

US EPA ARCHIVE DOCUMENT



United States
Environmental Protection
Agency

Prevention, Pesticides
And Toxic Substances
(7508C)

EPA 738-R-06-004
June 2006

Reregistration Eligibility Decision for Pyrethrins

List B

Case No. 2580

Reregistration Eligibility Decision (RED) Document
for
Pyrethrins

Approved by: /S/
Debra Edwards, Ph. D.
Director
Special Review and Reregistration
Division

Date: June 7, 2006

TABLE OF CONTENTS

Executive Summary	7
I. Introduction	11
II. Chemical Overview	12
A. Regulatory History	12
B. Chemical Identification	13
C. Use Profile	16
1. Pyrethrins Use Profile	16
III. Summary of Pyrethrins Risk Assessments	17
A. Human Health Risk Assessment	18
1. Toxicity Profile	18
2. FQPA Safety and Uncertainty Factors	21
3. Endocrine disruption	22
4. Drinking Water	22
5. Dietary Risk (Food + Water)	23
6. Residential Exposure and Risk	25
7. Aggregate Risk	30
8. Cumulative Risk Assessment	31
9. Occupational Risk	32
B. Environmental Risk Assessment	34
1. Environmental Fate and Transport	35
2. Ecological Risk	35
4. Ecological Incidents	45
IV. Risk Management, Reregistration, and Tolerance Reassessment Decision	46
A. Determination of Reregistration Eligibility and Tolerance Reassessment	46
B. Regulatory Position	46
1. Food Quality Protection Act Findings	47
2. Endocrine Disruptor Effects	48
3. Cumulative Risks	48
C. Tolerance Reassessment Summary	49
D. Regulatory Rationale	60
1. Human Health Risk	60
2. Non-Target Organism (Ecological) Risk Management	68
V. What Registrants Need to Do	75
A. Manufacturing Use Products	75
1. Additional Generic Data Requirements	75
2. Labeling Requirements	77
3. Spray Drift Management	77
4. Endangered Species	77
B. End-Use Products	78
1. Additional Product-Specific Data Requirements	78
2. Labeling for End-Use Products	78
Appendix: Technical Support Documents	107

Pyrethrins Reregistration Eligibility Decision Team

Office of Pesticide Programs:

Environmental Fate and Effects Risk Assessment

Jose Melendez

Mike Rexrode

Health Effects Risk Assessment

Christine Olinger (Risk Assessor)

Joseph Deluzio

Timothy Dole

Matthew Lloyd

Linda Taylor

Biological and Economic Analysis Division

Alan Halvorson

Nikhil Mallampalli

Registration

Richard Gebken

Mark Suarez

Kevin Sweeney

Risk Management

Tom Myers

Cathryn O'Connell

Glossary of Terms and Abbreviations

AGDCI	Agricultural Data Call-In
ai	Active Ingredient
aPAD	Acute Population Adjusted Dose
AR	Anticipated Residue
BCF	Bioconcentration Factor
CFR	Code of Federal Regulations
cPAD	Chronic Population Adjusted Dose
CSF	Confidential Statement of Formula
CSFII	USDA Continuing Surveys for Food Intake by Individuals
DCI	Data Call-In
DEEM	Dietary Exposure Evaluation Model
DFR	Dislodgeable Foliar Residue
DWLOC	Drinking Water Level of Comparison.
EC	Emulsifiable Concentrate Formulation
EDWC	Estimated Drinking Water Concentration
EEC	Estimated Environmental Concentration
EPA	Environmental Protection Agency
EXAMS	Exposure Analysis Modeling System
EUP	End-Use Product
FCID	Food Commodity Intake Database
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FFDCA	Federal Food, Drug, and Cosmetic Act
FQPA	Food Quality Protection Act
FOB	Functional Observation Battery
G	Granular Formulation
GENEEC	Tier I Surface Water Computer Model
GLN	Guideline Number
HAFT	Highest Average Field Trial
IR	Index Reservoir
LC ₅₀	Median Lethal Concentration. A statistically derived concentration of a substance that can be expected to cause death in 50% of test animals. It is usually expressed as the weight of substance per weight or volume of water, air or feed, e.g., mg/l, mg/kg or ppm.
LD ₅₀	Median Lethal Dose. A statistically derived single dose that can be expected to cause death in 50% of the test animals when administered by the route indicated (oral, dermal, inhalation). It is expressed as a weight of substance per unit weight of animal, e.g., mg/kg.
LOC	Level of Concern
LOD	Limit of Detection
LOAEL	Lowest Observed Adverse Effect Level
µg/g	Micrograms Per Gram
µg/L	Micrograms Per Liter
mg/kg/day	Milligram Per Kilogram Per Day
mg/L	Milligrams Per Liter
MOE	Margin of Exposure
MRID	Master Record Identification (number). EPA's system of recording and tracking studies submitted.
MUP	Manufacturing-Use Product
NA	Not Applicable
NAWQA	USGS National Water Quality Assessment
NPDES	National Pollutant Discharge Elimination System
NR	Not Required
NOAEL	No Observed Adverse Effect Level

OP	Organophosphate
OPP	EPA Office of Pesticide Programs
OPPTS	EPA Office of Prevention, Pesticides and Toxic Substances
PAD	Population Adjusted Dose
PCA	Percent Crop Area
PDP	USDA Pesticide Data Program
PHED	Pesticide Handler's Exposure Data
PHI	Preharvest Interval
ppb	Parts Per Billion
PPE	Personal Protective Equipment
ppm	Parts Per Million
PRZM/EXAMS	Tier II Surface Water Computer Model
Q ₁ *	The Carcinogenic Potential of a Compound, Quantified by the EPA's Cancer Risk Model
RAC	Raw Agriculture Commodity
RED	Reregistration Eligibility Decision
REI	Restricted Entry Interval
RfD	Reference Dose
RQ	Risk Quotient
SCI-GROW	Tier I Ground Water Computer Model
SAP	Science Advisory Panel
SF	Safety Factor
SLC	Single Layer Clothing
SLN	Special Local Need (Registrations Under Section 24(c) of FIFRA)
TGAI	Technical Grade Active Ingredient
TRR	Total Radioactive Residue
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UF	Uncertainty Factor
UV	Ultraviolet
WPS	Worker Protection Standard

Executive Summary

EPA has completed its review of public comments on the human health and environmental risk assessments and is issuing its reregistration eligibility and tolerance reassessment decisions for pyrethrins. There are currently 70 tolerances being reassessed for pyrethrins. EPA will accept public comments on these decisions and the supporting documents for 60 days. The revised risk assessments and response documents are based on comments submitted, information from the Pyrethrin Joint Venture (PJV), and other information provided to EPA. After considering the risks identified in the revised risk assessments, comments and mitigation suggestions, EPA developed its risk management decision for uses of pyrethrins that posed risks of concern. As a result, the Agency has determined pyrethrins-containing products are eligible for reregistration provided that risk mitigation measures are adopted, and labels are amended accordingly.

Pyrethrins were first registered as an insecticide in the 1950's and are used to target many different types of flying and crawling insects and arthropods. Pyrethrins are registered for use in agricultural, residential, commercial, industrial, and public health sites. Approximately 200,000 pounds are sold every year, with about 90% being used in non-agricultural sites.

Overall Risk Summary

Dietary Risk (Food + Drinking Water)

Acute dietary (food and drinking water) risk does not exceed the Agency's level of concern for the general U.S. population at 54% of the aPAD. The most highly exposed subpopulation, children 1-2, is at the Agency's level of concern at 100% of the aPAD calculated. Three commodities, pineapple, banana, and dried-oat baby food, were expected to contribute 71% of total exposure to children 1-2. 100% crop treated values were used with all three of these commodities; therefore, with any refinement in the percent crop treatment values or residue levels, the estimated risk for all population subgroups including children 1-2 is expected to decrease.

The chronic dietary (food and drinking water) risk is below the Agency's level of concern; risk estimates are 11% cPAD for the general U.S. population, and 32% of the cPAD for children 1-2 years old, the most exposed subpopulation.

Residential

In the residential handler exposure assessment a number of scenarios were assessed to estimate the exposure to homeowners handling products containing pyrethrins. From the results of the residential handler assessment, there are no residential risks of concern when pyrethrins are mixed, loaded, applied, or handled by homeowners.

A number of post-application residential scenarios were identified for adults and children exposed to pyrethrins indirectly after application. Of these, three were potentially of concern: 1) broadcast dust applications to carpets; 2) indoor metered release devices; and 3) outdoor

residential misting systems. To address the potential risks associated with these post-application scenarios, the PJV has agreed to limit dust application to carpets by allowing spot treatments only and add label language and use restrictions to address potential by-stander risks from products used in both metered release devices and outdoor residential misting systems. The PJV has agreed to prohibit the use of metered release devices in residential indoor areas. Further, the Agency will require confirmatory exposure and efficacy data for the outdoor misting systems.

FQPA

An FQPA safety factor of 3X for the lack of a developmental neurotoxicity study has been retained for the acute dietary and the short-term incidental oral dietary and residential assessments.

Aggregate Risks

Only short-term aggregate risk was calculated for pyrethrins because the oral and inhalation endpoints were similar (neurotoxicity). Intermediate- and long-term studies show different effects for oral and inhalation exposures, so an aggregate assessment is not appropriate.

Since the target MOEs for oral and inhalation exposures differ, the Agency uses an aggregate risk index (ARI) method to combine exposures. An ARI above 1 is not of concern. The aggregate exposures for most sub-populations were well above the target Aggregate ARI (ARI_{agg}). The ARI_{agg} for children of 0.96 is slightly below the target; however, it is considered to be a high-end estimate because the calculated exposure values for food and water were high-end estimates. For example, percent crop treated data were not available for all commodities, and high-end field trial data were generally used. Thus, the actual risk is likely to be much lower.

Cumulative

Pyrethrins are botanical insecticides that come from the pyrethrum flower, *Chrysanthemum cinerariaefolium*. Pyrethrins have limitations because of the cost of production and instability in sunlight; therefore, many synthetic pyrethrins-like compounds were developed to be more stable in sunlight and cost effective. These compounds are referred to as synthetic pyrethroids. Although all pyrethrins and pyrethroids alter nerve function by modifying the normal biochemistry and physiology of nerve membrane sodium channels, EPA is not currently following a cumulative risk approach based on a common mechanism of toxicity for these chemicals. Although all pyrethroids interact with sodium channels, there are multiple types of sodium channels and it is currently unknown whether the pyrethrins and pyrethroids have similar effects on all channels. EPA does not have a clear understanding of effects on key downstream neuronal function e.g., nerve excitability, nor does EPA understand how these key events interact to produce their compound specific patterns of neurotoxicity. There is ongoing research by the EPA's Office of Research and Development and the pyrethroid registrants to evaluate the differential biochemical and physiological actions of pyrethroids in mammals. This research is expected to be completed by 2007. When available, the Agency will consider this research and make a determination of common mechanism as a basis for assessing cumulative risk.

Occupational Risks

Of the scenarios assessed for handlers mixing, loading, and applying pyrethrins, three scenarios were potentially of concern including: 1) mixing and loading wettable powders for agricultural handlers and PCOs; 2) applying pyrethrins with handheld foggers indoors; and 3) applying dusts through power duster equipment. To address these potential risks, the PJV has agreed to repackage all wettable powder formulations into water soluble packages and require all applicators fogging with handheld equipment indoors to wear a dust-mist (PF5) respirator. Application of dust formulations with power dusters will be prohibited, due to the high potential for exposure with this formulation and type of equipment.

There were potential post-application risks estimated for products used in metered release devices which are commonly used in dairy barns and other sites. EPA believes that the potential post-application risks are lower for people working in these settings than for residential settings due to the fact that the occupational areas generally have a greater ventilation capacity. While it is possible workers could be exposed to pyrethrins from these metered release devices, it is not likely a worker would be exposed to the full daily amount for 30 or more days, as was assumed in this assessment. The PJV has agreed to submit data to confirm the assumptions in the risk assessment.

Ecological Risks

Aquatic Organisms

Risk to aquatic organisms can occur through exposure from agriculture, wide area mosquito abatement, down-the-drain applications (such as pet shampoos), and other non-agricultural (urban) use. Risks to aquatic organisms from agricultural applications appear to be reduced if typical application rates, frequency and numbers of applications are considered. There are possible risks from mosquito abatement applications to invertebrates and fish, which can be addressed by establishing release heights, droplets size, and application rates on all pyrethrins mosquito abatement product labels in accordance with PR Notice 2005-1. There are no risks of concern predicted from down-the-drain use. Non-agricultural (urban) use was not quantified in this assessment, but there is an on-going effort to develop a model and work with a number of stakeholders in order to address this source of pesticide exposure in the near future.

Terrestrial Organisms

The Agency did not find acute or chronic risk for listed or non-listed mammals and birds. There are risk concerns for honeybees that suggest there may also be non-target insect concerns.

Summary of Mitigation Measures

EPA has determined that the currently registered uses of pyrethrins are eligible for reregistration provided the mitigation measures outlined in this document are implemented through label amendments. Mitigation measures include:

Residential

- Restrict carpet dust applications to spot treatments only.
- Prohibit use of products in metered release devices in residential areas and remove day-care centers, nursing homes, schools and hospitals from product labels.
- Restrict use of outdoor residential misting systems by establishing a maximum use rate and precautionary label statements.

Occupational

- Require all wettable powders to be repackaged in water soluble packages.
- Require all applicators using hand held foggers indoors to wear a dust-mist (PF5) respirator.
- Prohibit power dusters as an application method.

Ecological

- All agricultural product labels must be updated to specify the following application information:
 - No more than 10 applications per season.
 - Do not reapply within 3 days, except under extreme pest pressure.
 - In case of extreme pest pressure, do not reapply within 24 hours.
- All wide area mosquito abatement labels will be updated according to PR Notice 2005-1.

I. Introduction

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) was amended in 1988 to accelerate the reregistration of products with active ingredients registered prior to November 1, 1984. The amended Act calls for the development and submission of data to support the reregistration of an active ingredient, as well as EPA review of all submitted data. Reregistration involves a thorough review of the scientific database underlying a pesticide's registration. The purpose of the Agency's review is to reassess the potential risks arising from the currently registered uses of the pesticide, to determine the need for additional data on health and environmental effects, and to determine whether or not the pesticide meets the "no unreasonable adverse effects" criteria of FIFRA.

On August 3, 1996, the Food Quality Protection Act of 1996 (FQPA) was signed into law. This Act amends FIFRA to require reassessment of all tolerances in effect on the day before it was enacted. In reassessing these tolerances, the Agency must consider, among other things, aggregate risks from non-occupational sources of pesticide exposure, whether there is increased susceptibility among infants and children, and the cumulative effects of pesticides that have a common mechanism of toxicity. When the Agency determines that aggregate risks are not of concern and concludes that there is a reasonable certainty of no harm from aggregate exposure, the tolerances are considered reassessed. EPA decided that, for those chemicals that have tolerances and are undergoing reregistration, tolerance reassessment will be accomplished through the reregistration process.

Pyrethrins are botanical insecticides that come from the pyrethrum flower, *Chrysanthemum cinerariaefolium*. Pyrethrins have limitations because of the cost of production and instability in sunlight; therefore, many synthetic pyrethrins-like compounds were developed to be more stable in sunlight and cost effective. These compounds are referred to as synthetic pyrethroids. Although all pyrethrins and pyrethroids alter nerve function by modifying the normal biochemistry and physiology of nerve membrane sodium channels, EPA is not currently following a cumulative risk approach based on a common mechanism of toxicity for these chemicals. Although all pyrethroids interact with sodium channels, there are multiple types of sodium channels and it is currently unknown whether the pyrethrins and pyrethroids have similar effects on all channels. Nor do we have a clear understanding of effects on key downstream neuronal function, e.g., nerve excitability, nor do we understand how these key events interact to produce their compound specific patterns of neurotoxicity. There is ongoing research by EPA's Office of Research and Development and the pyrethroid registrants to evaluate the differential biochemical and physiological actions of pyrethroids in mammals. This research is expected to be completed by 2007. When available, the Agency will consider this research and make a determination of common mechanism as a basis for assessing cumulative risk. For information regarding EPA's procedures for cumulating effects from substances found to have a common mechanism on EPA's website at <http://www.epa.gov/pesticides/cumulative/>.

This document addresses the tolerance reassessment and reregistration eligibility decisions for all the currently registered use of pyrethrins. The Agency also considers potential modification of the toxicity of a chemical due to the presence of other chemicals when

information is available which suggests that this could be of concern, as with the pyrethrins. pyrethrins are often formulated with synergists to extend the insecticidal effects. EPA considered the possibility for increased toxicity due to the presence of synergists, such as MGK-264 and piperonyl butoxide, in pyrethrins formulations. In order for synergistic effects to be observed in humans, the synergist must be absorbed at levels sufficient to affect mixed function oxidase enzymes. It is unlikely that these levels would occur based on the registered uses of pyrethrins. Therefore, risk quantification related to pyrethrins toxicity considered only pyrethrins. Separate risk assessments were completed that considered the specific toxic effects of the synergists piperonyl butoxide and MGK-264.

The Agency made its reregistration eligibility determination based on the required data, the current guidelines for conducting acceptable studies to generate such data, and published scientific literature. The Agency has found that currently registered uses of pyrethrins, except dust applications with power dusters, are eligible for reregistration provided the mitigation and labeling outlined in the RED are implemented. The document consists of six sections: Section I, the introduction, contains the regulatory framework for reregistration/tolerance reassessment; Section II provides an overview of the chemical, including a profile of its use and usage; Section III gives an overview of the human health and environmental effects risk assessments; Section IV presents the Agency's reregistration eligibility, tolerance reassessment, and risk management decisions; Section V summarizes label changes necessary to implement the risk mitigation measures outlined in Section IV; and Section VI includes the appendices, related supporting documents and Data Call-In (DCI) information. The revised risk assessment documents and related addenda are not included in this document, but are available on the Agency's web page <http://www.epa.gov/pesticides>, and in the Public Docket under docket number EPA-HQ-OPP-2005-0043.

II. Chemical Overview

A. Regulatory History

Pyrethrins were first registered in the United States for use as an insecticide in the 1950s. Currently there are approximately 1,350 end-use products containing pyrethrins for use on agricultural, commercial, residential, and public health areas. There are 70 tolerances for pyrethrins listed in the Code of Federal Regulations. The reregistration of the pyrethrins is being supported by the Pyrethrin Joint Venture whose members include: Botanical Resources Australia, S.C. Johnson & Sons, Inc., McLaughlin Gormely King Co., Prentiss Incorporated, Pyrethrin Board of Kenya, Societe du Pyrethre au Rwanda, Tanzania Pyrethrum Processing and Marketing Co., and Valent BioSciences Corporation.

A Phase IV Data Call-In was issued for the pyrethrins in May of 1991. This DCI required environmental fate and residue chemistry data. An agricultural reentry DCI was issued in October of 1995.

Pyrethrins are in reregistration case 2580. This reregistration case contains three active ingredients as described in Table 1 below. The last products for pyrethrum powder other than

pyrethrins and pyrethrin coils were cancelled in 1991; therefore, this RED does not consider potential risks associated with those two active ingredients.

Table 1: Ingredients in the Pyrethrin and Derivatives Chemical Case (2580)			
PC Code	Chemical Name	CAS Number	Status
069001	Pyrethrins	8003-34-7	Agricultural, commercial, residential, and public health uses being reregistered in this document.
069002	Pyrethrum powder other than pyrethrins	8003-34-7	Last product cancelled in 1991.
069004	Pyrethrin coils	Not assigned	Last product cancelled in 1991.

This Reregistration Eligibility Decision document evaluates risks from all currently registered uses of pyrethrins.

B. Chemical Identification

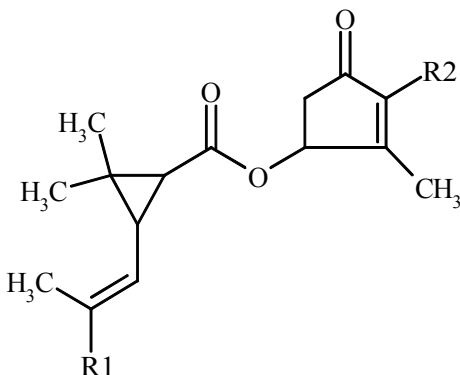
Throughout this document the term “pyrethrins” refers to all six isomers found in pyrethrum, extracts which are obtained from the dried and ground flowers of the pyrethrum plant, *Chrysanthemum cinerariaefolium*. The CAS Registry No. for the mixture is 8003-34-7. The individual isomers are referred to by the common names of the acid followed by an Arabic number 1 or 2 (i.e., pyrethrin 1, pyrethrin 2, cinerin 1, cinerin 2, jasmolin 1, jasmolin 2). If the term pyrethrins is followed by a roman numerical designation, than it refers to all of the isomers of that number in the pyrethrum extract (e.g., pyrethrins I includes pyrethrin 1, cinerin 1, and jasmolin 1). See Table 2 for a summary of terms.

Table 2: Pyrethrins Terms	
Pyrethrum	Plant extract from <i>Chrysanthemum cinerariaefolium</i> , containing all 6 isomers
Pyrethrins	pyrethrin 1, pyrethrin 2, cinerin 1, cinerin 2, jasmolin 1, jasmolin 2
Pyrethrins I	pyrethrin 1, cinerin 1, and jasmolin 1

Currently, food/feed uses are only registered for products under PC code 069001, mixed esters of (+)-trans-chrysanthemic acid and (+)-pyrethroic acid. The nomenclature of the individual pyrethrins active ingredients is presented below in Table 3. The physicochemical properties of the refined pyrethrin extracts (TGAI) are listed in Table 4.

Table 3: Pyrethrins Nomenclature

Chemical Structure



Pyrethrin I: R1 = CH₃; R2 = CH₂CH=CHCH=CH₂
 Pyrethrin II: R1 = COOCH₃; R2 = CH₂CH=CHCH=CH₂
 Cinerin I: R1 = CH₃; R2 = CH₂CH=CH₃
 Cinerin II: R1 = COOCH₃; R2 = CH₂CH=CH₃
 Jasmolin I: R1 = CH₃; R2 = CH₂CH=CHCHCH₃
 Jasmolin II: R1 = COOCH₃; R2 = CH₂CH=CHCHCH₃

Common name	pyrethrin 1
Molecular Formula	C ₂₁ H ₂₈ O ₃
Molecular Weight	328.4
IUPAC name	(Z)-(S)-2-methyl-4-oxo-3-(penta-2,4-dienyl)cyclopent-2-enyl (1R,3R)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate
CAS name	(1S)-2-methyl-4-oxo-3-(2Z)-2,4-pentadienylcyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate
CAS #	121-21-1
Common name	pyrethrin 2
Molecular Formula	C ₂₂ H ₂₈ O ₅
Molecular Weight	372.4
IUPAC name	(Z)-(S)-2-methyl-4-oxo-3-(penta-2,4-dienyl)cyclopent-2-enyl (E)-(1R,3R)-3-(2-methoxycarbonylprop-1-enyl)-2,2-dimethylcyclopropane-carboxylate
CAS name	(1S)-2-methyl-4-oxo-3-(2Z)-2,4-pentadienyl-2-cyclopenten-1-yl (1R,3R)-3-[(1E)-3-methoxy-2-methyl-3-oxo-1-propenyl]-2,2-dimethylcyclo-propanecarboxylate
CAS #	121-29-9
Common name	cinerin 1
Molecular Formula	C ₂₀ H ₂₈ O ₃
Molecular Weight	316.4
IUPAC name	(Z)-(S)-3-(but-2-enyl)-2-methyl-4-oxocyclopent-2-enyl (1R,3R)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate
CAS name	(1S)-3-(2Z)-2-butenyl-2-methyl-4-oxo-2-cyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate
CAS #	25402-06-6
Common name	cinerin 2
Molecular Formula	C ₂₁ H ₂₈ O ₅
Molecular Weight	360.4
IUPAC name	(Z)-(S)-3-(but-2-enyl)-2-methyl-4-oxocyclopent-2-enyl (E)-(1R,3R)-3-(2-methoxycarbonylprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate

Table 3: Pyrethrins Nomenclature	
CAS name	(1S)-3-(2Z)-2-butenyl-2-methyl-4-oxo-2-cyclopenten-1-yl (1R,3R)-3-[(1E)-3-methoxy-2-methyl-3-oxo-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS #	121-20-0
Common name	jasmolin 1
Molecular Formula	C ₂₁ H ₃₀ O ₃
Molecular Weight	328.4
IUPAC name	(Z)-(S)-2-methyl-4-oxo-3-(pent-2-enyl)cyclopent-2-enyl (1R,3R)-2,2-dimethyl-3-(2-methylprop-1-enyl)cyclopropanecarboxylate
CAS name	(1S)-2-methyl-4-oxo-3-(2Z)-2-pentenyl-2-cyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate
CAS #	4466-14-2
Common name	jasmolin 2
Molecular Formula	C ₂₂ H ₃₀ O ₅
Molecular Weight	374.4
IUPAC name	(Z)-(S)-2-methyl-4-oxo-3-(pent-2-enyl)cyclopent-2-enyl (E)-(1R,3R)-3-(2-methoxycarbonylprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate
CAS name	(1S)-2-methyl-4-oxo-3-(2Z)-2-pentenyl-2-cyclopenten-1-yl (1R,3R)-3-[(1E)-3-methoxy-2-methyl-3-oxo-1-propenyl]-2,2-dimethylcyclopropanecarboxylate
CAS #	1172-63-0

Table 4: Physicochemical Properties of Refined Pyrethrins (TGAI)	
Parameter	Value
Boiling point	pyrethrin 1 = 146-148 EC at 2×10^{-3} Torr pyrethrin 2 = 196-198 EC at 7×10^{-3} Torr cinerin 1 = 136-138 EC at 8×10^{-3} Torr cinerin 2 = 182-184 EC at 1×10^{-3} Torr
pH	Not applicable because the TGAI is practically insoluble in water.
Density, bulk density, or specific gravity	0.982 g/mL at 20 EC pyrethrin 1 = 1.5242 g/mL pyrethrin 2 = 1.5355 g/mL
Water solubility	<10 ppm pyrethrin 1 = 0.00002 g/100 mL at 20 EC pyrethrin 2 = 0.00090 g/100 mL at 20 EC
Solvent solubility	Completely soluble in nonpolar organic solvents; <0.1% in ethylene glycol Soluble in alcohol, petroleum ether, and methylene chloride
Vapor pressure	pyrethrin 1 = 2×10^{-5} mm Hg at 25 EC pyrethrin 2 = 4×10^{-7} mm Hg at 25 EC
Dissociation constant, pK _a	Not applicable because pyrethrins do not dissociate
Octanol/water partition coefficient	pyrethrin 1 = 5.90 pK _{OW} at 25 EC pyrethrin 2 = 4.30 pK _{OW} at 25 EC

C. Use Profile

Pyrethrins are botanical insecticides that come in many chemical forms and are found in numerous end-use products intended for a wide range of use patterns. Pyrethrins are an ingredient in approximately 1,350 agricultural, commercial, residential, and public health use products, as a sole active ingredient and in conjunction with other active ingredients. A Master Label includes a list of all uses supported by the Pyrethrin Joint Venture. A copy of the Master Label is available at <http://www.epa.gov/oppsrd1/reregistration/pyrethrins/ucm.pdf>. The following is information on the currently registered uses including an overview of use sites and application methods. A detailed table of the uses of pyrethrins eligible for reregistration is contained in the *Pyrethrins Residue Chemistry Chapter* (Deluzio, J. and Olinger, C., September 8, 2005) and shows there are at least 19 crop groups and several miscellaneous commodities being supported for reregistration.

