



Environmental  
Protection Authority  
*Te Mana Rauhi Taiao*

---

## CONSULTATION REPORT

---

# APP201045 – Organophosphate and carbamate plant protection insecticides

November 2012



## Executive Summary

Under The Hazardous Substances and New Organisms Act 1996 (HSNO) the Chief Executive of the EPA has the ability to request that previously approved substances be reassessed. EPA staff reassess the substances and provide recommendations to an independent decision making committee appointed in accordance with HSNO.

The Chief Executive (CE) of the Environmental Protection Authority (EPA) has requested a reassessment of a group of organophosphate and carbamate (OPC) based insecticides used for plant protection purposes (the Application). This consultation report has been prepared by EPA staff in response to the CE's application, and contains the EPA staff evaluation of the active ingredients and/or formulations within the Application. It includes a technical analysis of the adverse and positive effects (risks and benefits) associated with OPC plant protection insecticides and provides draft recommendations on the application for notification to the general public. These may or may not be the final recommendations that EPA staff make to the decision making committee in the final Evaluation and Review report which will be prepared following receipt of all submissions.

The EPA would like to thank all of the people who have responded to our requests for information. The time and effort you have spent has been invaluable to the evaluation process.

### Reading this document

This document is a consultation document. Shaded boxes have been used throughout this document to indicate where there are questions or assumptions which submitters may wish to address. The boxes are numbered for ease of reference.

This report is divided into 4 sections:

1. introduction to the HSNO process, the reassessment and the report;
2. the technical evaluation and methodology used by EPA staff;
3. the recommendations of EPA staff; and
4. appendices supporting the reassessment.

Table 1, below, contains a summary of EPA staff's recommendations.

Table 1: Recommendations for substances included in the Application

Active ingredient	Recommendations
Acephate <sup>(i)</sup>	Retain approvals with additional controls
Bendiocarb <sup>(ii) c</sup>	Revoke approval with 6 month phase-out
Benomyl <sup>(i) c</sup>	Revoke approval with 6 month phase-out

Active ingredient	Recommendations
Carbaryl <sup>(ii) c</sup>	Retain approvals with additional controls
Carbofuran <sup>(iii) c</sup>	Revoke approval with 6 month phase-out
Carbosulfan <sup>(i) c</sup>	Revoke approvals with 6 month phase-out
Chlorpyrifos <sup>(ii)</sup>	Retain approvals with additional controls
Chlorpyrifos-methyl <sup>(i)</sup>	Retain approvals for export-only manufacture
Diazinon <sup>(ii)</sup>	Revoke approvals with long phase-out period (e.g. up to 10 years) Apply additional controls during phase-out
Dichlofenthion <sup>(iii)</sup>	Revoke approval with 6 month phase-out
Dichlorvos <sup>(ii)</sup>	Phase-out outdoor uses (18 month phase-out period proposed). Retain indoor uses with additional controls.* Retain use of dichlorvos strips for biosecurity purposes
Dimethoate <sup>(i)</sup>	Revoke approvals with short phase-out (e.g. up to 3 years)
Ethion <sup>(iii)</sup>	Revoke approval with 6 month phase-out
Famphur <sup>(iii)</sup>	Revoke approval with 6 month phase-out
Fenamiphos <sup>(iv)</sup>	Revoke approvals with medium phase-out period (e.g. up to 5 years) Apply additional controls during phase-out
Fenitrothion <sup>(ii)</sup>	Revoke approval with short phase-out period (e.g. up to 3 years)
Isazofos <sup>(iii)</sup>	Revoke approval with 6 month phase-out
Maldison (malathion) <sup>(ii)</sup>	Retain approvals with additional controls*
Methamidophos <sup>(i)</sup>	Revoke approvals with medium phase-out period (e.g. up to 5 years) Apply additional controls during phase-out
Methomyl <sup>(ii) c</sup>	Phase-out outdoor uses (18 month phase-out period proposed). Retain indoor uses with additional controls
Omethoate <sup>(iii)</sup>	Revoke approval with 6 month phase-out
Oxamyl <sup>(iv) c</sup>	Retain approval with additional controls
Phorate <sup>(i)</sup>	Revoke approvals with short phase-out period (e.g. up to 3 years)
Phoxim <sup>(i)</sup>	Revoke approvals with 6 month phase-out

Active ingredient	Recommendations
Pirimicarb <sup>(iv)</sup> <sup>c</sup>	Retain approvals with additional controls
Pirimiphos-methyl <sup>(ii)</sup>	Phase-out outdoor uses (18 month phase-out period proposed). Retain indoor uses with additional controls
Prothiofos <sup>(iv)</sup>	Revoke approval with long phase-out period (e.g. up to 10 years) Apply additional controls during phase-out
Pyrazophos <sup>(iv)</sup>	Revoke approval with 6 month phase-out
Terbufos <sup>(iv)</sup>	Revoke approval with short phase-out period (e.g. up to 3 years)

<sup>c</sup> denotes carbamate

\* EPA staff have assessed three formulations for dichlorvos, and one for maldison which were not included in the original application but are used for plant protection and additional purposes. These recommendations are for consultation only and will not be included for consideration by the decision making committee.

<sup>(i)</sup> Currently has HSNO approval for importation and/or manufacture of the active ingredient and for plant protection formulations containing the active ingredient. Recommendations apply to active ingredient and formulations.

<sup>(ii)</sup> Currently has HSNO approval for importation and/or manufacture of the active ingredient, for plant protection formulations containing the active ingredient and formulations used for other purposes. Recommendations apply to the formulations used as plant protection insecticides.

<sup>(iii)</sup> Currently has HSNO approval for importation and/or manufacture of the active ingredient only, no approved formulations. Recommendations apply to the active ingredient.

<sup>(iv)</sup> Does not have approval for the active ingredient, but has approvals for plant protection formulations containing the active ingredient. Recommendations apply to all formulations.

## Overview of the Reassessment process



## Table of Contents

Executive Summary .....	2
Overview of the Reassessment process .....	5
Table of Contents .....	6
Part 1: Overview .....	9
1. Introduction .....	10
1.1. Hazardous Substances and New Organisms Act 1996 .....	10
2. The Application .....	11
2.1. Application for grounds to reassess substances .....	11
2.2. The Application for reassessment.....	11
2.3. Scope .....	13
3. Overview of staffs assessment of risks, benefits and controls.....	15
3.1. Data gathering.....	15
3.2. Risk assessment.....	15
3.3. Benefits assessment.....	16
3.4. Evaluation.....	16
3.5. Controls .....	16
3.6. Peer review .....	17
3.7. Dealing with uncertainty .....	17
4. Glossary of terms .....	18
Part 2: .....	20
5. Risk assessment: Human health and environment .....	21
5.1. Effects on human health of OPCs.....	21
5.2. Environmental effects of OPCs.....	24
5.3. Approach taken to assess the risk to human health and the environment .....	24
6. Benefits Assessment.....	27
6.1. Generic benefits of OPC use .....	27
6.2. Specific benefits of OPC use.....	28
6.3. Additional considerations in the benefits assessment .....	30
7. Social and cultural considerations .....	34
7.1. Adverse effects on society and communities .....	34
7.2. Benefits to society and communities .....	34
7.3. Identification of potential adverse effects to Māori .....	35

7.4.	Identification of benefits to Māori .....	37
7.5.	International obligations .....	38
8.	Recommended controls .....	39
8.1.	Standards for insecticide use .....	39
9.	Approach to evaluating the risks and benefits .....	41
9.1.	Qualitative assessment of risks .....	41
9.2.	Qualitative assessment of benefits .....	44
9.3.	Comparing risks and benefits .....	46
Part 3: Recommendations .....		47
10.	Recommendations and Rationale .....	48
10.1.	Acephate .....	49
10.2.	Carbaryl .....	53
10.3.	Chlorpyrifos .....	56
10.4.	Diazinon .....	58
10.5.	Dichlorvos .....	62
10.6.	Dimethoate .....	65
10.7.	Fenamiphos .....	67
10.8.	Fenitrothion .....	71
10.9.	Maldison .....	73
10.10.	Methamidophos .....	76
10.11.	Methomyl .....	79
10.12.	Oxamyl .....	82
10.13.	Phorate .....	85
10.14.	Pirimicarb .....	87
10.15.	Pirimiphos-methyl .....	90
10.16.	Prothiofos .....	92
10.17.	Terbufos .....	95
10.18.	Home garden use .....	97
10.19.	Substances not used for plant protection purposes .....	98
Part 4: Appendices .....		100
Appendix A: Substances with non-plant protection uses and not included in the scope of the current reassessment .....		101
Appendix B: Active ingredients and substances included in the scope of this Application ....		105

<b>Appendix C: Summary and Analysis Reports.....</b>	<b>109</b>
<b>Appendix D: Risk assessment methodology .....</b>	<b>110</b>
<b>Appendix E: Selection of Acceptable Daily intake values .....</b>	<b>151</b>
<b>Appendix F: Additional controls for organophosphate and carbamate formulated substances used for plant protection purposes .....</b>	<b>157</b>
<b>Appendix G: Description of additional controls for the mitigation of risk arising from organophosphate and carbamate plant protection substances. ....</b>	<b>162</b>
<b>Appendix H: International Context .....</b>	<b>173</b>

EPA staff that participated in the evaluation: Matthew Allen, Marie Bradley, Joanne Armstrong, Cora Drijver, Rachael Linklater, Richard Mohan, Carly O'Connor, Matthew Salter and Jim Waters

Contractors who provided support for the evaluation: Robin Toy, Helen Gear, Dr Martin Edwards, David Steven, Douglas Birnie and Melanie Davidson

Special thanks to other individuals who also provided input into the evaluation: Dave Lunn and David Manktelow



## Part 1: Overview

*This section of the report provides an overview of the HSNO reassessment process and an introduction to the reassessment for the plant protection applications of organophosphate and carbamates.*



# 1. Introduction

## 1.1. Hazardous Substances and New Organisms Act 1996

The EPA is responsible for regulating hazardous substances and new organisms under the Hazardous Substances and New Organisms Act 1996 (HSNO) which sets out the framework for the management of hazardous substances throughout their lifecycle.

When carrying out a reassessment of hazardous substances, EPA staff follow the statutory considerations set out in HSNO. A reassessment is a review of an existing approval for a hazardous substance, and the sections of HSNO relating to the original approval of the substance apply to the reassessment also.

The ultimate decision on a reassessment is made by an independent decision making committee. This decision making committee is a sub-committee of the full HSNO Committee. The full HSNO Committee is a committee of eight people appointed by the Minister for the Environment following a process of nomination. HSNO Committee members have a variety of backgrounds and expertise in a range of fields such as science, law and tikanga Māori and are appointed for a fixed term of 3 years.

EPA staff receive the application for a reassessment. They then consider the reassessment and provide recommendations to the decision making committee. When making a decision, the decision making committee is required to consider the controls that can be imposed on the substance; the positive and adverse effects of the substance, and the likely effects if the substance is unavailable. The decision making committee will also consider the purpose of HSNO when reaching their decision.

HSNO requires the assessment of adverse and positive effects. The adverse effects of substances have been considered in relation to their toxicity to human health and the environment, and are referred to as risks. Impacts of the availability of a substance on users and New Zealand's economy have been referred to as benefits. The process followed by EPA staff is explained in detail in Part 2 of this document.

This consultation report contains the assessment of EPA staff in relation to the substances identified in the Application. In carrying out its assessment, EPA staff have followed the statutory requirements in HSNO.

EPA staff have made recommendations on the outcome of the reassessment for each of the substances. The recommendations are contained in Part 3.

**It is important to note that the recommendations of EPA staff may or may not be supported by the decision making committee for this application. The decision making committee can choose to accept, reject or modify the recommendations. For this reason we encourage you to address both the process, and the recommendations themselves, when making submissions.**

## 2. The Application

### 2.1. Application for grounds to reassess substances

An application for a reassessment cannot be lodged if the applicant has not first established that grounds exist for a reassessment. To establish grounds an application for grounds is lodged with the EPA. It is heard by an independent decision making committee which is a sub-committee of the full HSNO Committee.

Grounds that supported a group reassessment of OPCs approved as active ingredients and formulations have been determined on the basis that there was new information available for these substances. This new information is significant as it has led to overseas regulators revoking approvals or restricting the use of many OPCs due to concerns over their effects on the environment and human health. OPCs are used for plant protection, veterinary medicines, public health (e.g. for pest control in hospitals, restaurants etc) and industrial uses (e.g. for warehouse or industrial structure pest control).

Grounds to assess these OPCs on the basis of the significant new information were granted in two stages:

1. In 2008 and 2009 the EPA's predecessor, the Environmental Risk Management Authority established grounds to reassess four organophosphates (*diazinon*, *dichlorvos*, *acephate* and *methamidophos*).
2. In 2012 the CE of the EPA lodged a further grounds application and established grounds to reassess 32 OPCs (*bendiocarb*, *benomyl*, *carbaryl*, *carbofuran*, *carbosulfan*, *chlorfenvinphos*, *chlorpyrifos*, *chlorpyrifos-methyl*, *coumaphos*, *dichlofenthion*, *dimethoate*, *ethion*, *famphur*, *fenamiphos*, *fenitrothion*, *fenthion*, *isazofos*, *maldison* (*malathion*), *methomyl*, *omethoate*, *oxamyl*, *phorate*, *phoxim*, *pirimicarb*, *pirimiphos-methyl*, *propetamphos*, *propoxur*, *prothiofos*, *pyrazophos*, *temephos*, *terbufos*, *tetrachlorvinphos*).

### 2.2. The Application for reassessment

Applications for reassessment were lodged by the Chief Executive (CE) of the EPA and were notified for dichlorvos November 2010, acephate and methamidophos in January 2011 and diazinon in June 2011. The reassessment application numbers for these substances are: dichlorvos (HRC08004), acephate and methamidophos (ERMA200399), and diazinon (ERMA200398). Public submissions were received on the applications in 2010 and 2011. Following receipt of submissions on the applications the EPA identified that there was merit in undertaking a group reassessment of a larger group of OPCs that have similar effects on human health and the environment; and are used in a similar way on similar crops.

Following approval of the grounds for a further 32 OPCs in October 2012, the applications for reassessment of diazinon, dichlorvos, acephate and methamidophos were withdrawn.

The Chief Executive of the EPA has requested that the EPA reassess the plant protection uses of 29 OPCs (the Application). Formulations containing diazinon, dichlorvos, acephate and methamidophos now form part of the Application. The active ingredients for diazinon and dichlorvos will be considered at a later stage as they also have non plant-protection uses and so cannot be assessed in their entirety in the present evaluation.

The submissions received on the original applications for the active ingredients acephate and methamidophos and the formulations containing them have been included in this Application and addressed in this consultation report (unless withdrawn by the submitter).

The submissions received for the formulations containing diazinon and dichlorvos have also been addressed in this consultation report. Some formulations for dichlorvos have been assessed by EPA staff even though they were not within the Application. This is because they have relevant plant protection applications.

The submissions which relate to the active ingredients diazinon and dichlorvos, or formulations containing them that are used for purposes other than plant protection, will be carried through in a similar way to the next application.

The reasons for undertaking the reassessment of this whole group rather than individual active ingredients are:

- to avoid perverse outcomes where active ingredients with greater risks remain available while uses are restricted, or approvals revoked for less hazardous substances;
- to establish consistent risk management controls across the group of substances;
- to provide greater certainty about pesticide availability in the medium term;
- to direct development of long-term solutions or alternatives to the use of some substances; and
- to ensure a more efficient use of industry and EPA resources by undertaking the reassessment process fewer times

The Application requests that decision makers consider both the risks and the benefits of these substances, and take into account the information used by international regulators in their evaluations, which have resulted in changes in the approvals for the substances. The proposed outcomes are:

- Continuation of approvals for substances where the benefits outweigh the risks.
- Introduction of appropriate controls to manage risks posed by specific substances.
- Revocation of approvals for substances where the risks outweigh the benefits and cannot be managed through the application of controls.

**Not all of the substances for which grounds have been established are included in this Application. The additional active ingredients and formulations, and non plant protection uses**

of OPCs, will be the subject of a further application for reassessment. A list of these substances is attached as Appendix A.

## 2.3. Scope

### Active ingredients and substances included in the scope of the Application

The Application and this consultation report evaluate the plant protection uses of 29 OPCs. It includes:

- Twelve active ingredients and/or their formulations not approved for use in NZ (or approved for containment and export only). These substances either have HSNO approvals as active ingredients only, or are not included in products that are registered under the ACVM Act as plant protection products in New Zealand (*Bendiocarb, Benomyl, Carbofuran, Carbosulfan, Chlorpyrifos-methyl, Dichlofention, Ethion, Fampur, Isazofos, Omethoate, Phoxim, Pyrazophos*).
- Nine active ingredients and the formulations containing them for which all approvals relate to plant protection (*Acephate, Dimethoate, Fenamiphos, Methamidophos, Oxamyl, Phorate, Pirimicarb, Prothiofos and Terbufos*).
- Eight substances included in formulations that are only used for plant protection, but are also included in other formulations used more broadly than plant protection. Only the plant protection formulations for these active ingredients are included in this application. The active ingredients themselves will be considered when the other uses of the active ingredients are assessed (*Carbaryl, Chlorpyrifos, Diazinon, Dichlorvos, Fenitrothion, Maldison (Malathion), Methomyl and Pirimiphos-methyl*).

A full list of active ingredients and their formulations is attached as Appendix B.

The EPA has also included in this consultation report 3 formulations for dichlorvos and 1 for maldison (malathion) which were not in the Application. These formulations have plant protection applications, and so EPA staff have assessed them for completeness. However, the recommendations made on these formulations are for consultation only. The recommendations will be included in a subsequent application for reassessment addressing the non-plant protection uses.

There are several OPCs which have been approved under HSNO that are excluded from this Application. This is because they:

- are not used as insecticides (i.e fungicides or herbicides), and either are not inhibitors of acetylcholinesterase (see Section 5.1) or are not proven to be acetylcholinesterase inhibitors (*fosetyl, glufosinate, glyphosate, tolclofos-methyl, asulam, chlorpropham, desmedipham, iodocarb, phenmedipham, propamocarb, propham, thiophanate (aka thiophanate-ethyl), thiophanate-methyl*);

- have a different use pattern, i.e. seed treatments or slug/snail pellets (*methiocarb*, *furathiocarb*, *thiodicarb*); or
- have only recently been reassessed or approved (*azinphos-methyl*, *trichlorfon*, *formetanate hydrochloride*).

## 3. Overview of staffs assessment of risks, benefits and controls

### 3.1. Data gathering

To be able to assess the effects of OPCs, real world data on the way the substances are used in New Zealand was sought. Initial risk assessments were performed based on the use patterns extracted from the Novachem manual<sup>1</sup> and product labels. These risk assessments were then consulted on through two rounds of stakeholder engagement and data gathering including:

1. Submissions and feedback on individual substances; and
2. Detailed feedback on substance uses across crop sectors.

#### Feedback on individual substances

In September 2011 the EPA published its *“Call For Information on the reassessment of organophosphate and carbamate plant protection insecticides”*<sup>2</sup>. This document contained the initial results of risk modelling for the 17 OPCs which are in regular use as plant protection insecticides in New Zealand. Each of the OPCs had multiple uses modelled across a variety of crops.

#### Detailed feedback on substance uses across crop sectors

In the next round of stakeholder engagement updated risk modelling which incorporated stakeholder feedback was consulted on<sup>3</sup>. Further information on the benefits of the substances, and on the use of OPCs on specific crop sectors was sought. Feedback was more focussed and allowed a better understanding of how OPCs are used, and what benefits they provide. A summary of the feedback received from stakeholders, including submissions on diazinon, acephate, methamidophos and dichlorvos, was compiled and used to determine the level of risks and benefits associated with use of the individual OPCs for each of the crop sectors. A link to these Summary and Analysis documents is available in Appendix C.

### 3.2. Risk assessment

The adverse effects on human health and the environment have been assessed by comparing predicted or measured exposures of the substances to operators, workers re-entering a recently sprayed area, bystanders and wildlife, to maximum levels of exposure that are not expected to result in harmful effects. The data relating to the toxicological and ecotoxicological effects are based on animal or human studies. Where possible, the toxicity and ecotoxicity data specific to the substances evaluated are those used by other international regulators. In some instances the EPA has not been

<sup>1</sup> <http://www.novachem.co.nz/>

<sup>2</sup> <http://www.epa.govt.nz/Publications/Call%20for%20information.pdf>

<sup>3</sup> <http://www.epa.govt.nz/publications-resources/topics/Pages/Sector-assessments-.aspx>



able to source key information about the toxicity of these substances. In these instances the EPA has used reasonable worst case scenarios or default values, or has not calculated the risks. A full explanation of the EPA's approach to assessing the risks is explained in Section 5 of this report.

### 3.3. Benefits assessment

The benefits of OPCs are assessed based on the advantages received by users and the New Zealand economy. The assessment considers the availability of alternative products, and the relative efficacy and cost of the alternative products. It also takes into account more generic benefits of OPCs such as their importance in resistance management, broad spectrum properties and generally short withholding periods. The full approach to assessing the benefits is explained in Section 6 of this report.

### 3.4. Evaluation

To compare risks and benefits, they were interpreted using qualitative descriptors of likelihood and magnitude. Combinations of likelihood and magnitude allow EPA staff to categorise a risk or a benefit as being negligible, low, medium or high to further focus comparisons. The definitions of negligible, low, medium or high, and how the qualitative descriptors have been derived, can be found in Section 9 of this report.

Staff recommendations follow the methodology below:

- If risks are negligible then the approvals should be retained
- If additional controls make the risks negligible, then the approval should be retained with those additional controls.
- If the risks are non-negligible even with extra controls a risk/benefit analysis is conducted and:
  - If benefits are greater than the risks the approval is recommended to be retained
  - If risks are greater than benefits the approval is recommended to be revoked either with or without a phase-out period

These recommendations also take into account the purpose of HSNO, and the effect of the removal of substances on the capacity of people and communities to provide for their own economic, social, and cultural well-being now and in the future. The recommendations also account for the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, valued flora and fauna and other taonga.

### 3.5. Controls

EPA staff have compiled a controls toolbox to help reduce the risks of OPCs. These controls are additional to those controls that currently apply to OPCs, and have been consulted on with stakeholders to test their practicality.



### 3.6. Peer review

The recommendations made by the EPA are dependent on the quality of the data they are based on. For this reason there has been a process of peer review involving parties external to the EPA.

The EPA procured additional services where needed following the EPA procurement process.

The data used in the risk modeling were reviewed by Dr Martin Edwards (Toxicology Consulting Ltd). In addition, the EPA's general risk assessment approach for pesticides which are sprayed outdoors (which is used for both new applications and reassessments) has been peer reviewed by Golder Associates (operator, re-entry worker and bystander assessments) and the Australian Environment Agency Pty Ltd (aquatic assessment).

Benefits information, evaluation and recommendations were reviewed by staff at Sapere Research Group and Plant & Food Research. David Steven at IPM Research Limited and Dave Lunn, a technical expert from the Ministry of Primary Industries were also involved in assessing benefits and formulating recommendations.

Controls have been reviewed by David Manktelow (Manktelow and Associates Ltd), a consultant to the horticulture industry.

### 3.7. Dealing with uncertainty

The risk-benefit assessment process deals with potential effects. In most circumstances there will be a degree of uncertainty around expected risks, costs and benefits. We have sought to reduce these uncertainties through research, modelling, stakeholder engagement and peer review.

Uncertainties persist where multiple sources have represented the risks, costs or benefits differently from each other. For example the anticipated level of financial loss to users without OPCs, the availability or efficacy of alternatives, and the rate and frequency of application.

EPA staff have indicated in their recommendations where there are uncertainties that are evident for each of the substances.

