)	11	0.0033-8.40	Caution/Warning
WP	2	35.0	Caution
LC	4	0.425 – 3.48	Caution/Warning
FC	1	0.425	Warning
TOTAL	79	----------	----------

[a] Product formulations as identified on DPR's label database (DPR, 2008a)

PL/S/F: Pressurized Liquid/Sprays/Foggers
Micro: Microencapsulated
EC: Emulsifiable Concentrate
S/L: Solution/Liquid (Ready-To-Use)
WP: Wettable Powder
LC: Liquid Concentrate
FC: Flowable Concentrate

LABEL REQUIREMENTS

As of July 15, 2008, there are 79 esfenvalerate-containing products registered in California (DPR, 2008a). There are three registered labels for use in crop production in California. Dupont™ Asana® XL Insecticide, Adjourn™ Insecticide, and S-Fenvalostar Insecticide contain 8.4% esfenvalerate [contain 0.66 pounds (lbs) esfenvalerate (active ingredient (AI) per gallon (gal)]. All three products are identified as emulsifiable concentrate formulations and are identified as federally restricted use pesticides due to their toxicity to fish and aquatic organisms. They can be applied via chemigation (irrigation system), ground, or aerial application equipment. Aerial applications should be made using a minimum of two gallons of solution per acre, except in tree and orchard crops a minimum of ten gallons per acre may be used. There are a number of label restrictions to avoid spray drift to non-target areas when esfenvalerate products are applied. These include buffer zones from bodies of water, runoff, and wind speed restrictions. These products are not allowed to be applied by ground within 25 feet, or by aerial methods within 150 feet of bodies of water such as lakes, reservoirs, rivers, permanent streams, marshes or natural ponds, estuaries or commercial fish farm ponds. The buffer zone must be increased to 450 feet when an ultralow volume application is made.

All three agricultural use products require applicators and other handlers to wear the following personal protective equipment (PPE):

- Long-sleeved shirt and long pants
- Chemical-resistant gloves, such as barrier laminate or neoprene rubber or nitrile rubber or viton
- Shoes plus socks
- Protective eyewear

When handlers use closed systems, closed cabs, or aircraft in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [Code of Federal Regulations, title 40, section 170.240(d)(4-6)], the handler PPE requirements may be modified as specified in the WPS.

Dupont™ Asana® XL Insecticide (0.66 lbs AI/gal) is a toxicity category II pesticide with the signal word "Warning" on the label. The restricted entry interval (REI) for treated crops is 12 hours. The maximum application rate for corn (sweet, field, pop, seed), cotton, peanuts, soybeans, sugar beets, sugarcane, sunflowers, kiwis, artichokes, beans, dry peas, dry lentils, snap beans, broccoli, carrots, collards, cucumbers, melons, pumpkins, squash, eggplant, head lettuce, mustard greens, green peas, peppers, radishes, tomatoes, potatoes, Christmas tree plantings, conifer plantations, conifer seed orchards, forest tree nurseries, and non-cropland (excluding public land such as forest, parks, or recreational areas) is 0.05 lbs AI/acre (A). The maximum application rate for apples, pears, stone fruits, and pecans is 0.075 lbs AI/A. The maximum application rate for almonds, filberts, walnuts, cotton, and potatoes is 0.10 lbs AI/A. The preharvest interval (PHI) for corn (sweet, seed and pop), artichokes, and tomatoes is one day; three days for snap beans, broccoli, cucumbers, melons, pumpkins, squash, kohlrabi, and green peas; seven days for carrots, collards, eggplant, head lettuce, mustard greens, peppers, potatoes, radishes, and turnips; 14 days for kiwis and stone fruits; 21 days for corn (field), cotton, peanuts, soybeans, sugar beets, sugarcane, apples, almonds, filberts, pecans, walnuts, beans, dry peas, and dry lentils; and 28 days for sunflowers and pears.

