United States
Environmental Protection
Agency

Prevention, Pesticides
and Toxic Substances
(7508C)

EPA 738-R-01-007
February 2002

Interim Reregistration Eligibility Decision for Chlorpyrifos

US Environmental Protection Agency
Office of Pesticide Programs

Reregistration Eligibility Decision for Chlorpyrifos

When EPA concluded the organophosphate (OP) cumulative risk assessment in July 2006, all tolerance reassessment and reregistration eligibility decisions for individual OP pesticides were considered complete. OP Interim Reregistration Eligibility Decisions (IREDs), therefore, are considered completed REDs. OP tolerance reassessment decisions (TREDs) also are considered completed.

Combined PDF document consists of the following:

- Finalization of Interim Reregistration Eligibility Decisions (IREDs) and Interim Tolerance Reassessment and Risk Management Decisions (TREDs) for the Organophosphate Pesticides, and Completion of the Tolerance Reassessment and Reregistration Eligibility Process for the Organophosphate Pesticides (July 31, 2006)
- Chlorpyrifos IRED

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

OFFICE OF
PREVENTION, PESTICIDES AND TOXIC
SUBSTANCES

MEMORANDUM

DATE: July 31, 2006

SUBJECT: Finalization of Interim Reregistration Eligibility Decisions (IREDs) and Interim Tolerance Reassessment and Risk Management Decisions (TREDs) for the Organophosphate Pesticides, and Completion of the Tolerance Reassessment and Reregistration Eligibility Process for the Organophosphate Pesticides

FROM: Debra Edwards, Director
Special Review and Reregistration Division
Office of Pesticide Programs

TO: Jim Jones, Director
Office of Pesticide Programs

As you know, EPA has completed its assessment of the cumulative risks from the organophosphate (OP) class of pesticides as required by the Food Quality Protection Act of 1996. In addition, the individual OPs have also been subject to review through the individual-chemical review process. The Agency's review of individual OPs has resulted in the issuance of Interim Reregistration Eligibility Decisions (IREDs) for 22 OPs, interim Tolerance Reassessment and Risk Management Decisions (TREDs) for 8 OPs, and a Reregistration Eligibility Decision (RED) for one OP, malathion.[1] These 31 OPs are listed in Appendix A.

EPA has concluded, after completing its assessment of the cumulative risks associated with exposures to all of the OPs, that:

(1) the pesticides covered by the IREDs that were pending the results of the OP cumulative assessment (listed in Attachment A) are indeed eligible for reregistration; and

[1] Malathion is included in the OP cumulative assessment. However, the Agency has issued a RED for malathion, rather than an IRED, because the decision was signed on the same day as the completion of the OP cumulative assessment.

(2) the pesticide tolerances covered by the IREDs and TREDs that were pending the results of the OP cumulative assessment (listed in Attachment A) meet the safety standard under Section 408(b)(2) of the FFDCA.

Thus, with regard to the OPs, EPA has fulfilled its obligations as to FFDCA tolerance reassessment and FIFRA reregistration, other than product-specific reregistration.

The Special Review and Reregistration Division will be issuing data call-in notices for confirmatory data on two OPs, methidathion and phorate, for the reasons described in detail in the OP cumulative assessment. The specific studies that will be required are:

- 28-day repeated-dose toxicity study with methidathion oxon; and
- Drinking water monitoring study for phorate, phorate sulfoxide, and phorate sulfone in both source water (at the intake) and treated water for five community water systems in Palm Beach County, Florida and two near Lake Okechobee, Florida.

The cumulative risk assessment and supporting documents are available on the Agency's website at www.epa.gov/pesticides/cumulative and in the docket (EPA-HQ-OPP-2006-0618).

Attachment A:

Organophosphates included in the OP Cumulative Assessment

Chemical	Decision Document	Status
Acephate	IRED	IRED completed 9/2001
Azinphos-methyl (AZM)	IRED	IRED completed 10/2001
Bensulide	IRED	IRED completed 9/2000
Cadusafos	TRED	TRED completed 9/2000
Chlorethoxyphos	TRED	TRED completed 9/2000
Chlorpyrifos	IRED	IRED completed 9/2001
Coumaphos	TRED	TRED completed 2/2000
DDVP (Dichlorvos)	IRED	IRED completed 6/2006
Diazinon	IRED	IRED completed 7/2002
Dicrotophos	IRED	IRED completed 4/2002
Dimethoate	IRED	IRED completed 6/2006
Disulfoton	IRED	IRED completed 3/2002
Ethoprop	IRED	IRED completed 9/2001 IRED addendum completed 2/2006
Fenitrothion	TRED	TRED completed 10/2000
Malathion	RED	RED completed 8/2006
Methamidophos	IRED	IRED completed 4/2002
Methidathion	IRED	IRED completed 4/2002
Methyl Parathion	IRED	IRED completed 5/2003
Naled	IRED	IRED completed 1/2002
Oxydemeton-methyl	IRED	IRED completed 8/2002
Phorate	IRED	IRED completed 3/2001
Phosalone	TRED	TRED completed 1/2001
Phosmet	IRED	IRED completed 10/2001
Phostebupirim	TRED	TRED completed 12/2000
Pirimiphos-methyl	IRED	IRED completed 6/2001
Profenofos	IRED	IRED completed 9/2000
Propetamphos	IRED	IRED completed 12/2000
Terbufos	IRED	IRED completed 9/2001
Tetrachlorvinphos	TRED	TRED completed 12/2002
Tribufos	IRED	IRED completed 12/2000
Trichlorfon	TRED	TRED completed 9/2001

United States Environmental Protection Agency | Prevention, Pesticides and Toxic Substances (7508C) | EPA 738-F-01-006 February 2002

Chlorpyrifos Facts

EPA has assessed the risks of chlorpyrifos and reached an Interim Reregistration Eligibility Decision (IRED) for this organophosphate (OP) pesticide. Provided that risk mitigation measures are adopted, chlorpyrifos fits into its own "risk cup"-- its individual, aggregate risks are within acceptable levels. Chlorpyrifos also is eligible for reregistration, pending a full reassessment of the cumulative risk from all OPs.

Used on a variety of food and feed crops, golf courses, as a non-structural wood treatment, and as an adult mosquitocide, chlorpyrifos residues in food and drinking water do not pose risk concerns. With mitigation eliminating virtually all homeowner uses, chlorpyrifos fits into its own "risk cup." With other mitigation measures, chlorpyrifos worker and ecological risks also will be below levels of concern for reregistration.

EPA's next step under the Food Quality Protection Act (FQPA) is to complete a cumulative risk assessment and risk management decision encompassing all the OP pesticides, which share a common mechanism of toxicity. The interim decision on chlorpyrifos cannot be considered final until this cumulative assessment is complete. Further risk mitigation may be warranted at that time.

EPA is reviewing the OP pesticides to determine whether they meet current health and safety standards. Older OPs need decisions about their eligibility for reregistration under FIFRA. OPs with residues in food, drinking water, and other non-occupational exposures also must be reassessed to make sure they meet the new FQPA safety standard.

The OP Pilot Public Participation Process

The organophosphates are a group of related pesticides that affect the functioning of the nervous system. They are among EPA's highest priority for review under the Food Quality Protection Act.

EPA is encouraging the public to participate in the review of the OP pesticides. Through a six-phased pilot public participation process, the Agency is releasing for review and comment its preliminary and revised scientific risk assessments for individual OPs. (Please contact the OP Docket, telephone 703-305-5805, or see EPA's web site, www.epa.gov/pesticides/op .)

EPA is exchanging information with stakeholders and the public about the OPs, their uses, and risks through Technical Briefings, stakeholder meetings, and other fora. USDA is coordinating input from growers and other OP pesticide users.

Based on current information from interested stakeholders and the public, EPA is making interim risk management decisions for individual OP pesticides, and will make final decisions through a cumulative OP assessment.

The chlorpyrifos interim decision was made through the OP pilot public participation process, which increases transparency and maximizes stakeholder involvement in EPA's development of risk assessments and risk management decisions. EPA worked extensively with affected parties to reach

the decisions presented in this interim decision document, which concludes the OP pilot process for chlorpyrifos.

Uses

- Chlorpyrifos is an organophosphate insecticide, acaricide and miticide used to control foliage and soil-borne insect pests on a variety of food and feed crops.

- Approximately 10 million pounds are applied annually in agricultural settings. The largest agricultural market for chlorpyrifos in terms of total pounds ai is corn (~5.5 million).

Health Effects

- Chlorpyrifos can cause cholinesterase inhibition in humans; that is, it can overstimulate the nervous system causing nausea, dizziness, confusion, and at very high exposures (e.g., accidents or major spills), respiratory paralysis and death.

Risks

- Dietary exposures from eating food crops treated with chlorpyrifos are below the level of concern for the entire U.S. population, including infants and children. Drinking water risk estimates based on screening models and monitoring data from both ground and surface water for acute and chronic exposures are generally not of concern.

- In June, 2000, the Agency entered into an agreement with the technical registrants to eliminate virtually all homeowner uses, except ant and roach baits in child resistent packaging.

- Residential postapplication exposures may occur after termiticide use in residential structures. To mitigate risks from this use, the technical registrants agreed in June 2000 to limit termiticide treatments to 0.5% solution, and cancel all postconstruction uses. Pre-construction use will remain until 2005, unless acceptable exposure data are submitted that show that residential postapplication risks from this use are not a concern.

- Occupational exposure to chlorpyrifos is of concern to the Agency. Exposures of concern include mixing/loading liquids for aerial/chemigation and groundboom application, mixing wettable powder for groundboom application, aerial application, and application by backpack sprayer, high-pressure handwand, and hand-held sprayer or duster. Generally, these risks can be mitigated by a combination of additional personal protective equipment and engineering controls, and by reductions in application rates. Additionally, the Agricultural Handler Task Force will be developing exposure data to better characterize the risk from certain uses (e.g., applying granulars by air).

- Risk quotients indicate that a single application of chlorpyrifos poses risks to small mammals, birds, fish and aquatic invertebrate species for nearly all registered outdoor uses. Multiple applications increase the risks to wildlife and prolong exposures to toxic concentrations. To address these risks, a number of measures including reduced application rates, increased retreatment intervals, reduced seasonal maximum amounts applied per acre, and no-spray setback zones around water bodies will be needed.

Risk Mitigation

In order to support a reregistration eligibility decision for chlorpyrifos, the following risk mitigation measures are necessary:

- To mitigate risks to agricultural workers PPE consisting of double layers, chemical resistant gloves, chemical resistant shoes plus socks, chemical resistant headgear for overhead exposure, chemical resistant apron when cleaning and mixing or loading and a dust/mist respirator are required for the following scenarios: mixing/loading liquids for groundboom and airblast application, loading granulars for ground application, tractor drawn granular spreader, and low pressure handwand.

- engineering controls are required for the following scenarions: mixing wettable powder for groundboom application (water soluble packaging), mixing wettable powder for airblast application (water soluble packaging), and aerial application of sprays (enclosed cockpit).

- There are still some occupational risk scenarios that are still below the target MOE of 100, even with all feasible PPE or engineering controls. The risk assessments for these uses will be refined with additional data.

- To mitigate ecological risks the technical registrants have agreed to label amendments which include the use of buffer zones to protect water quality, fish and wildlife, reductions in application rates, number of applications per season, seasonal maximum amounts applied, and increases in the minimum intervals for retreatment.

- The mitigation measures prescribed in the IRED along with mitigation that is already being implemented as a result of the June, 2000, Memorandum of Agreement, will reduce risk to both terrestrial and aquatic species. For example, many of the reported incidents of wildlife mortality associated with chlorpyrifos use were related to residential lawn and termite uses and use on golf courses. The residential uses have been eliminated, the termiticide use is being phased out, and the application rate on golf courses has been reduced from 4 to 1 lb/ai/A. Additionally, no-spray buffers around surface water bodies, as well as rate reductions for agricultural uses will be implemented as a result of this IRED and will further reduce the environmental burden of chlorpyrifos.

Next Steps

- Numerous opportunities for public comment were offered as this decision was being developed. In addition, the chlorpyrifos IRED has been issued with a public comment period (see www.epa.gov/REDs/ or www.epa.gov/pesticides/op).

- When the cumulative risk assessment for all organophosphate pesticides is completed, EPA will issue its final tolerance reassessment decision for chlorpyrifos and may request further risk mitigation measures. The Agency will revoke the tomato tolerance and amend the grape and apple tolerances for chlorpyrifos. For all OPs, raising and/or establishing tolerances will be considered once a cumulative assessment is completed.

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

OFFICE OF
PREVENTION, PESTICIDES
AND TOXIC SUBSTANCES

CERTIFIED MAIL

Dear Registrant:

This is to inform you that the Environmental Protection Agency (hereafter referred to as EPA or the Agency) has completed its review of the available data and public comments received related to the preliminary and revised risk assessments for the organophosphate pesticide chlorpyrifos. The public comment period on the revised risk assessment phase of the reregistration process is closed. Based on comments received during the public comment period and additional data received from the technical registrants, the Agency revised the human health and environmental effects risk assessments and made them available to the public on August 16, 2000. Additionally, the Agency held a Technical Briefing on June 8, 2000, where the results of the revised human health and environmental effects risk assessments and interim mitigation measures were presented to the general public. This Technical Briefing concluded Phase 4 of the OP Public Participation Pilot Process developed by the Tolerance Reassessment Advisory Committee, and initiated Phase 5 of that process. During Phase 5, all interested parties were invited to participate and provide comments and suggestions on ways the Agency might mitigate the estimated risks presented in the revised risk assessments. This public participation and comment period commenced on August 16, 2000, and closed on October 16, 2000.

Based on its review, EPA has identified risk mitigation measures that the Agency believes are necessary to address the human health and environmental risks associated with the current use of chlorpyrifos. The EPA is now publishing its interim decision on the reregistration eligibility of and risk management decision for the current uses of chlorpyrifos and its associated human health and environmental risks. The reregistration eligibility and tolerance reassessment decisions for chlorpyrifos will be finalized once the cumulative risks for all of the organophosphate pesticides are considered. The enclosed "Interim Reregistration Eligibility Decision for Chlorpyrifos," which was approved on September 28, 2001, contains the Agency's decision on the individual chemical chlorpyrifos.

A Notice of Availability for this Interim Reregistration Eligibility Decision (IRED) for chlorpyrifos was being published in the *Federal Register*. To obtain a copy of the interim RED document, please contact the OPP Public Regulatory Docket (7502C), US EPA, Ariel Rios Building, 1200 Pennsylvania Avenue NW, Washington, DC 20460, telephone (703) 305-5805. Electronic copies of the interim RED and all supporting documents are available on the Internet. See http:www.epa.gov/pesticides/op.

This IRED for chlorpyrifos has been revised based on comments received during the public comment period following the announcement of the availability of the chlorpyrifos IRED in the *Federal Register* (66 FR 57073). This revised IRED incorporates many of the comments that were received, other comments will be addressed under separate cover.

The interim RED is based on the updated technical information found in the chlorpyrifos public docket. The docket not only includes background information and comments on the Agency's preliminary risk assessments, it also includes the Agency's revised risk assessments for chlorpyrifos (revised as of June 8, 2000), and a document summarizing the Agency's Response to Comments. The Response to Comments document addresses corrections to the preliminary risk assessments submitted by chemical registrants, as well as responds to comments submitted by the general public and stakeholders during the comment period on the risk assessment. The docket will also include comments on the revised risk assessment, and any risk mitigation proposals submitted during Phase 5. During Phase 5, EPA and the technical registrants of chlorpyrifos entered into an agreement to implement interim risk mitigation.

This document and the process used to develop it are the result of a pilot process to facilitate greater public involvement and participation in the reregistration and/or tolerance reassessment decisions for these pesticides. As part of the Agency's effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), the Agency is undertaking a special effort to maintain open public dockets on the organophosphate pesticides and to engage the public in the reregistration and tolerance reassessment processes for these chemicals. This open process follows the guidance developed by the Tolerance Reassessment Advisory Committee (TRAC), a large multi-stakeholder advisory body that advised the Agency on implementing the new provisions of the FQPA. The reregistration and tolerance reassessment reviews for the organophosphate pesticides are following this new process.

Please note that the chlorpyrifos risk assessments and the attached interim RED concern only this particular organophosphate. This interim RED presents the Agency's conclusions on the dietary risks posed by exposure to chlorpyrifos alone. The Agency has also concluded its assessment of the ecological and worker risks associated with the use of chlorpyrifos. Because the FQPA directs the Agency to consider available information on the basis of cumulative risk from substances sharing a common mechanism of toxicity, such as the toxicity expressed by the organophosphates through a common biochemical interaction with the cholinesterase enzyme, the Agency will evaluate the cumulative risk posed by the entire organophosphate class of chemicals after considering the risks for the individual organophosphates. The Agency is working towards completion of a methodology to assess cumulative risk and the individual risk assessments for each organophosphate are likely to be necessary elements of any cumulative assessment. The Agency has decided to move forward with individual assessments and to identify mitigation measures necessary to address those human health and environmental risks associated with the current uses of chlorpyrifos. The Agency will issue the final tolerance reassessment decision for chlorpyrifos and finalize decisions on reregistration eligibility once the cumulative risks for all of the organophophates are considered.

This document contains generic and product-specific Data Call-Ins (DCIs) that outline further data requirements for this chemical. Note that a complete DCI, with all pertinent

instructions, is being sent to registrants under separate cover. Additionally, for product-specific DCIs, the first set of required responses is due 90 days from the receipt of the DCI letter. The second set of required responses is due eight months from the date of the DCI.

In this interim RED, the Agency has determined that, with the exception of open-pour dust formulations for fire ant control, chlorpyrifos products will be eligible for reregistration provided that all the conditions identified in this document are satisfied, including implementation of the risk mitigation measures outlined in Section IV of the document. The Agency believes that current uses of chlorpyrifos may pose unreasonable adverse effects to human health and the environment, and that such effects can be mitigated with the risk mitigation measures identified in this interim RED. Accordingly, the Agency recommends that registrants implement these risk mitigation measures immediately. Sections IV and V of this interim RED describe labeling amendments for end-use products and data requirements necessary to implement these mitigation measures. Instructions for registrants on submitting the revised labeling can be found in the set of instructions for product-specific data that accompanies this interim RED.

Should a registrant choose not to implement any of the risk mitigation measures outlined in this document, the Agency will continue to have concerns about the risks posed by chlorpyrifos. Where the Agency has identified any unreasonable adverse effect to human health or the environment, the Agency intends to initiate appropriate regulatory action to address this concern. At that time, any affected person(s) may challenge the Agency's action.

If you have questions on this document, the label changes necessary for reregistration, or the generic DCI, please contact the Chemical Review Manager, Tom Myers, at (703) 308-8589. For questions about product reregistration and/or the Product DCI that accompanies this document, please contact Venus Eagle at (703) 308-8045.

Sincerely,

Lois A. Rossi, Director
Special Review and Reregistration Division

Attachment

Interim Reregistration Eligibility Decision
for
Chlorpyrifos

Case No. (0100)

TABLE OF CONTENTS

CHLORPYRIFOS TEAM

Office of Pesticide Programs:

Health Effects Division
Deborah Smegal
David Soderberg
Steven Knizner
Timothy Leighton
Jerome Blondell
Virginia Dobozy

Environmental Fate and Effects Division
William Rabert
James Lin

Biological and Economic Analysis Division
Timothy Kiely
David Brassard
Donald Atwood
Neil Anderson

Registration Division
Dennis McNeilly
Akiva Abramovitch

Special Review and Reregistration Division

Robbi Farrell
Mark Hartman
Tom Myers

GLOSSARY OF TERMS AND ABBREVIATIONS

AE	Acid Equivalent
a.i.	Active Ingredient
AGDCI	Agricultural Data Call-In
ai	Active Ingredient
aPAD	Acute Population Adjusted Dose
AR	Anticipated Residue
ARC	Anticipated Residue Contribution
BCF	Bioconcentration Factor
CAS	Chemical Abstracts Service
CI	Cation
CNS	Central Nervous System
cPAD	Chronic Population Adjusted Dose
CSF	Confidential Statement of Formula
CFR	Code of Federal Regulations
CSFII	USDA Continuing Surveys for Food Intake by Individuals
DCI	Data Call-In
DEEM	Dietary Exposure Evaluation Model
DFR	Dislodgeable Foliar Residue
DRES	Dietary Risk Evaluation System
DWEL	Drinking Water Equivalent Level (DWEL) The DWEL represents a medium specific (i.e., drinking water) lifetime exposure at which adverse, noncarcinogenic health effects are not anticipated to occur.
DWLOC	Drinking Water Level of Comparison.
EC	Emulsifiable Concentrate Formulation
EEC	Estimated Environmental Concentration. The estimated pesticide concentration in an environment, such as a terrestrial ecosystem.
EP	End-Use Product
EPA	U.S. Environmental Protection Agency
FAO	Food and Agriculture Organization
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
GLC	Gas Liquid Chromatography
GLN	Guideline Number
GM	Geometric Mean
GRAS	Generally Recognized as Safe as Designated by FDA

HA	Health Advisory (HA). The HA values are used as informal guidance to municipalities and other organizations when emergency spills or contamination situations occur.
HAFT	Highest Average Field Trial
HDT	Highest Dose Tested
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.
LEL	Lowest Effect Level
LOC	Level of Concern
LOD	Limit of Detection
LOAEL	Lowest Observed Adverse Effect Level
MATC	Maximum Acceptable Toxicant Concentration
MCLG	Maximum Contaminant Level Goal (MCLG) The MCLG is used by the Agency to regulate contaminants in drinking water under the Safe Drinking Water Act.
mg/kg/day	Milligram Per Kilogram Per Day
mg/L	Milligrams Per Liter
MOE	Margin of Exposure
MP	Manufacturing-Use Product
MPI	Maximum Permissible Intake
MRID	Master Record Identification (number). EPA's system of recording and tracking studies submitted.
NA or N/A	Not Applicable
NAWQA	USGS National Water Quality Assessment
NOEC	No Observable Effect Concentration
NOEL	No Observed Effect Level
NOAEL	No Observed Adverse Effect Level
NPDES	National Pollutant Discharge Elimination System
OP	Organophosphate
OPP	EPA Office of Pesticide Programs
OPPTS	EPA Office of Prevention, Pesticides and Toxic Substances
Pa	pascal, the pressure exerted by a force of one newton acting on an area of one square meter.
PAD	Population Adjusted Dose
PADI	Provisional Acceptable Daily Intake
PAG	Pesticide Assessment Guideline
PAM	Pesticide Analytical Method
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
PRN	Pesticide Registration Notice
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
RBC	Red Blood Cell
RED	Reregistration Eligibility Decision
REI	Restricted Entry Interval
RfD	Reference Dose
RQ	Risk Quotient
RS	Registration Standard
RUP	Restricted Use Pesticide
SAP	Science Advisory Panel
SCI-GROW	Tier I Ground Water Computer Model
SF	Safety Factor
SLC	Single Layer Clothing
SLN	Special Local Need (Registrations Under Section 24(c) of FIFRA)
TC	Toxic Concentration. The concentration at which a substance produces a toxic effect.
TD	Toxic Dose. The dose at which a substance produces a toxic effect.
TEP	Typical End-Use Product
TGAI	Technical Grade Active Ingredient
TLC	Thin Layer Chromatography
TMRC	Theoretical Maximum Residue Contribution
torr	A unit of pressure needed to support a column of mercury 1 mm high under standard conditions.
TRR	Total Radioactive Residue
UF	Uncertainty Factor
μg/g	Micrograms Per Gram
μg/L	Micrograms Per Liter
USDA	United States Department of Agriculture
USGS	United States Geological Survey
WHO	World Health Organization
WP	Wettable Powder
WPS	Worker Protection Standard

Executive Summary

EPA has completed its review of public comments on the revised risk assessments and is issuing its interim reregistration eligibility decision for chlorpyrifos. The decisions outlined in this document do not include the final tolerance reassessment decision for chlorpyrifos; however, some tolerance actions will be undertaken prior to completion of the final tolerance reassessment. EPA intends to revoke the tolerance for tomatoes, because that use is being canceled, and to reduce the tolerances for grapes and apples. The final tolerance reassessment and reregistration eligibility decision for this chemical will be issued once the cumulative risks for all of the organophosphates are considered. The Agency may need to pursue further risk management measures for chlorpyrifos once cumulative risks are considered.

The revised risk assessments are based on review of the required target data base supporting the use patterns of currently registered products and new information received. The Agency invited stakeholders to provide proposals, ideas or suggestions on appropriate mitigation measures before the Agency issued its risk mitigation decision on chlorpyrifos. After considering the revised risks taking into account the interim mitigation as well as additional mitigation proposed by Dow AgroSciences (DAS), one of the technical registrants of chlorpyrifos, and comments and mitigation suggestions from other interested parties, EPA developed its risk management decision for remaining uses of chlorpyrifos that pose risks of concern. This decision is discussed fully in this document.

Chlorpyrifos is an organophosphate insecticide, acaricide and miticide used to control a variety of insects, first registered in 1965 for control of foliage and soil-borne insect pests on a variety of food and feed crops. Technical registrants include Dow AgroSciences, Cheminova, Inc., Gharda USA, Inc., Luxembourg-Pamol, Inc., Makhteshim-Agan of North America, Inc. and Platte Chemical Company, Inc. Chlorpyrifos is one of the most widely used organophosphate insecticides in the U.S. and, until 2000 when nearly all residential uses were cancelled, was one of the major insecticides used in residential settings. Currently registered uses include food and feed crops, golf course turf, greenhouses, non-structural wood treatments such as utility poles and fence posts, and as an adult mosquitocide. Structural treatments for termites are also currently registered, but are being phased out. All use of products for structural termite control will be prohibited after December 31, 2005, unless acceptable data demonstrate that risks from these exposures are not of concern. Indoor non-residential uses include shipholds, railroad boxcars, industrial plants and manufacturing plants.

Based on data reflecting usage for the years 1987 through 1998, the Agency estimates that the annual total domestic usage of chlorpyrifos was approximately 21 to 24 million pounds active ingredient (ai) for 8 million acres treated in the U.S. Approximately 11 million pounds were applied annually in non-agricultural settings (i.e., residences, schools, golf courses, parks) prior to the implementation of interim mitigation in 2000. The largest agricultural market for chlorpyrifos in terms of total pounds ai is corn (~5.5 million). The largest non-agricultural markets in terms of total pounds ai applied were pest control operators (PCOs) for termite control (5 million), and turf (2.5 million). Crops with a high average percentage of their total

U.S. planted acres treated include Brussels sprouts (73%), cranberries (46%), apples (44%), broccoli (41%) and cauliflower (31%).

In June, 2000, the Agency released its revised human health risk assessment and entered into an agreement with the technical registrants to eliminate and phase out certain uses of chlorpyrifos. The agreement was established at that time in order to expeditiously address food, drinking water, residential and non-residential uses posing the greatest risks to children. The mitigation contained in the agreement also reduced some occupational and ecological exposures by eliminating use sites and reducing application rates. Details of the interim risk mitigation can be found on the internet at http://www.epa.gov/pesticides/op/.

The technical registrants have since agreed to additional mitigation measures addressing occupational and ecological risks not addressed in the June, 2000 agreement. These measures are the result of discussion between the Agency and the technical registrants during Phase 5 of the public participation process, and are in the process of being implemented.

Overall Risk Summary

EPA's preliminary human health risk assessment for chlorpyrifos indicated dietary (food and drinking water), occupational and residential risk concerns. The revised risk assessment indicates that, with implementation of the June 2000 mitigation agreement, dietary risks from food are not of concern. Drinking water risk estimates based on screening models and monitoring data from both ground and surface water for acute and chronic exposures are generally not of concern. The exception is incidents of contamination resulting from termiticide use, which are highly localized and expected to be declining because the termiticide use is being phased out. There are concerns for some workers who mix, load, and apply chlorpyrifos to agricultural and other non-residential sites.

Application of chlorpyrifos poses acute and reproductive risks to many non-target aquatic and terrestrial animals for all outdoor uses reviewed. The risk quotients for all chlorpyrifos uses exceed the levels of concern for most terrestrial and aquatic categories. In general, risk quotients are greater among estuarine species than freshwater species. Terrestrial animals are at less risk than aquatic species. Birds appear to be more at risk than most mammalian species. Aquatic risk quotients for ground spray applications are less than aerial spray applications at the same application rate.

Results of the risk assessments, and the label amendments that EPA believes will mitigate risks to acceptable levels taking into account the benefits of chlorpyrifos use, are presented in this interim RED.

Dietary Risk

The preliminary risk assessment showed that acute dietary risks from food exceeded the acute population adjusted dose (aPAD) for infants, all children, and nursing females of child-bearing age (13-50 years old). To address these risks, the technical registrants agreed to eliminate use on tomatoes and restrict use on apples. EPA will revoke the tomato tolerance and lower the apple tolerance to ensure that both domestic and imported commodities do not contain residues of concern. Use on apples is restricted to dormant (pre-bloom) applications; the tolerance will be lowered to reflect this. In addition, the tolerance on grapes will be lowered to reflect the currently registered use. The proposed tolerance actions be announced in the *Federal Register* and will have a public comment period separate from the comment period for this IRED. With this mitigation, acute risks from food are not a concern for any population subgroup.

Acute and chronic exposures to drinking water do not exceed the DWLOCs and are therefore not of concern. Drinking water risk estimates based on screening models and monitoring data from both ground and surface water for acute and chronic exposures are generally not of concern. The exception is incidents of contamination resulting from termiticide use, which are highly localized and expected to be declining with the phasing out of the termiticide use and implementation of generic risk mitigation for termiticides (reduction of the concentration during the phase-out period.)

Chronic dietary risk from food and drinking water does not exceed the Agency's level of concern for the general U.S. population or for any population subgroup.

Occupational Risk

Occupational exposure to chlorpyrifos is of concern to the Agency. Exposures of concern include mixing/loading liquids for aerial/chemigation and groundboom application, mixing wettable powder for groundboom application, aerial application, and application by backpack sprayer, high-pressure handwand, bulbous duster and hand-held sprayer. Generally, these risks can be mitigated by a combination of additional personal protective equipment and engineering controls, and by reductions in application rates. Additionally, the Agricultural Handler Task Force will be developing exposure data to better characterize the risk from certain uses (e.g., applying granulars by air).

Postapplication risks can be mitigated by reducing application rates for a number of uses and in some cases by the establishment of new restricted entry intervals, i.e., the amount of time that must elapse before risks are not of concern to workers re-entering treated fields.

Residential Risk

Risks to residents, particularly children, from chlorpyrifos use in the home, as well as residential postapplication risks following residential treatments are a concern. To mitigate these risks, the technical registrants agreed in June 2000 to cancel almost all indoor and outdoor residential uses. Virtually all products labeled for homeowner use have been canceled effective December 31, 2001, except containerized ant and roach baits in child-resistant packaging which have not been canceled because they present minimal exposure. Distribution and sale of products for all other residential uses will be prohibited after December 31, 2001. The application rate for termite treatments was reduced as of December 1, 2000. Full-barrier (whole-house) termite treatment products may no longer be distributed or sold after December 31, 2001. Spot and local post-construction use will be canceled on December 31, 2002, and pre-construction termiticide uses will be canceled on December 31, 2005, unless acceptable exposure data are submitted and demonstrate that postapplication risks to residents are not of concern.

Non-Agricultural Non-Residential Risk

Risks to children in schools and parks, both indoors and outdoors, are of concern to the Agency. Therefore, per the mitigation agreement signed in June 2000, distribution and sale of products bearing these uses will be prohibited effective December 31, 2001. The only non-agricultural non-residential uses that will be reregistered are golf course turf, shipholds, railroad boxcars, industrial plants, manufacturing plants, and processed wood products, none of which are expected to result in risks to children. Exposure data are required to confirm that exposure to residents from chlorpyrifos-treated wood products is not of concern.

Aggregate Risk

Acute, short-term and chronic aggregate assessments were conducted. Taking into account residential risk mitigation, aggregate risks are not a concern for any of these scenarios.

Ecological Risk

Risk quotients indicate that a single application of chlorpyrifos poses risks to small mammals, birds, fish and aquatic invertebrate species for nearly all registered outdoor uses. Multiple applications increase the risks to wildlife and prolong exposures to toxic concentrations. In most cases, acute risk quotients exceed 1 for the most sensitive, small mammals and birds. All aquatic acute and reproductive risk quotients exceed 1; many aquatic risk quotients exceed 10 and 100, and both acute and reproductive risk quotients for estuarine invertebrates exceed 1,000 on some crops. In a few cases at maximum application rates, chlorpyrifos may bioconcentrate in the tissues of fish and aquatic invertebrates to levels that exceed acute LC_{50} values for sensitive bird species and reproductive NOAELs for birds and small mammalian species. Hence without mitigation to reduce levels in shallow waters,

bioconcentration of chlorpyrifos in ponds and estuarine areas may pose acute and/or reproductive risks to aquatic birds and mammals feeding adjacent to treated areas.

To address these risks, a number of measures including reduced application rates, increased retreatment intervals, reduced seasonal maximum amounts applied per acre, and no-spray setback zones around water bodies will be needed.

Interim Reregistration Eligibility Decision

With the addition of the label restrictions and amendments detailed in this document, the Agency has determined that all currently registered uses of chlorpyrifos, except open-pour dust formulations, may continue until the cumulative risks for all of the organophosphates have been considered.

The Agency is issuing this interim Reregistration Eligibility Decision (RED) for chlorpyrifos, as announced in a Notice of Availability published in the *Federal Register*. This interim RED document includes guidance and time frames for making label changes for products containing chlorpyrifos. There will be a 60-day public comment period for this interim RED. Phase 6 of the pilot process did not include a public comment period; however, for some chemicals, the Agency may provide for another comment period, depending on the content of the risk management decision. Neither the tolerance reassessment nor the reregistration eligibility decision for chlorpyrifos can be considered final, however, until the cumulative risks for all organophosphate pesticides are considered. The cumulative assessment may result in further risk mitigation measures for chlorpyrifos.

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 a review of all submitted data by the U.S. Environmental Protection Agency (referred to as EPA or "the Agency"). 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 hazards 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 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 tolerance reassessment of all existing tolerances. The Agency had decided that, for those chemicals that have tolerances and are undergoing reregistration, the tolerance reassessment will be initiated through this reregistration process. It also requires that by 2006, EPA must review all tolerances in effect on the day before the date of the enactment of the FQPA. FQPA also amends the FFDCA to require a safety finding in tolerance reassessment based on factors including an assessment of cumulative effects of chemicals with a common mechanism of toxicity. Chlorpyrifos belongs to a group of pesticides called organophosphates, which share a common mechanism of toxicity--they all affect the nervous system by inhibiting cholinesterase. Although FQPA significantly affects the Agency's reregistration process, it does not amend any of the existing reregistration deadlines. Therefore, the Agency is continuing its reregistration program while it resolves the remaining issues associated with the implementation of FQPA.

This document presents the Agency's revised human health and ecological risk assessments; its progress toward tolerance reassessment; and the interim decision on the reregistration eligibility of chlorpyrifos. It is intended to be only the first phase in the reregistration process for chlorpyrifos. The Agency will eventually proceed with its assessment of the cumulative risk of the OP pesticides and issue a final reregistration eligibility decision for chlorpyrifos.

The implementation of FQPA has required the Agency to revisit some of its existing policies relating to the determination and regulation of dietary risk, and has also raised a number of new issues for which policies need to be created. These issues were refined and developed through collaboration between the Agency and the Tolerance Reassessment Advisory Committee (TRAC), which was composed of representatives from industry, environmental groups, and other interested parties. The TRAC identified the following science policy issues it believed were key to the implementation of FQPA and tolerance reassessment:

- Applying the FQPA 10-Fold Safety Factor
- Whether and How to Use "Monte Carlo" Analyses in Dietary Exposure Assessments
- How to Interpret "No Detectable Residues" in Dietary Exposure Assessments
- Refining Dietary (Food) Exposure Estimates
- Refining Dietary (Drinking Water) Exposure Estimates
- Assessing Residential Exposure
- Aggregating Exposure from all Non-Occupational Sources
- How to Conduct a Cumulative Risk Assessment for Organophosphate or Other Pesticides with a Common Mechanism of Toxicity
- Selection of Appropriate Toxicity Endpoints for Risk Assessments of Organophosphates
- Whether and How to Use Data Derived from Human Studies

The process developed by the TRAC calls for EPA to provide one or more documents for public comment on each of the policy issues described above. Each of these issues is evolving and in a different stage of refinement. Some issue papers have already been published for comment in the *Federal Register* and others will be published shortly.

In addition to the policy issues that resulted from the TRAC process, the Agency issued, on September 29, 2000, a Pesticide Registration Notice (PR 2000-9, Worker Risk Mitigation for Organophosphate Pesticides, hereafter referred to as the Worker PR Notice) that presents EPA's approach for managing risks from organophosphate pesticides to occupational users. The Worker PR Notice describes the Agency's baseline approach to managing risks to handlers and workers who may be exposed to organophosphate pesticides, and the Agency expects that other types of chemicals will be handled similarly. Generally, basic protective measures such as closed mixing and loading systems, enclosed cab equipment, or protective clothing, as well as increased reentry intervals will be necessary for most uses where current risk assessments indicate a risk and such protective measures are feasible. The policy also states that the Agency will assess each pesticide individually, and based upon the risk assessment, determine the need for specific measures tailored to the potential risks of the chemical. The measures included in this interim RED are consistent with the Worker PR Notice.

This document consists of six sections. Section I contains the regulatory framework for reregistration/tolerance reassessment as well as descriptions of the process developed by TRAC for public comment on science policy issues for the organophosphate pesticides and the Worker PR notice. Section II provides a profile of the use and usage of the chemical. Section III gives an overview of the revised human health and environmental effects risk assessments resulting from public comments and other information. Section IV presents the Agency's interim decision on reregistration eligibility and risk management decisions. Section V summarizes the label changes necessary to implement the risk mitigation measures outlined in Section IV. Section VI provides information on how to access related documents. Finally, the Appendices include Data Call-In (DCI) information. The revised risk assessments and related addenda are not included in this document, but are available on the Agency's web page www.epa.gov/pesticides/op, and in the public docket.

II. Chemical Overview

A. Regulatory History

Chlorpyrifos, [0,0-diethyl 0-(3,5,6-trichloro-2-pyridinyl)-phosphorothioate], is a broad-spectrum, chlorinated organophosphate insecticide, acaricide and nematicide that was first registered in 1965 to control foliage- and soil-borne insect pests on a variety of food and feed crops. Chlorpyrifos' most common trade names are Dursban®, Empire 20®, Equity®, and Whitmire PT 270®. Lorsban® is a trade name for agricultural-use products. It is one of the most widely used organophosphate insecticides in the U.S., and until recently was one of the major insecticides used in residential settings. During the years 1987 to 1998, approximately 21 to 24 million pounds were used annually in the U.S., of which approximately 11 million pounds were applied in non-agricultural settings. At one time there were over 400 registered products containing chlorpyrifos on the market. Registered uses included: a variety of food crops (i.e., there are approximately 112 tolerances for food/feed commodities); golf course turf; non-residential sites such as industrial plants and vehicles; non-structural wood treatments such as utility poles, fence posts, and processed wood products; and public health uses (to control mosquitoes and fire ants) and impregnated in ear tags for cattle. Chlorpyrifos is also registered for structural pest control for termites; however, this use is being phased out and will be prohibited effective December 31, 2005, unless acceptable data demonstrate that exposures from this use are not of concern.

In January, 1997, the technical registrants entered into an agreement with the Agency to reduce indoor exposures to chlorpyrifos, especially to children and other sensitive groups. Indoor broadcast treatments, indoor total release aerosols/foggers, direct application to pets via shampoos, dips and sprays, and paint additives were eliminated.

In June 2000, the technical registrants entered into an agreement with the Agency to eliminate and phase out nearly all uses that result in residential exposures. The only exceptions are containerized baits and public health uses such as mosquito and fire ant control, which do not pose risks of concern and provide important public health benefits. The agreement phased in the various restrictions and cancellations to address higher risk uses of chlorpyrifos first. Because much of the risk reduction involves increasing margins of safety, the agreement focused first on mitigation that achieved the greatest risk reduction for children. Allowing uses with lower risks to continue for a specific period of time will help ensure that appropriate alternatives are available for a reasonable and orderly transition. The provisions of the agreement are summarized in Table 1 below. This document does not present the risks for those uses that will be phased out and/or have been canceled. Discussion of the risks associated with these uses can be found in the *Human Health Risk Assessment,* June 8, 2000, which is located in the public docket and on the internet at www.epa/gov/pesticides/op.

Table 1. Provisions of the June 2000 Memorandum of Agreement

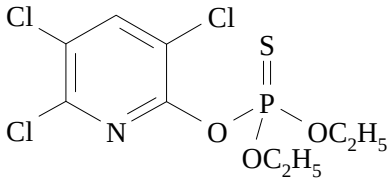
Food Uses		
Crop	**Mitigation Measures**	**Effective Dates**
Apples	Production of chlorpyrifos products labeled for post-bloom application is prohibited (only production for pre-bloom, dormant application is allowed) Post-bloom use is prohibited	August - September 2000 Stop use (use prohibited) as of 12-31-00
Tomatoes	Production of products for tomato use is prohibited	August - September 2000 Stop use as of 12-31-00
All Agricultural Uses	Classify new end-use products for restricted use or package in large containers New end-use products must bear revised Restricted Entry Intervals (REIs)	As of 12-1-00 As of 12-1-00

Home Uses		
Home lawn and most other outdoor uses	Classify new end-use products for restricted use or package in large containers (except baits in child resistant packaging) Use will be canceled	As of 12-1-00 Stop formulation 12-1-00 Formulators stop sale 2-1-01 Retailers stop sale 12-31-01
Crack and crevice and most other indoor uses	Classify new end-use products for restricted use or package in large containers Use will be canceled	As of 12-1-00 Stop formulation 12-1-00 Formulators stop sale 2-1-01 Retailers stop sale 12-31-01

Home Uses		
Termiticides	Classify new products for restricted use or package in large containers	As of 12-1-00
	Limit use to 0.5% solution	In label directions as of 12-1-00
❑ Full barrier (whole house) post-construction use	Use will be canceled	Stop formulation 12-1-00 Formulators stop sale 2-1-01 Retailers stop sale 12-31-01
❑ Spot and local post-construction use	Use will be canceled	Stop formulation 12-1-00 unless label has stop use date of 12-31-02
❑ Pre-construction use	Use will be canceled unless acceptable exposure data show that risks are not of concern	Stop production 12-31-04 Stop use 12-31-05
Non-Residential Uses		
Indoor areas where children could be exposed (such as schools)	Uses will be canceled	Stop formulation 12-1-00 Formulators stop sale 2-1-01 Retailers stop sale 12-31-01
Outdoor areas where children could be exposed (such as parks)	Uses will be canceled	Stop formulation 12-1-00 Formulators stop sale 2-1-01 Retailers stop sale 12-31-01
Non-Agricultural Uses that Will Remain		
Residential use of containerized baits	In child resistant packaging	(Use allowed to continue)
Indoor areas where children will not be exposed, including only ship holds, railroad boxcars, industrial plants, manufacturing plants, or food processing plants		New end-use product labels must reflect only these uses as of 12-1-00

Non-Agricultural Uses that Will Remain		
Outdoor areas where children will not be exposed, including only:		New end-use product labels must reflect only these uses as of 12-1-00
❑ Golf course turf	Reduce application rate from 4 lbs/acre to 1 lb/acre	
❑ Road medians	Reduce maximum application rate to 1 lb ai/acre	
❑ Industrial plant sites	Reduce maximum application rate to 1 lb ai/acre	
❑ Non-structural wood treatments including fenceposts, utility poles, railroad ties, landscape timbers, logs, pallets, wooden containers, poles, posts, and processed wood products	(Continue at current rate)	
Public health uses:		
❑ Fire ant mounds (drench and granular treatment)	For professional use only	
❑ Mosquito control	For professional use only	

B. Chemical Identification



- **Common name:** Chlorpyrifos
- **Chemical name:** [0,0-diethyl 0-(3,5,6-trichloro-2-pyridinyl-phosphorothioate]
- **Chemical family:** Organophosphate
- **Case number:** 0100
- **CAS registry number:** 2921-88-2
- **OPP chemical code:** 059101
- **Empirical formula:** $C_9H_{11}Cl_3NO_3PS$

- **Molecular weight:** 350.6

- **Trade and other names:** Dursban®, Lorsban®, Empire 20®, Equity®, Whitmire PT270®

- **Basic manufacturer:** Dow AgroSciences

Technical chlorpyrifos is a white crystalline solid with a melting point of 41.5-42.5°C. Chlorpyrifos is stable in neutral and acidic aqueous solutions; however, stability decreases with increasing pH. Chlorpyrifos is practically insoluble in water, but is soluble in most organic solvents (i.e. acetone, xylene and methylene chloride). Chlorpyrifos is not particularly volatile based on its low vapor pressure of 1.87×10^{-5}mm Hg at 20°C (Merck Index, 11th Edition). Its maximum attainable vapor concentration is 25 ppb at 25°C.

C. Use Profile

The following information is based on the currently registered uses of chlorpyrifos.

- **Type of Pesticide:** Insecticide, acaricide and nematicide

- **Summary of Use Sites:**

  Food/Feed: Registered for use on the following crops/sites: cranberries, strawberries, citrus, apples, figs, pears, nectarines, cherries, peaches, plums, grapes, almonds, pecans, walnuts, nut trees, onions, peppers, kale, broccoli, Brussels sprouts, cabbage, cauliflower, collards, cucurbits, asparagus, roots/tubers, corn, lentils, beans, peas, sorghum, tobacco, wheat, alfalfa, peanuts, soybeans, sunflower, cotton, sugar beets, mint, bananas, pasture

  Other agricultural sites: Cattle ear tags, Christmas trees, woodland

  Residential: Structural treament for termites, containerized baits

  Public Health: Fire ant mounds, mosquito adulticides

  Other Nonfood: Golf courses, shipholds, boxcars, industrial plants, processed wood products

- **Target Pests:** A wide variety of insects and related organisms, and root-knot nematodes

- **Formulation Types Registered**: Formulated as a liquid emulsifiable concentrate, granular, wettable powder, dry flowable, pressurized liquid, dust, ready-to-use solution, microencapsulated material, pellets/tablets, soluble concentrate and impregnated materials (eartags).

- **Method and Rates of Application**:

  Equipment: Applied by aerial, chemigation, groundboom, tractor-drawn granular spreader, airblast sprayer, low and high pressure hand wands, hydraulic hand-held sprayer, shaker can, belly grinder, push-type spreader, large tank sprayer, compressed air sprayer, hose-end sprayer, aerosol sprayer, hand, and eartags.

  Method: Foliar, bark, seed and soil-incorporated band or broadcast treatments

  Rates: Maximum application rates range from 0.5 lb/ai/A to 8 lb/ai/A. The maximum number of applications per year range from 1 to 3. Up to 4 applications are permissible in some citrus growing areas (grove floor treatment).

  Timing: Dormant, delayed dormant, preplant, at-planting, transplanting, postplant, post-transplant, preemergence and postemergence.

- **Use Classification**: Any emulsifiable concentrate (EC) end-use product formulated from chlorpyrifos must be labeled as a restricted use product. All other end-use products (other than containerized baits in child-resistant packaging) must either be labeled as restricted use or packaged in containers no smaller than 15 gallons of a liquid formulation or 25 pounds of a dry formulation.

D. Estimated Usage of Pesticide

This section summarizes the best estimates available for many of the pesticide uses of chlorpyrifos, based on available pesticide usage information for 1987-1998. Approximately 21 million pounds a.i. of chlorpyrifos were used annually, according to Agency and registrant estimates. As a result of the June 7, 2000 MOA, which eliminated residential uses and phased out the termite uses, approximately 10 million pounds of chlorpyrifos will be phased out of the market place. Table 2 provides usage estimates for selected use sites. A full list of all uses of chlorpyrifos, with the corresponding use and usage data for each site, has been completed and is in the "Quantitative Use Analysis," March 30, 2000, which is available in the public docket and on the internet. The data, reported on an aggregate and site (crop) basis, reflect annual

fluctuations in use patterns as well as the variability in using data from various information sources. These estimates do not reflect reductions in use from mitigation that has been implemented as a result of the Memorandum of Agreement.

Table 2. Chlorpyrifos Estimated Usage for Representative Sites

Crop	Lbs. Active Ingredient Applied (Wt. Avg.)[1]	Percent Crop Treated (Likely Maximum)	Percent Crop Treated (Wt. Avg.)
Cranberries	26,000	60	47
Oranges	460,000	19	14
Oranges, Fresh	350,000	54	41
Oranges, Processed	110,000	10	7
Apples	550,000	53	44
Pecans	240,000	36	20
Walnuts	197,000	39	30
Sweet Corn	120,000	13	11
Sweet Corn, Fresh	74,000	22	18
Sweet Corn, Processed	46,000	9	7
Corn	5,527,000	8	7
Broccoli	73,000	51	41
Brussels Sprouts	9,000	91	73
Cauliflower	27,000	36	31
Tobacco	146,000	14	11
Wheat, Winter	170,000	1	1
Alfalfa	480,000	3	3
Peanuts	316,000	15	10
Cotton	670,000	6	5
Sugar Beets	169,000	10	8
Nursery/Greenhouse	277,000	–	–
PCOs, Termite Control[2]	5,003,000	–	–
PCOs, Other (Roaches, Ants, Fleas, etc.)[2]	1,946,000	–	–

Crop	Lbs. Active Ingredient Applied (Wt. Avg.)[1]	Percent Crop Treated (Likely Maximum)	Percent Crop Treated (Wt. Avg.)
Mosquito Abatement Districts	29,000	–	–
Turf[3, 4]	2,519,000	–	–
Households, Outdoor[4]	1,112,000	–	–

[1] Weighted average is based on data for 1987-1998; the most recent years and more reliable data are weighted more heavily.
[2] Mitigation implemented in June 2000 included phase-out or cancellation of products for this use.
[3] Includes golf courses, turf farms, institutional turf, lawncare control operators, and landscape contractors.
[4] Products registered for residential use were cancelled effective December 31, 2000.

III. Summary of Chlorpyrifos Risk Assessment

Following is a summary of EPA's revised human health and ecological risk findings and conclusions for the organophosphate pesticide chlorpyrifos, as fully presented in the documents, *Human Health Risk Assessment for Chlorpyrifos,* June 8, 2000, and *Fate and Environmental Risk Assessment*, dated June 2000, and addenda thereto. The purpose of this summary is to assist the reader by identifying the key features and findings of these risk assessments, and to better understand the conclusions reached in the assessments.

These risk assessments for chlorpyrifos were presented at a Technical Briefing on June 8, 2000, which was followed by an opportunity for public comment on risk management for this pesticide. The risk assessments presented here form the basis of the Agency's risk management decision for chlorpyrifos only; the Agency must consider cumulative risks of all the organophosphate pesticides before any final decisions can be made.

A. Human Health Risk Assessment

EPA issued its preliminary risk assessments for chlorpyrifos in Phase 3 of the public participation process on October 18, 1999. In response to comments and new studies submitted during Phase 3, and mitigation measures agreed to by the technical registrants to address risks identified in the preliminary assessments, the risk assessments were updated and refined. The major revision to the human health risk assessment was the reassessment of acute dietary risks to reflect the cancellation of the tomato use and reduction of the grape and apple tolerances to 0.01 ppm; inclusion of new data from the Agricultural Reentry Task Force (ARTF); and preliminary consideration of a new acute study with human subjects and a new oral dog study with peripheral nervous system measurements. The registrant has submitted a rebuttal to the modification of the tolerances. This rebuttal is under review.

1. Dietary Risk from Food

a. Toxicity

The Agency has reviewed all toxicity studies submitted and has determined that the toxicity database is complete, and that it supports an interim reregistration eligibility determination. A brief overview of the studies used for the dietary risk assessment is outlined in Table 3 in this document. Further details on the toxicity of chlorpyrifos can be found in the Human Health Risk Assessment for Chlorpyrifos, June 8, 2000.

Table 3. Summary of Doses and Endpoints Selected for Chlorpyrifos Dietary Risk Assessment

Exposure Scenario	NOAEL/Dose (mg/kg/day)	Endpoint	Study
Acute Dietary	NOAEL=0.5 UF = 100 FQPA = 10 (infants, children and females 13-50)	Significant (28-40%) plasma ChE inhibition at peak time of (3-6 hours post exposure) at 1 mg/kg/day (Mendrala and Brzak 1998). Significant 30% RBC ChE inhibition 4 hours post exposure at the LOAEL of 1.5 mg/kg/day (Zheng et al. 2000).	Acute Blood Time Course Study in male rats (Mendrala and Brzak 1998) with support from Zheng et al. (2000)
	Acute RfD =0.005 mg/kg/day **Acute PAD (children and females 13-50) = 0.0005 or $5x10^{-4}$ mg/kg/day** **Acute PAD (general population) = 0.005 or $5x10^{-3}$ mg/kg/day**		
Chronic Dietary	NOAEL= 0.03 UF= 100 FQPA = 10 (infants, children and females 13-50)	Significant plasma and RBC cholinesterase inhibition at the LOAEL of 0.22 to 0.3 mg/kg/day	Weight of Evidence from 5 studies: 2 year dog 90 day dog 2 year rat 90 day rat developmental neurotoxicity (DNT) rat study (at 2 weeks)
	Chronic RfD =0.0003 mg/kg/day **Chronic PAD (children and females 13-50) = 0.00003 or $3x10^{-5}$ mg/kg/day** **Chronic PAD (general population) = 0.0003 or $3x10^{-4}$ mg/kg/day**		

NOAEL = No Observed Adverse Effect Level
RBC = red blood cell
UF = Uncertainty Factor
PAD = Population Adjusted Dose (includes UF and FQPA safety factor)

The Agency has evaluated the potential impact on the acute dietary risk assessment following the submission of an acute (single oral dose) toxicity study with chlorpyrifos in humans. The following observations can be made on the potential impact of these data on the chlorpyrifos risk assessment. Because the study is a single oral dose, it could be used in a weight-of-evidence approach to inform the selection of the inter-species uncertainty factor for

acute dietary risk assessment. The Agency's evaluation did not include an independent review of the ethical standards under which this study was conducted. The acute human study could be compared to existing acute animal data to determine if the full ten-fold inter-species uncertainty factor is needed to account for variation between species in the acute dietary assessment. However, because of its limited duration, this study would not be adequate for use in short-term or intermediate-term risk assessments, such as those used to estimate worker risk from chlorpyrifos use, nor would it be appropriate for the chronic dietary assessment.

The Agency has concluded that the primary metabolite of chlorpyrifos, 3,5,6-trichloro-2-pyridinol (TCP), does not induce cholinesterase inhibition, and exhibits effects only at doses high than those producing ChEI with chlorpyrifos, and therefore is less toxic than chlorpyrifos (58 FR 19354, April 14, 1993). The primary toxicological effect after subchronic and chronic exposure to TCP was alterations in liver enzymes seen at 30 mg/kg/day and increases in liver and kidney weights at 100 mg/kg/day. Because of the potential exposure to TCP in food and residential settings, and evidence of increased susceptibility of rabbit fetuses relative to dams, a screening-level dietary risk assessment for TCP resulting from chlorpyrifos, chlorpyrifos-methyl and trichlorpyr was conducted. That assessment indicated that the percentage of the acute PAD occupied for females 13+ years old (the population subgroup of concern for acute toxicity effects) was 2.4%. The percentage of the chronic PAD occupied ranged from 0.3% for the general U.S. population to 0.7% for children 1-6 years old. Upper-bound estimated environmental concentrations of TCP exceeded chronic DWLOCs for children. However, the Agency believes that actual concentrations are probably considerably lower than modeled values primarily because the acres treated with chlorpyrifos in any watershed is expected to be much lower than 100% assumed in the modeling. Uncertainties with surface and groundwater modeling are discussed more fully in the Summary of Risks to Nontarget Organisms later in this document. More detailed information on TCP and the screening assessment can be found in the "Preliminary Risk Assessment for Trichloropyridinol (TCP) Metabolite," June 5, 2000, which is available in the public docket and on the internet at www.epa.gov/pesticides/op.

b. FQPA Safety Factor

The FQPA 10X Safety Factor has been retained due to increased susceptibility and sensitivity to chlorpyrifos among neonates when compared with adults, and for the qualitative increased susceptibility occurring at the high dose in the developmental neurotoxicity (DNT) study (cholinesterase inhibition in dams versus structural effects on developing brain of the offspring). In addition, recent data in the literature suggest that the inhibition of cholinesterase may not be essential for adverse effects on brain development. Further uncertainty arises from the lack of an offspring No Observed Adverse Effect Level (NOAEL) in the DNT. In that study, structural alterations in brain development were the toxicity endpoint of concern and were seen at the lowest dose tested. The registrant has submitted a rebuttal to the EPA review of the DNT study. This rebuttal is under review.