## 4. Glossary of terms

Term	Definition
Acute	Adverse effect that occurs after a single exposure which usually lasts for a short time.
ADI	Acceptable Daily Intake is the amount of a substance in food or drinking water that can be ingested daily over a lifetime without an appreciable health risk.
AOEL	The Acceptable operator exposure level is the internal dose of a substance that an operator (worker) may be exposure to on a daily basis without the likelihood of an adverse toxicological effect.
Approved Handler	A person who holds a current test certificate certifying that the person has met the requirements of Hazardous Substances and New Organisms (Personnel Qualifications) Regulations 2001 in relation to an approved handler for 1 or more hazard classifications or hazardous substances.
Benefit	The value of a positive effect expressed either in monetary or non-monetary terms.
Chronic	Adverse effect that occurs after a repeated exposure and which usually are long lasting and recurring.
Cost	The value of an adverse effect expressed either in monetary or non-monetary terms.
DT <sub>50</sub>	Period required for 50% dissipation of substance.
Endpoint	Toxicological or ecotoxicological value used in the risk assessment
Exposure	Human or environmental organism contact with a substance.
GAP	Good Agricultural Practice. GAP is an internationally recognised food safety tool for describing best practice for safe and effective chemical use.
HSNO	The Hazardous Substances and New Organisms Act 1996.
K <sub>ow</sub>	Partition coefficient between n-octanol and water. Measures the difference in solubility of a substance in water or alcohol reflecting its tendency to bind to organic material and particulates rather than stay dissolved in water.
IPM	Integrated Pest Management involves the careful use of pest control techniques to discourage the development of pest populations and minimises the use of pesticides.
LC <sub>50</sub>	The median lethal concentration, being a statistically derived single concentration of a substance that can be expected to cause death in 50% of animals.

LD <sub>50</sub>	The median lethal dose, being a statistically derived single dose of a substance that can be expected to cause death in 50% of animals.
Likelihood	The probability of an effect occurring.
LOAEL	Lowest Observable Adverse Effect Level.
LOEL	Lowest Observable Effect Level.
Magnitude	Expected level of effect.
Mesocosm	A mesocosm is an experimental tool that brings a small part of the natural environment under controlled conditions. Mesocosms can be used to evaluate how organisms or communities might react to environmental change.
MRL	Maximum Residue Limits restrict the quantity of a given chemical remaining on food product samples, which is acceptable in a specific market.
MSDS	Material Safety Data Sheets contain data regarding the properties of a substance and procedures for handling or working with that substance.
NOAEL	No Observed Adverse Effect Level.
NOEL	No Observed Effect Level.
PEC	Predicted Environmental Concentration is the calculated value of a chemical in the environment based on exposure models.
PHI	Pre-Harvest Interval is the period required between insecticide application and harvest for human consumption.
Phytosanitary	Relates to the health of plants, especially with respect to the requirements of international trade.
PPE	Personal Protective Equipment including any item of equipment used to protect a person from hazards e.g. safety helmet, goggles, gloves, boots, respirator.
REI	A Restricted Entry Interval is the time which must elapse after application of a substance before entry into the treated area is permitted without use of PPE or Respiratory Protective Equipment.
RPE	Respiratory Protective Equipment (a type of PPE).
Risk	The combination of the magnitude of an adverse effect and the probability of its occurrence.

## Part 2:

*This section of the report provides the technical process and numbers followed by EPA staff.*



## 5. Risk assessment: Human health and environment

### 5.1. Effects on human health of OPCs

OPCs are known to affect the nervous system through the inhibition of the enzyme acetylcholinesterase. Acetylcholinesterase breaks down acetylcholine, a chemical which transmits nerve signals. Inhibition of acetylcholinesterase results in accumulation of acetylcholine, leading to overstimulation of the nervous system.

For organophosphates, even minor effects on enzyme levels are potentially of concern as it can take several months for normal enzyme function to be restored. There is also a risk of cumulative effects, as another exposure during a time of depressed cholinesterase enzyme levels can further reduce these levels. This increases the probability than an individual may experience adverse health effects. Enzyme inhibition by carbamates is more rapidly reversible. Repeat exposures to organophosphate insecticides are therefore of greater concern to human health than repeat exposure to carbamate insecticides.

A number of studies in laboratory animals and in human populations have shown an association between prenatal and/or early postnatal organophosphate exposure and adverse effects on the development of the nervous system for the foetus or in early childhood<sup>4,5,6,7</sup>. In addition, studies have indicated potential associations between exposure to some OPCs and immunotoxicity, cancer, obesity and diabetes<sup>8</sup>. This research has primarily focused on organophosphates rather than carbamates. Feedback received in response to calls for information on OPCs by the EPA cited reports of these health effects as issues of concern. A potential for the poisoning of domestic pets due to exposure was also raised as a concern during consultation.

To date, however, international regulatory bodies have considered the critical effects of OPCs to be neurotoxicity mediated by inhibition of the acetylcholinesterase enzyme, and their risk assessments have been based on this endpoint. The EPA staff have taken the same approach and used the values set by international regulators in this evaluation. EPA staff are aware that there are more recent studies which it has been unable to incorporate into its assessment because of the timing and number of substances in this Application. A full list of the values set by international regulators that EPA staff have relied on in its assessment is provided in Appendix D.

---

<sup>4</sup> Oostingh GJ et al (2009) The cytotoxic effects of the organophosphates chlorpyrifos and diazinon differ from their immunomodulating effects. *J Immunotoxicol* 6: 136-45.

<sup>5</sup> Bonner MR et al (2012) Occupational exposure to terbufos and the incidence of cancer in the Agricultural Health Study. *Cancer Causes Control* 21: 871-7.

<sup>6</sup> Giordan G, Costa LG (2012) Developmental neurotoxicity: Some old and new issues. *ISRN Toxicology* doi: 10.5402/2012/814795.

<sup>7</sup> Slotkin TA, Seidler FJ. (2012) Developmental neurotoxicity of organophosphates targets cell cycle and apoptosis, revealed by transcriptional profiles in vivo and in vitro. *Neurotoxicol Teratol* 34: 232-41.

<sup>8</sup> Slotkin TA (2011) Does early-life exposure to organophosphate insecticides lead to prediabetes and obesity? *Reprod Toxicol* 31:279-301.



## Acute poisoning

The acute effects of exposure to high levels of OPCs are well established from animal studies and numerous human poisoning incidents.

Short term exposure can result in symptoms including increased sweating and salivation, dizziness, fatigue, runny nose or eyes, nausea, intestinal discomfort, confusion and changes in heart rate. At high levels of exposure more severe effects such as paralysis, seizures, loss of consciousness and death may occur.

In addition to the immediate effects of OPC poisoning, there are a number of possible neurological complications that can develop in the subsequent days-weeks following initial recovery: intermediate syndrome (IMS) and OP-induced delayed polyneuropathy (OPIDP). These effects appear to be associated with exposure to organophosphates rather than to carbamates. IMS occurs in approximately 20% of patients around 2-4 days following exposure to organophosphates. IMS is associated with weakness of face, neck and respiratory muscles and can result in respiratory failure. Exposure to very high levels of some organophosphates can cause OPIDP, which generally occurs 1-4 weeks following single or short-term exposures. OPIDP is relatively rare, and is characterised by cramping and weakness of lower limb muscles (and in severe cases upper limb muscles as well) and difficulties with muscle coordination.

## Longer term health effects

As well as acute toxicity from OPC exposure, concerns have been raised over the potential for longer term adverse health effects. This includes the potential for chronic health effects following acute poisoning, and for effects as a result of chronic exposure to low levels that do not cause the clinical signs or symptoms of poisoning.

The UK Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) concluded in 1999<sup>9</sup> that the balance of epidemiological evidence supported the view that neuropsychological abnormalities can occur as a long-term complication of acute organophosphate poisoning, particularly if the poisoning is severe. Effects were most noticeable in neuropsychological tests involving sustained attention and mental agility.

With regard to neurological effects of low level chronic exposures to organophosphates, the UK COT considered that the balance of evidence was less convincing, and made recommendations for further research.

Since this time a number of further studies have been reported. In September 2012, the UK COT considered a systematic review of the epidemiological literature on the effects of acute and chronic

---

<sup>9</sup> <http://cot.food.gov.uk/pdfs/opchap.pdf>



organophosphate exposures on the nervous system. Due to the complexity of the data the COT has agreed to establish a Working Group to consider the review in detail<sup>10</sup>.

Research on a range of other possible health effects of OPCs has also been reported.

### **Poisoning incidents in New Zealand**

Internationally, OPCs have caused many poisoning incidents and deaths. New Zealand specific data on incidents of poisoning from OPCs resulting in hospital admissions between 2006 and 2010 were provided to the EPA by the Centre for Public Health Research at Massey University. These data indicate that 70 patients were admitted to hospital following exposure to OPCs in this period. The level of detail provided about these cases was limited, making it difficult to draw many conclusions. In the majority of cases reported as OPC poisoning the identity of the active ingredient or product was not reported, and little information was provided on clinical signs and symptoms.

The location of exposure was unspecified for a large proportion of cases (39%), while 37% of exposures took place in the home. Exposures in farms, orchards, industrial and construction areas and unspecified workplaces accounted for 16% of cases. A large proportion of patients (41%) were children between the ages of 0-10, while the remainder of admissions were fairly evenly spread across all ages. In the majority of cases (80%) the poisonings were accidental, with the remainder a result of intentional misuse.

Information on calls to the National Poisons Centre at Otago University relating to acephate, dichlorvos and diazinon was submitted to the EPA during the submission process following the initial assessments of these substances. It was stated that for acephate, there were 152 logged calls since 2002 (the submission was received in 2011). Some of these calls were for information only rather than relating to actual exposure incidents. Of these calls, six related to acephate being used for horticultural purposes. Three were due to not following label directions (e.g. not wearing Personal Protective Equipment (PPE), incorrect filter in the tractor cab). Details for the other three were vague, but exposure during spraying was possible.

A submission on dichlorvos, received in 2010, indicated that there were 51 incidents relating to dichlorvos since 2002. Four of these 51 incidents related to horticultural use. Of these, two were a result of not following label directions (standing beside equipment without protective equipment and not wearing gloves) and two were related to exposure during spraying.

For diazinon, it was stated that 148 calls had been logged by the National Poisons Centre between 2002 and 2009. An unspecified number of these related to animal exposures or were seeking information only. There were 15 incidents relating to accidental exposures during horticultural and arable use. Twelve of these were due to operators not wearing correct PPE, not using correct equipment and/or not observing sensible re-entry times. The remaining three were as a result of spray drift.

<sup>10</sup> <http://www.food.gov.uk/multimedia/pdfs/cotmin11sep12.pdf>



Overall, the lack of detail available on these incidents provides only a limited picture of OPC poisoning in New Zealand. It is also unclear how many incidents may have gone unreported or have not been identified as being caused by OPCs. The full extent of workplace exposures is unclear. A relatively large proportion of accidental exposures may relate to exposures at home, and many of these appear to involve children.

**5.1 Do you know of any anecdotal or other evidence of harm to human health caused by OPCs in acute or long term cases?**

## 5.2. Environmental effects of OPCs

OPCs are also harmful to the environment. They are toxic to the aquatic environment and to terrestrial invertebrates (e.g. bees). In general these substances are also toxic to birds. OPCs tend not to persist or bio-accumulate in the environment. Some of the OPCs are mobile in soil and can therefore leach into groundwater, for example in the USA diazinon has been detected in groundwater.

Incidents of harmful effects on wildlife due to OPCs have been reported overseas and in New Zealand. In the USA, incidences of fish and bird deaths and adverse effects on bee colonies have been directly or indirectly associated with use of a variety of OPCs. The majority of bird deaths occur on lawns or turf on recreational grounds such as golf courses.

In New Zealand, an incident of game-bird deaths in the Westport region was reported in April 2012. Diazinon had been sprayed aerially on neighbouring farmland and a pathology report confirmed that the deaths were a result of diazinon poisoning. This incident was reported to the EPA by Fish and Game New Zealand, which also stated that it had received numerous complaints over the past decade regarding the poisoning of waterfowl following treatment for Grass grub – a pest which is commonly treated with organophosphates.

**5.2 Do you know of any incidents of harm to the environment caused by OPCs?**

## 5.3. Approach taken to assess the risk to human health and the environment

The EPA is required to consider risk in the context of the lifecycle of the substance it is reassessing. Exposure is most likely at the stage when the product is applied and so this is where EPA staff have focused their assessment of risk.



The EPA has assessed the following risks to the environment and human health from the application of OPC plant protection products;

- Operator risks with full Personal Protective Equipment (PPE) and Respiratory Protective Equipment (RPE).
- Workers re-entering sprayed areas 24 hours after the time of the application (Re-entry workers)
- Bystanders
- Aquatic organisms
- Birds
- Bees

Full details of the risk assessment can be found in Appendix D. Risk is a function of hazard (toxicity) and exposure to the hazard. Both have been addressed in one risk assessment.

Where possible all of the toxicity and ecotoxicity endpoints used by EPA staff have been used by other international regulators. A full list of these data is in Appendix D. As pointed out in Section 5.1 these data may not necessarily reflect the most recent scientific information regarding these substances.

The human health endpoints used by EPA staff and overseas regulators are based on the depression of cholinesterase enzymes as the adverse health effect. As stated in 5.1, for organophosphates even minor effects on enzyme levels are potentially of concern as it can take up to a few months for normal enzyme function to be restored, whereas enzyme inhibition by carbamates is more rapidly reversible.

In some instances the EPA has not been able to source key information about the toxicity of these substances. In these instances the EPA has used reasonable worst case scenarios or default values, or has not calculated the risks. The EPA has identified the data gaps and explained them further in the recommendations for each substance in Section 10.

A small number of formulations under the scope of this reassessment contain additional active ingredients that are not OPCs. Only the risks from the OPC active ingredients of these formulations have been modelled.

Exposure information for the risk assessment came from two sources: either modelling or information from monitoring studies. All of the models that the EPA has used are based on those developed and used by other regulators for the registration of plant protection products. In the previous calls for information the EPA requested exposure and mesocosm data that could be used in its risk assessment. Several submitters have provided data for specific substances, and these have been incorporated into the risk assessment. Full details are contained in Appendix D.

**5.3 Submitters are encouraged to provide any exposure monitoring or dermal absorption studies**

which could be used to inform the EPA risk assessment.

Risks have been assessed through the calculation of Risk Quotient (RQ) values. RQs compare an estimated exposure concentration with a concentration of toxicological or ecotoxicological concern. RQs have been normalised such that values greater than 1 are considered to be of concern.

For the human health assessment, the toxicology values used are Acceptable Operator Exposure Levels (AOELs). AOELs are generally derived from the highest level at which no adverse effect is observed in tests in experimental animals or, if appropriate data are available, in humans. The AOELs selected by the EPA for this reassessment are those used by international regulators, and have been based on the inhibition of cholinesterase enzymes in experimental animals or in humans.

The values used in the environmental assessment are based on acute toxicity to aquatic organisms, birds or bees. Chronic environmental risks have not been evaluated.

The EPA has assessed the risks considering possible control measures. The results of the risk assessment have been both internally and externally peer reviewed, and are broadly consistent with those reached by other regulators, bearing in mind the different use patterns. The introduction of additional controls is intended to reduce human and environmental risks, and also to protect against any of the potential effects from long term exposure to OPCs.

### **Acceptable Daily Intake values**

In addition to the human and environmental health criteria selected for the risk assessment, the EPA has selected Acceptable Daily Intake (ADI) values based on those used by international regulators. The ADI is defined as the amount of a substance in food or drinking water that can be ingested daily over a lifetime without an appreciable health risk.

The evaluation has favoured selection of the Australian Pesticides and Veterinary Medicines Authority's (APVMA) ADIs for the majority of substances for the following reasons:

- They provide a consistent set of values from one regulator
- APVMA is undertaking a review programme which includes several of these OPCs
- There are advantages of aligning the assessments between Australia (APVMA) and New Zealand (EPA and the Ministry of Primary Industries Agricultural Compounds and Veterinary Medicines group), including in relation to the inputs used for the calculation of food maximum residue limit (MRL) values.

Details of the ADIs selected and the rationale for their selection can be found in Appendix E.

## 6. Benefits Assessment

### 6.1. Generic benefits of OPC use

The EPA identified positive effects on the market economy from the continued availability of some OPCs. The main benefits come from industry profitability. Stakeholder submissions and feedback have identified a number of key benefits provided by some of the substances in the Application. Some of the generic benefits of OPCs can be delivered to varying degrees by other substances, but it is the overall combination of benefits OPCs provide that farmers and growers value. For some pests, users claim there are few or no alternative substances that can adequately replace OPCs. Generic benefits of OPCs include:

- **Efficacy:** The reliability and effectiveness of OPCs were identified as the most important benefits
- **Broad spectrum:** OPCs control a wide variety of pests
- **Lower application rates:** Fewer OPC insecticides can be applied to achieve the same level of control as more targeted substances, because one OPC will control a variety of pests that would require multiple applications of other products
- **Cheaper:** OPCs are generally cheaper than other products
- **Short pre-harvest intervals:** Many OPCs only require a short period between application and harvest which means crops can be harvested for human and animal consumption soon after treatment
- **Short withholding periods:** Workers and livestock can quickly return to a sprayed area, maximising productivity of both the workers and the land
- **Maximum Residue Limits:** Meeting Maximum Residue Limits (MRLs) is important to ensure that international trading partners do not reject the produce. For some crops, specific MRLs are set for OPCs. Use of other substances without MRLs may not be permitted in some overseas markets, or may require growers to meet default MRLs which can be difficult.
- **Resistance Management:** a number of different chemicals are needed in rotation to control a pest, otherwise it may become resistant. OPCs are considered an important tool for resistance management
- **Biosecurity:** OPCs are considered an important tool for biosecurity, which is crucial for New Zealand producers:
  - to stop pest incursions at the New Zealand border
  - to eliminate pest threats that breach the New Zealand border
  - to meet the phytosanitary requirements of our international trading partners to eliminate pest threats that have not been detected and managed at the New Zealand border

Feedback claimed that these generic benefits allow good quality crops to be produced in sufficient quantities to meet demand and ensure New Zealand growers remain a major contributor to local and national economies.

## 6.2. Specific benefits of OPC use

In addition to the generic benefits, many OPC substances are particularly effective in controlling specific pests. This makes them beneficial on a number of crops where these pests are difficult to control. Specific benefits identified by stakeholders appear in Table 2.

Table 2 Specific benefits of OPC use

Active ingredient	Specific plant protection benefits
Acephate	Identified by stakeholders as critical on citrus, ornamentals and cymbidiums. Used to control leafroller, raspberry budmoth, leafhoppers and raspberry sawfly on boysenberries. Used in biosecurity and for resistance management in lettuces. Citrus is a major contributor to the Northland economy.
Bendiocarb	No benefit – no substances (formulations) containing bendiocarb are registered under the ACVM Act.
Benomyl	No benefit – substance not registered under the ACVM Act.
Carbaryl	Used against wasps, for apple thinning and as a biosecurity tool. Used by home gardeners to control army worm on sweetcorn, and is critical on ornamentals. Controls earthworms in turf.
Carbofuran	No benefit – no formulations approved under HSNO.
Carbosulfan	No benefit – no substances (formulations) containing carbosulfan are registered under the ACVM Act.
Chlorpyrifos	Most widely used organophosphate. Stakeholder feedback is that it is necessary for the control of Argentine stem weevil and springtails, and on grass grub when populations are low or diazinon is not available. Used on leafroller and greenhouse thrips in avocados and persimmons. Alternative for acephate on berryfruit. Used in biosecurity. Used by 100% of onion growers, and is critical on ornamentals and against army worm on sweetcorn. Helps control tomato/potato psyllid (TPP) on potatoes, and cotula weevils and sod web worm in turf. Used immediately after transplanting Chinese greens it controls leafminers, springtails and greasy cut worm, and on spinach it is used against symphylid.
Chlorpyrifos-methyl	This substance is only used in the manufacturing process of an export-only product. This means that it has economic benefits for the manufacturing company, but does not pose risks for New Zealand as it is not used outside of the manufacturing plant.

Active ingredient	Specific plant protection benefits
Diazinon	Used on porina and carrot rust fly and feedback indicates it is critical against grass grub in pasture, seeds, turf and many other crops. Diazinon's use has been identified by stakeholders as critical in the pasture and arable sectors and this results in a very high benefit to New Zealand. Used in biosecurity. Used against pests on citrus including Kelly's citrus thrips, greenhouse thrips, whitefly, aphids, mealybug and scale which stakeholders have identified as important to control. Identified as critical for cymbidiums and ornamentals, used against beetles and crickets on kumara, woolly apple aphid and apple leafcurling midge on pipfruit, aphids and thrips on strawberries and symphilids and springtails on lettuce. Preferred over methamidophos to fight TPP on tomatoes, as it has a better residue profile and shorter withholding period. Diazinon granules also control pests at planting.
Dichlofenthion	No benefit – no formulations approved under HSNO.
Dichlorvos	The fumigant action and short pre-harvest interval (PHI) are stated as critical properties for many export crops and in greenhouses, including cymbidiums. It is a required use for persimmons being exported to the USA. Identified as critical in biosecurity and on squash. Used on tropical army worm in kumara. Important for use on lettuce and onions due to short PHI; helps control TPP on tamarillos, and whitefly and thrips on eggplants. The fumigant action is often cited as a critical benefit of dichlorvos over other OPCs.
Dimethoate	Used in biosecurity and against aphids in fodder and forage crops.
Ethion	No benefit – no formulations approved under HSNO.
Famphur	No benefit – no formulations approved under HSNO.
Fenamiphos	Stakeholders identify fenamiphos as critical against nematodes in turf, root knot nematodes on root crops such as carrots, and potato cyst nematodes on potatoes. Used in biosecurity and is critical on ornamentals. Research has been identified which indicates that this is the most effective substance in combating nematodes globally. The only alternative identified is the carbamate oxamyl which is more expensive and less effective.
Fenitrothion	Used in the later stages of the porina lifecycle
Isazofos	No benefit – no formulations approved under HSNO.
Maldison (malathion)	Identified as critical against black field crickets and in biosecurity. Used for thrip outbreaks close to harvest on citrus. Used on turf against crickets and mealybugs.
Methamidophos	Stakeholders identified this as critical on potatoes, tomatoes, tamarillos and other crops against TPP. Used on brassicas against diamondback moth. Important on kumara because it works well on heavy soil types. Used by 100% of onion growers. Identified as critical against green vegetable bugs on sweetcorn.
Methomyl	Alternative for acephate on berryfruit. Used against caterpillars and sucking insects on strawberries.
Omethoate	No benefit – no formulations approved under HSNO.

Active ingredient	Specific plant protection benefits
Oxamyl	Considered by users to be critical for carrot rust fly, root knot nematode and Argentine stem weevil. Used for plant establishment in capsicums and other greenhouse crops.
Phorate	Used against wireworm and against grass grub if diazinon is not available, as granules can be used at planting. Drilled pre-planting of celery to control carrot rust fly-alternative is diazinon.
Phoxim	No benefit – no substances (formulations) containing phoxim are registered under the ACVM Act.
Pirimicarb	Identified on multiple crops as critical to combat aphids.
Pirimiphos-methyl	Identified as a critical use in grain silos for weevil control. Used against leafroller and greenhouse thrips on avocados, persimmons and cymbidiums. Controls mealybug and psyllid and is necessary for resistance management in greenhouses. Used in biosecurity.
Prothiofos	Considered critical for grape production to combat mealybugs which vector the Grapevine Leafroll Virus which can decimate vineyards.
Pyrazophos	No benefit – no substances (formulations) containing pyrazophos are registered under the ACVM Act.
Terbufos	Used against grass grub if diazinon is not available. Granules are used pre-planting on tuber-damaging pests.

Little benefit information has been provided for some lower risk substances such as dimethoate and fenitrothion. It may be because these substances have few uses and therefore a lower level of benefits, or it could be that respondents have focussed their feedback on critical high risk/high benefits substances. This will affect the risk/benefit analysis and ultimately the recommendations for these substances as the benefits may be considered to be lower than they are. Submitters are encouraged to provide further benefits information that will fill the gaps or update the data available to the EPA.

**6.1** Submitters are encouraged to provide any additional information on the benefits of the OPCs under review that should be taken into account in the benefits assessment.

### 6.3. Additional considerations in the benefits assessment

A number of important issues relating to the general use of pesticides have been identified by the EPA. An explanation of these issues provides a more complete understanding of OPC use in New Zealand. The issues include:

## Alternatives

The availability and efficacy of alternative pest management options is a key consideration in evaluating the benefits of OPC's. It is important to note that other agrichemicals are not the only alternatives available globally for plant protection. Options include:

**Resistant cultivars** - Not currently an option for many pests in New Zealand agro-ecosystems as resistant cultivars are not available. Where they are available, they may lack yield/food qualities preferred by markets. Also, in general, resistant cultivars only target a single pest species, so other control strategies are necessary to manage pest complexes.