Adjourn™ Insecticide (0.66 lbs AI/gal) is a toxicity category II pesticide with the signal word "Warning" on the label. The REI for treated crops is 12 hours. The maximum application rate is 0.05 lbs AI/A for corn (sweet, field, pop, seed), cotton, peanuts, soybeans, sugar beets, sugarcane, sunflowers, kiwis, artichokes, beans, dry peas, dry lentils, snap beans, broccoli, carrots, collards, cucumbers, melons, pumpkins, squash, eggplant, head lettuce, mustard greens, green peas, peppers, radishes, tomatoes, potatoes, Christmas tree plantings, conifer plantations, conifer seed orchards, forest tree nurseries, and non-cropland (excluding public land such as forest, parks, or recreational areas); 0.075 lbs AI/A for apples, pears, stone fruits, and pecans; and 0.10 lbs AI/A for almonds, filberts, and walnuts. The PHI is one day for corn (sweet, seed and pop), artichokes, and tomatoes; three days for snap beans, broccoli, cucumbers, melons, pumpkins, squash, and green peas; seven days for carrots, collards, eggplant, head lettuce, mustard greens, peppers, potatoes, and radishes; 14 days for kiwis and stone fruits; 21 days for corn (field), cotton, peanuts, soybeans, sugar beets, sugarcane, apples, almonds, filberts, pecans, walnuts, beans, dry peas, and dry lentils; and 28 days for sunflowers and pears.

S-Fenvalostar Insecticide is a toxicity category II pesticide with the signal word "Warning" on the label. The REI for treated crops is 12 hours. The maximum application rate is 0.05 lbs AI/A for corn (sweet, field, pop, seed), cotton, peanuts, soybeans, sugar beets, sugarcane, sunflowers, kiwis, artichokes, beans, dry peas, dry lentils, snap beans, broccoli, carrots, collards, cucumbers, melons, pumpkins, squash, eggplant, kohlrabi, head lettuce, mustard greens, green peas, peppers, potatoes, radishes, tomatoes, turnips, Christmas tree plantings, conifer plantations, conifer seed orchards, forest tree nurseries,

and non-cropland (excluding public land such as forest, parks, or recreational areas); 0.075 lbs AI/A for apples, pears, stone fruits, and pecans; and 0.10 lbs AI/A almonds, filberts, and walnuts. The PHI is one day for corn (sweet, seed and pop), artichokes, and tomatoes; three days for snap beans, broccoli, cucumbers, melons, pumpkins, squash, kohlrabi, and green peas; seven days for carrots, collards, eggplant, head lettuce, mustard greens, peppers, potatoes, radishes, and turnips; 14 days for kiwis and stone fruits; 21 days for corn (field), cotton, peanuts, soybeans, sugar beets, sugarcane, apples, almonds, filberts, pecans, walnuts, beans, dry peas, and dry lentils; and 28 days for sunflowers and pears.

Non-agricultural labels allow for use in commercial, industrial, and residential settings, including homes, office buildings, restaurants, schools, motels, barns, industrial buildings, poultry housing, feedlots, railroad cars, lawns, apartment buildings, warehouses, theaters, pet housing, kennels, dairy barns, truck trailers, milk rooms, livestock housing, garbage bins and receptacles, athletic facilities, vehicles, boats, campers, ornamental trees and landscapes, along subterranean cables, poles, post holes, alleys, general outdoor areas, and general indoor areas. Non-agricultural products may also be used on residential gardens (food crops such as fruits, tree nuts, vegetables, and non-food crops such as ornamentals, shrubs, roses, and trees). The products labels for garden use indicate that plants should be thoroughly sprayed until slightly wet. Applications may be made as necessary to maintain control, waiting at least seven days between each application. Days to harvest for vegetables, fruit and nut tree applications range from one to 28 days. The product labels specify that people and pets may not enter treated areas until the spray has dried.

There are ten fogger products that can be applied to indoor residential, institutional, and industrial sites such as homes, apartments, hospitals, office buildings, schools, and commercial buildings. All of these products contain 0.10% AI. All product labels have the signal word “Caution” except Hot Shot Flea Killer Plus Fogger and Real Kill Indoor Flea Fogger which have the signal word “Warning”. The product labels specify that the product may only be used in areas that have been vacated by human beings and pets. The reentry into treated rooms is two hours after application and treated areas must be ventilated for 30 minutes prior to re-entry.