1. Pyrethrins Use Profile

Type of Pesticide:	Insecticide
Summary of Use:	Pyrethrins are botanical insecticides. The six individual pyrethrins are pyrethrin 1, pyrethrin 2, cinerin 1, cinerin 2, jasmolin 1, and jasmolin 2. Pyrethrins are used in these four general ways: (i) pre-harvest and post-harvest uses on many agricultural crops; (ii) direct and indirect treatments of livestock animals and premises; (iii) treatments of commercial and industrial facilities and storage areas where raw and processed food/feed commodities are stored or processed; and (iv) wide area mosquito abatement use in areas which include aquatic areas.
Target Organisms:	Pyrethrins are used to kill many different types of flying and crawling insects and arthropods including various types of ants, worms, beetles, mites, flies, gnats, spiders, weevils, caterpillars, grubs, moths, ticks, lice, wasps, aphids, midges, and others.
Mode of Action:	Pyrethrins target the central and peripheral nervous systems in vertebrates and invertebrates where they disrupt the signal transmission along the nerve axon. Pyrethrins bind to the sodium channel causing it to remain open, whereby the nerve continues to be stimulated uncontrollably causing tremors. This condition results in rapid knock down and muscular paralysis in target organism resulting in death. Pyrethrins enter the target organism via ingestion and physical contact.
Tolerances:	There are 70 tolerances (40 CFR §180.128 and §180.905) being assessed for pyrethrins in/on: (i) plant commodities resulting from post-harvest uses; (ii) animal commodities; and (iii) food/feed items while in storage areas.

Use Classification: General Use

Formulation Types: Aerosol, liquid, ready-to-use solution, dust, wettable powder, microencapsulate, impregnated material, pressurized gas, pressurized liquid, pressurized spray, combustible coil, micro-emulsion, dilutable concentrate, shampoo, towelette, pour-on (spot-on), and water-based concentrate. Pyrethrins are usually formulated with synergists, such as piperonyl butoxide and MGK-264, which lack pesticidal effects of their own, but enhance the pesticidal properties of other chemicals.

Application Methods: Aerosol can, mist blower, metered release devices, total release aerosol, fixed wing aircraft, helicopter, truck-mounted ultra low volume (ULV) equipment, cold aerosol generator, hand held sprayers (high or low pressure handwands), thermal/cold/ULV fogging equipment, conventional dusting equipment (e.g., power duster, bulb duster, shaker can), outdoor misting systems, and irrigation systems.

Application Rates: Pyrethrum extracts, used for formulating the final product, contains 20-25% total pyrethrins, the main active constituents being pyrethrin 1 and pyrethrin 2, plus smaller amounts of the related cinerins and jasmolins. Formulated products generally contain 0.25 - 0.50 % active ingredient.

Usage of Pyrethrins: Approximately 200,000 lbs of pyrethrins are sold every year. Approximately 9% of the total amount of pyrethrins applied is used on agricultural commodities. Other sites where pyrethrins are applied include: 40% on indoor food areas (e.g. farm premises, food processing, dairies), 35% on indoor residential settings (e.g. pets, household domestic dwellings), 10% on indoor non-food areas (e.g. commercial, institutional industrial premises), and 6% on terrestrial non-food areas (e.g. show animals, turf, recreational areas).

III. Summary of Pyrethrins Risk Assessments

The following is a summary of EPA's human health and ecological risk findings and conclusions for pyrethrins, as presented fully in the Health Effects Division document, *Pyrethrins: Revised Human Health Risk Assessment for the Reregistration Eligibility Decision*, (Olinger, March 16, 2006), and the Environmental Fate and Effects Division document, *Revised Pyrethrins RED Chapter After Additional 60-Day Comment Period, Phase 5*, (Rexrode, February 16, 2006).

The purpose of this section is to summarize the key features and findings of the risk assessment in order to help the reader better understand the risk management decisions reached by the Agency. While the risk assessments and related addenda are not included in this document, they are available in the public docket EPA-HQ-OPP-2005-0043, that can be accessed through the website, www.regulations.gov.

A. Human Health Risk Assessment

The Agency has conducted a human health risk assessment for pyrethrins for the purposes of making a reregistration eligibility decision. The Agency evaluated the toxicology, product and residue chemistry, and occupational/residential exposure studies submitted and determined that the data are adequate to support a reregistration decision. Details of the risk assessments and separate supporting disciplinary documents are available in the electronic docket. A summary of the human health risk assessment findings and conclusions is provided below.

Although toxicity studies on degradates were not provided, an evaluation of the structures indicate that they are the result of the rupture of the ester bridge of the parent, resulting in a carboxylic acid (chrysanthemic acid), and an alcohol (that subsequently is degraded to an acid as well). The resulting molecules do not have neurotoxic activity; therefore, they were not considered in the human health assessment.

1. Toxicity Profile

The toxicological database is adequate to support the reregistration of pyrethrins. Data are sufficient for all exposure scenarios and for FQPA evaluation. A developmental neurotoxicity study and a comparative thyroid study are required to further characterize effects observed in the pyrethrins toxicity database.

Acute Toxicity Profile

Pyrethrins have low to moderate acute toxicity via the oral, dermal, and inhalation routes (Category III and IV). They are a moderate eye irritant (Category III), a mild dermal irritant (Category IV), and not a skin sensitizer. See Table 5 below.

Table 5: Acute Toxicity Profile - Pyrethrins				
Guideline No.	Study Type	MRID	Results	Toxicity Category
870.1100	Acute oral [rat]	42008101	LD ₅₀ = 1.40 g/kg LD ₅₀ = 2.14 g/kg (males) LD ₅₀ = 0.70 g/kg (females)	III
870.1200	Acute dermal [rabbit]	41964801	LD ₅₀ >2000 mg/kg	III
870.1300	Acute inhalation [rat]	42008002	LC ₅₀ = 3.4 mg/L LC ₅₀ = 3.9 mg/L (males) LC ₅₀ = 2.5 mg/L (females) tremors	IV
870.2400	Acute eye irritation [rabbit]	41964802	Produced conjunctival irritation in treated eyes of all 6 exposed rabbits; no conjunctival irritation observed in any eye by 72-hour reading. No corneal opacity or inflammation of the iris.	III

Table 5: Acute Toxicity Profile - Pyrethrins

Guideline No.	Study Type	MRID	Results	Toxicity Category
870.2500	Acute dermal irritation	41964803	Mild or slight skin irritant over 72 hours	IV
870.2600	Dermal sensitization	41964804	Not a dermal sensitizer	negative

Toxic Effects

The critical toxicological effects of pyrethrins are (1) neurobehavioral effects (tremors, labored breathing, hyperactivity, secretory signs, matted coats), following acute, short-term, and chronic exposure, with nervous system lesions observed in the rat and mouse following acute exposure; (2) thyroid effects, following chronic exposure in the rat and dog; and (3) liver effects, following short- and long-term exposure in the rat, dog, and mouse. Following inhalation exposure, neurobehavioral effects were observed initially, and respiratory tract lesions were observed at all dose levels. The neurobehavioral effects and the mode of action on the sodium channel are considered relevant to humans because the effects are observed in both the rat and mouse, and the mode of action affects a basic function of the nervous system that is common to all animals.

Toxic Mixtures Effects

EPA considered the possibility for increased toxicity due to the presence of synergists such as MGK-264 and piperonyl butoxide in pyrethrins formulations. In order for synergistic effects to be observed in humans, absorbed doses high enough to significantly affect the mixed function oxidase enzymes would be required. It is unlikely that these levels would occur based on the registered uses of pyrethrins. Therefore, risk quantification considered only the toxicity of the predominant ingredient in the pyrethrins product. Separate risk assessments were completed that considered the specific toxic effects of the synergists, piperonyl butoxide and MGK-264, that are different from those of the pyrethrins.

Neurotoxicity

There is a concern for neurotoxicity resulting from exposure to pyrethrins, based on (1) tremors in female rats, decreased motor activity in male rats, and neuropathology in both sexes in a rat acute neurotoxicity study; (2) clinical signs (excessive salivation and head arched backward) in a female rabbit following exposure during gestation; and (3) tremors in female rats in a subchronic inhalation study. In the range-finding developmental toxicity studies in rats and rabbits, tremors/convulsions were observed in those that died during the study. In the mouse 90-day range-finding study, tremors and increased/decreased activity were observed at dose levels that also resulted in mortality. As stated previously, pyrethrins are axonic poisons.

Cancer

Pyrethrins are classified as “Suggestive Evidence of Carcinogenicity, but Not Sufficient to Assess Human Carcinogenic Potential,” based on the weight-of-the-evidence including (i) the occurrence of benign liver tumors in female rats, (ii) no treatment-related increase in liver tumors

in male rats, (iii) no treatment-related increase in tumors in either sex of mice, and (iv) no concern for mutagenicity. Therefore, no quantification of cancer risk is required.

Toxicity Endpoints

The toxicological endpoints used in the human health risk assessment for pyrethrins are listed in Table 6. The uncertainty and safety factors used to account for interspecies extrapolation, intraspecies variability, and for completeness of the data with respect to exposure and toxicity to infants and children (FQPA Safety Factor) are also described in the table below.

Table 6: Toxicological Endpoints and Doses Used in the Pyrethrins Risk Assessments			
Exposure Scenario	Doses, Uncertainty Factors (UFs), and Safety Factors (SF)	Level of Concern: Population Adjusted Dose (PAD) or Target Margin of Exposure (MOE)	Study and Toxicological Effects
Acute Dietary (General population including infants and children)	NOAEL = 20 mg/kg/day UF = 100 FQPA SF = 3X (based on database uncertainties) Total UF = 300	aPAD = 0.07 mg/kg/day	Rat acute neurotoxicity study LOAEL = 63 mg/kg/day based on tremors in females (MRID: 42925801)
Chronic Dietary (All populations)	NOAEL = 4.37 mg/kg/day UF = 100 FQPA SF = 1X Total UF = 100	cPAD = 0.044 mg/kg/day	Rat chronic toxicity study LOAEL = 42.9 mg/kg/day based on increased incidence of thyroid follicular cell hyperplasia in males (MRID: 41559501)
Short-Term Incidental Oral (1-30 days)	NOAEL = 20 mg/kg/day UF = 100 FQPA SF = 3X (based on database uncertainties) Total UF = 300	Residential LOC for MOE = 300 Occupational = NA	Rat acute neurotoxicity study LOAEL = 63 mg/kg/day based on tremors in females (MRID: 42925801)
Intermediate-Term Incidental Oral (1-6 months)	NOAEL = 6.4 mg/kg/day UF = 100 FQPA SF = 1X Total UF = 100	Residential LOC for MOE = 100 Occupational = NA	2-generation rat reproduction study LOAEL = 65 mg/kg/day based on decreased F1b pup body weight/body-weight gain during lactation (MRID: 41327501)
Short-Term Inhalation (1 to 30 days)	NOAEL = 0.03 mL/kg/day (7.67 mg/kg/day) UF = 100 FQPA SF = 1X Total UF = 100	Residential LOC for MOE = 100 Occupational LOC for MOE = 100	Rat subchronic inhalation toxicity study LOAEL = 25.56 mg/kg/day based on tremors, labored breathing, hyperactivity, secretory signs, matted coat, decreased body weight/body-weight gain (MRID: 42478201)

Table 6: Toxicological Endpoints and Doses Used in the Pyrethrins Risk Assessments

Exposure Scenario	Doses, Uncertainty Factors (UFs), and Safety Factors (SF)	Level of Concern: Population Adjusted Dose (PAD) or Target Margin of Exposure (MOE)	Study and Toxicological Effects
Intermediate-Term Inhalation (1 to 6 months); Long-Term Inhalation (>6 months)	LOAEL = 0.01 mL/kg/day (2.56 mg/kg/day) UF = 100 FQPA SF = 1X Lack of NOAEL = 10X Total UF = 1000	Residential LOC for MOE = 1000 Occupational LOC for MOE = 1000	Rat subchronic inhalation toxicity LOAEL = 2.56 mg/kg/day based on respiratory tract lesions (MRID: 42478201)
Dermal Exposure	Dermal risk assessments are not required since no endpoint was identified following repeated [21 days] dermal exposure to rabbits at the limit dose of 1000 mg/kg/day. (MRID: 42212601)		
Cancer (oral, dermal, inhalation)	Classification: "Suggestive Evidence of Carcinogenicity, but Not Sufficient to Assess Human Carcinogenic Potential"		

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

2. FQPA Safety and Uncertainty Factors

The Food Quality Protection Act (FQPA) directs the Agency, in setting pesticide tolerances, to use an additional tenfold (10X) margin of safety to take into account potential pre- and postnatal toxicity and completeness of the data with respect to exposure and toxicity to infants and children. FQPA authorizes EPA to modify this tenfold safety factor only if reliable data demonstrate that the resulting level of exposure will be safe for infants and children.

No evidence of increased susceptibility of rats or rabbits to pyrethrins was seen in developmental toxicity studies. Although there was evidence of increased quantitative susceptibility following in utero and/or pre-/postnatal exposure in the 2-generation reproduction study in rats, the reproductive/offspring toxicity NOAELs and LOAELs were well characterized and were used as endpoints for risk assessment for the appropriate population subgroups. There were no residual uncertainties in the existing data for pyrethrins that indicate the need for a special FQPA safety factor (SF). However, because the pyrethrins database does not include a developmental neurotoxicity study (DNT), and there is a concern for neurotoxicity resulting from exposure to pyrethrins, EPA has retained a 3X FQPA factor for certain scenarios. The magnitude of 3 is based on a comparison of the lowest dose in the reproduction study to the doses selected for risk assessment.

A dose analysis was conducted in order to determine the need for and size of an uncertainty factor in the absence of a DNT for pyrethrins. Based on the dose analysis, the NOAEL determined in the DNT could be up to 3X lower than the NOAEL that EPA has selected to assess acute dietary and short-term incidental oral risks. However, it is unlikely that the NOAEL determined in the DNT would be lower than the doses EPA has selected to assess chronic dietary, incidental oral, and inhalation risks. Therefore, EPA has retained a 3X FQPA SF to account for database uncertainties for acute dietary risk and short-term incidental oral risk

assessment, but has reduced the FQPA SF to 1X for the other scenarios. Note that because a NOAEL was not determined in the study EPA has used for intermediate- and long-term inhalation risk assessment, EPA has applied a 10X factor to those assessments to account for the lack of a NOAEL.

3. Endocrine disruption

There is evidence that pyrethrins are associated with endocrine disruption. Direct measurements of serum thyroid hormones [T3, T4, and TSH], as well as histopathological alterations in the thyroid indicate there is concern regarding the potential for endocrine disruption. However, the FQPA SF of 3X due to lack of a DNT study is considered adequately protective for thyroid effects in the young because thyroid finding in the adult animal occur at high dose levels. Therefore, the pyrethrins risk assessments are adequately protective of potential thyroid effects in young and adult populations.

EPA is required under the FFDCA, as amended by FQPA, to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) “may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other such endocrine effects as the Administrator may designate.” Following recommendations of its Endocrine Disruptor and Testing Advisory Committee (EDSTAC), EPA determined that there was a scientific basis for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. EPA also adopted EDSTAC’s recommendation that the Program include evaluations of potential effects in wildlife. For pesticide chemicals, EPA will use FIFRA and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCA authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP). When additional appropriate screening and/or testing protocols being considered under the Agency’s EDSP have been developed, pyrethrins may be subjected to further screening and/or testing to better characterize effects related to endocrine disruption.

4. Drinking Water

For more detail on the drinking water assessment, see the *Tier 1 Estimated Drinking Water Concentrations of Pyrethrins and Derivatives for use in Human Health Risk Assessment*, (Dutta, August 19, 2004).

Drinking water exposure to pesticides can occur through ground and surface water contamination. EPA considers both acute (one-day) and chronic (lifetime) drinking water risks and uses either modeling or actual monitoring data, if available, to estimate those risks. The drinking water exposure assessment was performed using the environmental fate characteristics of a representative chemical, pyrethrin 1, for which the environmental fate database was developed. All other pyrethrins are expected to have similar environmental fate characteristics; therefore, the Estimated Drinking Water Concentrations (EDWCs) are considered suitable representative values for all the pyrethrins. The EDWC values generally represent upper-bound estimates of the concentrations that might be found in surface water and groundwater due to the use of pyrethrins on multiple crops. The mosquito adulticide uses of the pyrethrins were not

considered in this drinking water assessment because the agricultural use, which was simulated in the model, had higher application rates and will result in more conservative EDWCs.

Surface Water - Tier 1 EDWCs in surface water were modeled using the FIFRA Index Reservoir Screening Tool (FIRST). The Agency estimated an acute surface water concentration of 4.08 ppb and a chronic surface water concentration of 0.21 ppb based on 10 applications at the agricultural use rate from the Pyrethrins Master Label of 0.05 lb a.i./acre for all growing crops and assumed a re-application interval of 1 day, since none was specified.

Ground Water - Tier I EDWCs for ground water were modeled using the Screening Concentration In Ground Water (SCI-GROW) model. The Agency estimated a concentration of 0.003 ppb in ground water, based on a maximum seasonal application rate of 0.5 lbs a.i./acre per year, a mean soil half-life of 3.2 days and a K_{oc} of 12,400 mL/g pyrethrins.

5. Dietary Risk (Food + Water)

Dietary risk assessment incorporates both exposure to and toxicity of a given pesticide. Dietary risk is expressed as a percentage of a level of concern. The level of concern is the dose predicted to result in no unreasonable adverse health effects to any human population subgroup, including sensitive members of such population subgroups. This level of concern is referred to as the population adjusted dose (PAD), which reflects the reference dose (RfD), either acute or chronic, adjusted to account for the FQPA safety factor. Estimated risks that are less than 100% of the PAD are below EPA's level of concern.

Both acute and chronic dietary (food + water) risk assessments were conducted using the Dietary Exposure Evaluation Model software with the Food Commodity Intake Database (DEEM-FCID™, Version 2.03), which uses food consumption data from the USDA's Continuing Surveys of Food Intakes by Individuals (CSFII) from 1994-1996 and 1998. For residue in food, the acute and chronic dietary exposure and risk analysis was conducted using current tolerance values, Codex Maximum Residue Limits (MRLs), field trial data, and data translated from other crops. DEEM 7.81 processing factors were used in this assessment. An upper bound estimate for the drinking water concentration was used in the dietary exposure assessment since no monitoring data were available.

Acute

The acute dietary assessment incorporates both exposure to and toxicity of pyrethrins considering what is consumed in one day and maximum or high-end residue values in food and water. The acute Population Adjusted Dose (aPAD) is the dose an individual could be exposed to in one day and no adverse health effects would be expected.

The aPAD was based on tremors in female rats, as seen at the lowest observed adverse effect level (LOAEL) of 63 mg/kg/day in an acute neurotoxicity study in rats. The no observed adverse effect level (NOAEL) was 20 mg/kg/day. An uncertainty factor of 300 (10X for inter-species extrapolation, 10X for intra-species variation, and 3X FQPA database uncertainty due to lack of a DNT) was applied to the NOAEL.

The aPAD was calculated as $20 \text{ mg/kg/day} \div 300 = 0.07 \text{ mg/kg/day}$. Risk is expressed as a percentage of the aPAD. A risk estimate less than 100% of the aPAD does not exceed the Agency's level of concern.

Dietary risk estimates were calculated for the general U.S. population and various population subgroups. Pyrethrins acute dietary risk estimates (food + water) for the U.S. population (54% of the aPAD) and for the most highly exposed population subgroup, children 1-2 years of age (100% of the aPAD), were at or below the Agency's level of concern as shown in Table 7. The highest contributors to estimated exposures were pineapple, dried-oat baby food, and banana (71% of total exposure). EPA assumed 100 percent crop treated in the assessment for each of these commodities. The acute dietary assessment could be further refined with additional residue data reflecting pre-harvest uses and additional percent crop treated information.

Chronic

A somewhat refined assessment was conducted to assess the chronic dietary exposure to pyrethrins. Current tolerances, field trial data, translated data, default processing factors, percent crop treated (%CT), and an upper bound point estimate for the chronic drinking water concentration were used. The HAFT (highest average field trial) of 0.23 ppm from a spray food handling study was used for all food-handling establishment uses of pyrethrins. The chronic Population Adjusted Dose (cPAD) is the dose at which an individual could be exposed over the course of a lifetime and no adverse health effects would be expected.

The cPAD was based on increase thyroid follicular cell hyperplasia in male rats as seen at the lowest observed adverse effect level (LOAEL) of 42.9 mg/kg/day from a rat chronic toxicity study. The no observed adverse effect level (NOAEL) was 4.37 mg/kg/day. An uncertainty factor of 100 (10X for inter-species extrapolation, 10X for intra-species variation, and 1X FQPA) was applied to the NOAEL.

The cPAD was calculated as $4.37 \text{ mg/kg/day} \div 100 = 0.044 \text{ mg/kg/day}$. Risk is expressed as a percentage of the cPAD. A risk estimate less than 100% of the cPAD does not exceed the Agency's level of concern.

Chronic dietary risk estimates were calculated for the general U.S. population and various population subgroups. Pyrethrins chronic dietary risk estimates (food + water) for the U.S. population (11% of the cPAD) and for the most highly exposed population subgroup, children 1-2 years of age (32% of the cPAD), are below the Agency's level of concern.

Table 7: Summary of Dietary Exposure and Risk for Pyrethrins						
Population Subgroup	Acute Dietary (99.9th Percentile)			Chronic Dietary		
	aPAD, mg/kg/day	Exposure, mg/kg/day	% aPAD	cPAD, mg/kg/day	Exposure, mg/kg/day	% cPAD
General U.S. Population	0.07	0.038	54	0.04	0.0044	11

Table 7: Summary of Dietary Exposure and Risk for Pyrethrins

Population Subgroup	Acute Dietary (99.9th Percentile)			Chronic Dietary		
	aPAD, mg/kg/day	Exposure, mg/kg/day	% aPAD	cPAD, mg/kg/day	Exposure, mg/kg/day	% cPAD
All Infants (< 1 yr)	0.07	0.068	97	0.04	0.0088	22
Children 1-2 yrs	0.07	0.070	100	0.04	0.013	32
Children 3-5 yrs	0.07	0.051	73	0.04	0.011	27
Children 6-12 yrs	0.07	0.034	49	0.04	0.0068	17
Youth 13-19 yrs	0.07	0.025	35	0.04	0.0036	9
Adults 20-49 yrs	0.07	0.031	43	0.04	0.0035	9
Adults 50+ yrs	0.07	0.019	27	0.04	0.0031	8
Females 13-49 yrs	0.07	0.027	38	0.04	0.0031	8

The values for the population with the highest risk for the acute and chronic assessments are bolded.

In the dietary assessment, previously established tolerances were used for many of the food commodities that were lacking residue data. For all other commodities in the assessment, data were translated from either residue data or other tolerances values. No monitoring data were available. Default processing factors were used because there were limited processing data available. 100% crop treated was used as a default on more than half of crops due to lack of data. Both, the presence of processing factors and percent crop treated could impact the assessment greatly.

Estimated drinking water concentrations, which were included in the dietary assessment, represents the upper-bound estimated concentrations that might be found in surface water and groundwater due to the use of pyrethrins on multiple crops. This use of upper-bound estimates for drinking water is a conservative approach. When combining high-end food and water estimates, modeling results are higher than what is expected under actual conditions.

6. Residential Exposure and Risk

For more detail on the residential exposure and risk assessment, see the *Pyrethrins: 2nd Revised Occupational and Residential Exposure Assessment and Recommendations for the Reregistration Eligibility Decision*, (Dole, September 7, 2005), and for more detail on the residential outdoor misting system assessment, see the *Occupational and Residential Exposure Assessment for the Use of Pyrethrin in Residential Mosquito Mister Systems*, (Dole, September 7, 2005).

Based on the Pyrethrins' Master Label, ten residential exposure scenarios have been assessed for this RED. Only inhalation and incidental oral ingestion exposure assessments have been conducted for the residential scenarios. Dermal exposures were not assessed because no dose or endpoints were identified for dermal risk; therefore, toxicity from dermal exposure is not expected. Short term inhalation exposures are assessed for all handler and post-application exposure scenarios.

Non-cancer risk estimates are expressed as a margin of exposure (MOE) which is a ratio of the dose from a toxicological study selected for risk assessment, typically a NOAEL, to the predicted exposure. Estimated MOEs are compared to a level of concern which reflects the dose selected for risk assessment and uncertainty factors (UFs) applied to that dose. The standard UF is 100X which includes 10X for interspecies extrapolation (to account for differences between laboratory animals and humans) and 10X for intraspecies variation (to account for differences between humans). Additional uncertainty or safety factors may also be applied. A summary of the residential levels of concern, or target MOEs, is listed in Table 8. For pyrethrins, MOEs greater than 300 for incidental exposure, 100 for short-term inhalation exposure, and 1000 for intermediate- and long-term inhalation exposure do not exceed the Agency's level of concern.

Table 8: Residential (non-dietary) Level of Concern Summary (MOEs)			
Route of Exposure	Duration of Exposure		
	Short-Term (1-30 Days)	Intermediate-Term (1 - 6 Months)	Long-Term (> 6 Months)
Incidental Oral	300	N/A	N/A
Dermal	NR	NR	NR
Inhalation	100	1000	1000

NR = Not Required - No endpoints were identified for dermal exposure because no systemic effects were observed at the limit dose.

N/A = Not Applicable – Incidental oral exposures are not expected for intermediate- or long-term scenarios.

a. Toxicity

The toxicological endpoints used in the residential human health risk assessment for pyrethrins are listed in Table 9.

Table 9: Toxicological Endpoints and Doses Used in the Residential Risk Assessment			
Exposure Scenario	Doses, Uncertainty Factors (UFs), and Safety Factors (SF)	Target Level of Concern: Margin of Exposure (MOE)	Study and Toxicological Effects
Short-Term Incidental Oral (1-30 days)	NOAEL= 20 mg/kg/day UF =100 FQPA SF = 3X (based on database uncertainties) Total UF = 300	Residential LOC for MOE =300	Acute neurotoxicity study in rats LOAEL = 63 mg/kg/day based on tremors in females (MRID: 42925801)
Intermediate-Term Incidental Oral (1-6 months)	NOAEL = 6.4 mg/kg/day UF =100 FQPA SF = 1X Total UF = 100	Residential LOC for MOE = 100	2-generation rat reproduction study LOAEL = 65 mg/kg/day based on decreased F1b pup body weight/body-weight gain during lactation (MRID: 41327501)
Short-Term Inhalation (1 to 30 days)	NOAEL= 0.03 mL/kg/day (7.67 mg/kg/day) UF =100 FQPA SF = 1X Total UF = 100	Residential LOC for MOE = 100	Rat subchronic inhalation toxicity study LOAEL = 25.56 mg/kg/day based on tremors, labored breathing, hyperactivity, secretory signs, matted coat, decreased body weight/body-weight gain (MRID: 42478201)

Table 9: Toxicological Endpoints and Doses Used in the Residential Risk Assessment

Exposure Scenario	Doses, Uncertainty Factors (UFs), and Safety Factors (SF)	Target Level of Concern: Margin of Exposure (MOE)	Study and Toxicological Effects
Intermediate-Term Inhalation (1 to 6 months); Long-Term Inhalation (>6 months)	LOAEL = 0.01 mL/kg/day (2.56 mg/kg/day) UF = 100 FQPA SF = 1X Lack of LOAEL = 10X Total UF = 1000	Residential LOC for MOE = 1000	Rat subchronic inhalation toxicity LOAEL = 2.56 mg/kg/day based on respiratory tract lesions (MRID: 42478201)
Dermal Exposure	Dermal risk assessments are not required since no endpoint was identified following repeated [21 days] dermal exposure to rabbits at the limit dose of 1000 mg/kg/day.		

NOAEL = no observed adverse effect level, LOAEL = lowest observed adverse effect level, MOE = margin of exposure, LOC = level of concern

b. Residential Exposure Scenarios

Application rates for most of the exposure scenarios assessed are based on information provided in the Pyrethrins Master Label, which lists all of the uses that the Pyrethrins Joint Venture members are supporting. However, the application rate for the compact metered release scenario was based upon the Purge II label (EPA Reg No. 9441-161), which is a representative product that is used in the compact aerosol dispenser units. The use information on outdoor residential mosquito misting systems was provided in a discussion paper by the Consumer Specialty Products Association (CSPA), and the dilution rates are based on the Riptide ULV label (EPA Reg. No. 1021-1785).