The FQPA Safety Factor is applicable to females 13-50 as well as infants and children, for all exposure durations. The FQPA Safety Factor is applicable to the following assessments:

- Acute Dietary Assessment - The FQPA safety factor is applicable to the Females 13-50 and Infants and Children population subgroups for the acute dietary assessment because adverse effects could result from a single exposure to chlorpyrifos (as demonstrated in several open literature studies including Zheng et al.).

- Chronic Dietary Assessment - The FQPA safety factor is applicable to the Females 13-50 and Infants and Children population subgroups due to the concern that potential adverse effects could result from repeated exposure to chlorpyrifos (as demonstrated, for example, in the developmental neurotoxicity study in rats).

- Residential and Other Non-Occupational Exposure Assessment - The FQPA safety factor is applicable for Females 13-50 and the Infants and Children population subgroups for all exposure durations due to the adverse effects resulting from single and repeated exposure(s) to this organophosphate insecticide in and around residential (non-occupational) settings.

c. Population Adjusted Dose (PAD)

The Population Adjusted Dose, or PAD, is a term that characterizes the dietary risk of a chemical, and reflects the Reference Dose (RfD), either acute or chronic, that has been adjusted to account for the FQPA safety factor (i.e., RfD/FQPA safety factor). A risk estimate that is less than 100% of the acute or chronic PAD does not exceed the Agency's risk concern.

d. Exposure Assumptions

Chlorpyrifos is registered for use on a wide variety of food crops, and has approximately 112 tolerances for food and/or feed commodities (which translates to approximately 700 food forms in the dietary analysis). Food uses evaluated in this analysis were those reflected by the established tolerances in/on raw agricultural, animal, and processed food/feed commodities for chlorpyrifos as listed in 40 CFR §180.342. Food handling establishment (FHE) tolerances were also included as cited in 40 CFR §180.342(a)(4) for the chronic dietary analysis (i.e., as a result of the registered use in FHE, all foods have an established tolerance of 0.1 ppm, unless they are covered by higher tolerances). The established tolerances in/on raw agricultural, animal, and processed food/feed commodities are expressed either in terms of the combined residues of chlorpyrifos and its metabolite TCP or as chlorpyrifos *per se*. The Agency has determined that residues of TCP are not of concern for the chlorpyrifos dietary assessment, and concluded that it can therefore be excluded from the tolerance expression. Proposed tolerances are supported by available residue chemistry data and are expressed in terms of chlorpyrifos *per se*. Thus, for purposes of this analysis, only residues of chlorpyrifos *per se* were considered, when data were available. Whenever possible, data for anticipated residues (ARs) reflect levels of chlorpyrifos *per se*.

Highly refined acute and chronic dietary risk analyses for chlorpyrifos were conducted with the Dietary Exposure Evaluation Model (DEEM™). DEEM incorporates consumption data generated in USDA's Continuing Surveys of Food Intakes by Individuals (CSFII), 1989-91. For

chlorpyrifos, inputs to the DEEM analysis also include DAS's National Food Survey (NFS, 1993-1994), U.S. Department of Agriculture's Pesticide Data Program (PDP) monitoring data (1994-1999), the Food and Drug Administration (FDA) Surveillance Monitoring Program data (1992-1998), and field trial residue data. Percent crop treated data were supplied by EPA's Biological and Economic Analysis Division (see Quantitative Usage Analysis for Chlorpyrifos, March 30, 2000, available in the public docket). Where percent crop treated estimates indicated no chlorpyrifos use, a default assumption of 1% crop treated was applied. In general, when residues on commodities were nondetectable, one-half the limit of detection (LOD) was assumed. All available processing and cooking factors were incorporated into the dietary exposure analysis.

For chronic dietary risk assessments, the three-day average of the consumption data for each subpopulation is combined with average residues in commodities to determine the average exposure in mg/kg/day. For acute dietary risk assessment, the entire distribution of single day food consumption events is combined with a distribution of residues (probabilistic analysis, referred to as "Monte Carlo") to obtain a distribution of exposures in mg/kg/day.

e. Food Risk Characterization

Generally, a dietary risk estimate that is less than 100% of the acute or chronic PAD does not exceed the Agency's risk concerns. A summary of acute dietary risk estimates is shown in Table 4. Based on use patterns before the June 2000 mitigation agreement, the chlorpyrifos acute dietary risk from food at the 99.9th percentile for the most highly exposed subpopulation, children 1-6 years old, was 355% of the aPAD.

Commodities that contribute the most to that risk estimate are apples (residues resulting from post-bloom uses), grapes (residues primarily on imported crops) and fresh tomatoes (residues primarily on imported crops). Measures agreed to in the June 2000 agreement addressed these risks by canceling use on tomatoes and revoking the associated tolerance; restricting use on apples to pre-bloom (dormant) applications and reducing the tolerance to 0.01 ppm to reflect this new use pattern; and reducing the tolerance on grapes to 0.01 ppm to reflect the domestic dormant use pattern. The registrant has submitted a rebuttal to the modification of the tolerances. This rebuttal is under review.

With these measures in place, at the 99.9^{th} percentile, the dietary risk from food alone is below 100% of the aPAD for all population subgroups, including the most sensitive population subgroup, children 1-6 years old, with 82% of the aPAD occupied. Thus acute dietary risks from food alone are not of concern.

Table 4. Acute Dietary (Food Only) Risk Estimates for Chlorpyrifos as Percent of aPAD

Subpopulation	Pre-Mitigation[1] 99.9th Percentile	Post-Mitigation[2] 99.9th Percentile
U.S. population	16%	4.1%
All infants	130%	50%
Children 1-6	355%	82%
Children 7-12	270%	62%
Females 13+ , nursing	130%	39%

[1]Pre-mitigation refers to uses/use patterns in effect prior to the June 2000 mitigation agreement.
[2]Post-mitigation reflects changes in use/use patterns for tomatoes, apples and grapes as set forth in the June 2000 mitigation agreement.

The chronic dietary risk from food alone is not of concern, as shown in Table 5. Input values included PDP, FDA and Dow AgroSciences' (DAS')1993 National Food Survey (NFS) (a market basket survey), average residues from field trials, and percent crop treated data compiled by the Agency. Exposure estimates were below 100% of the cPAD for the most highly exposed subgroup, children 1-6 years old. With mitigation measures for apples, tomatoes and grapes in place per the June 2000 agreement and assuming use in food handling establishments, exposure for children 1-6 years old, the highest exposure subgroup, occupies 51% of the cPAD, and thus is not of concern.

Table 5. Chronic Dietary (food only) Risk Estimates for Chlorpyrifos as Percent of cPAD

Subpopulation	Pre-Mitigation[1] 99.9th Percentile	Post-Mitigation[2] 99.9th Percentile
U.S. population	4%	2.5%
All infants	45%	33%
Children 1-6	81%	51%
Children 7-12	59%	36%
Females 13+ , nursing	30%	20%

[1]Pre-mitigation refers to uses/use patterns in effect prior to the June 2000 mitigation agreement.
[2]Post-mitigation reflects changes in use/use patterns for tomatoes, apples and grapes as set forth in the June 2000 mitigation agreement.

These assessments are the most refined estimates of risk from exposure to chlorpyrifos through food, although some uncertainties exist. PDP data indicate that chlorpyrifos residues were detected in several commodities for which tolerances do not exist, specifically spinach, carrots, squash, lettuce, potatoes and celery. These residues were not included in the Agency's risk estimates because they represent misuse of chlorpyrifos. However, additional assessments

were conducted using spinach, carrots and squash, the commodities most frequently fed to children. These assessments were not significantly different from the mitigated acute or chronic dietary assessments and thus are not of concern.

A tolerance also does not exist for chlorpyrifos in freshwater fish. In a screening level assessment of the health risks to individuals who consume freshwater fish conducted by the EPA Office of Water in 1992, residues of chlorpyrifos were detected in fish from 26% of 388 sample collection sites. These data suggest that consumption of freshwater fish could contribute to the dietary exposures and risks from chlorpyrifos for sports fishermen and subsistence populations. Risk estimates could be of concern for an individual who consumed the maximum detected residue level daily for 70 years at a rate of 170 g/day; however, the Agency considers this unlikely. Subsistence populations are not expected to have exposures or risk that exceed the Agency's level of concern following chronic ingestion of fish fillets containing the mean detected residue level. For a more detailed discussion of risks from freshwater fish consumption, please refer to the *Human Health Risk Assessment for Chlorpyrifos*, June 8, 2000.

2. Dietary Risk from Drinking Water

Drinking water exposure to pesticides can occur through ground water 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. For chlorpyrifos, ground and surface water monitoring data were used as well as conservative Tier 1 and Tier 2 modeling. Modeling is considered to be an unrefined assessment and can provide a high-end estimate of risk.

The GENEEC and PRZM-EXAMS models were used to estimate surface water concentrations, and SCI-GROW was used to estimate groundwater concentrations. All of these are considered to be screening models, with the PRZM-EXAMS model being somewhat more refined than the other two.

The available environmental fate data suggest that chlorpyrifos has a low potential to leach to groundwater in measurable quantities from most typical agricultural uses, except following termiticide use. Chlorpyrifos is persistent in concentrated applications used in termiticide treatments. The available data indicate that the primary metabolite of chlorpyrifos, TCP is more mobile and significantly more persistent in many soils, especially under anaerobic conditions. A screening-level dietary risk assessment for TCP indicated that drinking water exposure following termiticide use may pose risks of concern to children. Generic risk mitigation action for termiticides has been implemented. The technical registrants agreed in June 2000 to a suite of mitigation measures for the termiticide products that will reduce the potential for exposure from this use. By December 31, 2000, the application rate was reduced to a 0.5% solution, and use was restricted to professional applicators. After December 31, 2001, whole house (post-construction) treatment will not be allowed. The preconstruction termiticide use will be eliminated by December 31, 2005, unless the registrants submit acceptable exposure data that demonstrate that risks are not of concern.

a. Surface Water

The Agency examined data of over 3000 samples from 20 of the U.S. Geological Survey's National Water Quality Assessment (NAWQA) Program study units for flowing surface water collected from rivers and streams. Chlorpyrifos was detected in 15% of 1530 agricultural streams, 26% of 604 urban stream samples in 1997 and in 65% of 57 urban stream samples from Georgia, Alabama and Florida in 1994. The maximum reported dissolved chlorpyrifos concentration in surface water was 0.4 ppb, with the majority of detections below 0.1 ppb. Although the data represent a large part of the U.S., they may not represent the most vulnerable watersheds where chlorpyrifos use is pervasive. A limited number of watersheds in the U.S. may have chlorpyrifos concentrations greater than 0.4 ppb due to higher usage rates or greater pesticide runoff. In particular, acute exposure levels could be higher for streams draining watersheds with more intense chlorpyrifos use or for lakes and reservoirs for which there are little data.

For comparison, the Agency developed screening-level model estimates of chlorpyrifos concentrations in surface water such as lakes and reservoirs using Tier I GENEEC and Tier II PRZM/EXAMS. Inputs to the models included high exposure agricultural scenarios for major crops (alfalfa, corn, citrus, and tobacco) at the maximum application rates. Estimated 90-day average and peak concentrations of chlorpyrifos in surface water using the PRZM/EXAMS screening model were 6.7 ppb and 40.6 ppb, respectively. The modeled estimates represent a pond draining an adjacent 100% treated field. These estimates should be highly conservative for most surface waters and all drinking water because it is unlikely that 100% of a watershed constituting a major drinking water source would be treated with chlorpyrifos in a given year.

After comparison of the NAWQA monitoring data and modeled estimates, an upper-bound range of concentrations was selected from the NAWQA study to assess acute and chronic risks associated with non-termiticide uses for surface water. For the acute assessment, a range of 0.026 to 0.4 ppb was used. The 0.026 ppb represents the 95th percentile chlorpyrifos concentration, while the 0.4 ppb concentration is the maximum detected concentration from streams and rivers. Estimated environmental concentrations (EECs) used in the assessments are shown in Table 6.

Table 6. Surface and Groundwater EECs for Chlorpyrifos

Drinking Water Source	Estimated Environmental Concentration (ppb)	
	Acute	Chronic
Groundwater	0.007 to 0.103 (a)	
Surface water	0.026 to 0.4 (b)	0.026 (c)

(a) Concentrations predicted by screening-level model SCI-GROW. The value is considered an upper bound concentration estimate.

(b) Based on the 95th percentile and maximum detected concentrations from surface water monitoring data.

(c) Based on the 95th percentile surface water concentration from monitoring data

To assess chronic risks, 0.026 ppb was used. As indicated above, 0.026 ppb represents the 95th percentile concentration from the NAWQA study. Although PRZM/EXAMS predicted a peak concentration of 40.6 ppb for lakes and reservoirs, this estimate was not used to assess chronic risks for the following reasons: 1) multi-month or annual mean concentrations in a reservoir are expected to be less than the maximum reported concentrations in the flowing water feeding the reservoir, which in this case is 0.4 ppb; therefore 40.6 ppb is unlikely to occur; and 2) the monitoring data demonstrate that chronic concentrations of chlorpyrifos in surface water are unlikely to exceed 0.1 ppb.

b. Ground Water

The Agency examined data of over 3000 samples of filtered well monitoring samples from the NAWQA database, and in the Agency's Pesticides in Ground Water Data Base (PGWDB). The NAWQA data showed that chlorpyrifos was detected in groundwater in fewer than 1% of the 3000 wells sampled, with the majority of concentrations reported at <0.01 ppb, and occasional detections at a maximum level of 0.026 ppb. Although the available monitoring data represent a large part of the U.S., it is not clear that they represent the most vulnerable groundwater where chlorpyrifos is used most intensively. The PGWDB reports a maximum detected concentration of 0.65 ppb.

Chlorpyrifos concentrations in groundwater were also estimated using the screening-level model SCI-GROW for four crops (corn, cotton, alfalfa and citrus). SCI-GROW predicted chlorpyrifos concentrations ranging from 0.007 ppb (typical application to alfalfa) to 0.103 ppb (maximum multiple applications to sweet corn). An analysis of both monitoring and modeling data suggest that chlorpyrifos concentrations in 99% of potable water in the U.S. are unlikely to exceed 0.1 ppb. Based on these data, EECs ranging from 0.007 to 0.103 ppb were used to evaluate both acute and chronic exposures for groundwater. The NAWQA monitoring data support that the SCI-GROW estimates are conservative.

Chlorpyrifos use as a termiticide is significant, with a recent estimate of seven million pounds ai applied annually, constituting about 30% of the total annual use. Chlorpyrifos groundwater exposure from termiticidal use occurs only in wells located within 100 feet of the treatment area and when the well casing is cracked. The maximum reported dissolved concentration following termiticide use is 2090 ppb. The current U.S. EPA Health Advisory for a child is 30 ppb. Therefore, acute concentrations are estimated at 30 to 2090 ppb. Chronic concentrations are presumably significantly lower but persistent at detectable levels for at least six months. Chronic concentrations following this use are estimated at 8.3 to 578 ppb. These values were derived by adjusting the acute concentrations for partial environmental degradation.

The Agency is concerned about exposure associated with termiticide use. However, because these exposures are isolated incidents and because termiticide use is being phased down with immediate reduction in applied concentrations, these exposures were not included in the dietary risk assessment. The following points support this determination. First, the technical

registrants state that this exposure only occurs in homes where the well is near or in the foundation and the well casing is cracked. The Agency has determined that because of changes made to termiticide labels as a result of the Label Improvement Process for Termiticides (PR Notice 96-7 for termiticides), potential exposure from incidents of this type has been reduced. For example, reported incidents associated with termiticide use were 28.2 per 100,000 homes in 1997 (before PR 96-7), and were 8.3 per 100,000 homes in 1998 (after PR 96-7).

Secondly, the technical registrants agreed in June 2000 to a suite of mitigation measures for termiticide products that reduced the potential for exposures from this use. By December 31, 2000, the application rate was reduced to a 0.5% solution, and use was restricted to professional applicators. After December 31, 2001, whole house (post-construction) treatment will not be allowed. By December 31, 2005, all residential termiticide use will be canceled.

c. Drinking Water Levels of Comparison (DWLOCs)

To determine the maximum allowable contribution of water-containing pesticide residues permitted in the diet, EPA first looks at how much of the overall allowable risk is contributed by food (and if appropriate, residential uses), and then determines a "drinking water level of comparison" (DWLOC) to determine whether modeled or monitored concentrations exceed this level. The Agency uses the DWLOC to estimate risk associated with exposure to pesticides in drinking water. The DWLOC is the maximum concentration in drinking water which, when considered together with dietary exposure, does not exceed a level of concern.

For acute risk, the potential drinking water exposure derived from either ground or surface water is not of concern for any population subgroup. Long-term exposure to chlorpyrifos as a result of well contamination from termiticide use could result in exposures of concern; however, these incidents are unlikely given ongoing mitigation. In addition, the technical registrants have agreed to reductions in use in the interim until all termiticide use is canceled. This is discussed in greater detail above and in Section IV of this document.

Table 7 presents the calculations for the acute and chronic drinking water assessment. Details of this analysis are found in the *Human Health Risk Assessment for Chlorpyrifos,* June 8, 2000.

Table 7. Drinking Water DWLOC and EEC Comparisons (Excluding Well Contamination)

Population Subgroup	DWLOCS (ppb)		Estimated Environmental Concentrations (ppb)		
			Ground Water	Surface Water	
	Acute	Chronic	Acute and Chronic	Acute	Chronic
U.S. Population	166	10	0.007-0.103	0.026-0.4	0.026
All Infants (<1 year)	2.4	0.2			
Children (1-6 years)	0.9	0.15			
Females (13-50 years)	9	0.72			

3. Occupational and Residential Risk

a. Toxicity

All risk calculations in this assessment are based on the most current toxicity information available for chlorpyrifos, including a 21-day dermal toxicity study. The toxicological endpoints and other factors used in the occupational and residential risk assessments for chlorpyrifos are shown in Table 8.

Table 8. Toxicological Endpoints and Other Factors Used in the Occupational and Residential Risk Assessment for Chlorpyrifos

Exposure Scenario	NOAEL Dose (mg/kg/day)	Endpoint	Study	Target MOE for Occupa-tional	Target MOE for Residential/Homeowner Exposures
Dermal Short-Term 1-30 days	Dermal NOAEL =5 Absorbed Dermal NOAEL = 0.15 (for biomonitoring) (a)	Plasma and RBC cholinesterase inhibition of 45 and 16%, respectively at LOAEL of 10 mg/kg/day after 4 days. (Dermal absorption factor not necessary)	21-day dermal rat study	100	1000 (infants, children and females 13-50) 100 (all other subpopulations)
Dermal Intermediate-Term (1–6 months) Long-Term (>6 months)	Oral NOAEL = 0.03 (3% dermal absorption)	Plasma and RBC cholinesterase inhibition at LOAEL of 0.22 to 0.3 mg/kg/day	Weight of Evidence from 5 studies: 2 year dog , 90 day dog, 2 year rat, 90 day rat, DNT study (at 2 weeks)	100	1000 (infants, children and females 13-50) 100 (all other subpopulations)
Inhalation Short-Term (1-30 days) Intermediate-Term (1–6 months)	Inhalation NOAEL = 0.1	Lack of effects in 2 rat inhalation studies at the highest dose tested; 43% plasma and 41% RBC cholinesterase inhibition following oral doses of 0.3 mg/kg/day for 2 weeks in the DNT study	Two 90 day rat inhalation studies (NOAEL) and DNT (LOAEL)	100	1000 (infants, children and females 13-50) 100 (all other subpopulations)

Exposure Scenario	NOAEL Dose (mg/kg/day)	Endpoint	Study	Target MOE for Occupa-tional	Target MOE for Residential/Homeowner Exposures
Inhalation Long-Term (>6 months)	Oral NOAEL= 0.03 (assume inhalation absorption is 100% of oral absorption)	Significant plasma and RBC cholinesterase inhibition at 0.22 to 0.3 mg/kg/day	Weight of Evidence from 5 studies: 2 year dog, 90 day dog, 2 year rat, 90 day rat, DNT (at 2 weeks)	100	1000 (infants, children and females 13-50) 100 (all other subpopulations)

NOAEL = No Observed Adverse Effect Level
RBC = red blood cell
UF = Uncertainty Factor
PAD = Population Adjusted Dose (includes UF and FQPA safety factor)
(a) For comparison with absorbed biomonitoring data, use dermal NOAEL of 0.15 mg/kg/day * 0.03 dermal absorption factor

The Agency has evaluated a 6-week dietary study in dogs designed to assess cholinesterase inhibition (ChEI) in peripheral nervous system (PNS) tissues, such as the heart and leg muscles, as well as measure cholinesterase activity in the blood and brain. The study was conducted by DAS in Michigan to address regulatory requirements in the United Kingdom. This type of study is not required under current EPA guidelines, but the Agency has recommended direct measurement of ChEI in the target peripheral nervous system tissues as a potential alternative to measuring ChEI in the blood only.

This study conducted with beagle dogs was designed to assess for inhibition of red blood cell (RBC), peripheral tissue (brain, nodose ganglion, left atrium, diaphragm and quadriceps muscle) and brain acetylcholinesterase (AChE). A separate report presented a histopathological evaluation of the adrenal gland.

All dogs survived the six week study and there were no clinical signs or effects on body weight or food consumption. There were also no histopathological alterations in the adrenal gland noted in the special assessment of this organ. The results of this study demonstrates that in the dog, RBC AChE is more sensitive than brain or peripheral tissue AchE. Overall, the peripheral tissue data were considered too variable and the cohort of dogs too small to make a meaningful evaluation of potentially small changes in AChE activity in these structures. There were, however, sufficient data to *imply* that peripheral tissue was not demonstrated to be inhibited by chlorpyrifos. No *definite* conclusions that chlorpyrifos inhibits peripheral tissue AChE can be drawn from the data with the four peripheral tissue preparations. The peripheral tissue aspects of the study cannot be upgraded due to the small number of animals assessed and the variability of the data.

If another study was conducted that addressed the study deficiencies and limitations as described in the data evaluation record and found to be acceptable, the following observations could be made on the potential impact of these data on the chlorpyrifos risk assessment. Because the study would be a repeat dose over a 6 week period, it could be used in a weight-of-evidence approach to inform the selection of short and intermediate term endpoints for the chlorpyrifos worker risk assessment. Taking into account the established dermal absorption rate of rate of 3%, this study would yield MOEs 3-6 times greater than those currently shown in EPA's assessment. At a minimum, if the data are reliable, they could increase the confidence that EPA's current assessment does not underestimate worker risk.

The Agency uses the results of acute toxicity studies to determine early entry PPE and other labeling requirements. Acute toxicity values and categories for the technical grade of chlorpyrifos are summarized in Table 9. Chlorpyrifos is moderately toxic following acute oral, dermal and inhalation exposures, and is classified in toxicity category II for all three routes of exposure for rats.

Table 9. Acute Toxicity Profile for Occupational Exposure for Chlorpyrifos

Study	MRID Number	Results	Toxicity Category
Acute Oral LD_{50} - rat	44209101	223 mg/kg M&F	II
Acute Dermal LD_{50} - rat	Accession No. 112115	202 mg/kg	II
Acute Dermal LD_{50} - rabbit	44209102	>5000 mg/kg	IV
Acute Inhalation LC_{50} - rat	00146507 and Acc.No. 257590	LC_{50} > 0.2 mg/L (200 mg/m^3) (nominal concentration)	II
Eye Irritation - rabbit	44209103	slight irritation resolved within 24 hours	IV
Dermal Irritation - rabbit	44209104	mild irritant; (irritation resolved within 7 days)	IV
Dermal Sensitization - guinea pig	44209105	non-sensitizing	NA
Acute Delayed Neurotoxicity - hens	00097144 00405106	not neurotoxic at 50, 100 or 110 mg/kg	NA

NA = Not Applicable

b. Occupational Exposure and Risk

1) Occupational Handler Exposure

Several chemical-specific handler exposure studies conducted and submitted by the technical registrants measured the exposures to professional pesticide applicators during application of chlorpyrifos products. These data include biological monitoring of urinary TCP, the primary metabolite of chlorpyrifos, and passive dosimetry data. In the absence of chemical-specific data, the Pesticide Handlers Exposure Database (PHED) Version 1.1 was used to assess potential exposures resulting from handling and applying chlorpyrifos. The exposure factors (e.g., body weight, amount treated per day, protection factors, etc.) are all standard values that are used by the Agency, and the PHED unit exposure values are the best available estimates of exposure. Nevertheless, it should be noted that some aspects of the included studies (e.g., duration, acres treated, pounds of active ingredient handled) may not accurately represent labeled uses in all cases. Further details on the data used for the assessments are discussed in the *Human Health Risk Assessment for Chlorpyrifos*, June 8, 2000, which is available in the public docket and on the internet at www.epa.gov/pesticides/op.

Anticipated use patterns and application methods, range of application rates, and daily amount treated were derived from current labeling and other available information. Application rates specified on chlorpyrifos labels range from 0.25 to 8 pounds of active ingredient per acre.

The Agency typically uses acres treated per day values that are thought to represent a typical work day for specific types of application equipment.

Occupational handler exposure assessments are conducted by the Agency using different levels of personal protective equipment (PPE). The Agency typically evaluates all exposures in a step-wise fashion, first assuming minimal protection and then incrementally adding protective measures until the target MOE is reached. For agricultural handlers, the estimated exposures considered PPE (a double layer of clothing and gloves and/or a dust/mist respirator), and engineering controls (closed mixing/loading systems and enclosed cabs/trucks).

The Agency identified 31 major occupational handler scenarios for which there were potential exposures during mixing, loading, and applying products containing chlorpyrifos to agricultural crops and ornamentals (22 scenarios) and to non-agricultural use sites (9 scenarios) such as sodfarms, golf courses and mosquito adulticide treatment. These scenarios reflect a broad range of application equipment, application methods and use sites. For agricultural uses, handler activities include open and closed mixing/loading, and aerial, tractor-drawn and handheld application. The application rates used in the assessment are intended to reflect the upper range of rates on the labels. In some instances, the rates also include values that registrants indicated were "typical" (e.g., a variety of sod farm rates, corn, citrus, greenhouse, and nursery rates).

The scenarios were classified as short-term (1 to 30 days) and intermediate-term (1 to 6 months). The handler scenarios for agricultural and golf course uses are expected to be of short-term duration only; the scenarios for mosquitocide use are short- and intermediate-term; and the scenario for pre-termiticide treatment is long-term (>6 months).

2) Occupational Handler Risk

Agricultural and Ornamental/Greenhouse Handler Risk

Combined dermal and inhalation margins of exposure for agricultural, ornamental and greenhouse handlers range from 8 to 10,890. The following exposure scenarios (by number as presented in Table 10) result in MOEs below 100 with engineering controls (or with PPE where engineering controls are not feasible) and thus are of concern:

(1a) Mixing/loading liquids for aerial/chemigation application at 1.5 lbs. ai/A
(1b) Mixing/loading liquids for groundboom application at 5 lbs. ai/A
(2a) Mixing wettable powder for aerial/chemigation application at 2 and 3.5 lbs. ai/A
(2b) Mixing wettable powder for groundboom application at 3 lbs. ai/A
(4a) Aerial application of spray in enclosed cockpit at 2 lbs. ai/A
(4b) Aerial application of granular in enclosed cockpit at 1.95 lbs. ai/A
(12) Application by backpack sprayer at 0.08 and 0.16 ai/gal, and at 3.5 lbs. ai/A

(14) Application by high-pressure handwand at 0.0033 and 0.0066 lbs. ai/gal
(15) Application by hydraulic hand-held sprayer for bark beetle treatment at 3.5 lbs. ai/A and at 0.08 lbs. ai/gal

Seed treatment, pre-plant peach dip and dry bulk fertilizer impregnation were not assessed due to a lack of appropriate data.

Table 10. Occupational Risk Estimates for Agricultural and Ornamental Uses of Chlorpyrifos

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre) (a)	Daily Acres Treated (b)	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
Mixer/Loader Exposure								
Mixing/Loading Liquids for Aerial/Chemigation Application (1a)	1.5 cranberries, corn	350	39	56	23	78	160	52
	3.5 citrus (c)	100	59	83	34	120	240	78
Mixing/Loading Liquids for Groundboom Application (1b)	1.5 predominant max	80	170	240	100	Target MOE reached at PPE		
	5.0 tobacco max (d)	80	51	73	30	100	210	69
	2 Sodfarm (includes tobacco/potatoes)	80	130	180	75	250	530	170
	4 Sodfarm (e)	80	64	91	38	130	260	86
	8.0 sodfarm fire ants	10	260	360	150	Target MOE reached at PPE		
Mixing/Loading Liquids for Airblast Application (1c)	2.0 predominant max such as Fruits & Nuts	40	260	360	150	Target MOE reached at PPE		
	6.0 citrus	20	170	240	100	Target MOE reached at PPE		
Mixing WP for Aerial/Chemigation Application (2a)	2.0 predominant max (orchards)	350	DAS is not supporting the open bag formulation for the WP			51	42	23
	3.5 citrus (c)	100				100	83	46
Mixing WP for Groundboom Application (2b)	1.0 predominant max (brassica)	80				450	360	200
	4.0 soil treatment ornamentals outdoors	10				890	730	400
	1.3 & 3.0 Sodfarm	80				340 / 150	280 / 120	150 / 67
	8.0 sodfarm fire ants (harvest only)	10				4500	3600	200

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre) (a)	Daily Acres Treated (b)	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
Mixing WP for Airblast Application (2c)	2.0 predominant max	40				450	360	200
	6.0 citrus	20				300	240	130
Loading Granulars for Aerial Application (3a)	1.95 maximum aerial rate (f)	350	150	30	25	3000	300	270
Loading Granulars for Ground Application (3b)	1.0 typical corn	80	1300	260	210	Target MOE reached at PPE		
	2.0 max corn	80	640	130	110	Target MOE reached at PPE		
	3.0 maximum ground rate (tobacco)	80	430	86	71	8600	860	780
Applicator Exposure								
Aerial (Spray) -- Enclosed Cockpit (4a)	2.0 orchards	350	No Open cockpit data available			100	150	60
	3.5 citrus (c)	100				200	290	120
Aerial (Granulars) -- Enclosed Cockpit (4b)	1.95 (f)	350	No Open cockpit data available			320	8	8
Groundboom Tractor (5)	1.5 predominant max	80	The biological monitoring results (Table A4) indicate that open cabs provide insufficient protection . Therefore, only the enclosed cab MOEs are presented.			580	1400	410
	5.0 tobacco max (d)	80				180	410	120
	4 Sodfarms (e)	80				220	510	150
	8.0 sodfarm fire ants	10				880	2000	610
Airblast Applicator (6)	2.0 predominant max	40	The biological monitoring results indicate that open cabs are insufficient.			230	190	110
	6.0 citrus	20				150	130	70
Tractor-Drawn Granular Spreader (7)	1.0 typical corn	80	1000	360	270	Target MOE reached at PPE		
	2.0 max corn	80	520	180	140	Target MOE reached at PPE		

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre) (a)	Daily Acres Treated (b)	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
	3.0 maximum ground rate (tobacco)	80	350	120	90	690	130	110
Seed Treatment (8)	No Data	No Data	No Data			No Data		
Dip Application (Preplant Peaches) (9)	No Data	No Data	No Data			No Data		
Flagger Exposure								
Spray Applications (10)	2.0 predominant max	350	50	140	37	2300	1400	880
	3.5 citrus (c)	100	100	290	74	4500	2900	1800
Granular Applications (11)	1.95	350	320	340	170	Target MOE reached at PPE		
Mixer/Loader/Applicator Exposure								
Backpack Sprayer (12)	0.0417 lb ai/gal predominant max / 0.08 lb ai/gal bark beetle treatment / 0.03 lb ai/gal stump treatment	40 gal/day	130 / 68 / 180	700 / 360 / 970	110 / 58 / 150	Target MOE reached at PPE, except for the higher concentration for the beetle bark treatment		
	3.5 citrus bark	1 A/day	63	330	53	Not feasible		
	0.039 lb ai/gal /750 ft2	1,000 ft2	4200	22000	3500	Target MOE reached at PPE		
Low Pressure Handwand (13)	0.0417 lb ai/gal predominant max / 0.08 lb ai/gal bark beetle treatment / 0.03 lb ai/gal stump treatment	40 gal/day	570 / 300 / 790	700 / 360 / 970	310 / 160 / 440	Target MOE reached at PPE		
	3.5 citrus bark	1 A/day	270	330	150	Target MOE reached at PPE		

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre) (a)	Daily Acres Treated (b)	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
	0.039 lb ai/gal/ 750 ft2 animal prem.	1,000 ft2	18,000	22,000	10,000	Target MOE reached at PPE		
High Pressure Handwand (greenhouse uses) (14)	Min. 0.0033 lb ai/gal	1,000 gal/day	66	88	38	Not feasible		
	Max. 0.0066 lb ai/gal		33	44	19	Not feasible		
Hydraulic Hand-held Sprayer for Bark Treatment (15)	3.5 citrus bark	10	16	100	14	Not feasible		
	0.08 lb ai/gal bark beetle treatment	1,000 gal/day	14 / 7	88 / 44	12 / 6	Not Feasible		
	0.039 lb ai/gal /750 ft2 animal prem	10,000 ft2	2,200	13,000	1,900	Target MOE reached at PPE		
Dry Bulk Fertilizer Impregnation	1.0 lb ai / 200 lb fertilizer / acre	No Data	No Data			No Data		

(a) Application rates are the maximum labeled rates found on EPA Reg. Nos. 62719-38, -221, -245, -34; -79, -72, -166, -220, 34704-66 (Clean Crop Chlorpyrifos 4E -- sodfarm fire ant rate), 499-367 (499-367 is the only greenhouse label identified), and 10350-22 for animal premise treatments. **"Predominant max"** in this table refers to the most **frequently identified maximum** application rate found on the labels for the specific formulation and equipment type. Typical rates are also included to characterize the chlorpyrifos uses. Not all application rates are included for all crops, instead, a cross-section of rates are used to represent the uses of chlorpyrifos.

(b) Daily acres treated are based on EPA's estimates of acreage (or gallonage) that would be reasonably expected to be treated in a single day for each exposure scenario of concern. The sodfarm fire ant rate is restricted on the label for harvest only, therefore, this rate is limited to the amount of sod that may be harvested in a reasonable time frame. Using the limited data available, 10 acres treated per day are assumed to be the upper range.

(c) The application rates on the Lorsban 4E (EPA Reg. No. 62719-220) and 50W (EPA Reg. No. 62719-39 discontinued as of 1995 and sold as -221) labels indicate that for citrus at the 6.0 lb ai/A rate it is necessary to use 100 to 2,400 gallons per acre dilute spray. Therefore, this rate is not expected to be feasible for an aerial applicator. The label language should be clarified so that the 6.0 lb ai/A rate is for ground only. Additionally, citrus orchards are believed to be relatively small plots and 100 acres per day is assumed in the assessment for aerial applications.

(d) The 5.0 lb ai/A rate for mixing/loading or applying liquids by groundboom application on tobacco has been canceled.

(e) The 4.0 lb ai/A rate for mixing/loading or applying liquids by groundboom application to sodfarms has been reduced to 3.0 lb ai/A.

(f) The 1.95 lb ai/A rate for aerial mixing/loading or applying granulars has been reduced to a maximum of 1.0 lb ai/A.

Non-Agricultural Occupational Handlers

The following exposure scenarios (by number as presented in Table 11) result in combined dermal and inhalation MOEs below 100 with label-recommended PPE, and thus are of concern.

(3) Short-term groundboom applicators of liquids on golf courses at 1 lb. ai/A wearing baseline PPE
(5) Short- and intermediate-term applicators of a dust product for control of fire ants
(9) Long-term mixer/loader/applicators of pre-construction termiticide treatments wearing baseline PPE
(13) Intermediate-term aerial applicators and mixer/loaders of mosquito adulticides using engineering controls at 0.023 lbs. ai/A

More detailed information on the non-agricultural occupational assessments can be found in the *Human Health Risk Assessment*, June 8, 2000, in the public docket and on the internet at www.epa.gov/pesticides/op.

Table 11. Risk Estimates for Non-Agricultural Occupational Handlers

Application Scenario	Clothing	Method of Evaluation	MOE			Risk Characterization/ Uncertainties
			Dermal	Inhalation	Total	
(3) Golf Course Use (Dursban Turf Insecticide; EPA Reg. 62719-35) (Short-term)						
Mixer/Loader (Liquid)	LS, LP, gloves	PHED V1.1	418	165	118	Central tendency estimate. Assumes handling product to treat 40 acres at lb ai/acre. The Agency has more confidence in the biomonitoring results than PHED.
Mixer/Loader (Wettable Powder in water soluble bags)	LS, LP, gloves	PHED V1.1	902	803	425	
Groundboom Applicator	LS, LP, no gloves	PHED V1.1	693	264	191	
		Biomonitoring (MRID 42974501)	69		69	
Mix/Load/Apply via Handgun (greens/tees) (Liquid)	LS, LP, gloves	PHED V1.1	209	594	155	Central tendency estimate. Assumes handling product to treat 5 acres at 1 lb ai/acre.
(5) Insecticidal Dust Product (Shaker Can or Bulbous Duster)						
Short-term	LS, LP, gloves	Scientific Literature Study	108 (7.9 g) 4.3 (198 g)	NE	108 (7.9 g) 4.3 (198 g)	Central-tendency short term risk assessments for 7.9 and 198 g ai; High-end intermediate-term risk estimates for 7.9 and 198 g ai (based on size of dust container); inhalation exposure not assessed due to an absence of data.

Application Scenario	Clothing	Method of Evaluation	MOE			Risk Characterization/ Uncertainties
			Dermal	Inhalation	Total	
Intermediate-term			22 (7.9 g) 0.9 (198 g)	NE	22 (7.9 g) 0.9 (198 g)	
(9) Pre-Construction Termiticide Treatment (0.5% chlorpyrifos as Dursban TC) (EPA Reg. 62719-47) (long-term)						
Mixer/Loader/ Applicator (3 hour average exposure)	label-specified PPE: single layer clothes and forearm-length chemically-resistant gloves (forearm length gloves not required by label)	Dosimetry and air monitoring from Registrant Study MRID No. 44589001	61	215	46	Low-end risk estimates for workers that wore double layer of clothing and forearm length gloves not required by the label; Central-tendency risk estimates for workers that wore a single layer of clothing and forearm length gloves; assumes 3 hour exposure, which could underestimate risks to workers exposed > 3 hrs/day, or that use 2% ai to treat utility poles or fences These MOEs have been adjusted to reflect the dilution rate of 0.5% ai for all termiticide products.
	double layer clothes (LS,LP, coveralls, rubber boots, and forearm-length gloves) (forearm-length gloves not required by label)		200	215	104	
(13) Mosquitocide Mixer/Loader/Applicator (PHED V1.1) (Short- and intermediate-term) (Mosquitomist One EPA Reg. 8329-24)						
Mixer/Loader--Aerial	PPE double layer clothes and gloves	PHED V1.1	132 (ST) 26 (IT)	58 (ST&IT)	40 (ST) 18 (IT)	High end risk estimates. Application rate of 0.023 lb ai/acre for 7500 acres
	Engineering Controls (enclosed cockpit) single layer clothes and gloves		260 (ST) 52 (IT)	833(ST&IT)	198 (ST) 49 (IT)	

Application Scenario	Clothing	Method of Evaluation	MOE			Risk Characterization/ Uncertainties
			Dermal	Inhalation	Total	
Mixer/Loader-- Ground-based fogger	PPE, single layer clothes and gloves		1111 (ST) 220 (IT)	663 (ST&IT)	415 (ST) 165 (IT)	High end risk estimates. Application rates of 0.005 and 0.01 lb ai//acre for 3000 acres. Surrogate ground-based fogger exposure data are not available, and therefore, it was necessary to extrapolate from airblast exposure data
	engineering controls (enclosed cab) and single layer clothes and gloves		297 (IT)	4760 (IT)	280 (IT)	
Aerial Applicator	engineering controls (enclosed cockpit) and single layer clothes and no gloves		440 (ST) 89 (IT)	2100 (ST&IT)	364 (ST) 85 (IT)	High end risk estimates. Application rate of 0.023/acre for 7500 acres
Ground-based fogger Applicator	engineering controls (enclosed cab) and single layer clothes and no gloves		671-1353 (ST)	1820-3640 (ST)	490-986 (ST)	High end risk estimates. Application rates of 0.005 and 0.01 lb ai/acre for 3000 acres. Surrogate ground-based fogger exposure data are not available, and therefore, it was necessary to extrapolate from airblast exposure data
			132-275 (IT)	1820-3640 (IT)	123-256 (IT)	

LS=Long sleeves; LP = Long pants; SS = short sleeves; SP = short pants
H20 = water; ST = short-term (1- 30 days); IT = intermediate term (30 days to 6 months) LT = long term (> 6 months)
NE = Not evaluated

3) Occupational Postapplication Exposure

Occupational postapplication exposure occurs when workers enter treated sites. In the agricultural setting, this includes scouts, pruners and harvesters, and may be of short- or intermediate-term duration. In the recreational setting, this includes golf course maintenance workers. Although a golf course maintenance worker may work up to 12 months per year, chlorpyrifos levels on turf will decline fairly rapidly, and so exposures are expected to be of short-term duration only. Postapplication activities are categorized as having low, medium and high potential for dermal contact.

Several chemical-specific postapplication exposure studies were conducted by the technical registrants and submitted to the Agency. These studies included biological monitoring, passive dosimetry and dislodgeable foliar residue (DFR) data. Data were submitted for sugar beets, cotton, sweet corn, almonds, pecans, apples, citrus, cauliflower, and tomatoes.

Specific transfer coefficients were also monitored and submitted for citrus harvesting, citrus tree pruning, cauliflower scouting, and tomato scouting. Transfer coefficients for other crops/activities have been submitted by the Agricultural Reentry Task Force (ARTF). In those scenarios where data have not been submitted, the Agency's standard values for transfer coefficients are used to estimate potential reentry exposure.

Chemical-specific DFR data are not available for many crops that are treated with chlorpyrifos. Therefore, the assessment of exposures for those crops is based on typical postapplication activities associated with representative crops, grouped according to their potential for dermal contact. Table 12 summarizes the crops and activities in terms of potential for dermal contact. Chemical-specific data are available for citrus, cauliflower, tree nuts and tree fruits, and these crops are assessed separately.

4) Occupational Postapplication Risk

For a detailed explanation of the preliminary occupational postapplication risk, refer to the *Agricultural and Occupational Exposure Assessment and Recommendations for the Reregistration Eligibility Decision Document for Chlorpyrifos*, dated June 19, 2000, which is available in the public document. In that preliminary risk assessment, restricted entry intervals (REIs) were calculated using default assumptions for transfer coefficients (Tc). Since that time, new exposure data for some activities have been submitted by the ARTF. The REIs have been recalculated using the new data for particular activities and are shown below in Table 12.

Table 12. Restricted Entry Intervals Based on Data Submitted by ARTF

Crop	Current REI	Proposed REI	Activity	PHI	MOE
Citrus Trees	5 days	5 days	Pruning during wet conditions	21 days	220
Fruit Trees	4 days	4 days	Thinning	28 days	280
Cauliflower	10 days	3 days	Using Tc for scouting, weeding, irrigating or hoeing	21 days	150
Nut Trees	2 days	24 hours	New Tc for pruning or thinning	14 days	270
Potatoes	2 days	24 hours	New Tc for irrigation or scouting	7 days	750
All Other Crops	24 hours	24 hours	Scouting, harvesting	7 days	110

Postapplication risks to golf course workers during mow/maintenance activities are presented in Table 13. The short-term MOEs are above 100 (MOE 110 to 210) and therefore are not of concern. These risk estimates assume contact with golf course turf on the day of treatment.

Table 13. Short-term Postapplication Risks to Workers in Mow/Maintenance Activities after Chlorpyrifos Treatment at 4 lbs. ai/A

Transfer Coefficient	DAT	Short-term MOE
500 cm2/hour	0	210
1000 cm2/hour	0	110

Postapplication risks to greenhouse/nursery workers were not assessed due to a lack of data. Information is needed concerning the timing of the applications in relation to the postapplication activities and a lack of residue data (foliar and bark treatments) to assess the REIs for the ornamental/greenhouse uses. These risks are of concern for activities such as pruning, transplanting and burlap/balling. The National Agricultural Pesticide Impact Assessment Program (NAPIAP 1996) reports chlorpyrifos is widely used for a broad range of insect applications including wood-boring, foliage feeding, sucking and soil-borne pests. NAPIAP (1996) also reports that although chlorpyrifos use represents only 5% of the total lbs. ai used in greenhouse/nursery operations, it is used by 35% of the survey respondents. It is obvious that chlorpyrifos is an important chemical for the industry, especially as a tool for resistance management. With such reliance by an industry, it is important to collect additional use information, greenhouse DFR data, and biological monitoring data to develop transfer coefficients for various greenhouse/nursery activities.

c. Residential Exposure and Risk

1) Residential Handler Exposure and Risk

Containerized baits in child-resistant packaging is the only residential use which may be applied by the homeowner. This use is not expected to result in exposures of concern. For further details, refer to the *Human Health Risk Assessment for Chlorpyrifos*, June 8, 2000, which is available in the public docket and on the internet at www.epa.gov/pesticides/op.

2) Residential Postapplication Exposure

Residential postapplication exposure occurs when people enter a treated golf course or following an application for mosquito control by a public agency. Residential postapplication exposures are expected to be of short-term duration (one day to one month).

Environmental concentrations of chlorpyrifos in homes may also result from spray drift, track-in, or from redistribution of residues brought home on the clothing of farm workers or pesticide applicators. The Agency is currently developing standard methodologies and guidance to evaluate these exposures. Modifications to EPA's assessment will be incorporated as that guidance becomes available.

3) Residential Postapplication Risk

No residential postapplication exposures pose risks of concern. A summary of the risk estimates, method of evaluation, and risk characterization/uncertainties is presented in Table 14. For residential postapplication risk, the target MOE is 1000. For golfers on a course treated at a rate of 1 lb. ai/A, MOEs are1500-2400. Following aerial and ground-based fogger mosquito adulticide use, MOEs are 17,000 and 29,000 for children and adults, respectively.

Table 14. Postapplication Risk Estimates to Residents/Recreational Users

Reentry Scenario	Method of Evaluation	Central-tendency MOE		Risk Characterization/ Uncertainties
		Adult	Child	
(8) Golf Course Treatment (Dursban Turf Insecticide; EPA Reg 62719-35) (1 lb ai/acre) (Short-term)				
Adolescent Golfer (12 yrs; 44kg)	Residential SOPs and surrogate residue data from flurprimidol study the day of treatment	1500 (1 lb ai/acre)		High-end risk estimates. Assumes exclusively dermal exposure the day of turf treatment Assumes a 4 hour exposure for an 18-hole round of golf.
Adult Golfer		2400 (1 lb ai/acre)		
(9) Aerial and Ground-Based Fogger Mosquitocide Application (Mosquitomist One, EPA Reg. 8329-24) (0.01 lb ai/acre) (Short-term)				
Dermal	Literature studies, the AgDrift Model and the updated Residential SOPs	42,000	26,000	High-end risk estimates based on the updated Residential SOPs. Assumes long-term inhalation exposure is negligible based on low application rate and infinite dilution.
Oral (hand to mouth)		NE	13,000	
Oral (Turfgrass Ingestion)		NE	54,000	
Oral (Soil Ingestion)		NE	20,000,000	
Total Exposure		42,000	15,000	

4) Incidents

Prior to implementation of the mitigation established in June 2000, chlorpyrifos was one of the most widely used insecticides in the home both by consumers and PCOs or exterminators. In a 1990 EPA-sponsored survey of pesticide use in households, chlorpyrifos was the fourth most commonly used insecticide, present in 18% of all households. A 1993 EPA survey of PCOs found it was the number one insecticide in use and accounted for a quarter of the poundage used in residential settings. Consequently, there have been many reports of human exposure and poisonings due to the widespread use of chlorpyrifos. The Agency estimates that approximately 98% of chlorpyrifos exposures discussed in the incident reports were associated with products removed as a result of the mitigation contained in the June 8, 2000 agreement. Human and pet poisoning incidents associated with chlorpyrifos exposure are discussed in greater detail in the *Human Health Risk Assessment for Chlorpyrifos*, June 8, 2000, which is available in the public docket and on the internet at www.epa.gov/pesticides/op.

4. Aggregate Risk

An aggregate risk assessment combines risk from dietary exposure (food and drinking water routes) and residential exposure (homeowner handler and postapplication exposures, including incidental oral exposure for toddlers who put grass in their mouths following mosquito adulticide use and exposure to treated golf course turf). As noted previously, this aggregate assessment reflects the mitigation that reduced potential chlorpyrifos exposures from food (elimination of use on tomatoes and limitations on the apple and grape uses) and in the residential/recreational environment. Acute, short-term and chronic aggregate assessments were conducted. For this assessment, the target MOE is 1000. Results of the aggregate risk assessment are summarized in here, and are discussed extensively in the *Human Health Risk Assessment for Chlorpyrifos,* June 8, 2000.

a. Acute Aggregate Risk

The acute aggregate risk assessment for chlorpyrifos addresses exposure from food and drinking water. For the highly refined acute probabilistic dietary exposure analysis, PDP, FDA and NFS monitoring data were used to the greatest extent possible, along with field trial data, and cooking and processing factors to assess dietary exposures. This aggregate assessment incorporates the mitigation measures agreed to in June 2000 (i.e., reduction of apple tolerance to 0.01 ppm to reflect dormant application, reduction of grape tolerance to 0.01 ppm based on domestic use pattern, cancellation of use on tomatoes and revocation of the tolerance on tomatoes).

With the apple, grape and tomato mitigation measures in place, the acute dietary risk estimates range from 4.1% to 82% of the aPAD, with children 1-6 years old being the most highly exposed population subgroup. Thus, the mitigated acute dietary (food only) risk estimate for chlorpyrifos exposure is not of concern. Acute estimated concentrations of chlorpyrifos in groundwater, derived from a conservative screening-level model, range from 0.007 to 0.103 ppb.

The acute surface water EECs, taken from monitoring data, range from 0.026 to 0.4 ppb. As indicated in Table 15 below, the EECs are below the DWLOCs for all populations. Thus acute food and drinking water exposures (except possible well contamination) are not of concern. It should be noted that neither the SCI-GROW model nor the monitoring data reflect concentrations after dilution (from source to treatment to tap) or drinking water treatment.

Table 15. Acute Aggregate Risk from Chlorpyrifos Including Risk Mitigation[a]

Population Subgroup (b)	Acute PAD (μg/kg/day)	Food Exposure 99.9th (μg/kg/day) (c)	Max. Water Exposure (μg/kg/day) (d)	Surface Water EEC (ppb)	Ground Water EEC (ppb)	Acute DWLOC (ppb) (e,f, g)
U.S. Population	5	0.237	4.76	0.026-0.4	0.007-0.103	166
All Infants (< 1 Year)	0.5	0.258	0.242			2.4
Children (1-6 years)	0.5	0.410	0.09			0.9
Females (13-50 years)	0.5	0.201	0.299			9

(a) Reflects mitigation implemented in June 2000 eliminating use on tomatoes and limiting use on grapes and apples.
(b) In addition to the U.S. population (all seasons), the most highly exposed subgroup within each of the infants, children, female groups is listed.
(c) 99.9th percentile exposure. Values are from Table 3 in Human Health Risk Assessment for Chlorpyrifos, June 8, 2000 (and rounded).
(d) Maximum Water Exposure (μg/kg/day) = Acute PAD (μg/kg/day) - [Acute Food Exposure (μg/kg/day)].
(e) DWLOC (μg/L) = Maximum water exposure (μg/kg/day) x body wt (kg) ÷ water consumed daily (L/day)]
(f) Default body weights are: general U.S. population, 70 kg; adult females, 60 kg; and infants/children, 10 kg.
(g) Default daily drinking water rates are 2 L/day for adults and 1 L/day for children.

b. Short-Term Aggregate Risk

The short-term aggregate risk estimate includes chronic dietary (food and water) exposure and short-term non-occupational (i.e., residential/recreational uses) exposures from chlorpyrifos use. As noted previously, this aggregate assessment reflects the mitigation that reduced potential chlorpyrifos exposures from food (apples, grapes and tomatoes) and in the residential/ recreational environment. This assessment evaluates potential exposures to treated golf courses and as a result of mosquitocide treatment by public agencies.

Table 16 presents the aggregate exposure estimates for chlorpyrifos from dietary and residential/non-occupational uses (golfing and mosquito abatement). Children 1-6 years old were assumed to be exposed to residues on turf following ground-based fogger applications of a mosquitocide and food residues. Children 7-12 years were assumed to be dermally exposed to chlorpyrifos residues while playing golf on the day of treatment, and to ingest food residues. Female residents were assumed to be concurrently exposed to turf following mosquito abatement, golfing (dermal contact with turf on the day of treatment), and food residues.

As shown in Table 16, aggregate MOEs are greater than 1000 for all subpopulations and are not of concern. Therefore, short-term DWLOCs were estimated to account for potential drinking water exposures.

Table 16. Short-Term Aggregate Exposure
[Chronic Dietary (Excluding Water) and Short-Term Residential Use]
Including Risk Mitigation[a]

Population Subgroup	Chronic Dietary Exposure	Short-Term Residential/Recreational Exposure (μg/kg/day)/ MOE Including Risk Mitigation			Total Aggregate MOE (c)
		Mosquitocide Exposure		Golf Course Exposure	Dietary & Residential Exposure
	Food (μg/kg BW/day) (b) / MOE	Oral (μg/kg BW/day) / MOE	Dermal (μg/kg BW/day) / MOE	Dermal (μg/kg BW/day) / MOE	Oral and Dermal MOE
Children (1-6 years)	0.008 MOE = 62,500	0.013 MOE = 38,500	0.19 MOE = 26,000	NE	12,000
Children (7-12 years)	0.015 MOE = 33,000	NE	NE	3.4 MOE = 1,500	1,400
Females 13-50	0.006 MOE = 83,000	NE	0.14 (d) MOE= 36,000	2.45 (d) MOE = 2,000	1,900

(a) Reflects mitigation implemented in June 2000 eliminating use on tomatoes and limiting use on grapes and apples.
(b) MOE calculated based on acute oral NOAEL of 500 μg/kg/day, and short-term dermal NOAEL of 5000 μg/kg/day.
(c) Oral and dermal exposures were combined because the oral and dermal endpoints are both based on plasma and RBC ChE inhibition.
(d) Adjusted from 70 kg to 60 kg for aggregate exposure.
NE = Not evaluated.

The short-term DWLOC values are presented in Table 17. The EECs for chronic exposures are below the DWLOCs for all populations. Thus, potential short-term aggregate exposure to chlorpyrifos resulting from food, water, golf course and mosquito abatement exposures are not of concern. This analysis is conservative because the Agency assumed that there could be concurrent residential and recreational exposures to chlorpyrifos (i.e., golfing and mosquito abatement on the same day). In addition, neither SCI-GROW nor the monitoring data reflect concentrations after dilution (from source to treatment to tap) or drinking water treatment.