Evercide Emulsifiable Concentrate 2667 is designed for repackaging or formulating with deionized water to produce insecticide sprays. It is a toxicity category II pesticide with the signal word “Warning” on the label, and contains 0.425% AI. The label indicates that it is for formulation for the following uses: (1) Food and feed and non-food crops for which tolerances exist, residential outdoor and indoor food, and non-food, medical, and residential uses; (2) Uses for which U.S. EPA has accepted required data and/or citations of data that the formulator has submitted in support of registration; and (3) Uses for experimental purposes that are in compliance with U.S. EPA requirements.

POTENTIAL EXPOSURE SCENARIOS

Esfenvalerate products are categorized into the following three major use sites:

1. Indoor and outdoor residential
2. Indoor and outdoor industrial and institutional
3. Agricultural [including Christmas tree plantings, conifer plantations, conifer seed orchards, forest tree nurseries, and non-cropland (excluding public land such as forests, parks, or recreational areas)]

These use sites do not have clear boundaries, but rather overlap each other. However, these site categories provide some understanding regarding the type of handlers, their activities, and the type of equipment that may be used. These use sites also provide some information on the non-handlers that may potentially be exposed during or after an application. Given this information, esfenvalerate exposure scenarios are grouped as follows: (A) occupational handlers such as agricultural and commercial pesticide applicators; (B) non-occupational residential handlers; (C) occupational/non-handlers such as fieldworkers; and (D) non-occupational/non-handlers.

A –Occupational/Handler Exposure Scenarios

For the purpose of this document, agricultural handlers include those workers who are involved in the application of esfenvalerate to agricultural sites. Structural pest control operators (commercial pesticide applicators) are those who are involved in the application of esfenvalerate to residential, institutional and industrial sites. Occupational handler (both agricultural and commercial applicators) activities associated with the use of esfenvalerate formulations are shown in Table 5. Non-crop occupational reentry scenarios for esfenvalerate, including all use sites, application rates, and reentry activities are listed in Appendix B.

B –Non-Occupational/Handler Residential Exposure Scenarios

Residential applicators may handle various formulations of esfenvalerate products using hand-held equipment. They may use compressed air sprayers or watering cans, hose-end sprayers, tank sprayers, or power operated sprayers. Ready-to-use products such as aerosol cans, foggers, injection tubes or trigger sprayers may also be used by residential applicators. Non-occupational residential handler activities associated with the use of esfenvalerate formulations are shown in Table 6.

C – Occupational/Non-Handlers (Fieldworkers) Exposure Scenarios

Occupational non-handlers are those workers who may be exposed to pesticides after an application. Exposure may result from contact to pesticide residues on crops or other surfaces or from pesticide drift. Exposure scenarios for agricultural fieldworkers (reentry workers) who enter treated fields after an application are primarily determined by type of crop and the type of work activity performed. Work activities include harvesting, pruning, thinning, scouting, weeding, irrigating, staking/tying, and transplanting. The crops on esfenvalerate labels include almonds, peaches, tomatoes, corn, artichokes,

walnuts, pecans, filberts, prunes, cotton, peanuts, beans, broccoli, head lettuce, carrots, collards, cucumbers, melons, eggplant, mustard greens, peas, peppers, potatoes, radishes, sugar beets, sugarcane, sunflowers, apples, pears, stone fruits, kiwis, Christmas tree plantings, conifer plantations, conifer seed orchards, forest tree nurseries, and non-cropland (excluding public land such as forests, parks, or recreational areas).

The restricted entry interval (REI) on the product label specifies the earliest time of entry to treated fields by workers following an application. A person may enter a treated site prior to harvesting time to perform work activities if the REI is shorter than the preharvest interval (PHI). In this case, the exposure of a worker reentering a treated field would likely be greater than that for a harvester. Crop reentry scenarios for esfenvalerate, including each use site, and the corresponding maximum application rate, REI, preharvest interval (PHI), and reentry activities are listed in Appendix A.

D – Non-Occupational/Non-Handler Exposure Scenarios

The product labels for esfenvalerate allow uses in and around residential, commercial, institutional, and industrial areas. Men, women, and children may be exposed to treated environments following an application of esfenvalerate to areas such as homes, apartments, lawns, schools, office buildings, warehouses, theaters, industrial buildings, hotels, kennels, livestock housing, food processing plants, food service establishments, grocery stores, and transportation equipment. Exposure may also occur post-application during harvesting of garden fruits, nuts, and vegetables. Residential and public reentry scenarios for esfenvalerate, including all use sites, application rates, and reentry activities are listed in Appendix C.