The residential exposure assessment includes both handler and post-application exposure scenarios. The term “handler” applies to individuals, including homeowners, who mix, load, and apply the pesticide product. The term “post-application” describes exposure to individuals who enter areas previously treated with pesticides. Only short-term exposures were assessed for most scenarios because the pyrethrins are used on an intermittent basis and the residues disperse quickly. Intermediate-term exposures were assessed for indoor metered release scenarios and outdoor residential mister systems.

i. Residential Handler Scenarios

The quantitative residential handler exposure/risk assessment is based on these scenarios:

- 1) Aerosol can application - indoor surface spray
- 2) Load/apply dusts - indoor surface treatment and home gardens
- 3) Mix/load/apply liquids with low pressure (LP) handwand - indoor surface spray and crack and crevice application
- 3) Mix/load/apply liquids with trigger sprayer - indoor surface spray and crack and crevice application
- 4) Mix/load/apply liquids with hose-end sprayer - lawns
- 5) Load outdoor residential mister tanks

ii. Residential Post Application Scenarios

The quantitative residential post application exposure/risk assessment is based on these scenarios:

- 1) Inhalation exposure from aerial application of mosquito adulticide
- 2) Inhalation exposure from truck mounted ULV application of mosquito adulticide
- 3) Toddler incidental oral ingestion of residue from treated turf (ground application)
- 4) Toddler incidental oral ingestion of residues deposited on carpet
- 5) Toddler incidental oral ingestion of residues deposited on vinyl flooring
- 6) Toddler incidental oral ingestion of residues on pets
- 7) Inhalation exposure to aerosol spray during and after space spray application
- 8) Inhalation exposure from compact metered release systems
- 9) Inhalation exposure from outdoor mosquito mister systems
- 10) Toddler incidental oral ingestion of residue from treated turf (mister application)

Due to lack of data, risk calculations from broadcast dust applications to carpet were not calculated. Qualitative descriptions of the possible risk concerns are included in Section IV.

c. Exposure Data and Assumptions

Handler Exposure Data

Data from the Pesticide Handler Exposure Database (PHED) and Occupational Residential Exposure Task Force (ORETF) database were used to assess residential handler exposures. Default application assumptions regarding areas treated or amounts applied for residential handler scenarios are documented in the HED Science Advisory Committee on Exposure SOP 12: Recommended Revisions to the Standard Operating Procedures for Residential Exposure Assessment (February 22, 2001). Other residential exposure standard operating procedures (SOPs) may be viewed at the following website:

<http://www.epa.gov/oscpmont/sap/1997/september/sopindex.htm> .

Post Application Exposure Data

The Agency used default factors from the Exposure Science Advisory Committee SOP 12, Non-Dietary Exposure Task Force (NDETF) data, and Spray Drift Task Force exposure data throughout the post-application risk assessment. Refer to the Occupational and Residential Exposure Assessment for further data information.

Exposure Parameters

The parameters and assumptions used in estimating risks from residential exposure to pyrethrins can be found in Section 7.2 of the Occupational and Residential Exposure Assessment (September 7, 2005). The information listed was used to assess all scenarios including mosquito abatement, incidental oral, aerosol space sprays, and outdoor residential misting systems.

d. Residential Risk Estimates

Most residential handler and post application scenarios were assessed as short-term exposures because pyrethrins are used only on an intermittent basis and the residues disperse or degrade rapidly. However, the compact metered release sprays are packaged to release product regularly for a 30-day period and may be immediately replaced, resulting in intermediate-term exposures. Products used in metered release devices are usually formulated in ready to use aerosol cans with a special nozzle that fits into the device. A battery-operated timer system allows a spray of pyrethrins to dispense regularly throughout a day. These systems are registered for use to control flying insects in food handling establishments, animal premises, and other areas.

All of the residential short-term scenarios have MOEs that are greater than the target MOE; therefore the risks are below EPA's level of concern. Most intermediate-term post-application inhalation risks associated with metered release devices and outdoor residential misting systems are above EPA's level of concern (i.e., MOEs are less than 1000). Exposure and risk estimates for residential scenarios potentially of concern are summarized in Table 10 below.

The indoor metered release device scenario was based on the Multi-Chamber Concentration and Exposure Model (MCCCEM) single chamber model to predict the air concentrations that could result from metered release device applications to an entire house, or applications to kitchen areas only. The risk estimates for the metered release scenarios are conservative because it was assumed that the aerosol particles would remain airborne until they were removed by ventilation and the effect of aerosol particle settling was not considered. Aerosol particle settling could be a major factor depending upon the aerosol particle size and rate of evaporation.

Table 10: Summary of Residential Risks of Concern - Inhalation			
Scenario	Exposed Population	Short Term MOE ^a	Intermediate Term MOE ^b
Post Application Exposure Following Metered Release			
Single Chamber MCCCEM Modeling of Whole House Metered Release at 0.18 air changes per hour (ACH)	Children	120	40
	Adult	370	130
Single Chamber MCCCEM Modeling of Whole House Metered Release at 0.45 ACH	Children	290	100
	Adult	890	310
Two Zone MCCCEM Modeling of Kitchen Only Metered Release at 0.18 ACH	Children	310	100
	Adult	940	310
Two Zone MCCCEM Modeling of Kitchen Only Metered Release at 0.45 ACH	Children	740	240
	Adult	2,200	740
Post Application Exposure – Outdoor Residential Misting Systems			
Outdoor Mister	Children	1,800	600
	Adult	3,500	1200
^a Target short term MOEs are 100 for inhalation exposures. ^b The target intermediate term MOE is 1000 for inhalation exposures.			

7. Aggregate Risk

In accordance with the FQPA, the Agency must consider pesticide exposures and risks from all potential sources. These usually include food, drinking water, and residential exposures. In an aggregate assessment, exposures from relevant sources are added together and compared to quantitative estimates of hazard (e.g., a NOAEL), or the risks themselves can be aggregated. When aggregating exposures and risks from various sources, the Agency considers both the route (oral, dermal, and inhalation) and duration (short-, intermediate-, or long-term) of exposure.

Endpoints related to neurotoxicity were selected for short-term (1-30 days) via the oral and inhalation routes, so they may be aggregated. The endpoints selected for intermediate- and long-term exposures have different effects for the oral and inhalation routes, so an aggregate assessment for these exposure intervals is not appropriate.

Acute (one-day) Aggregate Risk (Food + Water)

Only food and water are generally aggregated for acute (one-day) exposures to pesticides and those risk assessment calculations are presented above in the Acute Dietary Risk section of this document. All acute aggregate risks are at or below EPA's level of concern.

Short-Term (1-30 days) Aggregate Risk (Food + Water + Residential Exposures)

There were different levels of concern for oral (MOE = 300) and inhalation (MOE = 100) exposure, so an aggregate risk index (ARI) method was used to estimate the short-term risk. An aggregate ARI above 1 is not of concern for the Agency. The highest oral exposure estimated was from incidental exposure to residues on vinyl floors after a fogging application (0.0029 mg/kg/day). The highest inhalation exposure was from space spray applications (0.012 mg/kg/day). These two exposure scenarios were included in the aggregate assessment to represent the highest oral and inhalation values anticipated over a short term duration.

Since there were multiple sources of oral exposure, they were added together for the short-term aggregate. The chronic dietary exposure (0.011 mg/kg/day) was added to the incidental oral exposure to residues on vinyl floors after fogging (0.0029 mg/kg/day) to calculate the total oral exposure expected (0.0139 mg/kg/day). This results in an MOE of 1440 ($20 \text{ mg/kg/day} / 0.0139 \text{ mg/kg/day} = 1440$) for all sources of oral exposure. Only one source of inhalation exposure was added to the aggregate, the space spray scenario noted above (0.012 mg/kg/day).

The ARI method was then used to compare the oral exposures (target MOE = 300) to the inhalation exposures (target MOE = 100). See Section 7.2 of the Human Health Assessment for an explanation of ARI calculations and Table 11 below for a summary of the calculation results for pyrethrins. The aggregate results for most sub-populations were well above the target Aggregate ARI (ARI_{agg}) of 1 and are below EPA's level of concern. Although the ARI_{agg} for children does not reach the target ($\text{ARI}_{\text{agg}} = 0.96$) it is considered to be a high-end estimate.

In the dietary assessment, high-end field trial data and 100 percent crop treated values were used. The incidental oral and inhalation values from the residential risk assessment both represent the highest anticipated contribution from these individual routes of exposure. It is unlikely a child would be exposed to both the highest possible incidental oral exposure from a fogging application and to the highest possible inhalation exposure from a space spray application at the same time. The actual short-term aggregate risk is likely to be much lower.

Table 11: Short-Term Aggregate Risk					
Population	MOE Food + Water + Incidental Oral	ARI Food + Water + Incidental Oral ¹	MOE Inhalation	ARI Inhalation ¹	Aggregate ARI ² (Target ARI > 1)
Adult Male	5405	18	370	3.7	3.1
Adult Female	5850	20	370	3.7	3.1
Child (ages 1-6)	1440	4.8	120	1.2	0.96
Non-hispanic/non-white/non-black (Highest Exposed Adult Subpop)	2900	9.7	370	3.7	2.7

¹ARI = [MOE_{CALCULATED} (i.e., FOOD, WATER, INHALATION, ORAL) ÷ MOE_{ACCEPTABLE}]

$$^2\text{Aggregate ARI} = \frac{1}{\frac{1}{\text{ARI}_{\text{FOOD + WATER + ORAL}}} + \frac{1}{\text{ARI}_{\text{INHALATION}}}}$$

Intermediate-Term (30 days – 6 months) Aggregate Risk

There are no aggregate risk estimates for the intermediate- or long-term durations because the oral and inhalation endpoints that were selected are based on different toxicological effects. No incidental oral exposures, were expected for intermediate- or long-term durations.

8. Cumulative Risk Assessment

Pyrethrins are botanical insecticides that come from the pyrethrum flower, *Chrysanthemum cinerariaefolium*. Pyrethrins have limitations because of the cost of production and instability in sunlight; therefore, many synthetic pyrethrins-like compounds were developed to be more stable in sunlight and cost effective. These compounds are referred to as synthetic pyrethroids. Although all pyrethrins and pyrethroids alter nerve function by modifying the normal biochemistry and physiology of nerve membrane sodium channels, EPA is not currently following a cumulative risk approach based on a common mechanism of toxicity for these chemicals. Although all pyrethroids interact with sodium channels, there are multiple types of sodium channels and it is currently unknown whether the pyrethrins and pyrethroids have similar effects on all channels. EPA does not have a clear understanding of effects on key downstream neuronal function e.g., nerve excitability, nor does EPA understand how these key events interact to produce their compound specific patterns of neurotoxicity. There is ongoing research by the EPA's Office of Research and Development and the pyrethroid registrants to evaluate the differential biochemical and physiological actions of pyrethroids in mammals. This research is expected to be completed by 2007. When available, the Agency will consider this research and make a determination of common mechanism as a basis for assessing cumulative risk. For

information regarding EPA's procedures for cumulating effects from substances found to have a common mechanism on EPA's website at <http://www.epa.gov/pesticides/cumulative/>.

9. Occupational Risk

For more detail on the occupational assessment, see the *Pyrethrins: 2nd Revised Occupational and Residential Exposure Assessment and Recommendations for The Reregistration Eligibility Decision (RED)*, (Dole, September 7, 2005).

a. Occupational Toxicity

Table 12 provides a listing of the toxicological endpoints used in the pyrethrins occupational risk assessment. No dermal endpoint was identified; therefore, no dermal assessment was warranted.

Table 12: Endpoints and Doses Used in the Occupational Risk Assessment			
Exposure Scenario	Doses, Uncertainty Factors (UFs), and Safety Factors (SF)	Target Level of Concern: Margin of Exposure (MOE)	Study and Toxicological Effects
Short-Term Inhalation (1 to 30 days)	NOAEL = 0.03 mL/kg/day (7.67 mg/kg/day) UF = 100	Occupational LOC for MOE = 100	Rat subchronic inhalation toxicity study LOAEL = 25.56 mg/kg/day based on tremors, labored breathing, hyperactivity, secretory signs, matted coat, decreased body weight/body-weight gain (MRID: 42478201)
Intermediate-Term Inhalation (1 to 6 months); Long-Term Inhalation (>6 months)	LOAEL = 0.01 mL/kg/day (2.56 mg/kg/day) UF = 100 Lack of NOAEL = 10X Total UF = 1000	Occupational LOC for MOE = 1000	Subchronic inhalation toxicity - rat LOAEL = 2.56 mg/kg/day based on respiratory tract lesions (MRID: 42478201)

UF = uncertainty factor, NOAEL = no observed adverse effect level, LOAEL = lowest observed adverse effect level, MOE = margin of exposure, LOC = level of concern

b. Occupational Handler Exposure

Workers can be exposed to a pesticide through mixing, loading, or applying the pesticide and through reentering a treated site. Worker risk is measured by a Margin of Exposure (MOE) which determines how close the occupational exposure comes to the NOAEL taken from animal studies. A summary of the occupational levels of concern is listed in Table 13. In the case of pyrethrins MOEs that are greater than 100 for short term exposure and 1000 for intermediate- and long-term exposure do not exceed the Agency's level of concern.

Table 13: Occupational Level of Concern Summary			
Route of Exposure	Duration of Exposure		
	Short-Term (1-30 Days)	Intermediate-Term (1 - 6 Months)	Long-Term (> 6 Months)
Occupational Exposure			
Dermal	NR	NR	NR
Inhalation	100	1000	1000

NR = Not Required - No endpoints were selected for dermal exposure because no systemic effects were observed at the limit dose.

c. Occupational Handler Risk Summary

Thirty occupational exposure scenarios have been assessed for pyrethrins. Only inhalation exposures have been assessed for each of the occupational scenarios because no toxicological endpoints were seen in dermal exposure studies. Due to lack of data, application of dust with bulb duster and power duster were not assessed. Also, handlers applying with handheld foggers could not be assessed due to lack of use and application information. All of the short term MOEs are greater than 100; therefore short-term risks to handlers are below EPA's level of concern.

The following 4 intermediate term exposure scenarios with wettable powder formulations do not reach the target MOE of 1000 with baseline PPE and are potentially of concern:

- Mix/Load wettable powders for aerial application or chemigation to field crops with an application rate of 0.05 lb ai/acre. The MOE is 69 for high acreage crops (1200 acres) and 240 for typical acreage crops (350 acres).
- Mix/Load/Apply wettable powders with low pressure handwand to greenhouses with an application rate of 0.15 lb ai/acre. The MOE is 240.
- Mix/Load/Apply wettable powders with low pressure handwand for surface treatments with an application rate of 0.056 lb ai/1000 ft². The MOE is 260 assuming 11,200 square feet (7 buildings) treated per day.
- Mix/Load/Apply wettable powders with low pressure handwand for crack and crevice treatment at an application rate of 0.22 lb ai/1000 ft². The MOE is 66 assuming 11,200 square feet (7 buildings) treated per day and 460 assuming 1600 square feet (one building) treated per day.

d. Occupational Post-application Risk Summary

Occupational post application inhalation exposures are expected from metered release applications. According to the Master Label, pyrethrins are used as space sprays in a wide variety of indoor areas such as barns, greenhouses, food storage areas, food processing areas, restaurants and residences. A scenario that involves a metered release into a dairy barn was evaluated to assess these exposures because pyrethrins are commonly used in dairy barns and because the ventilation characteristics of dairy barns are relatively well defined. The MOE for intermediate term exposure is 400, which does not reach the target MOE of 1000 as shown in Table 14.

The indoor metered release device scenario used the same model, the MCCEM single chamber model, as the residential metered release device scenario, except the occupational assessment assumed a ventilation rate of six air changes per hour, while the residential scenario assumed less than half an air change per hour. The risk estimates for the metered release scenarios are conservative because it was assumed that the aerosol particles would remain airborne until they were removed by ventilation and the effect of aerosol particle settling was not

considered. Aerosol particle settling could be a major factor depending upon the aerosol particle size and rate of evaporation. Data will be required to better characterize this exposure.

Table 14: Pyrethrins Occupational Post-Application Estimated Risks Following Metered Release			
Exposure Scenario	Location	Short Term MOE (Target MOE = 100)	Intermediate Term MOE (Target MOE = 1000)
Metered Release Space Spray	Dairy Barns	1,200	400

The restricted entry interval (REI) for pyrethrins will remain at 12 hours for all post-application scenarios that fall under the Worker Protection Standard. In addition, under the Worker Protection Standard for Agricultural Pesticides –WPS (40 CFR 170) greenhouses must be appropriately ventilated following pesticide applications so that post-application inhalation exposures are minimal.

7. Human Incident Data

In evaluating incidents to humans, the Agency reviewed reports from the OPP Incident Data System (IDS), Poison Control Centers, 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).

Because pyrethrins are often used with a synergist such as piperonyl butoxide (PBO), it was difficult to determine if the symptoms reported were due to pyrethrins alone. In the Incident Data System, only one case involving pyrethrum alone was reported. This incident involved 8 employees in Washington State who developed unspecified symptoms after repacking pyrethrum powder into smaller containers. Poison Control Center Data (1993-2001) indicated that there were nearly 10,000 reported pyrethrins exposures resulting in eye, respiratory, and dermal effects; however, most of these exposures were from pyrethrins in head lice shampoos. Some of the respiratory symptoms reported including dyspnea or breathing difficulty, bronchospasm, and cough/choke, could indicate that pyrethrins may pose risks for persons with a history of respiratory illness, allergy, or asthma. During 1993-1998, 48% of these exposures involved head lice shampoos and during 1999-2001, 99% of the reported exposures involved head lice shampoos. Shampoos used on people are regulated by the Food and Drug Administration (FDA). FDA has required warning language such as: "Ask a doctor before use if you are allergic to ragweed. May cause breathing difficulty or an asthmatic attack." (FR vol. 68, No. 250, 12/31/2003, 75414) EPA is considering the need for and feasibility of similar language. See a further discussion of this topic in Section IV.

B. Environmental Risk Assessment

For more detail on the environmental risk assessment, see the *Revised Pyrethrins RED Chapter After Additional 60-Day Comment Period, Phase 5*, (Rexrode, February 16, 2006). A summary of the Agency's environmental risk assessment for pyrethrins is presented below.

1. Environmental Fate and Transport

The environmental fate database is adequate to characterize the environmental fate, drinking water, and ecological exposure of the pyrethrins. However, EPA does intend to issue a DCI as part of this RED to require submission of additional data for the pyrethrins to address areas of uncertainty.

Since all six pyrethrins are structurally very similar, they are expected to have similar environmental fate properties. Pyrethrin 1 was selected as a surrogate for all the pyrethrins to generate the environmental fate data, because it is difficult to evaluate the environmental fate properties of a mixture. Based on structure analysis, degradates of pyrethrins are expected to lose their toxicological activity and are not considered in this risk assessment. The major routes of dissipation for pyrethrins in the environment are photolysis (both in water and soil, with half lives of less than one day in both cases) and to a lesser degree, aerobic soil metabolism. Hydrolysis under alkaline conditions is an important route of dissipation for pyrethrins in water (half-life at pH 9 is 14-17 hours); however, this reaction appears to be relatively slow under neutral or acidic conditions, which are more likely to occur in the environment.

Pyrethrins are more persistent to anaerobic microbial metabolism ($t_{1/2}$ = 86.1 days) than aerobic microbial metabolism ($t_{1/2}$ = 10.5 days). They adsorb strongly to soil surfaces and are generally considered immobile in soils (K_{oc} range 12,400 to 37,840); therefore, the potential to leach into groundwater is considered low. Pyrethrins could reach surface water via spray drift or runoff events accompanied by erosion where they quickly adsorb to suspended solids in the water column, and partition into the sediment. Non-degraded pyrethrins are likely to bind to sediment since they appear to persist under anaerobic conditions.

2. Ecological Risk

The Agency's ecological risk assessment compares toxicity endpoints from ecological toxicity studies to estimated environmental concentrations (EECs) based on environmental fate characteristics and pesticide use data. To evaluate the potential risk to non-target organisms from the use of pyrethrins, the Agency calculates a Risk Quotient (RQ), which is the ratio of the EEC to the most sensitive toxicity endpoint values, such as the median lethal dose (LD_{50}) or the median lethal concentration (LC_{50}). These RQ values are then compared to the Agency's levels of concern (LOCs), which are listed below in Table 15 and indicate whether a pesticide, when used as directed, has the potential to cause adverse effects to non-target organisms. When the RQ exceeds the LOC for a particular category, the Agency presumes a risk of concern. These risks of concern may be addressed by further refinements of the risk assessment or mitigation measures. Use, toxicity, fate, and exposure are considered when characterizing the risk, as well as the levels of certainty and uncertainty in the assessment. EPA further characterizes ecological risk based on any reported incidents to non-target terrestrial or aquatic organisms in the field (e.g., fish or bird kills).

The ecological risk assessment for pyrethrins focuses on maximum and typical application rates for agricultural and mosquito abatement uses. Consideration was also given for pharmacological uses in a "Down-the-Drain" scenario. Limited information was available to

compare the effects from technical grade pyrethrins to product formulated with the synergist piperonyl butoxide, and this comparison is summarized in the discussion below.

Table 15: EPA's Levels of Concern and Associated Risk Presumptions			
Risk Presumption	LOC Terrestrial Animals	LOC Aquatic Animals	LOC Plants
<i>Acute Risk</i> - there is potential for acute risk	0.5	0.5	1
<i>Acute Endangered Species</i> - endangered species may be adversely affected	0.1	0.05	1
<i>Chronic Risk</i> - there is potential for chronic risk	1	1	Not Applicable

a. Risk to Aquatic Organisms

i. Fish and Invertebrate Toxicity and Exposure

1. Toxicity

Aquatic Toxicity

Toxicity testing was conducted with both pyrethrum extract or technical grade active ingredient (TGAI), FEK-99 (57.5% a.i.), as well as with a formulated end-use product, typically a Pyreoneone crop spray (6.02% a.i.). A comparison of the toxicity results with both the TGAI and typical end-use product are shown in Table 17. Only toxicity data with the TGAI are summarized here.

The results of the toxicity testing with the TGAI suggest that pyrethrins are very highly toxic to freshwater fish ($LC_{50} = 5.1 \mu\text{g/L}$) and invertebrates ($EC_{50} = 11.6 \mu\text{g/L}$), as well as to estuarine/marine fish ($LC_{50} = 16.0 \mu\text{g/L}$) and invertebrates ($LC_{50}/EC_{50} = 1.4 \mu\text{g/L}$) on an acute basis.

Chronic toxicity studies were conducted with the TGAI only. Studies show that pyrethrins impair growth (length and weight) of freshwater fish (LOAEC of $3.0 \mu\text{g/L}$) and reproduction of freshwater invertebrates (LOAEC of $2.0 \mu\text{g/L}$). The chronic no observed adverse effect concentrations (NOAECs) for freshwater fish and invertebrates were reported as 1.9 and $0.86 \mu\text{g/L}$, respectively. No data were submitted to evaluate the chronic risk to estuarine/marine fish or invertebrates. However, as shown in Table 16, based on the acute-to-chronic ratio method described in Section IV of the EFED Risk Assessment, estimated NOAECs for the sheepshead minnow and mysid shrimp were used to assess chronic risks.

Since pyrethrins tend to bind to sediment, data regarding the toxicity of pyrethrins to sediment-dwelling benthic organisms are needed. For this risk assessment the Agency did not

have sediment monitoring or toxicity data to adequately evaluate the potential risk to benthic organisms; therefore, the toxicity to benthic organisms was estimated using the equilibrium partitioning approach, using the pore water concentrations obtained from PRZM/ EXAMS, and the toxicity reference value of the most sensitive invertebrate species. See Table 10 in the Environmental Fate and Effects Division's Revised Pyrethrins RED Chapter (Rexrode, January 15, 2006) for more information on this calculation.

Table 16: Toxicity reference values for aquatic organisms exposed to the Pyrethrins 57.5% technical grade active ingredient (TGAI).				
Exposure scenario		Species	Exposure duration	Toxicity reference value
Freshwater Fish				
Acute		Rainbow trout (<i>Oncorhynchus mykiss</i>)	96 hours	LC ₅₀ = 5.1 µg/L
Chronic		Fathead minnow (<i>Pimephales promelas</i>)	early life stage	NOAEC = 1.9 µg/L
Freshwater Invertebrates				
Acute		Waterflea (<i>Daphnia magna</i>)	48 hours	EC ₅₀ = 11.6 µg/L
Chronic		Waterflea (<i>Daphnia magna</i>)	reproduction	NOAEC = 0.86 µg/L
Estuarine/Marine Fish				
Acute		Sheepshead minnow (<i>Cyprinodon variegatus</i>)	96 hours	LC ₅₀ = 16.0 µg/L
Chronic ^a		Sheepshead minnow (<i>Cyprinodon variegatus</i>)	acute-to-chronic ratio method	NOAEC = 5.9 µg/L ^a (estimate)
^a The NOAEC estimated for the sheepshead minnow is based on the acute-to-chronic ratio method, determined by the following mathematical relationship: Freshwater fish LC ₅₀ (5.1) / Freshwater fish NOAEC (1.9) = Estuarine/marine fish LC ₅₀ (16.0 ppb)/ X (estimated value for estuarine/marine NOAEC).				
Estuarine/Marine Invertebrates				
Acute	Py TGAI 57.5% a.i. product	Mysid shrimp (<i>Mysidopsis bahia</i>)	96 hours	LC ₅₀ = 1.4 µg/L
Chronic ^b		Mysid shrimp (<i>Mysidopsis bahia</i>)	acute-to-chronic ratio method	NOAEC = 0.10 µg/L ^b (estimated)
^b The NOAEC estimated for the Mysid shrimp is based on the acute-to-chronic ratio method, determined by the following mathematical relationship: Freshwater invertebrate LC ₅₀ (11.6 ppb)/ Freshwater invertebrate NOAEC (0.86 ppb) = Estuarine/marine invertebrate LC ₅₀ (1.4 ppb)/ X (estimated value for estuarine/marine NOAEC).				
Aquatic Plants				

Table 16: Toxicity reference values for aquatic organisms exposed to the Pyrethrins 57.5% technical grade active ingredient (TGAI).

Exposure scenario	Species	Exposure duration	Toxicity reference value
Acute	Since toxicity data were unavailable for non-target plants, risks were not calculated.		
LD ₅₀ = Lethal dose to 50% of the test population. NOAEC = No-observed-adverse-effect concentration. LOAEC = Lowest-observed-adverse-effect concentration. LC50 = Lethal concentration to 50% of the test population. EC50/EC25 = Effect concentration to 50/25% of the test population.			

Mixtures Toxicity

Toxicity tests on the formulated product (60.25% piperonyl butoxide (PBO), and 6.02% pyrethrins) showed a relative increase in toxicity for the same species when compared to tests on pyrethrins alone. Table 17 gives an indication as to the synergistic effects of PBO that help to increase the effectiveness of the active ingredient. The results indicate that the formulated product was more acutely toxic to aquatic organisms than pyrethrins alone. Across all aquatic species tested, the formulated product was more toxic to fish and invertebrates on an acute basis than the TGAI. The greatest difference in toxicity was seen with the estuarine/marine invertebrates (e.g., shrimp). There was up to a 90% difference between LC₅₀ values, when comparing the TGAI to the formulated product.

Table 17: Comparison of acute toxicity of Pyrethrins extract/ technical grade active ingredient (FEK-99) to the formulated product (Pyrenone crop spray, 6.02% Pyrethrins and PBO).

Test Species		Exposure duration	LC50 (µg/L)		Percent Difference in Toxicity
			TGAI 57.5% Py TGAI a.i. product	Formulation 6.02% Py a.i. product with PBO	
Freshwater Fish					
Acute	Rainbow trout (<i>Oncorhynchus mykiss</i>)	96 hours	5.1	3.2	37%
Freshwater Invertebrates					
Acute	Waterflea (<i>Daphnia magna</i>)	48 hours	11.6	6.7	42%
Esutarine/Marine Fish					
Acute	Sheepshead minnow (<i>Cyprinodon variegatus</i>)	96 hours	16.0	3.8	76%

Table 17: Comparison of acute toxicity of Pyrethrins extract/ technical grade active ingredient (FEK-99) to the formulated product (Pyrenone crop spray, 6.02% Pyrethrins and PBO).

Test Species		Exposure duration	LC50 (µg/L)		Percent Difference in Toxicity
			TGAI 57.5% Py TGAI a.i. product	Formulation 6.02% Py a.i. product with PBO	
Estuarine/Marine Invertebrates					
Acute	Mysid shrimp (<i>Mysidopsis bahia</i>)	96 hours	1.4	0.14	90%

Aquatic Plants

No aquatic vascular or non-vascular plant data were required for pyrethrins. It is unlikely that pyrethrins pose a phytotoxic concern based on the toxic mode of action on the sodium channels in insects. Plants lack these sodium channels and this mode of action would not cause phytotoxicity in plants.