Table 17. Short-term Aggregate Exposure DWLOCs (Chronic Dietary and Short-Term Residential Use) Including Risk Mitigation[a]

Population Subgroup (b)	Acute Oral NOAEL (μg/kg/day)	ST Food and Residential MOE (b)	Water MOE (c)	Max. Water Exposure (μg/kg/ day) (d)	Surface Water (ppb)	Ground Water (ppb)	ST DWLOC (ppb) (e,f,g)
Children (1-6 years)	500	12,000	1,090	0.4587	0.026	0.007-0.103	4.5
Children (7-12 years)		1,400	3,450	0.14			1.4
Females (13-50 years)		1,900	2,100	0.238			7.1

(a) Reflects mitigation implemented in June 2000 eliminating use on tomatoes and limiting use on grapes and apples.
(b) Values are from Table 16.
(c) MOE_{WATER} = 1 / [(1/MOE_{AGG} - [1/MOE_{FOOD} + 1/MOE_{DERMAL} + 1/MOE_{ORAL}]), where MOE_{AGG} is 1000.
(d) Maximum Water Exposure (μg/kg/day) = Acute NOAEL of 500 (μg/kg/day)÷ MOE_{WATER}
(e) DWLOC (ppb) = Maximum water exposure (μg/kg/day) x body wt (kg) ÷ water consumed daily (L/day)]
(f) EPA default body weights are: adult females, 60 kg; and infants/children, 10 kg.
(g) EPA default daily drinking water rates are 2 L/day for adults and 1 L/day for children.
ST = short-term

c. Intermediate-Term Aggregate Risk

No residential/recreational uses result in exclusively intermediate-term exposures (i.e., greater than 30 days but less than 6 months). Therefore, an intermediate-term aggregate risk assessment was not conducted.

d. Chronic Aggregate Risk

The chronic aggregate risk assessment for chlorpyrifos addresses exposures from food and drinking water. For the highly refined chronic dietary exposure analysis, PDP, FDA and NFS monitoring data were used to the greatest extent possible, along with field trial data, and cooking and processing factors. This aggregate assessment incorporates the mitigation agreed to in June 2000 (limitation of use the use on apples and grapes and deletion of use on tomatoes), and assumes there are no chronic exposures from termiticide treatments, since these uses are being phased down.

The chlorpyrifos chronic dietary (food only) risk estimates range from 2.5 to 51% of the cPAD, with children 1-6 years old being the most highly exposed population subgroup. Thus, the chronic dietary (food) risk from chlorpyrifos exposure is not of concern.

Chronic groundwater EECs, derived from SCI-GROW, range from 0.007 to 0.103 ppb. Chronic surface water EECs, based on monitoring data, are estimated at 0.026 ppb. The chronic

DWLOC values are shown below in Table 18. For all subpopulations, surface and groundwater EECs are below the DWLOCs and therefore are not of concern. These estimates are conservative because neither the SCIGROW model nor the monitoring data reflect actual drinking water concentrations after dilution (from source to tap) or drinking water treatment.

Table 18. Chronic Aggregate Exposure DWLOCs Including Mitigation [(a)]

Population Subgroup (b)	Chronic PAD (μg/kg/day)	Chronic Food Exposure (μg/kg/day)(c)	Max. Water Exposure (μg/kg/day) (d)	Surface Water (ppb)	Ground Water (ppb)	Chronic DWLOC (ppb) (e,f,g)
U.S. Population	0.3	0.008	0.292	0.026	0.007 to 0.103	10
All Infants (< 1 Year)	0.03	0.01	0.02			0.2
Children (1-6 years)	0.03	0.015	0.015			0.15
Females (13-50 years)	0.03	0.006	0.024			0.72

(a) Reflects mitigation implemented in June 2000 eliminating use on tomatoes and limiting use on grapes and apples.
(b) In addition to the U.S. population (all seasons), the most highly exposed subgroup within each of the infants, children, female groups is listed.
(c) Values are from Table 4 from the Human Health Risk Assessment, June 8, 2000 (and rounded).
(d) Maximum Water Exposure (μg/kg/day) = Chronic PAD (μg/kg/day) - [Chronic Food Exposure + Chronic Residential Exposure (μg/kg/day) (if applicable)]. Chronic residential uses were not considered based on mitigation options.
(e) DWLOC (ppb) = Maximum water exposure (μg/kg/day) x body wt (kg) ÷ water consumed daily(L/day)]
(f) HED default body weights are: general U.S. population, 70 kg; adult females, 60 kg; and infants/children, 10 kg.
(g) HED default daily drinking water rates are 2 L/day for adults and 1 L/day for children.

B. Environmental Risk Assessment

A summary of the Agency's environmental risk assessment is presented below. For detailed discussions of all aspects of the environmental risk assessment, see the *Fate and Environmental Risk Assessment*, dated October 1999 and revised March and June 2000, available in the public docket and on the internet at www.epa.gov/pesticides/op.

1. Environmental Fate and Transport

The environmental fate database for chlorpyrifos is largely complete. The major route of dissipation appears to be aerobic and anaerobic metabolism. Abiotic hydrolysis, photodegradation and volatilization do not seem to play significant roles in the dissipation process. Based on available data, chlorpyrifos appears to degrade slowly in soil under both aerobic and anaerobic conditions. Information on leaching and adsorption/desorption indicate that parent chlorpyrifos is largely immobile. The environmental fate of the major chlorpyrifos degradate, TCP, indicates that it is mobile in soils and persistent in soils when not exposed to

light. Available field data indicate that chlorpyrifos has a half-life in the field of less than 60 days, with little or no leaching observed. Because of its low water solubility and high soil binding capacity, there is potential for chlorpyrifos sorbed to soil to run off into surface water via erosion. Chlorpyrifos has been detected in fish tissues. Chlorpyrifos residues in aquatic species may result in dietary exposure for aquatic birds and mammals feeding on aquatic organisms. Chlorpyrifos rapidly depurates from fish when aquatic chlorpyrifos exposures cease.

The degradate TCP appears to be more persistent than chlorpyrifos (substantial amounts remain 365 days after application) and it exhibits much lower soil/water partitioning than chlorpyrifos. Consequently, substantial amounts of TCP are probably available for runoff for longer periods than chlorpyrifos. The relatively low soil/water partitioning of TCP indicates that its concentrations in sediment and water are probably comparable, and that runoff occurs primarily by dissolution in runoff water rather than by adsorption to eroding soil. The low soil/water partitioning of TCP suggests that its bioaccumulation potential is probably low.

Chlorpyrifos can contaminate surface water via spray drift at the time of application or as runoff up to several months after application. Available data indicate that most chlorpyrifos runoff is generally via adsorption to eroding soil rather than by dissolution in runoff water. However, under some conditions, dissolution in runoff water may be significant.

2. Ecological Risks

Risk characterization integrates the results of the exposure and ecotoxicity data to evaluate the likelihood of adverse ecological effects. The means of integrating the results of exposure and ecotoxicity data is called the quotient method. For this method, risk quotients (RQs) are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic.

RQ = Exposure/Toxicity

RQs are then compared to EPA's levels of concern (LOCs). The LOCs are criteria used by OPP to indicate potential risk to nontarget organisms. The criteria indicate that a pesticide used as directed has the potential to cause adverse effects on nontarget organisms.

Ecotoxicity endpoints derived from the results of short-term laboratory studies that assess acute effects are: (1) LC_{50} (fish and birds) (2) LD_{50} (birds and mammals) (3) EC_{50} (aquatic plants and aquatic invertebrates) and (4) EC_{25} (terrestrial plants). Endpoints derived from the results of long-term laboratory studies that assess chronic effects are NOAEL and LOAEL for birds and mammals and NOAEC and LOAEC for fish and aquatic invertebrates.

Risk presumptions along with the corresponding RQs and LOCs are shown below in Table 19.

Table 19. Risk Presumptions for Non-target Organisms

Terrestrial Animals		
Risk Presumption	**RQ**	**LOC**
Acute High Risk	EEC/LC_{50} or LD_{50}/sqft^2 or LD_{50}/day^3	0.5
Acute Restricted Use	EEC/LC_{50} or LD_{50}/sqft^2 or LD_{50}/day (or LD_{50} < 50 mg/kg)	0.2
Acute Endangered Species	EEC/LC_{50} or LD_{50}/sqft^2 or LD_{50}/day	0.1
Chronic Risk	EEC/NOAEL	1
Aquatic Animals		
Acute High Risk	EEC/LC_{50} or EC_{50}	0.5
Acute Restricted Use	EEC/LC_{50} or EC_{50}	0.1
Acute Endangered Species	EEC/LC_{50} or EC_{50}	0.05
Chronic Risk	EEC/NOAEC	1
Terrestrial and Semi-Aquatic Plants		
Acute High Risk	EEC/EC_{25}	1
Acute Endangered Species	EEC/EC_{50} or NOAEC	1
Aquatic Plants		
Acute High Risk	EEC/EC_{50}	1
Acute Endangered Species	EEC/EC_{50} or NOAEC	1

Calculated risk quotients represent a screening level assessment. Risk characterization provides further information on the likelihood of adverse effects occurring by considering the fate of the chemical in the environment, geographic patterns of chemical usage, communities and species potentially at risk, their spatial and temporal distributions and the nature of the effects observed in the studies.

a. Exposure Assumptions

Three types of terrestrial wildlife risk assessments were conducted. For non-granular pesticides, acute and chronic dietary exposures were assessed by comparing estimated environmental concentrations on food items to LC_{50} values. To assess risks from granular products, acute exposures are expressed as LD_{50} per square foot. Acute risk quotients for

granular formulations were calculated by dividing the maximum milligrams of chlorpyrifos exposed on the soil surface per square foot by LD_{50} values of various wildlife species times the animal's body weight.

For non-granular (liquid and dust) pesticides, the estimated environmental concentrations (EECs) were compared with LC_{50} values to assess risk. Maximum EECs were used to derive a conservative estimate of risk to wildlife that may feed on foods with higher than average residues. This risk assessment estimated risks to birds and mammals feeding on short grass or foliage and fruits, seeds, and large and small insects, which provides a range of risk quotients depending on the particular dietary needs of a wildlife species. The assessment assumes that animals would consume only chlorpyrifos- treated food items. Measured residue levels reported in three field studies on corn, citrus and golf courses sprayed with chlorpyrifos support the use of maximum residue levels for risk assessment. In case of soil incorporation following spray applications, it is assumed that soil incorporation reduces the amount of treated vegetation and seeds available to wildlife on the surface, but soil incorporation does not reduce the pesticide concentration on these food items. Soil incorporation reduces the amount of pesticide available for runoff.

Estimated environmental concentrations in aquatic systems were modeled using GENEEC and PRZM-EXAMS to reflect use on corn, citrus, peanuts, cotton and tobacco. Use patterns for these sites reflect the range of application rates, frequency of application, maximum seasonal limits and application methods for chlorpyrifos. Estimated concentrations derived from the models were used to assess acute and chronic risks to freshwater and estuarine organisms in ponds and estuarine areas, respectively. Concentrations reported in NAWQA and California monitoring data were used to assess risks for some typical flowing waters. Acute risks were assessed using peak EECs. Chronic risk quotients were calculated using an exposure period ranging from 96 hours to 21 days. For greater detail on exposure assumptions, see the *Fate and Environmental Risk Assessment*, revised June 2000.

b. Toxicity

Extensive acute and chronic toxicity data are available for chlorpyrifos. A summary of toxicity values used in terrestrial risk assessments is shown below in Table 20.

Table 20. Summary of Terrestrial Toxicity Values Used In Risk Assessment for Chlorpyrifos

Toxicity Category	Most Sensitive Species	Toxicity Value	Derived Toxicity Values	
			Herbivores and Insectivores	Granivores
Mammalian Acute LD_{50}	Rat	97 mg/kg	15 gr. 102 ppm 35 gr. 147 ppm 1000 gr. 647 ppm	15 gr. 462 ppm 35 gr. 647 ppm 1000 gr. 3233 ppm
Mammalian Dietary LC_{50}	Rat	1330 ppm	N/A	
Mammalian Reproduction NOAEL	Rat	10 ppm	N/A	
Avian Acute LD_{50}	House Sparrow	10 mg/kg	N/A	
Avian Dietary LC_{50}	Mallard Duck	136 ppm	N/A	
Avian Reproductive NOAEL	Mallard Duck	25 ppm	N/A	

Aquatic toxicity studies indicate that chlorpyrifos is moderately to very highly toxic to both fish and aquatic invertebrates. TCP was found to be much less toxic than chlorpyrifos. Aquatic toxicity values for chlorpyrifos are shown below in Table 21.

Table 21. Summary of Aquatic Toxicity Values

Toxicity Category		**Toxicity Value**
Freshwater Fish	Acute LC_{50}	1.8 ppb (bluegill sunfish)
		595 ppb (mosquitofish)
	Reproductive NOAEC	0.57 ppb (fathead minnow)
Estuarine Fish	Acute LC_{50}	0.96 ppb
	Reproductive NOAEC	0.28 ppb (Atlantic silverside)
Freshwater Invertebrate	Acute LC_{50}	0.1 ppb (*Daphnia magna*)

Toxicity Category		Toxicity Value
		50 ppb (stonefly *P. californica*)
	Reproductive NOAEC	0.04 ppb (*Daphnia magna*)
Estuarine Invertebrate	Acute LC_{50}	0.035 ppb (Mysid shrimp)
		2000 ppb (Oyster embryo-larvae)
	Reproductive NOAEC	<0.0046 ppb (Mysid shrimp)
Estuarine Algae	Acute LC_{50}	140-300 ppb (*S. costatum*)

c. Summary of Risks to Nontarget Organisms

The Agency calculated risk quotients for most agricultural and some non-crop uses such as golf courses and perimeter treatments for termites. Risk quotients have been estimated based on maximum use rates and maximum seasonal poundage permitted by the label for both acute and chronic exposures. In addition, typical use rates were assessed for selected major crops. The chronic exposure values for assessing risks to avian and mammalian reproduction have been modified since completion of the *Fate and Environmental Risk Assessment*, June 2000, to reflect mean residue levels on grasses, foliage, seeds and insects. Risk quotients for major use sites are presented in this document. For detailed discussion of these and risk quotients for other uses, see the *Fate and Environmental Risk Assessment*, June 2000, which is available in the public docket and on the internet at www.epa/gov/pesticides/op.

Risk quotients indicate that a single application of chlorpyrifos may pose high risks to small mammals, birds, fish and aquatic invertebrate species for nearly all registered outdoor uses. For multiple applications, EPA assumes that residues are additive and has used minimum retreatment intervals along with calculated half-lives, half-lives for soils, foliage and water. Multiple applications increase the risks to wildlife and prolong exposures to toxic concentrations. In most cases, acute risk quotients exceed 1 for the most sensitive small mammals and birds. All aquatic acute and reproductive risk quotients exceed 1; many aquatic risk quotients exceed 10 and 100; several risk quotients for estuarine invertebrates exceed 1,000. In a few cases at maximum application rates, chlorpyrifos may bioconcentrate in the tissues of fish and aquatic invertebrates to levels that exceed acute LC_{50} values for sensitive bird species and reproductive NOAELs for birds and small mammalian species. Hence bioconcentration of chlorpyrifos in ponds and estuarine areas may pose acute and/or reproductive risks to aquatic birds and mammals feeding adjacent to treated areas.

For aquatic risk assessments, the Agency used the screening-level model GENEEC to predict concentrations of chlorpyrifos in water following a single application. To estimate concentrations on a single site over multiple years, PRZM-EXAMS was used. Peak EECs range from 1 to 37 ppb. These EECs may be considered highly conservative because 1) the EECs generated by both models reflect agricultural uses with the highest application rates of chlorpyrifos, and 2) the EECs represent one in ten-year concentrations in a one-hectare, 2-meter

deep farm pond or other water body with no outlet draining 10 hectares, 100% of which is treated with chlorpyrifos. The aquatic risk quotients derived from these EECs are therefore conservative. In addition, the RQs for estuarine organisms are likely to be even more conservative than those for freshwater organisms. Concentrations in estuarine environments could be expected to be much lower than in a contained pond because of flushing and dispersion as a result of tidal fluctuations. RQs derived from GENEEC may also overestimate aquatic risks for crops with ground cover such as pome fruits and tree nuts.

Endangered species LOCs are exceeded for small mammals, birds, freshwater fish and invertebrates, and estuarine fish and invertebrates for most chlorpyrifos uses. The Fish and Wildlife Service has reviewed the use of 4 EC, 15 G, 50 W and Dursban 10 CR on numerous crops and as a mosquito larvicide. In several opinions, the most recent in 1993, FWS found jeopardy for a few bird and amphibian species, a snake, and many species of fish and aquatic invertebrates, under the conditions of use at the time of the opinion.

The Agency has consulted several times with the Fish and Wildlife Service (FWS) on the potential effects of chlorpyrifos for various uses on endangered and threatened species. To date, the FWS has issued five Biological Opinions. In these Opinions, the FWS found jeopardy for 35 fish species, 33 aquatic invertebrate species, 7 avian species, 4 amphibian species and 13 insect species. An additional 18 fish species, 2 aquatic invertebrate species, 1 avian species and 1 amphibian species were expected to be affected, but not jeopardized. These consultations and the findings expressed in the Opinions, however, are based on old labels and application methods, less refined risk assessment procedures, and an older approach to consultation which is currently being revised through interagency collaboration.

EPA's current assessment of ecological risks uses both more refined methods to define ecological risks of pesticides and new data, such as that for spray drift. Therefore, the Reasonable and Prudent Measures (RPMs) in the Biological Opinion(s) may need to be reassessed and modified based on these new approaches.

The Agency is currently engaged in a Proactive Conservation Review with FWS and the National Marine Fisheries Service under section 7(a)(1) of the Endangered Species Act. The objective of this review is to clarify and develop consistent processes for endangered species risk assessments and consultations. Subsequent to the completion of this process, the Agency will reassess the potential effects of the remaining chlorpyrifos uses to federally listed threatened and endangered species. At that time, the Agency will also consider any regulatory changes recommended in this IRED that are being implemented. Until such time as this analysis is completed, the overall environmental effects mitigation strategy articulated in this document and the County Specific Pamphlets described below, will serve as interim protection measures to reduce the likelihood that endangered and threatened species may be exposed to chlorpyrifos at levels of concern.

1) Risks to Terrestrial Mammals

Risk quotients for both maximum and typical use rates exceed the levels of concern for small mammalian herbivores and insectivores for most crop and non-crop uses of chlorpyrifos. The high risk LOC (0.5) for the mammalian acute oral LD_{50} values is usually exceeded for 15 gram mammals, frequently exceeded for 35 gram mammals and occasionally exceeded for 1000 gram mammals. The high risk LOC (0.5) for mammalian subacute dietary LC_{50} is rarely exceeded, but the restricted use LOC (0.2) is exceeded frequently. The LOC for reproductive effects (1.0) is usually exceeded.

2) Risks to Terrestrial Birds and Reptiles

Risk quotients for both maximum and typical application rates for spray uses usually exceed the levels of concern for high risks (0.5) for subacute LC_{50}s and (1.0) for reproduction NOAEL for avian species. Risk quotients for both maximum and typical application rates for granulars usually exceed the LOC for high acute risk. Several incidents with robins and other bird species reported for lawn and residential perimeter treatments for termites support these risk quotients for birds and reptiles.

Sensitivity of reptiles to pesticides is assumed to be similar or less than for birds, hence the avian risk quotients apply to reptiles as well. Some snake carcasses tested positive for chlorpyrifos in two of the three field studies. The presence of chlorpyrifos in snake carcasses suggests the possibility of secondary toxicity, that is, effects caused by a chemical present in the carcass of an animal eaten by a predator.

3) Risks to Bees and Beneficial Insects

Chlorpyrifos is highly acutely toxic to honey bees and applications would be expected to pose a risk to bees and beneficial insects present in the treated area during application. At present, there is no accepted method to determine risk quotients based on the bee acute contact toxicity data. Results from some field studies confirm predicted risks to bees, which are killed if present during application and for as long as 24 hours after treatment.

4) Risks to Fish and Amphibians

Risk quotients exceed the LOC for high acute (0.5) and chronic (1.0) effects for freshwater and estuarine fish for all uses. Reproductive risks to fish populations are indicated by risk quotients which are greater than 21-day EECs for all uses. Freshwater fish reproductive effects seen in the fathead minnow include reduced survival at 1.09 ppb; for estuarine fish, reproductive effects include reduced survival and body weight at 0.28 ppb. Fish reproductive effects are likely to be greater than indicated by RQ values presented in risk quotient tables for all chlorpyrifos uses. The fathead minnow tested in the full life-cycle study is less sensitive on an acute basis than other species, such as bluegill and trout. Thus the RQs for more sensitive fish would be expected to be greater than for the fathead minnow.

5) Risks to Aquatic Invertebrates

Risk quotients for all uses exceed the acute and chronic LOCs for freshwater and estuarine invertebrates. For 14 major crop uses, eight of the fourteen peak EECs exceed the EC_{50}/LC_{50} values for three of the four freshwater species. In the estuarine/marine invertebrate life cycle toxicity study using mysid shrimp, reproductive effects were seen at 0.0046 ppb, the lowest dose tested. Effects observed were a reduced number of young and reduced mean number of young per female.

6) Risks to Freshwater Organisms in Field Monitoring Studies

In an Iowa corn field study, chlorpyrifos was applied as an emulsifiable concentrate to four fields (4 applications per field, 1.5-3 lbs. ai/A) and as a granular formulation to four fields (3 applications per field, 1-2.6 lbs. ai/A). Chlorpyrifos levels were measured in aquatic areas adjacent to the treated fields. The mean residue level of 66.9 ppb exceeds all predicted EECs. After granular treatment to corn at 2 lbs. ai/A, one water sample had residue level of 1.80 ppb seven days after the tassel broadcast treatment. This concentration is below predicted EECs ranging from 5.5 to 8.6 ppb.

In a California citrus field study, two orange groves were sprayed by airblast, and chlorpyrifos concentrations measured in soil, crop and non-crop foliage, invertebrates and water adjacent to the groves. Modeled EECs were generally comparable to measured concentrations. Measured chlorpyrifos levels in water ranged from 1.041 to 486 ppb, depending upon the application scenario. More detailed information can be found in the *Environmental Fate and Effects Assessment*, June 2000. Dead fish and other aquatic vertebrates were found in ponds adjacent to treated groves on several occasions.

A field study in Florida measured chlorpyrifos levels after two applications to golf course turf at 4 lbs. ai/A, with a 21-day interval between applications. Applications were made using both granular and liquid sprays. For areas treated with the liquid formulation, measured initial mean concentrations in water were <1.0 ppb (non-detect). The predicted Tier I EEC was 14.75 ppb, and the Tier II EEC was 29.03 ppb. For the granular formulation, the measured initial mean concentrations were <1.0 ppb (non-detect) and 0.905 ppb. The predicted Tier I EECs were 13.28 ppb; the Tier II EEC was 25.31 ppb. Thus, measured chlorpyrifos concentrations were below modeled estimates.

Monitoring results from the early 1990s indicate widespread and persistent occurrence of chlorpyrifos in aquatic areas throughout the nation. In a national fish monitoring study approximately 23 percent of the fish nationwide had measurable levels of chlorpyrifos residues (EPA 1992). Chlorpyrifos was detected at levels up to 59 ppb in mussels in coastal California, and in concentrations of 245 ppb in sediments in Massachusetts (NOAA, 1992). The Agency's Storet database reports measurable chlorpyrifos levels in biota in 12 states and in one water sample. It is uncertain whether the chlorpyrifos levels in aquatic organism tissues are sufficient to adversely affect exposed organisms.

Chlorpyrifos was detected in storm water runoff in the San Francisco Bay area in 1994-1995 at levels that exceed the California Department of Fish and Game water quality criterion of 15 ng/L (pptr). Approximately 80 percent of the samples collected from Sacramento and Stockton exceeded the water quality criterion. In the San Francisco Bay area, approximately 75 percent of the samples collected exceeded the water quality criterion. Rainfall samples also collected in the San Francisco area contained chlorpyrifos at levels toxic to *Ceriodaphnia*.

7) Risks to Piscivorous Birds and Mammals from Bioconcentration of Chlorpyrifos in the Food Chain

At high application rates, chlorpyrifos levels in fish and aquatic invertebrates could exceed the avian subacute dietary toxicity value (136 ppm) and reproductive NOAELs for birds (25 ppm) and mammals (10 ppm).

8) Risks to Nontarget Plants

Plant toxicity studies are not currently required for insecticides. However, chlorpyrifos toxicity data are available for one out of five recommended aquatic plant species. Based on toxicity values for three estuarine algal species (only one recommended species), risk quotients for the highest exposures do not exceed any level of concern. However, the EC_{50} for all three algal species were exceeded by measured chlorpyrifos levels in some water samples found in the citrus field study.

3. Risk Characterization of TCP

A full set of acute studies has been submitted using TCP as the test substance. Studies indicate that TCP's acute toxicity ranges from moderately toxic to practically non-toxic. TCP is less acutely toxic than chlorpyrifos, hence risks to fish and wildlife would appear to be reduced as chlorpyrifos degrades.

4. Risk Quotients for Major Use Sites

a. Corn

Corn is the largest use site for chlorpyrifos in terms of pounds of active ingredient applied per year. The Agency estimates that for the years 1987-1999, an average of approximately 5.5 million lbs. ai per year were applied to corn. Based on that usage data, chlorpyrifos was applied to approximately 7% of corn grown in the U.S. A typical application on corn is an at-plant granular treatment at 1.1 lbs. ai/A.

Wildlife utilization of corn fields is high with a broad diversity of avian and mammalian species. Wildlife reported to feed in corn fields include quail, grouse, partridge, pheasant, prairie chicken, ducks, doves, songbirds, red fox, muskrat, opossum, raccoon and deer. Bobwhite quail, pheasant and rabbits also nest and brood young in corn fields.

Applications of spray and granular formulations to corn result in risk quotients which indicate acute risks to small terrestrial mammals, birds and aquatic organisms, except estuarine algae. In a field study evaluating use on corn, forty-four carcasses collected in and around the treated site. Seven carcasses were analyzed for chlorpyrifos and three carcasses were found to contain residues of chlorpyrifos. The field study did not monitor for aquatic effects, but measured chlorpyrifos residues at a mean level of 66.9 ppb adjacent to treated fields.

A comparison of risk quotients for various application scenarios in Table 22 indicates that risks are lowest with the ground application. Approximately 98% of chlorpyrifos use on corn is by ground application. Risk quotients for aquatic species from a ground application are about 28% lower than for a single aerial application at the same application rate. Aquatic risks in shallow ponds (2 meters deep) will be greater than in deeper ponds (3 meters deep); risks are higher in standing waters, marshes and swamps than they are in shallow ponds.

Granular treatments to corn at pre-plant, at plant, at cultivation, whorl and tassel stages indicate high risks to many species from all four treatment scenarios. Risk quotients exceed the high risk LOCs for all wildlife categories, except mammals weighing 1,000 grams.

Table 22. Ranges of Risk Quotients for Chlorpyrifos Use on Corn

Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuar-ine Fish	Estuarine Inverts.
Ground spray, preplant, 1 app.@ 3 lbs. ai/A, 2" soil incorporation	Acute	0.014-7.1	--	1.5	28	2.9	79
	Subacute	0.03-0.54	0.33 – 5.3	--	--	--	--
	Reproduction NOAEL/NOAEC	4.5-26	1.8-19	2.2-3.8	32-54	4.6-7.8	>280 - >470
Ground spray, postemergence/ foliar, 1 app. @ 1.5 lbs. ai/A	Acute	0.007-3.5	--	3.1	55	5.7	160
	Subacute	0.02-0.27	0.17-2.6	--	--	--	--
	Reproduction NOAEL/NOAEC	2.3-13	0.92-5	4.7-8.4	68-120	9.6-17	>590->1000
Aerial spray, postemergence/foliar, 1 app. @ 1.5 lbs. ai/A	Acute	0.007 - 3.5	--	4.3	77	8	220
	Subacute	0.017 - 0.27	0.17 - 2.6	--	--	--	–
	Reproduction NOAEL/NOAEC	2.3 - 36	0.92 - 14	6.7 - 12	95 - 170	14 - 24	> 830 > 1500
Ground spray, postemergence/ foliar, 3 apps. @ 1.5 lbs. ai/A, 14-day intervals	Acute	0.009-4.6	--	13	240	25	690
	Subacute	0.02-0.35	0.22-3.5	--	--	--	--
	Reproduction NOAEL/NOAEC	3-17	1.2-6.7	21-38	290-540	42-77	>2500->4700

Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuar-ine Fish	Estuarine Inverts.
Aerial spray, postemergence/ foliar, 11 apps. @ 1 lb. ai/A, 3-day intervals	Acute	0.017-8.8	--	19	340	35	970
	Subacute	0.04-0.68	0.41-6.6	--	--	--	--
	Reproduction NOAEL/NOAEC	5.6-90	2.2-36	42-49	590 - 700	85-100	>5200 >6100
Granular, ground broadcast, preplant, 1 app. @ 1.1 lbs. ai/A, 4" soil incorporation (typical rate, modeled on Iowa soil)	Acute	0.018 - 1.1	6.1	0.54	9.8	1.0	28
	Reproduction NOAEL/NOAEC	--	–	0.77 - 1.4	11 - 19	1.6 - 2.8	>95 >167
Granular, ground broadcast, preplant, 1 app. @ 1.1 lbs. ai/A, 4" soil incorporation (typical rate, modeled on Mississippi soil)	Acute	0.018 - 1.1	6.1	1.5	27	2.8	77
	Reproduction NOAEL/NOAEC	--	–	2.3 - 3.9	32 - 55	4.6 - 7.9	>280 >480
Granular, ground broadcast, preplant, 1 app. @ 2 lbs. ai/A, 4" soil incorporation	Acute	0.032-2.1	11	0.92	17	1.7	47
	Reproduction NOAEL/NOAEC	NA[2]	--	1.4-2.5	20-36	2.9-5.1	>180 >310
Granular, at-plant, 7" band or T-band, 1 app. @ 1.8 oz/1000 row feet, 1" soil incorporation	Acute	0.13-8.5	46	3.7	66	6.9	190
	Reproduction NOAEL/NOAEC	--	–	5.9-10	84-140	12-21	>730 >1300
Granular, postemergence aerial broadcast, 2 apps. @ 0.975 ai/A, 14-day intervals, 50% interception by plant	Acute	0.05-3.3	18	3.5	64	6.6	180
	Reproduction NOAEL/NOAEC	--	–	5.4-9.6	78-140	11-20	>670 >1200

b. Cover Crops

Risk quotients for alfalfa, clover and grass grown for seed, mint and wheat are summarized in Table 23. Chlorpyrifos applications to these crops are largely limited to liquid formulations. Runoff from foliar applications to cover crops is expected to be lower than to crops grown on plowed or bare ground. The GENEEC and PRZM3-EXAMS Models estimate EECs for row crops, but data on runoff are unavailable to model EECs for vegetative ground cover. The degree to which ground cover reduces runoff and yields lower EECs is unknown.

Hence, the aquatic risk quotients in the following tables for these cover crops are higher than would actually be anticipated

Alfalfa is the major use site in this group. Alfalfa fields are heavily utilized by a diversity of avian and mammalian species. Ring-necked pheasants, grouses, partridges, quail, sandhill crane, ducks, geese, mourning dove, songbirds, rabbits, groundhogs, muskrats, deer and elk feed in alfalfa fields to a moderate to high degree. Many of the avian species also nest in alfalfa fields.

Table 23. Ranges of Risk Quotients for Chlorpyrifos Use on Cover Crops (Alfalfa, Clover and Grass Grown for Seed, Mint, Wheat)

Crop and Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuar-ine Fish	Estuarine Inverts.
Alfalfa, granular, at-plant, in-furrow, 1 app. @ 1 lb. ai/A, 4" soil incorporation	Acute	0.016-1.1	5.7	3.5	8.3	0.86	24
	Reproduction NOAEL/NOAEC	–	--	0.7-1.3	10-18	1.4-2.6	>87 >160
Alfalfa, aerial spray, postemergent/ foliar, 4 apps. @ 1 lb. ai/A, 42-day interval	Acute	0.005-2.4	--	10	180	19	510
	Subacute	0.011-0.18	0.11-1.8	--	--	--	--
	Reproduction NOAEL/NOAEC	1.5-8.5	0.6-3.4	15-28	220-400	31-57	>1900 >3500
Alfalfa, aerial spray, postemergence/ foliar, 1 app. @ 0.7 lbs. ai/A	Acute	0.003-1.6	--	2	36	3.7	100
	Subacute	0.008 - 0.13	0.08-1.2	--	--	--	--
	Reproduction NOAEL/NOAEC	1.1-6	0.42-2.4	3-5.5	52-78	6.1-11	>370 >680
Clover grown for seed, ground spray, preplant and foliar, 2 apps. @ 2 lbs. ai/A, 14-day interval	Acute	0.012-5.9	--	8.3	150	16	430
	Subacute	0.25 - 0.45	2.5-4.4	--	--	--	--
	Reproduction NOAEL/NOAEC	8.8 - 21	3.6 - 8.5	13-23	180-320	26-46	>1600 >2800
Grass grown for seed, aerial spray, foliar, 3 apps. @ 1 lb. ai/A, 7-day intervals	Acute	0.008-4.1	--	9.4	170	18	490
	Subacute	0.18-0.32	1.7-3.1	--	--	--	--
	Reproduction NOAEL/NOAEC	6.2 - 15	2.4 - 6	14-26	200-380	29-54	>1700 >3300

Crop and Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuar-ine Fish	Estuarine Inverts.
Mint, ground spray, foliar, 1 app. @ 2 lbs. ai/A	Acute	0.009-4.7	--	4.1	74	7.7	210
	Subacute	0.023-0.36	0.22-3.5	--	--	--	--
	Reproduction NOAEL/NOAEC	3-17	1.2-6.7	6.5 -11	93-160	13-23	>810 >1400
Wheat, aerial spray, foliar, 2 apps. @ 0.5 lb. ai/A, 7-day interval	Acute	0.004-1.8	--	3.1	55	5.7	160
	Subacute	0.01-0.14	0.096-1.3	--	--	--	--
	Reproduction NOAEL/NOAEC	1.3-6.4	0.52-2.6	4.6-8.6	65-120	9.3-18	>570 >1100
Winter wheat, aerial spray, foliar, 1 app. @ 0.47 lb. ai/A (typical)	Acute	0.002-1.1	--	1.3	24	2.5	69
	Subacute	0.005 - 0.085	0.05-0.83	--	--	--	--
	Reproduction NOAEL/NOAEC	0.18 - 3.9	0.07 - 1.6	2-3.7	28-53	4-7.6	>240 >460

c. Peanuts

Risk quotients for use on peanuts are shown in Table 24. About 1.5 percent of total chlorpyrifos poundage is used on peanuts and is applied to 10-15 percent of the approximately 1,600,000 acres of peanuts in the U.S. The granular formulation is the primary treatment on peanuts. The Agency estimates that the typical use rate is 1.1 granular applications at an average of 1.8 lbs ai/A on approximately 160,000 to 240,000 acres. The leading states using chlorpyrifos in decreasing order of poundage are Georgia, North Carolina, Virginia and Alabama. The registrant has agreed to eliminate the granular aerial spraying of peanuts. Therefore, the risk to wildlife from the aerial spraying of granulars will be eliminated.

Wildlife utilization of peanut fields is relatively high with a fair diversity of avian and mammalian species. Wildlife reported to feed with moderate to high frequency in peanuts fields include bobwhite quail, doves, songbirds, waterfowl, wild turkey, rabbits, squirrels, raccoons, opossum, and deer. Bobwhite quail is the only species specifically listed as nesting in peanut fields.

Table 24. Range of Risk Quotients for Chlorpyrifos Use on Peanuts

Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuar-ine Fish	Estuarine Inverts.
Ground spray, preplant, 1 app. @ 2 lbs. ai/A, 4" soil incorporation	Acute	0.009-4.7	--	1.4	24	2.5	70
	Subacute	0.023-0.36	0.22-3.5	--	--	--	--
	Reproduction NOAEL/NOAEC	3-17	1.2-6.7	2.2-3.8	31-54	4.4-7.8	>270 >470
Granular, 6" band, at-plant, 1 app. @ 2.25 oz ai/1000 ft, 4" soil incorp. (typical)	Acute	0.2-13	68	1.4	25	2.6	71
	Reproduction NOAEL/NOAEC	–	–	2.2-3.8	32-54	4.5-7.8	>270 >470
Granular, aerial broadcast, early pegging, 1 app. @ 1.95 lbs ai/A	Acute	0.21-13	71	0.92	17	1.7	47
	Reproduction NOAEL/NOAEC	–	–	1.5-2.5	21-36	3-5.1	>180 >320
Spray (preplant, 4" incorporation) followed by granular (early pegging, aerial broadcast), 2 apps. @ 2 lbs. ai/A, 40-day interval	Acute	NA[1]	NA	5.2	94	9.8	270
	Reproduction NOAEL/NOAEC	NA	NA	7.5-13	110-180	15-26	>930 >1600

[1] The Agency currently has no methodology for assessing risks from a combination of spray and granular formulations for terrestrial organisms. Therefore, only aquatic risks were assessed for this scenario.

d. Cotton

Risk quotients for use on cotton are shown in Table 25. The major chlorpyrifos use pattern on cotton is six foliar spray applications per season. The Agency estimates that about 3.2 percent of the total chlorpyrifos use is applied to up to 6 percent of the approximately 12,400,000 acres of cotton in the U.S. The typical average chlorpyrifos usage on cotton is 1.7 applications at 0.6 lbs ai/A on approximately 640,000 to 800,000 acres. The leading states using about 84 percent of the chlorpyrifos applied to cotton in decreasing order of poundage are Arizona, Mississippi, and California, Texas, and Louisiana.

Wildlife utilization of cotton fields is low to moderate. Wildlife that feed in cotton fields include quail, pheasant, doves, songbirds, rabbits, raccoon, and deer with a low to high degree of use. Bobwhite quail, pheasant (brood-rearing), and rabbits also nest and brood young in cotton fields.

Table 25. Range of Risk Quotients for Chlorpyrifos Use on Cotton

Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuarine Fish	Estuarine Inverts.
Aerial spray, foliar, 6 apps. @ 1 lb. ai/A, 3-day intervals	Acute	0.015-7.6	--	15	270	28	780
	Subacute	0.036-0.58	0.36-5.7	--	--	--	--
	Reproduction NOAEL/NOAEC	4.9-28	1.9-11	30-40	340-570	62-82	>3800 >5000
Aerial spray, foliar, 1 app. @ 0.6 lb. ai/A	Acute	0.002-1.2	--	0.77	14	1.5	40
	Subacute	0.007 - 0.09	0.055-0.89	--	--	--	--
	Reproduction NOAEL/NOAEC	0.75-4.2	0.3-1.7	1.1-1.9	15-28	2.1-3.9	>130 >240

e. Citrus

Risk quotients for use on citrus are shown in Table 26. Citrus use represents about 3 percent of the total chlorpyrifos poundage. Chlorpyrifos is applied to oranges on about 60 percent of the total US acreage; grapefruit on about 12-16 percent or approximately 23,000 to 32,000 acres; lemons on about 30-43 percent or approximately 19,000 to 27,000 acres; and other citrus (including kumquats, limes, tangelos and tangerines) on about 16-32 percent of the total US acreage or about 8,000 to 16,000 acres. Maximum and typical risks for chlorpyrifos on citrus are assessed only for applications to oranges, because oranges represent the highest use rate and largest acreage of any citrus crop.

Wildlife utilization of citrus groves ranges from low to high for a diversity of avian and mammalian species (Gusey and Maturgo 1973). Mammals reported to feed moderately in citrus groves include raccoons and deer. Mourning doves, pheasants and 13 species of birds are listed as nesting in citrus groves. During the California orange field study in which two airblast applications were made, between 188 to 561 birds were observed in orange groves. Wildlife carcasses with chlorpyrifos residues found in the field study included a mockingbird, ground squirrel, pocket gopher and a western rattlesnake.

Table 26. Range of Risk Quotients for Chlorpyrifos Use on Citrus

Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuarine Fish	Estuarine Inverts.
Airblast spray, foliar, 2 apps. @3.5 lbs. ai/A, 30-day interval, 5% spray drift	Acute	0.017-8.7	--	21	370	39	1100
	Subacute	0.041-0.66	0.4-6.5	--	--	--	--
	Reproduction NOAEL/NOAEC	5.5-88	2.2-35	33-54	470-770	67-110	>4100 >6700
Ground spray or sprinkler irrigation, 10 apps. @ 1 lb ai/A, 7-day interval	Acute	0.08-2.6	--	19	340	35	970
	Subacute	0.02-0.2	0.22-2	--	--	--	--
	Reproduction NOAEL/NOAEC	3-27	1.2-11	30-53	420-750	61-110	>3700 >6500
Airblast spray, foliar, 1 app. @ 6 lbs. ai/A, 5% spray drift	Acute	0.028-14	--	17	310	32	880
	Subacute	--	0.66-11	--	--	--	--
	Reproduction NOAEL/NOAEC	0-140	3.6-58	27-48	390-690	56-99	>3400 >6000

f. Golf Course Turf

Risk quotients for use on golf course turf are shown in Table 27. The volume of chlorpyrifos applied nationally on golf course turf and typical use rates have not been reported. Comparison of risk quotients for spray and granular applications on golf course turf at the same use rates suggest that the granular formulation is more acutely toxic to birds, mammals and other terrestrial species, while the spray formulation is only slightly more toxic to aquatic species. It is important to note that the risk quotients shown in Table 27 are based on application at the rate of 4 lbs. ai/A. Mitigation agreed to in June 2000 reduced the maximum application rate on golf course turf to 1 lb. ai/A. Therefore, actual RQs will be considerably lower than those shown below.

Table 27. Range of Risk Quotients for Chlorpyrifos Use on Golf Course Turf(a)

Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuarine Fish	Estuarine Inverts.
Ground spray, 2 apps. @ 4 lbs. ai/A, 30-day interval	Acute	0.097-9.9	--	16	290	30	830
	Subacute	0.43-0.76	4.2-7.4	--	--	--	--
	Reproduction NOAEL/NOAEC	57-100	23-58	26-456	370-640	52-91	>3200 >5500

Application Method	Exposure Scenario	Mammals	Birds	Fresh-water Fish	Aquatic Inverts.	Estuarine Fish	Estuarine Inverts.
Granular, soil broadcast, 2 apps. @ 4 lbs. ai/A, 30-day interval	Acute	0.43-28	--	14	250	26	720
	Subacute	--	150	--	--	--	--
	Reproduction NOAEL/NOAEC	NA	--	22-39	320-550	46-79	>2800 >4800

(a) Mitigation agreed to in June, 2000, reduced the maximum application rate to golf course turf to 1 lb. ai/A. Therefore, actual RQs will be considerably lower than those shown.

Risk quotients for use on other, minor crops can be found in the *Environmental Fate and Effects Assessment*, June 8, 2000, located in the public docket and on the internet at www.epa.gov/pesticides/op.

5. Incidents

Bird kills involving mallard ducklings, geese, other waterfowl, robins and a bluebird have been reported for chlorpyrifos, most of which occurred following golf course and lawn treatments. These incidents were reported between 1974 and 1992. In some cases, carcass analysis detected more than one pesticide per carcass. Determination of the presence of chlorpyrifos in an animal or carcass only indicates that the animal was exposed.

Aquatic mortality incidents have also been reported, most of which were related to perimeter applications around residences. Incidents were reported between 1975 and 1992.

The preceding assessment indicates potential risks of concern to nontarget species. However, it should be noted that some mitigation measures implemented as a result of the June 2000 agreement are not reflected in the assessment. For example, all outdoor residential uses and most outdoor non-residential uses have been eliminated. The few remaining outdoor uses, golf courses, road medians and industrial plant sites are now limited to 1 lb. ai/A (reduced from 4 lbs. ai/A). These measures are expected to result in significant reductions in the levels of chlorpyrifos in surface water, particularly in urban areas.

To address ecological risk from the agricultural uses of chlorpyrifos, additional measures including rate reductions, aquatic buffer zones, seasonal limits and increased intervals between applications will be needed. These are outlined in the following section.

IV. Interim Risk Management and Reregistration Decision

A. Determination of Interim Reregistration Eligibility

Section 4(g)(2)(A) of FIFRA calls for the Agency to determine, after submissions of relevant data concerning an active ingredient, whether products containing the active ingredient are eligible for reregistration. The Agency has previously identified and required the submission of the generic (i.e., active ingredient specific) data required to support reregistration of products containing the active ingredient chlorpyrifos.

The Agency has completed its assessment of the occupational and ecological risks associated with the use of chlorpyrifos, as well as a chlorpyrifos-specific dietary risk assessment that has not considered the cumulative effects of organophosphates as a class. Based on a review of these data and public comments on the Agency's assessments for the active ingredient chlorpyrifos, EPA has sufficient information on the human health and ecological effects of chlorpyrifos to make interim decisions as part of the tolerance reassessment process under FFDCA and reregistration under FIFRA, as amended by FQPA. Taking into account both risks and benefits, the Agency has determined that, with the exception of open-pour dust formulations for fire ant control, products containing chlorpyrifos uses are eligible for reregistration provided that: (i) current data gaps and additional data needs are addressed; (ii) the risk reduction measures outlined in this document as well as those in the Memorandum of Agreement of June 2000 are adopted, and label amendments are made to reflect these measures; and (iii) cumulative risks considered the organophosphates support a final reregistration eligibility decision. Label changes are described in Section IV. Appendix B identifies the generic data requirements that the Agency reviewed as part of its interim determination of reregistration eligibility of chlorpyrifos products, and lists the submitted studies that the Agency found acceptable.

Although the Agency has not yet considered cumulative risks of the organophosphates, the Agency is issuing this interim assessment now in order to identify risk reduction measures that are necessary to support the continued use of chlorpyrifos. Based on its current evaluation of chlorpyrifos alone, the Agency has determined that chlorpyrifos products, unless labeled and used as specified in this document, would present risks inconsistent with FIFRA. Accordingly, should a registrant fail to implement appropriate risk mitigation measures, the Agency will take regulatory action to address the risk concerns from use of chlorpyrifos.

At the time that a cumulative assessment is conducted, the Agency will address any outstanding risk concerns. For chlorpyrifos, if all changes outlined in this document are incorporated into the labels, risks will be mitigated to acceptable levels taking into account the benefits of chlorpyrifos use where appropriate. But, because this is an interim RED, the Agency may take further actions, if warranted, to finalize the reregistration eligibility decision for chlorpyrifos products after assessing the cumulative risk of the organophosphate class. Such an incremental approach to the reregistration process is consistent with the Agency's goal of improving the transparency of the reregistration and tolerance reassessment processes. By

evaluating each organophosphate in turn and identifying appropriate risk reduction measures, the Agency is addressing the risks from the organophosphates in as timely a manner as possible.

Because the Agency has not yet considered cumulative risks for the organophosphates, this reregistration eligibility decision does not fully satisfy the reassessment of the existing chlorpyrifos food residue tolerances as called for by FQPA. When the Agency has considered cumulative risks, chlorpyrifos tolerances will be reassessed in that light. At that time, the Agency will reassess chlorpyrifos along with the other organophosphate pesticides to complete the FQPA requirements and make a final reregistration eligibility determination. By publishing this interim decision on reregistration eligibility and requesting mitigation measures now for the individual chemical chlorpyrifos, the Agency is not deferring or postponing FQPA requirements; rather, EPA is taking steps to assure that uses which EPA has already determined exceed FIFRA's unreasonable risk standard do not remain on the label, pending completion of assessment required under the FQPA. This decision does not preclude the Agency from making further FQPA determinations and tolerance-related rulemakings that may be required on this pesticide or any other in the future.

If the Agency determines, before finalization of the RED, that any of the determinations described in this interim RED are no longer appropriate, the Agency will pursue appropriate action, including but not limited to, reconsideration of any portion of this interim RED.

B. Regulatory Position

1. FQPA Assessment

a. "Risk Cup" Determination

As part of the FQPA tolerance reassessment process, EPA assessed the risks associated with this organophosphate. The assessment is for this individual organophosphate, and does not attempt to fully reassess these tolerances as required under FQPA. FQPA requires the Agency to evaluate food tolerances on the basis of cumulative risk from substances sharing a common mechanism of toxicity, such as the toxicity expressed by the organophosphates through a common biochemical interaction with the cholinesterase enzyme. The Agency will evaluate the cumulative risk posed by the entire class of organophosphates once the methodology is developed and the policy concerning cumulative assessments is resolved.

EPA has determined that risk from exposure to chlorpyrifos is within its own "risk cup." In other words, if chlorpyrifos did not share a common mechanism of toxicity with other chemicals, EPA would be able to conclude today that the tolerances for chlorpyrifos meet the FQPA safety standards. In reaching this determination EPA has considered the available information on the special sensitivity of infants and children, as well as the chronic and acute food exposure. An aggregate assessment was conducted for exposures through food, residential uses and drinking water. Results of this aggregate assessment indicate that the human health risks from these combined exposures are considered to be within acceptable levels; that is,

combined risks from all exposures to chlorpyrifos "fit" within the individual risk cup. Therefore, except for tolerances that will be revoked as indicated in Tables 28 and 29, the chlorpyrifos tolerances remain in effect and unchanged until cumulative risks from all organophosphates are considered.

b. Tolerance Summary

In the individual assessment, established tolerances for residues of chlorpyrifos in/on raw agricultural, animal, and processed food/feed commodities [40 CFR §180.241] are presently expressed in terms of either the combined residues of chlorpyrifos and its metabolite 3,5,6-trichloro-2-pyridinol (TCP) or as chlorpyrifos *per se*. The Agency has determined that residues of TCP are not of concern for dietary risk and can therefore be excluded from the tolerance expression. The tolerance levels should be amended to reflect residues of chlorpyrifos *per se*. Based on the Agency's decision to change the tolerance expression, the tolerances listed in 40 CFR need to be reorganized as shown in Table 28. A summary of the tolerances is included in Table 29.

Table 28. Reorganization of Tolerances for Chlorpyrifos

	Current Tolerance	**Tolerance Reassessment***	
40 CFR	**Expression [Restrictions]**	**40 CFR**	**Tolerance Expression [Restrictions]**
§180.342 (a)(1)	Chlorpyrifos and TCP.	§180.342 (a)(1)	Chlorpyrifos per se.
§180.342 (a)(2)	Chlorpyrifos per se.	§180.342 (a)(1)	Transfer all tolerances under this section to §180.342 (a)(1) at their respective proposed levels.
§180.342(a)(3)	[Provisions on safe use of chlorpyrifos on food-handling establishments].	§180.342(a)(2)	Conditions for safe use of chlorpyrifos on food-handling establishments. Redesignate as §180.342(a)(2).
§180.342(a)(4)	Chlorpyrifos per se (tolerances established in food items [other than those already covered by a higher tolerance as a result of use on growing crops] in food-service establishments, as result of the application of microencapsulated form.	§180.342(a)(3)	Chlorpyrifos per se. Redesignate as §180.342(a)(3).
§180.342 (c)(1)	Chlorpyrifos and TCP [For regional registrations].	§180.342 (c)	Chlorpyrifos per se [For regional registrations].
§180.342 (c)(2)	Chlorpyrifos per se [For regional registrations].		Delete §180.342 (c)(2) section since all tolerances under this section are to be revoked (no registered uses).

* The term "reassessed" here is not meant to imply that the tolerance has been reassessed as required by FQPA, since this tolerance may be reassessed only upon completion of the cumulative risk assessment of all organophosphates, as required by this law. Rather, it provides a tolerance level for this single chemical, if no cumulative assessment was required, that is supported by all of the submitted residue data.

Table 29. Tolerance Summary for Chlorpyrifos.

Commodity	Current Tolerance (ppm)	Tolerance Reassessment* (ppm)	[*Correct Commodity Definition*]/ Comments
Tolerances Listed Under 40 CFR §180.342(a)(1)			
Alfalfa, forage	3	3	
Alfalfa, hay	13	13	
Almonds	0.2	0.2	[*Almond*].
Almonds, hulls	12.0	12.0	[*Almond, hulls*].
Apple, pomace, wet	None	0.02	[*Apple, wet pomace*] Proposed tolerance (0.01 ppm) and average concentration factor (2.1).
Apples	1.5	0.01	[*Apple*].The registrant has submitted a rebuttal to the modification of this tolerance. This rebuttal is under review.
Aspirated grain fractions	None	TBD	[*Grain, aspirated grain fractions*]. A 0.5 ppm tolerance was recommended for corn aspirated grain fractions based on a concentration factor of ~10x in the <420 μ dust fraction (see CBRS No. 11372, D188151, S. Knizner, 8/26/93). Additional data are required for sorghum, soybean, and wheat aspirated grain fractions before a tolerance for aspirated grain fractions can be established (see "Aspirated Grain Fractions (Grain Dust): A Tolerance Perspective", E.Saito and E.Zager, 6/7/94.
Bananas, whole	0.1	0.1	
Bananas, pulp with peel removed	0.01	0.01	
Bean, forage	0.7	Revoke	Not a feed item Table 1 (OPPTS 860.1000)
Beans, lima	0.05	Reassign	Covered by legume vegetables group.
Beans, lima, forage	1.0	Revoke	Not a food/feed item.
Beans, snap	0.05	Reassign	Covered by legume vegetables group.
Beans, snap, forage	1.0	Revoke	Not a food/feed item.
Beets, sugar, molasses	15.0	15.0	[*Beet, sugar, molasses*].
Beets, sugar, pulp (dried)	5.0	5.0	[*Beet, sugar, dried pulp*].
Beets, sugar, roots	1.0	1.0	[*Beet, sugar, roots*].
Beets, sugar, tops	8.0	8.0	[*Beet, sugar, tops*].
Blueberries	2 (1) [a]	Revoke	No registered uses exist.
Broccoli	1	Reassign	Covered by *Vegetable, Brassica, leafy, group.*
Brussels sprouts	1	Reassign	Covered by *Vegetable, Brassica, leafy, group.*
Cabbage	1	Reassign	Covered by *Vegetable, Brassica, leafy, group.*
Caneberries	1.0	Revoke	No registered uses exist.
Cattle, fat	0.3	0.3	
Cattle, meat and meat byproducts	0.05	0.05	[*Cattle, meat*]
	0.05	0.05	[*Cattle, meat byproducts*]

Commodity	Current Tolerance (ppm)	Tolerance Reassessment* (ppm)	[*Correct Commodity Definition*]/ Comments
Cauliflower	1	Reassign	Covered by *Vegetable, Brassica, leafy, group.*
Cherries	1	TBD	[*Cherries, sweet*] Additional data and/or label revisions are required.
		TBD	[*Cherries, tart*] Additional data and/or label revisions are required.
Chinese cabbage	1	Reassign	Covered by *Vegetable, Brassica, leafy, group.*
Citrus fruits	1.0	1.0	[*Fruit, citrus, group*].
Citrus oil	25.0	20	
Citrus pulp, dried	5.0	5.0	[*Citrus, dried pulp*].
Clover, forage	None	TBD	
Clover, hay	None	TBD	
Corn, fresh (inc. sweet K-CWHR)	0.1	0.05	[*Corn, sweet , kernel plus cob with husks removed*].
Corn, field, grain	0.05	0.05	
Corn, forage	8	8	[*Corn, field, forage*]
	8	8	[*Corn, sweet, forage*]
Corn, fodder	8	8	[*Corn, field, stover*]
	8	8	[*Corn, sweet, stover*]
Corn oil	3.0	0.25	[*Corn, field, refined oil*]/ Recommended tolerance based on a average concentration factor of 3.3x (see CBRS No. 11372, D188151, S. Knizner, 8/26/93).
Cotton, gin byproducts	None	TBD	
Cottonseed	0.2	0.2	[*Cotton, undelinted seed*]
Cranberries	1.0	1.0	[*Cranberry*]
Cucumbers	0.05	0.05	[*Cucumber*]
Eggs	0.01	0.01	[*Egg*]
Figs	0.01	0.01	[*Fig*]
Filbert	None	0.2	[*Filbert*] Use previously covered under tree nuts.
Goats, fat	0.2	0.2	[*Goat, fat*]
Goats, meat and meat byproducts	0.05	0.05	[*Goat, meat*]
	0.05	0.05	[*Goat, meat byproducts*]
Grass, forage	None	TBD	
Grass, hay	None	TBD	
Grass, seed screenings	None	TBD	
Hogs, fat	0.2	0.2	[Hog, fat]
Hogs, meat	0.05	0.05	[Hog, meat]
	0.05	0.05	[Hog, meat byproducts]

Commodity	Current Tolerance (ppm)	Tolerance Reassessment* (ppm)	[*Correct Commodity Definition*]/ Comments
Horses, fat	0.25	0.25	[Horse, fat]
Horses, meat	0.25	0.25	[Horse, meat]
	0.25	0.25	[Horse, meat byproducts]
Kiwifruit	2.0	2.0	
Legume vegetables, succulent or dried (except soybeans)	0.05	0.05	[*Vegetable, legume, group*]
Lettuce	None	1	Recommended tolerance from PP#4F03132.
Macadamia nut	None	0.2	Use previously covered under tree nuts.
Milk, fat	0.25	0.25	[*Milk fat (reflecting 0.01 ppm in whole milk)*]/ Recommended tolerance from PP#3F2884.
Milk, whole	0.01	Reassign	Covered by tolerance from milk fat (reflecting 0.01 ppm in whole milk).
Mint, hay	0.8	0.8	[*Peppermint, tops*]
		0.8	[*Spearmint, tops*]
Mushrooms	0.1	Revoke	No registered uses exist.
Nectarines	0.05	Revoke	[*Nectarine*]
Onions (dry bulb)	0.5	0.5	[*Onion, dry bulb)*].
Pea forage	0.7	Revoke	Not a feed item (Table 1, OPPTS 860.1000)
Peaches	0.05	0.05	[*Peach*]
Peanuts	0.2	0.2	[*Peanut, nutmeat]*.
Pears	0.05	0.05	
Plums (fresh prunes)	0.05	0.05	[*Plums*]
Pecan	None	0.2	Use previously covered under tree nuts.
Peppers	1.0	1.0	[*Pepper*] Chlorpyrifos labels from foreign countries that import peppers to the U.S. are required.
Poultry, meat, fat, and meat byproducts (inc. turkeys)	0.1	0.1	[*Poultry,fat*]
		0.1	[*Poultry, meat*]
		0.1	[*Poultry, meat byproducts*]
Pumpkins	0.05	0.05	[*Pumpkin*]
Radishes	2	2	[*Radish*]
Rutabagas	0.5	0.5	[*Rutabaga, root*]
Seed and pod vegetables	0.1	Revoke	Uses of chlorpyrifos on dill and okra, for which this obsolete crop group was supposed to cover, have been deleted.
Sheep, fat	0.2	0.2	
Sheep, meat and meat byproducts	0.05	0.05	[*Sheep, meat*]
		0.05	[*Sheep, meat byproducts*]
Soybean grain	0.3	0.3	[*Soybean, seed*].