**Cultural control options** - Such as cultivation (e.g. tillage/no-tillage), irrigation, timing of planting, crop rotation. Often can be quite effective, except potentially in years of high pest pressure. For example diamondback moths can develop from egg to adult in 8 -10 days at 30°C, and adult females can lay hundreds of eggs in their lifetime. Likewise, highly polyphagous species (e.g. onion thrips, green peach aphid) can develop on a wide range of host plants and migrate in high numbers into crops.

**Biological control** - Generalist predator and species-specific parasitoid species are considered most effective for biological control. In some instances a single natural enemy species may suppress a pest species below levels where injury to a crop will occur. There are a number of predators and parasitoids in New Zealand for a number of key pests in NZ, although there are exceptions such as grass grub, and to a lesser extent Nysius, springtails, and thrips. Also, numbers of pests can out-pace generalist predators in population growth i.e. natural enemies cannot consume enough pest prey to keep pest numbers below economically damaging levels.

**Organic production** - During consultation, stakeholders supplied feedback as to the benefit of organic primary production as an alternative to the use of pesticides including OPC's. Organic primary production uses production techniques that exclude or strictly limit the use of synthetic fertilisers and pesticides. Internationally organic production and consumption has been increasing over the last two decades<sup>11</sup>; particularly in developed economies. Until recently organic products have commanded a premium. Recently, however, there is evidence that this premium is being eroded as the amount of global organic production is increasing and the global recession is placing pressure on household budgets.

Advocates for organic production in New Zealand state that synthetic pesticides are not required for maintaining organic production levels and that the demand for organic produce will ensure New Zealand's organic production of primary exports is maintained.

Other stakeholder feedback identified negative consequences associated with a change from conventional to organic production including increased labour inputs and a reduction in product quality.

---

<sup>11</sup> Internationally organic agriculture grew 8% in 2010. In the US the growth in sales of organic food continues to outpace the growth of non organic food.

For all alternatives, there is a need to be able to produce quality products. This includes the need for pest-free products that will comply with the phytosanitary requirements of overseas markets. The entry of product to international markets requires the product to be free of pests of concern to the importing country. For example the presence of a single light brown apple moth would prevent the export of a number of fruit and flower crops to the United States.

The ability to produce blemish-free products is also critical. Insect damage that affects the look of product downgrades the appearance of horticultural product and prevents it receiving the maximum return and in many markets makes it unsalable, particularly in Asian markets.

## 6.2 Do you have any information on the efficacy of alternative pest control options to OPCs?

### Integrated pest management

Integrated Pest Management (IPM) involves the careful use of pest control techniques to discourage the development of pest populations and minimises the use of pesticides. IPM systems emphasise the production of a healthy crop while minimizing the disruption to the agro-ecosystem and encouraging natural pest control mechanisms. The insecticides used during the growth of the crop under IPM are normally from chemical families which pose fewer risks, are targeted at specific insects at critical times, and designed to minimise effects on predator insects.

The majority of OPCs are broad spectrum insecticides and so are not suited for use in IPM systems during the growing season, when manipulation of pest/predator populations is key.

Minimizing the development of resistance in specific pest populations is, however, key to the sustainability of IPM systems. OPCs are particularly useful in IPM systems for pre or post season hygiene to reduce problem pests to low levels and prevent the carryover of pests that are developing resistance to more specific pesticides. Without either a sufficiently broad range of chemical families or access to a broad spectrum spray, resistance management in IPM systems will become a critical issue over time.

## 6.1 Do you have any information on the use of OPCs in integrated pest management that is relevant to the EPA's assessment?

### New Zealand as a market for new pesticides

Insecticides represent only 10% of total pesticide sales in New Zealand and by world standards the market for insecticides in New Zealand is comparatively small. Some sectors such as pasture-based



agriculture and kiwifruit represent a reasonable market but many horticultural sectors are small with less than 100 growers. The average grower produces less than 10 hectares of any one product.

Feedback stated that the small size of the New Zealand market can impact on the availability of pesticides. The reasons given were that international agrichemical companies are:

- not introducing their full range of new products (particularly those that are of use to a small or limited number of sectors) because the cost of registration relative to the potential market is not viable
- not including smaller crops on the labels of new or existing chemicals if additional data is required for their inclusion. Off-label use is legal in New Zealand but industry or commercial standards may restrict the use of a product which is not labelled for use on the specific crop. For existing products, especially those that are outside their patent protection period, New Zealand's lack of data protection is cited by companies as a disincentive to extend registrations to a new pesticide/crop combination since the data would be available to their competitors in the New Zealand market
- not providing technical support or provision of further supplies of a product if the market decreases below an economic level
- taking five to ten years to introduce a new product to the New Zealand market. Other markets offer greater returns in shorter time frames

## 7. Social and cultural considerations

This section discusses those adverse and positive effects which cannot be quantified but are relevant to the reassessment of the substances. The decision making committee must consider the purpose and principles contained in Part 2 of HSNO. Two of these principles are:

1. to recognise and provide for the maintenance and enhancement of the capacity of people and communities to provide for their own economic, social, and cultural well-being now and in the future, and;
2. to account for the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, valued flora and fauna and other taonga

Considerations which are relevant to these principles are laid out below.

### 7.1. Adverse effects on society and communities

The effects on human health and the environment have been analysed in Section 5 of this report. In addition to poisoning experienced by individuals or discrete incidents of harm to the environment there is a broader adverse effect. This is the general social concern and anxiety associated with the effects of these products. For example, OPCs have been known to kill birds that feed on crops and grass that have been treated to control pests. The presence of groups of dead birds is not only an incident of environmental harm (which can be modelled in the risk assessment); it raises social concerns about the impact of these substances on ecosystems and communities. Although recent bird deaths in New Zealand have been linked to the use of diazinon, the social effects of this cannot be quantified.

The EPA is aware of community concerns about the health risks related to OPC use. In general it is bystanders who are worried about unintentional exposure of themselves, their children and pets to these substances. This is supported by regional council records of complaints made to them about spraydrift from agrichemical application. The risk to bystanders has been modelled in the EPA staff assessment. However, there is an additional consideration about the fear or anxiety that being exposed to OPCs (or pesticides in general) can cause to individuals and communities irrespective of whether exposure or any adverse health/environmental effect has occurred.

**7.1** Do you know of any additional adverse effects on society and communities that should be considered?

### 7.2. Benefits to society and communities

The EPA has identified a positive effect on society and communities in terms of reducing anxiety associated with expectations of future capability to counter pest problems. Users of OPCs across the

industry size and crop spectrum have expressed their concerns that loss of some or all of the OPCs would have negative effects on themselves, their families and local communities. They are worried that their choices on what to grow and where to live will be restricted. Flow-on effects from lower crop-yield, or the inability to produce a specific crop, could lead to a change in the make-up and vibrancy of local communities.

There may also be a social benefit from the continued use of OPCs in that they are generally cheaper to purchase than other substances. This means that production costs or costs of maintaining recreational facilities would increase without them. Therefore, OPCs may be considered to provide a social benefit by assisting in providing access to healthy eating by reducing increases in the cost of fresh produce that might arise if growers were required to use more expensive substances. However, this indirect potential benefit is speculative in the absence of precise costing indicating the increased cost of produce and the impact this would have on consumers.

OPCs are used by home gardeners who cite efficacy and cost as their main benefits. Gardening is a popular pastime in New Zealand and it has been suggested that the ability to successfully raise crops and flowers is considered an important contributing factor to the health and well-being of participants. A similar argument could be made for uses of sports turf including golf courses, bowling greens and playing fields. However, in the absence of further data the EPA is unable to quantify these benefits.

**7.2** Are there any additional positive effects on society and communities that are relevant to the decision makers consideration of OPC's?

### 7.3. Identification of potential adverse effects to Māori

In keeping with HSNO principles, the cultural concepts of kaitiakitanga (guardianship) and whaihua (to pursue economic productivity) need to be taken into consideration in regards to this reassessment.

To further define these concepts, kaitiakitanga is the undertaking of responsibilities and obligations inherited from the atua (spiritual guardians) over the realms of those atua. These obligations and responsibilities are accrued through an intricate system of relationships with the environment, for the control and management of resources.

There are numerous purposes of kaitiakitanga as it enables the protection of the life supporting capacity of resources; maintains the mana<sup>12</sup> and mauri<sup>13</sup> of those resources; and also safeguards the current and future welfare of the people those resources support. Therefore, kaitiakitanga is the key

<sup>12</sup> Mana commonly refers the prestige and character of a body and can be categorized into different classes such as: Mana Tipuna (authority handed down from ancestors); Mana Whenua (authority of the land); and Mana Tangata (authority of the people)

<sup>13</sup> Mauri is the spiritual integrity or life-force of all things whether they are animate or inanimate.

means by which sustainability is achieved and it is the responsibility of iwi/Māori, in their tribal regions, to exercise kaitiakitanga to protect these natural resources and ensure the previous points are upheld<sup>14</sup>.

Many submitters expressed real concern about the unknown and/or unmeasured effects of the substance and their impact on the environment and human health. For example, it was stated that there is little or no research on how these chemicals affect puha and watercress, let alone aquatic species that may come into contact with them via runoff from paddocks.

Whaihua in the context used by participants at the various hui is defined as the pursuit of economic productivity. At hui in the Marlborough region it was used to comment about the negative economic impact discontinuing the current use of certain OPCs could have on the large Māori workforce employed in the wine sector in the region. It was stated that if the wine industry has to stop using some of the current pesticides it would lead to a decrease in the amount of wine produced as there are presently no viable alternatives. This in turn would lead to the laying off of junior staff, the majority of whom are Māori.

Additionally, this would not only impact on the individual but also have a long term impact as often there are several generations of whānau employed by the wineries so while the loss of one job could be accommodated for within the whānau group, the loss of numerous jobs in the whānau could be a large barrier to overcome and its impact felt for a significant amount of time.

On the other hand, in Northland it was stated that the local iwi have recently established partnerships within the New Zealand honey production sector so that they would now be responsible for a host of hives within the region. Concern was expressed with regards to bees being killed when OPCs are being sprayed. However, it was stated that if bees are not around at the time of application or directly after application the adverse effects will be limited. The controls that will be put in place are assumed to be reasonably effective at reducing exposure so that the likelihood of an effect will be reduced.

To summarise these points, it was stated local Māori need to employ a balanced approach and take into consideration the negative impact on whānau along with the environmental impacts this application could have within the regions when they are deciding whether to support the application or not.

It was also noted at all the hui that they are particularly concerned about the impact that OPCs have on the health of whānau as well as the fuller societal impacts. These aspects have been responded to and commented on in section 5 of this report. Also included in these sections are the various mitigation measures that are being proposed in order to reduce risk.

<sup>14</sup> Miller DR. Nd. Western and Māori Values for Sustainable Development. Retrieved from <http://www.firstfound.org/david%20miller.htm>

In consideration of these matters, we anticipate that the effects from the reassessment of OPCs upon kaitiakitanga and whaihua will have a minor to moderate impact if mitigating steps are taken. The level of effect is therefore deemed to be minor.

## 7.4. Identification of benefits to Māori

In keeping with HSNO principles, again the concepts of kaitiakitanga, whaihua as well as ohanga (economic impact on the Māori economy) need to be taken into consideration in regards to this reassessment.

Iwi/Māori submitters noted the positive role of OPCs in supporting their role as kaitiaki in the protection of taonga koiora (native species) and taonga tuku iho (other valued species such as kūmara).

Acknowledging that the role of iwi/Māori as kaitiaki is an ongoing and proactive responsibility, some hui participants stated that protecting native and valued flora and fauna species often requires the use of hazardous substances and balancing of the effect on the mauri of these species is a challenging task in fulfilling their role. They stated that essentially it comes down to risk mitigation. It is about outlining controls to the operators; implementing robust provisions for the application rates; and setting a national minimum standard.

As previously stated, a large number of Māori are employed in sectors that are affected by this reassessment so to ensure whaihua for whānau in certain regions the continued use of certain OPCs is necessary for the financial stability of entire whānau.

Given the growing nature of the Māori economy (ohanga) and asset base following Treaty settlements, it is essential to position these assets in such a way as to enhance their economic development. Although the overall economic impact to New Zealand might not be significant, it represents a more significant potential outcome for iwi/Māori, particularly at a regional level.

Views were specifically canvassed from hui participants in regards to the impact the continued use of OPCs have on the wider Māori market economy.

A number of hui participants recognised that the ongoing use of OPCs, at least until a viable alternative is sourced, would ensure iwi/Māori are able to capitalise on the return of these assets both in terms of employment and asset production/development.

More specifically, they noted the importance of the continued availability of these chemicals in terms of maintaining the production rates and crop health of grapes in vineyards where Māori not only work but also in many cases own; maintaining the crop health in other horticultural industries where Māori are highly represented; and the beneficial impact certain OPCs have on bees where Māori have ever increasing involvement in the secondary processing of edible bee products.

It is considered there will be benefits from the reassessment of OPCs on the relationship of iwi/Māori to the environment and in their ongoing ability to develop economically. The corresponding level of benefit is therefore assessed to be moderate.

## 7.5. International obligations

To achieve the purpose of HSNO the EPA must consider the impacts of the Application on New Zealand's international obligations.

The EPA has identified that OPCs must meet the World Health Organization/Food and Agriculture Organisation Joint Meeting on Pesticide Specifications (JMPS).

If a decision is made to ban or severely restrict the use of OPCs, a New Zealand notification under the Rotterdam Convention<sup>15</sup> is required. This would apply on a case by case, substance by substance basis.

---

<sup>15</sup> <http://www.pic.int/>

## 8. Recommended controls

Where the risk assessment has indicated that additional controls are required to remove or reduce a risk, controls are proposed to be applied to the substance approvals. These additional controls are proposed to be applied to the substance approvals in addition to the existing controls that apply to an approved substance. In the interests of brevity, the existing controls for each approval have not been reproduced here, but can be found on the EPA's Controls Database<sup>16</sup>. The controls in Appendix F for a given approval should apply in addition to the existing controls that apply to the approval. EPA staff are not recommending that any of the existing controls be removed.

A 'toolbox' of additional controls has been developed (Appendix G), after taking into account feedback received through submissions on the Call for Information<sup>17</sup> and the Sector Assessments<sup>18</sup>. The controls reflect conditions of use and user obligations that are required to manage the exposure risks that may arise through the lifecycle of the substance.

The controls have been proposed in accordance with section 77A(4)(a) of HSNO, on the basis that "the proposed control is more effective in terms of its effect on the management, application, and risks of the substance".

Many of these additional controls are to be accompanied by a label statement to ensure that the information reaches the end users.

The purpose of the control and the proposed wording is provided in Appendix G. The approvals to which these controls have been applied are detailed in Appendix F.

In recommending controls, EPA staff have taken into account the existing standards.

### 8.1. Standards for insecticide use

There are a number of regimes in New Zealand which help to ensure the safe and efficient use of agricultural chemicals including OPCs. These regimes have been drawn upon by EPA staff in developing our controls.

#### **Good Agricultural Practice (GAP)**

GAP is an internationally recognised food safety tool for describing best practice for safe and effective chemical use. Under GAP the user should achieve the desired control without excessive use of chemicals, leaving a residue which is the smallest amount practicable. This is achieved by calculating the required application rate and frequency, and the pre-harvest interval (PHI) which is the time required between the last application and harvest. The PHI is then established as the withholding period (WHP) for each substance. The WHP takes account of the efficacy profile of each pesticide,

<sup>16</sup> <http://www.epa.govt.nz/search-databases/Pages/controls-search.aspx>

<sup>17</sup> <http://www.epa.govt.nz/Publications/Call%20for%20information.pdf>

<sup>18</sup> <http://www.epa.govt.nz/publications-resources/topics/Pages/Sector-assessments-.aspx>



and allows the longest interval between treatment and harvest that is compatible with good protection of the crop until harvest. In this way, residues are minimised without compromising efficacy.

Agricultural chemical users who are GAP accredited are audited at least annually to ensure that their use and safety processes meet the GAP standards. Regimes such as the Tesco Nurture scheme, and Global GAP ensure that growers of fresh produce use insecticides responsibly otherwise their goods are rejected by overseas markets.

### **New Zealand Standard NZS8409:2004**

NZS8409:2004 is the New Zealand Standard for the Management of Agrichemicals. It provides practical and specific guidance on the safe, responsible and effective management of agrichemicals, including plant protection products. NZS8409:2004 is a code of practice and as such is not mandatory, but adherence to the standard almost certainly assures that HSNO obligations for the entire life cycle of an agrichemical are met.

### **GROWSAFE Certification**

GROWSAFE is the brand of the New Zealand Agrichemical Education Trust.

GROWSAFE training covers the knowledge and practices required for safe, responsible and effective use of agrichemicals, based on the Industry Standard, NZS8409 - Management of Agrichemicals.

A GROWSAFE Certificate is issued at the completion of a GROWSAFE course, and demonstrates that agrichemical users understand their obligations and best practice for the use of agrichemical products.

GROWSAFE certification is required by orchardists and growers under both the NZGAP and GLOBALG.A.P. quality assurance programmes.

Many regional plans require commercial users of agrichemicals to hold GROWSAFE certificates.



## 9. Approach to evaluating the risks and benefits

In analysing the risks, costs and benefits we have given effect to the principles of the EPA Technical Guide *Assessment of Economic Risks, Costs and Benefits: Consideration of impacts on the market economy*<sup>19</sup>.

To enable a comparison between the risks and benefits associated with the application of OPCs, qualitative descriptors were developed to assign the level of risk or benefit into broad categories of negligible, low, medium or high.

### 9.1. Qualitative assessment of risks

Qualitative descriptors of overall risks have been derived from a matrix of likelihood and magnitude of the occurrence of an adverse effect (Tables 3 and 4). The matrix was developed to qualitatively differentiate between the level of risks associated with different OPCs and application scenarios, and to enable comparison with the benefits provided by the same substances.

The risk assessment is based on risk quotients (RQs) generated from the human health and ecotoxicological risk assessments. RQs compare predicted exposure levels with maximum concentrations that are not expected to cause adverse effects to human health or the environment. The methodology used to calculate the RQ values is described in Appendix D.

An RQ greater than 1 exceeds the EPA's level of concern and indicates that there is a risk of an adverse effect. However, staff recognise that an RQ of >1 – 10 does not reflect an equivalent level of risk to an RQ of greater than 100. This is because the likelihood and magnitude of the risk varies depending on the amount of insecticide to which people or other 'receptors', such as aquatic organisms and birds, are exposed.

For specific ranges of RQ values (<1, >1-10, >10-100 and >100), magnitude and likelihood of risk have been assigned. Differing descriptors were assigned depending on the 'receptor' (i.e. operators, re-entry workers, bystanders, aquatic organisms, birds and bees).

A matrix representing an overall level of risk was constructed to combine levels of likelihood and magnitude. Four overall levels of risk/benefit have been allocated: Negligible, Low, Medium, and High. Differentiation between very high risks (typically RQs over 100) is not considered to be meaningful, so in general risk descriptors do not vary above this RQ value.

#### Considerations on magnitude and likelihood

RQs take hazard and exposure into account, and therefore incorporate both magnitude and likelihood to some extent. Both the magnitude and the likelihood of individuals experiencing an adverse effect will increase with increasing levels of exposure (and RQ values). The likelihood increases because at lower RQ values it might be expected that only more susceptible individuals might be affected,

<sup>19</sup> <http://www.epa.govt.nz/publications/er-tg-05-assessing%20risks,%20costs%20and%20benefits.pdf>

whereas, at higher levels a wider range of the population may be expected to be affected. The magnitude increases because higher exposure may lead to more severe effects.

### **Likelihood**

When assessing likelihood, the 'receptor' group and the application of controls are taken into account. Exposure – and therefore likelihood of an adverse effect – is considered to be reduced by proposed control measures such as use of personal protective equipment (PPE), buffer zones, re-entry intervals and identification of a risk to bees on the label. Therefore the likelihood descriptors generally differ depending on the presence or absence of controls.

Operators are always assumed to use a base level of PPE and this was taken into account in the exposure modelling used to derive RQ values.

Bees are expected to be killed when they are directly exposed to the spray solution. However, if bees are not around at the time of, or directly after, application the adverse effects will be limited. The controls applied are assumed to be effective at reducing exposure so that the likelihood of an effect will be reduced. In the event that bees are directly exposed to spray solution it worker bees may be killed, but complete hives are unlikely be wiped out. For these reasons, the bee risks are all assessed as negligible with controls, regardless of the RQ value.

### **Magnitude**

Magnitude of effect measures are generally consistent for the same RQ values for operators and re-entry workers. For example, an RQ of 5 for an operator triggers the same magnitude of effect measure as an RQ of 5 for a re-entry worker. However, the equivalent RQ of 5 for a bystander has been ranked with a higher magnitude of effect measure because bystanders encompass the wider population including the aged, sick and the young, all of whom may be more sensitive.

In relation to human health, the rankings may appear relatively risk permissive in comparison to overseas regulators' approaches to the equivalent RQ values, given that any RQ greater than 1 is above the EPA's and overseas regulators' level of concern. The question could be raised as to how an RQ of 10 – 100 can be assigned a magnitude rating of "*moderate*". The rationale for this is that for a reassessment of a group of related substances which carry varying levels of benefit, it is necessary to distinguish between them based on relative risk.

Very limited controls (other than reducing application rate/frequency or covering granules with soil) are available for birds. For this reason, only risk descriptors in the absence of controls were developed for birds.

Table 3 Matrix of overall risk – human health

*The qualitative descriptors of risk are those in the presence of proposed controls.*

Risk Quotient	Risk Paramter	Operators	Re-Entry workers	Bystanders
<1	Overall	Negligible	Negligible	Negligible
>1-10	Likelihood	Minor	Minor	Moderate
	Magnitude	Likely	Very unlikely	Unlikely
	Overall	Low	Negligible	Low
>10-100	Likelihood	Moderate	Moderate	Moderate
	Magnitude	Likely	Unlikely	Unlikely
	Overall	Medium	Low	Low
>100	Likelihood	Major	Major	Major
	Magnitude	Highly likely	Likely	Unlikely
	Overall	High	Medium	Medium

Table 4 Matrix of overall risk – environment

*The qualitative descriptors of risk are those in the presence of proposed controls, except in the case of birds. Very limited control options are available to reduce bird risks. Therefore only risk descriptors in the absence of controls were developed for birds.*

Risk Quotient	Risk parameter	Aquatic	Birds	Bees
<1	Overall	Negligible	Negligible	Negligible
>1-10	Likelihood	Minor	Minor	Minor
	Magnitude	Very unlikely	Unlikely	Very unlikely
	Overall	Negligible	Low	Negligible
>10-100	Likelihood	Moderate	Minor	Minor
	Magnitude	Unlikely	Highly likely	Very unlikely
	Overall	Low	Medium	Negligible
>100	Likelihood	Major	Major	Minor
	Magnitude	Likely	Highly likely	Very unlikely
	Overall	Medium	High	Negligible

## 9.2. Qualitative assessment of benefits

Overall benefit is similarly derived from a matrix of likelihood and magnitude of positive impacts. These are the marginal benefits that accrue to individuals, communities and ultimately to the whole country, i.e. the benefit of the substance over the benefit of the next best substance. We have estimated the national benefits by considering the level of national OPC use (likelihood) and the marginal benefits received from this use (magnitude) taking into account the size of the sector.

The positive effects of individual OPCs on the market economy are addressed by first identifying and assessing adverse effects that would arise if that OPC was not available. This adverse effect is used as a surrogate measure of the positive effect of the continued availability of the OPC. The EPA notes that the adverse socio-economic effects from the unavailability of OPCs are evaluated for the broader economy. As these effects will not be evenly spread, the loss of a substance with even a low overall benefit could have major impacts on individuals and industry sectors.

Much of the benefit information is qualitative therefore we could not accurately quantify the costs and benefits. The EPA staff and peer reviewers undertook a qualitative assessment of the likely marginal benefits derived from each OPC using the likelihood and magnitude descriptors below (Tables 5, 6 and 7).