2. Exposure

Agricultural Exposure-Fish and Invertebrates

For exposure to fish and aquatic invertebrates, EPA considers surface water only, since most aquatic organisms are not found in ground water. The aquatic exposure assessment for pyrethrins relied on Tier II aquatic models. The Pesticide Root Zone Model (PRZM version 3.12) simulates fate and transport on the agricultural field, while the water body is simulated with Exposure Analysis Modeling System (EXAMS version 2.98). Simulations are run for multiple (usually 30) years and the reported EECs represent the values that are expected once every ten years based on the thirty years of daily values generated during the simulation.

PRZM/EXAMS modeling of pyrethrins was completed for thirteen crop scenarios based on 10 applications at the agricultural use rate of 0.05 lb a.i./acre for all growing crops from the Pyrethrins Master Label and assumed a re-application interval of 1 day, since none was specified. The range of peak daily EECs using the maximum application rate and assuming pyrethrins were reapplied after 1 day for all thirteen scenarios was 0.35-2.77 µg/L. Based on EPA use data, typical application rates, ranging from 0.01-0.02 lbs a.i./acre, were modeled for four crop scenarios. When typical application rates, ranging from 0.007 lbs a.i./acre to 0.024 lbs a.i./acre, were modeled the range of peak daily EECs was 0.002 - 0.056 µg/L. Of the 3 crop scenarios, Illinois corn, Idaho potato, and California onion, chosen to represent “typical” applications, the highest EEC is Illinois corn at 2.4 ppb. A complete listing of EECs, including those used for pyrethrins RQ calculations can be found in Table 6 in the EFED risk assessment (Melendez, February 16, 2006).

Agriculture Exposure – Sediment Organisms

The pyrethrins adsorb readily to particulate matter and sediments, thus possibly limiting exposure to aquatic life in the water column but increasing toxic exposure in the sediment. For exposure to sediment organisms, the Agency evaluated maximum and typical application rates of pyrethrins relative to expected sediment residues. The maximum application rate of 0.05 lbs a.i./acre produced EEC estimates for benthic pore water from PRZM/EXAMS that range from 0.029–0.209 µg/L, while the typical application rate resulted in lower EEC values of 0.002 - 0.010 ug/L (peak daily concentrations). The range of EECs follows the pattern exhibited by the surface water EECs with the highest EECs estimated for the IL Corn standard scenario and the lowest EECs for the CA Grape standard scenario. One of the key parameters in the PRZM/EXAMS model is weather, especially the rainfall pattern. The amount and frequency of rain for scenarios representing MN potato, IL corn, and PA tomato uses created conditions for greater runoff of pyrethrins from the field and into the adjacent pond compared to the warmer, dryer climates of the CA grape, FL citrus, and GA peaches standard scenarios.

Mosquito Abatement Exposure

The mosquito adulticides are applied as mists (very small droplet sizes) that do not deposit rapidly and may drift substantially. The deposition and drift of pyrethrins to adjacent bodies of water was estimated using the AGDISP (AGricultural DISPersal) computer model version 8.07 followed by the tier 2 aquatic model EXAMS, which follows degradation and partitioning between the water column and sediment, to predict EECs for both surface water and pore water with the Florida turf scenario. Simulations are run for multiple (usually 30) years and the reported EECs represent the values that are expected once every ten years based on the thirty years of daily values generated during the simulation.

The following assumptions were made for mosquito abatement uses: application rate of 0.008 lbs a.i./acre, 26 applications, and a 4-day interval. Factors such as release height, application rate, and droplet size all affect the predicted EECs. In general, the higher the release height, the lower the application rate, and the smaller the droplet size, the lower the predicted EECs. A range of EECs were predicted for pyrethrins depending on the manipulation of these three variables and a summary of these EECs is provided in the “Aquatic Exposure Modeling for Mosquito Abatement” Section of the EFED chapter.

Release Height:

The release height has a significant effect on the level of exposure observed in the pond. Peak EECs were calculated using the same application rate (0.008 lb a.i./A), droplet size (50 µm), but different release heights. A release height of 75 feet resulted in EECs of 0.81-0.95 ppb and a release height of 150 feet resulted in EECs of 0.05-0.06 ppb. A higher release height causes more dispersion of the ULV aerosol, and a smaller amount of it reaches the soil and the water.

Application Rate:

The peak EECs were 0.11-0.13 ppb at the maximum application rate of 0.008 lb a.i./A and 0.036-0.041 ppb at the typical application rate of 0.0025 lb a.i./A. The boom height and droplet size were held constant at 75 feet and 50 μm respectively.

Droplet Size:

The peak EECs observed for the runs performed with a droplet size of 40 microns ($D_{v0.5} \sim 40 \mu\text{m}$) were 0.51-0.59 ppb and 0.81-0.95 ppb with a droplet size of around 50 microns ($D_{v0.5} \sim 50 \mu\text{m}$). The boom height and application rate were held constant at 75 feet and 0.008 lb a.i./acre.

Wide Area Mosquito Adulticide Monitoring Data

In a Sacramento County monitoring study for pyrethrins and piperonyl butoxide (PBO), water samples were collected after mosquito adulticide applications in the Sacramento metropolitan area. In samples collected up to 10 hours after application there were detections of pyrethrins and PBO in the ppb range, that were similar to modeling predictions in the pyrethrins and the PBO mosquito adulticide assessment. Samples were also collected the day after application and measured lower or no concentrations for both active ingredients. This indicates both chemicals appear to dissipate fairly rapidly in the water column. The co-occurrence of pyrethrins and PBO in some of these first samples is an indication of direct transport to water from pesticide application and not transport by runoff.

Aquatic Exposure – “Down-the-Drain” Assessment

In order to address the issue of pyrethrins release to domestic wastewater treatment, the Agency relied on the Office of Pollution Prevention and Toxics (OPPT) consumer exposure model, Exposure and Fate Assessment Screening Tool (E-FAST) (USEPA, 1999). In particular the screening level module is specifically designed to address all sources of pollution, such as pyrethrins that could potentially contribute to domestic wastewater contamination from pesticide disposal down a drain. The model uses input parameters that include annual production volume of the pesticide, and takes into account the fraction of the chemical removed during wastewater treatment. The model assumes that in a given year, the total amount of pyrethrins produced annually is parceled out on a daily per capita basis to the U.S. population and converted to a mass release per capita (e.g., grams/person/day). This mass is diluted into the average daily volume of wastewater released per person per day to arrive at an estimated concentration of target chemical in wastewater prior to entering a treatment facility. The pyrethrins concentration in untreated wastewater is then reduced by the fraction removed during wastewater treatment process before release into a river or stream. The remaining chemical is discharged into surface water, where it is assumed that it is instantaneously diluted, with no further removal. The resulting estimated environmental concentration (EEC) values, listed in Table 18, are then used to calculate ecological risk. This method is a screening level assessment conducted with conservative assumptions that overestimate the contribution of pyrethrins from down-the-drain disposal.

Table 18: Surface Water Concentrations Modeled By E-FAST for “Down-the-Drain” Assessment		
Wastewater Treatment Removal Concentration (WWT)*	Acute	Chronic
92.7%	0.00242 ppb	0.000186 ppb

* Fraction of pyrethrins removed during wastewater treatment.

ii. Fish and Invertebrates Risk

Agricultural Uses

For freshwater and estuarine/marine fish and aquatic invertebrates, including sediment dwelling organisms, levels of concern (LOCs) were exceeded for acute risk, and endangered species with RQs ranging from 0.54-1.98 when maximum rates and minimum reapplication intervals are modeled. The greatest risk among aquatic organisms evaluated was for freshwater and estuarine/marine invertebrates. Although the estuarine/marine endangered invertebrate level was triggered, at this time there are no listed species in this category.

Chronic RQs from modeled agricultural exposure scenarios exceeded chronic LOCs for estuarine/marine invertebrates, while chronic RQs for risk to freshwater and estuarine/marine fish and freshwater invertebrates did not.

The risk quotients did not change substantially when the reapplication interval of 3 days was used instead of the high reapplication interval of 1 day. Since pyrethrins are used on a wide variety of crops, the typical application parameters can vary greatly depending on the commodity.

Typical application rates and number of applications appear to have the potential to reduce predicted risk to aquatic systems. Evaluation of four crop scenarios suggests that LOCs for freshwater and estuarine/marine fish and invertebrates would not be exceeded if the typical application rates are used.

Mixtures Risk

The Agency also assessed the maximum and typical rates for a product formulated with both pyrethrins and PBO, but only evaluated acute exposure to aquatic organisms. The calculated RQs show that acute risk from the highest application rate on the formulated product label appeared to be higher than risk calculated from the TGAI. This evaluation showed that acute risk from the formulation was about 2-7 times greater for freshwater and estuarine/marine fish and about 10 times greater for estuarine/marine invertebrates. However, the typical formulated product rate appears to reduce the risk (freshwater and estuarine/marine fish and freshwater invertebrates), but this reduction in exposure still presents the potential for acute, and chronic risk to estuarine/marine invertebrates species.

Mosquito Abatement

RQs calculated using the maximum rate of 0.008 lbs a.i./acre, did not result in acute risk to freshwater fish and invertebrates or estuarine/marine fish. RQs did exceed the acute LOC for estuarine/marine invertebrates (RQs range from 0.05 – 0.95). However, the risk to estuarine/marine invertebrates appears to be eliminated if the boom height is set at 150 ft and the droplet size at 40 microns ($D_{v0.5} \sim 40 \mu\text{m}$).

The Agency also evaluated the typical rate of 0.0025 lbs a.i./acre, and found that potential acute risk to estuarine/marine invertebrates could be eliminated with a boom height of 75ft and a 50 microns ($D_{v0.5} \sim 50 \mu\text{m}$) droplet size.

Down-the-Drain

The Agency evaluated the risks of pyrethrins found in domestic wastewater using a Down-the-Drain model and found that aquatic LOCs were not exceeded for freshwater or estuarine/marine organisms.

iii. Other Non-Agricultural Uses

The other non-agricultural applications of pyrethrins that include perimeter treatments in and around buildings, lawn care, outdoor surfaces, etc., may result in exposure to aquatic organisms in adjacent water bodies because of irrigation that can result in runoff and/or erosion. The Agency recognizes the potential of aquatic toxicity from non-agricultural uses, but did not assess the risks associated with these uses due to lack of available data at this time. The Agency's plan to consider aquatic exposure from non-agricultural uses of pyrethrins is further discussed in Section IV.

b. Risk to Terrestrial Organisms

i. Birds and Mammals Toxicity and Exposure

1. Toxicity

See Table 19 below for a summary of toxicity data for mammals and birds.

Birds

Pyrethrins were practically non-toxic to avian species on an acute oral and dietary basis (oral LD50 >2,000 mg/kg bw; dietary LC50 >5,620 mg/kg diet). Reproductive toxicity data were not required, so chronic avian risk could not be evaluated.

Mammals

Mammalian toxicity data suggest that pyrethrins are slightly toxic to small mammals on an acute oral basis (LD50 = 700 mg/kg body weight). In the two generation rat reproduction study, parental male systemic and reproductive toxicity were detected at 1000 ppm (65 mg/kg body weight per day) and parental female systemic toxicity was detected at 3000 ppm (196 mg/kg body weight per day). The NOAEL for parental systemic (male) and reproductive toxicity was 100 ppm (6.4 mg/kg body weight-day).

Non-target beneficial insects

Honey bee studies suggest that pyrethrins are highly toxic to non-target beneficial insects.

Terrestrial Plants

No vascular or non-vascular terrestrial plant data were submitted for pyrethrins. However, it is unlikely that pyrethrins pose a phytotoxic concern based on the toxic mode of action on the sodium channels in insects. Plants lack these sodium channels and this mode of action would not cause phytotoxicity in plants.

Table 19: Toxicity reference values for mammals and birds exposed to Pyrethrins.				
Exposure Scenario	Test Chemical ^a	Species	Exposure Duration	Toxicity Reference Value
Mammals				
Acute	57.6 % a.i	Rat (Rattus norvegicus)	Single dose	LD50 = 700 mg/kg bw ^b
Chronic	57.6% a.i.	Rat (Rattus norvegicus)	2-generation reproduction	NOAEL = 6.4 mg/kg-day
Birds				
Acute	57.6% a.i.	Bobwhite quail (Colinus virginianus)	5 days ^c	LC50 >5,620 mg/kg diet
Acute	57.6% a.i.	Mallard duck (Anas platyrhynchos)	5 days ^c	LC50 >5,620 mg/kg diet
Chronic: No data. However, chronic data from permethrin have been used as surrogate information because of similar mode of action NOAEC = 500 ppm.				
^a Test material reported as FEK-99, 57.467% to 57.6% a.i. pyrethrins, which is considered to be representative of technical grade active ingredient (TGAI). ^b Female rats only; LD50 for males in the same study was 2,140 mg/kg bw. ^c Referred to as a "subacute study"; 5-day dietary exposure followed by additional 3-day observation period.				

2. Exposure

Birds and mammals could be exposed shortly after application through dietary exposure to vegetative plant material or insects when foraging in the treated fields for nesting material or food. The EFED terrestrial exposure model (T-REX, Version 1.4), was used to estimate exposures and risks to avian and mammalian species. Input values on avian and mammalian toxicity as well as chemical application and foliar half-life data were required to run the model. The model provides estimates of both exposure concentrations and risk quotients (RQs). Specifically, the model provides estimates of concentrations (maximum and average) of chemical residues in different types of foliage that could be sources of dietary exposure to avian, mammalian, reptilian, or terrestrial-phase amphibian receptors. By comparing these estimated concentrations to acute and chronic toxicity reference values, acute and chronic RQs were calculated.

T-REX was run for a single crop use scenario that is considered generally representative of the maximum use rate of pyrethrins, with an application rate of 0.05 lbs a.i./acre, for all agricultural crops. EPA use information indicates typical rates for four representative crop scenarios (ID potato, PA tomato, CA onion, and OR snap beans) range from 0.01 – 0.02 lbs a.i./acre.

ii. Birds and Mammals Risk

In this screening-level risk assessment, the Agency did not find acute or chronic risks to listed or non-listed mammalian and avian species. All RQs were below the Agency's LOC.

iii. Terrestrial Plant

RQs were not calculated for terrestrial plants because no data were required for pyrethrins. However, it is unlikely that pyrethrins pose a phytotoxic concern base on the toxic mode of action on the sodium channels in insects. Plants lack these sodium channels and this mode of action would not cause phytotoxicity in plants.

iv. Non-Target Insects Risks

Currently, the Agency does not estimate RQs for terrestrial non-target insects. However, acute toxicity studies on honeybees suggest that pyrethrins are toxic to non-target beneficial insects, as well as listed insect species.

4. Ecological Incidents

Most of the ecological incidents reported involving pyrethrins were classified as "unlikely," except one involving plant damage, which was classified as "possible." Of the 11 reports in the Ecological Incident Information System (EIIS) database, all but one incident involved pyrethrins causing damage to non-target terrestrial plants. One report associates pyrethrins use with effects in aquatic organisms after fish from a small pond died after possible contamination from a dog treated with pyrethrins flea powder, but this report was also classified as "unlikely." Most of these incidents involved formulated products containing a very low concentration of pyrethrins and a high percentage of "inert" ingredients. The Agency does not consider pyrethrins, or the synergist PBO, to have phytotoxic properties and assumes that the reported toxicity to terrestrial plants after application of a formulation may be the result of inerts or other circumstances associated with the application.

5. Endangered Species Concerns

The Agency's screening level assessment results in the determination that pyrethrins will have no direct acute effects on threatened and endangered mammals or birds. The preliminary risk assessment for endangered species indicates that RQs exceed endangered species LOCs for freshwater fish and invertebrates, and estuarine/marine fish and invertebrates. Further, potential indirect effects to any species dependent upon a species that experiences effects from use of pyrethrins can not be precluded based on the screening level ecological risk assessment. These

findings are based solely on EPA's screening level assessment and do not constitute "may affect" findings under the Endangered Species Act.

IV. Risk Management, Reregistration, and Tolerance Reassessment Decision

A. Determination of Reregistration Eligibility and Tolerance Reassessment

Section 4(g)(2)(A) of FIFRA calls for the Agency to determine, after submission of relevant data concerning an active ingredient, whether or not products containing the active ingredient are eligible for reregistration. The Agency has previously identified and required the submission of the generic data to support reregistration of products containing pyrethrins. The Agency has completed its review of these generic data, and has determined that the data are sufficient to support reregistration of all products containing pyrethrins.

The Agency has completed its assessment of the dietary, occupational, residential, and ecological risk associated with the use of pesticide products containing the active ingredient pyrethrins. Based on a review of these data and on public comments on the Agency's assessments for the active ingredient pyrethrins, the Agency has sufficient information on the human health and ecological effects to make decisions as part of the tolerance reassessment process under FFDCA and reregistration process under FIFRA, as amended by FQPA. The Agency has determined that products containing pyrethrins are eligible for reregistration provided that: (i) the risk mitigation measures outlined in this document are adopted and (ii) label amendments are made to reflect these measures. Label changes are described in Section V. Appendix A summarizes the uses of pyrethrins that are eligible for reregistration. Appendix B identifies the generic data requirements that the Agency reviewed as part of its determination of reregistration eligibility of pyrethrins, and lists the submitted studies that the Agency found acceptable. Data gaps are identified as generic data requirements that have not been satisfied with acceptable data.

Based on its evaluation of pyrethrins, the Agency has determined that pyrethrins products, unless labeled and used as specified in this document, would present risks inconsistent with FIFRA and FQPA. Accordingly, should a registrant fail to implement any of the reregistration requirements identified in this document, the Agency may take regulatory action to address the risk concerns from the use of pyrethrins. If all changes outlined in this document are incorporated into the product labels, then all current risks for pyrethrins will be adequately mitigated for the purposes of this determination. Once an Endangered Species assessment is completed, further changes to these registrations may be necessary as explained under "Endangered Species Concerns" below.

B. Regulatory Position

Through the Agency's public participation process, EPA worked with stakeholders and the public to refine the risk assessments and reach regulatory decisions for pyrethrins. EPA released its pyrethrins preliminary risk assessments for public comment on April 27, 2005, for a 60-day public comment period (Phase 3 of the 6 Phase public participation process). Where

appropriate, the pyrethrins risk assessments were revised in response to the comments received, and the assessments were released for an additional 60-day public comment period on September 21, 2005 (Phase 5 of the 6-phase public participation process). During both public comment periods, the Agency received comments from the Pyrethrin Joint Venture, stakeholder groups such as the American Mosquito Control Association (AMCA), state and local government entities in California, the State of New York, California Water Boards, publicly owned treatment works (POTWs), Mosquito and Vector Control Districts, and several private citizens.

The registrant's comments focused on various aspects of the risk assessments including toxicological issues, human incidents, mosquito abatement modeling parameters, and agricultural modeling parameters. Others comments were received from the AMCA, local governments, and mosquito abatement applicators describing mosquito abatement activities and commenting on the ecological risk assessment. The State of New York pointed out areas of inconsistency in the risk assessments. All of the comments have been considered and the changes are reflected in this document where appropriate. Formal responses to these comments have been completed and are available separate from this RED document. All of the preliminary and revised pyrethrins risk assessments, public comments, responses to comments, and this RED document are available in the EPA public docket (OPP-2005-0043) and in the EPA's electronic docket at www.regulations.gov.

1. Food Quality Protection Act Findings

a. "Risk Cup" Determination

As part of the FQPA tolerance reassessment process, EPA assessed the risks associated with pyrethrins. EPA has determined that risk from dietary (food + water) exposure is within its own "risk cup." An aggregate assessment was conducted for pyrethrins for exposures through dietary and residential exposures. The Agency has determined that the human health risks from these combined exposures are within acceptable levels. In other words, EPA has concluded that the tolerances for pyrethrins meet FQPA safety standards. In reaching this determination, EPA has considered the available information on the special sensitivity of infants and children, as well as aggregate exposure from food and residential sources.

b. Determination of Safety to U.S. Population

The Agency has determined that the 70 established tolerances for pyrethrins, with amendments and changes as specified in this document, meet the safety standards under the FQPA amendments to Section 408(b)(2)(D) of the FFDCA, as amended by FQPA, and that there is a reasonable certainty no harm will result to the general population or any subgroup from the use of pyrethrins. In reaching this conclusion, the Agency has considered all available information on the toxicity, use practices, and the environmental behavior of pyrethrins. The acute, chronic, short-term, intermediate-term, and long-term risks from food, drinking water, and residential exposures do not exceed the Agency's levels of concern, with the risk mitigation specified in this document.

c. Determination of Safety to Infants and Children

EPA has determined that the established tolerances for pyrethrins, with amendments and changes as specified in this document, meet the safety standards under the FQPA amendments to Section 408(b)(2)(C) of the FFDCA. These safety standards require that there is a reasonable certainty of no harm for infants and children. The safety determination for infants and children factors in the toxicity, use practices and environmental behavior noted above for the general population, but also takes into account the possibility of increased dietary exposure due to the specific consumption patterns of infants and children, as well as the possibility of increased susceptibility to the toxic effects of pyrethrins residues in this population subgroup.

In determining whether or not infants and children are particularly susceptible to toxic effects from exposure to residues of pyrethrins, the Agency considered the completeness of the hazard database for developmental and reproductive effects, the nature of the effects observed, and other information. An FQPA safety factor of 3X has been retained for the acute dietary and short-term residential incidental oral assessments for lack of a developmental neurotoxicity study; there are no other residual uncertainties for pre- and/or post-natal toxicity, exposure is not underestimated, and there is no evidence of increased susceptibility.

2. Endocrine Disruptor Effects

EPA is required under the FFDCA, as amended by FQPA, to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) “may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other endocrine effects as the Administrator may designate.” Following recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there was a scientific basis for including, the androgen and thyroid hormone systems as part of the program, in addition to the estrogen hormone system. EPA also adopted EDSTAC’s recommendation that EPA include evaluations of potential effects in wildlife. For pesticides, EPA will use FIFRA and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCA authority to require the wildlife evaluations. As the science develops and resources allow, screening of additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP).

There is evidence that pyrethrins are associated with endocrine disruption. Direct measurements of serum thyroid hormones [T3, T4, and TSH], as well as histopathological alterations in the thyroid (i.e. follicular cell hypertrophy, follicular cell hyperplasia, follicular cell adenomas and/or carcinomas) indicate there is concern regarding the potential for endocrine disruption. When the appropriate screening and/or testing protocols being considered under the EDSP have been developed, pyrethrins may be subject to additional screening and/or testing.

3. Cumulative Risks

Pyrethrins are botanical insecticides that come from the pyrethrum flower, *Chrysanthemum cinerariaefolium*. Pyrethrins have limitations because of the cost of production and instability in sunlight; therefore, many synthetic pyrethrins-like compounds were developed to be more stable in sunlight and cost effective. These compounds are referred to as synthetic pyrethroids. Although all pyrethrins and pyrethroids alter nerve function by modifying the

normal biochemistry and physiology of nerve membrane sodium channels, EPA is not currently following a cumulative risk approach based on a common mechanism of toxicity for these chemicals. Although all pyrethroids interact with sodium channels, there are multiple types of sodium channels and it is currently unknown whether the pyrethrins and pyrethroids have similar effects on all channels. EPA does not have a clear understanding of effects on key downstream neuronal function, e.g., nerve excitability, nor does EPA understand how these key events interact to produce their compound specific patterns of neurotoxicity. There is ongoing research by the EPA's Office of Research and Development and the pyrethroid registrants to evaluate the differential biochemical and physiological actions of pyrethroids in mammals. This research is expected to be completed by 2007. When available, the Agency will consider this research and make a determination of common mechanism as a basis for assessing cumulative risk. For information regarding EPA's procedures for cumulating effects from substances found to have a common mechanism on EPA's website at <http://www.epa.gov/pesticides/cumulative/>.

C. Tolerance Reassessment Summary

Table 20, 21, 22, and 23 provide a summary of the pyrethrins tolerance reassessment decision. Further tolerance explanation is provided after the table.

All references that indicate use in combination with another active ingredient, such as piperonyl butoxide or n-octyl bicycloheptene dicarboximide (MGK-264), are removed, or decoupled from the tolerance expressions for pyrethrins. All tolerances established for use on bags are being revoked as the last active product supporting this use was cancelled on October 10, 1989, and there are no data to support this use. The 40 CFR should be updated to reflect all of these changes as summarized in Table 20 below.

Table 20: 40 CFR Changes for Pyrethrins		
Current 40 CFR Citation	Action	Comment
§180.128(a)(2)(i) all parts	Remove	This section refers to pyrethrins being used in conjunction with PBO. All references to use with multiple chemicals is being removed from the CFR.
§180.128(a)(2)(ii) all parts	Remove	This section refers to pyrethrins being used in conjunction with PBO and MGK-264. All references to use with multiple chemicals is being removed from the CFR.
§180.128(a)(2)(iii)(A)	Retain	This tolerance for cereal grain will be kept as indicated in Table 21 below. Recodify under §180.128 (a)(2)
§180.128(a)(2)(iii)(B)	Remove	This is a tolerance for use on bags. The last registration for this use was cancelled in 1989 and there are no data to support this use.
§180.128(a)(2)(iii)(C)	Retain	This citation refers to another part of the CFR for MGK-264 that is being revised. In order to clarify the statement it will be stated in its entirety here. The exact statement and section number are indicated in Table 21 below. Recodify under §180.128 (a)(3)
§180.128(a)(2)(iii)(D)	Remove	This is a tolerance for use on bags. The last registration for this use was cancelled in 1989 and there are no data to support this use.
§180.128(a)(2)(iii)(E)	Remove	This refers to other sections that are being removed, so

		this section is not relevant once the other parts are revised.
§180.128(a)(2)(iv)	Remove	Old language not used in the CFR currently.
§180.128(a)(2)(v)	Retain	Recodify under §180.128 (a)(4)
§180.128(a)(3) all parts	Remove	This is a tolerance for use on bags. The last registration for this use was cancelled in 1989 and there are no data to support this use.