Commodity	Current Tolerance (ppm)	Tolerance Reassessment* (ppm)	[*Correct Commodity Definition*]/ Comments
Soybean forage	0.7	Revoke	Feeding may be restricted on the label.
Sorghum, fodder	6.0	2.0	[*Sorghum, grain, stover*]. Recommended tolerance from PP#4F3008/FAP#1H5295.
Sorghum, forage	1.5	0.5	[*Sorghum, grain, forage*].
Sorghum, grain	0.75	0.5	[*Sorghum, grain, grain*].
Sorghum milling fractions	1.5	Revoke	According to Table 1, OPPTS Test Guidelines 860, August 1996, sorghum flour is used exclusively in the US as a component for drywall, not as either a human or animal feed item.
Strawberries	0.2	0.2	[*Strawberry*].
Sugarcane	0.01	Revoke	No registered uses exist.
Sunflower, seeds	0.25	0.1	[*Sunflower, seed*]. Recommended tolerance from PP#4F3008/FAP#1H5295.
Sweet potatoes	0.05	0.05	[*Sweet potato, root*].
Tomatoes	0.5	Revoke	The registrant has submitted a rebuttal to the modification of this tolerance. This rebuttal is under review.
Tree nuts	0.2	Reassign	Individual tolerances exist for almond and walnut, and are being established for filbert, pecan, and macadamia nut.
Turnip greens	0.3	0.3	[*Turnip, tops*].
Turnips	1	1	[*Turnip, root*].
Vegetables, leafy, *Brassica* (cole)	2.0 (1.0) [a]	1.0	[*Vegetable, Brassica, leafy, group*].
Walnuts	0.2	0.2	[*Walnut*].
Wheat, forage	3	3	
Wheat, grain	0.5	0.5	
Wheat, hay	None	TBD	
Wheat, straw	6	6	
Tolerances Listed Under 40 CFR §180.342(a)(2)			
Milling fractions (except flour) of wheat	1.5	Reassign	Wheat tolerance for wheat (0.5 ppm) will cover processed milling fractions under the revised procedures for the determination of need for food additive tolerances.
Mint oil	8	8	[Peppermint, oil]
		8	[Spearmint, oil]
Peanut oil	0.4	0.2	[*Peanut, refined oil*] Revised procedures for calculating food additive tolerance values. (HAFT (0.11) x average processing factor (1.7)).
Tolerances Listed Under 40 CFR §180.342(c)(1)			
Asparagus	5.0	5.0	

Commodity	Current Tolerance (ppm)	Tolerance Reassessment* (ppm)	[*Correct Commodity Definition*]/ Comments
Dates	0.5 (0.3) [a]	Revoke	[*Date*] No registered uses exist.
Grapes	0.5	0.01	[*Grape*] Tolerance based on currently registered US use pattern. The registrant has submitted a rebuttal to the modification of this tolerance. This rebuttal is under review.
Leeks	0.5 (0.2) [a]	Revoke	[*Leek*] No registered uses exist.
Tolerances Listed Under 40 CFR §180.342(c)(2)			
Cherimoya	0.05	Revoke	No registered uses exist.
Feijoa (pineapple guava)	0.05	Revoke	No registered uses exist.
Sapote	0.05	Revoke	No registered uses exist.

* The term "reassessed" here is not meant to imply that the tolerance has been reassessed as required by FQPA, since this tolerance may be reassessed only upon completion of the cumulative risk assessment of all organophosphates, as required by this law. Rather, it provides a tolerance level for this single chemical, if no cumulative assessment was required, that is supported by all of the submitted residue data.

The Agency will commence proceedings to modify the existing tolerances, and correct commodity definitions. The revocation of a tolerance, establishment of a new tolerance, or the raising or lowering of tolerances will be deferred until submitted data are reviewed.

c. Codex Harmonization

Residue data used to establish U.S. tolerances were examined to determine if U.S. tolerance levels could be adjusted to harmonize with Codex Maximum Residue Limits (MRLs). Whenever possible, tolerance levels were changed to achieve harmonization.

Several maximum residue limits (MRLs) for chlorpyrifos have been established by Codex in various commodities as shown below in Table 30. The Codex MRLs (expressed in terms of chlorpyrifos *per se*) and the U.S. tolerance expression will be compatible when TCP is deleted from the U.S. tolerance expressions.

Compatibility between the U.S. tolerances and Codex MRLs exists for cabbage, Chinese; kale [Brassica (cole) leafy vegetables group]; kiwifruits; milks; and poultry meat. Further harmonization of U.S. tolerances and Codex MRLs on other commodities are not feasible at this time. U.S. tolerances are based on domestic use patterns supported by domestic field trial data. Codex MRLs may differ from U.S. tolerances because of different use patterns in foreign countries.

Table 30. Codex MRLs and Applicable U.S. Tolerances

Commodity	MRL (mg/kg) [a]	U.S. Tolerance (ppm) [b]	Recommendation/ Comments
Apple	1	0.01	--
Cabbages, head	0.05 [c]	1	--
Carrot	0.5	None	--
Cattle meat	2 (fat)	0.05	--
Cauliflower	0.05 [c]	1	--
Celery	0.05 [c]	None	--
Chicken meat	0.1 (fat)	0.1	Compatibility exists.
Chinese cabbage, type "Pe-tsai"	1	1	Compatibility exists.
Citrus fruits	0.3	1.0	--
Common bean (pods and/or immature seeds)	0.2	0.05 (Legume vegetables group, except soybeans)	--
Cottonseed	0.05 [c]	0.2	--
Cotton seed oil, crude	0.05 [c]	None	--
Dried grapes	2	0.5	Recommend increase to 1.0.
Eggplant	0.2	None	--
Eggs	0.05 [c]	0.01	--
Grapes	1	0.01	
Kale	1	1 (Brassica (cole) leafy vegetables group)	Compatibility exists.
Kiwifruit	2	2.0	Compatibility exists.
Lettuce, head	0.1	1 (proposed)	--
Milk	0.01 [c]	0.01	Compatibility exists.
Mushrooms	0.05 [c]	Revoke	No registered US use.
Onion, bulb	0.05 [c]	0.5	--
Pear	0.5	0.05	--
Peppers	0.5	1.0	--
Potato	0.05 [c]	None	--
Raspberries, red, black	0.2	1.0 (caneberries)	--
Rice	0.1	None	--
Sheep meat	0.2 (fat)	0.05	--
Tomato	0.5	Revoke	under review
Turkey meat	0.2 (fat)	0.1 (poultry meat, including turkeys)	--

[a] All chlorpyrifos MRLs are final (CXL).
[b] Based on chlorpyrifos *per se*.
[c] At or about the limit of detection.

d. 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 such endocrine effects as the Administrator may designate." Following the recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), EPA determined that there were scientific bases 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 the appropriate screening and/or testing protocols being considered under the Agency's EDSP have been developed, chlorpyrifos may be subjected to additional screening and/or testing to better characterize effects related to endocrine disruption.

e. Labels

Provided the following risk mitigation measures are incorporated in their entirety into labels for chlorpyrifos-containing products, the Agency finds that, with the exception of the dust formulation for fire ant control, all currently registered uses of chlorpyrifos are eligible for reregistration, pending consideration of cumulative risks of the organophosphates. The regulatory rationale for each of the mitigation measures outlined below is discussed immediately after this list of mitigation measures.

Dietary Risk

Neither acute nor chronic dietary (food and drinking water) risks are of concern. This conclusion reflects measures agreed to in the Memorandum of Agreement of June 2000 eliminating use on tomatoes and limiting use on grapes and apples. No further mitigation is necessary at this time.

Occupational Risk

In order for chlorpyrifos products (except for the dust formulation for fire ant control) to be eligible for reregistration, a combination of reduced application rates and seasonal maximum limits, increased retreatment intervals, increased PPE and/or use of engineering controls to address occupational handler risks are needed. In addition, increased REIs for a number of crops will address postapplication risks to workers. Taking into account all feasible mitigation, several worker scenarios are still below the target MOE of 100. In such cases, and in accordance with

PR Notice 2000-9, EPA further characterizes the risk by looking at the strengths and weaknesses of the data and assumptions used in the risk assessment and evaluates the benefits of a chemical's use. The worker scenarios are discussed further below.

Residential Risk

No mitigation is necessary at this time. All products for homeowner use except ant and roach baits in child-resistant packaging have been canceled. Professional termiticide treatment products are being phased out, with all use for termite control prohibited by December 31, 2005.

Ecological Risk

Risks to terrestrial and aquatic organisms are of concern for all outdoor uses of chlorpyrifos. To address these risks, reductions in application rates, the number of applications per season and the maximum amount that may be applied per acre per season and increased intervals between applications will be needed. In addition, no-spray buffer zones will be applied to protect water bodies, further mitigating aquatic risks. Taking into account mitigation, some aquatic risk quotients still exceed levels of concern, particularly for estuarine invertebrates. EPA has considered benefits of chlorpyrifos use on the major crops contributing to aquatic risk concerns. The Agency will also require submission of water monitoring data to confirm the reduction of chlorpyrifos levels in surface water.

C. Regulatory Rationale

The following is a summary of the rationale for managing risks associated with the current use of chlorpyrifos products. Where labeling revisions are warranted, specific language is set forth in the summary tables of Section V of this document.

1. Benefits

The Agency has considered the benefits of chlorpyrifos use in its determination of eligibility for reregistration as well as appropriate reduction of remaining risks. Since corn, cotton, citrus and alfalfa represent approximately 70% - 80% of the use of chlorpyrifos and thus are the greatest contributors to ecological risk, the Agency has considered the benefits of chlorpyrifos use on these sites.

Corn

Chlorpyrifos use on corn (an estimated 5 ½ to 7 million pounds) accounts for more than half of the total annual use of chlorpyrifos in agriculture. Chlorpyrifos is applied to corn primarily to control corn rootworm (larvae and adults), cutworm and European corn borer. Corn growers considered chlorpyrifos critical for control of these damaging pests. The granular product is primarily incorporated in the soil at the time corn is planted for control of rootworm

larvae. This type of application represents the largest use of chlorpyrifos with approximately 4 to 5 ½ million pounds applied annually. Granular applications have the additional benefit of protecting the corn from cutworm. Foliar applications of granular chlorpyrifos by air are targeted at European corn borer. This method represents a relatively small portion of chlorpyrifos use–approximately 100,000 pounds of active ingredient per year. Approximately 500,000 pounds of the liquid formulation of chlorpyrifos are applied to corn per year. The liquid formulation is generally used as a foliar application, with some at-plant use as well.

The principal alternatives to chlorpyrifos on corn are terbufos (which is currently undergoing reregistration), tefluthrin, fipronil, and a combination product of tebupirimphos and cyfluthrin. The most effective non-chemical alternative for management of corn rootworm is crop rotation, which is practiced on the majority of corn acreage.

Citrus

Approximately 600,000 pounds of chlorpyrifos are applied annually to citrus primarily in California and to a lesser extent in Florida. Chlorpyrifos is the most effective product available for the control of California red scale (CRS). Other insecticides used to control CRS include methidathion, carbaryl, and oil. Chlorpyrifos is preferred due to its effectiveness against CRS and its relatively short residual activity compared to the other available insecticides. Chlorpyrifos' short residual minimizes the impact on beneficial insects such as the *Aphytis* wasp, which is important for late season biological control of CRS populations. The majority of California citrus is grown for the fresh market and for export. Although CRS damage is primarily cosmetic, there is a low threshold for CRS damaged fruit in these markets.

In Florida, Chlorpyrifos is used as an alternative chemical control for managing scale and thrips, and it is used to manage nuisance pests such as fire ants and termites in the grove. The majority of the chlorpyrifos use in Florida is for the control of fire ants. There are currently no alternatives labeled for this use. Fire ant control is critical to allow workers the opportunity to complete orchard production activities, such as harvesting, without the threat of attack by the fire ants.

Cotton

Approximately 700,000 pounds of chlorpyrifos are applied annually to cotton. Liquid chlorpyrifos is used on cotton primarily to control plant bugs in the Mississippi delta area, cotton aphid in Texas and California, silverleaf whitefly in Arizona, pink bollworm in Arizona and beet armyworms in all cotton growing areas. It is considered to be important in resistance management programs for cotton aphid. Alternatives to chlorpyrifos for aphid control include profenofos and carbofuran. Imidacloprid provides early season aphid and plant bug control. Two relatively new insect growth regulators (IGR), pyriproxyfen and buprofizen, have shown good control of silverleaf whitefly.

Alfalfa

Approximately 500,000 lbs. ai of chlorpyrifos are applied annually to alfalfa by both ground (Midwest to Northeast) and air (West) equipment. A single application per year is typical. Alfalfa weevil, Egyptian alfalfa weevil, armyworms (beet and Western yellowstriped) and aphids are the key pests. The principal alternatives to chlorpyrifos are carbofuran, methyl parathion and dimethoate. Pyrethroids are also registered for alfalfa pest management, but do not suppress and control aphids, as well as chlorpyrifos, carbofuran and methyl parathion.

Since corn, cotton, citrus and alfalfa represent 70% - 80% of the chlorpyrifos use, the Agency has considered the benefits of chlorpyrifos use on these sites. Additional benefits information on these and other uses can be found in the public docket and is discussed under specific worker scenarios below in the Occupational Risk Mitigation section. Usage information can also be found at http://pestdata.ncsu.edu/cropprofiles/cropprofiles.cfm.

2. Human Health Risk Mitigation

a. Dietary Mitigation

1) Acute Dietary (Food)

Based on use patterns established before the June 2000 mitigation agreement, acute dietary risk from food alone at the 99.9th percentile for the most highly exposed subpopulation, children 1-6 years old was 355% of the aPAD. The mitigation agreement addressed this risk by reducing or canceling use on three commodities frequently consumed by children: apples, grapes and tomatoes. Post-bloom use on apples was removed from product labels effective December 31, 2000 and the tolerance will lowered to 0.01 ppm. Production of products for use on tomatoes was prohibited effective September 2000, and use of existing products was stopped as of December 31, 2000. The tolerances for tomatoes will be revoked. The tolerance for grapes will be lowered to 0.01 ppm to reflect domestic use patterns. The Agency is coordinating with the FDA to implement these tolerance reductions/revocations. The registrant has submitted a rebuttal to the modification of the tolerances. This rebuttal is under review.

With implementation of these reductions, acute dietary risk from food alone is at 82% of the aPAD for children 1-6 years old, and thus is not of concern. No further mitigation of acute dietary risk is needed at this time.

2) Chronic Dietary (Food)

Prior to implementation of the mitigation for apples, grapes and tomatoes, chronic dietary risk from food alone occupied 81% of the cPAD for children 1-6 years old, the most highly exposed population subgroup, and thus was not of concern. The mitigation further reduced risks

to a range of 2.5% to 51% of the cPAD. No additional mitigation of chronic dietary risk is needed at this time.

3) Drinking Water

Neither acute nor chronic risks from drinking water are of concern for any population subgroup, except in the event of well contamination following termiticide use. Incidents of these types have occurred in the past as a result of the high concentrations required for termiticide use, treatments being applied when wells were in or near the building foundation, and/or when well casings were cracked. Since issuance of PR 96-7 instituting risk reduction measures for termiticides, the number of reported incidents has dropped significantly. For example, the frequency of incidents in 1997 (before PR 96-7) was 28.2 per 100,000 homes; in 1998 (after the notice) the frequency was 8.3 per 100,000 homes.

To address these remaining risks, termiticide products were reclassified to "restricted use." In addition, the application rate for all termiticide products was limited to 0.5% solution effective December 1, 2000. Use and sale of termiticide products will be phased out as follows: formulation of products for post-construction treatment stopped on December 1, 2000, and all sales of whole-house and spot/local treatment products will stop effective December 31, 2001, and December 31, 2002, respectively. Production of products for pre-construction treatment will stop as of December 31, 2004; these products may not be used after December 31, 2005. A provision of the June 2000 agreement allows the technical registrants to submit exposure data by June 2004. If acceptable data demonstrate that pre-construction use does not pose risks of concern to residents, that use may be allowed to continue.

b. Occupational Risk Mitigation

1) Agricultural and Ornamental/Greenhouse Handler Risks

Since the chlorpyrifos occupational assessment was completed, some refinements in methodology have been identified. In calculating occupational handler risks for the preliminary *Human Health Risk Assessment* completed in June 2000, the potential dermal and inhalation doses used to calculate exposures were those identified in the Agency's Series 875 Group A (previously known as Subdivision U).

However, for dermal calculations, the ratio of the body surface area to the body weight has been found to overestimate risk by a factor of 1.1. The ratio is not physiological matched in that the surface area is for an average male, while the body weight is the median for both male and female. Therefore, dermal MOEs from the June 2000 assessment have been adjusted with a reduction factor of 1.1 and are presented in the following table.

In addition, to calculate inhalation risks for handlers, the Agency used a standard breathing rate of 29 L/min for all exposure scenarios. Since that time, the Agency has adopted the breathing rates recommended by NAFTA. The NAFTA inhalation rates and the

corresponding exposure reduction factors are: 8.3 L/min. for sedentary activities (e.g., driving a tractor); exposure reduction factor 3.5; 16.7 L/min. for light activities (e.g., flaggers and mixer/loaders using <50 lb. containers); exposure reduction factor 1.7; and 26.7 L/min. for moderate activities (e.g., loading >50 lb. containers or using handheld equipment in hilly areas); exposure reduction factor 1.1.

Table 31 presents the MOEs for occupational risk taking into account the revised dermal surface area and breathing rate factors.

Table 31. Occupational Risk Estimates for Agricultural Uses of Chlorpyrifos

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre)	Daily Acres Treated	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
Mixer/Loader Exposure								
Mixing/Loading Liquids for Aerial/Chemigation Application (1a)	1.5 cranberries, corn	350	43	95	30	86	272	66
	3.5 citrus	100	65	141	44	132	408	100
Mixing/Loading Liquids for Groundboom Application (1b)	1.5 predominant max	80	187	408	128	Target MOE reached at PPE		
	2 Sodfarm (includes tobacco/ potatoes)	80	143	306	97	275	901	211
	3 Sodfarm	80	88	193	60	278	861	210
	8.0 sodfarm fire ants	10	286	612	195	Target MOE reached at PPE		
Mixing/Loading Liquids for Airblast Application (1c)	2.0 predominant max such as Fruits & Nuts	40	286	612	195	Target MOE reached at PPE		
	6.0 citrus	20	187	408	128	Target MOE reached at PPE		
Mixing WP for Aerial/Chemigation Application (2a)	2.0 predominant max (orchards)	350	DAS is not supporting the open bag formulation for the WP			56	71	31
	3.5 citrus (d)	100				110	141	62
Mixing WP for Groundboom Application (2b)	1.0 predominant max (brassica)	80				495	612	274
	4.0 soil treatment ornamentals outdoors	10				979	1241	547
	1.3 & 3.0 Sodfarm	80				374 / 165	476 / 204	209 / 91
	8.0 sodfarm fire ants (harvest only)	10				495	360	200
Mixing WP for Airblast Application (2c)	2.0 predominant max	40				495	612	274
	6.0 citrus	20				330	408	182
Loading Granulars for Aerial Application (3a)	1.0 maximum aerial rate for corn	350	321	99	75	3300	510	442

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre)	Daily Acres Treated	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
Loading Granulars for Ground Application (3b)	1.0 typical corn	80	1430	442	338	Target MOE reached at PPE		
	2.0 max corn	80	704	221	168	Target MOE reached at PPE		
	3.0 maximum ground rate (tobacco)	80	473	146	112	Target MOE reached at PPE		
Applicator Exposure								
Aerial (Spray) -- Enclosed Cockpit (4a)	2.0 orchards	350	No Open cockpit data available			110	525	91
	3.5 citrus	100				220	1015	181
Aerial (Granulars) -- Enclosed Cockpit (4b)	1.0	350	No Open cockpit data available			686	55	51
Groundboom Tractor (5)	1.5 predominant max	80	The biological monitoring results (Table A4) indicate that open cabs provide insufficient protection. Therefore, only the enclosed cab MOEs are presented.			638	4900	564
	3 Sodfarms	80				302	2231	270
	8.0 sodfarm fire ants	10				968	7000	850
Airblast Applicator (6)	2.0 predominant max	40	The biological monitoring results indicate that open cabs are insufficient.			253	665	183
	6.0 citrus	20				165	455	121
Tractor-Drawn Granular Spreader (7)	1.0 typical corn	80	1100	1260	587	Target MOE reached at PPE		
	2.0 max corn	80	572	630	300	Target MOE reached at PPE		
	3.0 maximum ground rate (tobacco)	80	385	420	201	Target MOE reached at PPE		
Seed Treatment (8)	No Data	No Data	No Data			No Data		
Dip Application (Preplant Peaches) (9)	No Data	No Data	No Data			No Data		
Flagger Exposure								
Spray Applications (10)	2.0 predominant max	350	55	490	49	2530	1540	957
	3.5 citrus (d)	100	110	319	82	4950	3190	1940
Granular Applications (11)	1.95	350	352	374	181	Target MOE reached at PPE		
Mixer/Loader/Applicator Exposure								

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre)	Daily Acres Treated	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
Backpack Sprayer/Bark and Pine Seedling Treatment (12)	0.0417 lb ai/gal predominant max	40 gal/day	143	770	121	Target MOE reached at PPE,		
	0.08 lb ai/gal bark beetle treatment	40 gal/day	75	396	63	Not feasible		
	0.03 lb ai/gal stump treatment	40 gal/day	198	1067	167	Target MOE reached at PPE,		
	0.16 lb ai/gal pine seedling treatment	40 gal/day	37	198	31	Not feasible		
	3.5 citrus bark	1 A/day	69	363	58	Not feasible		
	0.039 lb ai/gal /750 ft2	1000 ft2	4620	24,200	3,879	Target MOE reached at PPE		
Low Pressure Handwand (13)	0.0417 lb ai/gal predominant max	40 gal/day	627	770	346	Target MOE reached at PPE		
	0.08 lb ai/gal bark beetle treatment	40 gal/day	330	396	180	Target MOE reached at PPE		
	0.03 lb ai/gal stump treatment	40 gal/day	869	1067	479	Target MOE reached at PPE		
	3.5 citrus bark	1 A/day	297	363	163	Target MOE reached at PPE		
	0.039 lb ai/gal/ 750 ft2 animal prem.	1000 ft2	19,800	24,200	10,890	Target MOE reached at PPE		
High Pressure Handwand (greenhouse uses) (14)	Min. 0.0033 lb ai/gal	1000 gal/day	73	97	41	Not feasible		
	Max. 0.0066 lb ai/gal		36	48	21	Not feasible		
Hydraulic Hand-held Sprayer for Bark Treatment (15)	3.5 citrus bark	10	18	110	15	Not feasible		
	0.08 lb ai/gal bark beetle treatment	1,000 gal/day	15	97	13	Not Feasible		
	0.039 lb ai/gal /750 ft2 animal prem	10000 ft2	2420	14,300	2070	Target MOE reached at PPE		

Exposure Scenario (Scenario#)	Application Rates (lb ai/acre)	Daily Acres Treated	Short-Term PPE MOEs			Short-Term Eng. Control MOEs		
			Dermal	Inhalation	Total	Dermal	Inhalation	Total
Dry Bulk Fertilizer Impregnation	1.0 lb ai / 200 lb fertilizer / acre	No Data	No Data			No Data		

The following scenarios are not of concern, i.e., MOEs are greater than 100, with PPE consisting of double layers, chemical resistant gloves, chemical resistant shoes plus socks, chemical resistant headgear for overhead exposure, chemical resistant apron when cleaning and mixing or loading and a dust/mist respirator:

(1b) Mixing/loading liquids for groundboom application (except at 3 lbs. ai/A sodfarm use)
(1c) Mixing/loading liquids for airblast application
(3b) Loading granulars for ground application
(7) Tractor drawn granular spreader
(13) Low pressure handwand

The following scenarios have MOEs greater than 100 with appropriate engineering controls:

(2b) Mixing wettable powder for groundboom application (water soluble packaging)
(2c) Mixing wettable powder for airblast application (water soluble packaging)
(4a) Aerial application of spray (enclosed cockpit)

The following occupational risk scenarios are still below the target MOE of 100, even with all feasible PPE or engineering controls.

Mixing/Loading Liquids for Aerial/Chemigation Application

The MOEs for mixing/loading liquids for aerial application (scenario 1a) are 66 and 100 depending on the application rate and the acres treated. The dermal route is driving the total MOE in this scenario (dermal MOEs range from 86 to 132 and the inhalation MOEs range from 272 to 408). Mixer/loaders for aerial application must use mechanical transfer systems for any container greater than 2.5 gallons for transfer of material from container to chemical holding tank. The registrant has agreed to reduce the rate on corn from 1.5 to 1 lb ai/A.

Aerial application is critical to large field crops such as cotton, wheat and sorghum. Ground application is not economically feasible. Approximately 200,000 lbs. ai of chlorpyrifos are applied per year to sorghum for control of greenbugs. Chlorpyrifos is the primary insecticide for foliar applications to wheat and is important for control of Russian wheat aphid, pale western cutworm and grasshoppers. Approximately100,000-150,000 lbs ai per year are applied to wheat.

For chemigation the MOEs will be higher than aerial application because the typical use rates are lower (0.5 to 1 lb ai/A) and the acres treated would typically average 40 to 80 acres. The combination of these lower rates and acres will increase the MOEs above 100.

Mixing/Loading Liquids for Groundboom Application to Sodfarms at 3 lbs. ai/A

The MOE for mixing/loading liquids for groundboom application to sodfarms at the 3 lbs. ai/A rate (scenario 1b) is 60. Currently enclosed mixing/loading is not required for the groundboom application to sodfarms. Dermal exposure contributes the most to the total MOE in this scenario (dermal MOE is 88 and the inhalation MOE is 193). The 3 lb. ai/A rate is used to control mole crickets and is mainly used as a patch application. Therefore, the 80 acres applied in a day is an overestimate for this particular use. The 2 lbs. ai/A rate is critical for the control of chinch bugs and lepidopterus (sod webworms, cutworms and army worms). Current PPE consists of double-layer clothing, chemical resistant gloves, chemical resistant shoes plus socks, chemical resistant headgear for overhead exposure, chemical resistant apron when cleaning and mixing or loading and a dust/mist respirator. Usage data are being required to confirm the acres treated per day for the 3 lbs. ai/A rate on sodfarms to control mole crickets, and will be used to refine risk estimates.

Mixing Wettable Powders for Aerial/Chemigation Application

The MOEs for mixing wettable powders in water soluble packaging (WSP) for aerial or chemigation application (scenario 2a) are 31 and 62, depending on the application rate the worker uses and the acres treated. EPA acknowledges the uncertainties associated with the risk assessment for WSP for aerial or chemigation application. Current WSP data in PHED are of low quality due to a limited number of replicates.

EPA believes the actual exposure from water soluble packaging in aerial/chemigation operations is less than predicted by the limited data in PHED. Confirmatory data will be required for the WSP formulation. These data may be developed in conjunction with the Agricultural Handler Task Force which has been formed between EPA and the industry to generate data to update PHED.

Loading Granulars for Aerial Application

The MOE for loading granulars for aerial application is 75 (scenario 3a). The inhalation route is driving the total MOE in this scenario (dermal MOE is 321 and the inhalation MOE is 99). Currently enclosed loading systems are not required for loading chlorpyrifos granulars for aerial application.

Because of new technology to reduce the dust and exposure from granular pesticides, EPA believes the actual exposure from loading granulars for aerial application is less than predicted by the limited data in PHED. Confirmatory data will be required for loading granulars. These data may be developed in conjunction with the Agricultural Handler Task Force which has been formed between EPA and the registrants to generate data to update PHED.

Aerially Applying Granulars

The MOE for aerially applying granulars is 51 (scenario 4b). The inhalation route is driving the total MOE in this scenario (dermal MOE is 686 and the inhalation MOE is 51). The inhalation data in PHED for this scenario is of low confidence because it lacks the sufficient replicates. The data in PHED for applying granulars is based on smaller acreage being treated. The pilot entered and left the plane after every 17-acre application. For chlorpyrifos where up to 350 acres are treated per day this would result in an overestimate because the pilot would not be entering and leaving the plane after every 17 acres. Information from aerial applicators indicate that entering and leaving the plane 3-4 times during the day is typical

EPA believes the actual exposure from applying granulars for aerial application is less than predicted by the limited data in PHED. Confirmatory data will be required for applying granulars. These data may be developed in conjunction with the Agricultural Handler Task Force which has been formed between EPA and the registrants to generate data to update PHED.

Airblast/Groundboom Application

The MOEs for airblast/groundboom application range from 121 to 850 depending on the application rate and acres treated and with the engineering control of an enclosed cab (scenario 5 and 6). A label statement is needed indicating that airblast applicators must wear double-layer clothing and a dust-mist respirator.

The available biological monitoring data for groundboom application was conducted with baseline PPE (one-layer of clothing) and are of minimal quality due to a low number of replicates. A label statement is needed indicating that groundboom applicators must wear double-layer clothing.

Confirmatory data will be required for groundboom application. These data may be developed in conjunction with the Agricultural Handler Task Force which has been formed between EPA and the registrants to generate data to update PHED.

Backpack Sprayer

Risks to mixer/loader/applicators using a backpack sprayer for bark beetle and pine seedling treatment (scenario 12) are of concern. For bark beetle treatment using 3.5 lbs. ai/A (for citrus bark), the MOE is 58; for other crops at 0.08 lbs. ai/gal, the MOE is 63; and for pine seedling treatment, the MOE is 31. These risk estimates are of low confidence because the data available lacked sufficient replicates to meet Agency guideline requirements.

Dermal exposure contributes most to the total MOE in this scenario. Dermal MOEs range from 37 to 75 while the inhalation MOEs range from 198 to 396. Confirmatory backpack exposure data are required and are being developed by the Forest Service (USDA) to refine

current risk estimates. The Agency has reviewed the study protocol and the study will be initiated in Spring of 2002.

The Forest Service has stated that chlorpyrifos is important in the control of bark beetles or borers and that no suitable alternative exists. Documentation from the Forest Service indicates that 40 gallons per day (as assumed in EPA's assessment) would rarely if ever be used for pine seedlings.

Since the *Human Health Risk Assessment* was conducted, product labels for this use were amended to add protection including double layers, chemical-resistant gloves, footwear and apron (for mixers and loaders). These protective measures will be required unless or until exposure data for this scenario are submitted and demonstrate otherwise.

<u>High Pressure Handwand</u>

Mixer/loader/applicator risks for use of the high-pressure handwand (scenario 14) are of concern, with MOEs of 41 and 21 depending on the application rate. These risk estimates are based on biological monitoring data but are of low confidence due to a lack of information on the types of sprayers and volumes used in the studies. In addition, the data lacked sufficient replicates to meet Agency guideline requirements. Comments from the American Nursery and Landscape Association indicate the EPA's assumption of 1,000 gallons per day of use are extremely unrealistic. Chlorpyrifos is used as a rotational tool to treat small blocks or areas of plant material–only to areas of the greenhouse that have infestation problems. Actual use is likely to be 100 gallons per day or less, and use is intermittent. Usage data are being required to confirm the current use per day. Additional information is required concerning the types of sprayers used. This information will be used to refine risk estimates.

Since the *Human Health Risk Assessment* was conducted, product labels for this use were amended to add protection including double layers, chemical-resistant gloves, footwear and apron (for mixers and loaders). These protective measures will be maintained unless or until exposure data for this scenario are submitted and demonstrate otherwise.

<u>Hydraulic Handheld Sprayer</u>

Risks to mixer/loader/applicators using a hydraulic handheld sprayer (scenario 15) are of concern. For application to citrus bark at 3.5 lbs./gal, the MOE is 15; for other crops at 0.08 lbs./gal, the MOE is 13. These risk estimates are of low confidence because the data lacked sufficient replicates. The driving factor in this assessment is the volume of spray estimated to be applied. Usage data are being required to confirm the actual amount of chlorpyrifos used on a daily and seasonal basis. Preliminary industry estimates report a high end usage of about 500 gallons a day, half of EPA's estimate assumed. Additional information is required concerning the types of sprayers used since EPA's assessment assumed a rights-of-way type sprayer. This information will be used to refine risk estimates. The Forest Service has stated that chlorpyrifos is important in the control of bark beetles or borers and that no suitable alternative exists.

Since the *Human Health Risk Assessment* was conducted, product labels for this use were amended to add protection including double layers, chemical-resistant gloves, footwear and apron (for mixers and loaders). A dust-mist respirator will also be necessary.

Dry Bulk Fertilizer Impregnation

Risks to mixer/loader/applicators for dry bulk fertilizer impregnation could not be assessed due to a lack of exposure data. This use is for the control of fire ants on orchard floors. For this use, dry fertilizer is placed in a closed rotary drum mixer equipped with suitable spraying equipment. Spray nozzles are positioned to provide uniform spray coverage of the tumbling fertilizer with chlorpyrifos.

This use is similar to mixing/loading liquids for groundboom application at the 1 pound rate (scenario 1b) and applying with a tractor drawn granular spreader (scenario 7). The MOEs are above 100 for both of these scenarios. Thus, EPA assumes that PPE for this use should be similar, i.e., double-layer clothing.

Seed Treatment

The Agency has no data at this time to assess the exposure for mixer/loaders and applicators for seed treatment. Seed treatment labels currently specify single-layer clothing, chemical-resistant footwear over socks, chemical-resistant gloves and respirators. The Agency does not anticipate that the exposures for this use with the prescribed PPE will be any greater than for mixer/loaders of wettable powders for groundboom application with engineering controls (MOEs 200-400), and the amount of ai handled per day is likely to be less. Therefore, this use is eligible for reregistration and confirmatory data are required. This protective equipment must be maintained on the labels until/unless exposure data indicate that less PPE is appropriate.

Preplant Peach Dip

The Agency has no specific data at this time to assess the exposure for mixer/loaders and applicators for the preplant peach dip. Labels for the preplant peach dip currently require double-layer clothing, chemical-resistant gloves, chemical-resistant shoes plus socks, protective eyewear, chemical-resistant headgear for overhead exposure, chemical-resistant apron when cleaning equipment and mixing or loading and a respirator. The Agency does not anticipate that exposures for this use will be any greater than for mixer/loaders of liquids for citrus and fruit ground applications (MOEs 100-150) and the amount of ai handled per day is likely to be less. Confirmatory data are required. Therefore, this use is eligible for reregistration and confirmatory data are required. This protective equipment must be maintained on the label until/unless exposure data indicate that less PPE is appropriate.

Flaggers

Risks to flaggers involved in spray applications (scenarios 10 and 11) are of concern with use of PPE, with MOEs of 49 and 82. Information from USDA indicates that human flagging is no longer necessary in modern agriculture. Therefore, a prohibition against human flagging will mitigate these risks with minimum impact on current production practices.

Taking into account the strengths and weaknesses of the risk assessment and the benefits of chlorpyrifos use, EPA has determined that the uses listed above are eligible for reregistration with the designated mitigation and confirmatory data.

2) Agricultural and Ornamental/Greenhouse Postapplication Risks

The results of the short- and intermediate-term postapplication assessments indicate that REIs need to be established. The REIs range from 24 hours for most crops to 5 days for citrus trees. REIs and pre-harvest intervals (PHIs) are needed to ensure that risks are not of concern are shown below in Table 32.

Table 32. Restricted Entry Intervals and Preharvest Intervals

Crop	REI	MOEs	PHI
Cauliflower	3 days	150	21-30 days
Nut trees	24 hours	270	14 days
Potatoes	24 hours	750	7 days
Citrus trees	5 days	220	21 days
Fruit trees	4 days	280	21 days
Sweet corn	24 hours	83	7 days
All other crops	24 hours	110	7 days

In addition to the foliar chlorpyrifos treatments, there are many soil incorporated/directed treatments to field crops and citrus. At this time, there are insufficient exposure and soil residue data to assess the potential risk from soil incorporated/directed uses of chlorpyrifos. However, these treatments are expected to result in less postapplication exposure than the foliar treatments. Confirmatory data for soil directed/incorporated uses are required.

Postapplication risks to greenhouse/nursery workers were not assessed due to a lack of data. Information is needed concerning the timing of the applications in relation to the

postapplication activities and a lack of residue data (foliar and bark treatments) to assess the REIs for the ornamental/greenhouse uses. These risks are of concern for activities such as pruning, transplanting and burlap/balling. The National Agricultural Pesticide Impact Assessment Program (NAPIAP 1996) reports chlorpyrifos is widely used for a broad range of insect applications including wood-boring, foliage feeding, sucking and soil-borne pests. NAPIAP also reports that although chlorpyrifos use represents only 5% of the total lbs. ai used in greenhouse/nursery operations, it is used by 35% of their survey respondents. Chlorpyrifos is an important chemical for the industry, especially as a tool for resistance management. Additional use information, i.e., timing of application relative to postapplication activities, greenhouse DFR data, and biological monitoring data to develop transfer coefficients for various greenhouse/nursery activities are required.

The current REI of 24 hours was established by the MOA of June 2000 and remains in effect until acceptable data indicate that it should be changed.

3) Non-Agricultural Occupational Handler Risks

Risk estimates for the application of a dust product for fire ant control are of concern. With PPE, the short-term MOEs are 4.3 to 108; intermediate-term MOEs are 0.9 to 22. These MOEs are based on one literature study, which did not include inhalation exposure data; therefore, the MOEs are likely to underestimate actual risk. This use is ineligible for reregistration at this time. Since this product is used to control fire ants and may have public health benefits, registrants and other interested parties may provide benefits and usage information and mitigation suggestions during the comment period.

Application by groundboom to golf course turf is of concern. Using baseline PPE, the short-term MOE is 60. A label statement is needed indicating that groundboom applicators must be in fully enclosed cabs or, if not in fully enclosed cabs, applicators must wear double-layer clothing, chemical-resistant footwear and socks, and a dust-mist respirator.

4) Non-Agricultural Occupational Postapplication Risks

Occupational postapplication exposures by commercial operators in the residential setting (termiticide and mosquito adulticide uses) are not expected to occur. For golf course workers, postapplication exposures are not of concern.

c. Residential Risk Mitigation

1) Residential Handler Risk

The only products that can be applied by a resident are the containerized baits in child-resistant packaging. This is not expected to result in exposures of concern. All other residential uses have been canceled.

2) Residential Postapplication Risk

Residential postapplication exposures may occur after termiticide use in residential structures. To mitigate risks from this use, the technical registrants agreed in June 2000 to limit termiticide treatments to 0.5% solution, and cancel all postconstruction uses. Pre-construction use will remain until 2005, unless acceptable exposure data are submitted that show that residential postapplication risks from this use are not a concern.

Chlorpyrifos treatments to processed wood products was maintained in the Memorandum of Agreement of June, 2000. Since that time, it has come to the Agency's attention that some wood products such as window frames and floor joists that are treated are eventually used in homes. Exposure data are required to confirm that this use is not a concern.

3. Environmental Risk Mitigation

The technical registrants have agreed to the following label amendments to address environmental risk concerns. The amendments include the use of buffer zones to protect water quality, fish and wildlife, reductions in application rates, number of applications per season, seasonal maximum amounts applied, and increases in the minimum intervals for retreatment.

The mitigation measures prescribed in this IRED along with mitigation that is already being implemented as a result of the June, 2000, Memorandum of Agreement, will reduce risk to both terrestrial and aquatic species. For example, many of the reported incidents of wildlife mortality associated with chlorpyrifos use were related to residential lawn and termite uses and use on golf courses. The residential uses have been eliminated, the termiticide use is being phased out, and the application rate on golf courses has been reduced from 4 to 1 lb/ai/A. Additionally, no-spray buffers around surface water bodies, as well as rate reductions for agricultural uses will be implemented as a result of this IRED and will further reduce the environmental burden of chlorpyrifos.

Although the magnitude of the risk reduction cannot be precisely quantified, EPA's recalculation of risk quotients, taking into account new use restrictions, indicates that the potential risk to invertebrates, particularly estuarine invertebrates may still be of concern. Risk quotients represent a screening level assessment and are inadequate to predict whether the levels of chlorpyrifos entering estuarine areas are sufficient to affect invertebrate populations or

populations of the larger species that depend on them as a food source. Monitoring for chlorpyrifos in waters that feed into estuaries would provide useful information on the magnitude and frequency of actual residues.

Taking into account the extensive mitigation already underway, additional mitigation to be adopted as a result of this IRED, as well as the benefits of chlorpyrifos use, EPA finds the remaining risk to non-target species is not unreasonable. Because the use of chlorpyrifos will be declining over the next few years as existing stocks of canceled products are exhausted, EPA expects that levels of chlorpyrifos in the environment will also be reduced. In order to confirm that levels of chlorpyrifos in the aquatic environment are declining, EPA is requiring updated usage information and collection of water monitoring data for the areas of greatest remaining chlorpyrifos use.

The following crop-specific mitigation will be needed to address environmental risk concerns:

Alfalfa (liquid formulations)

The maximum number of applications per season will be reduced from 8 to 4.

Citrus (liquid formulations)

The maximum number of applications per season will be limited to 2; the maximum application rate of 6 lbs. ai/A will be limited to five counties in California (Fresno, Tulare, Kern, Kings, and Madera); the minimum interval for retreatment will be 30 days. The 6 lbs. ai/A rate is for ground application only. Sprays must be directed toward the canopy.

Citrus orchard floors (granular formulations)

The maximum number of applications per season will be reduced from 10 to 3; the maximum amount applied per season will be reduced from 10 lbs. ai/A to 3 lbs. ai/A.

Corn, field, sweet and seed (liquid formulations)

The maximum number of applications per season will be limited to 3; the maximum amount applied per season will be reduced from 7.5 lbs. ai/A to 3 lbs. ai/A.

Corn, field, sweet and seed (granular formulations)

The maximum number of applications per season will be limited to 2; the maximum amount applied per season will be limited to 2 lbs. ai/A.

Cotton (liquid formulations)

The maximum number of applications per season will be reduced from 6 to 3; the maximum amount applied per season will be reduced from 6 lbs. ai/A to 3 lbs. ai/A.

Peanuts (granular formulations)

Aerial application will be eliminated.

Sorghum (liquid formulations)

The maximum number of applications per season will be limited to 3; it was previously unspecified.

Soybeans (liquid formulations)

The maximum number of applications per season will be limited to 3; it was previously unspecified.

Sugar beets (liquid formulations)

The maximum number of applications per season will be reduced from 4 to 3; the maximum amount applied per season will be reduced from 4 lbs. ai/A to 3 lbs. ai/A.

Sugar beets (granular formulations)

The maximum number of applications per season, previously unspecified, will be limited to 3; the maximum amount applied per season will be reduced from 13.5 lbs. ai/A to 3 lbs. ai/A.

Sunflowers (liquid formulations)

The maximum number of applications per season, previously unspecified, will be limited to 3; the maximum amount applied per season will be reduced from 4.5 lbs. ai/A to 3 lbs. ai/A.

Tobacco (liquid formulations)

The maximum number of applications per year will be limited to 1; the application rate of 5 lbs. ai/A for root-knot nematodes in North Carolina, South Carolina, and Virginia will be eliminated; the maximum amount applied per season will be reduced from 1.5 lbs. ai/A to 1 lb. ai/A.

Tree nuts (liquid formulations)

The maximum amount applied per season will be reduced from 8 lbs. ai/A to 4 lbs. ai/A.

Walnut and almond orchard floors (liquid formulations):

The maximum amount applied per season will be reduced from 8 lbs. ai/A to 4 lbs. ai/A; the maximum number of applications per season, previously unspecified, will be limited to 2.

All crops

Spray drift warnings and no-spray zones will be included on labels, as shown in Table 33. These no-spray zones will apply to rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries and commercial fish ponds. For more information on spray drift management language, please see section 4. Other Labeling, subsection b. Spray Drift Management.

Table 33. Proposed No-Spray Buffer Zones around Water Bodies

Application Method	Required Setback (No-spray Zone)
Ground Boom	25 feet
Chemigation	25 feet
Orchard Airblast	50 feet
Aerial (fixed-wing or helicopter)	150 feet

Table 34 summarizes the range of risk quotients for major use sites taking into account the mitigation measures outlined above.

Table 34. Risk Quotients for Corn, Citrus, Cotton and Tobacco With Proposed Risk Mitigation

Species	Range of Risk Quotients
Freshwater Fish Acute LC_{50}	2.8 - 11
Fish Reproduction NOAEC	8.9 -36 [1] 5.4 - 46 [2]
Aquatic Invertebrate Acute LC_{50}	51 - 210
Freshwater Invert. Reproduction NOAEC	130 520 [1] 65 - 230 [2]
Estuarine Fish Acute LC_{50}	5.3 - 22
Estuarine Fish Reproduction NOAEC	11 - 74 [1] 9.3 - 20 [2]
Estuarine Invertebrate Acute LC_{50}	110 - 590

Estuarine Invert. Reproduction NOAEC	>1100 [1]
Estuarine Algae EC_{50}	0.036 - 0.15

[1] Peak EECs in 2-meter deep pond or estuarine water
[2] 21-day EECs in 2-meter deep pond or estuarine water

4. Other Labeling

In order to remain eligible for reregistration, other use and safety information needs to be placed on the labeling of all end-use products containing chlorpyrifos. For the specific labeling statements, refer to Section V of this document

a. Endangered Species Statement

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 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 to affect any particular species, EPA puts basic toxicity and exposure data developed for REDs into context for individual listed species and their locations by evaluating important ecological parameters, pesticide use information, the geographic relationship between specific pesticides uses and species locations, and biological requirements and behavioral aspects of the particular species. This analysis will take into consideration any regulatory changes recommended in this RED that are being implemented at that time. A determination that there is a likelihood of potential impact to a listed species may result in limitations on use of the pesticide, other measures to mitigate any potential impact, or consultations with the Fish and Wildlife Service and/or the National Marine Fisheries Service as necessary.

The Endangered Species Protection Program as described in a Federal Register notice (54 FR 27984-28008, July 3, 1989) is currently being implemented on an interim basis As part of the interim program, the Agency has developed County Specific Pamphlets that articulate many of the specific measures outlined in the Biological Opinions issued to date. These Pamphlets are available for voluntary use by pesticide applicators, on EPA's web site at www.epa.gov/espp. A final Endangered Species Protection Program, which may be altered from the interim program, is scheduled to be proposed for public comment in the Federal Register before the end of 2001.

b. Spray Drift Management

The Agency is in the process of developing more appropriate label statements for spray and dust drift control to ensure that public health and the environment are protected from unreasonable adverse effects. In August 2001, EPA published draft guidance for label statements in a pesticide registration (PR) notice ("Draft PR Notice 2001-X"

http://www.epa.gov/PR Notices/#2001). A Federal Register notice was published on August 22, 2001 (http://www.epa.gov/fedrgstr) Announcing the availability of this draft guidance for a 90-day public comment period. After receipt and review of the comments, the Agency will publish final guidance in a PR notice for registrants to use when labeling their products.

Until EPA decides upon and publishes the final label guidance for spray and dust drift, registrants (and applicants) may choose to use the statements proposed in the draft PR notice. Registrants should refer to and read the draft PR notice to obtain a full understanding of the proposed guidance and its intended applicability, exemptions for certain products, and the Agency's willingness to consider other versions of the statements.

For purposes of complying with the deadlines for label submission outlined in this document, registrants (and applicants) may elect to adopt the appropriate sections of the proposed language below, or a version that is equally protective, for their end-use product labeling.

For products as liquids:

"Do not allow spray to drift from the application site and contact people, structures people occupy at any time and the associated property, parks and recreation areas, nontarget crops, aquatic and wetland areas, woodlands, pastures, rangelands or animals."

"For ground boom applications, apply with nozzle height no more than 4 feet above the ground or crop canopy, and when wind speed is 10 mph or less at the application site as measured by an anemometer. Use _____ (registrant to fill in blank with spray quality, e.g. fine or medium) or coarser spray according to ASAE 572 definition for standard nozzles or VMD for spinning atomizer nozzles."

"For orchard and vineyard airblast applications, do not direct spray above trees and vines, and turn off outward pointing nozzles at row ends and outer rows. Apply only when wind speed is 3 -10 mph at the application site as measured by an anemometer outside of the orchard or vineyard on the upwind side."

"For aerial applications, the boom width must not exceed 75% of the wingspan or 90% of the rotary blade. Use upwind swath displacement, and apply only when wind speed is 3 - 10 mph as measured by an anemometer. Use _____ (registrant to fill in blank with spray quality, e.g. fine or medium) or coarser spray according to ASAE 572 definition for standard nozzles or VMD for spinning atomizer nozzles. If application includes a no-spray zone, do not release spray at a height greater than 10 feet above the ground or the crop canopy."

For hand-applied products, to be applied as sprays:

"Do not allow spray to drift from the application site, and contact people, structures people occupy at any time, and the associated property, parks and recreation areas, nontarget crops, aquatic and wetland areas, woodlands, pastures, rangelands, or animals. Apply only when wind speed is not more than 10 mph. For sprays, apply largest size droplets possible."

Alternatively, registrants may elect to use the following language, which is the current Agency policy on drift labeling. For products that are applied outdoors in liquid sprays (except mosquito adulticides), regardless of application method:

"Do not allow this product to drift."

The Agency recognizes that the above option does not address other application types. Registrants may therefore wish to adapt some variation of the old, and proposed new language for their particular products, depending on their application methods.

V. What Registrants Need to Do

In order to be eligible for reregistration, registrants need to implement the risk mitigation measures outlined in Section IV and V, which include, among other things, submission of the following:

For chlorpyrifos technical grade active ingredient products, registrants need to submit the following items.

Within 90 days from receipt of the generic data call-in (DCI):

(1) completed response forms to the generic DCI (i.e., DCI response form and requirements status and registrant's response form); and

(2) submit any time extension and/or waiver requests with a full written justification.

Within the time limit specified in the generic DCI:

(1) Cite any existing generic data which address data requirements or submit new generic data responding to the DCI.

Please contact Tom Myers at 703/308-8589 with questions regarding generic reregistration and/or the DCI. All materials submitted in response to the generic DCI should be addressed:

By US mail:
Document Processing Desk (DCI/SRRD)
Chemical Review Manager's Name
US EPA (7508C)
1200 Pennsylvania Ave., NW
Washington, DC 20460

By express or courier service:
Document Processing Desk (DCI/SRRD)
Chemical Review Manager's Name
Office of Pesticide Programs (7508C)
Room 266A, Crystal Mall 2
1921 Jefferson Davis Highway
Arlington, VA 22202

For products containing the active ingredient chlorpyrifos, registrants need to submit the following items for each product.

Within 90 days from the receipt of the product-specific data call-in (PDCI):

(1) Complete response forms to the PDCI (i.e., PDCI response form and requirements status and registrant's response form); and

(2) Submit any time extension or waiver requests with a full written justification.

For all products that have agricultural uses, items 1 through 5, listed below, are required to be submitted to the Agency within 45 days of receipt of the PDCI. Item number 6, the product specific data, is required within eight months from the receipt of the PDCI.

Within eight months from the receipt of the PDCI:

(1) Two copies of the confidential statement of formula (EPA Form 8570-4);

(2) A completed original application for reregistration (EPA Form 8570-1). Indicate on the form that it is an "application for reregistration";

(3) Five copies of the draft label incorporating all label amendments outlined in Table 35 of this document;

(4) A completed form certifying compliance with data compensation requirements (EPA Form 8570-34);

(5) If applicable, a completed form certifying compliance with cost share offer requirements (EPA Form 8570-32); and

(6) The product-specific data responding to the PDCI.

Please contact Venus Eagle at (703)308-8045 with questions regarding product reregistration and/or the PDCI. All materials submitted in response to the PDCI should be addressed:

By US mail:
Document Processing Desk (PDCI/PRB)
Chemical Review Manager's Name
US EPA (7508C)
1200 Pennsylvania Ave., NW
Washington, DC 20460

By express or courier service only:
Document Processing Desk (PDCI/PRB)
Chemical Review Manager's Name
Office of Pesticide Programs (7508C)
Room 266A, Crystal Mall 2
1921 Jefferson Davis Highway
Arlington, VA 22202

A. Manufacturing Use Products

1. Additional Generic Data Requirements

The generic data base supporting the reregistration of chlorpyrifos for the above eligible uses has been reviewed and determined to be substantially complete. The following data gaps remain:

Product Chemistry Data requirements for the TGAI and Manufacturing-Use Products.

830.1550 (formerly 61-1)	Product Identity and Disclosure of Ingredients
830.1600 (formerly 61-2a)	Starting Materials and Manufacturing Process
830.1670 (formerly 61-2b)	Discussion of Formation of Impurities
830.1700 (formerly 62-1)	Preliminary Analysis
830.1750 (formerly 62-2)	Certification of Limits
830.1800 (formerly 62-3)	Analytical Method
830.6302 (formerly 63-2)	Color
830.6303 (formerly 63-3)	Physical State
830.6304 (formerly 63-4)	Odor
830.7200 (formerly 63-5)	Melting Point
830.7300 (formerly 63-7)	Density, Bulk Density or Specific Gravity
830.7840 and 830.7860 (formerly 63-8)	Solubility
830.7950 (formerly 63-9)	Vapor Pressure
830.7550 (formerly 63-11)	Octanol/Water Partition Coefficient
830.6313 (formerly 63-13)	Stability
830.6316 (formerly 63-16)	Explodability
830.6317 (formerly 63-17)	Storage Stability
830.6320 (formerly 63-20)	Corrosion Characteristics

Residue chemistry data requirements.