### Likelihood

Likelihood of benefit derived from OPCs has been directly related to actual use patterns. Where a substance is heavily relied upon across sectors this equates to a high likelihood of benefit, or conversely, a large negative impact if the substance is removed. Consideration has been given to the quality of data supplied. Sectors citing lack of alternatives and describing research efforts have been ranked higher than those claiming a less well-defined need.

Table 5 Likelihood of benefits

Category	Criteria
Very unlikely	No evidence provided of actual use
Possible	Used only rarely or when needed
Likely	Some current use across industry
Highly likely	Significant and regular use across industry

### Magnitude

The magnitude of costs and benefits are described as the estimated marginal, cumulative effect on GDP. The marginal benefit takes account of:

- Efficacy and availability of alternatives. If one insecticide has a control rate of 90% for an insect, and the alternative controls 80%, then the marginal benefit of using the first insecticide is 10%. In some cases it is noted that no effective alternatives are available

- Alternative land uses. If a crop is not economic then the land will revert to another crop or land use. The marginal cost or benefit is the difference between the two land uses, including the short term costs/losses incurred during the change-over period
- Impacts on employment which are considered short to medium term, as over time they will readjust
- Relative cost of alternatives
- Pest management issues including the level of pest impacts and the need for resistance management
- Local or regional benefits where impacts of loss would be severe in the short to medium term

Table 6 Magnitude of benefits

Marginal cumulative benefits	
Minor	Difficult to ascertain material impacts.
Moderate	Medium term regional effects with some national implications for GDP - \$0-\$15 million
Major	Measurable beneficial effect on GDP - \$15-\$50 million
Massive	Significant on-going beneficial effect on GDP - Above \$50 million

Table 7 Matrix of overall benefit

Likelihood	Magnitude			
	Minor	Moderate	Major	Massive
Very unlikely	Negligible	Negligible	Negligible	Negligible
Possible	Negligible	Low	Medium	Medium
Likely	Negligible	Low	Medium	High
Highly likely	Negligible	Medium	High	High

### Assigning overall benefits

The initial analysis of OPC benefits carried out by the EPA was based on the information provided by industry sectors in response to the Call for Information. Information on the size of the industry sectors (in terms of annual sales) was taken into account, as well as estimated losses in yield and/or profit that would result from a specific insecticide no longer being available. Information on the availability of alternatives and the need for a range of tools for resistance management was also considered. This analysis was peer reviewed by Sapere Research Group (Sapere) in its report provided to the EPA to support this reassessment. The report is available on the EPA website along with other supporting documents for this application<sup>20</sup>. Draft recommendations on the level of benefit provided by each substance were then made at a workshop attended by staff from the EPA, Ministry for Primary

<sup>20</sup> <http://www.epa.govt.nz/search-databases/Pages/applications-details.aspx?appID=APP201045>



Industries, Plant and Food Research, Sapere and IPM Research Ltd. These recommendations were refined by EPA staff using the magnitude and likelihood framework to ensure consistency across substances and sectors.

In sectors where little benefits information was provided by stakeholders (e.g. ornamentals and home garden use), EPA staff have based their recommendations for these substances on written feedback, field trips and the uses that other sectors have for the same substances.

### 9.3. Comparing risks and benefits

The final stage of the analysis was to compare the overall risks and benefits of each substance across all of its crop uses. This was done qualitatively, rather than through formal addition of the sum of all risks/benefits. Draft recommendations for additional controls and whether to retain or revoke approvals were made taking into account this balance of risks and benefits.

The draft recommendations were then tested with industry representatives and non-governmental organisations. The result of this consultation and additional EPA analysis was to improve understanding of some of the risks and benefits, which led to the further refinement of some recommendations.

## Part 3: Recommendations

*This section of the report provides the recommendations of EPA staff.*



## 10. Recommendations and Rationale

One of the reasons for reassessing this group of OPCs together was to avoid perverse outcomes where revoking the approval of one substance could leave another substance with greater risks available. Therefore, an integral part of making the recommendations was to consider the impacts across the whole group of OPCs under reassessment. For example, if two substances control similar pests a specific comparison of the risks and benefits of the two substances was made. In some cases, this resulted in a substance with slightly lower benefits being recommended for retention instead of another with higher benefits, but also greater risks. It was assumed that in these instances the relative level of benefit provided by the substance to be retained would be likely to increase due to the lack of availability of the substance proposed for phase-out.

Taking this approach did not, however, result in recommendations for short term revocation of the approvals of several of the higher risk substances. This is because they also have very high benefits as they control major pests in crops with high economic value, and no effective alternatives have been identified. Conversely some substances with relatively low risks have been identified for phase-out because they also have low benefits. These substances are not considered to be alternatives for the higher risk/higher value substances based on the information available to the EPA. Further submissions on the benefits of these lower risk substances would be welcome.

**10.1** Submitters are encouraged to provide additional benefits information on any of the substances proposed for phase out due to their low benefits.

The balance of risks and benefits was taken into account in recommending the duration of phase-out periods for revocation of approvals. A minimum phase-out period of 3 years was proposed for substances in general use, but periods of 5 or 10 years were recommended for substances of particularly high economic value for New Zealand. The length of phase-out also reflects the time needed to research and develop alternative forms of pest control.

The following substance-by-substance recommendation sections set out the risks and benefits for each substance and the draft recommendations made by EPA staff. For each substance, tables are included that show the level of risk associated with different uses of the substance. One table shows the risks for operators, re-entry workers and bystanders; another shows risks for aquatic organisms, birds and bees. The uses modelled in the risk assessment take into account the method of application, the form of the substance (e.g. granule, liquid etc), the amount and frequency of application of the substance, the application area and the crop to which the substance is applied. Use pattern information has been taken from product labels and industry feedback. The level of risk from



each use is classified as negligible, low, medium or high based on risk quotient (RQ) values, as described in Section 9.

Data gaps for which additional information could potentially refine the risk assessment are identified for each substance as appropriate. Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

In order to consider the impacts across all plant protection uses of OPCs, EPA staff have considered 3 formulations for dichlorvos and 1 for maldison (malathion) which were not included in the Application but have plant protection applications. The recommendations made on these formulations are for consultation only. The recommendations will be included in a subsequent application for reassessment addressing the non-plant protection uses.

Full details of the proposed controls for all substances are set out in Appendix F.

**10.2** The EPA has identified substances for which data on dermal absorption, higher tier operator or re-entry worker exposure, and higher tier ecotoxicological information are lacking. This is identified in the substance-specific recommendations below. The EPA is eager to hear of any additional studies that may be available which have been carried out according to international best practice. Further guidance can be found on the following websites:

**Operator exposure**

[http://search.oecd.org/officialdocuments/displaydocumentpdf/?doclanguage=en&cote=ocde/gd\(97\)148](http://search.oecd.org/officialdocuments/displaydocumentpdf/?doclanguage=en&cote=ocde/gd(97)148)

**Dermal absorption**

<http://www.efsa.europa.eu/en/efsajournal/doc/2665.pdf>

**Re-entry**

USEPA Occupational and Residential Exposure Test Guidelines OPPTS 875.2100 Foliar Dislodgeable Residue Dissipation OPPTS 875.2100

## 10.1. Acephate

### Risks

The risks presented in Tables 8 and 9 are those with the default controls and the following additional controls in place;

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

**R-12** Restricted entry interval (REI) of 24 hours

Table 8 Risks associated with modelled uses of acephate – human health

Overall risk	Number of uses		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	15	5	10
Low	15	18	22
Medium	2	9	-
High	-	-	-
<b>Total</b>	<b>32</b>	<b>32</b>	<b>32</b>

The majority of use scenarios for acephate are associated with low human health risks, even in the presence of controls. There are also a small number of medium risks for operators and re-entry workers. It is important to note that even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals. Medium operator and re-entry worker risks are associated with RQ values of >10-100 and >100-1000, respectively.

Table 9 Risks associated with modelled uses of acephate – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	32	10	All <sup>a</sup>
Low	-	13	-
Medium	-	9	-
High	-	-	-
<b>Total</b>	<b>32</b>	<b>32</b>	

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Risks to aquatic organisms and bees from the modelled uses of acephate are all negligible with the proposed controls (buffer zones and a restricted entry interval of 24 hours in addition to the default controls) in place. However, there are a number of low and medium risks to birds. As with the human health assessment, even low risks are above the EPA's level of concern and could potentially result in harmful effects.

## Benefits

Table 10 Benefits profile for acephate

Level of benefit	Sectors <sup>a</sup>
Negligible	Brassica; Field tomato; Potato; Tamarillo
Low	Avocado; Berryfruit; Cymbidiums; Home garden; Lettuce & Salad
Medium	Citrus, Ornamentals
High	Biosecurity

<sup>a</sup> Sectors not mentioned are those where acephate is not used

Acephate is only used in a minority of sectors and its benefit in terms of the national economy is relatively small. In most of these sectors some alternative insecticide options are available or the use of acephate is not widespread.

However, the use of acephate has been identified as critical by the citrus industry, for the control of citrus flower moth. The majority of this use is for Yen Ben lemon growers, with some use for oranges. The industry estimates a \$12.5 million loss per annum from loss of access to the fresh fruit market due to rindspotting on the fruit if acephate is unavailable. The industry has been investing in research on alternatives to acephate, including mating disruption, but to date this has not provided an option that provides adequate control. Loss of acephate would therefore be expected to have a significant impact on lemon growers, who are predominantly based in the Gisborne (70%) and Northland (30%) regions.

Acephate is also used on occasion for biosecurity purposes. Feedback from the New Zealand Quarantine Treatment Centre to the EPA indicated that acephate was used on eight occasions over a six month period in 2011 to treat import and export crops for biosecurity purposes.

## International context

The international status of acephate is detailed in Appendix H. Acephate is approved for use on a variety of crops in the USA, Canada and Australia. Both the US Environmental Protection Agency (USEPA) and Canadian Pest Management Regulatory Agency (PMRA) have introduced a number of controls to mitigate ecological risks and risks to workers. The EU decided not to approve acephate in 2003 because of risks to consumers and non-target organisms.

## Request for further information

The risk assessment for operators, re-entry workers and the environment could potentially be refined if any **higher tier operator or re-entry worker exposure monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none

has been submitted to date. Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Acephate is used in a minority of sectors. The benefits it provides for the national economy in most of these sectors are low. However, its value for the lemon industry provides a medium benefit for the economy.

The regions of Gisborne and Northland have the majority of New Zealand's lemon industry; therefore, a significant impact on this sector is expected in those regional economies if approvals for acephate were revoked.

The human health risks associated with acephate are generally low or negligible for the use scenarios modelled. These risks assume the introduction of additional controls.

Medium risks to operators and re-entry workers were identified for a minority of use scenarios. The two uses with medium risks to operators are by greenhouse application using a spray gun, and could be avoided through the application of an additional control to restrict application in greenhouses to automated methods only.

Risks to the aquatic environment and bees are negligible, although there are some low-medium risks to birds.

**On the basis of the overall low risk profile for acephate, and its medium economic benefits to the lemon industry, it is recommended that the decision making Committee considers maintaining the approval for acephate and formulations that contain it, with the application of controls.**

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing acephate are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-3** Maximum application rate: 3500 g/ha, maximum application frequency: 3 times/year
- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-7** Application in greenhouses to be by automated means only. This will remove all medium risks to operators.
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

- R-11** Notification of neighbours in advance of application
- R-13** Approved handler required for all uses
- R-12** Restricted entry interval (REI) of 24 hours
- R-14** Signage to inform where acephate has been applied to an indoor environment, and when unrestricted entry is allowed

## 10.2. Carbaryl

### Risks

The risks presented in Tables 11 and 12 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 12 hours

Table 11 Risks associated with modelled uses of carbaryl – human health

Overall Risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	13	5	7
Low	4	14	12
Medium	-	-	-
High	-	-	-
Unknown	2		
<b>Total</b>	<b>19</b>	<b>19</b>	<b>19</b>

For all the uses for which operator RQ values could be derived for carbaryl, the majority of risks are negligible, with a small number of uses having low risks. Risks for re-entry workers and bystanders are generally low with some negligible risks, although it is important to note that even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 12 Risks associated with modelled uses of carbaryl – environment

Overall Risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	4	13	All <sup>b</sup>
Low	11	6	-
Medium	4	-	-
High	-	-	-
<b>Total</b>	<b>19</b>	<b>19</b>	<b>19</b>

<sup>b</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Aquatic risks for the use scenarios modelled for carbaryl are generally negligible or low, although there are four uses associated with medium risks. The majority of use scenarios are of negligible risk to birds, with a small number carrying low risks. As with the human health assessment, even low risks are above the EPA's level of concern and could potentially result in harmful effects.

## Benefits

Table 13 Benefits profile for carbaryl

Level of benefit	Sectors <sup>a</sup>
Negligible	Berry-fruit; Field tomatoes; Maize; Persimmon; Strawberry; Sweetcorn; Tamarillo
Low	Avocado; Home garden; Pasture; Turf
Medium	Ornamentals; Pipfruit; Stonefruit
High	Biosecurity

<sup>a</sup>Sectors not mentioned are those where carbaryl is not used.

Carbaryl is used in a minority of sectors, providing a low-medium benefit for the national economy. It is valued as a tool for resistance management, for clean-up of stonefruit close to harvest as it has a short pre-harvest interval, and as a low cost fruitlet thinner in late spring in the pipfruit sector.

For stonefruit, chlorpyrifos can be used to control the same pests, but has a longer pre-harvest interval. For the pipfruit sector, alternatives to carbaryl are available for fruitlet thinning, but these are not considered to be effective in as wide a range of temperatures as carbaryl.

Carbaryl is also used on occasion for biosecurity purposes. Feedback from the New Zealand Quarantine Treatment Centre to the EPA indicated that carbaryl was used on seven occasions over a six month period in 2011 to treat import and export crops.

## International context

The international status of carbaryl is detailed in Appendix H. Carbaryl is no longer approved in the EU due to concerns about effects on human health and non-target organisms. Domestic use has

been restricted or prohibited in the USA, Canada and Australia, but its use for plant protection purposes is generally still permitted in these countries, with the application of controls.

### Request for further information

The risk assessment for operators, re-entry workers and the environment could potentially be refined if any **higher tier operator or re-entry worker exposure monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date. Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Carbaryl is used in a small number of industry sectors. Its use generally contributes a low benefit to the national economy, while its use in the ornamentals, stonefruit, and pipfruit sectors contributes medium economic benefits. The pipfruit and ornamental sectors are both worth over \$400 million in annual sales.

Risks associated with the current uses of carbaryl are generally low or negligible with proposed controls in place, although there are a small number of medium aquatic risks. Even low risks are above the EPA's level of concern. However, the lack of risks to operators, very small number of medium environmental risks and absence of high risks means that carbaryl has a generally favourable risk profile in comparison with many of the other OPCs included in the reassessment.

**Based on the low-medium economic benefits provided by the use of carbaryl, and the overall low risk profile, it is recommended that the approval for plant protection formulations that contain carbaryl be maintained, with the application of controls.**

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing carbaryl are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-3** Maximum application rate: 2700 g/ha, maximum application frequency: 3 times/year
- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-11** Notification of neighbours in advance of application
- R-12** Restricted entry interval (REI) of 12 hours
- R-13** Approved handler required for all uses
- R-14** Signage to inform where carbaryl has been applied to an indoor environment, and when unrestricted entry is allowed

## 10.3. Chlorpyrifos

### Risks

The risks presented in Tables 14 and 15 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones (excluding granular products) as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours

Table 14 Risks associated with modelled uses of chlorpyrifos – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	110	110	104
Low	-		6
Medium	-	-	-
High	-	-	-
<b>Total</b>	<b>110</b>	<b>110</b>	<b>110</b>

The human health risks for the chlorpyrifos use scenarios modelled are almost all negligible. A small proportion carry low risks for bystanders.

Table 15 Risks associated with modelled uses of chlorpyrifos – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	37	9	All <sup>a</sup>
Low	63	29	-
Medium	10	70	-
High	-	2	-
<b>Total</b>	<b>110</b>	<b>110</b>	<b>110</b>

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

The majority of chlorpyrifos use scenarios modelled are associated with environmental risks. There are many low risks for aquatic organisms, with a few uses posing medium risks. The majority of uses



have medium risks for birds, while two uses have high bird risks. Even low risks are above the EPA's level of concern.

## Benefits

Table 16 Benefits profile for Chlorpyrifos

Level of benefit	Sectors <sup>a</sup>
Negligible	Citrus; Kiwifruit; Pipfruit; Cucurbits
Low	Berryfruit; Blackcurrants; Blueberries; Carrots & parsnips; Cymbidiums; Grapes; Home garden; Kumara; Persimmons; Stonefruit; Strawberries; Sweetcorn; Vegetables other
Medium	Arable; Avocado; Beans & Peas; Maize; Onions; Ornamentals; Potatoes;
High	Fodder & forage; Pasture; Turf; Biosecurity

<sup>a</sup> Sectors not mentioned are those where chlorpyrifos is not used

Feedback indicates that chlorpyrifos is used in the majority of agricultural sectors for a wide range of pests. While its use in many of these sectors is only associated with low benefits for the national economy, its overall benefits for the economy can be considered high given the wide variety of sectors in which it is used and the high benefits associated with its use in the fodder and forage, pasture and turf industries.

## International context

The international regulatory status of chlorpyrifos is presented in Appendix H. Chlorpyrifos is approved for use on a variety of crops in the USA, Canada, the EU and Australia. In the USA, virtually all domestic uses were voluntarily withdrawn in 2006, because of human health and environmental risks.

## Overall assessment

Chlorpyrifos is used in almost all industry sectors including particularly large sectors such as pasture, fodder and forage and turf. These uses combined provide a high level of overall benefit to the national economy.

The risk profile for human health indicates that in almost all cases there are negligible risks to operators, re-entry workers and bystanders. Many uses are associated with low and medium risks to aquatic organisms and birds, while two use scenarios have high bird risks. While it is not possible to eliminate the risks to birds, risks associated with application of granules could be reduced to some extent through a control requiring granules to be covered with soil following application.

**The high level of economic benefit provided by chlorpyrifos outweighs the risks and therefore it is recommended that the decision making committee considers maintaining the approvals for plant protection formulations that contain chlorpyrifos.**

## Controls

Additional controls that would further reduce risks for plant protection insecticides containing chlorpyrifos applied as liquids are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-3** Maximum application rate: 1500 g/ha
- R-4** Buffer zones (excluding granular products) as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-6** Restrict droplet size for aerial application only (to reduce spraydrift)
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-11** Notification of neighbours in advance of application
- R-12** Restricted entry interval (REI) of 24 hours
- R-13** Approved handler required for all uses

Additional controls that would further reduce risks for plant protection insecticides containing chlorpyrifos applied as granules are:

- R-3** Maximum application rate: 1500 g/ha, maximum frequency 1 time per year
- R-5** Cover granules with soil immediately after application
- R-8** Identification as an OP-containing substance on label
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours
- R-13** Approved handler required for all uses

## 10.4. Diazinon

### Risks

The risks presented in Tables 17 and 18 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones (excluding granular products) as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees

**R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

**R-12** Restricted entry interval (REI) of 24 hours

Table 17 Risks associated with modelled uses of diazinon – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	20	28	27
Low	56	24	65
Medium	17	43	3
High	2	-	-
<b>Total</b>	<b>95</b>	<b>95</b>	<b>95</b>

There are a large number of use scenarios for diazinon that pose a low or medium risk to operators and re-entry workers, even with the application of controls. Two use scenarios pose high risks to operators but these can be managed by additional controls (see below). For bystanders, the majority of use scenarios are associated with a low level of risk. It is important to note that even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects such as neurotoxicity in exposed individuals.

Table 18 Risks associated with modelled uses of diazinon – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	32	3	All <sup>a</sup>
Low	29	-	-
Medium	34	8	-
High	-	84	-
<b>Total</b>	<b>95</b>	<b>95</b>	<b>95</b>

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Many use scenarios are associated with low or medium risks to aquatic organisms. The majority of uses carry high risks to birds. As with the human health assessment, even low risks are above the EPA's level of concern and could potentially result in harmful effects.

## Benefits

Table 19 Benefits profile for diazinon

Level of benefit	Sectors <sup>a</sup>
Negligible	Brassica; Feijoa; Kiwifruit; Persimmon; Onion; Tamarillo
Low	Cymbidiums; Field tomatoes; Grapes; Home garden; Kumara; Lettuce and salad; Passionfruit; Strawberries; Sweetcorn
Medium	Avocado; Beans and peas; Carrots and parsnips; Citrus; Maize; Ornamentals
High	Arable; Biosecurity; Fodder and forage; Pasture; Pipfruit; Turf

<sup>a</sup> Sectors not mentioned are those where diazinon is not used

Diazinon is widely used and provides benefits for a broad range of sectors. In particular, diazinon is considered critical for the control of grass grub, a significant pest for the arable, pasture, fodder & forage and turf sectors and for which effective alternatives are not currently available. All of these sectors are worth at least hundreds of millions of dollars. Diazinon is also currently considered critical for control of apple leaf curling midge for the pipfruit sector, and it has been estimated that loss of diazinon would cost this industry around \$175 million annually. For both these pests, research on alternatives is underway, but to date there has been little success in finding an effective alternative for grass grub.

The importance of diazinon for these very large sectors, together with its benefits for a broad range of other crops, indicates that diazinon provides high benefits for the New Zealand economy overall.

## International context

The international status of diazinon is detailed in Appendix H. Diazinon is not approved for use in the EU due to concerns over risks to workers and bystanders, birds, aquatic organisms and other wildlife. The United States Environmental Protection Agency (US EPA) and Pest Management Regulatory Agency (PMRA) in Canada have introduced controls to mitigate risks to workers and wildlife. The US EPA acknowledged that additional controls may not completely eliminate the risks to wildlife and workers, but retained some uses of diazinon due to their high benefit. Residential uses were phased out because of risks to children and others.

## Request for further information

The risk assessment for operators, re-entry workers and the environment could potentially be refined if any **higher tier operator or re-entry worker exposure monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested and some ecotoxicological information has been provided, however the EPA still have concerns about risks to the environment. Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

## Overall assessment

Diazinon is of high value to the agricultural industry in New Zealand and the national economy as a whole. It is used by a broad range of sectors including some of the largest on a national scale, such as the arable, pasture and turf industries. However, it carries significant risks for operators, re-entry workers and bystanders. Many uses of diazinon also pose low to medium risks to aquatic species and nearly all pose high risks to birds.

**Given the high risks for human health and the environment, it is proposed that the decision making committee considers revoking approvals for all plant protection insecticides containing diazinon. However, given the high level of benefit provided by this substance and the need for further research on alternatives for control of grass grub and apple leaf curling midge, it is proposed that there should be a long phase-out period (e.g. 10 years) to allow time for industry to adjust and develop alternative insecticides.**

For the period while approvals for diazinon and diazinon-containing substances continue to be maintained, it is proposed that additional controls be put in place in order to mitigate some of the biggest risks. The two highest risks for operators are associated with hand-held spreading of granules and application in a greenhouse with a spraygun. Therefore it is proposed that a control be introduced to restrict application in greenhouses to automated methods only, and a control to eliminate handheld application of granules.

## Controls

Additional controls that would further reduce risks for plant protection insecticides containing diazinon applied as liquids are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-2** Phase-out: A long phase-out (up to 10 years) is proposed
- R-3** Maximum application rate: 2400 g/ha (an authorised person may use at a higher rate), maximum application frequency: 2 times/year
- R-4** Buffer zones (excluding granular products) as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-6** Restrict droplet size for aerial application only
- R-7** Application Method for indoor use is restricted to automatic application equipment only. This will remove one of the high operator risks.
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-11** Notification of neighbours in advance of application

- R-12** Restricted entry interval (REI) of 24 hours
- R-13** Approved handler required for all uses
- R-14** Signage to inform where diazinon has been applied to an indoor environment, and when unrestricted entry is allowed

Additional controls that would further reduce risks for plant protection insecticides containing diazinon applied as granules are:

- R-2** Phase-out: A long phase-out (up to 10 years) is proposed
- R-3** Maximum application rate: 3000 g/ha, maximum application frequency: 2 times/year
- R-7** No handheld application. This will remove one of the high operator risks.
- R-8** Identification as an OP-containing substance on label
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours
- R-13** Approved handler required for all uses

## 10.5. Dichlorvos

### Risks

The risks presented in Tables 20 and 21 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 12 hours

Table 20 Risks associated with modelled uses of dichlorvos – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	16	9	24
Low	16	2	14
Medium	8	29	2
High	-	-	-

<b>Total</b>	40	40	40
--------------	----	----	----

A majority of the use scenarios modelled are associated with low or medium risks to operators and re-entry workers. Just over half the uses have negligible risks for bystanders, but there are also a number of scenarios with low or medium risks. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals. Medium operator and re-entry worker risks are associated with RQ values of >10-100 and >100-1000, respectively.