Table 21: Tolerance Reassessment Summary for Pyrethrins (PC 069001)

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/ [Correct Commodity Definition]
Tolerances Listed Under 40 CFR §180.128 (a)(1)			
Almond, postharvest	1	TBD ¹	
Apple, postharvest	1	TBD	
Barley, postharvest	3	TBD	[Barley, grain, postharvest]
Bean, postharvest	1	TBD	[Bean, succulent, postharvest]
Birdseed, mixtures, postharvest	3	TBD	
Blackberry, postharvest	1	TBD	
Blueberry (huckleberry), postharvest	1	TBD	[Blueberry, postharvest]
Boysenberry, postharvest	1	TBD	
Buckwheat, grain, postharvest	3	TBD	
Cattle, fat	0.1	1	
Cattle, meat byproducts	0.1	0.05	
Cattle, meat	0.1	0.05	
Cherry, postharvest	1	TBD	
Cocoa bean, postharvest	1	TBD	[Cocoa bean, dried bean, postharvest]
Coconut, copra, postharvest	1	TBD	
Corn (including popcorn), postharvest	3	TBD	[Corn, field and pop, grain, postharvest]
Cottonseed, postharvest	1	TBD	[Cotton, undelinted seed, postharvest]
Crabapple, postharvest	1	TBD	
Currant, postharvest	1	TBD	
Dewberry, postharvest	1	TBD	
Egg	0.1	Revoke	Based on exaggerated feed and premise treatment studies, there are no reasonable expectations of finite residue in poultry products.
Fig, postharvest	1	TBD	
Flaxseed, postharvest	1	TBD	[Flax, seed, postharvest]
Goat, fat	0.1	1	
Goat, meat byproducts	0.1	0.05	
Goat, meat	0.1	0.05	

Table 21: Tolerance Reassessment Summary for Pyrethrins (PC 069001)

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/ [Correct Commodity Definition]
Gooseberry, postharvest	1	TBD	
Grape, postharvest	1	TBD	
Guava, postharvest	1	TBD	
Hog, fat	0.1	1	
Hog, meat byproducts	0.1	0.05	
Hog, meat	0.1	0.05	
Horse, fat	0.1	1	
Horse, meat byproducts	0.1	0.05	
Horse, meat	0.1	0.05	
Loganberry, postharvest	1	TBD	
Mango, postharvest	1	TBD	
Milk fat (reflecting negligible residues in milk)	0.5	0.05	
Muskmelon, postharvest	1	TBD	
Oat, postharvest	1	TBD	[Oat, grain, postharvest]
Oranges, postharvest	1	TBD	[Orange, sweet, postharvest]
Peach, postharvest	1	TBD	
Peanut (with shell removed), postharvest	1	TBD	[Peanut, nutmeat, postharvest]
Pear, postharvest	1	TBD	
Pea, postharvest	1	TBD	[Pea, dry, seed, postharvest]
Pineapple, postharvest	1	TBD	
Plum, prune, fresh, postharvest	1	TBD	
Potato, postharvest	0.05	0.05	The reassessed tolerance is based on data reflecting residues of pyrethrins.
Poultry, fat	0.2	Revoke	Based on exaggerated feed and premise treatment studies, there are no reasonable expectations of finite residue in poultry products.
Poultry, meat byproducts	0.2	Revoke	Based on exaggerated feed and premise treatment studies, there are no reasonable expectations of finite residue in poultry products.
Poultry, meat	0.2	Revoke	Based on exaggerated feed and premise treatment studies, there are no reasonable expectations of finite residue in poultry products.
Raspberry, postharvest	1	TBD	
Rice, postharvest	3	TBD	[Rice, grain, postharvest]
Rye, postharvest	3	TBD	[Rye, grain, postharvest]

Table 21: Tolerance Reassessment Summary for Pyrethrins (PC 069001)

Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/ [Correct Commodity Definition]
Sheep, fat	0.1	1	
Sheep, meat byproducts	0.1	0.05	
Sheep, meat	0.1	0.05	
Sorghum, grain, postharvest	1	TBD	
Sweet potato, postharvest	0.05	0.05	The postharvest use on stored raw sweet potatoes are supported by residue data translated from potatoes.
Tomato, postharvest	1	TBD	
Walnut, postharvest	1	TBD	
Wheat, postharvest	3	TBD	[Wheat, grain, postharvest]
Tolerance Listed Under 40 CFR §180.128(a)(2)(iii)(A)			
Grains, Cereal, Milled Fractions	1	1	
Tolerance Listed Under 40 CFR §180.128(a)(2)(iii)(B)			
Stored Dried Food (Multiwall paper bags (50 lbs +))	1	Revoke	This is a tolerance for use on bags. The last registration for this use was cancelled in 1989 and there are no data to support this use.
Tolerance Listed Under 40 CFR §180.128(a)(2)(iii)(C)			
Processed Food (food handling establishments)	1	1	Decouple pyrethrins tolerance from MGK-264 and PBO. The new tolerance should be stated as: “A tolerance of 1.0 ppm is established for residues of the insecticide pyrethrins in or on all food items in food handling establishments where food and food products are held, processed, prepared and/or served. Food must be removed or covered prior to use.”
Tolerance Listed Under 40 CFR §180.128(a)(2)(iii)(D)			
Processed Food (Cotton bags (50 lbs +) with waxed paper liners containing Stored Dried Food (4% fat or less))	1	Revoke	This is a tolerance for use on bags. The last registration for this use was cancelled in 1989 and there are no data to support this use.
Tolerance Listed Under 40 CFR §180.128(a)(3)(iii)(A)			
Processed Food (Stored Feed (Dried Feed from use on outer ply of multiwall paper bags 50 lbs or more))	1	Revoke	This is a tolerance for use on bags. The last registration for this use was cancelled in 1989 and there are no data to support this use.

Table 21: Tolerance Reassessment Summary for Pyrethrins (PC 069001)			
Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/ [Correct Commodity Definition]
Tolerance Listed Under 40 CFR §180.128(a)(3)(iii)(B)			
Stored Feed (Dried Feed (containing 4% fat or less) from use on cotton bags with waxed paper liners 50 lbs or more)	1	Revoke	This is a tolerance for use on bags. The last registration for this use was cancelled in 1989 and there are no data to support this use.
Tolerances Listed Under 40 CFR §180.905(a)(6)			
Raw Agricultural Commodities	Exemption	Revoke	Formerly established under 180.1001 (b). The Agency will not revoke this tolerance immediately, but will issue a DCI for the data. When the data have been reviewed and approved by the Agency, the appropriate crop group tolerances will be established concomitant with revocation of the exemption.

¹ TBD = To be determined. EPA notes that while additional data are needed to support certain tolerances, conservative assumptions have been used in the risk assessment and no dietary risks have been identified. Thus, EPA considers the tolerances reassessed.

Table 22: Tolerance Reassessment Summary for Pyrethrum Powder Other than Pyrethrins (PC 069002)			
Commodity	Current Tolerance (ppm)	Tolerance Reassessment (ppm)	Comment/ [Correct Commodity Definition]
Tolerances Listed Under 40 CFR §180.905 (a)(6)			
Raw Agricultural Commodities	Exemption	Revoke	Previously established under 180.1001 (b) The last active product with this active ingredient was cancelled in 1991.

Table 23: Pyrethrins Tolerances to be Established Under Section 40 CFR §180.128			
Commodity	Current Tolerance (ppm)	Proposed Tolerance (ppm)	Comment/ [Correct Commodity Definition]
Tolerances to be Established Under CFR §180.128(a)			
Aspirated grain fractions	None	TBD ¹	
Atemoya	None	TBD	
Avocado	None	TBD	
Banana	None	TBD	
Carob bean	None	TBD	
Cherimoya	None	TBD	

Coffee, green bean	None	TBD	
Cranberry	None	TBD	
Date	None	TBD	
Durian	None	TBD	
Jojoba	None	TBD	
Lychee	None	TBD	
Okra	None	TBD	
Papaya	None	TBD	
Persimmon	None	TBD	
Pomegranate	None	TBD	
Safflower, seed	None	TBD	
Strawberry	None	TBD	
Sugarcane	None	TBD	
Sunflower, seed	None	TBD	
Tea, leaves	None	TBD	

¹ TBD = To be determined. EPA notes that while additional data are needed to support certain tolerances, conservative assumptions have been used in the risk assessment and no dietary risks have been identified.

Tolerance exemption under CFR §180.905(a)(6)

Pyrethrum and pyrethrins are currently exempt from the requirements of tolerances when applied to growing crops in accordance with good agricultural practices [40 CFR §180.905(a)(6)]; the tolerance exemption was previously established under 40 CFR §180.1001(b). Based on the results of limited field trials reflecting pre-harvest uses, the Agency recommends for the revocation of this tolerance exemption. The results of pre-harvest trials show detectable and variable residues of Pyrethrins I components in/on many raw agricultural commodities following applications of one formulation class (EC) at the maximum seasonal rate the PJV wishes to support for pre-harvest uses. Additional residue data reflecting pre-harvest uses are required to confirm and refine the dietary risk assessment. When the requested data have been evaluated, the Agency will recommend for the revocation of the tolerance exemption in 40 CFR §180.905(a)(6) concomitant with the establishments of crop group tolerances, if appropriate, in 40 CFR §180.128 to support all uses.

Tolerances Established Under CFR §180.128

Tolerances are currently established in 40 CFR §180.128 for residues of pyrethrins, insecticidally active principles of *Chrysanthemum cinerariaefolium* in/on: (i) plant commodities resulting from post-harvest uses; (ii) animal commodities; and (iii) food/feed items while in storage areas. Since residues of pyrethrins are identified by a marker compounds, the tolerance in the CFR will be updated to read as follows: “Tolerances for residues of pyrethrins 1 ((1S)-2-methyl-4-oxo-3-(2Z)-2,4-pentadienyl)cyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate), cinerin 1 ((1S)-3-(2Z)-2-butenyl-2-methyl-4-oxo-2-cyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate), and jasmolin 1 ((1S)-2-methyl-4-oxo-3-(2Z)-2-pentenyl-2-cyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate), which serve as a marker for residues of the

insecticide pyrethrins (insecticidally active principles of *Chrysanthemum cinerariaefolium*), are established in or on the following food commodities:”. A list of tolerances established for Pyrethrins I along with EPA’s recommendations of changes to correct commodity definitions are presented in Tables 20, 21, and 22.

The qualitative nature of the residue in plants is understood based on acceptable metabolism studies conducted on three dissimilar crops: leaf lettuce, potatoes, and tomatoes. The qualitative nature of the residue in ruminants and poultry is also adequately understood based on acceptable metabolism studies reflecting both dermal and oral treatments. The results of the above plant as well as animal metabolism studies will be presented to the Agency for a determination of terminal residues of concern (i.e., residues that need to be regulated or included in the tolerance expression). If the Agency determines that additional metabolites of toxicological concern should be regulated (i.e., included in the tolerance expression), then additional data concerning residue analytical methods, storage stability, and magnitude of the residue (in plants, processed commodities, animals, and food/feed items in storage areas) may be required in the future.

The pyrethrins tolerances for plant commodities, resulting from postharvest uses [40 CFR §180.128(a)(1)], range from 0.05 ppm (potato and sweet potato) to 3 ppm (most cereal grains). The available data are inadequate to support many of the established tolerances resulting from postharvest uses (except those uses for potato and sweet potato), and additional data are required for tolerance reassessment.

Assuming there is a linear relationship between feeding levels and tissue concentrations and provided that the residues of concern in animals are the components of pyrethrins I, the established tolerances of negligible residues for milk and 0.1 ppm for the fat, meat, and meat byproducts of cattle, goat, hogs, horses, and sheep need to be revised. A tolerance of 0.05 ppm would be appropriate for milk, meat, and meat byproducts of cattle, goats, hogs, horses, and sheep; a tolerance of 1.0 ppm would be appropriate for fat of cattle, goats, hogs, horses, and sheep.

The remainder of tolerances and tolerance exemptions established in CFR §180.128 pertain to uses of pyrethrins in food/feed storage areas.

- According to 40 CFR §180.128(a)(2)(i), pyrethrins may be safely used in combination with piperonyl butoxide (PBO) for control of insects when used according to conditions specified in the same 40 CFR section.
- According to 40 CFR §180.128(a)(2)(ii), pyrethrins may be safely used in combination with PBO and N-octylbicycloheptene dicarboximide for insect control in accordance with 40 CFR 180.367(a)(2).
- According to 40 CFR §180.128(a)(2)(iii), a tolerance of 1 ppm is established for residues of pyrethrins *per se* in/on:
(A) milled fractions derived from cereal grains when present therein as a result of its use in cereal grain mills and in storage areas for milled cereal grain products;

- (B) dried foods when present as a result of migration from its use on the outer ply of multiwall paper bags of 50 pounds or more capacity;
- (C) foods treated in accordance with 40 CFR 180.367(a)(2);
- (D) dried foods that contain 4 % fat, or less, when present as a result of migration from its use on the cloth of cotton bags of 50 pounds or more capacity constructed with waxed paper liners; and
- (E) foods from treated food processing and storage areas provided the food is removed or covered prior to such use.

- According to 40 CFR §180.128(a)(2)(iv), to assure safe use of the pesticide, its label and labeling shall conform to that registered with the U.S. Environmental Protection Agency, and it shall be used in accordance with such label and labeling.

- According to 40 CFR §180.127(a)(2)(v), where tolerances are established on both raw agricultural commodities and processed foods made from the total residues of pyrethrins in/on the processed food shall not be greater than that permitted by the larger of the two tolerances.

- According to 40 CFR §180.128(a)(3), pyrethrins may be safely used in accordance with the following prescribed conditions:

(i) It is used or intended for use in combination with PBO for control of insects:

(A) On the outer ply of multiwall paper bags of 50 pounds or more capacity in amounts not exceeding 6 milligrams per square foot; or

(B) On cotton bags of 50 pounds or more capacity in amounts not exceeding 5.5 milligrams per square foot of cloth. Such treated bags are constructed with waxed paper liners and are to be used only for dried feeds that contain 4 percent fat or less; or

(ii) It is used in combination with PBO, whereby the amount of pyrethrins is equal to 10 percent of the amount of PBO in the formulation. Such treated bags are to be used only for dried feeds.

The tolerance regulations establish that pyrethrins may be safely used in combination with piperonyl butoxide [40 CFR §180.128(a)(2)(i)] and piperonyl butoxide and N-octylbicycloheptene dicarboximide [40 CFR §180.128(a)(2)(ii)], for control of insects in food/feed processing areas and food/feed storage areas provided that the food/feed is removed or covered prior to use of the products. The Agency concludes that for pyrethrins no additional data are required to maintain the above tolerance regulations. This determination does not apply to PBO and n-octylbicycloheptene dicarboximide because the labels for these pesticide chemicals were not examined in this decision, but are considered in separate Reregistration Eligibility Decisions documents.

Adequate data depicting the magnitude of residues of pyrethrins in food-handling establishments and food storage areas are available. These data indicate that the established tolerance of 1 ppm will not be exceeded in representative food commodities and surfaces that had been covered during space, contact, and intermittent spray aerosol treatments using representative soluble concentrate/liquid and pressurized liquid formulations. The submitted pyrethrins Master Label provides adequate instructions that need to be included on end use

labels, which specify that food should be removed or covered during treatment, and that all food processing surfaces should be covered during treatment, or thoroughly cleaned before use.

No data are available to support uses of pyrethrins on foods stored in multi-walled paper or cloth bags. The last active product with this use was cancelled in October 15, 1989. Therefore, the stored dried food tolerance in section 180.128(a)(2)(iii)(B), the two processed food tolerances in sections 180.128(a)(2)(iii)(D) and 180.128(a)(3)(iii)(A), and the stored feed tolerance in section 180.128(a)(3)(iii)(B) should be revoked.

Maximum Contaminant Level

No maximum contaminant level (MCL) for pyrethrins in potable water has been established. Pyrethrins can be directly applied to water in flooded rice fields. Data from field trials conducted in aquatic environments simulating use of the pesticide in flooded rice fields detected residues of pyrethrins 10 days after application. A 10-day water holding interval must be established for the kill of adult mosquitoes in flooded rice fields. The 10-day water hold requirement addresses the concerns of pyrethrins contamination in potable water, so an MCL for pyrethrins does not need to be established.

Tolerances to be Established Under 40 CFR §180.128

The data requirements to support preharvest uses, which are recommended in the Pyrethrins Residue Chemistry Chapter (dated 9/8/2005), are designed to support the establishments of crop group tolerances. Therefore, several crop group tolerances, if appropriate, will need to be proposed by the registrants when the requested data have been reviewed. In addition, tolerances for the following miscellaneous commodities need to be proposed upon receipt of the requested residue data: asparagus, aspirated grain fraction, atemoya, avocado, banana, carob bean, cherimoya, coffee green bean, cranberry, date, durian, jojoba, kiwifruit, lychee, okra, papaya, persimmon, pomegranate, safflower seed, strawberry, sugarcane, sunflower seed, and tea leaves.

Codex/International Harmonization

The Codex Alimentarius Commission has established several maximum residue limits (MRLs) for residues of pyrethrins. The Codex MRLs are expressed in terms of total pyrethrins, calculated as the sum of pyrethrins 1 and 2, cinerins 1 and 2, and jasmolins 1 and 2, determined after calibration with the World Standard pyrethrum extract, which is identical to the current U.S. tolerance expression. Canadian MRLs have been established for residues of pyrethrins [4-hydroxy-3-methyl-2-(2,4-pentadienyl)-2-cyclopenten-1-one 2,2-dimethyl-3-(2-methyl-propenyl) cyclopropanecarboxylate and 4-hydroxy-3-methyl-2-(2,4-pentadienyl)-2-cyclopenten-1-one 1-methyl-3-carboxy-%,2,2-triethylcyclo-propaneacrylate ester]. The *Pyrethrins Revised Residue Chemistry Chapter* (Deluzio, September 8, 2005) incorrectly included MRLs from Mexico. There are no Mexican MRLs established for pyrethrins. A numerical comparison of the Codex MRLs and the corresponding current U.S. tolerances for pyrethrins is presented in Table 24.

Table 24: Codex MRLs and Applicable U.S. Tolerances for Pyrethrins

Codex		Current U.S. Tolerance, ppm
Commodity, As Defined	MRL (mg/kg)	
Cereal grains	0.3 (Po ¹)	1 ppm for oat and sorghum resulting from postharvest uses; 3 ppm for barley, buckwheat, corn, (including popcorn), rice, rye, and wheat resulting from postharvest uses
Citrus fruits	0.05	1 ppm for oranges resulting from postharvest uses
Dried fruits	0.2 (Po)	
Fruiting veg, cucurbits	0.05	1 ppm for muskmelon and tomato resulting from postharvest uses
Pea hay or fodder	1	1 ppm for pea resulting from postharvest uses
Pea vines (green)	10	
Peanut	0.5 (Po)	1 ppm for peanut (with shell removed) resulting from postharvest uses
Peppers	0.05	
Pulses	0.1	
Root and tuber veg	0.05	0.05 ppm for potato and sweet potato resulting from postharvest uses
Tomato	0.05	1 ppm for tomato resulting from postharvest uses
Tree nuts	1 (Po)	1 ppm for almond and walnut resulting from postharvest uses
Limits for Canada		Current U.S. Tolerance, ppm
Commodity, As Defined	MRL (mg/kg)	
Raw cereals	3	
Almonds	1	1 ppm for almond resulting from postharvest uses
Apples	1	1 ppm for apple resulting from postharvest uses
Beans	1	1 ppm for bean resulting from postharvest uses
Blackberries	1	1 ppm for blackberry resulting from postharvest uses
Blueberries	1	1 ppm for blueberry (huckleberry) resulting from postharvest uses
Boysenberries	1	1 ppm for boysenberry resulting from postharvest uses
Cherries	1	1 ppm for cherry resulting from postharvest uses
Copra	1	1 ppm for coconut, copra resulting from postharvest uses
Crabapples	1	1 ppm for crabapple resulting from postharvest uses
Cocoa beans	1	1 ppm for cocoa bean resulting from postharvest uses
Currants	1	1 ppm for currant resulting from postharvest uses
Dewberries	1	1 ppm for dewberry resulting from postharvest uses
Figs	1	1 ppm for fig resulting from postharvest uses
Gooseberries	1	1 ppm for gooseberry resulting from postharvest uses
Grapes	1	1 ppm for grape resulting from postharvest uses
Guavas	1	1 ppm for guava resulting from postharvest uses

Table 24: Codex MRLs and Applicable U.S. Tolerances for Pyrethrins

Codex		Current U.S. Tolerance, ppm
Commodity, As Defined	MRL (mg/kg)	
Huckleberries	1	1 ppm for blueberry (huckleberry) resulting from postharvest uses
Loganberries	1	1 ppm for loganberry resulting from postharvest uses
Mangoes	1	1 ppm for mango resulting from postharvest uses
Muskmelons	1	1 ppm for muskmelon resulting from postharvest uses
Oranges	1	1 ppm for oranges resulting from postharvest uses
Peaches	1	1 ppm for peach resulting from postharvest uses
Nectarines	1	1 ppm for peach resulting from postharvest uses
Peanuts	1	1 ppm for peanut (with shell removed) resulting from postharvest uses
Pears	1	1 ppm for pear resulting from postharvest uses
Peas	1	1 ppm for pea resulting from postharvest uses
Pineapple	1	1 ppm for pineapple resulting from postharvest uses
Plums	1	1 ppm for plum (fresh prune) resulting from postharvest uses
Raspberries	1	1 ppm for raspberry resulting from postharvest uses
Tomatoes	1	1 ppm for tomato resulting from postharvest uses
Walnuts	1	1 ppm for walnut resulting from postharvest uses

¹ Po = Postharvest

Updated 40 CFR

The 40 CFR should be updated to incorporate all the changes specified above. Once these changes are made the CFR should be in the format listed below.

§180.128 Pyrethrins; tolerances for residues

(a) General.

(1) Tolerances for residues of the pyrethrins 1 ((1S)-2-methyl-4-oxo-3-(2Z)-2,4-pentadienylcyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate), cinerin 1 ((1S)-3-(2Z)-2-butenyl-2-methyl-4-oxo-2-cyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate), and jasmolin 1 ((1S)-2-methyl-4-oxo-3-(2Z)-2-pentenyl-2-cyclopenten-1-yl (1R,3R)-2,2-dimethyl-3-(2-methyl-1-propenyl)cyclopropanecarboxylate), which serve as a marker for residues of the insecticide pyrethrins (insecticidally active principles of *Chrysanthemum cinerariaefolium*), are established in or on the following food commodities:

[Insert list as specified in the tables above after all data to support these tolerances have been submitted and reviewed.]

(2) A tolerance of 1.0 ppm is established for residues of the insecticide pyrethrins in or on milled fractions derived from Grain, cereal when present as a

result of its use in cereal grain mills and in storage areas for milled cereal grain products.

(3) A tolerance of 1.0 ppm is established for residues of the insecticide pyrethrins in or on all food items in food handling establishments where food and food products are held, processed, prepared and/or served. Food must be removed or covered prior to use.

(4) Where tolerances are established on both the raw agricultural commodities and processed foods made there-from, the total residues of pyrethrins in or on the processed food shall not be greater than that permitted by the larger of the two tolerances.

(b) *Section 18 emergency exemptions.*

[Reserved]

(c) *Tolerances with regional registrations.*

[Reserved]

(d) *Indirect or inadvertent residues.*

[Reserved]

D. Regulatory Rationale

The Agency has determined that the pyrethrins are eligible for reregistration provided that the risk mitigation measures and label amendments specified in this RED are implemented. The following is a summary of the rationale for managing risks associated with the use of pyrethrins.

1. Human Health Risk

a. Dietary (Food and Drinking Water) Risk Mitigation

Acute Risk

Acute dietary (food and drinking water) risk does not exceed the Agency's level of concern; acute dietary risk estimates are 54% of the aPAD for the general U.S. population, and 100% for children 1-2 years old, the most highly exposed subgroup. The dietary risk assessment overestimates acute risk because the acute dietary assessment was not refined for all commodities. EPA calculated that 71 % of the total dietary exposure was attributed to pineapple, dried-oat baby food, and banana, all of which included the conservative assumption of 100% of the crop treated with pyrethrins.

In this dietary assessment, previously established tolerances were used for many of the food commodities that were lacking residue data. For all other commodities in the assessment, data were translated from either residue data or other tolerances values. No monitoring data were available. Default processing factors were used because there were limited processing data available. 100% crop treated was used as a default on more than half of crops due to lack of data. Both, the presence of processing factors and percent crop treated impact the assessment greatly.

Estimated drinking water concentrations, which were included in the dietary assessment, represents the upper-bound estimated concentrations that might be found in surface water and groundwater due to the use of pyrethrins on multiple crops. This use of upper-bound estimates for drinking water is a conservative approach. When combining high-end food and water estimates, modeling results are higher than what is expected under actual use conditions.

The aPAD for children 1-2 is at the Agency's level of concern at 100%, with any refinement in the percent crop treatment values or residue levels, the estimated risk for children 1-2 is expected to decrease and therefore, no mitigation is necessary for this scenario.

Chronic Risk

The chronic dietary (food and drinking water) risk is below the Agency's level of concern; risk estimates are at 11% of the cPAD for the general U.S. population, and 32% of the cPAD for children 1-2 years old, the most highly exposed population subgroup. Therefore, no mitigation is necessary for this scenario.

b. Residential Risk Mitigation

Application rates for most of the exposure scenarios assessed were based on information provided in the Pyrethrins Master Label, which lists all of the uses that the PJV members were supporting. The label table provided in Section V includes updated label language that reflect the supported uses, maximum application rates, and use restrictions that are required as a result of the pyrethrins risk assessments and have been agreed upon by the PJV. All labels must be revised to reflect these changes.

i. Handler

In the residential handler exposure assessment a number of scenarios were assessed to estimate the exposure to homeowners handling products containing pyrethrins. From the results of the residential handler assessment, there are no residential risks of concern when pyrethrins are mixed, loaded, applied, or handled by homeowners. Therefore, no mitigation is warranted based on the risk assessment.

ii. Post-Application

A number of post-application residential scenarios were assessed for adults and children exposed to pyrethrins indirectly after application. Of these scenarios, three post-application residential scenarios assessed were of concern to the Agency including: 1) broadcast dust applications to carpets, 2) indoor metered release devices, and 3) outdoor residential misting systems. To address the potential risks associated with these post-application scenarios, the following mitigation measures are to be implemented.

Dusts - Broadcast Applications to Carpets

Applying dusts to carpets over a wide area can lead to exposure to children through incidental oral exposures. Most of the labels containing this type of application indicate the dust needs to be vacuumed after application. Since there is no information to determine how much pyrethrins are removed from the carpet while vacuuming, there is an unknown amount of dust available for exposure to children. The Agency has concerns from the potential incidental oral exposure children could have from this type of broadcast application to large carpeted areas. To reduce exposure to children from broadcast dust applications to carpets, the PJV has agreed to restrict carpet applications to spot treatments no greater than 3 feet by 3 feet in area.

Pyrethrins are also used on turf, and so an incidental oral assessment was conducted for use on turf which is considered a conservative risk estimate including 3 separate incidental oral exposure activities and assumes the exposures occur simultaneously. The turf scenario methodology, which has been peer reviewed and is better understood than the carpet dust scenario, includes incidental oral exposure to pesticide on turf from (1) hand to mouth activities, (2) object to mouth activities, and (3) ingesting soil particles. The aggregate of all three of these incidental oral turf exposures is above the Agency's target MOE of 300 with an MOE of 11,000. Given the conservative nature of the turf exposure scenario, it is unlikely that the magnitude and frequency of exposure to small spot treatments (3 sq ft) of dust formulations of PBO would result in exposure estimates equal or greater than estimated for the residential lawns. Since there are no incidental oral risks of concern from the turf scenario, and the PJV has agreed to reduce the amount of potential exposure to children by restricting applications to spots only, the Agency is not requiring and additional data at this time.

Indoor Metered Release Devices - Residential

There are potential risk concerns for post-application intermediate-term exposures following indoor applications with metered release devices. The MOEs range from 40 to 780 and are less than the target MOE of 1000. The risk calculations for the metered release scenarios are conservative because it was assumed that the aerosol spray would remain airborne until removed by ventilation and the effect of aerosol spray settling was not considered. Aerosol spray settling could be a major factor depending upon the aerosol droplet size and the rate of evaporation. Information regarding the aerosol droplet size and evaporation rate could be used to refine the risks, particularly for the residential scenarios where the ventilation removal rate is probably slower than the settling rate.

Therefore, to reduce the risks to sensitive bystander populations, the Pyrethrin Joint Venture has agreed to remove the following use sites from their metered release device product labels: day care centers, nursing homes, schools, and hospitals. In addition, EPA is requiring air concentration and particle size data for indoor metered release devices and will prohibit metered release device use in residential areas unless data are submitted in a timely fashion. Once these data are submitted and reviewed, the Agency will make a determination regarding the use in residential areas.

Outdoor Residential Misting Systems

Outdoor residential misting systems are fairly new to the pesticide market, and vary in their system design. Based on available information including outreach to the pyrethrins registrants and other stakeholders, and review of labels currently registered for use in these systems, the Agency used the following assumptions in the pyrethrins risk assessment:

- The spray droplets would be inhaled over a period of 5 hours for adults or 3 hours for toddlers, based on information from the Exposure Factors Handbook (EPA 1997) on how much time individuals spend outside.
- The initial concentration is based on instantaneous release and mixing into a fixed space with a height of 8 feet.
- The exposure is assumed to encompass 2 spray events that occur in the morning or evening.

Based on these assumptions, the Agency has identified a potential risk of concern for toddlers over the intermediate-term exposure duration. The target intermediate-term inhalation MOE is 1000, and the toddler bystander assessment calculated an MOE of 400.

The inhalation exposure durations used for the mosquito mister scenarios (5 hours/day for adults, 3 hours/day for toddlers) represent the 95th percentile values for time spent outdoors at a restaurant/picnic area (USEPA, 1997). During this exposure period the individual is assumed to be exposed to 2 spray events each lasting a period of 1 minute. Although this spray duration is appropriate for risk assessment purposes, shorter spray durations (i.e., 20- or 30-second durations) may be more representative of actual system rates, particularly for intermediate exposure durations. If products used in misting systems had standardized label language for use rates a more refined risk assessment would be possible. Currently, the labels do not specify the maximum daily application rates.