860.1500 (formerly 171-4k)	Magnitude of the residue in corn fodder and forage
860.1500 (formerly 171-4k)	Magnitude of the residue in cotton gin by-products
860.1500 (formerly 171-4k)	Magnitude of the residue in clover and grasses

860.1500 (formerly 171-4k)	Magnitude of the residue in aspirated grain fractions of sorghum, soybeans and wheat
860.1500 (formerly 171-4k)	Magnitude of the residue in cherries

Other data requirements:

875.1100 and 875.1300	Exposure data for seed treatment uses.
875.1100 and 875.1300	Exposure data for dip applications (e.g., preplant peaches).
875.1100 and 875.1300	Exposure data for mixing wettable powders for aerial/chemigation application.
875.1100 and 875.1300	Exposure data for loading and applying granulars for aerial application.
875.1100 and 875.1300	Exposure data for groundboom application.
875.1100 and 875.1300	Exposure data for backpack spray application.
875.1100 and 875.1300	Exposure data for reentry into treated areas with soil incorporated/directed applications.
875.2100 (formerly 132-1a)	Dislodgeable foliar residues on ornamentals in greenhouses.
233 and 234	Risk Assessment data for treated wood in residential structures.
810.1000 (formerly 90-1)	Use pattern information for hydraulic handheld spray applications (amounts handled per day, per season; types of sprayers used).
810.1000 (formerly 90-1)	Use pattern information for high pressure hand-wand spray applications (amounts handled per day, per season; types of sprayers used).
810.1000 (formerly 90-1)	Use pattern information, i.e., timing of application relative to postapplication activities, greenhouse DFR data, and biological monitoring data to develop transfer coefficients for various greenhouse/nursery activities are required.
810.1000 (formerly 90-1)	Usage data to confirm the acres treated for the 3 lb/A on sodfarms for mole crickets.

Summarize water monitoring data to confirm reduction of residue levels in surface water.

Also, a Data Call-In Notice (DCI) was sent to registrants of organophosphate pesticides currently registered under FIFRA (August 6, 1999 64FR42945-42947, August 18 64FR44922-44923). DCI requirements included acute, subchronic, and developmental neurotoxicity studies.

2. Labeling for Manufacturing Use Products

To remain in compliance with FIFRA, manufacturing use product (MUP) labeling should be revised to comply with all current EPA regulations, PR Notices and applicable policies. The MP labeling should bear the labeling contained in Table 38 at the end of this section.

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. Registrants 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.

A product-specific data call-in, outlining specific data requirements, accompanies this interim RED.

2. Labeling for End-Use Products

Labeling changes are necessary to implement the mitigation measures outlined in Section IV above. Specific language for these changes is specified in the Table 35.

C. Existing Stocks

Registrants may generally distribute and sell products bearing old labels/labeling for 26 months from the date of the issuance of this Interim Reregistration Eligibility Decision document. Persons other than the technical registrants may generally distribute or sell such products for 50 months from the date of the issuance of this interim RED. However, 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. Refer to "Existing Stocks of Pesticide Products; Statement of Policy"; *Federal Register*, Volume 56, No. 123, June 26, 1991.

The Agency has determined that registrant may distribute and sell chlorpyrifos products bearing old labels/labeling for 26 months from the date of issuance of this interim RED. Persons other than the technical registrants may distribute or sell such products for 50 months from the date of the issuance of this interim RED. Registrants and persons other than the technical registrants remain obligated to meet pre-existing label requirements and existing stocks requirements applicable to products they sell or distribute.

D. Labeling Changes Summary Table

In order to be eligible for reregistration, amend all product labels to incorporate the risk mitigation measures outlined in Section IV. Table 35 describes how language on the labels should be amended.

Table 35. Summary of Labeling Changes for Chlorpyrifos

Description	Amended Labeling Language	Placement on Label
Manufacturing Use Products		
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	"Only for formulation into an ***insecticide*** for the following use(s) [fill blank only with those uses that are being supported by MP registrant]."	Directions for Use
	"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)." Or "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)."	Directions for Use
Environmental Hazards Statements Required by the RED and Agency Label Policies	This pesticide is toxic to birds and wildlife, and extremely toxic to fish and aquatic organisms. 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.	Directions for Use
End Use Products Intended for Occupational Use Products That Have Worker Protection Standard (WPS) Uses Only or Both WPS and Non WPS Uses on Same Label		
Handler PPE requirements (all formulations)	Note the following information when preparing labeling for all end use products: For **sole-active-ingredient** end-use products that contain chlorpyrifos, the product label must be revised to adopt the handler personal protective equipment (PPE)/engineering control requirements set forth in this section. Any conflicting PPE requirements on the current label must be removed.	

Description	Amended Labeling Language	Placement on Label
	For **multiple-active-ingredient** end-use products that contain chlorpyrifos, the handler PPE/engineering control requirements set forth in this section must be compared with the requirements on the current label, and the more protective language must be retained. For guidance on which requirements are considered to be more protective, see PR Notice 93-7. PPE that is established on the basis of Acute Toxicity testing with the end-use products must be compared with the active ingredient PPE specified below in this document. The more protective PPE must be placed in the product labeling. For example, the Handler PPE in this RED does not require protective eyewear which may be required by the Acute Toxicity testing for the end-use product. For guidance on which PPE is considered more protective, see PR Notice 93-7.	
Handler PPE requirements for liquid formulation packaged in containers holding more than 2.5 gallons.	"Personal Protective Equipment (PPE) Some materials that are chemical-resistant to this product are [registrant inserts correct material]. For more information, following instructions in Supplement Three of PR Notice 93-7. If you want more options, follow the instructions for category [insert A,B,C,D,E,F,G or H] on an EPA chemical-resistance category selection chart." "Mixers and loaders using a mechanical transfer loading system and applicators using aerial application equipment must wear: - long sleeved shirt and long pants; - socks and shoes. In addition to the above, mixers and loaders using a mechanical transfer loading system must wear: - chemical resistant gloves; - chemical resistant apron; - a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter. See engineering controls for additional requirements	Immediately following/below Precautionary Statements: Hazards to Humans and Domestic Animals

Description	Amended Labeling Language	Placement on Label
	All other mixers, loaders, applicators and handlers must wear: - coveralls over long-sleeved shirt and long pants; - chemical-resistant gloves; - chemical resistant apron when mixing or loading or exposed to the concentrate; - chemical-resistant footwear plus socks; - chemical-resistant headgear for overhead exposures; - a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter. *Note: The registrant must drop the N-series filter from the respirator statement if the pesticide product contains or is used with oil.*	
Handler PPE requirements for liquid formulation packaged in containers holding 2.5 gallons or less.	"Personal Protective Equipment (PPE) Some materials that are chemical-resistant to this product are" [registrant inserts correct material]. "For more information, following instructions in Supplement Three of PR Notice 93-7. If you want more options, follow the instructions for category [insert A,B,C,D,E,F,G or H] on an EPA chemical-resistance category selection chart." All mixers, loaders, other applicators and other handlers must wear: - coveralls over long-sleeved shirt and long pants; - chemical-resistant gloves; - chemical resistant apron when mixing or loading or exposed to the concentrate; - chemical-resistant footwear plus socks; - chemical-resistant headgear for overhead exposures; - a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter. *Note: The registrant must drop the N-series filter from the respirator statement if the pesticide product contains or is used with oil.*	

Description	Amended Labeling Language	Placement on Label
Handler PPE requirements for wettable powder formulations. (wettable powder formulations must be in water-soluble packaging to be eligible for reregistration)	"Personal Protective Equipment (PPE) Some materials that are chemical-resistant to this product are" [registrant inserts correct material]. " For more information, following instructions in Supplement Three of PR Notice 93-7. If you want more options, follow the instructions for category [insert A,B,C,D,E,F,G or H] on an EPA chemical-resistance category selection chart." "Mixers and loaders must wear: - long-sleeved shirt and long pants; - socks and shoes; - chemical resistant gloves; - chemical resistant apron. Applicators using aerial application equipment must wear: - long-sleeved shirt and long pants; - socks and shoes. See engineering controls for additional requirements. All other handlers must wear: - coveralls over long-sleeved shirt and long pants; - chemical-resistant gloves; - chemical resistant apron when mixing or loading; - chemical-resistant footwear plus socks; - chemical-resistant headgear for overhead exposures; - a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter. *Note: The registrant must drop the N-series filter from the respirator statement if the pesticide product contains or is used with oil.*	Immediately following/below Precautionary Statements: Hazards to Humans and Domestic Animals

Description	Amended Labeling Language	Placement on Label
Handler PPE requirements for granular products	"Personal Protective Equipment (PPE) Some materials that are chemical-resistant to this product are" [registrant inserts correct material]. "For more information, following instructions in Supplement Three of PR Notice 93-7. If you want more options, follow the instructions for category [insert A,B,C,D,E,F,G or H] on an EPA chemical-resistance category selection chart." "Loaders, applicators and all other handlers must wear: - coveralls over long-sleeved shirt and long pants; - chemical-resistant gloves; - chemical-resistant footwear plus socks; - a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter.	Immediately following/below Precautionary Statements: Hazards to Humans and Domestic Animals
User Safety Requirements	"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." "Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them." (*This second statement is not required for granular formulations*)	Precautionary Statements: Hazards to Humans and Domestic Animals immediately following the PPE requirements

Description	Amended Labeling Language	Placement on Label
Engineering Controls required for liquid formulations packaged in containers holding more than 2.5 gallons.	"Engineering Controls" "Mixers and loaders supporting aerial applications must use a mechanical transfer system that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(4)] for dermal protection, and must: -- wear the personal protective equipment required above for mixers/loaders, -- wear protective eyewear if the system operates under pressure, and -- be provided and have immediately available for use in an emergency, such as a broken package, spill, or equipment breakdown: coveralls, chemical resistant footwear and chemical resistant headgear if overhead exposure." "Pilots must use an enclosed cockpit in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)]." "Use of human flaggers is prohibited. Mechanical flagging equipment must be used." "When handlers use closed cab motorized ground application equipment in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS."	Precautionary Statements: Hazards to Humans and Domestic Animals (Immediately following PPE and User Safety Requirements.)
Engineering Controls for liquid formulations packaged in containers less than 2.5 gallons.	"Engineering Controls" "When handlers use closed systems or closed cab motorized ground application equipment in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS."	Precautionary Statements: Hazards to Humans and Domestic Animals (Immediately following PPE and User Safety Requirements.)

Description	Amended Labeling Language	Placement on Label
Engineering controls for wettable powder formulations	"Engineering Controls" "Water-soluble packets, when used correctly, qualify as a closed mixing/loading system under the Worker Protection Standard (WPS) for Agricultural Pesticides [40 CFR 170.240(d)(4)]. Mixers and loaders using water-soluble packets must wear the PPE required above for mixer/loaders, and have immediately available for use in emergency (such as a broken package, spill or equipment breakdown) additional PPE. These PPE include coveralls and chemical-resistant footwear and a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter." "Pilots must use an enclosed cockpit in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)]." "Use of human flaggers is prohibited. Mechanical flagging equipment must be used." "When applicators use closed cab motorized ground equipment in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS." *Note: The registrant must drop the N-series filter from the respirator statement if the pesticide product contains or is used with oil.*	Precautionary Statements: Hazards to Humans and Domestic Animals (Immediately following PPE and User Safety Requirements.)
Engineering controls for Granular formulations	"Engineering Controls" "Pilots must use an enclosed cockpit in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)]." "When applicators use closed cab equipment in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS."	Precautionary Statements: Hazards to Humans and Domestic Animals (Immediately following PPE and User Safety Requirements.)

Description	Amended Labeling Language	Placement on Label
User Safety Recommendations	"User Safety Recommendations" "Users should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet." "Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing." "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."	Precautionary Statements immediately following the Engineering Controls
Environmental Hazards	"Environmental Hazards" "This pesticide is toxic to fish, aquatic invertebrates, small mammals and birds. Do not apply directly to water, or to areas where surface water is present or to intertidal areas below the mean high water mark. Drift and runoff may be hazardous to aquatic organisms in water adjacent to treated areas. Do not contaminate water when disposing of equipment wash water or rinsate. This product is highly toxic to bees exposed to direct treatment or residues on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds if bees are visiting the treatment area."	Precautionary Statements immediately following the User Safety Recommendations
Restricted-Entry Interval	"Do not enter or allow entry into treated areas during the restricted entry interval (REI). The REI for each crop is listed in the directions for use associated with each crop"	Directions for Use, Agricultural Use Requirements Box
WPS Restricted Entry Intervals (REI)	The Directions for Use must be amended to reflect the following REI: The REI for all crops except those listed below is 24 hours cauliflower: 3 days citrus trees: 5 days fruit trees: 4 days	Directions for Use Under Application Instructions for Each Crop

Description	Amended Labeling Language	Placement on Label
Early Re-entry Personal Protective Equipment established by the RED.	"PPE required for early entry into treated areas that is permitted under the Worker Protection Standard and involves contact with anything that has been treated, such as plants, soil, or water, is: Coveralls over short sleeved shirt and shirt pants; Chemical resistant gloves made out of any waterproof material; Chemical resistant footwear plus socks; Chemical Resistant headgear for over head exposures." "Notify workers of the application by warning them orally and by posting warning signs at entrances to treated areas."	Directions for Use, Agricultural Use Requirements Box
Entry Restrictions for products applied as sprays that have Non-WPS uses on the label	"Do not enter or allow others to enter until sprays have dried"	Directions for Use in the Non-Agricultural Use Requirements Box.
General Application Restrictions	"Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application." Labels must be amended to reflect the following application restrictions which supercede or are in addition to restrictions currently on labels: **Preharvest interval restrictions:** All crops 7 days except: cauliflower: 21-30 days nut trees: 14 days citrus trees: 21 days fruit trees: 21 days **Aerial application restrictions:** All formulations: "Aerial application to peanuts is prohibited." Granular formulations: "Do not apply by aircraft at a rate greater than 1 lb. ai/A."	Place in the Direction for Use

Description	Amended Labeling Language	Placement on Label
	Maximum application rates for a single application: - golf course turf : 1 lb. ai/A - citrus: 4 lbs. ai/A, except in Fresno, Tulare, Kern, Kings and Madera Counties, in California, where it may be applied at 6 lbs. ai/A for control of red scale by ground application. - tobacco (liquids): 2 lbs. ai/A - tobacco (granulars): 3 lbs. ai/A - corn 1.0 lb/A **Maximum number of applications per season:** - alfalfa (liquids): 4 - citrus orchard floors (granulars): 3 - corn (field, sweet, seed) (granulars): 2 - sorghum (liquids): 3 - sugar beets (liquids): 3 - sunflowers (liquids): 3 - walnut and almond orchard floors (liquids): 2 - citrus (liquids): 2 - corn (field, sweet, seed) (liquids): 3 - cotton (liquids): 3 - soybeans (liquids): 3 - sugar beets (granulars): 1 - tobacco (liquids): 1 **Maximum amount a.i to be applied per acre per season:** - citrus (granulars) use on orchard floors: 3 lbs. ai/A - corn (field, sweet, seed) (liquids): 3 lbs. ai/A - corn (field, sweet, seed) (granulars): 2 lbs. ai/A - cotton (liquids): 3 lbs. ai/A - sugar beets (liquids): 3 lbs ai/A - walnut and almond orchard floors (liquids): 4 lbs. ai/A - sugar beets (granulars): 2 lbs ai/A - tobacco (liquids): 2 lbs ai/A - tree nuts (liquids): 4 lbs. ai/A - sunflowers (liquids): 3 lbs. ai/A	

Description	Amended Labeling Language	Placement on Label
Spray drift restrictions for outdoor products applied as sprays.	"Do not allow spray to drift from the application site and contact people, structures people occupy at any time and the associated property, parks and recreation areas, nontarget crops, aquatic and wetland areas, woodlands, pastures, rangelands, or animals." "For ground boom applications, do not apply within 25 feet of rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries and commercial fish ponds. Apply with nozzle height no more than 4 feet above the ground or crop canopy and when wind speed is 10 mph or less at the application site as measured by an anemometer. Use (registrant to fill in blank with spray quality, e.g. fine or medium) or coarser spray according to ASAE 572 definition for standard nozzles or VMD for spinning atomizer nozzles." "For orchard/vineyard airblast applications, do not apply within 50 feet of rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries and commercial fish ponds. Direct spray above trees/vines and turn off outward pointing nozzles at row ends and outer rows. Apply only when wind speed is 3 –10 mph at the application site as measured by an anemometer outside of the orchard/vineyard on the upwind side." "For aerial applications, do not apply within 150 feet of rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries and commercial fish ponds. The boom width must not exceed 75% of the wingspan or 90% of the rotary blade. Use upwind swath displacement and apply only when wind speed is 3 -- 10 mph as measured by an anemometer. Use _____ (registrant to fill in blank with spray quality, e.g. fine or medium) or coarser spray according to ASAE 572 definition for standard nozzles or VMD for spinning atomizer nozzles. If application includes a no-spray zone, do not release spray at a height greater than 10 feet above the ground or the crop canopy." "For overhead chemigation, do not apply within 25 feet of rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries and commercial fish ponds. Apply only when wind speed is 10 mph or less." "The applicator also must use all other measures necessary to control drift."	Directions for Use in General Precautions and Restrictions

Description	Amended Labeling Language	Placement on Label
End Use Products Intended for Occupational Use Products That Have Only Non-Worker Protection Standard (Non-WPS) Uses on the Label		
Handler PPE requirements (all formulations)	Note the following information when preparing labeling for all end use products: For **sole-active-ingredient** end-use products that contain chlorpyrifos, the product label must be revised to adopt the handler personal protective equipment (PPE)/engineering control requirements set forth in this section. Any conflicting PPE requirements on the current label must be removed. For **multiple-active-ingredient** end-use products that contain chlorpyrifos, the handler PPE/engineering control requirements set forth in this section must be compared with the requirements on the current label, and the more protective language must be retained. For guidance on which requirements are considered to be more protective, see PR Notice 93-7. PPE that is established on the basis of Acute Toxicity testing with the end-use products must be compared with the active ingredient PPE specified below in this document. The more protective PPE must be placed in the product labeling. For example, the Handler PPE in this RED does not require protective eyewear which may be required by the Acute Toxicity testing for the end-use product. For guidance on which PPE is considered more protective, see PR Notice 93-7.	
Handler PPE requirements for liquid formulations [1]	"Personal Protective Equipment (PPE) All mixers, loaders, applicators and handlers must wear: - coveralls over long-sleeved shirt and long pants; - chemical-resistant gloves such as (insert glove type as per Supplement Three of PR Notice 93-7); - chemical resistant apron when mixing or loading or exposed to the concentrate; - chemical-resistant footwear plus socks; - chemical-resistant headgear for overhead exposures; - a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter." *Note: The registrant must drop the N-series filter from the respirator statement if the pesticide product contains or is used with oil.*	Immediately following/below Precautionary Statements: Hazards to Humans and Domestic Animals

Description	Amended Labeling Language	Placement on Label
Handler PPE requirements for wettable powder formulations. (wettable powder formulations must be in water-soluble packaging to be eligible for reregistration)	"Personal Protective Equipment (PPE) Mixers and loaders must wear: - long-sleeved shirt and long pants; - socks and shoes; - chemical resistant gloves such as (Registrant inserts glove type as per Supplement Three of PR Notice 93-7); - chemical resistant apron. Applicators using motorized ground boom application equipment must wear: - long-sleeved shirt and long pants; - socks and shoes. See engineering controls for additional requirements. All other handlers must wear: - coveralls over long-sleeved shirt and long pants; - chemical-resistant gloves; - chemical resistant apron when mixing or loading; - chemical-resistant footwear plus socks; - chemical-resistant headgear for overhead exposures; - a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter." *Note: The registrant must drop the N-series filter from the respirator statement if the pesticide product contains or is used with oil.*	Immediately following/below Precautionary Statements: Hazards to Humans and Domestic Animals

Description	Amended Labeling Language	Placement on Label
Handler PPE requirements for granular products[1]	"Personal Protective Equipment (PPE) "Loaders, applicators and all other handlers must wear: –long-sleeved shirt and long pants; –socks and shoes. In addition to the above, loaders must wear: –chemical-resistant gloves such as (registrant inserts glove type as per Supplement Three of PR Notice 93-7.); –chemical-resistant apron; –a NIOSH-approved dust mist filtering respirator with MSHA/NIOSH approval number prefix TC-21C or a NIOSH-approved respirator any N, R, P, or HE filter. *Note: The registrant must drop the N-series filter from the respirator statement if the pesticide product contains or is used with oil.*	Immediately following/below Precautionary Statements: Hazards to Humans and Domestic Animals
User Safety Requirements	"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." "Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them." (*This second statement is not required for granular formulations*)	Precautionary Statements: Hazards to Humans and Domestic Animals immediately following the PPE requirements
Engineering Controls requirements for liquid formulations	"Engineering Controls" "When handlers use closed cab motorized ground application equipment in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS."	

Description	Amended Labeling Language	Placement on Label
Engineering Controls requirements for wettable powder formulations for products in water-soluble packaging	"Engineering Controls" "Water-soluble packets, when used correctly, qualify as a closed mixing/loading system. Mixers and loaders using water-soluble packets must wear the PPE required above for mixer/loaders, and have immediately available for use in emergency (such as a broken package, spill or equipment breakdown) additional PPE. These PPE include coveralls and chemical-resistant footwear and a non-powered air purifying respirator equipped with an N-, R- or P-series filter." "When handlers use closed cab motorized ground application equipment in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides (40 CFR 170.240(d)(4-6), the handler PPE requirements may be reduced or modified as specified in the WPS."	
User Safety Recommendations	"User Safety Recommendations" "Users should wash hands before eating, drinking, chewing gum, using tobacco or using the toilet." "Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing." "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."	Placed in a box in the Precautionary Statements under Hazards to Humans and Domestic Animals immediately following Engineering Controls.
Entry Restrictions for products applied as sprays	"Do not enter or allow others to enter until sprays have dried"	Directions for Use under Application Restrictions.
Entry Restrictions for granular products	"Do not enter or allow others to enter until dusts have settled"	Directions for Use under Application Restrictions.

Description	Amended Labeling Language	Placement on Label
Application Restrictions (all applicable formulations)	"Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application." The following statement should be placed on labels of products used on either golf course turf or manhole covers: "The maximum application rate per application is 1 lb. ai/A." "Do not use this product on manhole covers in storm drain systems."	Directions For Use under General Precautions and Restrictions
Spray drift restrictions for outdoor products applied as sprays.	"Do not allow spray to drift from the application site and contact people, structures people occupy at any time and the associated property, parks and recreation areas, nontarget crops, aquatic and wetland areas, woodlands, pastures, rangelands, or animals. For ground boom applications, do not apply within 25 feet of rivers, natural ponds, lakes, streams, reservoirs, marshes, estuaries and commercial fish ponds. Apply with nozzle height no more than 4 feet above the ground or crop canopy and when wind speed is 10 mph or less at the application site as measured by an anemometer. Use (registrant to fill in blank with spray quality, e.g. fine or medium) or coarser spray according to ASAE 572 definition for standard nozzles or VMD for spinning atomizer nozzles. The applicator also must use all other measures necessary to control drift."	Directions for Use under Application Restrictions.

[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. The more protective PPE must be placed in the product labeling. For guidance on which PPE is considered more protective, see PR Notice 93-7.

[2] If the product contains oil or bears instructions that will allow application with an oil-containing material, the "N" designation must be dropped.

Instructions in the Labeling Changes section of Table 35 appearing in quotations represent the exact language that should appear on the label.

Instructions in the Labeling Changes section of Table 35 not in quotes represents actions that the registrant should take to amend their labels or product registrations.

VI. Related Documents and How to Access Them

This interim Reregistration Eligibility Document is supported by documents that are presently maintained in the OPP docket. The OPP docket is located in Room 119, Crystal Mall #2, 1921 Jefferson Davis Highway, Arlington, VA. It is open Monday through Friday, excluding legal holidays from 8:30 am to 4 pm..

The docket initially contained preliminary risk assessments and related documents as of October 17, 1999. Sixty days later the first public comment period closed. The EPA then considered comments, revised the risk assessment, and added the formal “Response to Comments” document and the revised risk assessment to the docket on August 16, 2000.

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.epa.gov/pesticides/op."

VII. Appendices

Appendix A. Table of Chlorpyrifos Use Patterns Eligible for Reregistration

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Crop Uses					
Alfalfa					
Soil in-furrow treatment At planting Ground equipment	15% G	1 lb/A	1	Not Applicable (NA)	Use limited to MO. A 21-day PHI/PGI has been established.
Broadcast application Foliar or postemergence Ground, sprinkler irrigation, or aerial equipment	4 lb/gal EC	1 lb/A	1 (per cutting) 4 (per season)	10	A 7-day PHI (rates ≤0.25 lb ai/A), a 14-day PHI (rates ≤0.5 lb ai/A), and a 21-day PHI (rates >0.5 lb ai/A) have been established.
Broadcast application Foliar Ground or aerial equipment	2 lb/gal EC	0.5 lb/A	1 (per cutting) 4 (per season)	10	Use limited to AZ and CA. A 4-day PHI/PGI (rates 0.375-0.5 lb ai/A) has been established.
Almonds					
Spray application Dormant/delayed dormant Ground equipment	50% WP	2 lb/A or 2 lb/100 gal	1	NA	
Spray application Dormant/delayed dormant Ground equipment	1 lb/gal EC 4 lb/gal EC	0.5 lb/100 gal [200-600 gal finished spray/A, 1 lb/A - 3 lb/A]	1	NA	Application may be made alone or as a tank mix with petroleum spray oil. Grazing of meat or dairy animals in treated orchards is prohibited.
Spray application Foliar Ground or aerial equipment	50% WP 50% DF 1 lb/gal EC 4 lb/gal EC	2 lb/A or 2 lb/100 gal	3	--	A 14-day PHI has been established. Grazing of livestock in treated orchards is prohibited (Section 3 and CA940017).

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Almonds (cont.)					
Trunk spray (bark) application Ground equipment	4 lb/gal EC	2 lb/A	1	--	Use limited to CA (CA940013). Grazing of livestock in treated orchards is prohibited.
Soil broadcast application Orchard floor Ground equipment	4 lb/gal EC	4 lb/A	2	--	A 14-day PHI has been established. Grazing of livestock in treated orchards is prohibited.
Soil broadcast application Orchard floor Ground equipment	4 lb/gal EC	3 lb/100 gal with 1.5 gal spray/tree	2	--	Use limited to CA (CA940024). Grazing of livestock in treated orchards is prohibited.
Apples					
Spray application Dormant/delayed dormant Ground equipment	1 lb/gal EC 4 lb/gal EC	0.5 lb/100 gal [200-600 gal finished spray/A]	1	NA	Application may be made alone or as a tank mix with petroleum spray oil. Grazing of meat or dairy animals in treated orchards is prohibited.
Spray application - branches and trunk Dormant/delayed dormant	4 lb/gal EC	2.0 lb/A	1		Use restricted to CA (Section 24(c) CA940013)

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Asparagus					
Broadcast foliar application Preharvest Ground equipment	4 lb/gal EC	1 lb/A	1	NA	Use limited to AZ, CA, the Midwest, and Pacific Northwest. A 1-day PHI has been established.
Broadcast application Postharvest (fern stage) Ground equipment	4 lb/gal EC	1 lb/A	2	10	Use limited to AZ, CA, the Midwest, and Pacific Northwest.
Bananas					
Fruit bag (shroud) application	1% Impr	--	--	--	Shrouds are installed on the stem after all fruit bunches have formed and are removed at harvest.
Bean (field, green, kidney, lima, navy, snap, string and wax)					
Slurry seed treatment Preplant	50% WP	1 oz/cwt	(1)	--	Grazing/feeding of livestock on bean hay grown from treated seed is prohibited. Treated seeds may not be used for food, feed, or oil purposes.
Slurry seed treatment Stored seed	50% WP	19.3 oz/23.5 gal [3 fl.oz/cwt]	(1)	--	Use limited to TX. Treated seeds may not be used for food, feed, or oil purposes.
Broccoli					
Soil band treatment At planting/transplanting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	Maximum seasonal application rates of 2.25 lb ai/A (0.5-15% G and 4 lb/gal EC) and 2.6 lb ai/A (1 lb/gal EC) are in effect. A 30-day PHI has been established for the EC formulations.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Broccoli (continued)					
Soil band treatment At planting Ground equipment	4 lb/gal EC	1.4 oz/1,000 ft. of row	2	10	Use limited to CA (CA940016). Maximum seasonal application rate of 2.25 lb ai/A is in effect. Application may be repeated at thinning time as a directed spray. A 30-day PHI has been established.
Soil injected sidedress application	4 lb/gal EC	1.3 oz/1,000 ft. of row	1	NA	A 30-day PHI has been established.
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	A 21-day PHI has been established. Application may be made alone or as a tank mix with other pesticides (AZ870006, AZ940003, CA860066, CA940001).
Broccoli Raab (rapini)					
Soil application At planting Ground equipment	4 lb/gal EC	2.25 lb/A	1	NA	Section 24(c) CA940015.
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	40-day PHI. Section 24(c) AZ870006, AZ940003, CA860066, CA940001

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Brussels sprouts					
Soil band treatment At planting/transplanting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."
Soil band treatment At planting Ground equipment	4 lb/gal EC	1.4 oz/1,000 ft. of row	2	10	See "Broccoli."
Broadcast application Foliar Ground or aerial equipment	4 lb/gal EC	1 lb/A	3	10	A 21-day PHI has been established.
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli."

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Cabbage					
Soil band treatment At planting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."
Soil band treatment At planting Ground equipment	4 lb/gal EC	1.4 oz/1,000 ft. of row	2	--	See "Broccoli."
Soil injected sidedress application	4 lb/gal EC	1.3 oz/1,000 ft. of row	1	NA	See "Broccoli."
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli."
Carrot (grown for seed)					
Broadcast application Foliar, After Bolting Ground or aerial equipment	4 lb/gal EC	1 lb/A	--	--	Use limited to WA (WA940002). Feeding of treated carrot cuttings or seed screenings to livestock or grazing of livestock in treated areas is prohibited.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Cauliflower					
Soil band treatment At planting/transplanting Ground equipment	0.5% G 1% G 15% G	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."
Soil band treatment At planting Ground equipment or Directed spray application Post-transplant Ground equipment	1 lb/gal EC 4 lb/gal EC	1.2 oz/1,000 ft. of row	1	NA	Maximum seasonal application rate of 2 lb ai/A is in effect. A 30-day PHI has been established.
Soil band treatment At planting Ground equipment	4 lb/gal EC	1.2 oz/1,000 ft. of row or 2 lb/A	2	10	Use limited to CA (CA960016). Maximum seasonal application rate of 2 lb ai/A is in effect. A 30-day PHI has been established.
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli."
Cherries					
Trunk spray (bark) application Foliar and postharvest and/or dormant/delayed dormant Ground equipment	1 lb/gal EC 4 lb/gal EC	3 lb/100 gal	3	10	Use limited to sweet cherries. One of the three permitted applications per season may be applied as a dormant spray tank mixed with petroleum spray oil at 0.5 lb ai/100 gal. A 6-day PHI has been established. Grazing of meat or dairy animals in treated orchards is prohibited.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Cherries (continued)					
Spray application Foliar Ground or aerial equipment	50% WP 1 lb/gal EC	1.5 lb/A or 1.5 lb/100 gal	8	10	Use limited to sour (tart) cherries. A 14-day PHI has been established. Grazing of livestock in treated orchards is prohibited.
Chinese broccoli (gai lon)					
Soil application At planting Ground equipment	4 lb/gal EC	2.25 lb/A	1	NA	See "Broccoli raab."
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/gal	3	10	See "Broccoli."
Chinese cabbage (bok choy, napa)					
Soil band treatment At planting/transplanting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."
Soil application At planting Ground equipment	4 lb/gal EC	2.25 lb/A	1	NA	See "Broccoli."

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Chinese cabbage (bok choy, napa) (continued)					
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli." (AZ870006, AZ940003, CA860066, CA940001)
Chinese mustard (gai choy)					
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli, raab."
Citrus					
Spray application Foliar Ground or aerial equipment	4 lb/gal EC	6 lb/A (rates above 4 lb/A are limited to 5 counties in California)	1	30	Maximum seasonal application rate of 7.5 lb ai/A is in effect. A 21-day PHI (rates ≤ 3.5 lb ai/A) and a 35-day PHI (rates > 3.5 lb ai/A) have been established. Grazing of livestock in treated areas is prohibited. Application may be made alone or as a tank mix with other pesticides.
Spray application Foliar Ground or aerial equipment	4 lb/gal EC	3.5 lb/A	2	30	Maximum seasonal application rate of 7.5 lb ai/A is in effect. A 21-day PHI (rates ≤ 3.5 lb ai/A) and a 35-day PHI (rates > 3.5 lb ai/A) have been established. Grazing of livestock in treated areas is prohibited. Application may be made alone or as a tank mix with other pesticides.
Spray application Foliar Ground equipment	4 lb/gal EC	0.5 lb/100 gal	2	30	Use limited to residential citrus. A 21-day PHI has been established.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Citrus (continued)					
Spray application Foliar Ground or aerial equipment	1 lb/gal EC	0.4 lb/100 gal	2	30	Maximum seasonal application rate of 2 lb ai/A is in effect. A 21-day PHI has been established.
Trunk spray application Foliar Ground equipment	4 lb/gal EC	0.625 lb/A	4	--	Use limited to CA. A 28-day PHI has been established.
Fiberglass band application Foliar Ground equipment	4 lb/gal EC	2.5 lb/A	4	--	
Soil broadcast application Postplant (grove floor) Ground or sprinkler irrigation equipment	15% G 4 lb/gal EC	1 lb/A	3	10	Maximum seasonal application rate of 3 lb ai/A is in effect. A 28-day PHI has been established. Grazing of livestock in treated areas is prohibited. For use in FL, a maximum seasonal rate of 3 lb ai/A (EC) is in effect.
Clover (grown for seed)					
Soil broadcast application Preplant Ground equipment or Broadcast application Foliar Ground equipment	4 lb/gal EC	2 lb/A	1	--	Use limited to OR (OR940031). Grazing or feeding of treated clover cuttings or seed screenings or using of hay for livestock is prohibited.[b]

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Collards					
Soil band treatment At planting/transplanting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."
Collards (continued)					
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli, Raab."
Corn: field or sweet or pop or grown for seed					
Soil incorporated treatment Ground equipment	15% G	2 lb/A	(1)	NA	Maximum seasonal application rate of 2 lb ai/A is in effect. A 35-day PHI (corn grain), a 14-day PGI (corn silage), and a 35-day PFI (corn fodder) have been established.
Soil treatment At planting Ground equipment	0.5% G 1% G 7.5% G 15% G	2.4 oz/1,000 ft. of row or 2 lb/A	(1)	NA	
Soil treatment or broadcast application Ground or aerial equipment	15% G	1.2 oz/1,000 ft. of row	(1)	NA	

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Corn: field or sweet or pop or grown for seed (continued)					
Soil incorporated treatment Preplant Ground equipment	4 lb/gal EC	3 lb/A	(1)	NA	Maximum seasonal application rate of 3 lb ai/A is in effect. A 35-day PHI (corn grain), a 14-day PGI (corn silage), and a 35-day PFI (corn fodder) have been established. Application may be made alone or as a tank mix with other pesticides.
Soil broadcast application Preplant, at planting, or preemergence Ground equipment	4 lb/gal EC	1 lb/A	(1)	NA	
Broadcast application Postemergence/foliar Ground, aerial, or sprinkler irrigation equipment	4 lb/gal EC	1.5 lb/A	(5)	10	
Corn: Sweet					
Broadcast application Foliar Ground, aerial, or sprinkler irrigation equipment	4 lb/gal EC	1 lb/A	3	10	Use limited to FL and GA. Maximum seasonal application rate of 3 lb ai/A is in effect. A 21-day PHI (corn ears), PGI, and PFI (corn silage, fodder, or grain) have been established.
Broadcast application Foliar Ground or aerial equipment	4 lb/gal EC	0.5 lb/A	3	10	Use limited to DE (DE930004), A 7-day PHI has been established. Grazing of livestock in treated areas and feeding treated corn silage, forage, or fodder to meat or dairy animals is prohibited.[b]

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Corn: Field and Sweet					
Slurry seed treatment Preplant	50% WP	1 oz/cwt	(1)	--	Treated seeds may not be used for food, feed, or oil purposes.
Slurry seed treatment Stored seed	50% WP	19.3 oz/23.5 gal [3 fl.oz/cwt]	(1)	--	See "Bean."
Cotton					
Broadcast application Foliar Ground, sprinkler irrigation, aerial equipment	4 lb/gal EC	1 lb/A	3	10	A 14-day PHI has been established. Grazing of livestock in treated areas and feeding of gin trash or treated forage to livestock is prohibited.[b]
Broadcast application Foliar Ground or aerial equipment	2 lb/gal EC	0.5 lb/A	3	10	Use limited to AZ and CA. A 40-day PHI has been established. Grazing of livestock in treated areas and feeding of gin trash or treated forage to livestock is prohibited.[b] Applications may be made undiluted at the same rate.
Slurry seed treatment Stored seed	50% WP	19.3 oz/23.5 gal [3 fl.oz/cwt]	(1)	--	See "Bean."
Gin trash treatment Ground equipment	4 lb/gal EC	1 lb per 20 tons of gin trash	--	--	Use limited to MS.
Cranberry					
Broadcast application Foliar Ground, aerial, or sprinkler irrigation equipment	4 lb/gal EC	1.5 lb/A	2	10	A 60-day PHI has been established. Application may not be made when bogs are flooded.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Cucumbers					
Slurry seed treatment Preplant	50% WP	1 oz/cwt	(1)	--	Treated seeds may not be used for food, feed, or oil purposes.
Figs					
Soil incorporated treatment Dormant Ground equipment	4 lb/gal EC	2 lb/A	1	NA	Use limited to CA. A 210-day PHI has been established.
Filberts					
Spray application Foliar Ground or aerial equipment	50% WP 1 lb/gal EC 4 lb/gal EC	2 lb/A or 2 lb/100 gal	3	--	A 14-day PHI has been established. Grazing of livestock in treated orchards is prohibited.
Grapefruit					
Spray application Foliar Ground or aerial equipment	4 lb/gal EC	6 lb/A	2	30	See "Citrus."
Spray application Foliar or transplant Ground or aerial equipment	4 lb/gal EC	3.5 lb/A	2	30	See "Citrus."
Spray application Foliar Ground equipment	4 lb/gal EC	0.5 lb/100 gal	2	30	See "Citrus."

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Grapefruit (continued)					
Spray application Foliar Ground or aerial equipment	1 lb/gal EC	0.4 lb/100 gal	2	30	See "Citrus."
Grapes					
Directed spray soil application Ground equipment	1 lb/gal EC 4 lb/gal EC	2.25 lb/100 gal [2 qt finished spray/15 sq. ft.]	1	NA	Use limited to states east of the Rocky Mountains. A 35-day PHI has been established.
Directed spray soil application Ground equipment	4 lb/gal EC	1.125 lb/100 gal [2 qt finished spray per 15 sq. ft.]	2	--	Use limited to TN (TN940001). A 35-day PHI has been established.
Directed spray soil application Ground equipment	4 lb/gal EC	1 lb/A	3	--	Use limited to CA (CA940018). A 76-day PHI has been established.
Spray/drench application Prebloom Ground equipment	4 lb/gal EC	1 lb/A	1	NA	Use limited to MI and MO (MI940001 and MO940001).
Broadcast foliar application **Nonbearing** Ground or aerial equipment	4 lb/gal EC	1 lb/A	--	--	Use limited to ID, OR, and WA (ID940013, OR940030, and WA940003).

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Grass (grown for seed)					
Broadcast application Foliar Ground or aerial equipment	4 lb/gal EC	1 lb/A	3	--	Use limited to OR and NV (OR940032 and NV940002). Grazing of livestock in treated areas or feeding treated grass, straw, or seed screenings to livestock or using hay for livestock bedding is prohibited.[b]
Kale					
Soil band treatment At planting/transplanting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli."
Kohlrabi					
Soil band treatment At planting/transplanting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Kohlrabi (continued)					
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli."
Lemon					
Spray application Foliar Ground or aerial equipment	4 lb/gal EC	6 lb/A	2	30	See "Citrus."
Spray application Foliar or transplant Ground or aerial equipment	4 lb/gal EC	3.5 lb/A	2	30	See "Citrus."
Spray application Foliar Ground equipment	4 lb/gal EC	0.5 lb/100 gal	2	30	See "Citrus."
Spray application Foliar Ground or aerial equipment	1 lb/gal EC	0.4 lb/100 gal	2	30	See "Citrus."
Macadamia Nuts					
Trunk spray (bark) application Ground equipment	50% WP	1 lb/A	8	30	Use limited to HI (HI930010 and HI930011). Maximum seasonal application rate of 8 lb ai/A is in effect. A 14-day PHI has been established. Grazing of livestock in treated areas is prohibited.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Mint - Peppermint					
Soil incorporated treatment Preplant Ground equipment	4 lb/gal EC	2 lb/A	1	NA	Use limited to OR (OR940027). Application following a broadcast foliar spray is not permitted.
Broadcast foliar application Preharvest and postharvest Ground or sprinkler irrigation equipment	1 lb/gal EC 4 lb/gal EC	2 lb/A	1 preharvst + 1 postharvest	NA	A 90-day PHI has been established.
Mustard greens					
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli."
Nectarines					
Spray application Dormant/delayed dormant Branches and Trunk Ground equipment	1 lb/gal EC 4 lb/gal EC	0.5 lb/100 gal [200-600 gal finished spray/A, 1 lb/A-3 lb/A]	1	NA	Application may be made alone or as a tank mix with petroleum spray oil. Grazing of meat or dairy animals in treated orchards is prohibited.
Spray application Dormant/delayed dormant Branches and Trunk Ground equipment	4 lb/gal EC	2/ lb/A	1	NA	Use limited to CA (CA940013)

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Nectarines (continued)					
Trunk spray (bark) application Ground equipment	1 lb/gal EC 4 lb/gal EC	3 lb/100 gal	1	NA	A 14-day PHI has been established. Grazing of meat or dairy animals in treated orchards is prohibited.
Onions, bulb					
Soil application At seeding Ground equipment	0.5% G 1% G 15% G	0.035 lb/1,000 ft. of row	1	NA	Maximum seasonal application rate of 1 lb ai/A is in effect for the 15% G formulation.
Soil drench application At seeding Ground equipment	1 lb/gal EC 4 lb/gal EC	0.04 lb/1,000 ft. of row (1 lb/gal EC) 0.03 lb/1,000 ft. of row (4 lb/gal EC)	1	NA	
Soil drench application Post planting Ground equipment	4 lb/gal EC	1 lb/A	2		Use limited to MI (MI940002. 60 day PHI. Total number of applications should include both at planting and post crop uses.
Oranges					
Spray application Foliar Ground or aerial equipment	4 lb/gal EC	6 lb/A	2	30	See "Citrus."
Spray application Foliar or transplant Ground or aerial equipment	4 lb/gal EC	3.5 lb/A	2	30	See "Citrus."

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Oranges (continued)					
Spray application Foliar Ground equipment	4 lb/gal EC	0.5 lb/100 gal	2	30	See "Citrus."
Spray application Foliar Ground or aerial equipment	1 lb/gal EC	0.4 lb/100 gal	2	30	See "Citrus."
Peaches					
Spray application Dormant/delayed dormant Ground equipment	1 lb/gal EC 4 lb/gal EC	0.5 lb/100 gal [200-600 gal finished spray/A]	1	NA	See "Nectarines."
Trunk spray (bark) application Ground equipment	4 lb/gal EC	3 lb/100 gal	1	NA	See "Nectarines."
Dip application Preplant (nonbearing)	4 lb/gal EC	3 lb/100 gal	1	NA	

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Peanuts					
Soil incorporated treatment Preplant Ground equipment	4 lb/gal EC	2 lb/A	1	NA	A combined maximum seasonal application rate of 4 lb ai/A is in effect for preplant and postplant use. A 21-day PHI has been established. Feeding peanut forage or hay to meat or dairy animals is prohibited.
Soil band application At planting, postplant, or early pegging Ground equipment	0.5% G 1% G 15% G	2.25 oz ai/1,000 ft. of row (2 lb/A)	2	NA	A maximum seasonal application rate of 4.5 oz ai/1,000 ft. of row or 4 lb ai/A for the 15% G formulation is in effect. A maximum seasonal rate of 2.25 oz ai/1,000 ft. of row is in effect. A 21-day PHI has been established. Feeding peanut forage or hay to meat or dairy animals is prohibited.
Broadcast application Prior to or at pegging	15% G	1.95 lb/A	--	10	A maximum seasonal application rate of 4 lb ai/A is in effect. A 21-day PHI has been established. Feeding peanut forage or hay to meat or dairy animals is prohibited.
Directed spray application Foliar Ground equipment	1 lb/gal EC	2 lb/A	1	NA	A 21-day PHI has been established. A maximum seasonal application rate of 2 lb ai/A is in effect.
Pears					
Spray application Dormant/delayed dormant Ground equipment	1 lb/gal EC 4 lb/gal EC	0.5 lb/100 gal [200-600 gal finished spray/A]	1	NA	See "Apples."
Spray application Dormant/delayed dormant Branches and Trunk	4 lb/gal EC	2 lb/A	1	NA	Use limited to CA (CA940013).

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Peas (black-eyed, field, and garden)					
Slurry seed treatment Preplant	50% WP	1 oz/cwt	(1)	--	See "Bean."
Slurry seed treatment Stored seed	50% WP	19.3 oz/23.5 gal [3 fl.oz/cwt]	(1)	--	See "Bean."
Pecans					
Spray application Foliar Ground or aerial equipment	50% WP 50% DF 1 lb/gal EC 4 lb/gal EC	1 lb/100 gal or 1 lb/A (50% WP, 50% DF, and 1 lb/gal EC) 2 lb/A (4 lb/gal EC)	5	--	A maximum seasonal application rate of 10 lb ai/A is in effect for the 4 lb/gal EC formulation. Application may be made alone or as a tank mix with other pesticides. A 28-day PHI has been established. The grazing of livestock in treated orchards is prohibited.
Soil broadcast application Orchard floor Ground equipment	50% WP 1 lb/gal EC 4 lb/gal EC	1 lb/100 gal or 1 lb/A (50% WP and 1 lb/gal EC) 2 lb/A (4 lb/gal EC)	5	--	
Peppers					
Broadcast application Foliar Ground equipment	50% WP	1 lb/A	8	-	Use limited to FL and GA (FL920007, FL920009, GA930003, and GA930004). A 7-day PHI has been established.
Broadcast application Foliar Ground equipment	50% WP	1 lb/A	8		Use limited to NM and TX (NM95001). A 14 day PHI has been established.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Plum/Prune					
Spray application Dormant/delayed dormant Ground equipment	1 lb/gal EC 4 lb/gal EC	0.5 lb/100 gal [200-600 gal finished spray/A, 1 lb/A -3 lb/A]	1	NA	See "Apples."
Spray application Dormant/delayed dormant Ground or aerial equipment	4 lb/gal EC	2 lb/A	1	NA	Use limited to CA (CA940013)
Pumpkin					
Slurry seed treatment Preplant	50% WP	1 oz/cwt	(1)	--	See "Bean."
Radish					
Soil in-furrow treatment At planting Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	0.5 oz/1,000 ft. of row (2.75 lb/A)	1	NA	A maximum seasonal application rate of 2.75 lb ai/A is in effect for the 0.5-15% G, 1 lb/gal EC and 4 lb/gal EC formulations.
Radish (grown for seed)					
Soil incorporated treatment Preplant Ground equipment	4 lb/gal EC	2 lb/A	(1)	NA	Use limited to OR (OR94033). Grazing of livestock in treated areas or the feeding of radish cuttings or seed screenings to livestock is prohibited.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Rape					
Broadcast application Foliar Ground or aerial equipment	50% WP	1 lb/A	3	10	See "Broccoli."
Rutabagas					
Soil band treatment At planting/transplanting Ground equipment	0.5% G 1% G 15% G	1.4 oz/1,000 ft. of row (2.25 lb/A)	1	NA	Maximum seasonal application rate of 2.25 lb ai/A is in effect. The use of rutabaga tops for food/feed purposes is prohibited.
	4 lb/gal EC	1.6 oz/1,000 ft. of row (2.25 lb/A)	1	NA	
Soil band treatment At planting Ground equipment	1 lb/gal EC	1.3 oz/1,000 ft. of row	1	NA	Maximum seasonal application rate of 1.9 lb ai/A is in effect. The use of rutabaga tops for food/feed purposes is prohibited.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Sorghum					
Soil T-band incorporated treatment At planting Ground equipment	15% G	8 oz/1,000 ft. of row (1.5 lb/A)	1	NA	
Broadcast application Foliar Ground, sprinkler irrigation, or aerial equipment or Directed spray application Foliar Ground equipment	4 lb/gal EC	1 lb/A	3	10	Maximum seasonal application rate of 1.5 lb ai/A is in effect. A 30-day PHI/PGI/PFI for rates 0.5 lb ai/A and a 60-day PHI/PGI/PFI for rates >0.5 lb ai/A have been established. Use on sweet sorghum is prohibited.
Slurry seed treatment Stored seed	50% WP	19.3 oz/23.5 gal [3 fl.oz/cwt]	(1)	NA	See "Bean."

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Soybean					
Soil T-band incorporated treatment At planting or postemergence Ground equipment	15% G	1.2 oz/1,000 ft. of row	1	NA	
Soil band application At planting Ground equipment or Directed soil band application, Postemergence Ground equipment or Broadcast spray application Foliar Ground, sprinkler irrigation, or aerial equipment	4 lb/gal EC	1 lb/A	3	14 (between final two applications)	Maximum seasonal application rate of 3 lb ai/A is in effect. A 28-day PHI has been established. Grazing of livestock in treated areas or the feeding of treated soybean forage, hay, and straw to meat or dairy animals is prohibited.
Strawberry					
Soil incorporated treatment Preplant Ground equipment	4 lb/gal EC	2 lb/A	1	NA	Use limited to ID, OR, and WA (ID940012, OR940035, and WA94004) Application made one year before harvest season.
Broadcast foliar application Prebloom Ground equipment	1 lb/gal EC 4 lb/gal EC	1 lb/A	2	10	A 21-day PHI has been established.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Strawberry (continued)					
Broadcast foliar application Prebloom Ground equipment	1 lb/gal EC 4 lb/gal EC	1 lb/A	1 pre-plant 2 foliar	10 (foliar)	A 21-day PHI has been established.
Directed spray application Postharvest Ground equipment	4 lb/gal EC	1 lb/A	2	14	Use limited to OR (OR940034).
Sugar beet					
Soil T-band application At planting or postemergence (two- to four-leaf stage) Ground equipment	15% G	1.35 oz/1,000 ft. of row or 2 lb/A (based on a 22-inch row spacing)	1	NA	
Soil incorporated treatment Preplant Ground equipment or Soil band application At planting Ground equipment	4 lb/gal EC	4.6 oz/100 ft row (30 in row) or 1 lb/A	(1)	NA	Maximum seasonal application rate of 4 lb ai/A is in effect. A 30-day PHI/PGI have been established. Application may be made alone or as a tank mix with other pesticides.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Sugar beet (continued)					
Broadcast application Foliar Ground or aerial equipment or Soil band application Foliar Ground equipment	4 lb/gal EC	1 lb/A	3	10	Maximum seasonal application rate of 4 lb ai/A is in effect. A 30-day PHI/PGI have been established.
Sugar beet (grown for seed)					
Soil broadcast application Preplant Ground equipment	4 lb/gal EC	2 lb/A	1 - fall before harvest season	NA	Use limited to ID and OR (ID950018 and OR940028).
Sunflower					
Soil band application At planting Ground equipment	0.5% G 1% G 15% G	1.25 oz/1,000 ft. of row	1	NA	
Soil incorporated treatment Preplant Ground equipment	4 lb/gal EC	2 lb/A	1	NA	Maximum seasonal application rate of 3 lb ai/A is in effect. A 42-day PHI has been established. Grazing of livestock in treated areas is prohibited.
Broadcast foliar application Postemergence Ground or aerial equipment	4 lb/gal EC	1.5 lb/A	3	7	

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Sweet Potato					
Soil incorporated treatment Preplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	2 lb/A	1	NA	A 125-day PHI has been established.
Tobacco					
Soil incorporated treatment Pre-transplant Ground equipment	15% G 4 lb/gal EC	3 lb/A	1	NA	
Soil incorporated treatment Pre-transplant Ground equipment	4 lb/gal EC	2 lb/A	1	NA	Tank mix use in all tobacco growing regions.
Turnip					
Soil band treatment At planting/transplanting Ground equipment or Directed spray application Post-transplant Ground equipment	0.5% G 1% G 15% G 1 lb/gal EC 4 lb/gal EC	1.4 oz/1,000 ft. of row	1	NA	See "Broccoli."

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Walnuts					
Spray application Dormant/delayed dormant Ground or aerial equipment	50% WP	2 lb/A or 2 lb/100 gal	1	NA	
Spray application Foliar Ground or aerial equipment	50% WP 50% DF 1 lb/gal EC 4 lb/gal EC	2 lb/A or 2 lb/100 gal	2	--	A 14-day PHI has been established. Grazing of livestock in treated orchards is prohibited.
Soil spray application Ground equipment	4 lb/gal EC	4 lb/A	2		A 14-day PHI has been established. Grazing of livestock in treated orchards is prohibited. Ant control for orchard floors.
Wheat					
Broadcast application Foliar Ground, sprinkler irrigation, or aerial equipment	4 lb/gal EC	0.5 lb/A	2	--	A 14-day PHI for forage and hay, and a 28-day PHI for grain and straw have been established.

Appendix A. Food/Feed Use Patterns Subject to Reregistration for Chlorpyrifos (Case 0100).

Site Application Type Application Timing Application Equipment	Form	Max. Single Application Rate (ai)	Max. # Apps.	Min. Retreatment Interval (Days)	Use Limitations
Animal uses					
Cattle (beef, calves, and lactating and non-lactating dairy)					
Ear tag treatment	5% Impr	Two ear tags/animal	--	--	One tag is attached to each ear when pests first appear in the spring. Tags may be replaced as needed.
Outdoor turkey pens					
Soil treatment Before turkeys are transferred to pens Ground equipment	50% WP 50% DF	4 lb/A	2	28	Direct application to turkeys is prohibited. A 7-day PSI has been established. Open feed should be covered during spraying and water troughs should be flushed out immediately after spraying operations.
Food-handling establishment uses					
Food-Handling Establishments					
Spot and/or crack and crevice treatment Coarse low pressure sprayer or paint brush	1 lb/gal Mcap 1.7 lb/gal Mcap	0.5% spray	--	14	
Spot and/or crack and crevice treatment Coarse low pressure sprayer or paint brush	2 lb/gal EC 4 lb/gal EC 0.5% RTU	0.5% spray	--	7	Applications may be repeated at 7-day intervals in food service establishments and every 14 days in other types of food handling establishments. Emergency application may be made 2 days after the last treatment; limited to one emergency treatment per month.

[a] Unless protective clothing is worn.
[b] According to Table 1 (OPPTS, 860.1000) label restrictions on these commodities are not practical and will no longer be accepted.