Table 21 Risks associated with modelled uses of dichlorvos – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	23	22	All <sup>a</sup>
Low	1	-	-
Medium	16	15	-
High	-	3	-
<b>Total</b>	<b>40</b>	<b>40</b>	<b>40</b>

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

While just over half the use scenarios have negligible risks, there are a large number of uses that pose medium risks to aquatic organisms and birds. There are also three use scenarios with high bird risks.

## Benefits

Table 22 Benefits profile for dichlorvos

Level of benefit	Sectors <sup>a</sup>
Negligible	Berryfruit; Arable; Strawberry; Onion; Mushroom; Fodder & forage
Low	Asparagus; Cucurbit; Cymbidiums; Kumara; Lettuce & Salad; Ornamentals; Passionfruit; Persimmons; Tamarillos; Vegetables other
Medium	Brassica; Capsicum; Greenhouse crops
High	Biosecurity

<sup>a</sup> Sectors not mentioned are those where dichlorvos is not used

Dichlorvos is used in a broad range of sectors, with its use in brassicas, capsicum and greenhouse crops all contributing a medium benefit to the national economy. It is particularly valued for its broad spectrum and fumigant properties, as well as having a short pre-harvest interval, helping to ensure phytosanitary conditions for export are met.

Dichlorvos is also of significant importance for biosecurity purposes. Information provided to the EPA by the Ministry of Primary Industries stated that Dichlorvos strips are considered the best tool in surveillance traps to help keep New Zealand free from economically damaging species of fruit fly.

### International context

The international regulatory status of dichlorvos is presented in Appendix H. Dichlorvos is approved for indoor and grain store uses in the USA. It is approved for use in Canada with the application of controls, and in Australia it is approved for use in grain and cereal stores. Approval for dichlorvos in the EU was withdrawn in 2006 due to risks to bystanders, operators and re-entry workers.

### Request for further information

The risk assessment for operators, re-entry workers and the environment could potentially be refined if any **higher tier operator or re-entry worker exposure monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date. Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Several industry sectors use dichlorvos. Its use in most of these sectors is associated with a low benefit to the national economy, but its use on brassicas, capsicums and greenhouse crops is of particular value, contributing medium economic benefits.

Many of the uses of dichlorvos pose risks for human health and environmental species, even with the proposed controls in place. Almost all of these risks are associated with outdoor uses.

Taking into account the relatively significant human and environmental risks, and the particular value of dichlorvos for capsicums and other greenhouse crops, it is proposed that the outdoor uses of dichlorvos be phased out, and that a control be added requiring the use of automatic or fogger application methods for indoor uses along with full PPE and RPE. **This recommendation is for consultation only, and will not be provided to the decision maker as it is based on three formulations not included in the Application. The recommendation will be considered in a subsequent reassessment application as these substances also have non-plant protection applications.**

**Dichlorvos strips are considered critical for biosecurity purposes in New Zealand, and their use is associated with negligible risks for human health and the environment. It is therefore recommended that the decision making committee maintain the approval for dichlorvos strips.**

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing dichlorvos are listed below. This list includes relevant controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context



of the proposed risk management framework. Buffer zones and a label warning of effects on bees are not listed due to the proposal to limit application to indoor use only.

- R-7** Prohibition of outdoor use. Use of automatic application methods only when used indoors. This would remove risks for bystanders, aquatic organisms and birds, and minimise risks to operators. An 18 month phase-in of this control is proposed.
- R-8** Identification as an OP-containing substance on label
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 12 hours
- R-13** Approved handler required for all uses
- R-14** Signage to inform where dichlorvos has been applied to an indoor environment, and when unrestricted entry is allowed.

Additional controls that would further reduce risks for dichlorvos strips are:

- R-10** Use gloves and tweezers when handling unpackaged strips
- R-15** Requiring strips to be transported in sealed, unopened packaging or an air-tight container.

## 10.6. Dimethoate

### Risks

The risks presented in Tables 23 and 24 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 48 hours

Table 23 Risks associated with modelled uses of dimethoate – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	10	10	8
Low	-	1	3

Medium	-	-	-
High	-	-	-
Unknown	1		
<b>Total</b>	<b>11</b>	<b>11</b>	<b>11</b>

Risks to operators are negligible for all the use scenarios for dimethoate for which an RQ could be calculated. A small proportion of use scenarios pose low risks for re-entry workers and bystanders. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects such as neurotoxicity in exposed individuals.

Table 24 Risks associated with modelled uses of dimethoate – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	11	1	All <sup>a</sup>
Low	-	2	-
Medium	-	8	-
High	-	-	-
<b>Total</b>	<b>11</b>	<b>11</b>	<b>11</b>

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

The modelled uses of dimethoate do not pose risks for aquatic organisms and bees. However, all but one use has low or medium risks to birds.

## Benefits

Table 25 Benefits profile for dimethoate

Level of benefit	Sectors
Negligible	Berryfruit; Arable; Strawberry; Pipfruit; Carrot; Potato
Low	Cymbidiums; Fodder & forage
Medium	
High	Biosecurity

<sup>a</sup> Sectors not mentioned are those where dimethoate is not used

Dimethoate is registered for use in a small number of agricultural industry sectors, but information submitted to the EPA indicated that in the majority of these dimethoate is not actually used, or is not considered as critical. In several sectors where it is used, no information on any specific benefits was provided. Its use in the cymbidium and fodder and forage sectors is associated with low economic

benefits, based on the size of these industries and the information provided. Dimethoate is considered critical for aphid control by the fodder and forage industry and of medium priority for cymbidiums.

Dimethoate is potentially of value for biosecurity e.g. for supporting market access of fruit and vegetable crops. However, no specific information was provided in support of its use.

### International context

The international status of dimethoate is detailed in Appendix H. It is approved for use on specific crops in the USA, EU and Canada. The Australian Pesticides and Veterinary Medicines Authority (APVMA) has suspended the use of dimethoate on a number of food crops until 5 October 2013 due to potential dietary risks.

### Request for further information

Very limited information on the **benefits** provided by dimethoate has been submitted to the EPA during the consultation process to date. The EPA would be prepared to consider further evidence in support of its use.

The risk assessment for the environment could potentially be refined if any **higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Dimethoate is not widely used, and provides only limited benefits to the New Zealand economy. The uses modelled are generally of low or negligible risk to human health and aquatic organisms, but most uses are associated with low or medium risks to birds.

**Due to the apparently negligible or low benefit provided by dimethoate, and the potential risks for human health and birds, it is proposed that the decision making committee consider revoking the approvals for plant protection insecticides containing dimethoate. A relatively short phase out period (e.g. up to 3 years) is proposed. Due to the proposed short phase out period, specific additional controls for dimethoate-containing substances have not been recommended.**

## 10.7. Fenamiphos

### Risks

The risks presented in Tables 26 and 27 are those with the default controls and the following additional controls in place:

**R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals



**R-9** Label warning of effects on bees

**R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

**R-12** Restricted entry interval (REI) of 48 hours

Table 26 Risks associated with modelled uses of fenamiphos – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	-	1	2
Low	1	-	2
Medium	3	6	3
High	3	-	-
<b>Total</b>	<b>7</b>	<b>7</b>	<b>7</b>

All use scenarios modelled for fenamiphos are associated with low, medium or high risks to operators, even with the application of controls. The majority of uses also pose low or medium risks to re-entry workers and bystanders. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 27 Risks associated with modelled uses of fenamiphos – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	2	1	All <sup>a</sup>
Low	1		-
Medium	4	1	-
High	-	5	-
<b>Total</b>	<b>7</b>	<b>7</b>	<b>7</b>

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

The majority of uses of fenamiphos that were modelled pose low or medium risks to aquatic organism. All but one of the use scenarios has medium or high risks for birds.

## Benefits

Table 28 Benefits profile for fenamiphos<sup>a</sup>

Level of benefit	Sectors
Negligible	Kumara; Fodder & forage
Low	Cymbidiums
Medium	Carrots & parsnips; Ornamentals; Turf
High	Biosecurity; Potatoes

<sup>a</sup> Sectors not mentioned are those where fenamiphos is not used

Fenamiphos is used in a relatively small number of sectors. It is used to control nematodes as well as carrot rust fly and Argentine stem weevil, and is seen as particularly critical for the potato and carrot and parsnip industries. Its use for potatoes is associated with high economic benefits for New Zealand and medium benefits are provided by its use on carrots and parsnips, ornamentals and turf.

Oxamyl is an alternative to fenamiphos for nematode control. It is stated to be less efficacious and around three times as expensive, although it is widely used overseas to control nematodes.

Fenamiphos is potentially of value for biosecurity. Feedback from the New Zealand Quarantine Treatment Centre to the EPA indicated that fenamiphos was used once over a six month period in 2011 to treat import and export crops.

## International context

The international status of fenamiphos is detailed in Appendix H. Fenamiphos is not registered for use in Canada. The USEPA has raised concerns over risks for workers and terrestrial, aquatic and endangered species. Products containing fenamiphos have been voluntarily withdrawn by industry in the USA. In the EU, fenamiphos can only be applied by drip irrigation in greenhouses. Fenamiphos is currently under review by the Australian Pesticides and Veterinary Medicines Authority.

## Request for additional information

The EPA was unable to obtain **dermal absorption information for fenamiphos in diluted products**. As a result default values were used. Information from studies conducted according to international best practice would potentially refine the risk assessment for human health. Guidance on this issue from the European Food Safety Authority can be found on their website<sup>21</sup>.

The risk assessment for operators and the environment could potentially be refined if any **higher tier operator or re-entry worker exposure monitoring studies, or higher tier ecotoxicological**

<sup>21</sup> <http://www.efsa.europa.eu/en/efsajournal/doc/2665.pdf>

**information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Fenamiphos is valued for the control of nematodes, and its use in several sectors is associated with medium and high benefits for the national economy. However, its use poses medium – high risks to human health and the environment in almost all the use scenarios modelled, despite the application of controls. The carbamate oxamyl can also be used for the control of nematodes, although it is reported to be less effective and is currently more expensive.

**Given the high risks for human health and the environment, it is proposed that the decision making committee consider revoking approvals for all plant protection insecticides containing fenamiphos. However, given the relatively high level of benefit provided by this substance in some sectors and the need to develop better alternatives for control of nematodes, it is suggested that there should be a medium-term phase-out period (e.g. up to 5 years) to allow time for industry to adjust and develop alternatives.**

For the period that approvals for plant protection products containing fenamiphos continue to be maintained, it is proposed that additional controls be put in place to mitigate risks as far as possible.

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing fenamiphos are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-2** Phase-out: A medium-term phase-out (up to 5 years) is proposed
- R-3** Maximum application rate: 8000 g/ha, maximum application frequency: once/year. This will remove one high operator and bird risk and one medium re-entry, bystander risk.
- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-6** Restrict droplet size: may only be applied using equipment that produces droplets no finer than coarse (to reduce spraydrift)
- R-7** Aerial application is prohibited
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

**R-11** Notification of neighbours in advance of application

**R-12** Restricted entry interval (REI) of 48 hours

**R-13** Approved handler required for all uses

## 10.8. Fenitrothion

### Risks

The risks presented in Tables 29 and 30 are those with the default controls and the following additional controls in place:

**R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals

**R-9** Label warning of effects on bees

**R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

**R-12** Restricted entry interval (REI) of 48 hours

Table 29 Risks associated with modelled uses of fenitrothion – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	3	1	1
Low	4	6	6
Medium	-	-	-
High	-	-	-
<b>Total</b>	<b>7</b>	<b>7</b>	<b>7</b>

All but one of the use scenarios modelled for fenitrothion carry low risks of adverse effects for re-entry workers, and all but one use scenario poses low risks for bystanders. Several uses of fenitrothion are associated with low risks for operators. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 30 Risks associated with modelled uses of fenitrothion – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	4	-	All <sup>a</sup>
Low	3	2	-

Medium	-	5	-
High	-	-	-
Total	7	7	7

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Several uses of fenitrothion that were modelled pose low risks to aquatic organisms. All of the use scenarios have low or medium acute risks for birds.

## Benefits

Table 31 Benefits profile for fenitrothion

Level of benefit	Sectors
Negligible	Turf
Low	Arable; Fodder & forage; Pasture
Medium	
High	

<sup>a</sup> Sectors not mentioned are those where fenitrothion is not used

Fenitrothion is used by the arable, pasture and fodder and forage sectors. It is considered essential for the control of the latter stages of Porina larvae. A non-OP insecticide can be used in the earlier larval stages, but is stated as not being effective in the latter stages. Diazinon and chlorpyrifos are reported to be less preferred alternatives to fenitrothion for Porina treatment.

Use of fenitrothion in these sectors provides low economic benefits for New Zealand.

## International context

The international status of fenitrothion is detailed in Appendix H. Fenitrothion is registered for use in ant and cockroach baits in the USA, but no uses on crops are registered. In Canada, it is registered for use in forests and woodlands, while in Australia it is registered for use on several crops with the application of controls to mitigate risks. Fenitrothion is not approved in Europe, where concerns were raised over risks for operators, re-entry workers, bystanders, aquatic organisms, birds and mammals.

## Request for additional information

Very limited information on the **benefits** provided by fenitrothion has been submitted to the EPA during the consultation process to date. The EPA would be prepared to consider further evidence in support of its use.

The risk assessment for fenitrothion could potentially be refined if any **higher tier operator or re-entry worker studies, or higher tier ecotoxicological information**, are available. Such data have previously been requested but none has been submitted to date.



Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Fenitrothion is not widely used. Its use to control Porina larvae in the arable, pasture and fodder and forage sectors is associated with low economic benefits on a national scale. Diazinon and chlorpyrifos are reported to be alternatives for Porina control, although they are apparently less preferred choices for this specific pest. A non-OP insecticide is used to control early larval stages of this pest.

Use of fenitrothion is generally associated with human health risks even in the presence of controls, and it also has risks for aquatic organisms and birds.

**Given the relatively low benefits associated with use of fenitrothion, the availability of some OP and non-OP alternatives, and the human and environmental risks, it is proposed that the decision making committee considers revoking approvals for plant protection insecticides containing fenitrothion. A relatively short phase-out period (e.g. up to 3 years) is proposed. Due to the short phase out period proposed, specific additional controls for fenitrothion-containing substances have not been recommended.**

## 10.9. Maldison

### Risks

The risks presented in Tables 32 and 33 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-7** Baits treated with maldison must be dyed blue or green
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours

Table 32 Risks associated with modelled uses of maldison – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	22	12	9
Low	1	12	15
Medium	-	-	-
High	-	-	-

Unknown	1		
<b>Total</b>	24	24	24

The majority of use scenarios modelled for maldison have negligible risks for operators; only one use scenario has a low risk for operators. However, most uses have low risks for bystanders and half have low risks for re-entry workers. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 33 Risks associated with modelled uses of maldison – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	16	10	All <sup>a</sup>
Low	7	13	-
Medium	1	1	-
High	-	-	-
<b>Total</b>	24	24	24

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

The majority of uses of maldison that were modelled pose negligible or low environmental risks. Only two use scenarios have medium risks for aquatic organisms or birds. As with the human health assessment, even low risks are above the EPA's level of concern and could potentially result in harmful effects.

## Benefits

Table 34 Benefits profile for maldison<sup>a</sup>

Level of benefit	Sectors
Negligible	Brassica, grape, arable, pipfruit
Low	Avocado; Carrots & parsnips; Citrus; Fodder & forage; Home garden; Kumara; Pasture; Turf
Medium	
High	Biosecurity

<sup>a</sup> Sectors not mentioned are those where maldison is not used

Maldison is used in a relatively broad range of agricultural sectors. Although its use in each of these sectors provides only low benefits to the economy it is considered critical for the control of crickets in the pasture and kumara sectors. It is also considered important for greenhouse thrips on citrus fruits.

Maldison was identified as being of particular value for biosecurity purposes. It is used in bait spots for control of female fruit flies.

### International context

The international status of maldison is detailed in Appendix H. Maldison is currently approved for use on a variety of crops in the USA, Canada, EU and Australia, with the application of controls.

### Request for additional information

The risk assessment could be refined if any **re-entry worker monitoring studies or higher tier ecotoxicological information** are available. Such data have previously been requested and some has been provided, however the EPA still have concerns about risks to re-entry workers and the environment.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Maldison is used in a number of agricultural sectors, contributing low economic benefits for the country from each of these uses. It is also considered of importance as part of biosecurity measures to prevent fruit fly infestation in New Zealand. Risks for human and environmental health with the application of controls are relatively low in comparison with several other OPCs.

**Given the broad range of sectors for which maldison provides benefits, together with its relatively low risk profile, it is proposed that the decision making committee considers maintaining approvals for plant protection insecticides containing maldison with the application of controls.**

Please note this recommendation does not include Fyfanon 440EW (HSR100380) as this formulation was not included in the Application. It will be considered in a subsequent reassessment application as it also has non-plant protection applications.

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing maldison are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-3** Maximum application rate: 4500 g/ha, maximum application frequency: 2 times/year (this would not apply to an authorised person under the biosecurity act).
- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees

- R-11** Notification of neighbours in advance of application
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours
- R-13** Approved handler

Additional controls that would further reduce risks for substances containing maldison used in making insecticide baits are:

- R-7** Only for use in making baits. Baits should be blue or green of colour.
- R-8** Identification as an OP-containing substance on label
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-11** Notification of neighbours in advance of application
- R-13** Approved handler

Additional controls that would further reduce risks for maldison-treated wheat are:

- R-8** Identification as an OP-containing substance on label
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-13** Approved handler

## 10.10. Methamidophos

### Risks

The risks presented in Tables 35 and 36 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 48 hours

Table 35 Risks associated with modelled uses of methamidophos – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	2	-	1
Low	8	2	17
Medium	10	18	2
High	-	-	-
<b>Total</b>	20	20	20

Almost all use scenarios modelled for methamidophos have low or medium risks for operators and bystanders, even with controls in place. All of the uses have low or medium risks for bystanders. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 36 Risks associated with modelled uses of methamidophos – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	1	-	All <sup>a</sup>
Low	-	-	-
Medium	19	20	-
High	-	-	-
<b>Total</b>	20	20	20

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

All but one of the modelled use scenarios is associated with a medium risk for aquatic organisms. All uses of methamidophos have medium risks for birds.

## Benefits

Table 37 Benefits profile for methamidophos<sup>a</sup>

Level of benefit	Sectors
Negligible	Beans & peas; Ornamentals
Low	Brassica; Field tomatoes; Sweetcorn; Tamarillo
Medium	Kumara; Maize; Onions
High	Potatoes

<sup>a</sup> Sectors not mentioned are those where methamidophos is not used

Use of methamidophos in a variety of industry sectors is associated with low, medium and high economic benefits. It is used to control a range of pests including onion thrips, green vegetable bug in sweetcorn and maize, and tomato/potato psyllid (TPP) in a range of crops including field tomatoes, tamarillos and potatoes.

Other OPs can also be used for onion thrips and TPP, but methamidophos is seen as the preferred option for TPP in the potato and tamarillo sectors, and is considered an important tool for resistance management in many sectors for TPP and for onion thrips. Alternatives for TPP are available, but many of these act on contact and methamidophos is preferred for its systemic action. Non-OP alternatives for onion thrips are stated to be less effective, not registered for use in onions (and so do not have an MRL set) and more costly.

### International context

The international status of methamidophos is detailed in Appendix H. Uses of methamidophos in the USA were cancelled in 2009. In the EU, approval of methamidophos was withdrawn as of 2008 due to concerns over risks for human health, birds and mammals. In Australia, all approvals of methamidophos were cancelled at the request of the approval holder in June 2012. A two-year phase out period, ending on 15 June 2014, applies to the supply and use of existing stock of methamidophos products in Australia. There are existing approvals for some uses in Canada until the end of 2012.

### Request for additional information

The risk assessment could potentially be refined if any **higher tier operator or re-entry worker studies or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Methamidophos is used to control a variety of pests in a range of industry sectors, and is considered of particular importance in the management of green vegetable bug, onion thrips and TPP. Its use provides a range of benefits for the New Zealand economy. Most of these benefits are low or medium, but high benefits are associated with its use on potatoes, an industry worth around \$560 million in sales.

The risk profile for methamidophos is relatively high in comparison with other OPCs included in the reassessment. Almost all uses have risks for humans, aquatic organisms and birds.

**It is proposed that the decision making committee considers revoking approvals for methamidophos and plant protection insecticides containing this active substance, based on the overall high level of risks associated with methamidophos. Given the range of benefits from methamidophos it is proposed that a medium-term (e.g. up to 5 year) phase-out period be**

**applied, to allow time for industry to adjust and make further progress in developing alternative pest control options.**

**If a medium-term phase-out period is applied, additional controls should be put in place to mitigate risks as far as possible. Full details of the recommended controls are set out in Appendix F.**

## Controls

Additional controls that would further reduce risks for plant protection insecticides containing methamidophos are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-2** Phase-out: A medium-term phase-out (up to 5 years) is proposed
- R-3** Maximum application rate: 900 g/ha. This would remove one medium operator risk, 2 medium re-entry risks and 3 medium aquatic and bird risks.
- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-11** Notification of neighbours in advance of application
- R-12** Restricted entry interval (REI) of 48 hours
- R-13** Approved handler required for all uses

## 10.11. Methomyl

### Risks

The risks presented in Tables 38 and 39 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-12** Restricted entry interval (REI) of 48 hours

Table 38 Risks associated with modelled uses of methomyl – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	17	6	10

Low	5	16	12
Medium	-	-	-
High	-	-	-
<b>Total</b>	22	22	22

Risks to operators from the use of methomyl are negligible for most use scenarios modelled, although there are some uses with low and medium risks. Most uses have low risks for re-entry workers and just over half of the uses have low risks for bystanders. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 39 Risks associated with modelled uses of methomyl – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	21	4	All <sup>a</sup>
Low	1	3	-
Medium	-	15	-
High	-	-	-
<b>Total</b>	22	22	22

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Risks to aquatic organisms from the use of methomyl are negligible in all but one case. However, the majority of use scenarios are associated with bird risks, and these are mostly medium risks.

## Benefits

Table 40 Benefits profile for methomyl<sup>a</sup>

Level of benefit	Sectors
Negligible	Beans & peas; Brassica; Field tomato; Grape; Lettuce; Maize; Arable; Sweetcorn
Low	Berryfruit; Blueberry; Capsicum; Greenhouse crops; Pasture; Strawberry
Medium	
High	

<sup>a</sup> Sectors not mentioned are those where methomyl is not used

Methomyl is used in a relatively small group of industry sectors to control a broad range of pests. Feedback from the greenhouse and capsicum sectors indicates that it is particularly valued for its broad spectrum properties and short withholding period, making it useful for cleanup close to harvest.



However, growers exporting produce to Japan cannot use it as it is not approved. Its uses in each sector provide a low economic benefit.

### International context

Limited information on the **benefits** provided by methomyl has been submitted to the EPA during the consultation process to date. The EPA would be prepared to consider further evidence in support of its use.

The international status of methomyl is set out in Appendix H. It is approved for use on a range of crops in the USA, EU and Australia, with the application of controls. Ornamental uses were voluntarily cancelled in the USA in 1998. In the EU, use on strawberries has been removed from end-use product labels. Methomyl has been nominated for review in Australia because of human health and residue concerns.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Request for additional information

The risk assessment could potentially be refined if any **higher tier operator studies, re-entry worker exposure monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

### Overall assessment

Methomyl is used in a small number of sectors, providing a low level of national economic benefit.

A relatively large number of use scenarios are associated with low risks for re-entry workers and bystanders, and almost all uses have low or medium risks for birds, even with the application of controls.