The Consumer Specialty Products Association (CSPA) submitted a discussion paper outlining some use information associated with these outdoor residential misting systems. Mosquito mister risks were calculated based on automatic applications of 2 sprays per day. It was noted in the CSPA discussion paper that the systems could be manually activated by the homeowner to apply additional sprays. Although re-filling and maintenance costs would likely limit homeowner use, label language indicating appropriate daily spray cycles and maximum daily application rates is also needed to address current concerns over excessive use.

Therefore, to mitigate the risks for toddler bystander exposure from intermediate-term outdoor residential misting systems, the PJV has agreed to restrict the maximum allowable daily rate to 0.00011 lb Py/1000 cubic feet/day, which is the rate where risks to children are not a concern to the Agency. Further, the PJV has agreed to submit data to allow the Agency to better understand these systems and refine the risk assessment. Information on use and usage of outdoor residential misting systems, as well as air concentration and droplet size data will be submitted. The PJV has also agreed to add the label statements listed in the label table in Section V of this document. These label statements will restrict the maximum allowable daily rate that can be applied, specify how the systems should be installed to reduce off-site drift, and specify measures to make the system reservoirs less accessible to children or other individuals.

Future Steps for Outdoor Residential Misting Systems

The distribution or sale, and use of pesticides in outdoor residential misting systems are subject to several statutory requirements. At this time, pyrethrins, piperonyl butoxide (PBO), and permethrin appear to be the only chemicals known to be used in outdoor residential misting systems; however, it is possible that other pesticide registered for residential outdoor use might also be used in similar systems. Section 2(ee)(3) of FIFRA permits the use of any application methods that are not prohibited by the pesticide's labeling; however, the application must only be to sites specified by the labeling and at no more than the maximum dosage rates specified by the labeling. Since most pesticide labels do not explicitly prohibit use in outdoor residential misting systems, other chemicals that target similar pests could be used in these misting systems. The Agency is not aware of other pesticides being used in outdoor residential misting systems, and therefore, has not assessed the potential risks to homeowners associated with use of pesticides other than pyrethrins, PBO, and permethrin.

All pyrethrins, PBO, and permethrin registrants that do not support outdoor residential misting systems use for their products will be expected to amend their Manufacturing Use Product label to state the following, "This product must not be formulated into an end use product for use in outdoor misting systems." Additionally, all registrants of pyrethrins end-use products must either include a statement prohibiting use in an outdoor residential misting system, for example, "This product must not be used in an outdoor residential misting system," or include separate and specific instructions for use in outdoor residential misting systems, including the maximum application rate per day, use directions, and restrictions specified in Section V, Table 26. Although this action will only address pyrethrins, PBO, and permethrin products, the Agency plans to issue broader guidance pertaining to use of outdoor misting systems and the pesticides which can be used in these systems as part of its on-going effort to standardize the way in which these systems are used.

By definition in FIFRA Section 2(e)(1) and (gg), leaving unapplied pesticide at a use site constitutes the distribution or sale of a pesticide. In order to be in compliance with FIFRA, companies which sell, install, and service outdoor residential misting systems must ensure that one of the following transactions occur when providing these services:

- The unopened registered pesticide is distributed or sold to the use-site owner prior to mixing and loading into the equipment; or
- The diluted registered pesticide is distributed or sold as a custom blend in accordance with EPA's custom blending policies at FIFRA Compliance Program Policies Nos. 3.4 and 7.1 of the FIFRA Compliance Program Policy Compendium; or
- The diluted pesticide is registered and is distributed or sold to the use-site owner prior to loading into the equipment.

Several issues, in addition to those discussed above, have been raised to EPA Regions through State FIFRA Issues Research and Evaluation Group (SFIREG) issue papers, stakeholder

forums and comments, and other sources regarding the use of these systems. These issues include, but are not limited to, the potential for inadvertent exposure and risks to residents, misuse of the systems and pesticide products, offsite drift and potential exposure to non-target organisms, and pest resistance issues. The Agency is aware of a cooperative effort lead by the National Pest Management Association involving state and industry stakeholders, and pest management professionals to standardize these systems and address the issues raised above, and intends to continue to address these on-going issues through continued involvement and discussions with the States, industry and stakeholder groups.

The Agency will have a 60-day comment period after the publication of the RED to solicit feedback on the label language in Section V, Table 26, and the issues discussed above.

i. Human Incidents

EPA has identified potential concern for people using pyrethrins-containing products in residential settings based on the Agency's analysis of exposure incident reports. This analysis suggested a possible connection between allergic and respiratory reactions in susceptible individuals and use of these products. A large number of reported incidents are related to use of the pediculicide (lice killing) shampoo products. These products are regulated by FDA and already contain language advising susceptible individuals to contact their physicians before use. In its incident analysis EPA recommended similar language for all pyrethrins products.

The Pyrethrin Joint Venture, an industry task force representing registrants, submitted a response to EPA summarizing 61 literature references on pyrethrum botany, chemistry, refining process, allergic reactions and contact dermatitis. The industry paper concludes that based on current chemistry and the current level of diagnostic standards, allergic contact dermatitis does not occur in response to use of pyrethrins products at a significant incidence in ragweed sensitive individuals as compared to the general population, although EPA's review of the submission found the basis for that conclusion to be unclear (R. Allen, Review of Mosby, and Registrant Submissions, DP 326085). The PJV is preparing a similar report focusing on respiratory incidents.

In order to clarify the issue of possible correlation between use and incidents, the PJV has committed to a product stewardship program that would involve outreach to physicians and Poison Control Centers with better guidance and diagnostic standards, as well as prospective in-depth follow-up of reported cases. In order to track the progress and information gathered from this program, annual reports that include information the program has collected, as well as progress of the program will be required as a data requirement in the Data Call-In. These annual reports will be required for at least 5 years, with a possible extension based on the information collected.

EPA will continue its research and discussion with the PJV and other interested stakeholders on whether or not precautionary labeling is warranted for some or all products and if so, what statements would be most useful to consumers. In the interim, all product labeling will be revised to include common-sense precautions for all consumers, including required ventilation statements as noted in Table 26. EPA's analyses and the PJV responses are available

in the docket (OPP-2005-0043). The protocol for the product stewardship program will also be posted when it is finalized.

c. Aggregate Risk Mitigation

Only short-term aggregate risk was calculated for pyrethrins because the oral and inhalation endpoints that were selected demonstrated different effects for the intermediate-term duration.

i. Short-Term Aggregate

An aggregate ARI_{agg} above 1 is not of risk concern for the Agency. The aggregate results for most sub-populations were well above the target Aggregate ARI of 1 and are not a concern. However, the ARI_{agg} ($ARI_{agg} = 0.96$) for children does not reach the target. It is considered to be a high-end estimate because the calculated exposure values for food and water were high-end estimates. Percent crop treated data were not available for all commodities. High-end field trial data were generally used, because sufficient data were not available for all commodities. The results from the dietary assessment are discussed in further detail under the “Dietary Mitigation” section above. Since high end values were used in the dietary assessment, and the incidental oral and inhalation values both represent the highest anticipated contribution from these sources, the actual short-term aggregate risk is likely to be much lower. Therefore, the Agency is not requiring specific mitigation to address the short-term aggregate assessment.

d. Occupational Risk Mitigation

Occupational exposure assessments are completed by the Agency considering the use of baseline PPE and, if warranted, for handlers, increasing levels of PPE and engineering controls in order to estimate the potential impact on exposure and risk. The target MOEs for pyrethrins are 100 for short-term inhalation exposures, and 1000 for intermediate- and long-term inhalation exposures.

i. Handler Risk Mitigation

Wettable Powders – Agricultural and Pest Control Operator (PCO)

There are inhalation risk concerns for agricultural and PCO mixers and loaders of wettable powder pyrethrins products at baseline attire. Therefore, to mitigate the risks to mixers and loaders of wettable powders in agricultural and professional applicator settings, the Pyrethrin Joint Venture has agreed to package wettable powders only in water soluble bags. When wettable powder products are packaged in water soluble bags, there are no risks of concern for mixers and loaders in agricultural settings or for PCOs. Therefore, to be eligible for reregistration, all wettable powders must be in water soluble bags. At this time, the Agency is not aware of any wettable powder products being actively marketed in the US. If wettable powders are sold in the future all products must comply with the water soluble bag and other requirements established in this decision document.

Indoor Handheld Equipment (including thermal, cold, and ULV foggers)

Handheld fogging equipment was not included in the Phase 5 pyrethrins risk assessment, but risk has subsequently been estimated based on both conservative application assumptions and data from a fogging study for the chemical prallethrin (MRID: 45869301). There are potential risks of concern for professional applicators with this scenario that can be mitigated with additional PPE of a protection factor 5 (PF5) dust mist respirator for applicators. The application rate assessed was 0.00042 lbs ai/1000 cubic feet which is representative of pyrethrins products. Therefore, to mitigate the risks to applicators using handheld fogging equipment, the Pyrethrin Joint Venture has agreed to require a PF 5 dust mist respirator for indoor applications, and will submit information on general fogging practices. There is no risk of concern with applicators using a PF 5 dust mist respirator while fogging.

Dusts Applied through Power Dusters

The Agency was not able to assess scenarios involving dust applications with power dusters because there are no exposure data to represent this application method. Power dusters could potentially pose inhalation risk. Due to a lack of data on this exposure scenario and no interest in supporting this application method from the Pyrethrin Joint Venture, EPA has determined that this application scenario is not eligible for reregistration. If data are submitted to support this application method, EPA will reconsider this decision in the future. Dust product labels must prohibit use of power dusters.

Dusts Applied through Bulb Dusters

The Agency was not able to assess scenarios involving dust applications with bulb dusters because of a lack of data. Bulb dusters are only used for crack and crevice treatments, which reduces the possible exposure to an applicator. Due to small amounts of dust used in this application method, the exposure is expected to be negligible. Therefore, no mitigation or data are required for this scenario.

ii. Post-Application Worker Risk Mitigation

Metered Release Devices – Dairy Barns

The Agency has similar concerns for post-application intermediate-term exposures from these systems as described in the occupational post-application section of this chapter. According to the Master Label, pyrethrins are used as space sprays in a wide variety of indoor areas such as barns, greenhouses, food storage areas, food processing areas, restaurants and residences. A scenario that involves a metered release into a dairy barn was evaluated to assess these exposures because pyrethrins are commonly used in dairy barns and because the ventilation characteristics of dairy barns are relatively well defined.

There are no risk concerns over the short-term exposure duration (MOE is 1200 and the target is 100). Risks are lower for these occupational scenarios than for residential settings due to the fact that the occupational areas generally have a greater ventilation capacity and the risk assessment assumes a higher number of air changes per hour in these settings. The MOEs for metered release devices in occupational areas like dairy barns were calculated to be 400 with a

target of 1000 for intermediate-term exposure. While it is possible workers could be exposed to pyrethrins from these metered release devices, it is not likely a worker would be exposed to the full daily amount for more than 30 consecutive days.

Therefore, to confirm the Agency's exposure assumptions that intermediate-term exposures are not likely to occur from metered release devices in occupational settings, the Agency is requesting additional usage information about the metered release device products, as well as requiring the label changes included in Section V. Some products labeled for use in occupational areas are also labeled for use in residential settings and areas where children may be present. Therefore, as mentioned in the residential metered release device section above, the Pyrethrin Joint Venture has agreed to remove the following use sites from metered release device product labels: day-care centers, nursing homes, schools, and hospitals.

2. Non-Target Organism (Ecological) Risk Management

a. Aquatic Organisms

i. Agricultural Use

For freshwater and estuarine/marine fish and aquatic invertebrates, including sediment dwelling organisms, acute risk and endangered species RQs exceed LOCs with RQs ranging from 0.54-1.98 when maximum rates and minimum reapplication intervals are modeled. Chronic RQs from modeled agricultural exposure scenarios also exceed LOCs for estuarine/marine invertebrates.

The risk estimates did not change substantially when the "typical" reapplication interval of 3 days was used instead of the shortest reapplication interval of 1 day. Since pyrethrins are used on a wide variety of crops, the typical application parameters can vary greatly depending on the commodity. However, the typical application rates and number of applications represented in this assessment appear to have the potential to reduce risk to aquatic systems. Evaluation of four crop scenarios suggests that all LOCs for freshwater and estuarine/marine fish and invertebrates would not be exceeded if the typical application rate is used.

Currently there are label restrictions on some, but not all product labels indicating the maximum application frequency and rate. All product labels will be revised to include the following information:

- No more than 10 applications per season.
- Do not reapply within 3 days except under extreme pest pressure.
- In case of extreme pest pressure, do not reapply within 24 hours.

ii. Mixtures Risk

The Agency assessed the maximum and typical rates for a pyrethrins product formulated with a synergist, piperonyl butoxide, but only evaluated acute exposure to aquatic organisms based on the toxicity data available. The calculated EECs show that acute risk from the maximum formulation rate appeared to be higher than risk calculated only from the TGAI.

Toxicity data showed that acute risk from the formulation was about 2-7 times greater for freshwater and estuarine/marine fish and about 10 times greater for estuarine/marine invertebrates. However, the typical formulated product rate appears to reduce the risk (freshwater and estuarine/marine fish and freshwater invertebrates), but this reduction in exposure still presents the potential for acute and chronic risk to estuarine/marine invertebrate species.

Because the limited information available indicates the toxicity to certain non-target organisms, specifically aquatic invertebrates, fish, and non-target insects, increases significantly (2-7 times) in the presence of a synergist, additional product specific data will be required to better characterize these risks.

iii. Down-the-Drain

There were no risks of concern identified in this assessment attributed to the contribution of pyrethrins to domestic wastewaters. Therefore, no mitigation is needed.

iv. Wide Area Mosquito Abatement

The estimated exposure for mosquito adulticide applications of pyrethrins were compared to the toxicity values for both freshwater and estuarine/marine fish and invertebrates. All of the fish and the freshwater invertebrate risk calculations did not exceed the Agency's acute levels of concern for acute or endangered species levels.

The only organism for which RQs exceed the Agency's level of concern for acute and endangered species was the estuarine/marine invertebrate. There are currently no Federally listed threatened or endangered ("listed") estuarine/marine invertebrates. Even so, different application parameters were modified in the risk assessment to determine which parameter had the biggest effect on risk to aquatic organisms from mosquito adulticide applications.

By changing the application rate, droplet size, and release height parameters a range of RQs were calculated, as shown in Table 25 below. Droplet sizes ranged from 40 μm to 50 μm , but only decreased the RQs minimally. Other wide area mosquito adulticide pesticides require a droplet size of 60 μm , and since this parameter does not affect the risk assessment significantly pyrethrins will conform with this droplet size. Similarly the maximum application rate of 0.008 lb ai/acre did not significantly affect predicted RQs by rate reduction alone. The parameter to affect the risk calculation the greatest was the release height. Release heights of 75 feet and 150 were modeled. At a release height of 150 feet and either a smaller droplet size or a typical application rate, the estimated risk for estuarine/marine invertebrates reaches a level below the level of concern for endangered species.

Table 25: Estuarine/marine invertebrate RQs

Rate (0.0080 or 0.0025 lb ai/A)	Droplet (50 or 40 μm)	Boom release height (75 or 150 ft)	Estuarine/Marine Invertebrate RQ 6" water
0.0080	50	75	0.81^a
0.0080	40	75	0.51^a
0.0025	50	75	0.25^c
0.0080	50	150	0.05
0.0080	40	150	0.02
0.0025	50	150	0.02

Bolded values do not meet the acute LOC for either acute^a (LOC = 0.5) or acute endangered species ^c (0.05) risk.

Therefore, to mitigate the risks from wide area mosquito adulticide applications, the Pyrethrin Joint Venture agreed to the following restrictions:

- Droplet size for aerial applications: $Dv_{0.5} < 60 \mu\text{m}$ and $Dv_{0.9} < 80 \mu\text{m}$
- Droplet size for ground applications: $Dv_{0.5} < 30 \mu\text{m}$ and $Dv_{0.9} < 50 \mu\text{m}$
- Release height: 100 ft. airplane, 75 for helicopter
- Yearly application rate: 0.2 lbs ai/acre/year
- Wind Speed: Apply when the wind speed is greater than or equal to 1 mph.

v. Other Non-Agricultural Uses

Office of Pesticide Programs (OPP) generally tries to estimate pesticide exposure through all significant routes of exposure from both agricultural and non-crop uses. However, the ecological risk assessments for pyrethrins and pyrethroid insecticides focus predominantly on the agricultural uses for these insecticides, because pesticide transport models are available to estimate potential aquatic exposure. Based on laboratory toxicity tests with terrestrial and aquatic animals, aquatic exposure would be more likely to cause adverse effects in the environment.

However, sales data indicate that non-crop uses of the pyrethrins and pyrethroids comprise a much larger fraction of total use than agricultural uses. The use of pyrethrins and pyrethroids in urban and suburban settings has increased since the phase-out of these uses of the organophosphate insecticides diazinon and chlorpyrifos. Outdoor non-crop uses of pyrethrins include landscape maintenance and homeowner lawn and garden use. Indoor uses include insect control, and treatment of pets and clothing.

The Agency uses a "Down-the-Drain" model to perform a screening aquatic risk assessment for indoor uses of pesticides. In these simulations, waste water containing pesticide residue from pet shampoos or treated clothing flows into a building drain and passes through a sanitary sewer and publicly owned treatment works (POTW) before being discharged to surface water. However, no analogous exposure model has been developed to allow a similar screening assessment for pesticides applied in an outdoor urban setting. As a result, the Agency has had to take a qualitative approach to characterize the potential aquatic risk from urban and suburban use of pyrethrins and pyrethroids.

For outdoor urban uses it is assumed that runoff water from rain and/or lawn watering may remove pesticide to storm sewers and then directly to surface water. Conceptually, a greater contribution to contamination of surface water bodies would be expected from application to impervious surfaces such as walkways, driveways or the sides of buildings than to lawns or bare ground, because of the pyrethrins and pyrethroids' strong affinity to bind to organic carbon in soils. However, the Agency has not identified a model which can simulate the different application methods for urban use and the physical representation of the urban landscape, storm sewer and receiving water configuration.

There are models available that can be calibrated to simulate sites and pesticides for which extensive flow and pollutant data have been collected in advance. The HSPF/NPSM model, for instance, which is included in the Office of Water's BASINS shell, has been used to calibrate stream flow and copper pesticide use data to simulate loading of these pesticides consistent with concentrations measured in surface water monitoring. Risk assessors with the California Department of Environmental Protection confirmed in conversations with the Agency that they also have used watershed models calibrated to previously collected flow and pesticide monitoring data, but that they did not know of any models capable of predicting concentrations of pyrethrins and pyrethroids that might occur because of outdoor urban uses.

Development of a screening model which could simulate the fate and transport of pesticides applied in an urban setting would require a large body of data which is currently unavailable. For instance, an urban landscape cannot be simulated as easily as an agricultural field. The PRZM model simulates runoff from an agricultural field using readily available data describing surface soil characteristics and laboratory data detailing the persistence and mobility of pesticides in these soils. The agricultural field simulated is homogeneously planted to a single crop, and soil and water are transported from the field to a receiving water body with dimensions consistent with USDA farm-pond construction guidelines.

By contrast, an urban landscape or suburban housing development consists of impervious surfaces such as streets and sidewalks, and permeable surfaces such as lawns and parkland. One could expect much greater mobility for pesticides applied to impervious surfaces, but laboratory soil metabolism studies may not provide an accurate measure of the persistence of pesticides on these surfaces. The path runoff water and eroded sediment might take is less obvious for an urban setting than an agricultural field. First, an urban landscape cannot be considered homogeneous, as the proportion of impervious and pervious surfaces varies for different locations. In addition, the flow path of runoff water and sediment is not necessarily a direct path over land, but can pass below ground through storm sewer networks, or be directed or slowed by pumping stations or temporary holding ponds.

The timing and magnitude of urban uses is less well defined than agricultural uses. While agricultural uses would occur within a predictable window during the growing season, the need for urban uses could occur at different times each year, and might occur at different times within the same watershed. In addition, since records of how and to what extent pyrethrins and pyrethroids are applied by homeowners are less well defined than for professional applications, it is harder to estimate the total load to model.

Monitoring Data

The Agency considers surface water monitoring data in addition to modeling results when they are available. However, surface water monitoring for pyrethrins has been limited. In a Sacramento County monitoring study targeting pyrethrins and PBO, water samples were collected after mosquito adulticide applications in the Sacramento metropolitan area. In samples collected up to 10 hours after application there were detects of pyrethrins and PBO from in the ppb range, similar to modeling predictions in the pyrethrins and the PBO mosquito adulticide assessment. Samples were also collected the day after application and measured lower or no concentrations for both active ingredients. This indicates both chemicals appear to dissipate fairly rapidly in the water column. The co-occurrence of pyrethrins and PBO in some of these first samples is an indication of direct application to water and not transport by runoff.

There has been limited monitoring for the pyrethroids, but recently researchers from the University of California- Berkeley have published studies which reported transport of pyrethroids to stream bed sediment as a result of urban uses. In 2004, Weston, et al. collected sediment from creeks draining a residential area in Rosedale, California. The sediments were analyzed for 7 pyrethroids (including two currently in the reregistration process), as well as for other insecticides. All of the pyrethroids were detected in the bed sediment from at least one sampling location. The researchers exposed the aquatic amphipod *Hyalella azteca* to the 21 sediment samples they collected; pesticide concentrations in 9 of these samples were sufficient to cause 90% mortality in the amphipods after a 10-day exposure. The concentrations of pyrethroids detected in the sediments were above the level expected to cause 50% mortality in *H. azteca*, suggesting that the pyrethroids were responsible for the observed toxicity.

In a subsequent study, Weston, et al. collected samples from 15 urban creeks in California and 12 in Tennessee. Toxicity to *H. azteca* was observed at least once with sediments taken from 12 of the 15 California sampling sites. In most cases, the toxicity could be accounted for by the concentrations of pyrethroids detected in the sediment. Pyrethroids were rarely detected in the Tennessee sediment samples, and exposure to the Tennessee sediments did not prove to be toxic to *H. azteca*. The Weston studies did not sample for pyrethrins.

The Weston, et al. studies indicate that urban uses of pesticides can lead to surface-water contamination, including contamination by pesticide that would bind almost completely to soil in an agricultural setting. The pyrethrins are similar to pyrethroid in that respect, but are less persistent and somewhat less toxic to aquatic organism; therefore, while pyrethrins may pose risk to aquatic organisms in their own right, comments from California water boards have suggested pyrethrins are a possible alternative to pyrethroids in urban settings. Nevertheless, efforts taken to better understand use practices and environmental conditions which may lead to transport of pyrethroids to surface water in urban settings would help improve the exposure assessment for pyrethrins.

The results of the Weston, et al. studies have led a number of organizations, such as the California State Water Resources Control Board (SWRCB) to submit comments to the Agency calling for mitigation measures to prevent pyrethrins and pyrethroid surface-water contamination. However, the lack of data and information to develop an urban pesticide

transport model also makes it difficult to identify whether risks may exceed some LOCs, and appropriate mitigation at this time. The Agency is committed to develop mitigation options during the reregistration process, and to identify steps which can be taken to allow a greater understanding of potential ecological risk from urban pyrethrins and pyrethroid uses.

One reason that broad mitigation measures cannot be adopted during reregistration is that only three pyrethroid insecticides are being reregistered. If use restrictions were placed on one of these three pesticides, one of the other pyrethroids would likely replace it for that use. It would be useful, as some commenters have suggested, to perform a risk assessment for all of the pyrethroids at the same time. The Weston papers indicated that the sediments which proved toxic to the tested aquatic invertebrate were contaminated not only with the pyrethroids undergoing reregistration, but also other pyrethroids such as bifenthrin and lambda-cyhalothrin.

The next opportunity to assess the pyrethroids as a group will occur during the Registration Review program, for which the Agency issued a proposed rule in July 2005 and plans to issue the final rule and begin implementing the program in 2006. The purpose of Registration Review is to ensure the periodic review of all pesticides to make sure they continue to meet current scientific and regulatory requirements, with the goal of reviewing each pesticide every fifteen years. The pyrethroids are tentatively scheduled for re-evaluation under the proposed Registration Review program in 2010. Efforts to improve the exposure assessment for urban uses of pyrethroids should improve the Agency's ability to evaluate these uses for pyrethrins as well.

A number of steps are planned for the intervening years which should improve the Agency's ability to assess the level of aquatic exposure to pesticides such as pyrethrins and pyrethroids from urban use. One step is to better identify what conditions in an urban setting might lead to greater vulnerability to transport to urban water bodies. Although the Weston paper reported sediment toxicity from samples from California but not Tennessee, the authors could only speculate what differences in use or geography made an area more vulnerable to exposure than the other.

Further investigation into the dominant urban uses and application practices of pyrethrins around the country would also help provide a clearer picture of relative vulnerability. The California SWRCB commented that structural pest control is likely a major source of pyrethroids in urban runoff, and suggested best management practices (BMP). The Pyrethroid Working Group (PWG) indicated that irrigation of lawns in areas of California with little rainfall during the application season could be a major contributor, and has contacted organizations such as Responsible Industry for a Sound Environment (RISE) and the Coalition for Urban/Residential Environmental Stewardship (CURES) to develop BMPs as part of their product stewardship plan. As further sediment monitoring studies are published reflecting various parts of the country with different weather and pest pressures, more detailed usage data will make it easier to correlate the causes of pyrethrins and pyrethroid contamination of surface water with use practices.

The Agency will also continue in its efforts to develop a screening model for urban pesticide uses. Advances in the resolution of GIS databases may allow better representation of

the impervious and pervious portions of a typical urban landscape. As it becomes clearer which uses are most likely to lead to transport of pyrethrins and pyrethroids to surface water, the conceptual model of how urban transport should be simulated will be more focused.

The Agency will evaluate available published literature and call-in data to resolve data gaps to ensure a robust comparison of the potential ecological risk of all the pyrethrins and pyrethroids during Registration Review. Toxicity data cited by several commenters from published literature are included in the Agency's ECOTOX database. The Agency will evaluate the quality of studies to identify those to be included in the risk assessments during Registration Review.

Stewardship Language

While the Agency cannot currently assess the potential risks to aquatic organisms from non-agricultural uses of pyrethrins, the Agency is still seeking to reduce the potential drift and run-off of pyrethrins into aquatic habits through explicit directions for use on both professional and consumer use products for use in residential settings. These use directions include best management and stewardship practices which are formulation specific, and will serve to reduce the potential run-off and drift that can occur from applications of these products. Label statements implementing these measures are listed in the "direction for use" section of the label table (Table 26) in Section V of this RED document.

b. Terrestrial Organisms

Birds and Mammals

No acute and chronic risk for listed or non-listed mammalian and avian species exceed EPA's level of concern; therefore, no mitigation is needed.

Terrestrial Plants

Risks were not calculated for non-target plants because the sodium channel mechanism of action for pyrethrins does not indicate that pyrethrins would be toxic to plants. Therefore, no mitigation is needed.

Non-Target Insects

There are risk concerns for honeybees that suggest there are non-target beneficial insect concerns as well. Therefore, to mitigate concerns for honeybees and other non-target insects, an environmental hazard statement for honeybees will be added to all Environmental Hazard statements on product labels.

b. Endangered Species

The Agency's screening level assessment results in the determination that pyrethrins will have no direct acute effects on threatened and endangered mammals or birds. The preliminary

risk assessment for endangered species indicates that RQs exceed endangered species LOCs for freshwater fish and invertebrates, and estuarine/marine fish and invertebrates. Further, potential indirect effects to any species dependent upon a species that experiences effects from use of pyrethrins can not be precluded based on the screening level ecological risk assessment. These findings are based solely on EPA's screening level assessment and do not constitute "may affect" findings under the Endangered Species Act.

V. What Registrants Need to Do

The Agency has determined that pyrethrins are eligible for reregistration provided that the mitigation measures and label changes identified in this RED are implemented. Registrants will need to amend their product labeling to incorporate the label statements set forth in the Label Changes Summary Table 26. The Agency intends to issue Data Call-Ins (DCIs) requiring generic and product specific data. Generally, the registrant will have 90 days from receipt of a DCI to complete and submit response forms or request time extensions and/or waivers with a full written justification. For product-specific data, the registrant will have eight months to submit data and amended labels.

A. Manufacturing Use Products

1. Additional Generic Data Requirements

The generic data base supporting the reregistration of pyrethrins for currently registered uses has been reviewed and determined to be substantially complete. However, the data listed below are necessary to confirm the reregistration eligibility decision documented in this RED.