Table 5. Agricultural and Commercial Occupational Handler Scenarios for Esfenvalerate.

Handler activity [a]	**PRODUCT FORMULATIONS** [b]					
	LC	**WP**	**S/L (RTU)**	**PL/S/F**	**Micro**	**EC**
Aerial M/L						x
Aerial applicator						x
Flagger						x
Airblast M/L						x
Airblast applicator						x
Airblast M/L/A						x
Groundboom M/L						x
Groundboom applicator						x
Groundboom M/L/A						x
Chemigation M/L						x
Ground applicator						x
Low-pressure sprayers M/L/A	x	x	x		x	x
High-pressure sprayers M/L/A	x	x			x	x
Hose-end sprayer M/L/A	x	x				x
Hand spray aerosol can				x		
Fogger can (press valve/finger pad)				x		
Injection Tubes (crack & crevice)				x		
Mechanical aerosol fogger or generator M/L/A			x	x		x
Repacking or reformulating M/L						x

[a] Handler activities identified on product labels
[b] Product formulations as identified on DPR's label database (DPR, 2008a)
X Handler activities associated with the identified formulation on product labels

PL/S/F: Pressurized Liquid/Sprays/Foggers
Micro: Microencapsulated
EC: Emulsifiable Concentrate
S/L (RTU): Solution/Liquid (Ready-To-Use)
WP: Wettable Powder
LC: Liquid Concentrate
M/L/A: Mixer/Loader/Applicator

Table 6. Non-Occupational Residential Handler Scenarios for Esfenvalerate.

PRODUCT FORMULATIONS [b]						
Handler activity [a]	**LC**	**FC**	**S/L (RTU)**	**PL/S/F**	**EC**	**MICRO**
Compresses air sprayer M/L/A					x	
Hose-end or tank sprayer M/L/A	x	x	x		x	
Nozzle/trigger sprayer			x			x
Hand spray aerosol can				x		
Watering can M/L/A	x				x	
Injection tubes (crack & crevice)				x		
Fogger can (press valve/finger pad)				x		

[a] Handler activities identified on product labels
[b] Product formulations as identified on DPR's label database (DPR, 2008a)
X Handler activities associated with the identified formulation on product labels

PL/S/F: Pressurized Liquid/Sprays/Foggers
Micro: Microencapsulated
EC: Emulsifiable Concentrate
S/L (RTU): Solution/Liquid (Ready-To-Use)
FC: Flowable Concentrate
LC: Liquid Concentrate
M/L/A: Mixer/Loader/Applicator

PESTICIDE ILLNESS REPORTS

Reports of illnesses and injuries associated with exposure to pesticide products are maintained in the Pesticide Illness Surveillance Program database of DPR. Reported illnesses associated with esfenvalerate indicated a total of 48 incidents from 2002 to 2006 in California (Mehler, 2008). These cases were classified as definitely, probably, or possibly associated with esfenvalerate alone or esfenvalerate in combination with other pesticides. These cases stemmed from 37 episodes in which one or more people developed symptoms following esfenvalerate exposure (Table 7). The affected people included 21 pesticide handlers, nine field workers, and 18 people engaged in routine activities with no particular expectation of pesticide exposure (such as office workers and bystanders). The symptoms of exposure included itching and burning skin (which was worsened by sweating and washing), dizziness, eye irritation, nausea, vomiting, headache, difficulty breathing, and nose and throat irritation.

Table 7. Number of Episodes and Illnesses Associated With Esfenvalerate Exposure for 2002-2006

YEAR	NUMBER OF EPISODES[a]	NUMBER OF ILLNESSES[b]
2002	10	10
2003	12	12
2004	9	12
2005	3	3
2006	3	11
TOTAL	37	48

[a] An episode refers to any single pesticide-related event (application, accidental spill, mix/load) that resulted in 1 or more illnesses.

[b] An illness refers to a single person reporting symptoms.