Closer evaluation of the risks and the possibility of applying further controls indicate that risks for bystanders and birds could be eliminated by restricting application to greenhouse use only.

Prohibiting the use of spray gun application in greenhouses would reduce operator risks to low or negligible, and use of greenhouse fogging equipment would reduce operator and re-entry worker risks to negligible.

**Taking into account the balance of human and environmental risks and economic benefits, it is recommended that the outdoor uses of plant protection substances containing methomyl are phased out, and use of knapsack, automatic or fogger application methods are required for uses in greenhouses. This would effectively eliminate bystander and environmental risks, reduce risks to operators and re-entry workers, and maintain the benefits of methomyl for growers of capsicums and greenhouse crops.**

### Controls



Additional controls that would further reduce risks for plant protection insecticides containing methomyl are listed below. This list includes relevant controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework. Buffer zones and a label warning of effects on bees are not listed due to the proposal to limit application to indoor use only.

- R-3** Maximum Application Rate: 480 g/ha
- R-7** Prohibition of (a) outdoor use, and (b) application indoors using a spray gun. This would remove all bystander and environmental risks, and reduce operator and re-entry worker risks.
- R-8** Identification as an OP-containing substance on label
- R-12** Restricted entry interval (REI) of 48 hours
- R-13** Approved handler required for all uses
- R-14** Signage to inform where methomyl has been applied to an indoor environment, and when unrestricted entry is allowed

## 10.12. Oxamyl

### Risks

The risks presented in Tables 41 and 42 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours

Table 41 Risks associated with modelled uses of oxamyl – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	6	4	3
Low	5	3	8
Medium	-	4	-
High	-	-	-
<b>Total</b>	11	11	11

The majority of use scenarios modelled for oxamyl have human health risks. Almost half have low risks for operators, most uses have low or medium risks for re-entry workers, and the majority have low bystander risks. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 42 Risks associated with modelled uses of oxamyl – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	11	2	All <sup>a</sup>
Low	-	-	-
Medium	-	4	-
High	-	5	-
Total	11	11	11

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Oxamyl is of negligible risk to aquatic organisms based on the use scenarios modelled. However, there are a number of medium to high risks to birds.

## Benefits

Table 43 Benefits profile for oxamyl<sup>a</sup>

Level of benefit	Sectors
Negligible	Blackcurrant; Pipfruit
Low	Capsicum; Carrots & parsnips; Cymbidiums; Greenhouse crops; Pasture
Medium	Arable; Ornamentals; Turf
High	

<sup>a</sup> Sectors not mentioned are those where oxamyl is not used

Oxamyl is used in several sectors. Its use in the majority of these is associated with a low economic benefit. In the arable sector oxamyl is used in carrot seed production for the control of carrot rust fly, root knot nematode and Argentine stem weevil, and is associated with a medium level of benefit. It is also used for nematodes in the turf industry, providing a medium level of economic benefit. Information provided to the EPA indicates that losses of up to 50% of crop value can occur if infestation is uncontrolled.

Oxamyl is an alternative to fenamiphos for nematode control, but is stated to be more expensive and not as efficacious.

## International context

The international status of oxamyl is presented in Appendix H. It is approved for use on specific crops in the USA, Canada, EU and Australia, with the application of controls to mitigate risks to human health and the environment. It is not approved for residential use in the USA.

## Request for further information

The risk assessment could potentially be refined if any **higher tier operator studies, re-entry worker exposure monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

## Overall assessment

Oxamyl is used in a variety of sectors, mainly for the control of nematodes. It is used by some of the larger industry sectors such as Arable and Turf, and these uses provide low or medium benefits to the New Zealand economy.

Oxamyl has risks for humans and birds in the majority of use scenarios modelled. However, in assessing oxamyl consideration was also given to the recommendation to phase out approvals of plant protection insecticides containing fenamiphos. This is because both are used for the same purpose, the control of nematodes. Oxamyl was reported by some sectors (e.g. carrot and parsnip) to be of lower efficacy and more expensive, but in other sectors (e.g. arable) it was reported as being critical.

**It is currently important to retain an OPC for the control of nematodes. Given the recommendation to the decision making committee to phase out approvals for plant protection insecticides containing fenamiphos, it is recommended that approvals for substances containing oxamyl are retained, with the application of additional controls. This is because oxamyl presents lower risks to human health and the environment than fenamiphos.**

## Controls

Additional controls that would further reduce risks for plant protection insecticides containing oxamyl are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

**R-3** Maximum Application Rate: 6720 g/ha

**R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals

**R-7** Prohibition of aerial application. Use of automatic application methods when used indoors.

- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-11** Notification of neighbours in advance of application when used outdoors
- R-12** Restricted entry interval (REI) of 24 hours (not required for dosing via irrigation)
- R-13** Approved handler required for all uses

### 10.13. Phorate

#### Risks

The risks presented in Tables 44 and 45 are those with the default controls and the following additional controls in place.

- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

Table 44 Risks associated with modelled uses of phorate – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	1	15	15
Low	11	-	-
Medium	3	-	-
High	-	-	-
<b>Total</b>	15	15	15

All but one of the use scenarios for phorate have low or medium risks to operators. In contrast, all uses have negligible risks for re-entry workers and bystanders. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 45 Risks associated with modelled uses of phorate – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks

Negligible	15	-	All <sup>a</sup>
Low	-	-	-
Medium	-	-	-
High	-	15	-
Total	15	15	15

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Phorate has negligible risks for aquatic organisms based on the modelled use scenarios. However, all uses have high risks for birds.

## Benefits

Table 46 Benefits profile for phorate<sup>a</sup>

Level of benefit	Sectors
Negligible	Strawberry, cucurbit
Low	Arable; Carrots & parsnips; Fodder & forage; Kumara; Pasture; Potato; Vegetables other
Medium	Ornamentals
High	

<sup>a</sup> Sectors not mentioned are those where phorate is not used

Phorate is used in a variety of sectors to control a range of pests. Its use in most of these sectors is associated with a low benefit for the national economy. Information from the arable and carrot and parsnips sectors indicates that diazinon is a preferred alternative to phorate for control of a variety of pests, while terbufos is preferred over phorate for tuber damaging pests in kumara.

## International context

The international status of phorate is detailed in Appendix H. Phorate is approved for use on specific crops in the USA. Its use in Canada has been phased out and it is not approved for use in the EU. Phorate is currently under review by the Australian Pesticides and Veterinary Medicines Authority (APVMA) because of human health concerns.

## Request for further information

The risk assessment for operators and the environment could potentially be refined if any **higher tier operator monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

## Overall assessment

Phorate is used to control a range of pests in several industry sectors. Its use is generally associated with low economic benefits, although its use for ornamentals has a medium benefit. For many pests, diazinon is a preferred alternative.

Almost all uses of phorate have low or medium risks for operators and high risks for birds, even with the application of controls.

**On the basis of the risks for operators and birds, the stated preference for using diazinon, and the relatively low benefits provided, it is recommended that the decision making committee considers phasing out approvals for phorate and substances containing phorate. A relatively short phase out period (e.g. up to 3 years) is proposed. Due to the short phase-out period, specific additional controls for phorate-containing substances have not been recommended.**

## 10.14. Pirimicarb

### Risks

The risks presented in Tables 47 and 48 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours

Table 47 Risks associated with modelled uses of pirimicarb – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	35	35	35
Low	-	-	-
Medium	-	-	-
High	-	-	-
<b>Total</b>	35	35	35

All of the pirimicarb use scenarios have negligible risks for operators, re-entry workers and bystanders.

Table 48 Risks associated with modelled uses of pirimicarb – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	34	3	All <sup>a</sup>
Low	1	29	-
Medium	-	3	-
High	-	-	-
Total	35	35	35

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

All but one of the modelled use scenarios for pirimicarb have negligible risks for aquatic organisms. The majority of uses have low bird risks, with a small number having negligible or medium risks. As with the human health assessment, even low risks are above the EPA's level of concern.

## Benefits

Table 49 Benefits profile for pirimicarb<sup>a</sup>

Level of benefit	Sectors
Negligible	Field tomato; Pipfruit
Low	Beans & peas; Blackcurrant; Brassica; Citrus; Cucurbits; Cymbidiums; Fodder & forage; Kumara; Pasture; Potato; Strawberry; Vegetables other
Medium	Arable; Maize; Stonefruit
High	

<sup>a</sup> Sectors not mentioned are those where pirimicarb is not used

Pirimicarb is used on many crops for the control of aphids, which can cause direct damage and also act as a vector for Barley Yellow Dwarf Virus, an issue of concern for the arable sector. It is valued in the stonefruit industry as a means of ensuring export fruit is free from aphids. In most of these sectors its use provides a low economic benefit, while use for the arable, maize and stonefruit sectors provides medium benefits to the national economy.

## International context

The international status of pirimicarb is detailed in Appendix H. Pirimicarb is not approved for use in the USA or Canada. It is approved for use on wheat in the EU and for use on a variety of crops in Australia.



### Request for further information

The risk assessment for operators and the environment could potentially be refined if any **higher tier operator, re-entry worker exposure monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Overall assessment

Pirimicarb is widely used for the control of aphids. Its use in many sectors provides a low benefit to the New Zealand economy, while use in the arable, maize and stonefruit sectors is associated with medium benefits.

Risks to human health from use of pirimicarb are negligible. Aquatic risks are also generally negligible, but the majority of uses have risks for birds.

**The overall risk profile for pirimicarb is generally low in comparison with many of the other OPCs under review, while it provides economic benefits through its use on a relatively large number of crops. On this basis, it is proposed that the decision making committee considers maintaining approvals for plant protection insecticides containing pirimicarb, with the application of controls.**

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing pirimicarb are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 24 hours
- R-13** Approved handler required for all uses

## 10.15. Pirimiphos-methyl

### Risks

The risks presented in Tables 50 and 51 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 12 hours

Table 50 Risks associated with modelled uses of pirimiphos-methyl – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	26	13	24
Low	2	15	4
Medium	-	-	-
High	-	-	-
<b>Total</b>	28	28	28

Most of the use scenarios modelled for pirimiphos-methyl have negligible risks for operators and bystanders. Just over half of the modelled uses have low risks for re-entry workers. Re-entry worker risks are generally negligible for indoor uses i.e. in greenhouses and grain silos. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 51 Risks associated with modelled uses of pirimiphos-methyl – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	14	13	All <sup>a</sup>
Low	7	4	-
Medium	7	11	-
High	-	-	-

Total	28	28	28
-------	----	----	----

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Around half of the modelled uses of pirimiphos-methyl have low or medium risks for aquatic organisms and birds. As with the human health risks, even low risks are above the EPA's level of concern.

## Benefits

Table 52 Benefits profile for pirimiphos-methyl<sup>a</sup>

Level of benefit	Sectors
Negligible	Grape, kiwifruit, citrus, brassica
Low	Avocado; Cymbidiums; Fodder & forage; Greenhouse crops; Home garden; Pasture; Persimmons
Medium	Arable; Ornamentals
High	Biosecurity

<sup>a</sup> Sectors not mentioned are those where pirimiphos-methyl is not used

Pirimiphos-methyl controls a wide range of pests and is used on a variety of crops. Its use for the majority of these is associated with low benefits for the national economy. It is considered critical for the treatment of grain silos for the arable sector, where its use provides medium economic benefits.

Pirimiphos-methyl may also be used for biosecurity purposes.

## International context

The international status of pirimiphos-methyl is detailed in Appendix H. Pirimiphos-methyl is approved for post-harvest use in the USA, for use in empty cereal stores in the EU, and for buildings and stored grain in Australia. It is not approved in Canada.

## Request for further information

The risk assessment could potentially be refined if any **higher tier operator or re-entry workers studies (for cymbidium and greenhouse crops), or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

## Overall assessment

Pirimiphos-methyl is used in a range of agricultural industry sectors, providing low economic benefits from the majority of these. It is particularly important for the arable industry where it is used in grain silos.

A number of the modelled uses of pirimiphos-methyl have risks for human health and the environment, even with application of controls. However, almost all of these risks could be eliminated by restricting its use to indoor application only. This would be consistent with its use overseas. Prohibiting the use of spray gun application in greenhouses would avoid the low operator risks associated with this treatment method.

**Taking into account the overall balance of risks and benefits, it is recommended that the decision making committee considers phasing out outdoor uses of plant protection insecticides containing primiphos-methyl, and requiring the use of knapsack, automatic or fogger application methods for uses in greenhouses. This would effectively eliminate the human and environmental risks, and maintain the benefits provided by pirimiphos-methyl use in the arable (grain silo), greenhouse and cymbidium industries.**

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing pirimiphos-methyl are listed below. This list includes relevant controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework. Buffer zones and a label warning of effects on bees are not listed due to the proposal to limit application to indoor use only.

- R-7** Prohibition of (a) outdoor use, and (b) application indoors using a spray gun. This would remove seven medium aquatic and bird risks. An 18 month phase-in period is proposed for this control.
- R-8** Identification as an OP-containing substance on label
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 12 hours
- R-13** Approved handler required for all uses
- R-14** Signage to inform where pirimiphos-methyl has been applied to an indoor environment, and when unrestricted entry is allowed

## 10.16. Prothiofos

### Risks

The risks presented in Tables 53 and 54 are those with the default controls and the following additional controls in place:

- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals

- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-12** Restricted entry interval (REI) of 48 hours

Table 53 Risks associated with modelled uses of prothiofos – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	-	-	-
Low	-	-	1
Medium	1	2	1
High	1	-	-
<b>Total</b>	2	2	2

Two use scenarios were modelled for prothiofos based on label rates, one for grapes and one for pipfruit. Use of prothiofos on grapes is associated with medium risks for operators and re-entry workers, and low risks for bystanders. Use on pipfruit is associated with high operator risks and medium re-entry worker and bystander risks. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 54 Risks associated with modelled uses of prothiofos – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	1	-	All <sup>a</sup>
Low	-	2	-
Medium	1	-	-
High	-	-	-
<b>Total</b>	2	2	2

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

Use of prothiofos on grapes has negligible aquatic risks and low risks for birds, while use on pipfruit has medium risks for aquatic organisms and low bird risks.

## Benefits

Table 55 Benefits profile for prothiofos<sup>a</sup>

Level of benefit	Sectors
Negligible	Pipfruit
Low	
Medium	
High	Grapes

<sup>a</sup> Sectors not mentioned are those where prothiofos is not used

Prothiofos is used on grapes for the control of mealybugs, which are a vector for Grapevine leafroll-associated virus type 3 (GLRaV-3). GLRaV-3 shortens the commercial lifespan of vineyards by causing serious deterioration in fruit quality and vine performance. The grape industry is worth over \$1 billion in annual sales and use of prothiofos is associated with high economic benefits for New Zealand. Prothiofos also has a label claim for pipfruit, but information from this sector indicates that it is not used for this purpose.

## International context

The international status of prothiofos is detailed in Appendix H. Prothiofos is not registered for use in the USA, EU or Canada. It is approved for use on several crops in Australia.

## Request for further information

The EPA was unable to obtain **dermal absorption information** for prothiofos for either the concentrated or diluted product. As a result default values were used. Information from studies conducted according to international best practice would potentially refine the risk assessment for human health. Guidance on this issue from the European Food Safety Authority can be found on their website<sup>22</sup>.

The risk assessment could potentially be refined if any **higher tier operator or re-entry worker studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

## Overall assessment

<sup>22</sup> <http://www.efsa.europa.eu/en/efsajournal/doc/2665.pdf>

Prothiofos is a critical insecticide for the grape sector and its use provides high economic benefits for New Zealand. However, its use has risks for operators, re-entry workers, bystanders and birds.

**Given the human and environmental risks and its apparent lack of use on pipfruit, it is recommended that the decision making committee considers phasing out approvals for plant protection insecticides containing prothiofos. However, given the high economic benefits provided by its use on grapes, a relatively long phase-out period (e.g. up to 10 years) is proposed. For the period while approvals for prothiofos-containing substances continue to be maintained, it is proposed that additional controls are put in place.**

### Controls

Additional controls that would further reduce risks for plant protection insecticides containing prothiofos are listed below. This list includes those controls listed at the beginning of this recommendation that were taken into account in the risk assessment and are relevant in the context of the proposed risk management framework.

- R-2** Phase out: A long phase-out (up to 10 years) is proposed
- R-3** Maximum Application Rate: 500 g/ha, Maximum Application Frequency: once/year. This will remove one high operator risk, 1 medium re-entry, bystander and aquatic risk.
- R-4** Buffer zones as specified in New Zealand Standard NZS:8409 Management of Agrichemicals
- R-7** Prohibition of aerial application
- R-8** Identification as an OP-containing substance on label
- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed
- R-11** Notification of neighbours in advance of application
- R-12** Restricted entry interval (REI) of 48 hours
- R-13** Approved handler required for all uses

## 10.17. Terbufos

### Risks

The risks presented in Tables 56 and 57 are those with the default controls and the following additional controls in place.

- R-9** Label warning of effects on bees
- R-10** Use of personal protective equipment (PPE and RPE) required, with minimum standards prescribed

Table 56 Risks associated with modelled uses of terbufos – human health

Overall risk	Number of use scenarios		
	Operator risks	Re-entry worker risks	Bystander risks
Negligible	-	9	9
Low	7	-	-
Medium	2	-	-
High	-	-	-
<b>Total</b>	9	9	9

All of the use scenarios modelled for terbufos have low or medium risks to operators. Risks for re-entry workers and bystanders are all negligible. Even low risks are above the EPA's level of concern (RQ value >1) and could potentially result in harmful effects in exposed individuals.

Table 57 Risks associated with modelled uses of terbufos – environment

Overall risk	Number of use scenarios		
	Aquatic risks	Bird risks	Bee risks
Negligible	9	-	All <sup>a</sup>
Low	-	-	-
Medium	-	9	-
High	-	-	-
<b>Total</b>	9	9	9

<sup>a</sup> All risks to bees are considered negligible as bees are only expected to be killed when they are directly exposed to the spray solution. Controls are assumed to be effective in restricting application to times when bees are not present.

All 11 of the uses of terbufos have medium bird risks.

## Benefits

Table 58 Benefits profile for terbufos<sup>a</sup>

Level of benefit	Sectors
Negligible	Beans and Peas; Maize; Sweetcorn; Carrot
Low	Fodder & forage; Kumara; Pasture
Medium	
High	

<sup>a</sup> Sectors not mentioned are those where terbufos is not used



Terbufos is used in a small number of sectors. Its use in three sectors is associated with a low benefit in terms of the national economy. Limited information on the value of terbufos was provided by the fodder and forage and pasture sectors. It is used pre-planting for kumara, to reduce symphillid numbers and aid plant establishment.

### International context

The international status of terbufos is detailed in Appendix H. Terbufos is approved for use on a number of crops in the USA, with the application of controls. It is not approved for use in the EU, and its use was phased out by the Canadian Pest Management Regulatory Agency in 2006. Terbufos has been nominated for review by the Australian Pesticides and Veterinary Medicines Authority (APVMA) because of environmental and human health concerns.

Recommendations for each substance are not yet final recommendations, so provision of further information to inform the risk assessments is still desirable.

### Request for further information

The risk assessment for operators and the environment could potentially be refined if any **higher tier operator monitoring studies, or higher tier ecotoxicological information** are available. Such data have previously been requested but none has been submitted to date.

### Overall assessment

Terbufos is only used in a small number of agricultural sectors where its use has a low economic benefit.

All of the modelled use scenarios have low or medium risks for operators and medium risks to birds, even in the presence of controls.

**On the basis of the risks for operators and birds, and the relatively low benefits provided, it is recommended that the decision making committee considers phasing out approvals for substances containing terbufos. A relatively short phase-out period (e.g. up to 3 years) is proposed. Due to the short phase-out period, specific additional controls for terbufos-containing substances have not been proposed.**

## 10.18. Home garden use

OPC plant protection insecticides pose a number of risks to human health and the environment. In many cases these risks can be mitigated through the use of personal protective equipment or implementation of buffer zones and re-entry intervals, but such measures are unlikely to be appropriately applied in a home environment.

The EPA considers that home users do not have the knowledge or awareness to manage these high hazard products. The home garden is also a place where the most sensitive individuals (e.g. very young children) are most likely to be present. Information on poisoning incidents involving OPCs

indicates that a large proportion of accidental exposures relate to exposures at home, and many of these appear to involve children.

**To mitigate this risk the EPA proposes the application of an approved handler control on all of the substances for which approvals are to be retained.** This will ensure that only trained agrichemical handlers will apply OPCs in home gardens and they should inform the home owner as to the risks of the substances.

## 10.19. Substances not used for plant protection purposes

The reassessment includes 11 OPCs that either have HSNO approvals as active ingredients only, or are included in products that are not registered under the ACVM Act as plant protection products in New Zealand (Table 59). No formal risk assessment was conducted for these substances as they are not in use. **However, due to the inherent risks associated with OPCs, and the lack of benefit provided by these particular substances as evidenced by the fact they are not used, it is recommended that their HSNO approvals are revoked. A phase-out period of 6 months is proposed to allow adequate time for disposal of any remaining stocks.**

In addition, a substance has been identified containing the active ingredients carbaryl, maldison and rotenone. This substance has no ACVM approval and to the best of the EPA staff's knowledge is not currently in use. **It is recommended that the approval (HSR000185) for this substance is also revoked.**

For one substance, chlorpyrifos-methyl, the active ingredient is used in a substance that is manufactured in New Zealand for export only, and in a substance that can only be used in the manufacture of other substances (Table 60). **It is recommended that the approvals for the active ingredient and these formulated products are retained, as the risks to the New Zealand population and environment from their manufacture and export only are expected to be minimal.**

Table 59 Substances with HSNO approvals as active ingredients only, or not included in products registered under the ACVM Act as plant protection products in New Zealand

Substance description	HSNO Approval Number
Wettable powder containing 800 g/kg bendiocarb	HSR000451
Benomyl (active)	HSR002816
Wettable powder containing 500 g/kg benomyl	HSR000347
Dustable powder containing 2 g/kg carbaryl, 20 g/kg maldison and 5 g/kg rotenone	HSR000185

Substance description	HSNO Approval Number
Carbofuran (active)	HSR002928
Carbosulfan (active)	HSR003451
Granular material containing 100 g/kg carbosulfan	HSR000696
Dichlofenthion (active)	HSR003685
Ethion (active)	HSR002985
Famphur (active)	HSR002847
Isazofos (active)	HSR002857
Omethoate (active)	HSR002842
Phoxim (active)	HSR003195
Emulsifiable concentrate containing 500 g/litre phoxim	HSR000217
Emulsifiable concentrate containing 300 g/litre pyrazophos	HSR000215

Table 60 Chlorpyrifos-methyl is used in a substance manufactured in New Zealand for export only, and a substance that can only be used in the manufacture of other substances

Substance description	HSNO Approval Number
Chlorpyrifos-methyl (active)	HSR004064
Liquid containing 400 - 500 g/litre chlorpyrifos methyl	HSR100299
Liquid containing 500 - 600 g/litre chlorpyrifos methyl	HSR100326

**10.1** Do you agree with the recommendations for each substance? If not, please identify the substance(s) and explain how the recommendation(s) should differ, providing evidence to support your view.