Human Health Data Requirements

The following toxicology and residue chemistry data are being required to support the registration of pyrethrins:

Toxicology

- Developmental neurotoxicity study.
- Comparative thyroid study.

Residue Chemistry

- An independent lab validation (ILV) for the proposed single analyte regulatory method (as opposed to multiresidue methods) is required for the determination of pyrethrins residues of concern in/on plant commodities.
- Storage stability data for representative commodities of oilseeds, non-oily grains, and root crops.
- Storage stability data for the processed commodities of representative oilseeds (cottonseed or peanut) and grains (preferably field corn or wheat). In addition, storage

stability data on dried fruits (preferably raisins or prunes) to confirm whether residues of pyrethrins 1 decline on other dried processed fruits.

- Magnitude of Residue Studies to support uses of pyrethrins on foods stored in multi-walled paper or cloth bags.
- Magnitude of the residue studies reflecting preharvest uses on representative commodities of all crop groups and miscellaneous commodities which are being supported for reregistration.
- Magnitude of the residue studies reflecting postharvest uses for all crops (except potato and sweet potato) which are being supported for reregistration.
- Magnitude of Residue Study to support the use on tobacco.
- Processing studies on apple, barley, cacao bean, coconut, coffee, corn (field), cotton, fig, flax, oat, peanut, pineapple, plum, rice, rye, safflower, sorghum, soybean, sugarcane, sunflower, tea, and wheat.
- A confined rotational crop study.

Occupational and Residential Exposure

- Metered release devices: use and usage information, as well as air concentration and particle size data.
- Outdoor residential misting systems: use and usage information, as well as air concentration and droplet size data.
- Applicators using handheld fogging equipment: use and usage data on application practices.

Incident

- In order to clarify the issue of possible correlation between use and incidents, the PJV has committed to a product stewardship program that would involve outreach to physicians and Poison Control Centers with better guidance and diagnostic standards, as well as prospective in-depth follow-up of reported cases. In order to track the progress and information gathered from this program, annual reports that include information the program has collected, as well as progress of the program will be required for at least 5 years, with a possible extension based on the information collected.

Environmental Fate and Effects Data Requirements

The fate and ecological effects data bases are adequate to conduct a Tier I risk assessment. The following ecological effects data are needed because of the phytotoxic effects pyrethrins have on plants and potential risk to benthic organisms:

- A life-cycle study (Guideline 850.1300 and 850.1350) with an estuarine/ marine invertebrate (e.g., Mysid shrimp) and fish early life-stage study with an estuarine/marine fish (e.g., Sheepshead Minnow).
- Tier I plant studies [Guideline 850.4225 Seedling Emergence and Guideline 850.4150 Vegetative Vigor] and aquatic plant growth studies with algae (Guideline 850.5400) and

duckweed (Guideline 850.4400) be submitted to the Agency to fully evaluate the potential risk to plants.

- A whole sediment acute test with the freshwater organism, *Chironomus ripirians* (Guideline number 850.1735) and the marine water organism, *Leptocheirus plumulosus* (Guideline number 850.1740) are needed to fully evaluate potential risk to benthic organisms.
- Pyrethrins urban use data, to better identify what conditions in an urban setting might lead to greater vulnerability to transport to urban water bodies.

In addition to the ecological and fate data requirements listed above for pyrethrins, the limited information available indicates end-use products formulated with a synergist, like piperonyl butoxide, to certain non-target organisms, specifically aquatic invertebrates, fish, and non-target insects, increases the toxicity of the active ingredient significantly. To better inform these potential risk concerns, additional data for typical end-use products formulated with piperonyl butoxide, including products containing pyrethrins, will be required in the piperonyl butoxide RED and Data Call-In.

2. Labeling Requirements

To ensure compliance with FIFRA, manufacturing use product (MUP) labeling should be revised to comply with all current EPA regulations, PR Notices, and applicable policies. The MUP labeling must bear the labeling contained in Table 26 to be eligible for reregistration.

3. Spray Drift Management

The Agency has been working closely with stakeholders to develop improved approaches for mitigating risks to human health and the environment from pesticide spray and dust drift. As part of the reregistration process, the EPA will continue to work with all interested parties on this important issue.

Specific spray drift language for pyrethrins is outlined in the “spray drift management” section of the label table.

4. Endangered Species

The Agency has developed the Endangered Species Protection Program to identify pesticides whose use may cause adverse impacts on endangered and threatened species, and to implement mitigation measures that address these impacts. The Endangered Species Act (ESA) requires federal agencies to ensure that their actions are not likely to jeopardize listed species or adversely modify designated critical habitat. To analyze the potential of registered pesticide uses that may affect any particular species, EPA uses basic toxicity and exposure data developed for this RED and considers it in relation to individual species and their locations by evaluating important ecological parameters, pesticide use information, geographic relationship between specific pesticide uses and species locations, and biological requirements and behavioral aspects of the particular species, as part of a refined species-specific analysis. When conducted, this

species-specific analysis will take into consideration any regulatory changes recommended in this RED that are being implemented at that time.

Following this future species-specific analysis, a determination that there is a likelihood of potential impact to a listed species or its critical habitat may result in: limitations on the use of pyrethrins, other measures to mitigate any potential impact, or consultations with the Fish and Wildlife Service or the National Marine Fisheries Service as necessary. If the Agency determines use of pyrethrins “may affect” listed species or their designated critical habitat, EPA will employ the provisions in the Services regulations (50 CFR Part 402). Until that species-specific analysis is completed, the risk mitigation measures being implemented through this RED will reduce the likelihood that endangered and threatened species may be exposed to pyrethrins at levels of concern. EPA is not requiring specific pyrethrins label language at the present time relative to threatened and endangered species. If, in the future, specific measures are necessary for the protection of listed species, the Agency will implement them through the Endangered Species Protection Program.

B. End-Use Products

1. Additional Product-Specific Data Requirements

Section 4(g)(2)(B) of FIFRA calls for the Agency to obtain any needed product-specific data regarding the pesticide after a determination of eligibility has been made. The Registrant must review previous data submissions to ensure that they meet current EPA acceptance criteria and if not, commit to conduct new studies. If a registrant believes that previously submitted data meet current testing standards, then the study MRID numbers should be cited according to the instructions in the Requirement Status and Registrants Response Form provided for each product. The Agency intends to issue a separate product-specific Data Call-In (PDCI), outlining specific data requirements. For any questions regarding the PDCI, please contact Karen Jones at (703) 308-8047.

In addition, efficacy data for all applications that target public health pests must be submitted, including data for outdoor residential misting systems. Additional information on the efficacy data can be found in the Series 810 Product Performance Test Guidelines on the Agency’s website.

(http://www.epa.gov/opptsfrs/publications/OPPTS_Harmonized/810_Product_Performance_Test_Guidelines/index.html)

2. Labeling for End-Use Products

To be eligible for reregistration, labeling changes are necessary to implement measures outlined in Section IV above. Specific language to incorporate these changes is specified in Table 26. Generally, conditions for the distribution and sale of products bearing old labels/labeling will be established when the label changes are approved. However, specific existing stocks time frames will be established case-by-case, depending on the number of products involved, the number of label changes, and other factors.

Labeling Changes Summary Table 26

In order to be eligible for reregistration, all product labels must be amended to incorporate the risk mitigation measures outlined in Section IV. The following table describes how language on the labels should be amended.

Description	Pyrethrins Required Labeling Language	Placement on Label
<i>Manufacturing-Use Products</i>		
Required on all MUPs	<p>“Only for formulation into an insecticide for the following use(s) [fill blank only with those uses that are being supported by MP registrants].”</p> <p>“Not for formulation into wettable powder end use products (EUP), unless the EUP is packaged in water soluble bags.”</p> <p>“Not for formulation into granular End Use Products.”</p> <p>>>Delete any reference to tolerance exemptions on labels.</p> <p>If Registrants are not supporting outdoor residential misting systems use for their products, the following statement must appear on the MUP label of all liquid or wettable powder products: “Not for formulation into an end use product for use in outdoor residential misting systems.”</p> <p>Direct Application to Non-domestic Animals/Livestock</p> <p><u>Formulated products eligible for reregistration may not contain a percentage of a.i. that exceeds the following:</u></p> <p>Dusts for application to livestock only– 1.0% ai Liquids for application to livestock only – 0.035 lb ai/gallon Towelettes for application to livestock only – 0.2% ai Spot-on applications – 1.0% ai Liquids for applications to poultry only – 0.01% ai</p> <p>Pet Care</p>	Directions for Use

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p><u>Formulated products eligible for reregistration may not contain a percentage of a.i. that exceeds the following:</u></p> <p>Shampoos – 0.3% ai Sprays – 0.01% ai Spot-on or Pour-on – 1.0% ai Dust – 1.0% ai Towelettes-0.2% ai</p>	
One of these statements may be added to a label to allow reformulation of the product for a specific use or all additional uses supported by a formulator or user group.	<p>“This product may be used to formulate products for specific use(s) not listed on the MP label if the formulator, user group, or grower has complied with U.S. EPA submission requirements regarding support of such use(s).”</p> <p>“This product may be used to formulate products for any additional use(s) not listed on the MP label if the formulator, user group, or grower has complied with U.S. EPA submission requirements regarding support of such use(s).”</p>	Directions for Use
Environmental Hazards Statements Required by the RED and Agency Label Policies	<p>“This product is toxic to aquatic organisms, including fish and invertebrates. Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans or other waters unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA. Do not contaminate water when disposing of equipment wash-waters.”</p>	Directions for Use
<p align="center"><i>End-Use Products Intended for Occupational Use (WPS and non-WPS) And Wide Area Mosquito Adulticide Applications</i></p>		
<p>Handler PPE Requirements for Wettable Powders Formulations¹ packaged in water soluble packaging</p> <p>[Note: Wettable Powders must be packaged in water soluble bags to be eligible for reregistration.]</p>	<p>“Personal Protective Equipment (PPE)”</p> <p>“Mixers, loaders, applicators, and other handlers must wear:</p> <ul style="list-style-type: none"> - long-sleeve shirt, - long pants, and - shoes and socks.” <p>“In addition to the above PPE, applicators using hand held foggers in an enclosed area must wear a half-face, full-face, or hood-style NIOSH-approved respirator with:</p> <p>-- a dust/mist filtering cartridge (MSHA/NIOSH approval number prefix TC-21C), or</p>	Precautionary Statements: Hazards to Humans and Domestic Animals

Description	Pyrethrins Required Labeling Language	Placement on Label
<p>Note: If the use of handheld foggers in enclosed areas is not permitted or not feasible for the end-use product, the statement requiring respirators for those uses may be omitted.</p>	<p>-- a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G), or -- a cartridge or canister with any N,R,P or HE filter.”</p> <p>“See engineering controls for additional requirements.”</p> <p><i>Instruction to Registrant:</i></p> <p>Drop the “N” type prefilter from the respirator statement, if the pesticide product contains, or is used with, oil.</p>	
<p>Handler PPE Requirements for Liquid Formulations¹ [including: liquid concentrates, total release foggers, microencapsulated concentrates, foams, aerosols, gels, pastes, and pressurized liquids]</p> <p>Note: The statement may be omitted if the end-use product is labeled only for use on pets.</p> <p>Note If aerial application is not permitted or not feasible for the end-use product, the reference to engineering control statements may be omitted.</p> <p>Note: If the use of handheld foggers in</p>	<p>“Personal Protective Equipment (PPE)”</p> <p>“Mixers, loaders, applicators, and other handlers must wear the following: - long-sleeve shirt, - long pants, - shoes and socks.”</p> <p>“In addition to the above PPE, applicators using hand held foggers in an enclosed area must wear a half-face, full-face, or hood-style NIOSH-approved respirator with: -- a dust/mist filtering cartridge (MSHA/NIOSH approval number prefix TC-21C), or -- a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G), or -- a cartridge or canister with any N,R,P or HE filter.”</p> <p>“See engineering controls for additional requirements.”</p> <p><i>Instruction to Registrant:</i></p> <p>Drop the “N” type filter from the respirator statement, if the pesticide product contains, or is used with, oil.</p>	<p>Precautionary Statements: Hazards to Humans and Domestic Animals</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
enclosed areas is not permitted or not feasible for the end-use product, the statement requiring respirators for those uses may be omitted.		
Handler PPE Requirements for Dusts ¹	<p>“Personal Protective Equipment (PPE)”</p> <p>“Mixers, loaders, applicators, and other handlers must wear the following:</p> <ul style="list-style-type: none"> - long-sleeve shirt, - long pants, - shoes and socks.” 	Precautionary Statements: Hazards to Humans and Domestic Animals
User Safety Requirements	<p>“Follow manufacturer’s instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.”</p> <p>“Discard clothing and other absorbent material that have been drenched or heavily contaminated with the product’s concentrate. Do not reuse them.”</p>	Precautionary Statements: Hazards to Humans and Domestic Animals immediately following the PPE requirements
<p>Engineering Controls: Wettable Powders packaged in Water-Soluble Bags</p> <p>[Note: Wettable Powders must be packaged in water soluble packages to be eligible for reregistration.]</p>	<p>“Engineering Controls:”</p> <p>“Water-soluble packets when used correctly qualify as a closed mixing/loading system under the Worker Protection Standard for Agricultural Pesticides [40 CFR 170.240(d)(4)]. Mixers and loaders using water-soluble packets must :</p> <ul style="list-style-type: none"> -- wear the personal protective equipment required in the PPE section of this labeling for mixers and loaders, and -- be provided and must have immediately available for use in an emergency, such as a broken package, spill, or equipment breakdown a half-face, full-face, or hood-style NIOSH-approved respirator with: -- a dust/mist filtering cartridge (MSHA/NIOSH approval number prefix TC-21C), or -- a canister approved for pesticides (MSHA/NIOSH approval number prefix TC-14G), or -- a cartridge or canister with any N,R,P or HE filter.” 	Precautionary Statements: Hazards to Humans and Domestic Animals (Immediately following PPE and User Safety Requirements.)

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>“Pilots must use an enclosed cockpit that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)].”</p> <p>“Human flagging is prohibited. Flagging to support aerial application is limited to use of the Global Positioning System (GPS) or mechanical flaggers.”</p> <p>Instructions to Registrant:</p> <p>Drop the “N” type prefilter from the respirator statement, if the pesticide product contains, or is used with, oil.</p>	
<p>Engineering Controls for all liquid formulations.</p> <p>Note if aerial application is not permitted or not feasible for the end-use product, the engineering control statements referring to pilots or human flaggers may be omitted.</p>	<p>“Engineering Controls:”</p> <p>“Pilots must use an enclosed cockpit that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)].”</p> <p>“Human flagging is prohibited. Flagging to support aerial application is limited to use of the Global Positioning System (GPS) or mechanical flaggers.”</p>	<p>Precautionary Statements: Hazards to Humans and Domestic Animals (Immediately following PPE and User Safety Requirements.)</p>
<p>User Safety Recommendations</p>	<p>“USER SAFETY RECOMMENDATIONS”</p> <p>“Users should wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.”</p> <p>“Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.”</p> <p>“Users should remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.”</p>	<p>Precautionary Statements under: Hazards to Humans and Domestic Animals immediately following Engineering Controls</p> <p>(Must be placed in a box.)</p>
<p>Environmental Hazards Statements for</p>	<p>“ENVIRONMENTAL HAZARDS”</p>	<p>Precautionary Statements under</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
<p>products labeled for outdoor uses other than as a wide area mosquito adulticide:</p> <p>(PR Notice 2005-1 recommends separating labels intended for wide area mosquito adulticide applications.)</p>	<p>“This product is toxic to aquatic organisms, including fish and invertebrates. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. This product may contaminate water through runoff. This product has a potential for runoff for several weeks after application. Poorly draining soils and soils with shallow water tables are more prone to produce runoff that contains this product.”</p> <p>“This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.”</p> <p>“Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash-waters or rinsate.”</p>	Environmental Hazards
<p>Environmental Hazards Statements for products labeled solely for use as a wide area mosquito adulticide:</p> <p>(PR Notice 2005-1 recommends separating labels intended for wide area mosquito adulticide applications.)</p>	<p>“ENVIRONMENTAL HAZARDS”</p> <p>“This pesticide is toxic to aquatic organisms, including fish and invertebrates. Runoff from treated areas or deposition of spray droplets into a body of water may be hazardous to fish and aquatic invertebrates.”</p> <p>“This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.”</p> <p>“Before making the first application in a season, it is advisable to consult with the state or tribal agency with primary responsibility for pesticide regulation to determine if other regulatory requirements exist.”</p> <p>“Do not apply over bodies of water (lakes, rivers, permanent streams, natural ponds, commercial fish ponds, swamps, marshes or estuaries), except when necessary to target areas where adult mosquitoes are present, and weather conditions will facilitate movement of applied material away from the water in order to minimize incidental deposition into the water body. Do not contaminate bodies of water when disposing of equipment rinsate or washwaters.”</p>	Precautionary Statements under Environmental Hazards
Environmental	“ENVIRONMENTAL HAZARDS for TERRESTRIAL APPLICATIONS”	Precautionary

Description	Pyrethrins Required Labeling Language	Placement on Label
<p>Hazards Statements for products labeled as a wide area mosquito adulticide and is labeled for other outdoor uses as well:</p> <p>(PR Notice 2005-1 recommends separating labels intended for wide area mosquito adulticide applications.)</p>	<p>“This product is toxic to aquatic organisms, including fish and invertebrates. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. This product may contaminate water through runoff. This product has a potential for runoff for several weeks after application. Poorly draining soils and soils with shallow water tables are more prone to produce runoff that contains this product.”</p> <p>“This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.”</p> <p>“Except as specified in the directions for use, do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment wash-waters or rinsate.”</p> <p>“ENVIRONMENTAL HAZARDS for WIDE AREA MOSQUITO ADULTICIDE APPLICATIONS”</p> <p>“This pesticide is toxic to aquatic organisms, including fish and invertebrates. Runoff from treated areas or deposition of spray droplets into a body of water may be hazardous to fish and aquatic invertebrates.”</p> <p>“When applying as a wide area mosquito adulticide, before making the first application in a season, it is advisable to consult with the state or tribal agency with primary responsibility for pesticide regulation to determine if other regulatory requirements exist.”</p> <p>“This product is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply when bees are visiting the treatment area, except when applications are made to prevent or control a threat to public and/or animal health determined by a state, tribal, or local health or vector control agency on the bases of documented evidence of disease causing agents in vector mosquitoes or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort.”</p> <p>“When applying as a wide area mosquito adulticide, do not apply over bodies of water (lakes,</p>	<p>Statements under Environmental Hazards</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
	rivers, permanent streams, natural ponds, commercial fish ponds, swamps, marshes or estuaries), except when necessary to target areas where adult mosquitoes are present, and weather conditions will facilitate movement of applied material away from the water in order to minimize incidental deposition into the water body.	
<p>Environmental Hazards for Products labeled only for Indoor Use EXCEPT ready to use impregnated materials (e.g. flea collars, ear tags, coils, mats)</p> <p>(Note: Products used on domestic animals like flea collars and ear tags, generally do not require an Environmental Hazards statement. In addition, products containing the statement: "For indoor use only," may also omit the environmental hazards statement.)</p>	<p>"ENVIRONMENTAL HAZARDS"</p> <p>"This product is toxic to aquatic organisms, including fish and invertebrates. Do not contaminate water when disposing of equipment, washwater, or rinsate. See Directions for Use for additional precautions and requirements."</p> <p>For indoor products packaged in containers equal to or greater than 5 gallons or 50 lbs add the following statement:</p> <p>"Do not discharge effluent containing this product into lakes, streams, ponds, estuaries, oceans, or other waters unless in accordance with the requirements of a National Pollution Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA."</p>	Precautionary Statements under Environmental Hazards
Restricted-Entry Interval for products with WPS uses	"Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hours."	Directions for Use, Agricultural Use Requirements Box
Early Entry Personal Protective Equipment for products with WPS uses	<p>"PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as soil or water, is:</p> <ul style="list-style-type: none"> - coveralls, - chemical-resistant gloves made of any waterproof material, and - shoes plus socks." 	Directions for Use, Agricultural Use Requirements Box
<p>Entry Restrictions for products with non-WPS uses on the label</p> <p>Note: This excludes</p>	<p>Entry Restriction for products applied as a spray (does not apply to products applied directly to domestic animals):</p> <p>"Do not enter or allow others to enter until sprays have dried."</p>	If no WPS uses on the product label, place the appropriate statement in the Directions for Use Under General

Description	Pyrethrins Required Labeling Language	Placement on Label
products labeled for use when people are permitted to be present (e.g. wide-area mosquito adulticide applications, metered release devices, and pet applications)	<p>Entry Restriction for products applied dry:</p> <p>“Do not enter or allow others to enter until dusts have settled.”</p> <p>Entry Restriction for products applied as a space spray or as a fog:</p> <p>“Do not enter or allow others to enter until vapors, mists, and aerosols have dispersed, and the treated area has been thoroughly ventilated.”</p>	Precautions and Restrictions. If the product also contains WPS uses, then create a Non-Agricultural Use Requirements box as directed in PR Notice 93-7 and place the appropriate statement inside that box.
Entry Restrictions for products labeled solely for use when people are present (e.g. wide-area mosquito adulticide applications, metered release devices, and applications to pets)	Note to Registrants: No entry restrictions are required. See below under Use Restrictions for further requirements.	
Entry Restrictions for products labeled for use when people are present (e.g. wide-area mosquito adulticide applications, metered release devices, and applications to pets) and for use on other sites as a directed or space spray.	<p>Products labeled for use as a directed spray (does not apply to products applied directly to domestic animals):</p> <p>“Except when (insert application method or site that allows people to be present), do not enter or allow others to enter until sprays have dried.”</p> <p>Products labeled for use as a space spray:</p> <p>“Except when (insert application method or site that allows people to be present), do not enter or allow others to enter until vapors, mists, and aerosols have dispersed, and the treated area has been thoroughly ventilated.”</p> <p>Note to Registrant: An example is as follows: Except when applying in a metered release system, do not enter or allow others to enter until sprays have dried.</p>	If no WPS uses on the product label, place the appropriate statement in the Directions for Use Under General Precautions and Restrictions. If the product also contains WPS uses, then create a Non-Agricultural Use Requirements box as directed in PR Notice 93-7 and place the appropriate statement inside that box.
General Application Restrictions for products	“Do not apply this product in a way that will contact workers or other persons, either directly or through drift.”	Place in the Direction

Description	Pyrethrins Required Labeling Language	Placement on Label
<p>with WPS or non-WPS uses on the label</p> <p>Note: This excludes products that contain any directions for uses when people are permitted to be present in the treated area (e.g. . wide-area mosquito adulticide applications, metered release devices, and applications to pets)</p>	<p>“Only protected handlers may be in the area during application.”</p>	<p>for Use.</p>
<p>General Application Restrictions for products with WPS and non-WPS uses on the label AND contain directions for uses when people are permitted to be present in the treated area (e.g. . wide-area mosquito adulticide applications, metered release devices, and applications to pets)</p>	<p>“Except when” (insert application method or site that allows people to be present) “do not apply this product in a way that will contact workers or other persons, either directly or through drift.”</p> <p>“Except when” (insert application method or site that allows people to be present) “only protected handlers may be in the area during application.”</p>	<p>Place in the Direction for Use.</p>
<p>General Application Restrictions for products labeled for use solely when people are permitted to be present in the treated area (e.g. wide-area mosquito adulticide applications, metered-release devices, and applications to pets)</p>	<p>Note to Registrants: No entry restrictions are required. See below under Use Restrictions for further requirements.</p>	<p>Place in the Direction for Use.</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
Other Application Restrictions	<p>Note to Registrants: Delete any reference to tolerance exemptions on labels.</p> <p>In addition add the following restrictions depending on the registered product uses and formulation:</p> <p>Wettable powder formulations: “Do not apply this product as a dust.” “Do not apply in forestry areas.”</p> <p>Dust formulations: “Aerial applications are prohibited.” “Applications with power duster equipment are prohibited.”</p> <p>Products labeled for use as a space spray: “Do not remain in treated area. Exit area immediately and remain outside the treated area until aerosols, vapors, and/or mists have dispersed.”</p> <p>Products labeled for spray applications to plants: “Do not wet plants to point of runoff or drip.”</p> <p>Products labeled for spray applications to articles: “Do not wet articles to point of runoff or drip.” “Do not use treated article until spray has dried.”</p> <p>Products labeled for applications to clothing articles: “Dry clean treated clothes before wearing.”</p> <p>Products labeled for dip applications: “Do not use treated article before it is dry.”</p> <p>Products labeled for crack and crevice, surface or space spray, fogging or dust applications</p>	Directions for Use under General Precautions and Restrictions and/or Application Instructions

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>indoors:</p> <p>“Remove or cover exposed food and drinking water before application.”</p> <p>“Remove or cover dishes, utensils, food processing equipment, and food preparation surfaces, or wash them before use.”</p> <p>Products labeled for applications to non-residential indoor sites:</p> <p>“Do not use in aircraft cabins except in compliance with PR Notice 96-3.”</p> <p>“When used in dairy barns or facilities: Close milk bulk tank lids to prevent contamination from spray and from dead or falling insects. Remove or cover milking utensils before application. Wash teats of animals before milking.”</p> <p>Products labeled for use in food handling and processing facilities:</p> <p>“Do not make space spray applications when facility is in operation.”</p> <p>“During space spray applications, cover or remove food.”</p> <p>“During space spray applications, cover food processing surfaces or clean after treatment with a suitable detergent and rinse with potable water before use.”</p>	
<p>Use-Specific Application Restrictions</p> <p>(Note: The maximum allowable application rate and maximum allowable seasonal rate must be listed as pounds or gallons of formulated product per acre, not just as pounds active ingredient per acre.</p> <p>All rates must be expressed in terms the applicator can use in order to arrive at the maximum application rate. For example, for sprays</p>	<p>Food Crops Grown Outdoors or in Greenhouses in Agricultural Settings</p> <p><u>Maximum application rates:</u></p> <p>Field and orchard– 0.05 lbs ai/acre or 0.0012 lb ai /1000 square feet</p> <p>Hydroponically grown crops – 0.10 ppm ai in water</p> <p>Greenhouse space sprays - 0.00014 lbs ai/1000 cubic feet</p> <p>Greenhouse surface spray – 0.0012 lbs per 1000 square feet or 0.05 lbs ai per acre</p> <p><u>Use restrictions:</u></p> <p>“Do not apply more than 10 times per season.”</p> <p>“Do not reapply within 3 days except under extreme pest pressure.”</p> <p>“In case of extreme pest pressure, do not reapply within 24 hours.”</p> <p>“Do not harvest until spray has dried.”</p> <p>“Do not apply to cotton within 14 days of seed harvest.” (For labels with cotton only)</p> <p>Rice Fields</p>	<p>Directions for Use under General Precautions and Restrictions and/or Application Instructions</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
<p>rates must specify the duration of spray to a specific area, i.e., spray for X seconds to a space Y feet by Z feet.)</p>	<p>“A 10 day water hold is required for all applications when rice fields are flooded.”</p> <p>Greenhouse Grown Ornamental, Flowering and Foliage Plants:</p> <p><u>Maximum application rates:</u> Surface applications – 0.0036 lbs ai/1000 square feet (or 0.15 lb ai/acre) Space sprays (including space, total release, and fogger applications) – 0.00042 lbs ai/1000 cubic feet</p> <p><u>Use restrictions:</u> “Do not apply more than 1 time per day.”</p> <p>Post-harvest Application to Vegetables (Potato, Tomato, Pea, Sweet Potato), Fruits (Apple, Blackberry, Blueberry, Boysenberry, Cherry, Crabapple, Currant, Dewberry, Fig, Gooseberry, Grape, Guava, Loganberry, Mango, Muskmelon, Orange, Peach, Pear, Pineapple, Plum, Raspberry) Nuts (Almonds, Walnuts) and Other Commodities (Copra and Peanut)</p> <p><u>Maximum application rates:</u> Surface applications – 0.010 lb ai/ 1000 square feet Surface application to fruits or tomatoes in baskets or hampers – 1.6 x 10⁻⁷ lbs ai/ lb of fruit (or 0.16 ppm) Space spray to fruits, vegetables, copra – 0.0001 lbs ai/1000 cubic feet Dip or spray – 0.0004 lbs ai/ gallon</p> <p><u>Use restrictions:</u> “Do not reapply within 7 days.” “Do not apply more than 10 times to sweet potatoes.”</p> <p>Post-harvest Applications to Stored Grain and Seed (Barley, Beans, Lima Beans, Birdseed, Buckwheat, Cocoa beans, Corn, Cottonseed, Flax, Grain sorghum, Oats, Field Peas, Rice, Rye, Wheat)</p> <p><u>Maximum application rates:</u> Surface applications – 0.050 lbs ai/1000 square feet</p>	