Appendix B. Table of Generic Data Requirements and Studies Used to Make the Reregistration Decision

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
PRODUCT CHEMISTRY				
New Guideline Number	**Old Guid. Number**	**Guideline Name**		**MRID**
830.1550	**61-1**	**Product Identity and Composition**	**All**	**00146506, 00146508, 45434001, data gap for MPs**
830.1600	**61-2A**	**Start. Mat. & Mnfg. Process**	**All**	**00146506, 00146508, 40105301, 40411301, 45434001, data gap for MPs**
830.1670	**61-2B**	**Formation of Impurities**	**All**	**00146506, 00146508, 40105301, 42495401, 45434001, data gap for MPs**
830.1700	**62-1**	**Preliminary Analysis**	**All**	**00146506, 00146508, 40144101, 42544901, 45434001, data gap for MPs**
830.1750	**62-2**	**Certification of limits**	**All**	**00146506, 00146508, 40105301, 45434001, data gap for MPs**
830.1800	**62-3**	**Analytical Method**	**All**	**00146506, 00146508, 40144101, 45434001, 42527203, data gap for MPs**
830.6302	**63-2**	**Color**	**All**	**00146506, 00146508, data gap for MPs**
830.6303	**63-3**	**Physical State**	**All**	**00146506, 00146508, data gap for MPs**
830.6304	**63-4**	**Odor**	**All**	**00146506, 00146508, data gap for MPs**
830.7200	**63-5**	**Melting Point**	**All**	**00146506, 00146508, data gap for MPs**
830.7300	**63-7**	**Density**	**All**	**00146506, 00146508, 42495402, 41747202, data gap for MPs**
830.7840 830.7860	**63-8**	**Solubility**	**All**	**00146506, 00146508, data gap for MPs**
830.7950	**63-9**	**Vapor Pressure**	**All**	**00146506, 00146508, data gap for MPs**
830.7370	**63-10**	**Dissociation Constant**	**All**	**N/A**

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
830.7550	63-11	Octanol/Water Partition Coefficient	All	00146506, 00146508, 42652601, data gap for MPs
830.7000	63-12	pH	All	N/A
830.6313	63-13	Stability	All	00146506, 00146508, data gap for MPs
830.6314	63-14	Oxidizing/Reducing Action	All	41742705, 43428701
830.6315	63-15	Flammability	All	N/A
830.6316	63-16	Explodability	All	00146506, 43046602, 43428702, data gap for MPs
830.6317	63-17	Storage Stability	All	00146506, 00146508, 41747204, 43633901, data gap for MPs
830.7100	63-18	Viscosity	All	N/A
830.6319	63-19	Miscibility	All	N/A
830.6320	63-20	Corrosion characteristics	All	00146506, 00146508, 41653503, 42527201, data gap for MPs
830.7050	None	UV/Visible Absorption	A,B	data gap for MPs
	ECOLOGICAL EFFECTS			
850.2100	71-1	Avian Acute Oral Toxicity	A,B	00046954, 40854701, 41043901, 41885201, 44057101, 44057102, 44585403
850.2200	71-2A	Avian Dietary Toxicity - Quail	A,B	00046955, 00095123, 00095304, 00095305, 40854703, 41965502, 44055101, 44062601, 44585401
850.2200	71-2B	Avian Dietary Toxicity - Duck	A,B	00046958, 00095007, 00095446, 00095449, 40854702, 41965501
850.2400	71-3	Earthworm Toxicity	A,B	00078524, 00095371,
850.2300	71-4A	Avian Reproduction - Quail	A,B	00046951, 42144902
850.2300	71-4B	Avian Reproduction - Duck	A,B	00046952, 00046953, 42144901

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
850.1075	72-1A	Fish Toxicity - Bluegill	A,B	00095013, 00095125, 00095298, 00095296, 00095321, 00154732, 40840904, 41043903, 41885203
850.1075	72-1C	Fish Toxicity, Rainbow Trout	A,B	00095013, 00095297, 00155781, 40840903, 41885204
850.1010	72-2A	Invertebrate Toxicity	A,B	00024400, 00095338, 00095365, 00095366, 00095368, 00095370, 00102520, 00154727, 05000774, 05000821, 05000841, 40840902, 41073401
850.1010	72-2B	Invertebrate Toxicity TEP	A,B	41885202
None	72-3A	Estuarine/Marine Toxicity - Fish	A,B	00102758, 00154718, 42144904
None	72-3B	Estuarine/Marine Toxicity - Mollusk	A,B	42144905, 42495405, 42495406
None	72-3C	Estuarine/Marine Toxicity - Shrimp	A,B	00095363, 42144906, 42245902
None	72-4A	Fish- Early Life Stage	A,B	00154732, 41043903
None		Estuarine Field Studies	A,B	00095130, 00095301, 00095367, 00104696, 00158261, 05000928, 41205409, 41228801, 44585408
850.1500	72-5	Life Cycle Fish	A,B	42834401, 00154721
		Terrestrial Field Toxicity Study	A,B	00095114, 42144903, 43483101, 43483102, 43730301, 43706701, 43785201, 43785202, 44692001, 44709401
850.4400	123-2	Aquatic Plant Growth	A,B	00024400, 41063402
850.3020	141-1	Honey Bee Acute Contact	A,B	00040602, 00060632, 41654701
		Water Monitoring	A,B	43065601, 43760601, 43760602, 43760603, 43760604, 43760605, 43760608, 43760609, 43760610, 43760611, 43786901, 43823901, 43853201, 43853202, 43918301, 44033401, 44033402, 44223601, 44235001, 44711601, 45013101, 43319201. Data gap for collection of water monitoring data to confirm reduction of residues in surface water.

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
		Amphibian Toxicity	**A,B**	**44692201, 45506303**
		Simulated Freshwater Field Studies	**A,B**	**00024400, 00095366, 00154717, 44823801**
		Freshwater Microcosm/Fish Toxicity	**A,B**	**00092775, 00095128, 00095370, 41205403, 43216401, 43216402, 43216403, 44692101, 44585405**
TOXICOLOGY				
870.1100	**81-1**	**Acute Oral Toxicity-Rat**	**A,B**	**44209101, 42495404, 44884301**
870.1200	**81-2**	**Acute Dermal Toxicity-Rabbit/Rat**	**A,B**	**44209102**
870.1300	**81-3**	**Acute Inhalation Toxicity-Rat**	**A,B**	**00146507, 40055001**
870.2400	**81-4**	**Primary Eye Irritation-Rabbit**	**A,B**	**44209103**
870.2500	**81-5**	**Primary Skin Irritation**	**A,B**	**44209104**
870.2600	**81-6**	**Dermal Sensitization**	**A,B**	**44209105**
870.6100	**81-7**	**Acute Delayed Neurotoxicity - Hen**	**A,B**	**00097144, 00405106**
		Special Acute Rat Neurotoxic Esterase	**A,B**	**44273901**
		Acute Pharmacokinetic Study - rat	**A,B**	**44648102**
		Cognitive Rat Study	**A,B**	**44020901**
870.3100	**82-1A**	**90-Day Feeding - Rodent**	**A,B**	**40436406, 40952801**
870.3150	**82-1B**	**90-Day Feeding - Non-rodent**	**A,B**	**42172801**
870.3200	**82-2**	**21-Day Dermal - Rabbit/Rat**	**A,B**	**40972801, 41340201**
870.3465	**82-4**	**90-Day Inhalation-Rat**	**A,B**	**40013901, 40166501, 40908401**
	82-8	**13-Week Rat Neurotoxicity study**	**A,B**	**42929801, 43426601**
870.4100	**83-1A**	**Chronic Feeding Toxicity - Rodent**	**A,B**	**40952802, 42172802, 42534201**

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
870.4100	83-1B	Chronic Feeding Toxicity - Non-Rodent	A,B	00064933, 00146519, 45360101
870.4200	83-2A	Oncogenicity - Rat	A,B	40952802, 42172802
870.4200	83-2B	Oncogenicity - Mouse	A,B	00054352, 00142902, 42534201
870.3700	83-3A	Developmental Tox. - Rat	A,B	00095268, 00130400, 40436407
870.3700	83-3B	Developmental Toxicity - Rabbit	A,B	40436408
870.3800	83-4	2-Generation Repro. - Rat	A,B	00029064, 00064934, 41930301
870.6200	83-6	Developmental Neurotoxicity - rat	A,B	44556901, 44648101, 45360102
870.5140 870.5375	84-2A 84-2B	Mutagenicity Studies	A,B	00152683, 00152684, 00157058, 00157057, 40057201 40436401, 40436409, 40436411, 41340203, 44533401
870.7485	85-1	General Metabolism	A,B	40458901, 44648102, 44810701
		6-Week Dietary Study Acetylcholinesterase Inhibition in the Dog	A,B	45467301, 45467302
		Human data	A,B	42008401, 42031701, 44035001, 44811002, 44889501, 45098001, 45144101, 45195701, 45195702, 45195703, 45195704, 45195705
OCCUPATIONAL/RESIDENTIAL EXPOSURE				
875.2100	132-1A	Foliar Residue Dissipation	A,B	42974501, 42994401, 43062701, 43062702, 44748101, 44748102, data gap for ornamentals grown in greenhouses, biological monitoring data to develop transfer coefficientf for various greenhouse/nursery activities
875.2200	132-1B	Soil Residue Dissipation	A,B	41540202, 42974501, data gap for reentry into treated areas with soil incorporated/directed applications

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
875.2400	133-3	Dermal Passive Dosimetry Exposure	A,B	42974501, 42994401, 42994401, 43027901, 43042002, 43138101, 43138102, 44483501, 44739302,
875.2500	133-4	Inhalation Passive Dosimetry Exposure	A,B	42974501, 42994401, 42994401, 43027901, 43042002, 43138101, 43138102, 44483501, 44739302,
875.1100	231	Estimation of Dermal Exposure at Outdoor Sites	A,B	40026001, 43013501, 43013502, 43013503, 43042001 44167101, 44444801, 44729401, 44729402, 44739301, 44589001, data gap for seed treatment uses, dip applications (preplant peach), mixing wettable powders for aerial/chemigation application, loading and applying granulars for aerial applications, groundboom application, and backpack spray applications
875.1300	232	Estimation of Inhalation Exposure at Outdoor Sites	A,B	40026001, 43013501, 44167101, 44444801, 44729401, 44729402, 44739301, 44589001, data gap for seed treatment uses, dip applications (preplant peach), mixing wettable powders for aerial/chemigation application, loading and applying granulars for aerial applications , groundboom application, and backpack spray applications
	233	Estimation of Dermal Exposure at Indoor Sites	A,B	40094001, 44458201, 42887201, Data gap for treated wood in residential structures.
	234	Estimation of Inhalation Exposure at Indoor Sites	A,B	40094001, 44458201, 43963701, Data gap for treated wood in residential structures.
ENVIRONMENTAL FATE				
None	160-5	Chemical Identity	A,B	00146506, 00146508
835.2120	161-1	Hydrolysis	A,B	00155577
835.2240	161-2	Photodegradation - Water	A,B	41747206, 40026101
835.2410	161-3	Photodegradation - Soil	A,B	42495403
835.2370	161-4	Photodegradation - Air	A,B	40234801, waived

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
835.4100	**162-1**	**Aerobic Soil Metabolism**	**A,B**	**00025619, 42144911, 42144912**
835.4200	**162-2**	**Anaerobic Soil Metabolism**	**A,B**	**00025619**
835.4400	**162-3**	**Anaerobic Aquatic Metabolism**	**A,B**	**waived**
835.4300	**162-4**	**Aerobic Aquatic Metabolism**	**A,B**	**44083401, waived**
835.1240	**163-1**	**Leaching/Adsorption/ Desorption**	**A,B**	**00155636, 00155637, 40050401, 41892801, 41892802, 42493901**
835.6100	**164-1**	**Terrestrial Field Dissipation**	**A,B**	**40059001, 40395201, 42874702, 42874703, 42874704, 42924801, 42924802,**
835.1850	**165-1**	**Confined Rotational Crop**	**A,B**	**43210801**
None	**165-4**	**Bioaccumulation in Fish**	**A,B**	**40056401, 42495405, 42495406**
RESIDUE CHEMISTRY				
None	**171-2**	**Chemical Identity**	**A,B**	**00146506, 00146508**
860.1300	**171-4A**	**Nature of Residue - Plants**	**A,B**	**00066724, 00066725, 00072657, 00072660, 00157541, 00157542, 00157543, 40638801, 40638802, 41829007**
860.1300	**171-4B**	**Nature of Residue- Livestock**	**A,B**	**00077055, 00154734,00161743, 40638802**
860.1340	**171-4C+D**	**Residue Analytical Method - Plants and Animals**	**A,B**	**00034031, 00037455, 00037457, 00037458, 00039642, 00039643, 00051801, 00058089, 00084330, 00084331, 00095179, 00095201, 00095216, 00095251, 00095383, 00095387, 00095436, 00134720, 00141725, 00148881, 00155578, 00155579, 00155580, 00157713, 00158566, 00158567, 00158568, 00158569, 00162109, 00164187, 40131301, 40131302, 40288501**
860.1380	**171-4E**	**Storage Stability**	**A,B**	**00033586, 00034031, 00044555, 00051798, 00077120, 00095227, 00095260, 00095374, 00101566, 00116675, 00134720, 00162109**

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
860.1480	171-4J	Magnitude of Residues - Meat/Milk/Poultry/Egg	A,B	00058087, 00095179, 00095438, 42542701
860.1500	171-4K	Magnitude of Residue in Plants (Root and Tuber Vegetables Group)	A,B	Radish, fresh - 0095259 Rutabagas, root - 0095259 Sugar beets, root - 00039641, 00101566 Sweet potatoes, root - 00095227 Turnip, root - 0095259
860.1500	171-4K	Mag. of Res.- Plants (Leaves of Root and Tuber Veg. Group)	A,B	Sugar beets, tops - 00039641, 00101566 Turnip, tops - 00095259
860.1500	171-4K	Mag. of Res.- Plants (Bulb Veg. Group)	A,B	Leeks - 00157909 Onions, dry bulb(only) - 00154019, 42649001
860.1500	171-4K	Mag. of Res.- Plants (Brassica Leafy Vegetables group)	A,B	Broccoli - 00095273, 00155580, 00158566 Brussels sprouts - 00095273, 00158566 Cabbage - 00095273, 00155580, 00158566 Cabbage, Chinese - 00095273 Cauliflower - 00095273, 00158566
860.1500	171-4K	Mag. of Res.- Plants Legume Vegetables (succulent or dried) Group	A,B	Beans, lima - 42245907 Beans, snap - 42245907 Soybeans - 00095270, data gap for aspirated grain fractions
860.1500	171-4K	Mag. of Res.- Plants (Foliage of Legume Vegetables Group)	A,B	Beans, vines - 00095264, 42245907 Beans, lima, vines - 00095264, 42245907 Beans, snap, vines - 42245907 Peas, vines - 00095264 Soybeans, forage - 00095270
860.1500	171-4K	Mag. of Res.- Plants [Fruiting Vegetables (except cucurbits) Group]	A,B	Tomatoes -00095251, 00131864, (tomato tolerance being revoked)

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
860.1500	171-4K	Mag. of Res.- Plants (Cucurbit Veg Group)	A,B	Cucumbers - 00095264 Pumpkins - 00095264
860.1500	171-4K	Mag. of Res.- Plants Citrus Fruits Group	A,B	00084326, 00095260
860.1500	171-4K	Mag. of Res.- Plants (Pome Fruits Group)	A,B	Apples - 00044555, 00088978, 00095264 Pears - 00044555, 43445601
860.1500	171-4K	Mag. of Res.- Plants (Stone Fruits Group)	A,B	Cherries - 00044555, 00077120, data gap Nectarines - 00044555, 00095179 Peaches - 00044555, 00095179 Plums (fresh prunes) - 00044555
860.1500	171-4K	Mag. of Res.- Plants (Small Fruits and Berries Group)	A,B	Bluberry - 00164187 Caneberries - PP#7E3557 Cranberries - 00108813 Grapes - 00085785, 00126713, 00134499, PP#3F02872/3H05393 Strawberries - 00095271, 40131302
860.1500	171-4K	Mag. of Res.- Plants (Tree Nuts Group)	A,B	00132786, 00044555, 00116675, 41424401
860.1500	171-4K	Mag. of Res.- Plants Cereal Grains Group	A,B	Corn, field, grain - 00070509 Corn, sweet (K+CWHR) - 00095216, 42245904 Sorghum, grain (milo) - 00046785, 00095249, 42245905, data gap for aspirated grain fractions Wheat, grain - data gap for aspirated grain fractions

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
860.1500	171-4K	Mag. of Res.- Plants (Forage, Fodder, and Straw of Cereal Grains Group)	A,B	Corn, Fodder - 00070509, 00078962, data gap Corn, Forage - 00070509, 00078962, data gap Sorghum, Fodder (milo) - 00046785, 00158569, Sorghum, Forage (milo) - 00046785, 00158569, Wheat, forage - PP#3F2947/FAP#3H5411, data gap for aspirated grain fractions Wheat, straw - PP#3F2947/FAP#3H5411, data gap for aspirated grain fractions
860.1500	171-4K	Mag. of Res.- Plants (Non-grass Animal Feeds (forage, fodder, straw, and hay) Group)	A,B	Alfalfa, forage - 00125686, 00158567, 00158568, 41739001 Alfalfa, hay - 00125686, 00158567, 00158568, 41739001
860.1500	171-4K	Mag. of Res.- Plants (Miscellaneous Commodities)	A,B	Asparagus - 00094088 Bananas - 00125686 Cherimoya - PP#7E3536 Cottonseed - 00095373, 40131303, data gap for cotton gin by-products Dates - 00162109 Feijoa (pineapple guava) - PP#7E3536 Figs - 00098580 Kiwifruits - 00115260 Mint - 00034031 Mushrooms - 00129295 Peanuts - 00025942, 00083840, 00095263 Sapote - PP#7E3536 Sugarcane - 42645401 Sunflower - 00084845, 42245906, 43181401 Tobacco - 40265201
860.1500	171-4K	Mag. of Res.- Plants (Crops Grown Solely for Seed)	A,B	Clover forage, seed and hay - data gap Grass forage and hay - data gap

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT			USE PATT	CITATION(S)
860.1520	**171-4L**	**Magnitude of the Residues in Processed Food/Feed**	**A,B**	**Alfalfa - 00125686, 00158567, 00158568 Apples - 00044555, 00088978, 00095264 Citrus - 00084326 Corn, field - 00084266, 42649002 Corn, sweet - 42649002 Cottonseed - 00037455 Grapes - 00085785, 00126713, 00134499 Mint - 00034031 Peanuts - 00025942, 00083840, 00095263 Plums - 00044555 Sorghum - 00046785, 00095249 Soybeans - 00095270 Sugar beet - 00039641, 00101566 Sugarcane - 42645401 Sunflower - 00084846, 42245906, 43181401 Tomatoes - 00095251 Wheat - PP#3F2947/FAP#3H5411**
860.1460	**171-4I**	**Magnitude of Residue in Food Handling Establishments**	**A,B**	**00090562, 00090563**
OTHER				
810.1000	**90-1**	**Usage Data for hydraulic handheld equipment**	**A,B**	**Data gap for usage data of amount of ai handled per day, per season and types of equipment.**
810.1000	**90-1**	**Usage Data for high pressure hand-wand equipment**	**A,B**	**Data gap for usage data of amount of ai handled per day, per season and types of equipment.**
810.1000	**90-1**	**Usage Data for groundboom applications to sodfarms**	**A,B**	**Data gap for usage data of acres treated per day at the 3 lb/A rate on sodfarms.**
810.1000	**90-1**	**Usage Data for greenhouse activities**	**A,B**	**use pattern information, timing of application relative to post-application activities**

APPENDIX B

Data Supporting Guideline Requirements for the Reregistration of Chlorpyrifos

REQUIREMENT		USE PATT	CITATION(S)
201-1	Droplet Size Spectrum	A,B	43760606, 43760607, 43786902
202-1	Drift Field Evaluation	A,B	41887501, 43786903
	Incident data	A,B	43798001, 44039901, 44186301, 44245801

Appendix C.Technical Support Documents

Appendix C. TECHNICAL SUPPORT DOCUMENTS

Additional documentation in support of this RED is maintained in the OPP docket, located in Room 119, Crystal Mall #2, 1921 Jefferson Davis Highway, Arlington, VA. It is open Monday through Friday, excluding legal holidays, from 8:30 am to 4 pm.

The docket initially contained preliminary risk assessments and related documents as of August 10, 1998. Sixty days later the first public comment period closed. The EPA then considered comments, revised the risk assessment, and added the formal "Response to Comments" document and the revised risk assessment to the docket on June 16, 1999.

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:

www.epa.gov/pesticides/op

These documents include:

HED Documents:

1. David Soderberg (USEPA/OPPTS/OPP/HED). Acute Dietary Risk Assessment for Chlorpyrifos, Revised after Public Comments. June 22, 2000.

2. David Soderberg (USEPA/OPPTS/OPP/HED). Chronic Dietary Exposure Assessment for Chlorpyrifos RED with Updated Values for Anticipated Residues, Revised after Public Comments. June 22, 2000.

3. Steven A. Knizner (USEPA/OPPTS/OPP/HED). Chlorpyrifos - Revised Product and Residue Chemistry Chapters of the HED Chapter of the RED. June 20, 2000.

4. Tim Leighton (USEPA/OPPTS/OPP/HED). Agricultural and Occupational Exposure Assessment and Recommendations for the RED Document for Chlorpyrifos. June 19, 2000.

EFED Document:

1. William Rabert (USEPA/OPPTS/OPP/EFED). EFED Review of Lorsban-4E, Lock-On, and Lorsban 15G Label Changes. July 31, 2001.

Appendix D. Citations Considered to be Part of the Data Base Supporting the Interim Reregistration Decision (Bibliography)

Appendix D. CITATIONS CONSIDERED TO BE PART OF THE DATA BASE SUPPORTING THE INTERIM REREGISTRATION DECISION (BIBLIOGRAPHY)

GUIDE TO APPENDIX D

1. CONTENTS OF BIBLIOGRAPHY. This bibliography contains citations of all studies considered relevant by EPA in arriving at the positions and conclusions stated elsewhere in the Reregistration Eligibility Document. Primary sources for studies in this bibliography have been the body of data submitted to EPA and its predecessor agencies in support of past regulatory decisions. Selections from other sources including the published literature, in those instances where they have been considered, are included.

2. UNITS OF ENTRY. The unit of entry in this bibliography is called a "study". In the case of published materials, this corresponds closely to an article. In the case of unpublished materials submitted to the Agency, the Agency has sought to identify documents at a level parallel to the published article from within the typically larger volumes in which they were submitted. The resulting "studies" generally have a distinct title (or at least a single subject), can stand alone for purposes of review and can be described with a conventional bibliographic citation. The Agency has also attempted to unite basic documents and commentaries upon them, treating them as a single study.

3. IDENTIFICATION OF ENTRIES. The entries in this bibliography are sorted by Master Record Identifier, or "MRID" number. This number is unique to the citation, and should be used whenever a specific reference is required. It is not related to the six-digit "Accession Number" which has been used to identify volumes of submitted studies (see paragraph 4(d)(4) below for further explanation). In a few cases, entries added to the bibliography late in the review may be preceded by a nine character temporary identifier. These entries are listed after all MRID entries. This temporary identifying number is also to be used whenever specific reference is needed.

4. FORM OF ENTRY. In addition to the Master Record Identifier (MRID), each entry consists of a citation containing standard elements followed, in the case of material submitted to EPA, by a description of the earliest known submission. Bibliographic conventions used reflect the standard of the American National Standards Institute (ANSI), expanded to provide for certain special needs.

   a Author. Whenever the author could confidently be identified, the Agency has chosen to show a personal author. When no individual was identified, the Agency has shown an identifiable laboratory or testing facility as the author. When no author or laboratory could be identified, the Agency has shown the first submitter as the author.

   b. Document date. The date of the study is taken directly from the document. When the date is followed by a question mark, the bibliographer has deduced the date

from the evidence contained in the document. When the date appears as (1999), the Agency was unable to determine or estimate the date of the document.

c. Title. In some cases, it has been necessary for the Agency bibliographers to create or enhance a document title. Any such editorial insertions are contained between square brackets.

d. Trailing parentheses. For studies submitted to the Agency in the past, the trailing parentheses include (in addition to any self-explanatory text) the following elements describing the earliest known submission:

(1) Submission date. The date of the earliest known submission appears immediately following the word "received."

(2) Administrative number. The next element immediately following the word "under" is the registration number, experimental use permit number, petition number, or other administrative number associated with the earliest known submission.

(3) Submitter. The third element is the submitter. When authorship is defaulted to the submitter, this element is omitted.

(4) Volume Identification (Accession Numbers). The final element in the trailing parentheses identifies the EPA accession number of the volume in which the original submission of the study appears. The six-digit accession number follows the symbol "CDL," which stands for "Company Data Library." This accession number is in turn followed by an alphabetic suffix which shows the relative position of the study within the volume.

Chlorpyrifos Bibliography

Barone, S., C. Lau, V.C. Moser, P.M. Phillips, K.L. McDaniel, D. Hunter, R. Marshall, P. Kodavanti, F. Dern-Yellin, and S. Padilla. (1997) Developmental effects of gestational exposure to chlorpyrifos in the rat [abstract 1301]. *Toxicologist* 36(1):256.

Bradman MA, et al. 1997. Pesticide exposures to children from California's Central Valley: results of a pilot study. J. Expos. Anal. Environ. Epidem. Vol 7 No. 2, pp. 217-234.

Brzak, K.A., Harms, D.W., Bartels, M.J., and Nolan, R.J. 1998. Determination of Chlorpyrifos, Chlorpyrifos-oxon and 3,5,6-trichloro-2-pyridinol in rat and human blood. J. Anal Toxicol. 22:203-230.

Capodicasa, E., Scapellato, M.L., Moretto, A., Caroldi S., and Lotti, M. 1991. Chlorpyrifos-induced delayed polyneuropathy. Arch Toxicol. 65:150-155.

Campbell, C.G., Seidler, F.J, and Slotkin, T.A. (1997). Chlorpyrifos interferes with cell development in rat brain regions (Brain Res. Bull 43(2):179-189.

Chakraborti, T.K., J.D. Farrar, and C.N. Pope. (1993) Comparative neurochemical and neurobehavioral effects of repeated chlorpyrifos exposures in young and adult rats. *Pharmacology Biochemistry and Behavior* 46:219-224.

Chanda, S.M., J. Chaudhuri, T. Chakraborti, and C. Pope. (1993) Persistent fetal brain cholinesterase inhibition induced by a single maternal dose of chlorpyrifos [abstract 257]. *Toxicologist* 13:88.

Chanda, S.M., P. Harp, J. Liu, and C.N. Pope. (1995) Comparative developmental and maternal neurotoxicity following acute gestational exposure to chlorpyrifos in rats. *Journal of Toxicology and Environmental Health* 44:189-202.

Chanda, S.M., S.R. Mortensen, S. Barone, V.C. Moser, and S. Padilla. (1997) Developmental profiles of two organophosphate detoxifying enzymes: carboxylesterase and A-esterase [abstract 1757]. *Toxicologist* 36(1):346.

Chanda S.M. and C.N. Pope. (1996) Neurochemical and neurobehavioral effects of repeated gestational exposure to chlorpyrifos in maternal and developing rats. *Pharmacology Biochemistry and Behavior* 53(4):771-776.

Costa LG, Li WF, Richter RJ, Shih DM, Lusis A, and Furlong CE. 1999. The role of paraoxonase (PON1) in the detoxication of organophosphates and its human polymorphism. Chemico-Biological Interactions 119-120: 429-438

Chlorpyrifos Bibliography

Dam K, Garcia SJ, Seidler FJ, Slotkin TA (1999a) Neonatal chlorpyrifos exposure alters synaptic development and neuronal activity in cholinergic and catecholaminergic pathways. Developmental Brain Res. 116:9-20.

Dam K; Seidler FJ; Slotkin TA (1999b) Chlorpyrifos releases norepinephrine from adult and neonatal rat brain synaptosomes. Brain Res Dev Brain Res, 118(1-2):129-33.

Das KP, Barone S (1999) Neuronal differentiation in PC 12 cells is inhibited by chlorpyrifos and its metabolites: Is acetylcholinesterase inhibition the site of action? Toxicol. Applied Pharmacol. 160:217-230.

Davies HG, Richter RJ, Keifer M, Broomfield CA, Sowalla J, and Furlong CE. 1996. The effect of the human serum paraoxonase polymorphism is reverse with diazoxon, soman and sarin. Nat Genet. Nov 14(3):334-6.

Furlong, CE., Li WF., Costa, LG., Richter RJ., Shih DM, and Lusis AJ. 1998 Genetically determined susceptibility to organophosphorus insecticides and nerve agents: developing a mouse model for the human PON1 polymorphism. Neurotoxicology. Aug-Oct: 19(4-5):645-60

GAO. 2000. Improvements needed to ensure the safety of farm workers and their children. GAO Report Number RCED-00-40.

Johnson, D.E., Seidler F.J., and Slotkin, T.A. 1998. Early Biochemical Detection of Delayed Neurotoxicity Resulting from Developmental Exposure to Chlorpyrifos. Brain Research Bulletin. 45(2):143-147.

Lassiter, T.L., S. Padilla, and S. Barone. (1997) Effects of gestational exposure to chlorpyrifos on the developmental profiles of acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) activity in the rat brain [abstract 1313]. *Toxicologist* 36(1):259.

Lassiter, T.L., D. Hunter, R. Marshall, S. Mortensen, S. Chanda, K. Das, and S. Padilla. (1997) The fetal brain appears to be protected from late gestational exposure to chlorpyrifos. Platform/Poster submission, Neurobehavioral Teratology Society Meeting.

Lassiter TL, Padilla S, Mortensen SR, Chanda SM, Moser VC, Barone S (1998) Gestational exposure to chlorpyrifos: Apparent protection of the fetus? Toxicol. Applied Pharmacol. 152: 56-65.

Li WF, Costa LG, Furlong CE. 1993. Serum paraoxonase status: a major factor in determining resistence to organophosphates. J Toxicol Environ Health. Oct-Nov: 40(2-3):337-46.
Leighton TM, Nielsen AP. 1995. The U.S. Environmental Protection Agency, Health Canada, and National Agricultural Chemicals Association, Pesticide Handlers Exposure Database. Appl. Occup. Environ. Hyg. 10(4).

Chlorpyrifos Bibliography

Mortensen, S.R., Hooper M.J. S. Padilla. 1998. Rat brain acetylcholinesterase activity: developmental profile and maturational sensitivity to carbamate and organophosphorus inhibitors. Toxicology. 125:13-19.

Mortensen, S.R., S.M. Chanda, M.J. Hooper, and S. Padilla. (1997, draft) Maturational differences in chlorpyrifos-oxonase activity may contribute to age-related sensitivity to chlorpyrifos.

Mortensen, S.R., M.J. Hooper, and S. Padilla. (1997, draft) Developmental profiles and maturational sensitivity of rat brain acetylcholinesterase activity.

Moser, V.C. and S. Padilla. 1998. Age- and gender-related differences in the time-course of behavioral and biochemical effects produced by oral chlorpyrifos in rats. Toxicology and Applied Pharmacology. 149:107-119.

Moser, V.C., Chanda, S.M., Mortensen S.R., and Padilla, S. 1998. Age- and Gender-Related Differences in Sensitivity to Chlorpyrifos in the Rat Reflect Developmental Profiles of Esterase Activities. Toxicological Sciences. 46:211-222.

National Agricultural Pesticide Impact Assessment Program (NAPIAP). 1996. Biologic and economic assessment of pest management in the United States greenhouse and nursery industry. NAPIAP Report Number 1-CA-96.

Nigg NN and Knaak JB. 2000. Blood cholinesterases as human biomarkers of organophosphorus pesticide exposure. Rev Environ Contam Toxicol 163:29-112.

Nolan R.J., Rick D.L., Freshour M.L., and Saunders J.H. 1982. Chlorpyrifos: Pharmacokinetics in human volunteers following single oral and dermal doses. The Dow Chemical Co. Biomedical Medical Research Lab. Toxicology Research Lab. Midland MI. Accession No. 249203.

Padilla S., Wilson, V.Z., and Bushnell, P.J. (1994). Studies on the correlation between blood cholinesterase inhibition and “Target Tissue” inhibition in pesticide-treated rats. Toxicology 92;11-25.

Phillips, P.M., K.L. McDaniel, T.L. Lassiter, S. Barone, and V.C. Moser. (1997) Behavioral effects of gestational exposure to chlorpyrifos in rats [abstract 1300]. *Toxicologist* 36(1):256.

Pope, C.N., T.K. Chakraborti, M.L. Chapman, J.D. Farrar and D. Arthun. (1991) Comparison of in vivo cholinesterase inhibition in neonatal and adult rats by three organophosphorothioate insecticides. *Toxicology* 68:51-61.

Pope, C.N. and T.K. Chakraborti. (1992) Dose-related inhibition of brain and plasma cholinesterase in neonatal and adult rats following sublethal organophosphate exposures. *Toxicology* 73:35-43.

Chlorpyrifos Bibliography

Pope, C.N, Chakraborti, T.K., Chapman, M.L and Farrar, J.D. (1992). Long-Term neuro - behavioral and behavioral effects induced by acute chlorpyrifos treatment (1992) Pharm. Biochem. Behav. 42:251-256

Pope, C.N and Liu, J (1997). Age-Related Differences in Sensitivity to Organophosphorous Pesticides. *Environmental Toxicol. And Pharmacol.* 4;309-314.

Richardson R.J., Moore T.B., Kayyali, U.S., and Randall J.C. 1993. Chlorpyrifos: Assessment of Potential for Delayed Neurotoxicity by Repeated Dosing in Adult Hens with Monitoring of Brain Acetylcholinesterase, Brain and Lymphocyte Neurotoxic Esterase, and Plasma Butyrylcholinesterase Activities. Fund. Applied. Toxicology. 21:89-96.

Roy TS, Andrews JE, Seidler FJ, Slotkin TA (1998) Chlorpyrifos elicits mitotic abnormalities and apoptosis in neuroepithelium of cultured rat embryos. Teratology 58:62-68.

Shih DM, Gu L, Xia YR, Navab M, Li WF, Hama S, Castellani LW, Furlong CE, Costa LG, Fogelman AM and Lusis AJ. 1998. Mice Lacking serum paraoxonase are susceptible to organophosphate toxicity and atherosclerosis. Nature. Jul 16: 394 (6690):284-7

Simcox NJ, Fenske RA, Wolz SA, Lee IC, Kalman DA. 1995. Pesticides in household dust and soil: exposure pathways for children of agricultural families. Environ Health Perspect 103: 1126-1134.

Slokin T.A. 1999. Developmental Cholinotoxicants: Nicotine and Chlorpyrifos. Environmental Health Perspectives. 107, Supplement 1, 71-80.

Song, X., Seidler, F.J., Saleh, J.L., Zhang, J. Padilla, S., Slotkin T.A. 1997. Cellular mechanisms for developmental toxicity of chlorpyrifos: targeting the adenylyl cyclase signaling cascade. Toxciol Appl. Pharmacol. 145:158-174.

Stanton, M.E., W.R. Mundy, T. Ward, V. Dulchinos, and C.C. Barry. (1994) Time-dependent effects of acute chlorpyrifos administration on spatial delayed alternation and cholinergic neurochemistry in weanling rats. *NeuroToxicology* 15(1):201-208.

Tang J, Carr RL, Chambers JE (1999) Changes in rat brain cholinesterase activity and muscarinic receptor density during and after repeated oral exposure to chlorpyrifos in early postnatal development. Toxicological Sciences 51:265-272.

USDA. 1979. Planting and harvesting data for U.S. vegetables. USDA Handbook 507.

U.S. EPA 1987. Pesticide Assessment Guidelines, Subdivision U: Applicator Exposure Monitoring. (Currently referred to as Series 875 Group A). Office of Pesticide Programs, Washington, DC. EPA/540/9-87-127.

Chlorpyrifos Bibliography

U.S. EPA 1992a. Guidelines for exposure assessment. Federal Register Notice. Vol. 57. No. 104, pp. 22888 - 22938.

U.S. EPA 1992b. Dermal exposure assessment: principles and applications. Office of Health and Environmental Assessment, Washington, DC. EPA/600/8-9/011F.

U.S. EPA and Health Canada. 1995a. PHED Evaluation Guidance. Prepared by Versar, Inc. March 15, 1995.

U.S. EPA, Health Canada, American Crop Protection Association. 1995b. PHED: The Pesticide Handlers Exposure Database, Reference Manual Version 1.1. Prepared by Versar, Inc. February 1995.

Whitney, K.D., Seidler, F.J., and Slotkin, T.A (1995). Developmental Neurotoxicity of Chlorpyrifos Cellular Mechanism.*Toxicol. And Pharmacol*134:53-62

Zheng, Q., Olivier K., Won Y., and Pope C. 1999. Comparative Cholinergic Neurotoxicity of Oral Chlorpyrifos Exposures in Neonatal and Adult Rats. Abstract and Poster Presentation. presented at the 38th Annual Society of Toxicology Meeting in New Orleans, March 14-18. The Toxicologist Vol 48, No.1-S, #874. March 1999.

Zheng Q, Olivier K, Won YK, Pope CN (2000) Comparative cholinergic neurotoxicity of oral chlorpyrifos exposures in preweanling and adult rats. Accepted for Publication.

Product Chemistry MRID References

00146506 Dow Chemical U.S.A. (1985) Product Chemistry: Dursban F Insecticidal Chemical. Unpublished compilation. 63 p.

00146508 Dow Chemical U.S.A. (1985) Product Chemistry: Dursban R Insecticidal Chemical. Unpublished compilation. 34 p.

40105301 Dow Chemical Co. (1987) Dursban F Insecticidal Chemical Product Identity and Composition. Unpublished compilation. 29 p.

40144101 Dow Chemical U.S.A. (1987) Dursban F Insecticidal Chemical Analysis and Certification of Product Ingredients. Unpublished compilation. 74 p.

40411301 Dow Chemical Co. (1987) Dursban R Insecticidal Chemical: Product Identity and Composition. Unpublished study. 17 p.

Chlorpyrifos Bibliography

41653503 Hamburg, F. (1990) Determination of the Compatibility Characteristics of Dursban R: Lab Project No: 90014: GH-C2369. Unpublished study by DowElanco. 11 p.

41747202 Hamburg, F. (1990) Determination of the Density of Dursban F Technical: Lab Project Number: GH-C 2405. Unpublished study prepared by DoeElanco. 10 p.

41747204 Hamburg, F. (1990) Storage Stability of Dursban R: Lab Project Number: GH-C 2439. Unpublished study prepared by DowElanco. 10 p.

41747205 Hamburg, F. (1990) Determination of the Oxidizing or Reducing Action of Dursban F Technical: Lab Project No: GH-C 2422. Unpublished study by DowElanco. 10 p.

42495401 Jones-Jefferson, T.; Bischoff, R. (1992) Response to EPA Chlorpyrifos Generic Data Call-in dated September 18, 1991: Product Chemistry|: Lab Project Number: RFB-92. Unpublished study prepared by DowElanco. 6 p.

42495402 Jones-Jefferson, T. (1992) Density of Dursban Technical: Lab Project Number: FOR92037. Unpublished study prepared by DowElanco. 11 p.

42527201 Krause, R. (1988) Laboratory Immersion Compatibility Test Procedure for Testing with Metals, Rubbers, and Plastics: Lab Project Number: REK51688. Unpublished study prepared by DowElanco. 10 p.

42527203 Skelly, N. (1980) Analytical Method Validation Report for the Determination of Chlorpyrifos in Dursban Insecticide Formulations by Reversed-phase Liquid Chromatography: Lab Project Number: ML-AL-80-70511. Unpublished study prepared by DowElanco. 36 p.

42544901 Hermann, E. (1992) Batch Analysis of Dursban FM Insecticide for the Presence of 2,3,7,8-Tetrachloro-1,4-Dioxino-2,3B-5,6B Dipyridine: Lab Project Number: DECO ML-AL 92-030221. Unpublished study by The Dow Chemical Co. 15 p.

42652601 Macdonald, I. (1985) The Determination of Physico-Chemical Parameters of Chlorpyrifos: Lab Project Number: DWC 432/85579. Unpublished study prepared by Huntington Research Centre Ltd. 28 p.

43046602 Powers, J.; Beckrow, R. (1992) Explodability of Dursban R Insecticide AGR Sample 220406 by Drop Weight Tester: Lab Project Number: ML-AL 91-110098. Unpublished study prepared by The Dow Chemical Co. 9 p.

43428701 Kinnunen, C. (1994) Series 63-14: Determination of Oxidation/Reducing Action of Dursban R: Lab Project No: FOR94049. Unpublished study by DowElanco. 10 p.

43428702 Kinnunen, C. (1994) Series 63-16: Determination of Explodability of Dursban FM: Lab Project Number: FOR94010. Unpublished study by DowElanco. 8 p.

43633901 Krause, R.; Kinnunen, C. (1995) Storage Stability of Dursban FM: One Year Ambient Temperature Storage Study Results: Lab Project Number: FOR94009. Unpublished study prepared by DowElanco. 14 p.

45434001 Smith, A. (2001) Group A: Product Identity and Composition, Description of Materials Used to Produce the Product, Description of Production Process, Discussion of Formation of Impurities, Preliminary Analysis, and Enforcement Analytical Methods for Dursban F, Dursban FM, Dursban FE, Dursban FI, Lorsban F, or Lorsban Technical: Lab Project Number: NAFST407: P97-057: DECO ML-AL 97-000023. Unpublished study by Dow AgroSciences LLC and The Dow Chemical Company. 448 p. {OPPTS 830.1550, 830.1600, 830.1620, 830.1670, 830.1700, 830.1800, 830.1750}

Ecological Effects MRID References

00024400 Hurlbert, S.H.; Mulla, M.S.; Keith, J.O.; et al. (1970) Biological effects and persistence of Dursban in freshwater ponds. Journal of Economic Entomology 63(1):43-52. (Also In unpublished submission received Jul 19, 1978 under 201-403; submitted by Shell Chemical Co., Washington, D.C.; CDL:234468-O)

00040602 Johansen, C.; Mayer, D.; Baird, C. (1973) Bee Research Investigations, 1973. (Incomplete, unpublished study received Oct 21, 1976 under 6F1696; prepared by Washington State Univ., Dept. of Entomology in cooperation with Alfalfa Seed Pest Management Project, submitted by E.I. du Pont de Nemours & Co., Inc., Wilmington, Del.; CDL:095326-M)

00046951 Fink, R.; Beavers, J.B.; Brown, R. (1978) Final Report: One-Generation Reproduction Study-Bobwhite Quail: Project No. 103-177. (Unpublished study received Oct 15, 1980 under 464-448; prepared by Wildlife International, Ltd. and Washington College, submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:243487-L)

00046952 Fink, R.; Beavers, J.B.; Brown, R. (1978) Final Report: One-Generation Reproduction Study--Mallard Duck: Project No. 103-178. (Unpublished study received Oct 15, 1980 under 464-448; prepared by Wildlife International, Ltd. and Washington College, submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:243487-M)

Chlorpyrifos Bibliography

00046953 Fink, R. (1977) Final Report: Eight-Week Feeding Study-Mallard Duck: Project No. 103-176. (Unpublished study received Oct 15, 1980 under 464-448; prepared by Wildlife International, Ltd., submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:243487-N)

00046954 Fink, R.; Beavers, J.B.; Brown, R. (1978) Final Report: Eight-Day Dietary LC50--Mallard Duck: Project No. 103-180. (Unpublished study received Oct 15, 1980 under 464-448; prepared by Wildlife International, Ltd. and Washington College, submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:243487-O)

00046955 Fink, R.; Beavers, J.B.; Brown, R. (1978) Final Report: Eight-Day Dietary LC50--Bobwhite Quail: Project No. 103-179. (Unpublished study received Oct 15, 1980 under 464-448; prepared by Wildlife International, Ltd. and Washington College, submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:243487-P)

00046958 Fink, R.; Beavers, J.B.; Brown, R. (1978) Final Report: Eleven-Day Toxicant 2 X LC50, with Five-Day Half-Life, Decreasing Concentrations--Mallard Duck: Project No. 103-183. (Unpublished study received Oct 15, 1980 under 464-448; prepared by Wildlife Inter national, Ltd. and Washington College, submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:243487-S)

00060632 Johansen, C.; Eves, J. (1967) Bee Research Investigations, 1967: Report No. 21866. (Unpublished study received Mar 27, 1974 under 4F1485; prepared by Washington State Univ., submitted by Chemagro Corp., Kansas City, Mo.; CDL:092011-M)

00078524 Thompson, A.R. (1971) Effects of nine insecticides on the numbers and biomass of earthworms in pasture. Bulletin of Environmental Contamination & Toxicology 5(6):577-586. (Submitter report no. 31421; also~In~unpublished submission received July 31, 1972 under 3125-213; submitted by Mobay Chemical Corp., Kansas City, Mo.; CDL:120480-AW)

00092775 Davey, R.B.; Meisch, M.V.; Carter, F.L. (1976) Toxicity of five ricefield pesticides to the mosquitofish, Gambusia affinis, and green sunfish, Lepomis cyanellus, under laboratory and field conditions in Arkansas. Environmental Entomology 5(6): 1053-1056. (Also In unpublished submission received Mar 30, 1977 under 279-2712; submitted by FMC Corp., Philadelphia, Pa.; CDL:229241-Q)

00095007 Stevenson, G.T. (1965) A Gamebird Toxicology Study--Acute Dietary Feeding of Dursban to Wild Type Mallard Ducklings. (Unpublished study received Jan 11, 1966 under 464-343; by Dow Chemical U.S.A., Midland, Mich.; CDL:003570-F)

Chlorpyrifos Bibliography

00095013 Alexander, H.C.; Batchelder, T.L. (1965) Results of a Study on the Acute Toxicity of Dursban (R) to Three Species of Fish. (Unpublished study received Jan 11, 1966 under 464-343; by Dow Chemical U.S.A., Midland, Mich.; CDL:003570-L)

00095114 Kenaga, E.E. (1968) Simulated Wildlife-environmental Effects with Dursban Insecticide Using Laboratory Rabbits and Ducks in Small Scale Field Tests. (Unpublished study received Aug 14, 1970 under 464-343; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:050843-I)

00095123 Stevenson, G.T. (1965) A Game Bird Toxicology Study--Acute Dietary Feeding of Dursban to Bobwhite Quail: Ref. No. 3-1197-23. (Unpublished study received Dec 18, 1967 under 464-368; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:050916-G)

00095125 Ferguson, D.E.; Gardner, D.T.; Lindley, A.L. (1966) Toxicity of Dursban to three species of fish. Mosquito News 26(1):80-82. (Also In unpublished submission received Dec 18, 1967 under 464-368; submitted by Dow Chemial U.S.A., Midland, Mich.; CDL: 050916-Q)

00095128 Miller, W.O. (1966) Pond Treatment with Dursban For Bluegill Sunfish: Toxicity Studies. (Unpublished study received Dec 18, 1967 under 464-368; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:050916-U)

00095130 Ludwig, P.D.; McNeill, J.C., IV; Miller, W.O. (1967) Preliminary results obtained with Dursban in the biotic community. Down to Earth 22(4):3-5. (Also in unpublished submission received Dec 18, 1967 under 464-368; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:050916-W)

00095296 McCann, J.A. (1970) Dursban 25W Insecticide: Bluegill (Lepomis macrochirus): Test No. 273. (U.S. Fish and Wildlife Service, Pesticides Regulation Div., Animal Biology Laboratory; unpublished study; CDL:130360-A)

00095297 McCann, J.A. (1969) Dursban: Rainbow Trout (Salmogairdneri): Test No. 196. (U.S. Fish and Wildlife Service, Pesticides Regulation Div., Animal Biology Laboratory; unpublished study; CDL:130361-A)

00095298 McCann, J.A. (1970) Dursban 25W Insecticide: Bluegill (Lepomis macrochirus): Test No. 274. (U.S. Fish and Wildlife Service, Pesticides Regulation Div., Animal Biology Laboratory; unpublished study; CDL:130360-B)

00095301 Ludwig, P.D.; Dishburger, H.J.; McNeill, J.C., IV; et al. (1968) Biological effects and persistence of Dursban(R) insecticide in a salt-marsh habitat. Journal of Economic Entomology 61(3): 626-633. (Also in unpublished submission received

Jun 1, 1968 under unknown number.; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:128666-A)

00095304 Shellenberger, T.E. (1971) Letter sent to Eugene E. Kanaga dated May 24, 1971: Toxicity and acceptance studies of granular Dowco-179 formulations with bobwhite quail--study: GSRI Project No. NC-428. (Unpublished study received Jun 28, 1971 under unknown admin. no.; prepared by Gulf South Research Institute, by Dow Chemical U.S.A., Midland, Mich.; CDL:132116-D)

00095305 Shellenberger, T.E. (1971) Letter sent to Eugene E. Kanaga dated May 24, 1971: Toxicity and acceptance studies of granular Dowco-179 formulations with bobwhite quail--study I: GSRI Project No. NC-428. (Unpublished study received Jun 28, 1971 under unknown admin. no.; prepared by Gulf South Research Institute, submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:132116-F)

00095321 McCann, J.A. (1969) Dursban 6: Bluegill (Lepomis machrochirus): Test No. 163. (U.S. Agricultural Research Service, Pesticides Regulation Div., Animal Biology Laboratory; unpublished study; CDL:131663-A)

00095338 Nelson, J.H.; Evans, E.S., Jr. (1973) Field Evaluation of the Larvicidal Effectiveness, Effects on Nontarget Species and Environmental Residues of a Slow-release Polymer Formulation of Chloryrifos: March-October 1973. By U.S. Army Environmental Hygiene Agency, Entomological Sciences and Pesticide Div., Aberdeen Proving Ground, Md.: USAEHA. (Entomological Special Study No. 44-022-73/75; published study; CDL:220988-C)

00095363 Hansen, D.J.; Schimmel, S.C.; Keltner, J.M., Jr. (1973) Avoidance of pesticides by grass shrimp (Palaemonetes pugio). Bulletin of Environmental Contamination & Toxicology 9(3)129-133. (Also In unpublished submission received Nov 10, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL: 226828-C)

00095365 Hurlbert, S.H.; Mulla, M.S.; Willson, H.R. (1972) Effects of an organophosphorus insecticide on the phytoplankton, zooplankton, and insect populations of fresh-water ponds. Ecological Monographs 42(3):269-299. (Also In unpublished submission received Nov 10, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:226828-F)

00095366 Macek, K.J.; Walsh, D.F.; Hogan, J.W.; et al. (1972) Toxicity of the insecticide Dursban(R) to fish and aquatic invertebrates in ponds. Transactions of the American Fisheries Society 101 (3):420-427. (Also In unpublished submission received Nov 10, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:226828-I)

Chlorpyrifos Bibliography

00095367 Marganian, V.M.; Wall, W.J., Jr. (1972) Dursban(R) and Diazinon residues in biota following treatment of intertidal plots on Cape Cod--1967-69. Pesticides Monitoring Journal 6(3):160-165. (Available from: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; CDL: 226828-J)

00095368 Roberts, D.R.; Roberts, L.W.; Miller, T.A.; et al. (1973) Polymer formulations of mosquito larvicides: III. Effects of a polyethylene formulation of chlorpyrifos on non-target populations naturally infesting artificial field pools. Mosquito News 33(2):165-172. (Also In unpublished submission received Nov 10, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:226828-K)

00095370 Washino, R.K.; Ahmed, W.; Linn, J.D.; et al. (1972) Rice field mosquito control studies with low volume Dursban(R) sprays in Colusa County, California: IV. Effects upon aquatic nontarget organisms. Mosquito News 32(4):531-537. (Also in unpublished submission received Nov 10, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:226828-P)

00095371 Thompson, A.R.; Sans, W.W. (1974) Effects of soil insecticides in southwestern Ontario on non-target invertebrates: Earthworms in pasture. Environmental Entomology 3(2):305-308. (Also In unpublished submission Nov 10, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:226828-R)

00095446 Kenaga, E.E.; Fink, R.J.; Beavers, J.B. (1978) Dietary Toxicity Tests with Mallards Simulating Residue Decline of Chlorpyrifos and Avoidance of Treated Food. Summary of studies 236884-B, 236884-C and 236884-E. (Unpublished study received Jan 29, 1979 under 464-343; prepared in cooperation with Wildlife International, Ltd., by Dow Chemical U.S.A., Midland, Mich.; CDL:236884-A)

00095449 Fink, R.; Beavers, J.B.; Brown, R. (1978) Final Report: Elevenday Toxicant 1 X LC50, with Five-day Half-life, Decreasing Concentrations--Mallard Ducks: Chlorpyrifos: Project No. 103-184. (Unpublished study received Jan 29, 1979 under 464-343; prepared by Wildlife International, Ltd., and Washington College, submitted by Dow Chemical U.S.A., Midland, Mich.; CDL: 236884-D)

00102520 McCarty, W.M. (1977) Toxicity of Chlorpyrifos to Daphnids: Report ES-164. (Unpublished study received Feb 13, 1978 under 464-363; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:232910-A)

00102758 Hansen, D. (1969) Avoidance of pesticides by untrained sheepshead minnows. Trans. Amer. Fish. Soc. 98(3):426-429. (Also In unpublished submission received Jan 5, 1972 under 2E1221; submitted by U.S. Dept. of the Army, Washington, DC; CDL:097882-X)

Chlorpyrifos Bibliography

00104696 Miller, W.O. (1966) The Effects of an Aerial Application of Dursban on the Fauna on a Coastal Island and in Associated Marsh Areas. (Unpublished study, Apr 29, 1968 under 464-368; by Dow Chemical U.S.A., Midland, Mich.; CDL:003574-D)

00154717 Eaton, J.; Arthur, J,; Hermanutz, R. et al. (1985) Biological Effects of Continuous and Intermittant Dosing of Outdoor Experimental Streams with Chlorpyrifos. Unpublished study prepared by US Environmental Protection Agency. 59 p.

00154718 Goodman, L.; Hansen, D.; Middaugh, D.; et al.(1984) Method for early life-stage toxicity tests using three atherinid fishes and results with Chlorpyrifos. Aquatic Toxicology: Seventh Symposium Paper 14 d.3054pd4-4-84:145-154.

00154721 Jarvinen, A.; Nordling, B.; Henry, M. (1982) Chronic toxicity of Dursban (Chlorpyrifos) to the fathead minnow (Pimephales promelas) and the resultant acetylcholinesterase inhibition. Ecotoxicology and Environmental Safety 7:423-434.

00154727 Siefert, R. (1984) Effects of Dursban (Chlorpyrifos) on Non-target Aquatic Organisms in a Natural Pond Undergoing Mosquito Control Treatment. Unpublished report prepared by Environmental Research Lab.-Duluth. 207 p.

00154732 Jarvinen, A.; Tanner, D. (1982) Toxicity of selected controlled release and corresponding unformulated technical grade pesticides to the fathead minnow Pimephales promelas. Environmental Pollution 27:179-195.

00155781 Holcombe, G.; Phipps, G.; Tanner, D. (1982) The acute toxicity of kelthane, dursban, disulfoton, pydrin, and permethrin to fathead minnows Pimephales promelas and rainbow trout Salmo gairdneri. Environ. Pollution 29:167-178.

00158261 Wall, W.; Marganian, V. (1973) Control of salt marsh Culicoides and Tabanus larvae in small plots with granular organophosphorus pesticides, and the direct effect on other fauna. Mosquito News 33(1):88-93.

05000774 Roberts, D.R.; Miller, T.A. (1970) Effects of Polymer Formulations of Dursban and Abate on Non-target Organism Populations, April-October, 1970. Edgewood Arsenal, Md.: U.S. Army Environmental Hygiene Agency. (Entomological special study no. 31-004-71; avail. from: NTIS, Springfield, Va.: AD-729 342)

05000821 Wallace, R.R.; West, A.S.; Downe, A.E.R.; Hynes, H.B.N. (1973) The effects of experimental blackfly (Diptera, Simuliidae) larviciding with Abate, Dursban, and Methoxychlor on stream invertebrates. The Canadian Entomologist 105(6):817-831.

Chlorpyrifos Bibliography

05000841 Ali, A.; Mulla, M.S. (1978) Effects of chironomid larvicides and diflubenzuron on nontarget invertebrates in residential lakes. Environmental Entomology 7(1):21-27.

05000928 Wall, W. J., Jr.; Marganian, V.M. (1971) Control of Culicoides melleus (Diptera: Ceratopogonidae) with granular organophosphorus pesticides, and the direct effect on other fauna. Mosquito News 31(2):209-214.

40840902 Burgess, D. (1988) Acute Flow-through Toxicity of Chlorpyrifos to Daphnia magna: Final Report No. 37190. Unpublished study prepared by Analytical Bio-Chemistry Laboratories, Inc. 158 p.

40840903 Bowman, J. (1988) Acute Flow-Through Toxicity of Chlorpyrifos to Rainbow Trout (Salmo gairdneri): Project ID: 37188. Unpublished study prepared by Analytical Bio-Chemistry Laboratories, Inc. 174 p.

40840904 Bowman, J. (1988) Acute Flow-Through Toxicity of Chlorpyrifos Technical to Bluegill Sunfish (Lepomis macrochirus): Project ID:37189. Unpublished study prepared by Analytical Bio-Chemistry Laboratories, Inc. 188 p.

40854701 Roberts, N.; Phillips, C. (1987) The Acute Oral Toxicity (LD50) of Chlorpyrifos to the Mallard Duck: Project ID: MBS 24/871401. Unpublished study prepared by Huntingdon Research Centre Ltd. 25 p.

40854702 Roberts, N.; Phillips, C. (1987) The Dietary Toxicity (LC50) of Chlorpyrifos to the Mallard Duck: Project ID: MBS 26/871179. Unpublished study prepared by Huntingdon Research Centre Ltd. 20 p.

40854703 Roberts, N.; Phillips, C. (1987) The Dietary Toxicity (LC50) of Chlorpyrifos to the Bobwhite Quail: Project ID: MBS 25/871220. Unpublished study prepared by Huntingdon Research Centre Ltd. 20 p.