## Part 4: Appendices



## Appendix A: Substances with non-plant protection uses and not included in the scope of the current reassessment

Substance description	HSNO Approval Number
<b>Bendiocarb (active)</b>	<b>HSR003444</b>
Flammable liquid containing 30 - 60 g/litre bendiocarb	HSR002235
<b>Carbaryl (active)</b>	<b>HSR002822</b>
Dustable powder containing 50 g/kg carbaryl	HSR000672
Aerosol containing 0.3 - 0.7% carbaryl and 0.4 - 0.8% piperonyl butoxide	HSR001811
Liquid containing 1.4 - 2.6% 2-hydroxybenzoic acid, 0.7 - 1.3% carbaryl and 0.11 - 0.29% chlorocresol	HSR001825
Wettable powder containing 800 g/kg carbaryl	HSR000819
Carbaryl 80 (new)	HSC000269
<b>Chlorfenvinphos (active)</b>	<b>HSR003564</b>
Liquid containing 900 - 1100 g/litre chlorfenvinphos	HSR001809
Formula C4	HSR007945
Formula C5	HSR007946
<b>Chlorpyrifos (active)</b>	<b>HSR002942</b>
Ready to use bait containing 5 g/kg chlorpyrifos	HSR000164
Paste containing 5 g/kg chlorpyrifos	HSR000166
Water dispersible granule containing 750 g/litre chlorpyrifos	HSR000167
Microencapsulated suspension concentrate containing 200 g/litre chlorpyrifos	HSR000168
Emulsifiable concentrate containing 240 g/litre chlorpyrifos. Also contains xylene	HSR000169
Ready to use liquid containing 20 g/litre chlorpyrifos	HSR000172
Flammable liquid containing 2.5 - 3 % chlorpyrifos	HSR001810
Flammable liquid containing 7 - 13 g/litre chlorpyrifos and 100 - 120 g/litre cypermethrin	HSR001812
Flammable liquid containing 120 - 180 g/litre chlorpyrifos	HSR001814
Flammable liquid containing 32 - 50% chlorpyrifos	HSR001816

Substance description	HSNO Approval Number
<b>Coumaphos (active)</b>	<b>HSR002829</b>
Liquid containing 48 - 65 g/litre coumaphos	HSR001804
Flammable liquid containing 13 - 16.5% coumaphos	HSR001923
Solid containing 2.6 - 3% coumaphos, 1 - 2.5% propoxur and 3 - 7% sulphanilamide	HSR002229
CheckMite+	HSC000267
<b>Diazinon (active)</b>	<b>HSR002836</b>
Collar containing 140 - 180 g/kg diazinon and 1.7 - 3.2 g/kg pyriproxyfen	HSR001802
Collar containing 140 - 180 g/kg diazinon	HSR001807
Solid containing 20 - 50 g/kg diazinon	HSR001808
Flammable liquid containing 360 - 440 g/litre diazinon	HSR001953
Flammable liquid containing 0.26 - 5% diazinon	HSR002288
General purpose Insect spray	HSR001741
<b>Dichlorvos (active)</b>	<b>HSR002838</b>
Flammable aerosol containing 3.1 g/litre dichlorvos and 8.7 g/litre propoxur	HSR000207
Ready to use liquid containing 4.4 g/litre dichlorvos and 9.6 g/litre propoxur	HSR000209
Emulsifiable concentrate containing 1000 g/litre dichlorvos (multiple uses)	HSR000211
Aerosol containing 50 g/kg dichlorvos (multiple uses)	HSR000212
Emulsifiable concentrate containing 1140 g/litre dichlorvos (multiple uses)	HSR000213
<b>Fenitrothion (active)</b>	<b>HSR002849</b>
Ready to use liquid containing 7.8 g/litre fenitrothion	HSR000202
Solid containing 100 - 150 g/kg narasin	HSR002021
Solid containing 75 - 95 g/kg narasin and 75 - 95 g/kg nicarbazin	HSR002035
<b>Fenthion (active)</b>	<b>HSR002850</b>
Flammable liquid containing 100 - 202 g/litre fenthion	HSR002237
<b>Maldison (malathion) (active)</b>	<b>HSR003011</b>
Solid containing 25 - 40 g/kg morantel citrate	HSR001843
Solid containing 2.6 - 4.6% maldison	HSR002238

Substance description	HSNO Approval Number
Fyfanon 440EW (multiple uses)	HSR100380
<b>Methomyl (active)</b>	<b>HSR002864</b>
Bait containing 10 g/kg methomyl	HSR000675
<b>Pirimiphos methyl (active)</b>	<b>HSR002870</b>
Emulsifiable concentrate containing 500 g/litre pirimiphos-methyl	HSR000196
Dustable powder containing 20 g/kg pirimiphos-methyl	HSR000197
<b>Propetamphos (active)</b>	<b>HSR003646</b>
Liquid containing 35 - 45% p-dichlorobenzene and 1.2 - 2% propetamphos	HSR001796
Liquid containing 36 - 44% propetamphos	HSR001803
Liquid containing 12.8 - 18.5% propetamphos	HSR001806
Liquid containing 100 - 120 g/litre propetamphos	HSR001948
Liquid containing 0.04 - 0.075% propetamphos	HSR002337
Flammable liquid containing 30 - 44% propetamphos	HSR002338
<b>Propoxur (active)</b>	<b>HSR003072</b>
Emulsifiable concentrate containing 200 g/litre propoxur	HSR000195
Ready-to-use liquid containing 7.9 g/litre propoxur	HSR000199
Flammable aerosol containing 3.1 g/litre dichlorvos and 8.7 g/litre propoxur	HSR000207
Ready to use liquid containing 4.4 g/litre dichlorvos and 9.6 g/litre propoxur	HSR000209
Flammable aerosol containing 0.4 g/kg cyfluthrin, 10 g/kg propoxur and 0.4 g/kg transfluthrin	HSR000283
Dustable powder containing 10 g/kg propoxur and 5 g/kg triflumuron	HSR000725
Collar containing 7.5 - 9.8% propoxur	HSR001805
Solid containing 2.6 - 3% coumaphos, 1 - 2.5% propoxur and 3 - 7% sulphanilamide	HSR002229
<b>Temephos (active)</b>	<b>HSR002880</b>
Liquid containing 300 - 400 g/litre temephos	HSR001823
Solid containing 16 - 30 g/kg temephos	HSR001826
Flammable liquid containing 10 - 13% temephos	HSR001949
Liquid containing 200 - 210 g/litre temephos	HSR002239

Substance description	HSNO Approval Number
<b>Tetrachlorvinphos (active)</b>	<b>HSR003430</b>
Liquid containing 0.5 - 0.9% alpha-cypermethrin, 6 - 9% piperonyl butoxide and 1.4 - 2.6% tetrachlorvinphos	HSR001776



## Appendix B: Active ingredients and substances included in the scope of this Application

Table 61: Active ingredients and substances approved under the HSNO Act included in the present reassessment

Substance description	HSNO Approval Number
<b>Acephate (active)</b>	<b>HSR002724</b>
Soluble concentrate containing 195 g/litre acephate. Also contains ethylene glycol	HSR000154
Water soluble powder containing 750 - 970 g/kg acephate	HSR000155
Emulsifiable concentrate containing 45 g/litre acephate and 8.8 g/litre myclobutanil	HSR000156
Emulsifiable concentrate containing 45 g/litre acephate and 39 g/litre triforine	HSR000157
Emulsifiable concentrate containing 22.5 g/litre acephate and 19.5 g/litre triforine	HSR000158
<b>Substances containing bendiocarb as the active ingredient</b>	<b>-</b>
Wettable powder containing 800 g/kg bendiocarb	HSR000451
<b>Benomyl (active)</b>	<b>HSR002816</b>
Wettable powder containing 500 g/kg benomyl	HSR000347
<b>Substances containing carbaryl as the active ingredient</b>	<b>-</b>
Dustable powder containing 2 g/kg carbaryl, 20 g/kg maldison and 5 g/kg rotenone	HSR000185
Wettable powder containing 150 - 200 g/kg carbaryl and 150 - 200 g/kg mancozeb	HSR007696
Suspension concentrate containing 100 g/litre carbaryl	HSR000441
Suspension concentrate containing 500 g/litre carbaryl (Substance A)	HSR000450
Wettable powder containing 115 g/kg carbaryl, 250 g/kg copper as copper oxychloride and 284 g/kg sulphur	HSR000594
Suspension concentrate containing 500 g/litre carbaryl (Substance C)	HSR000680
Suspension concentrate containing 500 g/litre carbaryl (Substance B)	HSR000681
<b>Carbofuran (active)</b>	<b>HSR002928</b>
<b>Carbosulfan (active)</b>	<b>HSR003451</b>
<b>Granular material containing 100 g/kg carbo-sulfan</b>	<b>HSR000696</b>

Substance description	HSNO Approval Number
<b>Substances containing chlorpyrifos as the active ingredient</b>	<b>-</b>
Granular material containing 100 g/kg chlorpyrifos	HSR000163
Wettable powder containing 500 g/kg chlorpyrifos	HSR000165
Granular material containing 50 g/kg chlorpyrifos. Also contains xylene	HSR000170
Emulsifiable concentrate containing 480 g/litre chlorpyrifos	HSR000171
Wettable powder containing 56.25 g/kg carbendazim, 93.75 g/kg chlorpyrifos and 400 g/kg mancozeb	HSR000173
Emulsifiable concentrate containing 450 - 500 g/litre chlorpyrifos	HSR000224
Emulsifiable concentrate containing 480 g/litre chlorpyrifos. Also contains xylene	HSR000225
Solid containing 50 - 55 g/kg chlorpyrifos	HSR007698
Liquid containing 250 - 350 g/litre chlorpyrifos	HSR100298
Rampage	HSR100018
<b>Chlorpyrifos-methyl (active)</b>	<b>HSR004064</b>
<b>Liquid containing 500 - 600 g/litre chlorpyrifos methyl</b>	<b>HSR100326</b>
<b>Liquid containing 400 - 500 g/litre chlorpyrifos methyl</b>	<b>HSR100299</b>
<b>Substances containing diazinon as the active ingredient</b>	<b>-</b>
Emulsifiable concentrate containing 800 g/litre diazinon (Substance A)	HSR000174
Granular material containing 200 g/kg diazinon	HSR000175
Granular material containing 50 - 54 g/kg diazinon	HSR000176
Wettable powder containing 500 g/kg of diazinon	HSR000177
Emulsifiable concentrate containing 200 g/litre diazinon	HSR000178
Emulsifiable concentrate containing 500 g/litre diazinon and 25 g/litre permethrin	HSR000179
Emulsion (oil in water) containing 600 g/litre diazinon	HSR007700
Emulsion (oil in water) containing 500 - 600 g/litre diazinon	HSR000180
Emulsifiable concentrate containing 800 g/litre diazinon (Substance B)	HSR000181
Emulsifiable concentrate containing 95 g/litre diazinon	HSR000182
Emulsifiable concentrate containing 800 g/litre diazinon (Substance C)	HSR000183

Substance description	HSNO Approval Number
Emulsifiable concentrate containing 600 g/litre diazinon	HSR000184
Diazamax 800	HSR002481
<b>Dichlofenthion (active)</b>	<b>HSR003685</b>
<b>Substances containing dichlorvos as the active ingredient</b>	-
DDVP insecticide strip	HSR000126
J72.03	HSR001757
<b>Dimethoate (active)</b>	<b>HSR002841</b>
Emulsifiable concentrate containing 400 g/litre dimethoate	HSR000188
Emulsifiable concentrate containing 100 g/litre dimethoate	HSR000191
Emulsifiable concentrate containing 500 g/litre dimethoate	HSR000193
Perfekthion S-1	HSR000965
Danadim	HSR100129
<b>Ethion (active)</b>	<b>HSR002985</b>
<b>Famphur (active)</b>	<b>HSR002847</b>
<b>Substances containing fenamiphos as the active ingredient</b>	-
Emulsifiable concentrate containing 400 g/litre fenamiphos	HSR000198
Nemacur 400EC	HSR000956
Fenafos 400	HSR002480
Nematak 400EC	HSR007769
Nemacur CS	HSR007894
Canyon	HSR100282
<b>Substances containing fenitrothion as the active ingredient</b>	-
Emulsifiable concentrate containing 1000 g/litre fenitrothion	HSR000201
<b>Isazofos (active)</b>	<b>HSR002857</b>
<b>Substances containing maldison (malathion) as the active ingredient</b>	-
Dustable powder containing 2 g/kg carbaryl, 20 g/kg maldison and 5 g/kg rotenone	HSR000185
Technical concentrate containing 950 g/litre maldison	HSR000189
Emulsifiable concentrate containing 500 g/litre maldison	HSR000190
Malathion-treated wheat	HSR100407
<b>Methamidophos (active)</b>	<b>HSR002863</b>

<b>Substance description</b>	<b>HSNO Approval Number</b>
Soluble concentrate containing 600 g/litre methamidophos (Substance B)	HSR000203
Soluble concentrate containing 600 g/litre methamidophos (Substance A)	HSR000226
<b>Substances containing methomyl as the active ingredient</b>	-
Soluble concentrate containing 200 g/litre methomyl	HSR000584
Armourcrop Insecticide	HSR007761
<b>Omethoate (active)</b>	<b>HSR002842</b>
<b>Substances containing oxamyl as the active ingredient</b>	-
Soluble concentrate containing 240 g/litre oxamyl	HSR000791
<b>Phorate (active)</b>	<b>HSR003058</b>
<b>Granular product containing 200 g/kg phorate</b>	<b>HSR000210</b>
<b>Phoxim (active)</b>	<b>HSR003195</b>
<b>Emulsifiable concentrate containing 500 g/litre phoxim</b>	<b>HSR000217</b>
<b>Substances containing pirimicarb as the active ingredient</b>	-
<b>Water dispersible granule containing 500 g/kg pirimicarb</b>	<b>HSR000703</b>
<b>Water dispersible granule containing 500 g/kg pirimicarb</b>	<b>HSR000704</b>
<b>Piritek</b>	<b>HSR007884</b>
<b>Dovetail</b>	<b>HSR008052</b>
<b>Substances containing pirimiphos-methyl as the active ingredient</b>	-
Smoke generator containing 225 g/kg pirimiphos-methyl	HSR000186
Emulsifiable concentrate containing 25 g/litre permethrin and 475 g/litre pirimiphos-methyl	HSR000187
Emulsifiable concentrate containing 5 g/litre permethrin and 95 g/litre pirimiphos-methyl	HSR000192
Attack	HSR100602
<b>Substances containing prothiofos as the active ingredient</b>	-
Emulsifiable concentrate containing 500 g/litre prothiofos	HSR000200
<b>Substances containing pyrazophos as the active ingredient</b>	-
<b>Emulsifiable concentrate containing 300 g/litre pyrazophos</b>	<b>HSR000215</b>
<b>Substances containing terbufos as the active ingredient</b>	-
Granular product containing 200 g/kg terbufos	HSR000216

## Appendix C: Summary and Analysis Reports

Feedback received from stakeholders, including submissions on diazinon, acephate, methamidophos and dichlorvos, was compiled into Summary and Analysis reports. These reports provide an overview of the risks and benefits for individual sectors from using OPCs. They provide the rationale for the selection of the qualitative descriptors which are used to compare the overall risks and benefits of the OPCs.

The risks modelled include updated information provided to the EPA by users. The benefits are a reflection of feedback that the EPA has received from stakeholders, and also takes into account the peer review commissioned by the EPA.

The Summary and Analysis reports for the following sectors can be accessed at:

<http://www.epa.govt.nz/search-databases/Pages/applications-details.aspx?appID=APP201045>

Arable	Asparagus	Avocados
Beans & peas	Berryfruit	Biosecurity
Blackcurrants	Blueberry	Brassica
Capsicum	Carrots & Parsnips	Citrus
Cucurbits	Cymbidium	Feijoa
Field tomato	Fodder and forage	Grapes
Greenhouse crops	Home and garden	Kiwifruit
Kumara	Lettuce	Maize
Mushrooms	Onions	Ornamentals
Passionfruit	Pasture	Persimmons
Pipfruit	Potatoes	Stonefruit
Strawberries	Sweetcorn	Tamarillo
Turf	Vegetables other	

## Appendix D: Risk assessment methodology

### Introduction

This document provides background information as to how the exposure and risk assessments for human health and the environment have been derived.

Section 1 describes the risk assessment used to assess the risks of organophosphate and carbamate plant protection products.

Section 2 describes the critical toxicological, environmental fate and ecotoxicological values used in the risk assessment.

## Section 1 Risk Assessment

### Operator

All operator exposures were compared to the Acceptable Operator Exposure Level (AOEL) shown in Table 67. This ratio is known as the Risk Quotient (RQ) value, with values less than 1 indicating negligible risk. The dermal absorption of the spray and concentrate used in the modelling are also included in Appendix 1. These risk assessments all assumed the operator has a body weight of 70 kg.

#### **Operator exposure to sprayed pesticides using ground boom, airblast or knapsack application**

The UK Chemicals Regulation Directorate (CRD) version of the German Federal Biological Research Centre for Agriculture and Forestry (BBA) operator exposure model was used to calculate exposure (Chemicals Regulation Directorate, 2011). All of the exposure data and assumptions for this model are published online (Chemicals Regulation Directorate, 2011a). The model estimates the exposure of an operator and evaluates the impact of wearing different forms of Personal Protective Equipment (PPE) using exposure reduction factors which have been empirically derived (Chemicals Regulation Directorate, 2011a).

Where possible the work rates (ha/day) were taken from feedback received from the call for information in September 2011. Where this information was not provided, the following work rates for boom, airblast and knapsack spraying were assumed:

- Boom 20 ha/day; (Chemicals Regulation Directorate, 2011)
- Airblast 8 ha/day; (Chemicals Regulation Directorate, 2011)
- Knapsack 1 ha/day; (Chemicals Regulation Directorate, 2011)

Exposure was estimated assuming the following PPE levels:

- Full PPE (coveralls, sturdy footwear, hood and visor and gloves) during mixing, loading and application (excluding respirator);

- Full PPE (coveralls, sturdy footwear, hood and visor and gloves) during mixing, loading and application (including either a FFP2SL or P2 respirator).

Due to the relatively toxic nature of the OP and carbamate insecticides in general only these higher protection levels have been included in the risk assessment as clearly the risks from lower levels of protection will be higher.

### **Higher tier operator exposure monitoring studies**

The manufacturer of dimethoate and maldison supplied higher tier information including operator biological monitoring for some exposure scenarios which were considered by EPA Staff to be relevant to certain New Zealand applications. Staff have used these data in preference to the modelled exposure estimates where appropriate.

### **Operator exposure to sprayed pesticides by aerial application**

This was modelled using the same approach used for ground boom/airblast application but only considering mixing and loading exposure, as it was assumed that exposure of the pilot during application would be minimal.

### **Operator exposure to pesticides manually sprayed in greenhouses**

Risks from spraying pesticides in greenhouses were estimated using the Dutch greenhouse model (EFSA, 2008a). Where possible the work rates (ha/day) were taken from feedback received from the call for information. Where this information was not provided, it was assumed that an operator would treat 1.25 hectare per day. Risks were assessed assuming that full PPE (coveralls and gloves) would be worn by an operator either with or without a respirator.

### **Operator exposure to pesticides sprayed by automatic equipment in a greenhouse**

Risks from automated spraying were estimated by using the mixing and loading component of the UK version of the German BBA model. Where possible the work rates (ha/day) were taken from feedback received from the call for information. Where this information was not provided, it was assumed that an operator would mix enough spray to treat 1.25 hectare per day. Risks were assessed assuming that full PPE (coveralls and gloves) would be worn by the mixer/loader both with/without a respirator.

### **Operator and re-entry worker exposure from application of oxamyl through an irrigation system in greenhouses**

Risks from application through an irrigation system were estimated by using the mixing and loading component of the UK version of the German BBA model. Work rates (ha/day) were taken from feedback received from the call for information. Risks were assessed assuming that full PPE (coveralls and gloves) would be worn by an operator either with or without a respirator. It was also assumed that there would be no re-entry worker exposure with this method of application.

### **Operator exposure from greenhouse application using a trolley boom sprayer**

The EPA were unable to obtain any exposure models or operator monitoring datasets for this application method. To assess operator exposures the EPA used the exposure reduction factors suggested by Nuyttens *et al.* (2009) for novel application equipment in greenhouse assuming that use of a trolley boom sprayer would reduce operator dermal exposure by a factor of 60.

### Operator exposure to pesticides fogged in a greenhouse

Risks from fogged pesticides were estimated using the same approach as used in the dichlorvos application (ERMA, 2010). This assumed that mixing and loading exposure for fogging would be the same as mixing and loading exposure of a handheld sprayer using the UK version of the BBA model (CRD, 2011). Data from the Pesticide Handler Exposure Database (PHED) were used to estimate applicator exposure (see table 1). Protection factors to account for PPE were taken from the UK version of the BBA model. For Ready To Use (RTU) dichlorvos canisters, the exposure values have been taken from the Australian Pesticides and Veterinary Medicines Authority (APVMA) review of dichlorvos. These values were based on Pesticide Handlers Exposure Database (PHED) exposure model for high pressure handwand application modified to address the expectation that the efflux from a manual pressure gun would be significantly less diffuse and more directional, to estimate dermal exposures during enclosed space applications.

Table 62: Exposure of an applicator to active ingredients which are applied using fogging.

Dermal mg/kg a.s.			Inhalation mg/kg a.s.
Head	Hands	Body	
0.018	2.68	0.26	0.174

### Operator exposure from application of pirimiphos methyl to grain on conveyor belts

For this assessment it was assumed that exposure would only occur during mixing and loading of the product (EFSA, 2005b). This exposure was calculated using the UK version of the mixing and loading component of the German BBA model. It was assumed that an operator would handle 1 kg of active ingredient per day.

### Operator exposure from application of pirimiphos methyl to structural treatment to empty grain silos

For this assessment the EPA used exposure estimates derived from biological monitoring of operators carrying out structural treatment (EFSA, 2005b). This data was generated to support registration of pirimiphos methyl in the European Union and show that an operator wearing full PPE and a respirator would be exposed to 0.0048 mg/kg bw/day per kg of pirimiphos methyl handled. It is assumed that an operator would handle 1 kg of active ingredient per day.



### **Operator exposure from application of pirimiphos methyl smoke bombs to enclosed spaces**

It was assumed that provided smoke bombs are used in accordance with all relevant precautions outlined in the Material Safety Data Sheet (MSDS) by an appropriately trained person there should be no operator exposure from this application method.

### **Operator exposure to granules applied by tractor spreading**

Operator exposure to granules during application was estimated using the UK versions of the Pesticide Handlers Exposure Database (PHED) granule model (Chemicals Regulation Directorate, 2010a). Where possible the work rates (ha/day) were taken from feedback received from the call for information. Where this information was not provided, it was assumed that 20 ha/day would be treated by a tractor application. For these scenarios the risks associated with wearing normal work wear and chemical resistant gloves with and without a respirator were estimated.

### **Operator exposure to granules applied by tractor drilling, turnip boxes or aerial application**

Operator exposure to granules during application was estimated using the UK versions of the Pesticide Handlers Exposure Database (PHED) granule model considering only the loading of the granules (Chemicals Regulation Directorate, 2010a). Where possible the work rates (ha/day) were taken from feedback received from the call for information. Where this information was not provided, it was assumed that 20 ha/day would be treated by a tractor application and 50 ha/day by aerial application. For these scenarios the risks associated with wearing normal work wear and chemical resistant gloves with or without a respirator were estimated.

### **Operator exposure to granules applied by a handheld shaker**

Operator exposure to granules during application was estimated using the UK version of the Pesticide Handlers Exposure Database (PHED) granule model (Chemicals Regulation Directorate, 2010a). Where possible the work rates (ha/day) were taken from feedback received from the call for information. Where this information was not provided, it was assumed that 1 ha/day would be treated by handheld application. For these scenarios the risks associated with wearing normal work wear and chemical resistant gloves with or without a respirator were estimated.

### **Operator exposure when dipping plant material and bulbs**

Operator exposure was estimated for mixing and loading of the product using the UK version of the BBA model. Exposure to applicators was estimated using values from the Dutch Dipping model (EFSA, 2008b). This assumed that an applicator would get exposed to 0.0278 ml of dipping solution per minute, that they would use 300 litres of dipping solution per day and carry out dipping for 8 hours per day. Exposure was estimated assuming that an operator would wear full Personal Protective Equipment (PPE) and/or a respirator.

## Operator exposure to dichlorvos strips

As a reasonable worst case assumption it was assumed that an operator would be exposed to 80 traps per day for 20 seconds. This equates to 0.44 hours exposure time per day. The predicted inhalation exposure was assumed to be 0.21 mg dichlorvos/hour. This is based on the assumption that 41% of the 520 mg dichlorvos on a strip will be emitted continuously over the 6 week (1008 hours) service life. (ERMA, 2010). This would result in a total operator exposure of 0.093 mg/day which is equivalent to 0.00133 mg/kg bw/day (for a 70 kg worker).

## Re-entry workers

### Re-entry worker exposure

Re-entry exposure was estimated for all scenarios where pesticides are sprayed and re-entry workers may be required to carry out work activities after the application (aerial, ground boom, airblast, fogging, knapsack and greenhouse (manual and automatic)).