There were 16 drift related illnesses reported. Four of which were field workers suckering almond trees in a nursery field. They claimed that an applicator drifted pesticides toward them. Three reported headaches and one vomited. No violations were noted. Nine people at an outdoor party were sickened when drift occurred from a nearby application. The reported symptoms included burning eyes, irritated nose and throat, and headache. The agricultural commissioner planned to take civil penalty action against the pest control business.

There were 21 (16 agricultural and five non-agricultural) handler related exposures. One agricultural handler exposure case indicated that a worker applying pesticide to prunes via an open cab tractor towing an air fan sprayer got spray in his left eye, resulting in eye irritation and a headache. It was noted that the employer failed to provide the worker with eye protection or formal training. In another case a worker reported smelling pesticide odor through his dirty respirator cartridge, and became nauseated and vomited. In another case, an applicator reported shortness of breath while wearing a respirator to spray various fungicide and insecticides. A maintenance worker developed a headache, nausea, dizziness, burning sensation on the right arm, burning throat, and coughing. It was noted that he received no training or PPE and that he sprayed the insecticide more broadly than the label allowed.

Between 2002 and 2006 there were a total of 70 esfenvalerate related exposure cases reported in the United States, excluding California (Calvert, 2008). Fifty-seven (57) of the incidents reportedly took place in residential areas, six occurred in non-manufacturing commercial areas, four occurred in agricultural areas, two occurred in manufacturing areas, and one was unknown. Symptoms reported included shortness of breath, chest tightness, respiratory irritation, and nasal discharge.

Review of published literature related to pyrethroid poisonings provided information regarding acute fenvalerate poisonings. One hundred ninety-six (196) poisonings occurred in spraymen in China between 1983 and 1988 (He, F., et al., 1989). Symptoms included abnormal facial sensations described as a burning, itching, or tingling sensations, which were exacerbated by sweating and washing with warm water. Symptoms readily disappeared after several hours. Systemic symptoms included dizziness, headache, nausea, anorexia, fatigue, vomiting, chest tightness, parasthesia, palpitation, blurred vision and increased sweating.

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Appendix A
CROP REENTRY SCENARIOS FOR ESFENVALERATE

The following table was prepared by reviewing esfenvalerate product labels. Maximum single application rates (lbs AI/A unless specified otherwise) and minimum preharvest intervals (PHI) were chosen when they differed between labels; however, most application rates and PHI were generally the same on all labels.

Rows are sorted by site category (FC = Field Crops; FN = Fruits and Nuts; V = Vegetables; S = Specialty Uses), then by use sites.

Site Cat.	Use Site	Rate [a] (Single)	Rate [b] (Seasonal)	REI [c]	PHI [d]	Reentry Activities
FC	Corn (Field)	0.05	0.25	12	21	Irrigating, Detasseling, Mechanical Harvesting, Scouting, Weeding
FC	Corn (Popcorn/ Seed)	0.05	0.50/0.25	12	1	Irrigating, Detasseling, Mechanical Harvesting, Scouting, Weeding
FC	Corn, Sweet	0.05	0.50	12	1	Irrigating, Scouting, Weeding, Roguing, Detasseling, Hand Harvesting, Mechanical Harvesting
FC	Cotton	0.05	0.50	12	21	Irrigating, Weeding, Roguing, Scouting, Mechanical Harvesting
FC	Soybeans	0.05	0.20	12	21	Irrigating, Scouting, Weeding, Mechanical Harvesting
FC	Sugarcane	0.05	0.20	12	21	Irrigating, Scouting, Hand Harvesting, Mechanical Harvesting, Weeding
FC	Sunflowers	0.05	0.20	12	28	Irrigating, Scouting, Weeding, Roguing, Mechanical Harvesting
FN	Kiwis	0.05	0.35	12	14	Thinning, Hand Harvesting, Training, Pruning, Irrigating, Scouting, Weeding, Transplanting
FN	Pears	0.10	0.375	12	28	Thinning, Hand Harvesting, Pruning, Propping, Irrigating, Scouting, Weeding, Transplanting
FN	Apples	0.075	0.525	12	21	Thinning, Hand Harvesting, Pruning, Propping, Irrigating, Scouting, Weeding, Transplanting
FN	Stone Fruits (Includes Apricots, Cherries, Nectarines, Peaches, Plums, Prunes, and Plums)	0.075	0.375	12	14	Thinning, Hand Harvesting, Pruning, Propping, Irrigating, Scouting, Weeding, Mechanical Harvesting, Transplanting
FN	Almonds	0.10	0.20	12	21	Thinning, Hand Harvesting, Pruning, Irrigating, Scouting, Weeding, Mechanical Harvesting, Transplanting
FN	Walnuts	0.10	0.20	12	21	Thinning, Hand Harvesting, Pruning, Irrigating, Scouting, Weeding, Mechanical Harvesting, Transplanting
FN	Filberts	0.10	0.20	12	21	Thinning, Hand Harvesting, Pruning, Irrigating, Scouting, Weeding, Mechanical Harvesting, Transplanting
FN	Pecans	0.075	0.30	12	21	Thinning, Hand Harvesting, Pruning, Irrigating, Scouting, Weeding, Mechanical Harvesting, Transplanting
V	Carrots	0.05	0.50	12	7	Hand Harvesting, Scouting, Irrigating, Weeding, Mechanical Harvesting
V	Collards	0.05	0.20	12	7	Hand Harvesting, Scouting, Irrigating, Weeding, Mechanical Harvesting, Transplanting
V	Eggplant	0.05	0.35	12	7	Staking/Tying, Hand Harvesting, Scouting, Irrigating, Weeding, Transplanting, Mechanical Harvesting
V	Kohlrabi	0.05	0.40	12	3	Hand Harvesting, Scouting, Irrigating, Weeding, Thinning, Transplanting, Mechanical Harvesting