41043901 Smith, G. (1987) Pesticide Use and Toxicology in Relation to Wildlife: Organophosphorus and Carbamate Compounds. USDI, Fish and Wildlife Services. Resource Publication 170. 2p.

41043903 Jarvinen, A.; Tanner, D.; Kline, E. (1988) Toxicity of Chlorpyrifos Endrin or Fenvalerate to Fathead Minnows Following Episodic or Continuous Exposure. Ecotoxicology and Environmental Safety 15: 78-95

41063402 Brown, J.; Chow, L.; Ching, B. (1976) The effect of Dursban upon fresh water phytoplankton. Bull. of Environmental Contamination and Toxicology. 15(4):437-441.

Chlorpyrifos Bibliography

41073401 McCann, J. (1979) Dursban Daphnia magna 21 Day Life Cycle: Biological Report of Analysis: Static Test #2405. Unpublished study prepared by U.S. Environmental Protection Agency. 1 p.

41205403 ERL-Duluth Pesticide Research Branch (1988) The Effects of Chlorpyrifos on a Natural Aquatic System: A Research Design for Littoral Enclosure Studies and Final Research Report. Unpublished study prepared by U.S. Environmental Protection Agency in cooperation with Univ. of Wisconsin Superior. 200 p.

41205409 Schimmel, S.; Garnas, R.; Patrick, J.; et al. (1983) Acute Toxicity, bioconcentration, and persistence of AC 222,705, benthiocarb, chlorpyrifos, fenvalerate, methyl parathion, and permethrin in the estuarine environment. J. of Agricultural & Food Chemistry 31(1):104-113.

41228801 Geyer, H., Sheehan, P. Kotzias, D. et. al. (1982) Prediction of ecotoxicological behaviour of chemiacals: Relationship between physico-chemical properties and bioaccumulation of organic chemicals in mussel mytilus edulis. Chemosphere. 11(11): 1121-1134.

41654701 Atkins, E.; Kellum, D. (1990) A Compilation of Data Concerning the Effects of LORSBAN Applications on Honey Bees. Unpublished study prepared by University of California, Riverside. 19 p.

41885201 Campbell, S.; Hoxter, K.; Jaber, M. (1970) XRM 5160 (Microencapsulated Insecticide): An Acute Oral Toxicity Study with the Northern Bobwhite: Lab Project Number: 103-352. Unpublished study prepared by Wildlife International Ltd. 20 p.

41885202 Mayes, M.; Servinski, M.; Gorzinski, S. et al. (1991) XRM 5160 (Microencapsulated Insecticide): The Response of Daphnia magna in a 48 Hour Static Acute Test: Lab Project No: ES-DR-0320-1647-4. Unpublished study prepared by The Dow Chemical Co. 28 p.

41885203 Mayes, M.; Gorzinski, S.; Richardson, C.; et al. (1991) XRM 5160 (Microencapsulated Insecticide): Acute Toxicity to the Bluegill, Lepomis macrochirus Rafinesque: Lab Project Number: ES-DR-0320-1647-6. Unpublished study prepared by The Dow Chemical Co. 27 p.

41885204 Mayes, M.; Gorzinski, S.; Richardson, C.; et al. (1991) XRM 5160 (Microencapsulated Insecticide): Acute Toxicity to the Rainbow Trout, Oncorhynchus mykiss Walbaum: Lab Project Number: ES-DR-0320-1647-5. Unpublished study prepared by The Dow Chemical Co. 27 p.

Chlorpyrifos Bibliography

41965501 Long, R.; Smith, G.; Beavers, J. (1991) XRM 5160 (Microencapsulated Insecticide): A Dietary LC50 Study with the Mallard: Lab Project Number: 103-351A. Unpublished study prepared by Wildlife International Ltd. 33 p.

41965502 Long, R.; Smith, G.; Beavers, J. (1991) XRM 5160 (Microencapsulated Insecticide): A Dietary LC50 Study with the Northern Bobwhite: Lab Project No: 103/350A. Unpublished study prepared by Wildlife International Ltd. 33 p.

42144901 Hakin, B. (1990) The Effect of Dietary Inclusion of Chlorpyrifos on Reproduction in the Mallard Duck: Lab Project Number: MBS 28/88 1667. Unpublished study prepared by Huntingdon Research Centre Ltd. 180 p.

42144902 Hakin, B. (1990) The Effect of Dietary Inclusion of Chlorpyrifos on Reproduction in the Bobwhite Quail óVol I,II|: Lab Project Number MBS 27/881666. Unpublished study by Huntingdon Research Centre Ltd. 318 p.

42144903 Booth, G. (1989) A Simulated Field Study (Using Large Pens) on the Effect of Pyrinex 4E (Chlorpyrifos) on Bobwhite Quail: Lab Project Number: ELI/MAA-88. Unpublished study prepared by Environmental Labs, Inc. 167 p.

42144904 Surprenant, D. (1989) Acute Toxicity of Chlorpyrifos to Sheepshead Minnow (Cyprinodon variegatus) Under Flow-through Conditions: Lab Project Number: 89-1-2909. Unpublished study prepared by Springborn Life Sciences, Inc. 36 p.

42144905 Suprenant, D. (1989) Acute Toxicity of Chlorpyrifos to Eastern Oyssters (Crassostrea virginica) Under Flow-Through Conditions: Lab Project Number: 89-2-2931. Unpublished study prepared by Springborn Life Sciences, Inc. 41 p.

42144906 Surprenant, D. (1989) Acute Toxicity of Chlorpyrifos Technical to Mysid Shrimp (Mysidopsis bahia) Under Flow-Through Conditions: Lab Project Number: 89-2-2931. Unpublished study prepared by Springborn Life Sciences, Inc. 37 p.

42495405 Hansen, S.; Woodburn, K.; Ball, T.; et al. (1992) Chlorpyrifos: Distribution and Metabolism in the Eastern Oyster, Crassostrea virginica: Lab Project Number: DECO-ES-2377. Unpublished study prepared by The Dow Chemical Co. 50 p.

42495406 Thacker, J.; Strauss, K.; Smith, G. (1992) Chlorpyrifos: A Bioconcentration Test with the Eastern Oyster (Crassostrea virginica): Lab Project Number: 103A-105: DSI/OYSBIO: ES-DR-0043-4946-8. Unpublished study prepared by Wildlife International Ltd. 67 p.

42664901 Sved, D.; Drottar, K.; Swigert, J.; et al. (1993) A Flow-through Life-cycle Toxicity Test with the Saltwater Mysid (Mysidopsis bahia): Chlorpyrifos: Final Report: Lab

Project Number: 103A-103C: ES-DR-0043-4946: ES-2506. Unpublished study prepared by Wildlife International Ltd. 57 p.

42834401 Mayes, M.; Weinberg, J.; Rick, D.; et al. (1993) Chlorpyrifos: A Life-Cycle Toxicity Test with the Fathead Minnow, Pimephales promelas Rafinesque: Lab Project Number: ES-DR-0043-4946-9: DECO-ES-2557B. Unpublished study prepared by The Environmental Toxicology & Chemistry Research Lab. 108 p.

43065601 McCormick, R.; Melichar, M. (1993) Letter Sent to Office of Pesticide Programs dated Dec. 17, 1993 regarding several suspected water contaminations following applications of Dursban TC and Equity. Prepared by DowEloanco. 43 p.

43216401 Giddings, J. (1993) Chlorpyrifos (Lorsban 4E): Outdoor Aquatic Microcosm Test for Environmental Fate and Ecological Effects: Final Report: Lab Project No: 92/6/4288: Unpublished study by Springborn Lab., Inc. 670 p.

43216402 Giddings, J. (1993) Chlorpyrifos (Lorsban 4E): Outdoor Aquatic Microcosm Test for Environmental Fate and Ecological Effects of Combinations of Spray and Slurry Treatments: Final Report: Lab Project Number: 92/11/4486: 12550/0392/6104/310. Unpublished study by Springborn Lab., Inc. 323 p.

43216403 Racke, K.; Woodburn, K. (1994) Chlorpyrifos Aquatic Nontarget Organism Impact: Pond Microcosm Results and Risk Assessment Strategy: Lab Project No: GH/C/-3268. Unpublished study by North American Chemistry Lab., DowElanco. 59 p.

43319201 Havens, P.; Cryer, S.; Rolston, L. (1994) Chlorpyriphos Runoff: Regional Assessment of Potential Aquatic Impact in the Midwest Corn Belt: Lab Project Number: GH/C/3328. Unpublished study prepared by North American Environmental Chemistry Lab. 111 p.

43483101 Frey, L.; Palmer, D.; Krueger, H. (1994) Lorsban Insecticide: An Evaluation of Its Effects Upon Avian and Mammalian Species On and Around Corn Fields in Iowa: Lab Project Number: 103-366: ES-2524. Unpublished study prepared by MVTL Labs, Inc. and Wildlife International, Inc. 1273 p.

43483102 Fontaine, D. (1994) A Statistical Review of the Effects of Chlorpyrifos Insecticidal Treatments Upon Avian Abundance, Avian Casualties, and Vertebrate Casualties in Iowa Cornfields: Lab Project Number: DECO-ES-2886. Unpublished study prepared by The Dow Chemical Co. 101 p.

43706701 Fontaine, D. (1995) A Statistical Review of the Effects of Chlorpyrifos Insecticidal Treatments upon Avian Abundance, Avian Casualties, and Vertebrate Casualties in

California Citrus Groves: Lab Project Number: DECO-ES-2991. Unpublished study prepared by The Dow Chemical Co. 83 p.

43730301 Gallagher, S.; Palmer, D.; Krueger, H. (1994) Lorsban Insecticide: A Pilot Year Evaluation of its Effects Upon Avian and Mammalian Species On and Around Citrus Groves in California: Lab Project Number: 103-365: ES-2525: RES 92062. Unpublished study prepared by MVTL Labs, Inc. and Wildlife Int'l Ltd. 884 p.

43760601 Poletika, N.; Robb, C. (1994) A Field Runoff Study of Chlorpyrifos in Mississippi Delta Cotton: Lab Project Number: ENV93030. Unpublished study prepared by A&L Great Lakes Labs, Inc.; DowElanco North American Environmental Chemistry Lab; and PTRL East, Inc. 499 p.

43760602 Poletika, N. (1995) Simulation Modeling of A Field Runoff Study of Chlorpyrifos in Mississippi Delta Cotton: (Amended Report): Lab Project Number: ENV93030.01R. Unpublished study prepared by DowElanco North American Environmental Chemistry Lab. 123 p.

43760603 Cryer, S.; Dixon-White, H. (1995) A Field Runoff Study of Chlorpyrifos in Southeast Iowa During the Severe Flooding of 1993: Lab Project Number: ENV93008. Unpublished study by A&L Great Lakes Labs, Inc.; DowElanco North American Environmental Chemistry Lab.; and PTRL East, Inc. 822 p.

43760604 Cryer, S. (1994) Predicted Surface Runoff Comparison of Lorsban 4E and Lorsban 15G Insecticides in the Midwest Corn Growing Region: Lab Project Number: GH-C 3275. Unpublished study prepared by DowElanco North American Environmental Chemistry Lab. 123 p.

43760605 Cryer, S.; Tollner, E. (1995) Tillage, Soil Water, and Slope Effects on Banded Insecticide Granule Placement: Lab Project Number: ENV92106. Unpublished study prepared by University of Georgia. 23 p.

43760608 Ray, S. (1995) An Assessment of the Potential Aquatic Impact Due to Off-Target Drift from Aerial Applications of Chlorpyrifos: Lab Project Number: GH-C 3678. Unpublished study by DowElanco Modeling and Information Sciences Lab. 63 p.

43760609 Havens, P.; Peacock, A. (1995) Chlorpyrifos Runoff and Drift: Regional Assessment of Potential Aquatic Impact in Southeastern Peanuts, Mississippi Delta Cotton, Red River Sugarbeets, and Mid-Atlantic Tobacco: Lab Project Number: GH-C 3633. Unpublished study prepared by DowElanco North American Environmental Chemistry Lab. 101 p.

Chlorpyrifos Bibliography

43760610 Mihaliak, C. (1995) Validation Report for the Determination of Residues of Chlorpyrifos in Water by Immunoassay: Lab Project No: RES93141. Unpublished study by DowElanco North American Environmental Chemistry Lab. 57 p.

43760611 Poletika, N.; Dixon-White, H. (1995) Chlorpyrifos Removal from Surface Runoff by Vegetated Filter Strips: Lab Project Number: ENV94029. Unpublished study by A&L Great Lakes Labs, Inc.; DowElanco; and PTRL East, Inc. 526 p.

43785201 Worley, K.; Frey, L.; Palmer, D.; et al. (1994) Dursban Insecticide: An Evaluation of its Effects Upon Avian and Mammalian Species On and Around Golf Courses in Fall in Florida: (Final Report): Lab Project No: 103-364: ES-2596: RES 92059. Unpublished study by MVTL labs, Inc and Wildlife International Ltd. 549 p.

43785202 Fontaine, D. (1995) A Statistical Review of the Effects of Chlorpyrifos Insecticidal Treatments Upon Avian Abundance, Avian Casualties, and Vertebrate Casualties in Turf in Florida: Lab Project Number: DECO-ES-2992. Unpublished study prepared by The Dow Chemical Co. 99 p.

43786901 Racke, K.; Robb, C.; Ostrander, J. (1994) Field Evaluation of Chlorpyrifos Runoff Potential from Turfgrass: Lab Project Number: ENV93085. Unpublished study by DowElanco, PTRL-East, Inc., and A&L Great Lakes Labs, Inc. 295 p.

43823901 Poletika, N. (1995) Review of Existing Chlorpyrifos Surface Water Monitoring Studies: Lab Project Number: GH-C 3816: 0-149-250-0. Unpublished study prepared by DowElanco North American Chemistry Lab. 365 p.

43853201 Cryer, S.; Robb, C. (1995) Chlorpyrifos Runoff Transport and Pond Fate in a Southern Iowa Corn Watershed: Lab Project Number: ENV92026: 667: 1577. Unpublished study prepared by DowElanco; PTRL East, Inc.; and Minnesota Valley Testing Lab. 957 p.

43853202 Havens, P. (1995) Chlorpyrifos Runoff and Drift: Assessment of Potential Aquatic Impact in the Wheat and Alfalfa Use Regions: Lab Project Number: GH-C 3811. Unpublished study prepared by DowElanco. 85 p.

43918301 Cryer, S. (1996) Utilizing Simulated Weather Patterns to Predict Runoff Exceedence Probabilities for Nonpolar Pesticides: Lab Project Number: GH-C 3748. Unpublished study prepared by DowElanco North American Environmental Chemistry Lab. 72 p.

44033401 Cryer, S. (1996) An Overview of the DowElanco Method for Assessing Potential Environmental Impact Resulting from Agricultural Usage of Pesticides: Lab Project

Number: GH-C3283. Unpublished study prepared by Global Environmental Chemistry, DowElanco and CIBER, Inc. 27 p.

44033402 Cryer, S.; Nordstrom, P. (1996) Plackett and Bruman Experimental Design Sensitivity Analysis for the Environmental Fate Models GLEAMS, SWRRBWQ, EPICWQ, and PRZM-2: Lab Project Number: GH-C 3815. Unpublished study by North American Environmental Chemistry Laboratory, DowElanco. 53 p.

44055101 Pedersen, C. (1996) Acute Avian Oral Toxicity (LD50) Study with EF-1315 in Bobwhite Quail: Lab Project Number: 153-008-03: DECO-ES-3080. Unpublished study prepared by Bio-Life Associates, Ltd. 57 p.

44057101 Gallagher, S.; Grimes, J.; Beavers, J.; et al. (1996) Lorsban 15G: An Acute Oral Toxicity Study with the House Sparrow: Lab Project Number: 103-417: 103/040396/HSLD.NC/SUB103: DECO-ES-3132. Unpublished study prepared by Wildlife International, Ltd. 41 p.

44057102 Gallagher, S.; Beavers, J.; Jaber, M. (1996) Chlorpyrifos Technical: An Acute Oral Toxicity Study with the House Sparrow: Lab Project Number: 103-418A: 103/040396/HSLD.NCa/SUB103: DECO-ES-3133. Unpublished study prepared by Wildlife International Ltd. 45 p.

44062601 Pedersen, C. (1996) Acute Avian Dietary Toxicity (LC50) Study with EF-1315 in Bobwhite Quail: Lab Project Number: 153-009-01: DECO-ES-3081: ES-3081. Unpublished study prepared by Bio-Life Associates, Ltd. 79 p.

44223601 Poletika, N.; Dolder, S. (1997) Chlorpyrifos Removal from Artificial Runoff by Vegetative Filter Strips: Lab Project Number: ENV95004: 934: 1859. Unpublished study by A&L Great Lakes Labs, Inc.; PTRL East, Inc.; and DowElanco. 356 p.

44235001 Thomas, J.; Chambers, D. (1997) An Analysis of Factors Involved in Suspected Well Contaminations by Chlorpyrifos-based Termiticide Emulsions (Dursban TC, Equity Termiticide) Based on Water Incident Survey and Analytical Data: Lab Project No.: DERBI 48202: 48202. Unpublished study by DowElanco. 16 p.

44585401 Maguire, C.; Williams, B. (1998) Response of thermal stressed bobwhite to organophosphorus exposure. Environmental Pollution 47:25-37.

44585403 Thompson-Cowley, L. (1981) Dursban LC50 Tests Bobwhite Quail--Mallard Ducks. Unpublished study prepared by Oregon State University. 24 p.

44585405 Linn, J. (1968) Effects of Low Volume Aerial Spraying of DURSBAN and Fenthion on Fish. Down to Earth 24(2): 28-30.

Chlorpyrifos Bibliography

44585408 Thirugnanam, M.; Forgash, A. (1977) Environmental Impact of Mosquito Pesticides: Toxicity and Anticholinesterase Activity of Chlorpyrifos to Fish in a Salt Marsh Habitat. Archives of Environmental Contamination and Toxicology 5: 415-425.

44692001 Clements, R.; Bale, J. (1987) The short-term effects on birds and mammals of the use of chlopyrifos to control leatherjackets in grassland. Annual Applied Biology(112):41-47.

44692101 Shannon, L.; Yount, J.; Flum, T. (1989) The Effects of Dursban on Aquatic Systems: A Comparison Between Mixed Flask Microcosms and Field Enclosures. Unpublished study prepared by US EPA. 31 p.

44692201 Mayer, F.; Marking, L.; Bills, T. et al. (1994) Physicochemical factors affecting toxicity in freshwater: hardness, pH, and temperature: (chlorpyrifos). P. 5-22 in Bioavailability Physical, Chemical, and Biological Interactions by J. Hamelink, P. Landrum, H. Bergman, and W. Benson. Boca Raton, FL: Lewis Publishers.

44709401 Anderson, T.; Richards, S.; McMurray, S. et al. (1998) Avian Response to Chlorpyrifos Exposure in Corn Agroecosystems: Lab Project Number: GH-C4698. Unpublished study prepared by Ecorisk, Inc. 89 p.

44711601 Poletika, N.; Robb, C. (1998) A Monitoring Study to Characterize Chlorpyrifos Concentration Patterns and Ecological Risk in an Agriculturally Dominated Tributary of San Joaquin River: Lab Project Number: ENV96055. Unpublished study prepared by Dow AgroSciences and Paragon Research. 561 p.

44823801 Thomas, J.; Chambers, D. (1999) A Retrospective Analysis of Surface Water Contamination-based Termiticide Emulsions (Dursban TC, Equity Termiticide) Based on Water Incident Survey and Analytical Data: Lab Project Number: 68513. Unpublished study prepared by Dow AgroSciences LLC. 25 p.

45013101 van Wesenbeck, I.; Poletika, N.; Robb, C. (1999) A Monitoring Study to Characterize Chlorpyrifos Concentration Patterns and Ecological Risk in an Agricultural Dominated Tributary of the San Juaquin River: Part 2: Lab Project No: ENV96055.02. Unpublished study by Dow AgroSciences LLC. 153 p.

45506303 Henry, K.; Kirk, H. (2001) The Acute Toxicity of Chlorpyrifos to Larval Amphibians Using the Bullfrog, Rana catesbeiana, as a Biological Model: Lab Project Number: 001249. Unpublished study by The Dow Chemical Co. 28 p.

Toxicology MRID References

Chlorpyrifos Bibliography

00029064 Thompson, D.J.; Gerbig, C.G.; Warner, S.D. (1971) Three Generation Reproduction and Teratology Study in the Rat following Prolonged Dietary Exposure to Dursban O,O-Diethyl 0-3,5,6-trichloro-2- pyridyl phosphorothioate: HH-382. (Unpublished study received Aug 28, 1972 under 3F1306; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:099239-B)

00054352 Warner, S.D.; Gerbig, C.G.; Strebing, R.J.; et al. (1980) Results of a Two-Year Toxicity and Oncogenic Study of Chlorpyrifos Administered to CD-1 Mice in the Diet. (Unpublished study received Mar 20, 1980 under 464-343; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:242059-A)

00064933 McCollister, S.B.; Kociba, R.J.; Gehring, P.J.; et al. (1971) Results of Two-Year Dietary Feeding Studies on Dowco¼(R)µ179 in Beagle Dogs: T35.12-44793-18. (Unpublished study received Aug 28, 1972 under 3F1206; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:092213-A)

00064934 Thompson, D.J.; Gerbig, C.G.; Warner, S.D. (1971) Three Generation Reproduction and Teratology Study in the Rat following Prolonged Dietary Exposure to Dursban O,O-Diethyl 0-3,5,6-trichloro-2-pyridyl phosphorothioate: HH-382. (Unpublished study received Aug 28, 1972 under 3F1306; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:092213-B)

00095268 Deacon, M.M.; Murray, J.S.; Pilny, M.K.; et al. (1979) The Effects of Orally Administered Chlorpyrifos on Embryonal and Fetal Development in Mice. (Unpublished study received Aug 16, 1979 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; 098912-A)

00130400 Ouellette, J.; Dittenber, D.; Kloes, P.; et al. (1983) Chlorpyrifos: Oral Teratology Study in Fischer 344 Rats. (Unpublished study received Aug 15, 1983 under 3F2947; submitted by Dow Chemical U.S.A., Midland, MI; CDL:071866-A)

00142902 Davies, D.; Tollett, J.; Lomax, L. (1985) Chloropyrifos: A Four week Dietary Study In CD-1 Mice. Unpublished study Dow Chemical U.S.A. 154 p.

00146507 Hardy, C.; Jackson, G. (1984) Dursban Technical: Acute Inhalation Toxicity in Rats: Report No. DWC 411/84774. Unpublished study prepared by Huntingdon Research Centre, plc. 23 p.

00146519 Kociba, R.; McCollister, S.; Keyes, D.; et al. (1985) Results of Two-year Dietary Feeding Studies on Dowco 179 in Beagle Dogs: Supplement to Original Report. Unpublished report prepared by Dow Chemical U.S.A. 246 p.

Chlorpyrifos Bibliography

00152683 Mendrala, A. (1985) Evaluation of Chlorpyrifos in the Chinese Hamster Ovary Cell-Hypoxanthine (Guanine) Phosphoribosyl Transferase (CHO/HGPRT) Forward Mutation Assay: Report No. HET K-044793-072. Unpublished report prepared by Dow Chemical USA. 17 p.

00152684 Bhaskar, B.; Gollapudi, V.; Linscombe, A.; et al. (1985) Evaluation of Chlorpyrifos in the Mouse Bone Marrow Micronucleus Test: Final Report: TXT:K-044793-067. Unpublished report prepared by Dow Chemical Co. 29 p.

00157057 Mendrala, A.; Dryzga, M. (1986) Evaluation of Chlorpyrifos in the Rat Hepatocyte Unscheduled DNA Synthesis (UDS) Assay: Final Report: Laboratory Rep Code HETK-044793-073. Unpublished study by Dow Chemical U.S.A. 31 p.

00157058 Bruce, R.; Zempel, J. (1986) Chlorpyrifos: Evaluation in the Ames' Salmonella/Mammalian-microsome Mutagenicity Assay: Final Report: Lab. Report Code TXT:K-044793-075. Unpublished study by Dow Chemical U.S.A. 16 p.

40013901 Corley, R.; Landry, T.; Calhoun, L.; et al. (1986) Chlorpyrifos: 13-Week Nose-only Vapor Inhalation Exposure Study in Fischer 344 Rats: Laboratory Project Id: HET K-044793-077. Unpublished study prepared by Dow Chemical USA. 168 p.

40055001 Landry, T.; Dittenber, D.; Lomax, L.; et al. (1986) Chlorpyrifos: An Acute Vapor Inhalation Toxicity Study with Fischer Rats: Laboratory Project ID: HET-K-44793-74: Study ID: K-44793-74. Unpublished study prepared by Dow Chem Co., Mammalian and Environmental Toxicology Research Lab. 64 p.

40057201 Bruce, R.; Zempel, J. (1986) Chlorpyrifos: Evaluation in the Ames's Salmonella/Mammalian-microsome Mutagenicity Assay: Laboratory Project ID: HET K-044793-075: Supplemental Data to Mrid 157058. Unpublished study prepared by Dow Chemcial Co. 11 p.

40166501 Corley, R.; Landry, T.; Calhoun, L.; et al. (1986) Chlorpyrifos: 13-Week Nose only Vapor Inhalation Exposure Study in Fischer 344 Rats: Supplemental Data: Lab. Proj. I.D. HET K-044793-077. Unpublished data by Dow Chemical Co. 14 p.

40436406 Crown, S.; Gur, E.; Nyska, A.; et al. (1985) Toxicity in Dietary Administration to Rats for 13 Weeks óPyrinex|: Laboratory Project ID MAK/058/PYRA. Unpublished study performed by Life Science Research Israel Ltd. 174 p.

40436407 Rubin, Y.; Gal, N.; Waner, T.; et al. (1987) Teratogenicity Study in The Rat: Laboratory Project ID MAK/101/PYR. Unpublished study performed by Life Science Research Israel Ltd. 268 p.

40436408 Rubin, Y.; Nyska, A.; Waner, T. (1987) Pyrinex Teratogenicity Study in the Rabbit: Laboratory Project ID MAR/103/PYR. Unpublished study performed by Life Science Research Israel Ltd. 208 p.

40436409 Loveday, K. (1987) In vitro Chromosomal Aberration Assay on Pyrinex (Chlorpyrifos). Unpublished study performed by Arthur D. Little, Inc. 40 p.

40436411 Loveday, K.; Findlen, K.; Yadlon, S. (1987) Evaluation of Pyrinex in the Ames Mutagenesis Assay: ADL Reference 59487-00. Unpublished study performed by Arthur D. Little, Inc. 30 p.

40458901 Nolan, R.; Dryzga, M.; Landenberger, B.; et al. (1987) Chlorpyrifos: Tissue Distribution and Metabolism of Orally Administered Carbon 14-Labeled Chlorpyrifos in Fischer 344 Rats: Laboratory Project Study ID: K-044793-(76). Unpublished study prepared by Dow Chemical Co. 61 p.

40908401 Newton, P. (1988) A Thirteen Week Nose-Only Inhalation Toxicity Study of Chlorpyrifos Technical (Pyrinex) in the Rat: Project No. 88-8058. Unpublished study prepared by Bio/dynamics, Inc. 587 p.

40952801 Szabo, J.; Young, J.; Grandjean, M. (1988) Chlorpyrifos: 13-Week Dietary Toxicity Study in Fischer-344 Rats: Project ID: File No. TXT:K-044793-071. Unpublished study prepared by Dow Chemical Co. 242 p.

40952802 Young, J.; Grandjean, M. (1988) Chlorpyrifos: 2-Year Dietary Chronic Toxicity-Oncogenicity Study in Fischer-344 Rats: Study ID: TXT:K/044793/079. Unpublished study prepared by Dow Chemical Co. 990 p.

40972801 Calhoun, L.; Johnson, K. (1988) Chlorpyrifos: 4-Day Dermal Probe and 21-day Dermal Toxicity Studies in Fischer 344 Rats: Proj. ID(S) K-044793-085; K-044793-086. Unpublished study prepared by Dow Chemical Co. 191 p.

41340201 Calhoun, L.; Johnson, K. (1989) Supplemental Information to the Report Entitled: Chloropyrifos: 4-Day Dermal Probe and 21-Day Dermal Toxicity Studies in Fischer 344 Rats (MRID 40972801, Dated September 1, 1988): Lab Project Number: K/044793/085; K/044793/086. Unpublished study by Dow Chemical Co. 8 p.

41340203 McClintock, M.; Gollapudi, B. (1989) Evaluation of Chloropyrifos in the Bone Marrow Micronucleus Test: Lab Project Number: TXT/K/044793/067A. Unpublished study prepared by Dow Chemical Co. 24 p.

41930301 Breslin, W.; Liberacki, A.; Dittenber, D. et al. (1991) Chlorpyrifos: Two-Generation Dietary Reproduction Study in Sprague-Dawley Rats: Lab Project

Number: K-044793-088: F1: F1W:F2W. Unpublished study prepared by Dow Chemical Co., Tox. Research Lab. 1181 p.

42008401 Vaccaro, J.; Nolan, R.; Hugo, J.; et al. (1991) Evaluation of Dislodgable Residues and Absorbed Doses of Chlorpyrifos to Crawling Infants Following Indoor Broadcast Applications of a Chlorpyrifos Based Emulsifiable Concentrate: Lab Project No: DECO HEH2.1-1-182(95). Unpublished study by Dow Chem. Co. 84 p.

42031701 Vaccaro, ?. et al. (1991) Validation data in Support of Chlorpyrifos Dislodgable Residue/ Human Absorption Study: Lab Project Number: A1A EC41 THUMAN AM. Unpublished study prepared by The Dow Chemical Co. 61 p.

42172801 Barker, M. (1989) Chlorpyrifos Oral Toxicity Study in Beagle Dogs (Repeated Daily Dosage for 13 Weeks): Lab Project Number: MBS 31/88999. Unpublished study prepared by Huntingdon Research Centre Ltd. 209 p.

42172802 Crown, S. (1990) Pyrinex Technical Oncogenicity Study in the Rat: Lab Project Number: MAK/095/PYR. Unpublished study prepared by Life Science Research Israel, Ltd. 1591 p.

42495404 Wilmer, J.; Berdasco, N.; Crissman, J. (1992) Chlorpyrifos: Acute Oral Toxicity (Range-finding) Study in Fischer 344 Rats: Lab Project Number: K-044793- 093A: K-044793-093R. Unpublished study by The Dow Chemical Co. 28 p.

42534201 Gur, E. (1992) Prinex Technical: Oncogenicity Study in the Mouse: Lab Project No: MAK/106/PYR. Unpublished study by Life Science Research Israel Ltd. 1238 p.

42669101 Wilmer, J.; Berdasco, N.; Crissman, J.; et al. (1992) Chlorpyrifos: Acute Neurotoxicity Study in Fischer 344 Rats: Lab Project Number: K-044793-093B: K-044793-093C: K-044793-093D. Unpublished study prepared by The Dow Chemical Co., Toxicology Research Lab. 271 p.

42929801 Shankar, M.; Bond, D.; Crissman, J. (1993) Chlorpyrifos: 13-Week Neurotoxicity Study in Fischer-344 Rats: Lab Project Number: K-044793-094. Unpublished study prepared by The Toxicology Research Lab., Dow Chemical Co. 535 p.

42943101 Spencer, P.; Albee, R.; Mattsson, J. (1993) Positive Control Exercises: Motor Activity, Functional Observational Battery and Neuropathology (with Chlorpyrifos). Unpublished study prepared by Dow Chemical Co. 137 p.

43426601 Maurissen, J. (1994) Chlorpyrifos: Range Finding (Pilot) Subchronic Neurotoxicity Study in Rats: Lab Project Number: K/044793/096. Unpublished study. 3 p.

Chlorpyrifos Bibliography

44020901 Maurissen, J.; Shankar, M.; Mattsson, J. (1996) Chlorpyrifos: Cognitive Study in Adult Long-Evans Rats: Lab Project Number: K-044793-096. Unpublished study by The Toxicology Research Laboratory, The Dow Chemical Co. 691 p.

44035001 Vaccaro, J.; Nolan, R.; Murphy, P. et al. (1993) Estimation of the Absorbed Dose of Chlorpyrifos to Adult Volunteers, Following Treatment of Carpeting with Empire 20 Insecticide: Lab Project Number: DECO-HEH2.1-1-182(123): HEH2.12-38-1(32). Unpublished study prepared by Industrial Hygiene Research & Technology, The Dow Chemical Co. 76 p.

44209101 Stebbins, K. (1996) Dursban F Insecticidal Chemical: Acute Oral Toxicity Study in Fischer 344 Rats: Lab Project Number: K-044793-102A: K-044793-102A1. Unpublished study prepared by The Dow Chemical Co. 54 p.

44209102 Stebbins, K. (1996) Dursban F Insecticidal Chemical: Acute Dermal Toxicity Study in New Zealand White Rabbits: Lab Project Number: K-044793-102D: K-044793-102D1. Unpublished study by The Dow Chemical Co. 41 p.

44209103 Stebbins, K. (1996) Dursban F Insecticidal Chemical: Primary Eye Irritation Study in New Zealand White Rabbits: Lab Project Number: K-044793-102C. Unpublished study prepared by The Dow Chemical Co. 16 p.

44209104 Stebbins, K. (1996) Dursban F Insecticidal Chemical: Primary Dermal Irritation Study in New Zealand White Rabbits: Lab Project Number: K-044793-102B. Unpublished study prepared by The Dow Chemical Co. 16 p.

44209105 Stebbins, K. (1996) Dursban F Insecticidal Chemical: Dermal Sensitization Potential in Hartley Albino Guinea Pigs: Lab Project Number: K-044793-102E: GPIGS02/27/96: GPIGS01/10/96. Unpublished study prepared by The Dow Chemical Co. 20 p.

44273901 Dittenber, D. (1997) Chlorpyrifos: Evaluation of Single Oral Doses on Cholinesterase and Neurotoxic Esterase Inhibition in F344 Rats: Lab Project Number: 960036. Unpublished study by The Dow Chemical Co. 27 p.

44533401 Linscombe, V.; Mensik, D.; Clem, B. (1992) Evaluation of Chlorpyrifos in an in vitro Chromosomal Aberration Assay Utilizing Rat Lymphocytes: Lab Project Number: K-044793-092. Unpublished study by The Dow Chemical Co. 32 p.

44556901 Hoberman, A. (1998) Developmental Neurotoxicity Study of Chloropyrifos Administered Orally via Gavage to Crl:CD BR VAF/Plus Presumed Pregnant Rats: Lab Project Number: 304-001: K-044973-109. Unpublished study prepared by Argus Research Laboratories, Inc. 833 p.

Chlorpyrifos Bibliography

44648101 Mattsson, J.; Maurissen, J.; Spencer, P. et al. (1998) Effects of Chlorpyrifos Administered via Gavage to CD Rats During Gestation and Lactation on Plasma, Erythrocyte, Heart and Brain Cholinesterase, and Analytical Determination of Chlorpyrifos and Metabolites: Lab Project Number: 971162. Unpublished study prepared by The Dow Chemical Company. 322 p. Relates to L0000448.

44648102 Mendrala, A.; Brzak, K. (1998) Chlorpyrifos: Part A- Concentration-Time Course of Chlorpyrifos and Chlorpyrifos-Oxon in Blood (in Rats): Lab Project Number: 971187A. Unpublished study by The Dow Chemical Company. 63 p.

44810701 Mendrala, A.; Engle, K. (1999) Chlorpyrifos: Part B--In Vitro Determination of A-Esterase Activity in Liver and Blood Towards Chlorpyrifos-Oxon: Lab Project Number: 971187. Unpublished study by The Dow Chemical Company. 51 p.

44811002 Kisicki, J.; Wilkinson Seip, C.; Combs, M. (1999) A Rising Dose Toxicology Study to Determine the No-Observable-Effect-Levels (NOEL) for Erythrocyte Acetylcholinesterase (AChE) Inhibition and Cholinergic Signs and Symptoms of Chlorpyrifos at Three Dose Levels: Lab Project Number: 21438: DR# K-044793-284: 432-01. Unpublished study prepared by MDS Harris. 578 p.

44884301 Cieszlak, F. (1999) Chlorpyrifos Oxon: Acute Oral Toxicity Study in Fischer 344 Rats: Lab Project Number: 991064. Unpublished study prepared by The Dow Chemical Company. 67 p. {OPPTS 870.1100}

44889501 Iachan, R.; Nishioka, M.; Van Dyck, K. et al. (1999) TCP Biomonitoring Study: Lab Project Number: GH-C 4946. Unpublished study prepared by Battelle Centers for Public Health Research and Evaluation. 138 p.

45098001 Iachan, R.; Nishioka, M.; van Dyck, K. (2000) TCP Biomonitoring Follow-Up Study: Final Report: Lab Project Number: FN003330: GH-C 5064. Unpublished study prepared by Battelle. 28 p.

45195701 Iachan, R.; Nishioka, M.; Dyck, K. (2000) TCP Biomonitoring Second Follow-Up Study: Final Report: Lab Project Number: MN101181. Unpublished study prepared by Battelle and Battelle Memorial Institute. 19 p.

45195702 Salazar, R. (2000) Pesticide Exposure Assessment: Downey Residence: (Chlorpyrifos): Lab Project Number: JJJ080800. Unpublished study prepared by Salazar & Spaul Environmental Consultants, Inc. 33 p.

45195703 Summer, S. (2000) Analysis of 3,5,6-Trichloro-2-pyridinol Residue in Urine: Final Analytical Phase Report: Lab Project Number: AG000008. Unpublished study prepared by Battelle. 89 p.

Chlorpyrifos Bibliography

45195704 Cleveland, C. (2000) Follow-Up Report on Downey Residence: TCP Urine Analysis and Environmental Samples: Lab Project Number: JJJ081400: MN101181. Unpublished study prepared by Dow AgroSciences LLC. 69 p.

45195705 Summer, S.; Biehl, D.; Nishioka, M. (2000) Chlorpyrifos Exposure Assessment-Analysis of 3,5,6-Trichloro-2-pyridinol Residue in Urine: Final Analytical Phase Report: Lab Project Number: N003330A: FN003330. Unpublished study prepared by Battelle. 160 p.

45360101 Mattsson, J.; Holden, L.; Eisendrandt, D. et al. (2001) Reanalysis with Optimized Power of Red Blood Cell Acetylcholinesterase Activity From a 1-Year Dietary Treatment of Dogs to Chlorpyrifos: Lab Project Number: GHC-5127. Unpublished study prepared by Dow AgroSciences LLC. 32 p.

45360102 Hoberman, A. (2000) Developmental Neurotoxicity Study of Chlorpyrifos Administered Orally via Gavage to Crl:CD BR VAF/Plus Presumed Pregnant Rats: Lab Project Number: 304-001: K-044793-109. Unpublished study prepared by Argus Research Laboratories, Inc. 28 p.

45467301 Marable, B.; Baker, P.; Stebbins, K. et al. (2001) Chlorpyrifos Technical: 6-Week Dietary Study of Acetylcholinesterase Inhibition in Beagle Dogs: Lab Project Number: 011036. Unpublished study by The Dow Chemical Company. 194 p.

45467302 Stebbins, K. (2001) Chlorpyrifos Technical: 6-Week Dietary Study with Histopathological Evaluation of the Adrenal Glands in Beagle Dogs: Lab Project Number: 011039. Unpublished study by The Dow Chemical Company. 18 p.

Occupational and Residential MRID References

40026001 Vaccaro, J. (1986) Evaluation of Airborne and Whole Body Exposure of Lawn Care Specialists to Chlorpyrifos During Routine Treatment of Turf: Laboratory Project Identification: GH-P 1300. Unpublished study prepared by Dow Chemical U.S.A., Agricultural Products Dept. 69 p.

40094001 Vaccaro, J.; Bohl, R.; Skowronski, B.; et al. (1987) Airborne Chlorpyrifos Concentrations Measured During and Following Applications of Dursban TC Insecticide to Residential Dwellings. Unpublished study prepared by Industrial Hygiene Laboratory, Dow Chemical Co. 53 p.

41540202 Wetters, J.; McKellar, R.; Ordiway, T.; et al. (1985) Dislodgeable Residues of Chlorpyrifos on Turf Grasses following a Foliar Application of Dursban 4E

Insecticide or Dursban 50W: Lab Project I.D.: GH-C 1774. Unpublished study prepared by Dow Chemical U.S.A., Agricultural Products Dept. 27 p.

42887201 Contardi, J. (1993) An Evaluation of the Appropriate Drying Time via Air Monitoring, Dislodgable Residue Determination, and Carpet Weight Loss, After Applying Dursban LO Insecticide to a Carpeted Surface, Indianapolis, Indiana, September 22, 1992: Lab Project Number: DECO-HEH2.1-1-182(126): HEH2.1-1-182(126).Unpublished study prepared by Dow Chemical Co., Health and Environmental Sciences. 29 p.

42974501 Shurdut, B.; Murphy, P.; Nolan, R.; et al. (1993) Lorsban 4E and 50W Insecticides: Assessment of Chlorpyrifos Exposures to Applicators, Mixer/Loaders, and Re-entry Personnel During and Following Application to Low Crops: Lab Project Number: DECO-HEH2.1-1-182(118): DECO-HEH2.1-1-182(124). Unpublished study prepared by Industrial Hygiene Department, DowElanco. 333 p.

42994401 Day, E.; Chen, W.; Nolan, R.; et al. (1993) Chlorpyrifos: An Exposure Assessment of Workers Associated with Mixing/Loading, Application and Reentry Following Ground Boom Application to Low Crops: Lab No: GH-C3116. Unpublished study by DowElanco, North American Environmental Chemistry Lab. 45 p.

43013501 Vaccaro, J.; Nolan, R.; Hugo, J.; et al. (1993) Chlorpyrifos: Exposure to Adults and Children upon Reentry to Domestic Lawns, Following Treatment with a Chlorpyrifos-Based Mixture: Lab Project Number: DECO/HEH2/1/1/182/121. Unpublished study prepared by Industrial Hygiene Research & Technology, The Dow Chemical Co. 75 p.

43013502 Hugo, J.; Berryman, K. (1993) Evaluation of Industrial Hygiene Monitoring Method DOWM 100863-HE90a for Determining Chlorpyrifos in Air During Applications of Chlorpyrifos Formulations: Lab Project No: HEH2/12/38/26/2/. Unpublished study by The Analytical Chemistry Lab., The Dow Chemical Co. 43 p.

43013503 Hugo, J.; Murphy, P.; Charron, K. (1993) Dursban Turf Insecticide: Evaluation and Validation of Monitoring Methods for Assessing Worker Exposures: Lab Project Number: DECO-HEH2/12/38/26/7. Unpublished study prepared by The Analytical Chemistry Lab., The Dow Chemical Co. 33 p.

43027901 Contardi, J.; Gilbert, J.; Lambesis, D.; et al (1993) Evaluation of Chlorpyrifos Exposures During Mixing/Loading and Application of EMPIRE 20 Insecticide to Ornamental Plants in Commercial Greenhouses: Lab Project Number: CO-HEH2.1-1-182(130): CO-HEH2.12-38-26(10). Unpublished study prepared by The Dow Chemical Co. 208 p.

Chlorpyrifos Bibliography

43042001 Nolan, R.; Vacarro, J.; Schnelle, K.; et al. (1993) Chlorpyrifos: Exposure Assessment for Adults and Children Entering and Playing on Lawns Treated with Dursban Turf Insecticide: Lab Project Number: GH/C/3179. Unpublished study prepared by DowElanco North American Environmental Chemistry Lab. 20 p.

43062701 Honeycutt, R.; DeGeare, M. (1993) Worker Reentry Exposures to Chlorpyrifos in Citrus Treated with Lorsban 4E Insecticide: Lab Project Number: 91-102HE: 93-307: DECO-HEH2.2-1-182(125)B. Unpublished study prepared by H.E.R.A.C., Inc. and The Dow Chemical Co. 950 p.

43062702 Day, E. (1993) Chlorpyrifos: An Exposure Assessment of Re-entry Workers Following Application in Citrus Crops: Lab Project Number: GH-C 3184. Unpublished study prepared by DowElanco 17 p.

43042002 Shurdut, B. (1993) Chlorpyrifos: An Exposure and Risk Assessment for Workers/Loading and Applying EMPIRE 20 Insecticide to Ornamentals in Greenhouses: Lab Project Number: GH/C3175. Unpublished study prepared by DowElanco North American Environmental Chemistry Lab. 39 p.

43138101 Chen, W.; Day, E.; Nolan, R. et al. (1994) Chlorpyrifos: An Exposure and Risk Assessment of Workers Associated with Air Blast Sprayer Application of LORSBAN 4E to High Crops (Citrus): Lab Project No: GH-C3224. Unpublished study by North American Environmental Chemistry Lab., DowElanco. 50 p.

43138102 Honeycutt, R.; DeGeare, M. (1994) Evaluation of the Potential Exposure of Workers to Chlorpyrifos During Mixing and Loading, Spray Application, Clean-Up Procedures During the Treatment of Citrus Groves with Lorsban* 4E Insecticide: Lab Project Number: 91-101HE: 93-308: O-HEH2.1-1-182(125)A. Unpublished study prepared by H.E.R.A.C., Inc. 1061 p.

43798001 Nolan, R. (1995) Letter sent to John Fitt (DowElanco) dated September 18, 1995: Itemized list of additional information requested by USEPA, Health Effects Div.: (Developmental toxicity and birth defects: chlorpyrifos). Prepared by The Dow Chemical Co. 277 p.

43963701 Maxey, S.; Murphy, P.; Berbrich, D. (1995) Determination of Dislodgeable Residues and Airborne Chlorpyrifos Concentrations Following Broadcast Treatment of a Carpeted Surface with NAF-53 (0.5%) Emulsifiable Concentrate: Lab Project Number: HEH 23: DECO-HEH-23: HEH 19. Unpublished study prepared by The Dow Chemical Co. 118 p.

Chlorpyrifos Bibliography

44039901 Burns, C.; Cartmill, J.; Powers, B.; et al. (1996) An Update of the Moribidity (sic) Experience Among Employees Potentially Exposed to Chlorpyrifos: Lab Project Number: EPI-3635. Unpublished study by The Dow Chemical Co. 85 p.

44167101 Vaccaro, J.; Beard, K.; Maxey, S.; et al. (1996) Chlorpyrifos: Exposure to Adults and Children Upon Re-Entry to Domestic Lawns, Following Treatment with a Chlorpyrifos-Based Granular Insecticide: Lab Project Number: HEH2.1-1-182(134). Unpublished study by The Dow Chemical Co. 75 p.

44186301 Gibson, J. (1996) Critical Review of Allegations Associating Dursban with Human Teratogenicity: Lab Project Number: JEG122396. Unpublished study prepared by DowElanco. 2401 p.

44245801 Shurdut, B.; Chen, W.; Burns, C.; et al. (1997) Critical Assessment of Report Entitled "Review of Chlorpyrifos Poisoning Data" (by J. Blondell and V. Dobozy, January 14, 1997): Lab Project Number: GH-C 4359. Unpublished study prepared by DowElanco. 118 p.

44444801 Vaccaro, J.; Murphy, P.; Marino, T. et al. (1997) Determination of Exposure and Dose of General Pest Control Operators to Chlorpyrifos During Routine Applications of Dursban Pro Insecticide to Cracks/Crevices and Spots: Lab Project Number: HEH 785. Unpublished study by Dow Chemical Co. 46 p.

44458201 Byrne, S.; Saunders, D.; Cook, W. et al. (1998) Residential Exposure to Chlorpyrifos from Reentry to Structures Treated with Crack and Crevice and Spot Applications of Dursban Pro: Lab Project Number: HEA97044. Unpublished study prepared by Dow AgroSciences. 133 p. {OPPTS 875.2400, 875.2500, 875.2600, 875.2800, 875.2900, 875.2000}

44589001 Murphy, P.; Beard, K.; Chambers, D. et al. (1997) Evaluation of Worker's Exposures to Chlorpyrifos During the use of Dursban TC Termiticide Concentrate for Pre-Construction Termiticide Applications: Lab Project Number: HEH 816. Unpublished study prepared by Dow Chemical Company. 96 p.

44483501 Murphy, P.; Beard, K.; Marino, T. et al. (1998) Evaluation of Chlorpyrifos Exposures to Workers During Loading and Application of Lorsban 15G Granular Insecticide During Corn Planting: Lab Project Number: HEH 311. Unpublished study prepared by Dow Chemical Co. 95 p.

44729401 Barnekow, D.; Shurdut, B. (1998) Evaluation of Workers' Exposure to Chlorpyrifos during the Use of Dursban Pro Insecticide Concentrate for Broadcast Turf Applications: Lab Project Number: HEA97089. Unpublished study prepared by

Dow Agrosciences LLC. 185 p. {OPPTS 875.1000, 875.1100, 875.1300, 875.1500, 875.2800, 875.1600}

44729402 Barnekow, D.; Shurdut, B. (1998) Evaluation of Workers' Exposures to Chlorpyrifos during the Use of Dursban TC Termiticide Concentrate for Post-Construction Termiticide Applications: Amended Report: Lab Project Number: HEA97054. Unpublished study prepared by Dow Agrosciences LLC. 177 p. {OPPTS 875.1000, 875.1100, 875.1200, 875.1300, 875.1400, 875.1500, 875.2800, 875.1600}

44739301 Barnekow, D.; Cook, W.; Meitl, T. et al. (1999) Exposure to Chlorpyrifos while Applying a Ready to Use Formulation: Lab Project Number: HEA97046. Unpublished study prepared by Dow AgroSciences LLC. 134 p. {OPPTS 875.2000, 875.2400, 875.2500, 875.2600, 875.2800, 875.2900}

44739302 Knutson, J.; Barnekow, D.; Cook, W. et al. (1999) Evaluation of Potential Exposures to Workers Mixing and Loading Lorsban-4E Insecticide Products for Aerial Application: Lab Project Number: HEA97038. Unpublished study prepared by DowAgroSciences LLC. 216 p. {OPPTS 875.1000, 875.1100, 875.1300, 875.1500, 875.1600}

44748101 Bargar, E.; Robb, C. (1999) Dissipation of Dislodgeable Foliar Residues of Chlorpyrifos from Treated Orchard Trees: Lab Project Number: RES98002: C0177. Unpublished study prepared by Dow AgroSciences LLC. 210 p.

44748102 Bargar, E.; Robb, C. (1999) Dissipation of Dislodgeable Foliar Residues of Chlorpyrifos from Treated Cotton, Sugar Beet and Sweet Corn Row Crops: Lab Project No: RES98027. Unpublished study by Dow AgroSciences LLC. 189 p.

Environmental Fate MRID References

00025619 Bidlack, H.D. (1979) Degradation of Chlorpyrifos in Soil under Aerobic, Aerobic/Anaerobic and Anaerobic Conditions. Method GH-C 1258 dated Nov 29, 1979. (Unpublished study received Dec19, 1979 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:241547-A)

00155577 McCall, P. (1986) Hydrolysis of Chlorpyrifos in Dilute Aqueous Solution: GH-C 1791. Unpublished study prepared by Dow Chemical U.S.A. 29 p.

00155636 McCall, P. (1985) Column Leaching and Sorption Studies with Chlorpyrifos :GH-C 1777. Unpublished study prepared by Dow Chemical U.S.A. 12 p.

Chlorpyrifos Bibliography

00155637 McCall, P. (1985) Chlorpyrifos Aged Soil Column Leaching Study: GH- C 1778. Unpublished study prepared by Dow Chemical U.S.A. 20 p.

40026101 McCall, P. (1986) Photodegradation of Chlorpyrifos in Aqueous Buffer: Laboratory Project Identification: GH-C 1862: (6015-293). Unpublished study prepared by Hazleton Laboratories America, Inc. 59 p.

40050401 McCall, P. (1986) Column Leaching and Sorption Studies with Chlorpyrifos and Chlorpyrifos Aged Soil Column Leaching Study: Supplemental Data. Unpublished compilation prepared by Dow Chemical U.S.A. 13 p.

40056401 Murphy, P.; Lutenske, N. (1986) Bioconcentration of Chlorpyrifos in Rainbow Trout (Salmo gairdneri Richardson): Laboratory Project Identification: ES-928. Unpublished study prepared by Dow Chemical Co. 49 p.

40059001 Oliver, G.; McKellar, R.; Woodburn, K.; et al. (1987) Field Dissipation and Leaching Study for Chlorpyrifos in Florida Citrus: Laboratory Report No. GH-C 1870. Unpublished study prepared by Dow Chemical U.S.A., Ag Chemistry R&D Laboratories. 94 p.

40234801 Fontaine, D.; Tester, D. (1987) Chlorpyrifos--Photodegradation of Chlorpyrifos in the Vapor Phase: Laboratory Project ID GH-C 1911. Unpublished study prepared by ABC Laboratories in cooperation with Dow Chemical U.S.A. 30 p.

40395201 Fontaine, D.; Wetters, J.; Weseloh, J.; et al. (1987) Field Dissipation and Leaching of Chlorpyrifos: Laboratory Project ID GHC-1957. Unpublished study by Dow Chemical U.S.A., Agricultural Chemistry R&D Laboratories. 115 p.

41747206 Batzer, F.; Fontaine, D.; White, F. (1990) Aqueous Photolysis of Chlorpyrifos: Lab Project Number: GH-C 2417. Unpublished study by DowElanco. 189 p.

41887501 Valcore, D. (1991) Evaluation of Modeling Results for the Deposition of Chlorpyrifos from an Ultra Low Volume Application. Unpublished study prepared by DowElanco Delivery Systems. 19 p.

41892801 McCall, P. (1987) Soil Adsorption Properties of Carbon 14-Chlorpyrifos: Lab Project No: GH-C 1971. Unpublished study by Dow Chemical Co. U.S.A. 35 p.

41892802 Racke, K.; Robbins, S. (1990) Factors Affecting the Degradation of 3,5,6,-Trichloro-2-Pyridinol in Soil. Unpublished Study by DowElanco. 18 p.

42144911 Cranor, W. (1990) Aerobic Soil Metabolism of carbon 14 Chlorpyrifos: Lab Project Number: 36640. Unpublished study by Analytical Bio-Chemistry Labs, Inc. 46 p.

Chlorpyrifos Bibliography

42144912 Cranor, W. (1990) Aerobic Soil Metabolism of carbon 14 TCP: Lab Project Number: 36641. Unpublished study by Analytical Bio-Chemistry Labs, Inc. 44 p.

42493901 Racke, K.; Lubinski, R. (1992) Sorption of 3,5,6-Trichloro-2-Pyridinol in Four Soils: Lab Project Number: ENV91081. Unpublished study by DowElanco. 44 p.

42495403 Havens, P.; Kieatiwong, S.; Shepler, K. (1992) The Photochemical Degradation of Chlorpyrifos on Soil by Natural Sunlight: Lab Project Number: 254W-1: 254W: ENV90075. Unpublished study prepared by DowElanco. 108 p.

42495405 Hansen, S.; Woodburn, K.; Ball, T.; et al. (1992) Chlorpyrifos: Distribution and Metabolism in the Eastern Oyster, Crassostrea virginica: Lab Project Number: DECO-ES-2377. Unpublished study by The Dow Chemical Co. 50 p.

42495406 Thacker, J.; Strauss, K.; Smith, G. (1992) Chlorpyrifos: A Bioconcentration Test with the Eastern Oyster (Crassostrea virginica): Lab Project Number: 103A-105: DSI/OYSBIO: ES-DR-0043-4946-8. Unpublished study prepared by Wildlife International Ltd. 67 p.

42874702 Robb, C.; Langer, W. (1993) Determination of Chlorpyrifos in Soils by Gas Chromatography: Lab Project Number: ACR 91.5. Unpublished study prepared by DowElanco, North American Envir. Chem. Lab. 22 p.

42874703 Racke, K. (1991) Response to Review of Field Dissipation and Leaching Study for Chlorpyrifos in Florida Citrus Groves: Lab Project Number: RFB072993A. Unpublished study prepared by DowElanco. 10 p.

42874704 Fontaine, D. (1991) Response to Review of Field Dissipation and Leaching of Chlorpyrifos: Lab Project No: RFB072993. Unpublished by DowElanco. 26 p.