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>Direct application to bulk grain and seed – 0.10 lb ai/1000 bushels grain</p> <p><u>Maximum application rates:</u> Barley – 0.0033 oz ai per cwt Beans – 0.0027 oz ai per cwt Lima beans – 0.0029 oz ai per cwt Birdseed – 0.0032 oz ai per cwt Buckwheat – 0.0033 oz ai per cwt Cocoa beans – 0.0037 oz ai per cwt Corn – 0.0029 oz ai per cwt Cottonseed – 0.0057 oz ai per cwt Flax – 0.0029 oz ai per cwt Grain sorghum – 0.0029 oz ai per cwt Oats – 0.0050 oz ai per cwt Field peas – 0.0027 oz ai per cwt Rice – 0.0036 oz ai per cwt Rye – 0.0029 oz ai per cwt Wheat (club, common, durham) – 0.0027 oz ai per cwt Wheat (emmer, spelt) – 0.0040 oz ai per cwt)</p> <p><u>Use restrictions:</u> “Do not reapply within 30 days.”</p> <p>Food Stored in Bags</p> <p><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u> Space sprays may be made to the surfaces of bags of stored food products at the rate of 0.0033 lbs ai/1000 cubic foot.</p> <p><u>Use restrictions:</u> “Direct application to food contact surfaces is prohibited.”</p> <p>Direct Application to Non-domestic Animals/Livestock</p>	

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p><u>Use restrictions:</u> “Do not apply more than 1 time per day.” “Do not apply microencapsulated product to lactating or food animals.”</p> <p>Indoor Agricultural Premises and Commercial Animal Housing and Equipment</p> <p><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p>Surface applications – 0.056 lbs ai/1000 square feet Crack/crevice or spot surface – 0.056 lbs ai/1000 square feet Space sprays when non-domestic animals are absent– 0.0033 lbs ai/1000 cubic feet Space sprays when non-domestic animals are present – 0.0008 lb ai/ 1000 cubic feet Metered release device space sprays – 0.005 lbs ai/1000 cubic feet/day</p> <p><u>Use Restrictions:</u> “Do not apply more than 1 time per day.”</p> <p>Indoor Food Handling/Processing Facilities</p> <p><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p>Surface applications – 0.056 lbs ai/1000 square feet Crack/crevice or spot surface –0.22 lbs ai/1000 square feet Space sprays– 0.00033 lbs ai/1000 cubic feet Metered release device space sprays – 0.000476 lbs ai/1000 cubic feet/day</p> <p><u>Use Restrictions:</u> “Do not apply more than 1 time per day.”</p> <p>In addition, these label statements should be deleted from all products registered for food handling and processing facilities: “Except in Federally inspected meat and poultry plants, food processing operations may continue when the product is applied as a general surface spray with care and in accordance</p>	

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>with the directions and precautions on the label, at a maximum rate of 0.11 pounds of pyrethrins per 1000 square feet.”</p> <p>“Except in Federally inspected meat and poultry plants, food processing operations may continue when the product is applied as a crack and crevice treatment with care and in accordance with the directions and precautions on the label, at a maximum rate of 0.56 pounds of pyrethrins per 1000 square feet.”</p> <p>Residential Dwellings and Commercial, Institutional Indoor Sites</p> <p><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p>Surface applications – 0.056 lbs ai/1000 square feet Crack/crevice or spot surface – 0.22 lbs ai/1000 square feet Space sprays– 0.00033 lbs ai/1000 cubic feet Metered release device space sprays – 0.000476 lbs ai/1000 cubic feet/day</p> <p>Outdoor Agriculture Premises</p> <p><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p>Surface applications – 0.0075 lbs ai/1000 square feet Crack/crevice or spot surface (including applications for fire ant applications or turf diagnostic aid) – 0.22 lbs ai/1000 square feet</p> <p><u>User Restrictions:</u></p> <p>“Do not apply more than 1 time per day.”</p> <p>General Outdoor Sites (including Non-Agricultural rights-of-way, Commercial/Institutional/Industrial Premises and Outdoor Eating Establishments)</p> <p><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p>Surface applications – 0.0075 lbs ai/1000 square feet Crack/crevice or spot surface – 0.22 lbs ai/1000 square feet</p>	

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p><u>User Restrictions:</u> “Do not apply more than 1 time per day.”</p> <p>Outdoor Ornamental and Lawns</p> <p><u>Maximum application rates:</u> Surface applications – 0.0075 lbs ai/1000 square feet Crack/crevice or spot surface (including applications for fire ant applications or turf diagnostic aid) – 0.002 lbs ai/1000 square feet</p> <p><u>User Restrictions:</u> “Do not apply more than 1 time per day.”</p> <p>Pet Care</p> <p><u>Use restrictions:</u> “Do not apply to pets less than 12 weeks old.” “Consult a veterinarian before applying this product on medicated, debilitated, aged, pregnant, or nursing animals.” “Sensitivities may occur after using any pesticide product for pets. If signs of sensitivity occur bathe your pet with mild soap and rinse with large amounts of water. If signs continue, consult a veterinarian immediately.”</p> <p>Pet Premise Treatment</p> <p><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u> Surface – 0.056 lb per 1000 square feet Crack and crevice – 0.22 lbs per 1000 square feet Space spray – 0.0033 lbs per 1000 square feet</p>	
Application Restrictions for products used in Metered Release Devices	Note to Registrants: Delete nurseries, day care centers, schools, hospitals, and nursing homes as registered use sites on all product labels for this use pattern.	Directions for Use under General Precautions and

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>Add the following statements:</p> <p>“Not for use in Residential areas.”</p> <p>“Do not use in nurseries or rooms where infants, ill, or aged persons are confined.”</p> <p>“Do not place metering device directly over or within 8 feet of exposed food, dishes, utensils, food processing equipment, and food handling or preparation.”</p> <p>“Do not install within 3 feet of air vents.”</p> <p>“Carefully follow directions for the dispenser unit when installing the dispenser and replacing cans or conducting maintenance.”</p>	Restrictions and/or Application Instructions
<p>Use-Specific Application Restrictions for all liquid and wettable powder labels</p> <p>(Outdoor residential misting system requirement)</p> <p>(Note: The maximum allowable application rate and maximum allowable seasonal rate must be listed as pounds or gallons of formulated product per acre, not just as pounds active ingredient per acre.)</p>	<p>Outdoor Residential Misting Systems</p> <p>Products not intended for use in outdoor residential misting systems must contain the following statement:</p> <p>“Not for use in outdoor residential misting systems.”</p> <p>Products intended for use in outdoor residential misting systems must contain the following statements:</p> <p>“Directions for use in outdoor residential misting systems:”</p> <p>“When using this product installers and service technicians must comply with the license, certification, or registration requirements of the state(s), tribe(s), or local authority(ies) where they are installed.”</p> <p>“If the system works on an automatic timer, set the timing for application when people, pets, and food are unlikely to be present.”</p> <p>“If the system works when a person operates a remote activation device, then application of this pesticide when people, pets, and food are present is prohibited.”</p> <p>“Do not use in an evaporative cooling system.”</p>	Directions for Use under General Precautions and Restrictions and/or Application Instructions

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>“Direct nozzles to spray towards the target area and away from swimming pools, water bodies, or eating and cooking areas.”</p> <p>“If used in a system with a reservoir tank for the end use dilution, the system reservoir tank must be locked. Securely attach the end use pesticide label and a dilution statement to the system reservoir tank in a weather protected area or plastic sleeve. The dilution statement must be phrased as follows: this container holds __ parts [<i>product name</i>] to __ parts water”</p> <p>“If used in a direct injection system, the pesticide container must be locked. Securely attach the end use label to the pesticide container in a weather protected area or plastic sleeve.” (These instructions not applicable to wettable powder products).</p> <p>“This product must only be used in systems that have been calibrated to apply no more than the maximum application rate of” [insert product application rate that is equal to 0.00011 lbs pyrethrins per 1000 cubic feet per day].</p> <p>Note to registrant: Also express this application rate as pounds or gallons of end-use product formulation.</p>	
<p>Use-Specific Application Restrictions for products labels for Mosquito Adulticide Application by ground or air.</p> <p>(Note: The maximum allowable application rate and maximum allowable seasonal rate must be listed as pounds or gallons of formulated product per acre, not just as pounds active ingredient per acre.)</p>	<p>“For use by federal, state, tribal, or local government officials responsible for public health or vector control, or by persons certified in the appropriate category or otherwise authorized by the state or tribal lead pesticide regulatory agency to perform adult mosquito control applications, or by persons under their direct supervision.”</p> <p>The maximum application rate for wide area mosquito adulticide applications is 0.0025 lbs ai/acre. When targeting <i>Aedes Taeniorhynchus</i> and other difficult species applications may be made up to 0.008 lbs ai/acre/day.</p> <p>“Do not apply more than 0.2 lbs ai/acre/year in any treated area. More frequent treatments may be made to prevent or control a threat to public and/or animal health determined by a state, tribal, or local health or vector control agency on the basis of documented evidence of disease causing agents in vector mosquitoes or the occurrence of mosquito-borne disease in animal or human populations, or if specifically approved by the state or tribe during a natural disaster recovery effort.”</p>	<p>Directions for Use under General Precautions and Restrictions and/or Application Instructions</p>
<p>Spray Drift Label Language</p>	<p>“SPRAY DRIFT MANAGEMENT for AGRICULTURE CROPS”</p>	<p>Directions for Use</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
for all products labeled for outdoor applications to agricultural use sites	<p>“Avoiding spray drift at the application site is the responsibility of the applicator and the grower. The interactions of many equipment and weather-related factors determine the potential for spray drift. The applicator and the grower are responsible for considering all these factors when making decisions.”</p> <p>“Do not apply at wind speeds greater than 10 mph at the application site.”</p> <p>“Do not make any type of application into temperature inversions.”</p> <p>“Apply as a medium or coarser spray (ASABE standard 572).”</p> <p><u>“Additional requirements for aerial applications:”</u></p> <p>“Do not release spray at a height greater than 10 feet above the ground or crop canopy.”</p> <p>“The boom length must not exceed 75% of the wingspan or 90% of the rotor blade diameter.”</p> <p>“Aerial applicators must consider flight speed and nozzle orientation in determining droplet size.”</p> <p>“When applications are made with a cross-wind, the swath will be displaced downwind. The applicator must compensate for this displacement at the downwind edge of the application area by adjusting the path of the aircraft upwind.”</p> <p><u>“Additional requirements for ground applications:”</u></p> <p>“Do not release spray at a height greater than 4 feet above the ground or crop canopy.”</p> <p><u>“Additional requirements for airblast applications:”</u></p> <p>“Direct sprays into the canopy.”</p> <p>“Turn off outward pointing nozzles at row ends and when spraying outer rows.”</p>	under General Precautions and Restrictions
Spray Drift Label Language for ALL Products Intended for ULV Mosquito	<p>“SPRAY DRIFT MANAGEMENT for WIDE AREA MOSQUITO ABATEMENT”</p> <p>“A variety of factors including weather conditions (e.g., wind direction, wind speed, temperature,</p>	Directions for Use under General Precautions and

Description	Pyrethrins Required Labeling Language	Placement on Label
Abatement Programs	<p>relative humidity) and method of application (e.g., ground, aerial, airblast, chemigation) can influence pesticide drift. The applicator must evaluate all factors and make appropriate adjustments when applying this product.”</p> <p>WIND SPEED: “Apply only when wind speed is greater than or equal to 1 mph.”</p>	Restrictions
<p>Spray Drift Label Language For End-Use Products Applied with Ground-Based Mechanical Application Equipment for ULV Mosquito Abatement Programs</p>	<p>“Ground-based wide area mosquito abatement application:</p> <p>Spray equipment must be adjusted so that the volume median diameter is less than 30 microns ($D_v 0.5 < 30 \mu m$) and that 90% of the spray is contained in droplets smaller than 50 microns ($D_v 0.9 < 50 \mu m$). Directions from the equipment manufacturer or vendor, pesticide registrant or a test facility using a laxer-based measurement instrument must be used to adjust equipment to produce acceptable droplet size spectra. Application equipment must be tested at least annually to confirm that pressure at the nozzle and nozzle flow rate(s) are properly calibrated.”</p>	Directions for Use under General Precautions and Restrictions
<p>Spray Drift Label Language for Products Applied as an Aerial Spray for ULV Mosquito Abatement Programs</p>	<p>“Aerial wide area mosquito abatement application:</p> <p>Spray equipment must be adjusted so that the volume median diameter produced is less than 60 microns ($D_v 0.5 < 60 \mu m$) and that 90% of the spray is contained in droplets smaller than 80 microns ($D_v 0.9 < 80 \mu m$). The effects of flight speed, and for non-rotary nozzles, nozzle angle on the droplet size spectrum must be considered. Directions from the equipment manufacturer or vendor, pesticide registrant or a test facility using a wind tunnel and laser-based measurement instrument must be used to adjust equipment to produce acceptable droplet size spectra. Application equipment must be tested at least annually to confirm that pressure at the nozzle and nozzle flow rate(s) are properly calibrated.”</p> <p>RELEASE HEIGHT:</p> <p>“Fixed wing:” “Apply using a nozzle height of no less than 100 feet above the ground or canopy.”</p> <p>“Rotary wing:” “Apply using a nozzle height of no less than 75 feet above the ground or canopy.”</p>	Directions for Use under General Precautions and Restrictions

Description	Pyrethrins Required Labeling Language	Placement on Label
	<i>Products Primarily Used by Consumers/Homeowners</i>	
Entry Restrictions for products except those products that contain any directions for uses when people are permitted to be present in the treated area (e.g. . applications to pets)	<p>Entry Restriction for products applied as a spray except for sprays applied directly to domestic animals:</p> <p>“Do not allow adults, children, or pets to enter the treated area until sprays have dried.”</p> <p>Entry Restriction for products applied dry:</p> <p>“Do not allow adults, children, or pets to enter the treated area until dusts have settled.”</p> <p>Entry Restriction for products applied as a space spray or as a fog:</p> <p>“Do not allow adults, children, or pets to enter until vapors, mists, and aerosols have dispersed, and the treated area has been thoroughly ventilated.”</p>	Directions for use under General Precautions and Restrictions
Entry Restrictions for products products that only contain directions for uses when people are permitted to be present (e.g. pet applications)	Note to Registrants: No entry restrictions are required. See below under Use Restrictions for further requirements.	Directions for use under General Precautions and Restrictions
Entry Restrictions for products that contain directions for uses when people are permitted to be present in the treated area (e.g. applications to pets) AND for use on other sites as a surface spray.	<p>Products labeled for use as a surface spray (does not apply to products applied directly to domestic animals):</p> <p>“Except when applying directly to pets, do not allow adults, children, or pets to enter until sprays have dried.”</p>	Directions for use under General Precautions and Restrictions
General Application Restrictions for all products except those that contain	“Do not apply this product in a way that will contact adults, children, or pets, either directly or through drift.”	Place in the Direction for Use

Description	Pyrethrins Required Labeling Language	Placement on Label
any directions for uses when people are permitted to be present in the treated area (e.g., applications to pets)	“Remove pets, birds, and cover fish aquariums before spraying.”	
General Application Restrictions for products that only contain directions for uses when people are permitted to be present (e.g. pet applications)	Note to Registrants: No entry restrictions are required. See below under Use Restrictions for further requirements.	Place in the Direction for Use
General Application Restrictions for products that contain directions for uses when people are permitted to be present in the treated area (e.g. applications to pets) AND for use on other sites as a surface spray.	<p>“Except when applying directly to pets, do not apply this product in a way that will contact adults, children, or pets, either directly or through drift.”</p> <p>“Remove pets, birds, and cover fish aquariums before spraying.”</p>	Place in the Direction for Use
<p>Environmental Hazards for Residential Products</p> <p>(Note: Products used on domestic animals like flea collars and ear tags, generally do not require an Environmental Hazards statement. In addition, products containing the statement: “For indoor use only,” may also omit the environmental hazards statement.)</p>	<p>“ENVIRONMENTAL HAZARDS”</p> <p>“This product is toxic to aquatic organisms, including fish and invertebrates. Do not contaminate water when disposing of equipment, washwater, or rinsate. See Directions for Use for additional precautions and requirements.”</p> <p>Note to Registrants: For products with outdoor uses include the following statement.</p> <p>“Do not apply directly to or near water. Drift and run-off may be hazardous to fish in water adjacent to treated areas.”</p>	Precautionary Statements under Environmental Hazards

Description	Pyrethrins Required Labeling Language	Placement on Label
Homeowner User Safety Recommendations Statements	<p>“User Safety Recommendations</p> <p>Users should wash hands with plenty of soap and water before eating, drinking, chewing gum, using tobacco, or using the toilet.</p> <p>Users should remove clothing immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.”</p>	<p>Precautionary Statements under: Hazards to Humans and Domestic Animals immediately following Engineering Controls</p> <p>(Must be placed in a box.)</p>
<p>Other Application Restrictions</p> <p>This was copied from above. Delete what is inappropriate.</p>	<p>Note to Registrants: Delete any reference to tolerance exemptions on labels.</p> <p>In addition add the following restrictions depending on the registered product uses and formulation:</p> <p>Wettable powder formulations: “Do not apply this product as a dust.”</p> <p>Dust formulations: “Aerial applications are prohibited.”</p> <p>Products labeled for use as a space spray: “Do not remain in treated area. Exit area immediately and remain outside the treated area until aerosols, vapors, and/or mists have dispersed.”</p> <p>Products labeled for spray applications to plants: “Do not wet plants to point of runoff or drip.”</p> <p>Products labeled for spray applications to articles: “Do not wet articles to point of runoff or drip.” “Do not use treated article until spray has dried.”</p> <p>Products labeled for applications to clothing articles:</p>	<p>Directions for Use under General Precautions and Restrictions and/or Application Instructions</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>“Dry clean treated clothes before wearing.”</p> <p>Products labeled for dip applications: “Do not use treated article before it is dry.”</p> <p>Products labeled for crack and crevice, surface or space spray, fogging or dust applications indoors: “Remove or cover exposed food and drinking water before application.” “Remove or cover dishes, utensils, food processing equipment, and food preparation surfaces, or wash them before use.”</p>	
<p>Use-Specific Application Restrictions</p> <p>For products with directions for residential uses</p>	<p>Requirement for Liquid Formulations (except for Ready to Use) with outdoor uses: “Do not apply directly to or near water, storm drains, or drainage ditches. Do not apply when windy. To prevent product run-off, do not over water the treated area(s) or apply when heavy rain is expected. Rinse applicator over lawn or garden area only.”</p> <p>Requirement for Ready to Use Liquid or Dust Formulations with outdoor uses: “Do not apply directly to or near water, storm drains, or drainage ditches. Do not apply when windy. To prevent product run-off, do not over water the treated area(s) or apply prior to heavy rainfall.”</p>	<p>Directions for Use under General Precautions and Restrictions and/or Application Instructions</p>
<p>Residential Use Restriction</p> <p>(Note: The maximum allowable application rate and maximum allowable seasonal rate must be listed as pounds or gallons of formulated product per acre or per square feet or per</p>	<p>Home Garden or Home Greenhouse Applications</p> <p><u>Maximum application rates:</u> Garden and orchard– 0.05 lbs ai/acre or 0.012 lb ai /1000 square feet Hydroponically grown crops – 0.10 ppm ai in water Greenhouse space sprays - 0.00014 lbs ai/1000 cubic feet Greenhouse surface spray – 0.0012 lbs per 1000 square feet or 0.05 lbs ai per acre</p> <p><u>Use restrictions:</u> “Do not apply more than 10 times per season.”</p>	<p>Directions for Use under General Precautions and Restrictions and/or Application Instructions</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
cubic feet, not just as pounds active ingredient per unit area.)	<p data-bbox="596 305 1314 363">“Do not reapply within 3 days except under extreme pest pressure.” “In case of extreme pest pressure do not reapply within 24 hours.”</p> <p data-bbox="539 396 894 422">Residential Dwellings - Indoors</p> <p data-bbox="596 456 1593 514"><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p data-bbox="596 518 1146 544">Surface applications – 0.056 lbs ai/1000 square feet</p> <p data-bbox="596 547 1241 573">Crack/crevice or spot surface – 0.056 lbs ai/1000 square feet</p> <p data-bbox="596 576 1073 602">Space sprays– 0.0025 lbs ai/1000 cubic feet ^a</p> <p data-bbox="539 639 793 665">General Outdoor Sites</p> <p data-bbox="596 699 1593 758"><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p data-bbox="596 761 1159 787">Surface applications – 0.0075 lbs ai/1000 square feet</p> <p data-bbox="596 790 1241 816">Crack/crevice or spot surface – 0.056 lbs ai/1000 square feet</p> <p data-bbox="596 854 789 880"><u>User Restrictions:</u></p> <p data-bbox="596 883 1037 909">“Do not apply more than 1 time per day.”</p> <p data-bbox="539 946 913 972">Outdoor Ornamental and Lawns</p> <p data-bbox="596 1006 1593 1065"><u>Products must be formulated to deliver no more than this maximum rate when used according to directions:</u></p> <p data-bbox="596 1068 1373 1094">Surface applications – 0.0020 lbs ai/1000 square feet (or 0.10 lbs ai/acre)</p> <p data-bbox="596 1097 1587 1156">Spot treatment (including applications for fire ant applications or turf aid) – 0.056 lbs ai/1000 square feet</p> <p data-bbox="596 1193 789 1219"><u>User Restrictions:</u></p> <p data-bbox="596 1222 1037 1248">“Do not apply more than 1 time per day.”</p> <p data-bbox="539 1286 638 1312">Pet Care</p> <p data-bbox="596 1349 768 1375"><u>Use restrictions:</u></p>	

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>“Do not apply to pets less than 12 weeks old.”</p> <p>“Consult a veterinarian before using this product on medicated, debilitated, aged, pregnant, or nursing animals.”</p> <p>“Sensitivities may occur after using any pesticide product for pets. If signs of sensitivity occur bathe your pet with mild soap and rinse with large amounts of water. If signs continue, consult a veterinarian immediately.”</p> <p>Dusts</p> <p><u>Use Restrictions:</u></p> <p>“Only apply as a spot treatment to areas no greater than 3 feet by 3 feet per room.”</p>	
<p>Use-Specific Application Restrictions for all liquid and wettable powder labels</p> <p>(Outdoor residential misting system requirement)</p> <p>(Note: The maximum allowable application rate and maximum allowable seasonal rate must be listed as pounds or gallons of formulated product per acre, not just as pounds active ingredient per acre.)</p>	<p>Outdoor Residential Misting Systems</p> <p>Products not intended for use in outdoor residential misting systems must contain the following statement:</p> <p>“Not for use in outdoor residential misting systems.”</p> <p>Products intended for use in outdoor residential misting systems must contain the following statements:</p> <p>“Directions for use in outdoor residential misting systems:”</p> <p>“When using this product installers and service technicians must comply with the license, certification, or registration requirements of the state(s), tribe(s), or local authority(ies) where they are installed.”</p> <p>“If the system works on an automatic timer, set the timing for application when people, pets, and food are unlikely to be present.”</p> <p>“If the system works when a person operates a remote activation device, then application of this pesticide when people, pets, and food are present is prohibited.”</p>	<p>Directions for Use under General Precautions and Restrictions and/or Application Instructions</p>

Description	Pyrethrins Required Labeling Language	Placement on Label
	<p>“Do not use in an evaporative cooling system.”</p> <p>“Direct nozzles to spray towards the target area and away from swimming pools, water bodies, or eating and cooking areas.”</p> <p>“If used in a system with a reservoir tank for the end use dilution, the system reservoir tank must be locked. Securely attach the end use pesticide label and a dilution statement to the system reservoir tank in a weather protected area or plastic sleeve. The dilution statement must be phrased as follows: this container holds __ parts [<i>product name</i>] to __ parts water”</p> <p>“If used in a direct injection system, the pesticide container must be locked. Securely attach the end use label to the pesticide container in a weather protected area or plastic sleeve.” (These instructions not applicable to wettable powder products).</p> <p>“This product must only be used in systems that have been calibrated to apply no more than the maximum application rate of” [insert product application rate that is equal to 0.00011 lbs pyrethrins per 1000 cubic feet per day].</p> <p>Note to registrant: Also express this application rate as pounds or gallons of end-use product formulation.</p>	

¹ PPE that is established on the basis of Acute Toxicity of the end-use product must be compared to the active ingredient PPE in this document. In the case of multiple active ingredients, the more protective PPE must be placed on the product labeling. For guidance on which PPE is considered more protective, see PR Notice 93-7.

Appendix: Technical Support Documents

Additional documentation in support of this RED is maintained in the OPP docket, located in room S-4400, One Potomac Yard (South Building), 2777 S. Crystal Drive, Arlington, VA 22202. It is open Monday through Friday, excluding legal holidays, from 8:30 am to 4 pm.

All documents, in hard copy form, may be viewed in the OPP docket room or downloaded or viewed via the Internet at the following site: <http://www.regulations.gov>

These documents include:

HED Documents:

Pyrethrins: Revised Human Health Risk Assessment for the Reregistration Eligibility Decision. Olinger, C.; D326648; March 16, 2006.

Pyrethrins: Responses to Public Comments on HED Risk Assessment and Supporting Documents; Olinger, C., et al.; D 324662; January 31, 2006.

Review of Pyrethrins Incident Reports - Second Revision. Blondell, J.; D320300; August 16, 2005.

Three Pyrethrin Health Effects Reviews: Mosby and Registrant Submissions. Allen, Ruth; D326085; July 2006.

Pyrethrins. Revised Residue Chemistry Considerations for Reregistration Eligibility Decision. Deluzio, J. and Olinger, C.; D 318633; September 8, 2005.

Pyrethrins RED - Reregistration Eligibility Decision. Product Chemistry Considerations. Deluzio, Joseph; D309022; March 21, 2005.

Pyrethrins: Report of the Cancer Assessment Review Committee (Third Evaluation). Kidwell, Jessica; TXR No.0052631, June 22, 2004.

Pyrethrins. Acute and Chronic Dietary Exposure Assessment for the Reassessment Eligibility Decision (RED) Document. Deluzio, Joseph; D295748; December 20, 2004.

PYRETHRINS Reregistration Branch 1/Health Effects Division Response to Comments on Draft Risk Assessment. Taylor, Linda; D320383; TXR# 0053661, August 17, 2005.

Pyrethrins: 2nd Revised Occupational and Residential Exposure Assessment and Recommendations for the Reregistration Eligibility Decision (RED). Dole, T. and Lloyd, M.; D318630; September 7, 2005.

Occupational and Residential Exposure Assessment for the Use of Pyrethrin in Residential Mosquito Mister Systems. Dole, Timothy; D315335; September 7, 2005.

Piperonyl Butoxide (PBO), Pyrethrins and MGK-264: Health Effects Division's response to the Registrant's concerns for using metaplasia seen in the larynx in subchronic inhalation studies as an endpoint for inhalation risk assessment. Ramasamy, S., et al.; D319913, D319914, and D320298; September 8, 2005.

Pyrethrins: Occupational Exposure Assessment for Indoor Fogging Applications. Dole, T.; D330441; July 5, 2006.

Revised Occupational and Residential Exposure Assessment for the Use of Pyrethrins in Residential Mosquito Mister Systems. Dole, T.; D330442; July 5, 2006.

EFED Documents:

Revised Pyrethrins RED Chapter After Additional 60-Day Comment Period, Phase 5. Rexrode, M. and Meléndez, J.; D324663; January 25, 2006.

Response to Comments of Phase 5 Period About Water Quality, and Other Issues on the Revised Draft EFED RED Chapters for Pyrethrins, PBO and MGK-264. Davy, M., et al.; D324663, D324664, D324667, D324662, D324671, and D324673; January 30, 2006.

Tier 1 Estimated Drinking Water Concentrations of Pyrethrin and Derivatives for use in Human Health Risk Assessment. Dutta, Subijoy; D295750; August 19, 2004.