Site Cat.	Use Site	Rate [a] (Single)	Rate [b] (Seasonal)	REI [c]	PHI [d]	Reentry Activities
V	Cucumbers, Melons (Cantaloupes, Honeydew Melons, Muskmelons, Watermelons), Pumpkins, Squash (Summer and Winter)	0.05	0.25	12	3	Staking/tying, Hand Harvesting, Scouting, Irrigating, Weeding, Transplanting, Mechanical Harvesting
V	Broccoli [Includes Chinese Broccoli, Cabbage, Cauliflower, Chinese Cabbage (Tighthead Varieties Only)]	0.05	0.40	12	3	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Artichokes	0.05	0.15	12	1	Head Breaking (Head Lettuce for Seed), Hand Harvesting, Irrigating, Scouting, Thinning, Weeding, Transplanting
V	Lettuce (Head)	0.05	0.35	12	7	Head Breaking (Head Lettuce for Seed), Hand Harvesting, Irrigating, Scouting, Thinning, Weeding, Transplanting
V	Mustard Greens	0.05	0.20	12	7	Head Breaking, Hand Harvesting, Irrigating, Scouting, Thinning, Weeding, Transplanting
V	Peanuts	0.05	0.15	12	21	Irrigating, Scouting, Weeding, Mechanical Harvesting
V	Bean, Dry Peas, Dry Lentils	0.05	0.20	12	21	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Snap Beans	0.05	0.20	12	3	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Green Peas	0.05	0.10	12	3	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Peppers	0.05	0.35	12	7	Tying, Training, Staking, Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting
V	Potatoes	0.05	0.35	12	7	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Radishes	0.05	0.10	12	7	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Turnips	0.05	0.40	12	7	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Sugar beets	0.05	0.25	12	21	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
V	Tomatoes	0.05	0.50	12	1	Hand Harvesting, Irrigating, Scouting, Weeding, Thinning, Transplanting, Mechanical Harvesting
S	Christmas Tree Plantings, Conifer Plantations, Conifer Seed Orchards, Forest Tree Nurseries	0.05	1.60 lbs/year	12	----	Hand Harvesting, Irrigating, Scouting, Thinning, Turning, Tying, Weeding, Transplanting

Site Cat.	Use Site	Rate [a] (Single)	Rate [b] (Seasonal)	REI [c]	PHI [d]	Reentry Activities
S	Non-Cropland (Excluding Public Lands Such as Forest, Parks, or Recreational)	0.05	0.50 lbs/year	12	----	Reentry into Treated Area

[a] Rate, is maximum single application rate in pounds active ingredient per acre (lbs AI/acre) , unless otherwise noted.