42924801 Racke, K.; Robb, C. (1993) Dissipation of Chlorpyrifos in Warm-Season Turfgrass and Fallow Soil in Florida: Lab Project Number: ENV90125. Unpublished study prepared by Dow Elanco, North American Environmental Chemistry Lab. 187 p.

42924802 Racke, K.; Robb, C. (1993) Dissipation of Chlorpyrifos in Cool-Season Turfgrass and Fallow Soil in Indiana: Lab Project Number: ENV90126. Unpublished study by Dow Elanco, North American Environmental Chemistry Lab. 186 p.

43210801 Thalacker, F. (1994) (Carbon 14)-Chlorpyrifos: Accumulation in Confined Rotational Crops (Screenhouse Study): Final Report: Lab Project Number: HWI 6397-114: PM-046: MET92056. Unpublished study prepared by Hazleton Wisconsin, Inc. and Plant Sciences, Inc. 216 p.

Chlorpyrifos Bibliography

43760606 Valcore, D. (1995) Droplet Size Data for XRM-5318 Chlorpyrifos Formulation: Lab Project Number: FOR91121. Unpublished study prepared by New Mexico State University. 39 p.

43760607 Valcore, D. (1995) Droplet Size Data for Lorsban 4E Chlorpyrifos Formulation: Lab Project Number: FOR91122. Unpublished study prepared by New Mexico State University. 38 p.

43786902 Valcore, D. (1995) Droplet Size Data for LOCK-ON Chlorpyrifos Formulation: Lab Project Numbers: FOR91123: PASS A91-006. Unpublished study prepared by New Mexico State University, and DowElanco. 38 p.

43786903 Valcore, D. (1995) Aerial Spray Drift Field Study for Chlorpyrifos Formulations: Lab Project No: FOR92068. Unpublished study prepared by DowElanco. 142 p.

44083401 Kennard, L. (1996) Aerobic Aquatic Degradation of Chlorpyrifos in Flow Through System: Lab Project No: ENV95024. Unpublished study by DowElanco. 93 p.

Residue Chemistry MRID References

00025942 Miller, P.W. (1980) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Peanut Oil Fractions. (Unpublished study received Jan 15, 1980 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:099201-D)

00033586 Davis, A.C.; Kuhr, R.J.; Helfman, G.; et al. (1980) Summary. Includes undated method entitled: 3,5,6-Trichloro-2-pyridinol on onions. (Unpublished study received Jul 8, 1980 under 0E2387; prepared in cooperation with Cornell Univ., New York State Agricultural Experiment Station, Dept. of Entomology and others, submitted by Dow Chemical U.S.A.; Midland, Mich.; CDL:099507-A)

00034031 Kiigemagi, U.; Inman, R.D.; Deinzer, M.L.; et al. (1979) Summary of Residue Trials. (Unpublished study received Jun 10, 1980 under 0E2372; prepared in cooperation with Oregon State Univ., Depts. of Agricultural Chemistry and Entomology and others, submitted by Interregional Research Project No. 4, New Brunswick, N.J.; CDL:099448-A)

00037455 McKellar, R.L.; Dishburger, H.J. (1975) Determination of Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Cottonseed, Gin Trash and Process Fractions following Multiple Treatments of Cotton Plants with Lorsban Insecticide. (Unpublished study received Feb 13, 1975 under 5G1595; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:094724-L)

Chlorpyrifos Bibliography

00037457 McKellar, R.L. (1974) Determination of Residues of 0,0-Diethyl 0-(3,5,6-trichloro-2-pyridyl) phosphorothioate in Cottonseed and Cotton Gin Trash by Gas Chromatography. Method ACR 74.4T dated May 13, 1974. (Unpublished study received Feb 13, 1975 under 5G1595; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL: 094724-N)

00037458 McKellar, R.L. (1973) Determination of Residues of 3,5,6-Trichloro-2-pyridinol in Lima and Snapbean Forage and Beans by Gas Chromatography. Method ACR 71.19R dated Sep 27, 1973. (Unpublished study received Feb 13, 1975 under 5G1595; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:094724-O)

00039641 Wetters, J.H.; Dishburger, H.J. (1974) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Sugar Beets and Process Fractions Treated with Lorsban Insecticide: GH-C 729. Summary of studies 095171-M through 095171-O. (Unpublished study received Feb 11, 1976 under 6F1745; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:095171-L)

00039642 Wetters, J.H. (1973) Determination of Residues of 0,0-Diethyl 0-(3, 5,6-trichloro -2-pyridyl)phosphorothioate in Sugar Beets and Solid Process Fractions by Gas Chromatography. Method ACR 73.5 dated Dec 6, 1973. (Unpublished study received Feb 11, 1976 under 6F1745; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:095171-M)

00039643 McKellar, R.L. (1972) Determination of Residues of 0,0-Diethyl 0- (3,5,6 -trichloro-2-pyridyl)phosphorothioate in Snapbeans and Snapbean Forage by Gas Chromatography. Method ACR 72.15 dated Dec 4, 1972. (Unpublished study received Feb 11, 1976 under 6F1745; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL: 095171-N)

00044555 Wetters, J.H.; Dishburger, H.J. (1975) Determination of Residues in Fruits and Nuts following Dormant Application of Lorsban Insecticide. (Unpublished study received Apr 20, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:095856-L)

00046785 Wetters, J.H.; Dishburger, H.J. (1976) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Sorghum Green Plant, Silage, Dry Plant, and Grain following Multiple Applications with Lorsban(R) Insecticide. (Unpublished study received May 15, 1980 under KS 80/6; submitted by Kansas, Dept. of Agriculture for Dow Chemical U.S.A., Midland, Mich.; CDL:242481-A)

00051798 Dow Chemical U.S.A. (19??) Proposed Analytical Methods for Regulatory Control: Determination of Chlorpyrifos and Its Pyridinol Moiety in or on Bananas.

Summary of studies 093656-M through 093656-P. (Unpublished study received Mar 13, 1973 under 3F1370; CDL:093656-L)

00051801 Herman, J.L. (1972) Determination of Residues of 0,0-Diethyl 0-(3, 5,6-trichloro -2-pyridyl)phosphorothioate in Bananas by Gas Chromatography with Flame Photometric Detection. Method ACR 72.14 dated Nov 21, 1972. (Unpublished study received Mar 13, 1973 under 3F1370; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:093656-O)

00058087 McKellar, R.L.; Dishburger, H.J. (1976) Determination of Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Tissues of Cattle Receiving a Single Treatment of Dursban Spot-On: Report No. GH-C-930. (Unpublished study received Aug 12, 1977 under unknown admin. no.; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:231282-E)

00058089 McKellar, R.L.; Dishburger, H.J. (1973) Determination of Residues of 3,5,6-Trichloro-2-pyridinol in Bovine Tissues by Gas Chromatography: ACR 70.19R. Method dated Aug 2, 1973. (Unpublished study, Aug 12, 1977 under unknown date; by Dow Chemical U.S.A., Midland, Mich.; CDL:231282-G)

00066724 Smith, G.N.; Watson, B.S.; Fischer, F.S. (1967) Investigations of Dursban insecticide. Uptake and translocation of 3,6C,O,-Diethyl-O-3, 5,6-trichloro-2-pyridyl phosphorothioate and 14C,O,O-DiethylO-3,5,6-trichloro- 2-pyridyl phosphorothioate by beans and corn. Journal of Agricultural and Food Chemistry 15(1):127-131. (Also In unpublished submission received Aug 28, 1972 under 3F1306; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:092215-R)

00066725 Smith, G.N.; Watson, B.S.; Fischer, F.S. (1967) Investigations on Dursban insecticide. Metabolism of O,O-Diethyl O-3,5, 6,-trichloro-2-pyridyl phosphorothioate and 3,5,6-Trichloro-2-pyridinol in plants. Journal of Agricultural and Food Chemistry 15(5):870-877. (Also In unpublished submission, Aug 28, 1972 under 3F1306; by Dow Chemical U.S.A., Midland, Mich.; CDL:092215-S)

00070509 McKellar, R.L.; Wetters, J.H.; Dishburger, H.J. (1972) Determination of Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Green Forage, Grain and Stover of Corn following Surface Band and Seed Furrow Applications of Dursban Insecticide: GH-C 530. (Unpublished study received Nov 12, 1980 under 464-523; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:244439-A)

00072657 Bauriedel, W.R.; Miller, J.H. (1980) The Metabolic Fate of 14µC- Chlorpyrifos Applied to an Apple Tree: GH-C 1397. (Unpublished study, Mar 6, 1981 under 464-448; by Dow Chemical U.S.A., Midland, Mich.; CDL:099939-A)

Chlorpyrifos Bibliography

00072660 Bauriedel, W.R.; Miller, J.H. (1981) The Metabolic Fate of 14µC- Chlorpyrifos Applied Topically to Soybeans: GH-C 1414. (Unpublished study received Mar 6, 1981 under 464-448; by Dow Chemical U.S.A., Midland, Mich.; CDL:099942-A)

00077055 Glas, R.D. (1981) The Metabolic Fate of 14C-Chlorpyrifos Fed to Lactating Goats: GH-C 1408 R. (Unpublished study received Jul 1, 1981 under 9F2221; submitted by Dow Chemical Co., Midland, Mich.; CDL:070176-A)

00077120 Interregional Research Project Number 4 (1981) The Results of Tests on the Amount of Chlorpyrifos Residues Remaining in or on Cherries Including a Description of the Analytical Method Used. (Compilation; unpublished study received Jun 5, 1981 under 1E2529; CDL:070135-A)

00078962 Norton, E.J.; Wetters, J.H.; Miller, P.W. (1981) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Field Corn following Multiple Applications of Lorsban Insecticides. (Unpublished study received Jul 8, 1981 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:070208-L)

00083840 Dow Chemical U.S.A. (1979) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. (Unpublished study received Mar 3, 1979 under 464-448; CDL:098038-I)

00084266 Wetters, J.H.; Norton, E.J.; Miller, P.W. (1981) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Corn Process Fractions following Treatment of Grain with Lorsban 4E Insecticide: GH-C 1465. (Unpublished study received Sep 9, 1981 under 1F2544; by Dow Chemical Co., Indianapolis, Ind.; CDL:070316-A)

00084326 Wetters, J.H. (1980) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Whole Citrus and Citrus Process Fractions following Foliar Applications of Lorsban 4E Insecticide. (Unpublished study received Sep 10, 1981 under 1F2575; submitted by Dow Chemical Co., Indianapolis, Ind.; CDL:070368-E)

00084330 Wetters, J.H. (1973) Determination of Residues of O,O-Diethyl O-(3,5,6-Trichloro-2-pyridyl) phosphorothioate in Sugar Beet Liquid Process Fractions by Gas Chromatography. Method ACR 73.6 dated Dec 7, 1973. (Unpublished study received Sep 10, 1981 under 1F2575; submitted by Dow Chemical Co., Indianapolis, Ind.; CDL:070368-N)

00084331 Wetters, J.H. (1975) Determination of Residues of O,O-Diethyl O- (3,5,6-Trichloro-2-pyridyl) phosphorothioate in Sweet Potatoes by Gas Chromatography. Method ACR 75.4 dated Jul 29, 1975. (Unpublished study received Sep 10, 1981 under 1F2575; by Dow Chemical Co., Indianapolis, Ind.; CDL:070368-O)

Chlorpyrifos Bibliography

00084845 Miller, P.W. (1980) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Sunflower Seed and Forage from Multiple Applications of Lorsban Insecticides. (Unpublished study received Oct 21, 1981 under 2F2588; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:070408-O)

00084846 Miller, P.W. (1981) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Sunflower Seed and Process Fractions from Sunflowers Treated with Lorsban Insecticides. (Unpublished study received Oct 21, 1981 under 2F2588; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:070408-P)

00085785 Interregional Research Project Number 4 (1981) The Results of Tests on the Amount of Chlorpyrifos Residues Remaining in or on Grapes Including a Description of the Analytical Method Used. (Compi lation; unpublished study received Oct 19, 1981 under 2E2584; CDL:070420-A)

00088978 Miller, P.W. (1981) Determination of Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Apple Process Fractions: GH-C 1488. (Unpublished study received Dec 2, 1981 under 2H5331; submitted by Dow Chemical Co., Indianapolis, Ind.; CDL:070576-A)

00090562 McKellar, R.L.; Morgan, R.W.; Dishburger, H.J.; et al. (1973) Residue Study: Determination of Chlorpyrifos in Food from Food Handling Establishments Treated with Dursban Insecticide: GH-C 678. (Unpublished study received Mar 11, 1975 under 5H5080; by Dow Chemical U.S.A., Midland, Mich.; CDL: 221800-J)

00090563 McKellar, R.L.; Dishburger, H.J.; Porteous, D.J.; et al. (1974) Residue Study: Determination of Chlorpyrifos in Human Food Resulting from Treatment of Food Handling Establishments with Dursban 2E Insecticide: GH-C 773R. (Unpublished study received Mar 11, 1975 under 5H5080; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:221800-K)

00094088 Interregional Research Project Number 4 (1980) The Results of Tests on the Amount of Chlorpyrifos Residues Remaining in or on Asparagus Including a Description of the Analytical Method Used. Includes methods dated Jul 12, 1978. (Unpublished study received Feb 3, 1982 under 2E2644; CDL:070655-A)

00095179 Dow Chemical Company (1972) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Dursban. Includes method ACR 58.5 dated Aug 1, 1958; method ACR 59.3R dated May 19, 1961; method ACR 70.19 dated Dec 14, 1970; and others. (Compilation; unpublished study, including published data, received Aug 28, 1972 under 3F1306; CDL: 092216-A; 092217, 092218)

Chlorpyrifos Bibliography

00095201 Hunt, L.M.; Gilbert, B.N.; Schlinke, J.C. (1969) Rapid gas chromatographic method for analysis of 0,0-diethyl-O-3,5-6-trichloro-2-pyridy/ phosphorothioate (Dursban) in turkey and chicken tissues. Journal of Agricultural and Food Chemistry 17(6):1166-1167. (Also In submission received Aug 28, 1972 under 3F1306; submitted by Dow Chemical Co., Indianapolis, Ind.; CDL:092219-J)

00095216 Dow Chemical U.S.A. (1973) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. Includes method ACR 72.15 dated Dec 4, 1972; method ACR 71.19R dated Sep 27, 1973; method 72.9 dated Dec 28, 1972; and others. (Compilation; unpublished study received Nov 29, 1973 under 4F1445; CDL:093852-E)

00095227 Dow Chemical U.S.A. (1975) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. Includes method ACR 75.4 dated Jul 29, 1975. (Compilation; unpublished study received May 12, 1976 under 464-404; CDL:095509-D)

00095249 Wetters, J.H.; Miller, P.W. (1978) Residues of Chlorpyrifos and 3,5,6-Trichloro -2-pyridinol in Grain and Milling Fractions Following Multiple Applications of Lorsban 4E Insecticide to Sorghum. (Unpublished study received Jun 7, 1978 under 464-448; by Dow Chemical U.S.A., Midland, Mich.; CDL:097128-A)

00095251 Dow Chemical U.S.A. (1977) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: óChlorpyrifos and Its Metabolite TCP. Includes methods ACR 73.5 dated Dec 6, 1973, ACR 73.5.S3 dated May 16, 1978, ACR 71.19R dated Sep 27, 1973. (Compilation; unpublished study received Jun 21, 1978 under 8E2092; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:097157-B)

00095259 Interregional Research Project Number 4 (1976) Results of Tests Concerning the Amount of Residues of Chlorpyrifos, O,O-Diethyl O-(3,5,6-Trichloro-2-pyridyl) Phosphorothioate and Its Metabolite, 3,5,6-Trichloro-2-pyridinol in or on Radishes, Rutabaga Roots, Turnip Roots, and Turnip Tops, Including a Description of the Analytical Method Used. (Compilation; unpublished study received Jan 5, 1978 under 8E2038; CDL:097451-A)

00095260 Dow Chemical U.S.A. (1978) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. Includes methods ACR 73.5 dated Dec 6, 1973, ACR 73.5.S1 dated May 21, 1976, ACR 71.19R dated Sep 27, 1973. (Compilation; unpublished study received Jan 29, 1979 under 464-EX-56; CDL:097781-D)

Chlorpyrifos Bibliography

00095263 Miller, P.W. (1979) Residues of Chlorpyrifos and 3,5,6-trichloro-2-pyridinol in Peanut Fractions. (Unpublished study received Jun 5, 1979 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:098335-A)

00095264 Dow Chemical U.S.A. (1978) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: óChlorpyrifos|. Includes method ACR 73.5 dated Dec 6, 1973; method ACR 71.19 dated Sep 27, 1973; method ACR 72.15 dated Dec 4, 1972; and Others. (Compilation; unpublished study received Jun 13, 1979 under 464-552; CDL:098337-A)

00095270 Dow Chemical U.S.A. (1979) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. Includes method ACR 73.5 dated Dec 6, 1973 and method ACR 71.19R dated Sep 27, 1973. (Compilation; unpublished study, including GH-C, 1224, received Sep 24, 1979 under 464-448 CDL:099023-P)

00095271 Interregional Research Project Number 4 (1979) Chlorpyrifos: Residue Tolerance Petition--Strawberries. (Compilation; unpublished study received Oct 16, 1979 under 0E2283; CDL:099065-A)

00095273 Interregional Research Project Number 4 (1976) Results of Tests Concerning the Amount of Residues of Chlorpyrifos and Its Metabolite, 3,5,6-Trichloro-2-pyridinol in or on Broccoli, Brussels Sprouts, Cabbage, and Cauliflower, Including a Description of the Analytical Method Used. (Compilation; unpublished study received Sep 29, 1977 under 7E2010; CDL:099111-A)

00095373 McKellar, R.L.; Dishburger, H.J. (1974) Determination of Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Cottonseed and Gin Trash Following Multiple Treatments of Cotton Plants With Lorsban Insecticide: GH-C 739. (Unpublished study received Sep 16, 1976 under 464-448; submitted by Dow Chemical U.S.A., Midland, Mich.; CDL:228192-D)

00095374 Wetters, J.H.; Dishburger, H.J. (1975) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Tomatoes Following Multiple Foliar Appliation with Lorsban(TM) Insecticide : GH-C 829. (Unpublished study received Sep 16, 1976 under 464-448; by Dow Chemical U.S.A., Midland, Mich.; CDL:228192-E)

00095383 Wetters, J.H. (1972) Determination of Residues of O-O-Diethyl O-(3,5,6-Trichloro-2-pyridyl) Phosphorothioate in Swine Tissues by Gas Chromatography with Flame Photometric Detection. Method ACR 72.1 dated Jan 6, 1972. (Unpublished study received Aug 11, 1977 under 26693-2; prepared by Dow Chemical U.S.A., submitted by Positive Formulators, Inc., Tucson, Ariz.; CDL:231274-B)

Chlorpyrifos Bibliography

00095387 Dow Chemical U.S.A. (1976) Determination of Residues of Dursban 44 (Chlorpyrifos) Insecticide in Tissues of Cattle|. Includes methods ACR 72.3 dated Feb 14, 1972, ACR 70.19R dated Aug 2, 1973 and ACR 72.1 dated Jan 6, 1972. (Compilation; unpublished study, Aug 12, 1977 under 464-EX-52; CDL:233132-C)

00095436 Claborn, H.V.; Mann, H.D.; Oehler, D.D. (1968) Dursban(R) determination in milk and body tissues of cattle. Journal of the Association of Official Analytical Chemists 51(6):1243-1245. (Also In unpublished submission, Mar 20, 1978 under KS 78/4; by state of Kansas for Y-Tex Corp., Cody, Wyo.; CDL:236565-L)

00095438 Y-Tex Corporation (1977) Tissue Residue Study: Chlorpyrifos in Cattle. (Compilation; unpublished study received Mar 20, 1978 under KS 78/4; submitted by state of Kansas for Y-Tex; CDL: 236565-P)

00098580 Interregional Research Project Number 4 (1980) The Results of Tests on the Amount of Chlorpyrifos Residues Remaining in or on Figs, Including a Description of the Analytical Method Used. (Compilation; unpublished study received Apr 12, 1982 under 2E2668; CDL:070783-A)

00101566 Dow Chemical U.S.A. (1982) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. (Compilation; unpublished study received May 14, 1982 under 2F2684; CDL:070855-C)

00108813 Interregional Research Project No. 4 (1981) The Results of Tests on the Amount of Chlorpyrifos Residues Remaining in or on Cranberries Including a Description of the Analytical Method Used. (Compilation; unpublished study received May 11, 1982 under 2E2682; CDL:070847-A)

00115260 Dow Chemical Co. (1982) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. (Compilation; unpublished study received Oct 1, 1982 under 3E2766; CDL:071167-B)

00116675 Dow Chemical U.S.A. (1982) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. (Compilation; unpublished study, Oct 26, 1982 under 464-552; CDL:071198-C)

00125686 Dow Chemical U.S.A. (1982) Chlorpyrifos: Residues in Alfalfa and Other Subjects. (Compilation; unpublished study, Feb 1, 1983 under 464-448; CDL:249449-A)

00126713 Dow Chemical U.S.A. (1983) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. (Compilation; unpublished study, Apr 12, 1983 under 464-448; CDL:071517-B)

Chlorpyrifos Bibliography

00129295 Interregional Research Project No. 4 (1982) The Results of Tests on the Amount of Chlorpyrifos Residues Remaining in or on Mushrooms Including a Description of the Analytical Method Used. (Compilation; unpublished study received May 5, 1983 under 3E2886; CDL:071593-A)

00131864 Miller, P. (1983) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-Pyridinol in Tomatoes Receiving Multiple Foliar Applications of Lorsban 4E Insecticide: GH-C 1641. (Unpublished study received Sep 1, 1983 under 464-448; submitted by Dow Chemical U.S.A., Midland, MI; CDL:251158-A)

00132786 Dow Chemical U.S.A. (1983) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. (Compilation; unpublished study, Nov 25, 1983 under 464-552; CDL:072160-C)

00134499 Wetters, J. (1983) Letter sent to R. Bischoff dated Oct 17, 1983: Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Grapes, Raisins, and Raisin Trash. (Unpublished study received Oct 28, 1983 under 3F2872; submitted by Dow Chemical U.S.A., Midland, MI; CDL:072086-A)

00134720 Dow Chemical U.S.A. (1979) Results of Tests on the Amount of Residue Remaining, Including a Description of the Analytical Method: Chlorpyrifos. (Compilation; unpublished study, Oct 18, 1979 under 464-448; CDL:099038-B)

00141725 Wetters, J. (1984) Letter sent to R. Bischoff dated Apr 26, 1984: Residues of chlorpyrifos and 3,5,6-trichloro-2-pyridinol on or in whole oranges. Prepared by Dow Chemical U.S.A. 9 p.

00148881 Wetters, J. (1985) Letter sent to R.F. Bischoff dated March 25, 1985: Residues of chlorpyrifos and 3, 5, 6-trichloro-2-pyridinol on or in alfalfa green forage and hay. Prepared by Dow Chemical USA. 9 p.

00154019 Braun, H.; Ritcey, G.; Frank, R.; et al. (1980) Dissipation rates of insecticides in six minor vegetable crops grown on organic soils in Ontario, Canada. Pest. Sci. 11(6):605-616.

00154734 Dow Chemical U.S.A. (1985) Residue Chem: Chlorpyrifos. Unpublished. 317 p.

00155578 Miller, P.; McKellar, R. (1986) Residues of Chlorpyrifos and 3,5,6- Trichloro -2-pyridinol in Wheat following Aerial or Ground Applications of Lorsban 4E Insecticide: GH-C 1790. Unpublished study by Dow Chemical U.S.A. 31 p.

Chlorpyrifos Bibliography

00155579 McKellar, R. (1986) Letter sent to R. Bischoff dated Jan 30, 1986: Plum/prune data: Residues of chlorpyrifos and 3,5,6-trichloro-2-pyridinol. Prepared by Dow Chemical U.S.A. 5 p.

00155580 Miller, P.; Wetters, J.; McKellar, R.; et al. (1986) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in Broccoli, Cabbage and Mustard Greens following Multiple Applications of Lorsban and/or Dursban Insecticides: GH-C 1788. Unpublished study prepared by Dow Chemical U.S.A. 52 p.

00157541 Bauriedel, W.; Miller, J. (1986) The Metabolic Fate of Carbon 14-Chlorpyrifos Applied to Field Corn at Planting (Soil Application) and in Mid-season (Foliar Application): GH-C 1807. Unpublished study by Dow Chemical U.S.A. 36 p.

00157542 Bauriedel, W. (1986) The Early Fate of Carbon 14-chlorpyrifos Applied to Leaf Surfaces of Corn, Soybean, and Sugar Beet: GH-C 1808. Unpublished study prepared by Dow Chemical U.S.A. 30 p.

00157543 Bauriedel, W.; Miller, J. (1986) The Metabolic Fate of Carbon 14-chlorpyrifos Applied to Sugar Beets at Planting (Soil Application and in Mid-season (Foliar Application): GH-C 1809. Unpublished study by Dow Chemical U.S.A. 31 p.

00157713 Wetters, J.; McKellar, R.; Ordiway, T. (1986) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol on or in Sweet Corn Ears and Green Forage following Multiple Foliar Applications of Lorsban 50W or Lorsban 4E Insecticides: GH-C 1797. Unpublished study prepared by Dow Chemical U.S.A. 33 p.

00157909 Interregional Reserach Project No. 4 (1985) The results of Tests on Amount of Chlorpyrifos Residues Remaining in or on Leeks Including a Description of the Analytical Method Used. Unpublished compilation. 56 p.

00158566 McKellar, R.; Ordiway, T. (1986) Residues of Chlorpyrifos and 3,5,6-Trichloro -2-pyridinol in Broccoli, Brussels Sprouts, Cabbage, and Cauliflower following Two Applications of Lorsban 4E Insecticide: Report No. GH-C 1802. Unpublished study prepared by Dow Chemical U S A. 19 p.

00158567 McKellar, R.; Ordiway, T. (1986) Residues of Chlorpyrifos and 3,5,6-Trichloro -2-pyridinol on or in Alfalfa Seed following an Application of Lorsban 4E Insecticide: Report No. GH-C 1803. Unpublished study by Dow Chemical U S A. 10 p.

00158568 Wetters, J. (1986) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol on or in Alfalfa Green Forage and Hay after Foliar Applications of Lorsban 4E Insecticide: Report No. GH-C 1805. Unpublished study by Dow Chemical U S A. 16 p.

Chlorpyrifos Bibliography

00158569 Miller, P.; McKellar, R. (1986) Residues of Chlorpyrifos and 3,5,6-Trichloro -2-Pyridinol in Sorghum Green Forage, Fodder and Grain following at Plant and Post Plant Applications of Lorsban 15G and Lorsban 4E Insecticides: Report No. GH-C 1813. Unpublished study prepared by Dow Chemical U S A. 17 p.

00161743 Puhl, R. (1986) Metabolism Study of Carbon 14-chlorpyrifos in Laying Hens: Final Report: Study No. 6148-102. Unpublished study prepared by Hazleton Laboratories America, Inc. 108 p.

00162109 Interregional Research Project No. 4 (1986) The Results of Tests on the Amount of Chlorpyrifos Residues Remaining in or on Dates Including a Description of the Analytical Method Used. Unpublished compilation. 52 p.

00164187 Interregional Research Project No. 4 (1986) The Results of Tests of the Amount of Chlorpyrifos Residues Remaining in or on Blueberry Including a Description of the Analytical Method Used: GHC-1832; 68-01-6670. Unpublished compilation. 44 p.

40131301 Doom, J. (1986) Determination of Residues of Chlorpyrifos and 3,5,6-Trichloro -2-pyridinol in or on Cabbage Following Two Applications of Lorsban 4E: Lab ID: GH-C 1847. Unpublished study by Dow Chemical U.S.A. 16 p.

40131302 Wetters, J. (1987) Residues of Chlorpyrifos and 3,5,6-Trichloro-2- pyridinol on or in Strawberries Treated by Preplant and/or Following Two Foliar Applications of Lorsban 4E Insecticide: Lab Project ID: GH-C 1871. Unpublished study prepared by Dow Chemical U.S.A. 19 p.

40131303 Wetters, J. (1987) Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in or on Cottonseed Following Five Foliar Applications of Lorsban 4E Insecticide: Lab Project ID: GH-C 1993. Unpublished study by Dow Chemical U.S.A. 16 p.

40265201 Levan, L.; McCall, P. (1987) A Study of Pyrolysis of 3,5,6-Trichloro-2-pyridinol in Cigarette Tobacco: Lab. project. ID HLA 6015-312. Unpublished study prepared by Hazleton Laboratories America, Inc. 44 p.

40288501 Wetters, J.; Markle, G. (1987) Chlorpyrifos--Residues of Chlorpyrifos and 3,5,6-Trichloro-2-pyridinol in or on Caneberries Receiving Multiple Foliar Applications of Lorsban 50W Insecticide: Protocol 9-83 and 3-84. Unpublished compilation prepared by Dow Chemical U.S.A. 46 p.

40638801 McCall, P. (1988) Response to EPA Review of Goat Metabolism Data Submitted to Support Separation of TCP from the Tolerance Expression for Chlorpyrifos. Unpublished study prepared by Dow Chemical U.S.A. 11 p.

Chlorpyrifos Bibliography

40638802 McCall, P. (1988) Response to EPA Review of Plant Metabolism Data Submitted to Support Separation of TCP from the Tolerance Expression for Chlorpyrifos. Unpublished study prepared by Dow Chemical Co. 9 p.

41424401 Oliver, G. (1990) Summary of Previously Submitted Residue Data to Support the Use of Chloryrifos on Walnuts. Unpublished study by DowElanco. 27 p.

41739001 Duebelbeeis, D. (1990) Determination of Chlorpyrifos And 3,5,6-Trichloro-2-Pyridinol Residues in Alfalfa Green Forage And Cured Hay Receiving A Postplant Application of Lorsban 2E Insecticide: Lab Project Number: GH-C 2293: 86098. Unpublished study prepared by DowElanco. 37 p.

41829007 Lewer, P. (1990) Reinvestigation of the Nature of the Residues in Forage from ócarbon 14|-Chlorpyrifos-Treated Field Corn: Lab Project Number: GH-C/2291. Unpublished study prepared by DowElanco. 60 p.

42245904 Nugent, P.; Schotts, B. (1991) Residues of Chlorpyrifos in Sweet Corn Ears and Forage Following Multiple Applications of Lorsban 4E: Lab Project Number: 90029. Unpublished study prepared by DowElanco. 33 p.

42245905 Robb, C. (1991) Determination of Chlorpyrifos Residues in Sorghum Grain and Fodder: Lab Project Number: 90025. Unpublished study by DowElanco. 30 p.

42245906 Robb, C. (1991) Determination of Residues of Chlorpyrifos in Sunflowers: Lab Project Number: 90026. Unpublished study prepared by DowElanco. 21 p.

42245907 Nugent, P.; Schotts, B. (1992) Residues of Chlorpyrifos in Snap Bean Hay Following a Preplant Application of Lorsban 50-SL to the Seeds: Lab Project Number: 90027. Unpublished study prepared by DowElanco. 26 p.

42542701 Robb, C.; Stafford, J.; Ostrander, J. (1992) Residues of Chlorpyrifos in Milk and Cream from Dairy Cows Wearing Chlorpyrifos-impregnated Plastic Ear Tags: Lab Project Number: RES92025. Unpublished study by DowElanco. 123 p.

42645401 Biehn, W. (1993) Chlorpyrifos: Magnitude of Residue on Sugarcane: Lab Project Number: 3239: 87124: 16-5258. Unpublished study prepared by Hawaiian Sugar Planters Assoc. 403 p.

42649001 Leavitt, R.; Markle, G.; Wells, A. (1983) Chlorpyrifos: Magnitude of Residue on Onions (Green and Bulb) Michigan: Lab Project Number: 452: 5186. Unpublished study by Michigan State University, IR-4 North Central Region 30 p.

Chlorpyrifos Bibliography

42649002 Robb, C.; Schotts, B.; Ostrander, J. (1993) Determination of Residues of Chlorpyrifos in Processed Fractions of Corn: Lab Project Number: 90030. Unpublished study by DowElanco and Texas A&M University. 212 p.

43181401 Turner, L.; Phillips, A.; Schotts, B. (1994) Magnitude of the Residue of Chlorpyrifos in Whole Seed and Hulls From the Processing of Sunflowers: Lab Project Number: RES93013. Unpublished study prepared by Texas A&M Univ. System, Food Protein Research & Development Center and DowElanco, American Environmental Chemistry Lab. 80 p.

43445601 Catta-Preta, R.; Rampazzo, P. (1994) Residues of Chlorpyrifos in Pears After Treatment with LORSBAN 50W--Chile, 1993-1994: Lab Project Numbers: EC 020/93: LARP93006: GHB-P 211. Unpublished study prepared by DowElanco Latin America. 52 p.

Chlorpyrifos Bibliography

Appendix E. Generic Data Call-In

Appendix E. Generic Data Call-in

See the following table for a list of generic data requirements. Note that a complete Data Call-In (DCI), with all pertinent instructions, is being sent to registrants under separate cover.

The following documents are part of the Generic Data Call-in.

DCI Response

Requirements Status and Registrant's Response

Footnotes and Key Definitions for Guideline Requirements

Appendix F. Product Specific Data Call-In

Appendix F. Product Specific Data Call-In

See attached table for a list of product-specific data requirements. Note that a complete Data Call-In (DCI), with all pertinent instructions, is being sent to registrants under separate cover.

Appendix G. EPA's Batching of Chlorpyrifos Products for Meeting Acute Toxicity Data Requirements for Reregistration

Appendix G. EPA'S BATCHING OF CHLORPYRIFOS PRODUCTS FOR MEETING ACUTE TOXICITY DATA REQUIREMENTS FOR REREGISTRATION

In an effort to reduce the time, resources and number of animals needed to fulfill the acute toxicity data requirements for reregistration of products containing ***Chlorpyrifos*** as an active ingredient, the Agency has batched products which can be considered similar for purposes of acute toxicity. Factors considered in the sorting process include each product's active and inert ingredients (identity, percent composition and biological activity), type of formulation (e.g., emulsifiable concentrate, aerosol, wettable powder, granular, etc.), and labeling (e.g., signal word, use classification, precautionary labeling, etc.). Note the Agency is not describing batched products as "substantially similar" since some products with in a batch may not be considered chemically similar or have identical use patterns.

Using available information, batching has been accomplished by the process described in the preceding paragraph. Notwithstanding the batching process, the Agency reserves the right to require, at any time, acute toxicity data for an individual product should need arise.

Registrants of products within a batch may choose to cooperatively generate, submit or cite a single battery of six acute toxicological studies to represent all the products within that batch. It is the registrants' option to participate in the process with all other registrants, only some of the other registrants, or only their own products within in a batch, or to generate all the required acute toxicological studies for each of their own products. If the registrant chooses to generate the data for a batch, he/she must use one of the products within the batch as the test material. If the registrant chooses to rely upon previously submitted acute toxicity data, he/she may do so provided that the data base is complete and valid by to-days standards (see acceptance criteria attached), the formulation tested is considered by EPA to be similar for acute toxicity, and the formulation has not been significantly altered since submission and acceptance of the acute toxicity data. Regardless of whether new data is generated or existing data is referenced, the registrants must clearly identify the test material by EPA Registration Number. If more than one confidential statement of formula (CSF) exists for a product, the registrant must indicate the formulation actually tested by identifying the corresponding CSF.

In deciding how to meet the product specific data requirements, registrants must follow the directions given in the Data Call-In Notice and its attachments appended to the RED. The DCI Notice contains two response forms which are to be completed and submitted to the Agency within 90 days of receipt. The first form, "Data Call-in Response, " asks whether the registrant will meet the data requirements for each product. The second form, "Requirements Status and Registrant's Response," lists the product specific data required for each product, including the standard six acute toxicity tests. A registrant who wishes to participate in a batch must decide whether he/she will provide the data or depend on someone else to do so. If the registrant supplies the data to support a batch of products, he/she must select the one of the following options: Developing data (Option 1), Submitting an existing Study (Option 4), Upgrading an existing Study (Option 5), or Citing an Existing Study (Option). If a registrant depends on another's data, he/she must choose

among: Cost sharing (Option 2), Offers to Cost Share (Option 3) or Citing an Existing Study (Option 6). If a registrant does not want to participate in a batch, the choices are Options 1, 4, 5 or 6. However, a registrant should know that choosing not to participate in a batch does not preclude other registrants in the batch from citing his/her studies and offering to cost share (Option 3) those studies.

Two hundred twenty four products were found which contain ***Chlorpyrifos*** as the active ingredient. These products have been placed into 27 batches and a "No Batch" category in accordance with the active and inert ingredients and type of formulation. Please note that this batching scheme may not apply to products with CSFs that have been revised after generation of this document.

Batch 1	EPA Reg. No.	Percent active ingredient	Formulation Type
	4787-38	99.7	Solid
	4787-40	98.5	Solid
	4748-41	97.0	Solid
	11678-58	97.0	Solid
	34704-826	99.0	Solid
	42519-23	97.0	Solid
	62719-353	97.0	Solid
	62719-355	99.0	Solid
	70907-19	99.3	Solid

Batch 2	EPA Reg. No.	Percent active ingredient	Formulation Type
	1812-446	62.5	Liquid
	4787-37	62.2	Liquid
	4787-39	61.9	Liquid
	51036-350	61.5	Liquid
	62719-77	62.5	Liquid
	62719-349	62.5	Liquid
	62719-351	62.5	Liquid
	70907-17	60.6	Liquid

Batch 3	EPA Reg. No.	Percent active ingredient	Formulation Type
	7501-29	50.0	Solid
	34704-693	50.0	Solid
	62719-38	50.0	Solid

Batch 4	EPA Reg. No.	Percent active ingredient	Formulation Type
	62719-39	50.0	Solid
	62719-68	50.0	Solid
	62719-72	50.0	Solid
	62719-221	50.0	Solid
	62719-255	50.0	Solid
	62719-352	50.0	Solid
	70907-8	50.0	Solid

Batch 5	EPA Reg. No.	Percent active ingredient	Formulation Type
	655-499	44.8	Liquid
	829-280	44.9	Liquid
	1022-543	44.9	Liquid
	1386-649	44.9	Liquid
	34704-66	41.2	Liquid
	51036-122	42.8	Liquid
	51036-154	44.7	Liquid
	60061-82	44.9	Liquid
	60061-108	44.9	Liquid

Batch 6	EPA Reg. No.	Percent active ingredient	Formulation Type
	10163-158	40.7	Liquid
	19713-504	45.0	Liquid
	19713-518	44.9	Liquid
	19713-520	40.2	Liquid

	51036-216	44.7	Liquid
	51036-291	44.7	Liquid
	51036-294	44.7	Liquid
	62719-382	42.0	Liquid
	66222-3	44.9	Liquid
	66222-17	44.9	Liquid
	66222-19	40.7	Liquid
	67760-7	44.6	Liquid
	67760-27	44.2	Liquid
	67760-28	44.2	Liquid
	70907-3	45.0	Liquid
	70904-4	45.0	Liquid
	70907-7	45.0	Liquid
	70907-13	45.0	Liquid
	70907-18	45.0	Liquid

Batch 7	EPA Reg. No.	Percent active ingredient	Formulation Type
	19713-300	44.9	Liquid
	42519-19	44.9	Liquid
	42519-21	44.9	Liquid
	62719-11	44.9	Liquid
	62719-35	44.9	Liquid
	62719-69	44.9	Liquid
	62719-220	44.9	Liquid
	62719-245	44.9	Liquid
	62719-254	44.9	Liquid

Batch 8	EPA Reg. No.	Percent active ingredient	Formulation Type
	655-466	24.6	Liquid
	829-279	24.7	Liquid

	28293-200	24.1	Liquid
	51036-152	24.6	Liquid
	66222-5	24.5	Liquid
	66222-6	24.9	Liquid

Batch 9	EPA Reg. No.	Percent active ingredient	Formulation Type
	42519-20	24.8	Liquid
	51036-257	24.6	Liquid
	62719-65	24.8	Liquid
	67760-6	24.7	Liquid
	67760-31	24.7	Liquid

Batch 10	EPA Reg. No.	Percent active ingredient	Formulation Type
	62719-166	23.5	Liquid
	62719-167	23.5	Liquid

Batch 11	EPA Reg. No.	Percent active ingredient	Formulation Type
	499-367	20.0	Liquid
	499-419	20.0	Liquid

Batch 12	EPA Reg. No.	Percent active ingredient	Formulation Type
	10350-22	20.0	Liquid
	62719-88	20.0	Liquid
	62719-364	20.0	Liquid

Batch 13	EPA Reg. No.	Percent active ingredient	Formulation Type
	19713-505	15.0	Solid
	62719-383	15.0	Solid
	70907-5	15.0	Solid

Batch 14	EPA Reg. No.	Percent active ingredient	Formulation Type
	19713-521	15.0	Solid
	66222-18	15.0	Solid

Batch 15	EPA Reg. No.	Percent active ingredient	Formulation Type
	829-290	12.9	Liquid
	1386-615	12.6	Liquid
	28293-210	12.6	Liquid
	62719-380	12.6	Liquid

Batch 16	EPA Reg. No.	Percent active ingredient	Formulation Type
	655-764	2.32	Solid
	769-825	2.5	Solid
	1386-653	2.0	Solid
	8378-34	2.32	Solid
	9198-39	2.5	Solid
	9198-127	2.32	Solid
	10404-15	2.32	Solid
	28293-201	2.5	Solid
	32802-22	2.32	Solid
	34704-423	2.0	Solid
	51036-247	2.5	Solid
	51036-259	2.32	Solid
	51036-264	2.32	Solid
	53883-52	2.5	Solid

Batch 17	EPA Reg. No.	Percent active ingredient	Formulation Type
	829-292	2.5	Solid
	62719-276	2.5	Solid

Batch 18	EPA Reg. No.	Percent active ingredient	Formulation Type
	769-679	1.0	Solid
	769-726	1.0	Solid
	829-291	1.0	Solid
	1386-652	1.0	Solid
	8329-26	1.0	Solid
	8378-33	1.14	Solid
	8378-46	1.0	Solid
	9198-68	1.0	Solid
	9198-132	0.97	Solid
	9198-167	1.34	Solid
	10404-67	1.0	Solid
	10404-81	0.97	Solid
	28293-202	1.0	Solid
	32802-20	1.14	Solid
	32802-49	1.0	Solid
	34704-448	1.0	Solid
	51036-153	1.0	Solid
	51036-220	1.0	Solid
	62719-54	1.0	Solid
	62719-210	1.0	Solid

Batch 19	EPA Reg. No.	Percent active ingredient	Formulation Type
	8378-26	0.92	Solid
	8378-27	1.14	Solid
	9198-32	0.92	Solid
	10404-27	0.97	Solid
	32802-21	1.14	Solid
	62719-271	1.0	Solid

Batch 20	EPA Reg. No.	Percent active ingredient	Formulation Type
	655-766	0.5	Solid
	829-223	0.5	Solid
	829-272	0.5	Solid
	2724-487	0.5	Solid
	4822-153	0.5	Solid
	4822-335	0.03	Solid
	4822-411	0.528	Solid
	8329-23	0.5	Solid
	8378-28	0.5	Solid
	8848-61	0.5	Solid
	9198-137	0.5	Solid
	9688-67	0.50	Solid
	32802-19	0.7	Solid
	32802-39	0.5	Solid
	34704-55	0.5	Solid
	47006-5	0.5	Solid
	51036-117	0.5	Solid
	51036-263	0.5	Solid
	53883-48	0.5	Solid
	62719-14	0.5	Solid

Batch 21	EPA Reg. No.	Percent active ingredient	Formulation Type
	228-161	0.7	Solid
	8378-42	0.7	Solid
	8378-43	0.5	Solid
	8378-44	0.6	Solid
	9198-82	0.52	Solid
	9198-84	0.65	Solid
	9198-85	0.71	Solid

	9198-166	0.55	Solid
	10404-29	0.74	Solid
	10404-40	0.42	Solid
	35512-36	0.67	Solid
	62719-316	0.7	Solid

Batch 22	EPA Reg. No.	Percent active ingredient	Formulation Type
	572-329	0.5	Liquid
	10088-84	0.5	Liquid
	28293-99	0.5	Liquid
	62719-89	0.4	Liquid
	62719-90	0.2	Liquid

Batch 23	EPA Reg. No.	Percent active ingredient	Formulation Type
	10088-94	Chlorpyrifos- 0.5 Resmethrin - 0.11	Liquid
	28293-121	Chlorpyrifos - 0.5 Resmethrin - 0.11	Liquid

Batch 24	EPA Reg. No.	Percent active ingredient	Formulation Type
	655-786	Chlorpyrifos-0.5 PBO-0.26 Pyrethrins- 0.052	Liquid
	11474-66	Chlorpyrifos - 0.5 PBO- 0.26 Pyrethrins - 0.052	Liquid
	28293-87	Chlorpyrifos - 0.5 PBO- 0.26 Pyrethrins - 0.052	Liquid

Batch 25	EPA Reg. No.	Percent active ingredient	Formulation Type
	28293-142	Chlorpyrifos - 0.5 N-octyl bicycloheptene dicarboximide -0.4 Allethrin - 0.05	Liquid
	28293-149	Chlorpyrifos - 0.5 N-octyl bicycloheptene dicarboximide - 0.4 Allethrin - 0.05	Liquid

Batch 26	EPA Reg. No.	Percent active ingredient	Formulation Type
	11474-40	Chlorpyrifos-0.5 N-octyl bicycloheptene dicarboximide - 0.4 Allethrin- 0.054	Liquid

	11474-93	Chlorpyrifos- 0.5 N-octyl bicycloheptene dicarboximide- 0.4 Allethrin - 0.054	Liquid

Batch 27	EPA Reg. No.	Percent active ingredient	Formulation Type
	9198-98	Chlorpyrifos- 0.57 Benefin - 0.77 Trifluralin - 0.38	Liquid
	9198-99	Chlorpyrifos- 0.57 Benefin - 0.38 Trifluralin- 0.19	Liquid

No Batch	EPA Reg. No.	Percent active ingredient	Formulation Type
	499-405	Chlorpyrifos- 8.0 Cyfluthrin - 1.6	Liquid
	499-413	Chlorpyrifos- 0.5	Liquid
	665-441	Chlorpyrifos- 13.0 Dichlorvos- 4.82	Liquid
	1386-613	Chlorpyrifos- 6.97	Liquid
	7501-31	Chlorpyrifos-30.0	Liquid
	8329-18	Chlorpyrifos- 24.6	Liquid
	8329-20	Chlorpyrifos- 19.36	Liquid
	8329-24	Chlorpyrifos- 13.6	
	8329-36	Chlorpyrifos- 12.0 Permethrin- 4.0	Liquid
	9198-168	Chlorpyrifos-0.92	Solid
	9198-200	Chlorpyrifos- 0.45 Pendimethalin- 0.68	Solid
	9444-184	Chlorpyrifos- 0.5	Liquid
	9444-202	Chlorpyrifos- 0.50	Liquid
	9688-131	Chlorpyrifos- 0.50 Sulfluramid- 1.0	Liquid
	10088-85	Chlorpyrifos- 0.5 PBO-0.1 Pyrethrins-0.05 N-octyl bicycloheptene dicarboximide- 0.166	Liquid
	11474-55	Chlorpyrifos- 0.5 PBO- 0.260 Pyrethrins - 0.052	Liquid
	11474-90	Chlorpyrifos -0.5 PBO- 0.260 Pyrethrins - 0.052	Liquid
	13283-14	Chlorpyrifos- 5.0	Liquid
	13283-17	Chlorpyrofos-7.0	Solid
	26693-2	Chlorpyrifos- 2.0	Liquid
	28293-203	Chlorpyrifos- 1.0	Solid
	28293-204	Chlorpyrifos- 44.4	Liquid
	28293-205	Chlorpyrifos- 12.6	Liquid

	28293-265	Chlorpyrifos- 6.7	Liquid
	34704-65	Chlorpyrifos- 22.4	Liquid
	39039-2	Chlorpyrifos- 5.0 Cypermethrin-7.0 PBO- 3.5	Solid
	39039-6	Chlorpyrifos-9.5 Diazinon- 30.0	Solid
	45600-1	Chlorpyrifos- 0.86	Liquid
	48273-14	Chlorpyrifos- 44.9	Liquid
	51036-300	Chlorpyrifos- 15.0	Solid
	55431-1	Chlorpyrifos- 42.4	Liquid
	60061-100	Chlorpyrifos- 0.1 3-Iodo-2-Propynyl butyl Carbamate- 0.5	Liquid
	62719-34	Chlorpyrifos- 15.0	Solid
	62719-47	Chlorpyrifos- 44.9	Liquid
	62719-79	Chlorpyrifos- 22.9	Liquid
	62719-293	Chlorpyrifos- 75.0	Solid
	62719-295	Chlorpyrifos-30.0	Solid
	62719-350	Chlorpyrifos- 22.8	Liquid
	62719-354	Chlorpyrifos-30.0	Liquid
	66222-4	Chlorpyrifos-2.3	Solid
	67517-36	Chlorpyrifos-9.4 Permethrin- 7.2 PBO- 2.0	Solid
	67760-10	Chlorpyrifos- 43.2	Liquid
	67760-14	Chlorpyrifos- 15.0	Solid

Appendix H. List of Registrants Sent this Data Call-In

Appendix I. List of Available Related Documents and Electronically Available Forms

Appendix I. LIST OF AVAILABLE RELATED DOCUMENTS AND ELECTRONICALLY AVAILABLE FORMS

Pesticide Registration Forms are available at the following EPA internet site:

http://www.epa.gov/opprd001/forms/

Pesticide Registration Forms (These forms are in PDF format and require the Acrobat reader)

Instructions

1. Print out and complete the forms. (Note: Form numbers that are bolded can be filled out on your computer then printed.)

2. The completed form(s) should be submitted in hardcopy in accord with the existing policy.

3. Mail the forms, along with any additional documents necessary to comply with EPA regulations covering your request, to the address below for the Document Processing Desk.

DO NOT fax or e-mail any form containing 'Confidential Business Information' or 'Sensitive Information.'

If you have any problems accessing these forms, please contact Nicole Williams at (703) 308-5551 or by e-mail at williams.nicole@epa.gov.

The following Agency Pesticide Registration Forms are currently available via the internet: at the following locations:

8570-1	Application for Pesticide Registration/Amendment	http://www.epa.gov/opprd001/forms/8570-1.pdf
8570-4	Confidential Statement of Formula	http://www.epa.gov/opprd001/forms/8570-4.pdf
8570-5	Notice of Supplemental Registration of Distribution of a Registered Pesticide Product.	http://www.epa.gov/opprd001/forms/8570-5.pdf
8570-17	Application an Experimental Use Permit	http://www.epa.gov/opprd001/forms/8570-17.pdf
8570-25	Application for/Notification of State Registration of a Pesticide To Meet a Special Local Need	http://www.epa.gov/opprd001/forms/8570-25.pdf
8570-27	Formulator's Exemption Statement	http://www.epa.gov/opprd001/forms/8570-27.pdf
8570-28	Certification of Compliance with Data Gap Procedures	http://www.epa.gov/opprd001/forms/8570-28.pdf

8570-30	Pesticide Registration Maintenance Fee Filing_	http://www.epa.gov/opprd001/forms/8570-30.pdf
8570-32	Certification of Attempt to Enter into an Agreement with other Registrants for Development of Data	http://www.epa.gov/opprd001/forms/8570-32.pdf
8570-34	Certification with Respect to Citations of Data (PR Notice 98-5)	http://www.epa.gov/opppmsd1/PR_Notices/pr98-5.pdf
8570-35	Data Matrix (PR Notice 98-5)	http://www.epa.gov/opppmsd1/PR_Notices/pr98-5.pdf
8570-36	Summary of the Physical/Chemical Properties (PR Notice 98-1)	http://www.epa.gov/opppmsd1/PR_Notices/pr98-1.pdf
8570-37	Self-Certification Statement for the Physical/Chemical Properties (PR No 98-1)	http://www.epa.gov/opppmsd1/PR_Notices/pr98-1.pdf

Pesticide Registration Kit www.epa.gov/pesticides/registrationkit/

Dear Registrant:

For your convenience, we have assembled an online registration kit which contains the following pertinent forms and information needed to register a pesticide product with the U.S. Environmental Protection Agency's Office of Pesticide Programs (OPP):

1. The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) and the Federal Food, Drug and Cosmetic Act (FFDCA) as Amended by the Food Quality Protection Act (FQPA) of 1996.

2. Pesticide Registration (PR) Notices

   a. 83-3 Label Improvement Program--Storage and Disposal Statements
   b. 84-1 Clarification of Label Improvement Program
   c. 86-5 Standard Format for Data Submitted under FIFRA
   d. 87-1 Label Improvement Program for Pesticides Applied through Irrigation Systems (Chemigation)
   e. 87-6 Inert Ingredients in Pesticide Products Policy Statement
   f. 90-1 Inert Ingredients in Pesticide Products; Revised Policy Statement
   g. 95-2 Notifications, Non-notifications, and Minor Formulation Amendments
   h. 98-1 Self Certification of Product Chemistry Data with Attachments (This document is in PDF format and requires the Acrobat reader.)

   Other PR Notices can be found at http://www.epa.gov/opppmsd1/PR_Notices

3. Pesticide Product Registration Application Forms (These forms are in PDF format and will require the Acrobat reader).

a. EPA Form No. 8570-1, Application for Pesticide Registration/Amendment
b. EPA Form No. 8570-4, Confidential Statement of Formula
c. EPA Form No. 8570-27, Formulator's Exemption Statement
d. EPA Form No. 8570-34, Certification with Respect to Citations of Data
e. EPA Form No. 8570-35, Data Matrix

4. General Pesticide Information (Some of these forms are in PDF format and will require the Acrobat reader).

a. Registration Division Personnel Contact List
B. Biopesticides and Pollution Prevention Division (BPPD) Contacts
A. Antimicrobials Division Organizational Structure/Contact List
d. 53 F.R. 15952, Pesticide Registration Procedures; Pesticide Data Requirements (PDF format)
e. 40 CFR Part 156, Labeling Requirements for Pesticides and Devices (PDF format)
f. 40 CFR Part 158, Data Requirements for Registration (PDF format)
g. 50 F.R. 48833, Disclosure of Reviews of Pesticide Data (November 27, 1985)

Before submitting your application for registration, you may wish to consult some additional sources of information. These include:

1. The Office of Pesticide Programs' website.

2. The booklet "General Information on Applying for Registration of Pesticides in the United States", PB92-221811, available through the National Technical Information Service (NTIS) at the following address:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161

The telephone number for NTIS is (703) 605-6000.

3. The National Pesticide Information Retrieval System (NPIRS) of Purdue University's Center for Environmental and Regulatory Information Systems. This service does charge a fee for subscriptions and custom searches. You can contact NPIRS by telephone at (765) 494-6614 or through their website.

4. The National Pesticide Information Center (NPIC) can provide information on active ingredients, uses, toxicology, and chemistry of pesticides. You can contact NPIC by telephone at 1-800- 858-7378 or through their website: http://npic.orst.edu.

The Agency will return a notice of receipt of an application for registration or amended registration, experimental use permit, or amendment to a petition if the applicant or

petitioner encloses with his submission a stamped, self-addressed postcard. The postcard must contain the following entries to be completed by OPP:

1. Date of receipt;
2. EPA identifying number; and
3. Product Manager assignment.

Other identifying information may be included by the applicant to link the acknowledgment of receipt to the specific application submitted. EPA will stamp the date of receipt and provide the EPA identifying file symbol or petition number for the new submission. The identifying number should be used whenever you contact the Agency concerning an application for registration, experimental use permit, or tolerance petition.

To assist us in ensuring that all data you have submitted for the chemical are properly coded and assigned to your company, please include a list of all synonyms, common and trade names, company experimental codes, and other names which identify the chemical (including "blind" codes used when a sample was submitted for testing by commercial or academic facilities). Please provide a chemical abstract system (CAS) number if one has been assigned.

Documents Associated with this RED

The following documents are part of the Administrative Record for this RED document and may be included in the EPA's Office of Pesticide Programs Public Docket. Copies of these documents are not available electronically, but may be obtained by contacting the person listed on the respective Chemical Status Sheet.

1. Health Effects Division and Environmental Fate and Effects Division Science Chapters, which include the complete risk assessments and supporting documents.
2. Detailed Label Usage Information System (LUIS) Report.