[b] Rate, is maximum seasonal application rate in pounds active ingredient per acre (lbs AI/acre) , unless otherwise noted.

[c] REI, given in hours, restricted entry interval for the specified crop.

[d] PHI, given in days, preharvest interval for the specified crop.

Appendix B
NON-CROP OCCUPATIONAL REENTRY SCENARIOS FOR ESFENVALERATE

The following table was prepared by reviewing esfenvalerate product labels. Maximum single application rates (units are specified) were chosen when they differed between labels. Rows are sorted by site category (M = Miscellaneous), then by use sites.

Site Categ	Use Site	Rate [a]	Units [b]	Reentry Activities
M	Structural Pest Control (In and Around Food and Non-food Commercial and Industrial Facilities)	1.0/1000= 0.25% AI 26/1000= 0.051% AI	Fl. oz./ft^3 (space spray) Fl. oz./gal/ft^2 (indoor, surface or premise)	Reentry into Structure
M	Structural Pest Control (In and Around Food and Non-food Commercial and Industrial Facilities)	10/1000= 0.25% AI 2.0/1000= 0.05% AI 0.002/1000 10/30/5,000	Fl. oz./gal/ft^3 (space spray) Fl. oz./gal/ft^2 (indoor/out-door, surface premise or perimeter) Fl. oz./gal/ft^2 (Lawn) tsp/gal/ft^2 (Outdoor Asian Cockroaches)	Reentry into Structure
M	Structural Pest Control (In and Around Non-food Commercial and Industrial Facilities)	Spray until wet Net wt. 12 oz (0.050% AI)		Reentry into Structure

Site Categ	Use Site	Rate [a]	Units [b]	Reentry Activities
M	Structural Pest Control (In and Around Food and Non-food Residential, Commercial and Industrial Facilities)	5.6 /1000 =0.05% AI (indoor/out-doors) 5.6/6/1000 (lawn) 4.67/30 /5000 (outdoor Asian cockroaches) container =130 gm (AI= 35%)	gm/gal/ ft^2 gm/gal/ ft^2 gm/gal/ ft^2	Reentry into Treated Area
M	Wasp and Hornet Killer	Spray nest until saturated (0.031% AI)	Net= 18 to 20oz	Reentry into Treated Area, Removing Nest

[a] Rate, maximum single application rate given for the active ingredient unless otherwise noted.

[b] Units are specified for each rate.

Appendix C
RESIDENTIAL AND PUBLIC REENTRY SCENARIOS FOR ESFENVALERATE

The following table was prepared by reviewing esfenvalerate product labels. Maximum single application rates (units are specified) were chosen when they differed between labels. Rows are sorted by site category (R = Residential; B = Both Residential and Public Areas), then by use sites.

Site Categ	Use Site	Rate [a]	Units [b]	Reentry Activities
R	Residential Surface Spray, Spot, Crack and Crevice Treatments	Spray Until Wet (AI=0.05%)		Reentry into Treated Area
B	Residential and Non-food Areas, Surface Spray, and Crack and Crevice Treatment	Spray Until Wet (AI=0.05%)		Reentry into Treated Area
B	Residential and Food and Non-food Areas, Surface Spray, and Crack and Crevice Treatment	1 sec spray/spot/12 inches (AI=0.10%)		Reentry into Treated Area
B	Outdoor/Indoor Residential and Food and Non-food Areas, Surface Spot, Crack and Crevice Treatments, Turf, and Landscaping	0.54 1/1000 (AI=6.40%)	lb AI/gal fl oz/gal/ft^2	Reentry into Treated Area
B	Outdoor/Indoor Residential and Non-food Areas, Surface Spot, Crack and Crevice Treatments, Turf, Landscaping, and In/Around Livestock and Poultry Structures	0.8/1000= 0.06% AI to treat 1,000 ft^2 (AI=9.36%)	fl oz/gal/ft^2	Reentry into Treated Area
B	Residential, Outdoor/Indoor Surface Spot, Crack and Crevice Treatments	N/S [c] (AI=0.05%)		Reentry into Treated Area
R	Residential, Surfaces or Indoor Spot, Crack and Crevice Treatments	N/S [c] (AI=0.05% And 0.025%)		Reentry into Treated Area
R	Lawns	16/36/6000 (AI= 0.44%)	Fl oz/gal/ft^2	Mowing, Playing on Lawn

Site Categ	Use Site	Rate [a]	Units [b]	Reentry Activities
R	Residential Lawn, Outdoor and Perimeter Pests	2/1000 (outdoor pests) 16 fl oz makes 36 gal for 6,000ft^2 (lawn) 16/1000 (perimeter) (AI=0.44%)	Fl. oz/gal/ft^2 Fl oz/gal/ft^2	Reentry into Treated Area, Mowing, Playing on Lawn
R	Residential Lawn, Outdoor and Perimeter Pests	2/1000 (outdoor pests) 30 fl oz makes 67 gal for 11,200 ft^2 (lawn) 16/1000 (perimeter) (AI=0.44%)	Fl. oz/gal/ft^2 Fl oz/gal/ft^2	Reentry into Treated Area, Mowing, Playing on Lawn
R	Residential Indoor/Outdoor Surface Spray	1/1000 (AI=0.025%)	gal/ft^2	Reentry into Treated Area
R	Residential Indoor/Outdoor Surface Spray	96/750	Fl. oz/gal/ft^2 AI=0.025%	Reentry into Treated Area
R	Residential Lawn, Outdoor and Perimeter Pests	32/16,000 (AI=0.425%)	Fl. oz/gal/ft^2	Reentry into Treated Area, Mowing, Playing on Lawn

Site Categ	Use Site	Rate [a]	Units [b]	Reentry Activities
R	Home Outdoor, Ornamental Plants, Garden (Vegetables, Melons, Berries, Fruit, and Nut Trees) Outdoor Surfaces, Perimeter, and Lawns	Garden – 1 fl oz/gal (Days to harvest 1 to 28 days) 7 days between applications Lawn – 1.33/3/500 Outdoor- 2/1000 Perimeter- 16/1000 (AI =0.425 %) Treats up to 16,000 ft^2 Various size containers Reentry- When spray has dried	 Fl oz/gal/ft^2 Fl oz/gal/ft^2 Fl oz/gal/ft^2	Hand Harvesting, Pruning, Staking, Tying, Thinning, Irrigating, Weeding, Mowing, Playing on Lawn, Reentry into Treated Area
R	Home Outdoor, Ornamental Plants, Garden (Vegetables, Melons, Berries, Fruit, and Nut Trees) Outdoor Surfaces, and Lawns	Garden – Enough to wet upper and lower leaf surfaces until dripping (Days to harvest 1 to 28 days) 7 days between applications Lawn – 2/1000 (AI =0.425 %) Treats up to 16,000 ft^2 Reentry- When spray has dried	 oz/ft^2	Hand Harvesting, Pruning, Staking, Tying, Thinning, Irrigating, Weeding, Mowing, Playing on Lawn, Reentry into Treated Area

Site Categ	Use Site	Rate [a]	Units [b]	Reentry Activities
R	Home Outdoor, Ornamental Plants, Garden (Vegetables, Melons, Berries, Fruit, and Nut Trees) and Outdoor Surfaces	Garden – Enough to coverall plant surfaces until slightly wet (Days to harvest 1 to 28 days) 7 days between applications (AI =0.0033%) Reentry- When spray has dried		Hand Harvesting, Pruning, Staking, Tying, Thinning, Irrigating, Weeding, Reentry into Treated Area
B	Indoor Fogger	5/5000 (AI=.10%)	oz/ft^3	Reentry into Treated Area
R	Indoor Fogger	6/6000 (AI=.10%)	oz/ft^3	Reentry into Treated Area
B	Indoor Fogger	6/6000 (AI=.10%)	oz/ft^3	Reentry into Treated Area
B	Indoor Fogger	7.5/6000 (AI=.10%)	oz/ft^3	Reentry into Treated Area
B	Wasp and Hornet Killer	Spray nest until saturated (AI =0.031%)		Reentry into Treated Area, Removing Nest
B	Wasp and Hornet Killer	Spray nest until saturated (AI =0.05%)		Reentry into Treated Area, Removing Nest

[a] Rate, maximum single application rate given for the active ingredient unless otherwise noted.

[b] Units are specified for each rate.

[c] N/S, application rate not specified on the label