The re-entry worker exposure is based on dermal exposure through contact with foliar residues only; inhalation exposure or exposure to other contaminated surfaces (e.g. soil) was not accounted for. Exposure following re-entry intervals is calculated using the formula below which was developed by other regulators (Chemicals Regulation Directorate, 2010b and EUROHAIR, 1997).

$$\text{Re-entry worker exposure} = \frac{\text{DFR} \times \text{TC} \times \text{WR} \times \text{AR} \times \text{DA}}{\text{BW}}$$

Where:

DFR is the Dislodgeable Foliar Residue (this value has either been provided to us by submitters based on overseas information or in the absence of information the EPA have assumed a value of 3 µg/cm<sup>2</sup> per kg a.i./ha (default value used by European regulators in the absence of data))

TC is the Transfer Coefficient for the anticipated activity being performed (cm<sup>2</sup>/h, default values for the TC are given in Table 62)

WR is the Work Rate per day (8 h/day)

AR is the Application Rate (kg active ingredient/ha)

BW is Body Weight (70 kg)

DA is Dermal Absorption, expressed as a proportion. Note that the most appropriate dermal absorption value to use is the value for the active ingredient itself (not the dilute spray) but when this was not available the more conservative of the dermal absorption values for the product or the spray was used (EUROPEM II, 2002).

### Transfer coefficients

Transfer coefficients (TCs) refer to the amount of contact between a re-entry worker and foliage. These can be regarded as independent of the active ingredient/product used and depend on the crop type and the activity that the re-entry worker is carrying out (EUROPOEM II, 2002). The values in Table 63 obtained from overseas regulators, were used.

Table 63 Default transfer coefficients used for the re-entry worker risk assessment

Crop	Activity	Transfer coefficient (cm <sup>2</sup> /h)	Source of transfer coefficient
Vegetables	Reach/Pick	2500	EUROPOEM, 2002
Fruit from trees	Search/Reach/Pick	4500	EUROPOEM, 2002
Berries	Reach/pick	3000	EUROPOEM, 2002
Ornamentals	Cut/Sort/Bundle/Carry	5000	EUROPOEM, 2002
Turf	Mowing	1000	NOHSC, 2011
Turf	Transplanting, hand weeding	20000	NOHSC, 2011
Pasture	Mowing	500	EFSA, 2005a
Cereals	scouting, irrigation, weeding mature/full foliage plants	1000	USEPA, 2007

These transfer coefficients all assume that re-entry workers are wearing long trousers and long sleeved shirts and are not wearing gloves.

### Impact of wearing PPE

When appropriate information is available, the transfer coefficients suggested in the EUROPOEM document have been divided between hand exposure and rest-of-body exposure. From this information the exposure of re-entry workers wearing chemical resistant gloves is estimated. In the absence of other information, it was assumed that chemical resistant gloves reduce hand exposure by 90 %, a default used by other regulators and research organisations (TNO, 2007; California Environmental Protection Agency, 2007). These revised TCs are shown in Table 64. Re-entry risks were calculated for workers wearing gloves and those not wearing gloves.

The impact of wearing gloves cannot be calculated for some crops/activities since TCs attributable to hands only are not available.

Table 64 Impact of gloves on re-entry worker transfer coefficients

Crop	Transfer coefficients for workers not wearing gloves (cm <sup>2</sup> /h)	Transfer coefficients attributable to hand exposure (cm <sup>2</sup> /h)	Transfer coefficients attributable to hand exposure assuming 90% reduction in hand exposure due to wearing gloves (cm <sup>2</sup> /h)	Transfer coefficients for re-entry workers wearing gloves (cm <sup>2</sup> /h)
Vegetables	2500	2200	220	520
Ornamentals	5000	4000	400	1400
Berries	3000	2500	250	750
Fruit trees	4500	2500	250	2250

### Multiple applications

When there are multiple applications, the exposure after the final application was estimated. It was assumed that Dislodgeable Foliar Residue (DFR) is the only parameter that is altered by multiple applications.

DFR was estimated immediately following the  $n^{\text{th}}$  application ( $\text{DFR}_{n(a)}$ ) by assuming first order dissipation and using the following equation derived from the FOCUS guidance (FOCUS, 1997):

$$\text{DFR}_{n(a)} = \text{DFR}_{\text{single-application}} \times (1 - e^{-nki}) / (1 - e^{-ki})$$

Where:

$n$  is the number of applications

$k$  is the rate constant for foliar dissipation

$i$  is the interval between applications (days)

If submitters provided information to the EPA about the foliar half life this value was used to calculate  $k$  ( $k = \ln 2 / \text{DT}_{50}$  (days) where  $\text{DT}_{50}$  = foliar half life (days)), otherwise if  $k$  was unknown, the FOCUS default of 0.0693, corresponding to a half-life<sub>foliar</sub> of 10 days, was used (FOCUS, 2003).

The reduction in  $\text{DFR}_{n(a)}$  over time after last application is then given by:

$$\text{DFR}_{n(a)+t} = \text{DFR}_{n(a)} \times e^{-kt}$$

where  $t$  is days since last application.

### Re-entry worker exposure risks after the re-entry intervals

The EPA has suggested re-entry intervals for each active ingredient (Table 65). These intervals came from overseas regulators but the data available to the EPA suggest that there may be risks to re-entry workers even after these re-entry intervals.

Table 65 Re-entry intervals suggested by the EPA

Active ingredient	Suggested re-entry interval obtained from overseas regulator (hours)
Acephate	24
Carbaryl	12
Chlorpyrifos	24
Diazinon	24
Dichlorvos	12
Dimethoate	48
Fenamiphos	48
Fenitrothion	48
Maldison	24
Methamidophos	48
Methomyl	48
Oxamyl	12
Phorate	48
Pirimicarb	24
Pirimiphos-methyl	12
Prothiofos	48
Terbufos	48

The risk to re-entry workers after the final treatment was estimated using the following equations.

$$DFR_{n(a)+t} = DFR_{n(a)} \times e^{-kt}$$

Where:

t = Re-entry interval obtained from overseas

The predicted exposure is calculated by:

$$DFR_{n(a)+t} \times e^{-kt} \times C \times D$$

Where:

C = TC x WR x AR/BW

D = Dermal absorption

AR = Application rate

BW = Body Weight

### Higher tier DFR data

The EPA have been provided with higher tier data for dimethoate. These data have been used in this risk assessment.

### Higher tier foliar half life data

The EPA used information from the USEPA Reregistration Eligibility Decision (RED) for chlorpyrifos to estimate foliar half lives of chlorpyrifos on New Zealand crops. Table 66 outlines the values that were used for each crop.

Table 66 Foliar DT50 used for the re-entry calculation for chlorpyrifos

Crop	Foliar DT50 used for the re-entry calculation for chlorpyrifos (days)
Apples	1.6
Arable	0.7
Avocado	1.6
Bean and Pea	1.6
Beets	1.6
Blackcurrants	0.7
Blueberries	0.7
Brassica forage	3.3
Brassica seeds	3.3
Bulbs	5.5
Carrots	1.6
Cereals	0.7
Cereals spring	0.7
Chinese greens	1.6
Citrus	4.9
Clover and seed crops	0.5

Conservation tillage	0.5
Cucurbits	1.6
Field crops	3.3
Forage brassica	3.3
Grain	0.7
Grapes	0.7
Kale crops	3.3
Kiwifruit	1.6
Kumara	1.6
lettuce	1.6
Lucerne	0.7
Maize	0.7
Onions	1.6
Ornamental trees/shrubs	1.6
Pasture	0.5
Pear	1.6
Persimmons	1.6
Potatoes	1.6
Rape	3.3
Seed crops	3.3
Spinach	1.6
Sports fields	0.5
Squash	1.6
Stonefruit	1.6
Strawberries	3.3
Summerfruit	1.6
Swedes	1.6
Sweetcorn	0.7
Turf	0.5

## Bystander

The EPA estimated bystander exposure for all applications where it was considered that spraydrift might occur (ground boom, airblast and aerial) and for home and garden use where it was assumed that bystanders could be directly exposed to the treated area. Predicted exposures were all compared to the Acceptable Operator Exposure Level (AOEL).

The EPA's bystander modelling is restricted to consideration of the exposure of a toddler to deposited spray drift which is based on CRD approaches with an additional input for soil ingestion used by the USEPA. The EPA assessment assumes exposure to contaminant residues for a toddler 8 m (default) away from the edge of the area to which the substance was applied. The EPA did not estimate bystanders' direct exposure to spraydrift since EPA does not have confidence that all of the assumptions used in the CRD/EFSA approach would be appropriate for New Zealand situations.

The CRD approach accounts for dermal exposure, hand-to-mouth exposure and object-to-mouth exposure (Chemicals Regulation Directorate, 2010c). Incidental ingestion of soil is taken into account using a modified exposure equation from the United States Environmental Protection Agency (USEPA, 1997).

For ground based application the fraction of the application rate that would be deposited as spray drift 8 m away from the application area was estimated using spray drift deposition curves from the Australian Pesticides and Veterinary Medicines Authority (APVMA) website (APVMA, 2010). These are based on the AgDrift model and are based on a series of field trials carried out in the United States. For ground boom applications there are deposition data for the following scenarios which represent the 90<sup>th</sup> percentile of the spray drift data collected:

- High boom (1.27 m above the ground) fine droplets
- Low boom (0.5 m above the ground) fine droplets

For airblast application there are the following scenarios which represent the 95<sup>th</sup> percentile of the spray drift data collected.

- Sparse orchard
- Dense orchard
- Vineyard

For aerial application spraydrift at 8 m from the application area was estimated using the AGDISP model. For all scenarios the EPA assumed that aerial application would use fine to medium size droplets. The exact inputs for all scenarios are not listed in this document but these are available from the EPA upon request.

The main factors influencing the AGDISP model are

- Release height



- Aircraft specifications
- Boom and nozzle characterises
- Water rate (l/ha)
- Weather conditions
- Canopy characteristics for the crop being treated

For home and garden use it was assumed that the bystander would be directly exposure to the treated area, i.e. that the spraydrift fraction would be 100 % of the application rate.

The following exposure parameters obtained from overseas regulators were used.

- Distance from the edge of the application area at which a toddler's exposure will be estimated (8 m)
- Turf transferable residue grass (0.05) (Chemicals Regulation Directorate, 2010c)
- Turf transferable residue object (0.2) (Chemicals Regulation Directorate, 2010c)
- Transfer coefficients (5200 cm<sup>2</sup>/h) (Chemicals Regulation Directorate, 2010c)
- Exposure duration (2 h) (Chemicals Regulation Directorate, 2010c)
- Toddler body weight (15 kg) (Chemicals Regulation Directorate, 2010c)
- Saliva extraction factor (0.5) (Chemicals Regulation Directorate, 2010c)
- Surface area of hands (20 cm<sup>2</sup>) (Chemicals Regulation Directorate, 2010c)
- Frequency of hand to mouth events (20 events) (Chemicals Regulation Directorate, 2010c)
- Ingestion rates grass (25 cm<sup>2</sup>/day) (Chemicals Regulation Directorate, 2010c)
- Ingestion rate soil (100 mg/day) (USEPA, 1997)
- Fraction of residue remaining in the soil (1) (USEPA, 1997)
- Soil density factor (6.7 x 10<sup>-4</sup> cm<sup>3</sup>/mg) (USEPA, 1997)

### Toddler's dermal exposure

Systemic exposures *via* the dermal route were calculated using the equation (Chemicals Regulation Directorate, 2010c):

$$SE(d) = \frac{AR \times DF \times TTR \times TC \times H \times DA}{BW}$$

Where:

SE(d) = systemic exposure via the dermal route

AR = field application rate (g a.i./ha)

DF = spray drift value (%)

TTR = turf transferable residues – the USEPA default value of 5 % was used

TC = transfer coefficient – the standard USEPA value of 5200 cm<sup>2</sup>/h was used

H = exposure duration for a typical day (hours) – 2 hours was used based on the USEPA default value (Chemicals Regulation Directorate, 2010c)

DA = percent dermal absorption (active ingredient specific)

BW = body weight – 15 kg which is the average of UK 1995-7 Health Surveys for England values for males and females of 2 and 3 yrs

### Toddler's hand-to-mouth exposure

Hand-to-mouth exposures were calculated using the equation (Chemicals Regulation Directorate, 2010c):

$$SE(h) = \frac{AR \times DF \times TTR \times SE \times SA \times Freq \times H}{BW}$$

Where:

SE(h) = systemic exposure *via* the hand-to-mouth route

AR = field application rate (g a.i./ha)

DF = spray drift value (%)

TTR = turf transferable residues – the USEPA default value of 5% derived from transferability studies with wet hands was used

SE = saliva extraction factor – the default value of 50% was used

SA = surface area of the hands – it was assumed that 20 cm<sup>2</sup> of skin area is contacted each time a child puts a hand in his or her mouth which is equivalent to the palmer surface of three fingers

Freq = frequency of hand to mouth events/hour – for short term exposures the value of 20 events/hour was used, this being the 90th percentile of observations that ranges from 0 to 70 events/hour

H = exposure duration (hours) – assumed to be 2 hours

BW = body weight - 15 kg

### Toddler's object-to-mouth exposure

Object to mouth exposures were calculated using the equation (Chemicals Regulation Directorate, 2010c):

$$SE(o) = \frac{AR \times DF \times TTR \times IgR}{BW}$$

Where:

SE(o) = systemic exposure via mouthing activity

AR = field application rate (g a.i./ha)

DF = spray drift value (%)

TTR = turf transferable residues - the default value of 20% transferability from object to mouth assessments was used

IgR = ingestion rate for mouthing grass/day –assumed to be equivalent to 25 cm<sup>2</sup> of grass/day

BW = body weight – 15 kg

### Toddler's incidental ingestion of soil

The approach used to calculate doses attributable to soil ingestion is (USEPA, 1997):

$$ADOD = \frac{AR \times DF \times F \times IgR \times SDF}{BW}$$

Where:

ADOD = oral dose on day of application (µg/kg/day)

AR = field application rate (g a.i./ha)

DF = spray drift value (%)

F = fraction or residue retained on uppermost 1 cm of soil (%) (Note: this is an adjustment from surface area to volume)

SDF = soil density factor - volume of soil (cm<sup>3</sup>) per milligram of soil

IgR = ingestion rate of soil (mg/day)

BW = body weight (kg)

Assumptions:

F = fraction or residue retained in uppermost 1 cm of soil assumes 100 percent of substance is incorporated into top 1 cm of soil after application (1.0/cm)

IgR = ingestion rate of soil is 100 mg/day

SDF = soil density factor - 6.7 x 10<sup>-4</sup> cm<sup>3</sup>/mg soil

BW = body weight of a toddler is 15 kg (as above)

### Toddler total exposure

Total exposure was calculated as the sum of the above equations:

$$\Sigma \text{ Exposure} = \text{SE (dermal)} + \text{SE (hand-to-mouth)} + \text{SE (object-to-mouth)} + \text{ADOD (soil ingestion)}$$

### Multiple applications and bystander exposure

If multiple applications occur, the residue immediately after the final application was estimated. The following equation was used to calculate the concentration of the pesticide in soil and in grass after the final application. This assumes first order degradation of the pesticide in the soil and on foliage (FOCUS, 2003).

$$MAF = PEC_{\text{one application}} \times (1 - e^{-nki}) / (1 - e^{-ki})$$

Where

MAF = Multiple Application Factor

PEC = Predicted Environmental Concentration

n = number of applications

k = ln2 / DT<sub>50</sub> (days) where DT<sub>50</sub> = foliar half life (days) for dermal, hand to mouth and object to mouth systemic exposure and DT<sub>50</sub> = soil half life (days) for the oral dose from soil on the day of application

i = interval between two consecutive applications (days)

e = constant = 2.718

When there was no information about the foliar half life of these active ingredients, an assumption was made that the foliar half life is 10 days, which is the default value assumed in the European FOCUS (FORum for Co-ordination of **pesticide** fate models and their Use) suite of environmental exposure models (FOCUS, 2003).

The soil half lives used in the assessment are included in Table 68.

## Aquatic

### Concentration of pesticide in a water body

The concentration of pesticide that would result from spraydrift to a waterbody 8 m away from the edge of an application area was calculated. Estimates of spraydrift 8 m away from the edge of the application area to a waterbody were taken from the datasets on the APVMA website, as per the human health assessment (APVMA, 2010). This assessment did not consider the impacts of other potential routes of aquatic exposure such as runoff. This will result in an underestimation of risk.

Firstly the concentration that would result from the direct overspraying of a water body was estimated. The calculation is as follows:

$$\begin{aligned} \text{Application rate (AR)} & \quad [\text{g a.i./ha}] \\ \equiv 0.1\text{AR} & \quad [\text{mg a.i./m}^2] \end{aligned}$$

Since 1 m<sup>3</sup> contains 1000 litres, the concentration in the receiving water (C) will be:

$$\begin{aligned} & 0.1\text{AR} \times 100 / (\text{depth} \times 1000) \\ & 0.01\text{AR} / \text{depth} \quad [\text{mg/L}] \end{aligned}$$

Where:

depth is the depth of the receiving water in cm (30 cm was assumed as per FOCUS, 2003).

The concentration that would result in a water body 8 m away from the edge of the application area was then calculated by multiplying the concentration resulting from direct overspray by the fraction of the application rate assumed to drift 8 m from the application area. So the initial concentration in the waterbody 8 m away from the edge of the application area (C<sub>0</sub>) is calculated as:

$$C_0 = (0.01\text{AR} / \text{depth}) * \text{DF}$$

Where DF is the spray drift value.

This concentration was then assumed to be reduced by 3 factors:

- Degradation
- Partitioning to suspended solids
- Partitioning to sediment

Degradation and partitioning were assumed not to occur on the day of application (Day 0) which is in accordance with the FOCUS model. Partitioning was assumed to occur within 24h from Day 1, so the

concentration on Day 1 and beyond is  $pC_0$  where  $C_0$  is the concentration on Day 0 and  $p$  is the proportion in the water phase. The average concentration over the period of exposure is then:

$$C_0(1+p(t-1))/t$$

where  $t$  is the number of days post-treatment.

' $p$ ' was then calculated for sorption to suspended solids and sediment.

### Partitioning to suspended solids

$$p_{\text{susp-solids}} = 1/(1 + f_{\text{oc,susp}} \times K_{\text{oc}} \times \text{susp}_{\text{water}} \times 10^{-6})$$

taken from ECHA (2010)

Where

$f_{\text{oc,susp}}$  is the fraction of organic carbon in the suspended solids (default, 0.1) (ECHA, 2010)

$K_{\text{oc}}$  is the organic carbon normalised sorption value (L/kg)

$\text{susp}_{\text{water}}$  is the suspended solids concentration in water, default 15 mg/L (ECHA, 2010)

$10^{-6}$  is a units conversion (L/kg x mg/L to kg/kg)

The  $K_{\text{oc}}$  values outlined in section 2 were used in the assessment

### Partitioning to sediment

$$p_{\text{sediment}} = \text{water depth} / (\text{water depth} + (\text{Effective sediment depth} \times \text{SBD} \times f_{\text{oc, sed}} \times K_{\text{oc}}))$$

taken from FOCUS steps 1 and 2 (FOCUS, 2003)

Where:

water depth was assumed to be 30 cm (FOCUS, 2003)

Effective sediment depth is the depth of sediment to which the substance will sorb, 1 cm (FOCUS, 1997)

SBD, Sediment Bulk Density is 0.8 (FOCUS, 2003)

$f_{\text{oc, sed}}$ , the fraction of organic carbon in the sediment is 0.05

$K_{\text{oc}}$  is the organic carbon normalised sorption value.

### Degradation

For degradation the average concentration over  $t$  days was calculated using the following formula (FOCUS, 1997):

$$C_0 \times (1 - e^{-kt})/kt$$

If it is assumed that there is no degradation on Day 0, then the average concentration can be calculated as follows

$$(C_0 + (t-1)(C_0 \times (1 - e^{-k(t-1)})/k(t-1)))/t$$

Therefore, the reduction in  $C_0$  due to degradation ( $p_{deg}$ ):

$$= 1 + d(t-1)/t$$

Where:

$k$  is the degradation rate constant ( $\ln 2/DT_{50}$ )

$t$  is the averaging period

$d$  is  $1 - e^{-k(t-1)}/k(t-1)$

The final Estimated Environmental Concentration (EEC) was then calculated as:

$$EEC = C_0 \times p_{deg} \times p_{susp-solids} \times p_{sediment} \times \text{dilution}$$

EEC can be viewed as a point estimate with no dilution within the receiving water, i.e. the concentration in a receiving water body at a certain distance from the field. However, if it is assumed that there will be instantaneous mixing within the pond,  $C_0$  will also be affected by the width of the water body (dilution). For this assessment the water body is assumed to be 50 m wide (the spraydrift deposition fraction was estimated by averaging the deposition values at 8 m and 58 m).

### Multiple applications and aquatic assessment

Exposure of the aquatic environment following multiple exposures uses the same equation as for bystander exposure except that  $DT_{50 \text{ (aquatic)}}$  (i.e. the aquatic half life of an active ingredient) is used instead of  $DT_{50 \text{ (foliar)}}$  or  $DT_{50 \text{ (soil)}}$ . The aquatic  $DT_{50}$  values outlined in section 2 were used.

### Aquatic risk assessment

The aquatic ecological risk is assessed for a substance by calculating a Risk Quotient (RQ) based on comparing an estimated exposure concentration with a concentration of ecotoxicological concern. Such calculations incorporate ecotoxicity values, exposure scenarios resulting from spray drift, application rates and frequencies, and the half-lives of the component(s) in water. The threshold for level of concern used by the EPA is Acute  $RQ > 0.1$ . For the aquatic environment, the calculations provide an EEC which, when divided by the  $L(E)C_{50}$ , gives a RQ acute value:

$$\text{Acute RQ} = EEC / L(E)C_{50}$$

To normalise these RQ values so that the threshold for the level of concern is 1 (to simplify comparison with the other risk assessments) the RQ values were calculated as follows.

$$\text{Acute RQ} = EEC / (L(E)C_{50}/10)$$

### Additional aquatic risk information

Submitters have provided the EPA with additional information regarding the risks of chlorpyrifos, diazinon and maldison to aquatic organisms. This information was reviewed and resulted in a change in the aquatic toxicity values for these substances.

## Birds

The avian toxicity assessment was performed according to “Risk Assessment to Birds and Mammals” (EFSA, 2009a). The EPA uses EFSA’s Bird model and Excel<sup>®</sup> spreadsheets that are available on EFSA’s website to assess risks to birds (EFSA, 2009b). The methodology calculates Toxicity Exposure Ratios (TER) where exposure is calculated as the dose that a bird will receive when feeding in crops that have been sprayed and effect is taken from bird gavage or feeding studies. To avoid doing detailed evaluations for low risk scenarios, assessments are performed in tiers of increasing complexity. Both acute and chronic assessment is possible but EPA has only performed acute risk assessment (screening and Tier 1).

The steps for the acute assessment are:

- Screening assessment
- Tier I assessment
- Higher tier assessment

Progression to the next tier is only made if the threshold for concern is exceeded at the previous tier.

### Determination of levels of exposure for spray applications

The principles underlying the exposure assessment are the same for all assessments other than higher tier assessments in which more specific field exposure data may be used. The dose that a bird receives (Daily Dietary Dose or DDD) is calculated from the application rate and a so-called ‘Shortcut value’ for the Residue per Unit Dose (RUD), reflecting the concentration on the bird’s food and the quantity of food consumed. Quantities consumed are based on a bird’s energy requirements, its energy assimilation and the energy content of its food (dry weight). Birds’ energy requirements are based on an algorithm based on bodyweight and bird type (e.g. passerine/non-passerine). For further details, refer to EFSA’s technical guidance document (EFSA, 2009a).

Screening step assessments select from 6 ‘indicator species’ of birds each applicable to a particular type of crop. They are not real species of birds, but, by virtue of their size and feeding habits, their exposure is considered worst-case for birds in a particular crop type. For example, the representative species for orchards is described as a ‘small insectivorous bird’. It is assumed that the relevant indicator species feeds only on contaminated food and the concentration of pesticide on the food is not affected by the growth stage of the crop. Thus, the exposure assessment is expressed as follows depending on the number of applications:

For acute test:

DDD one application = application rate (kg/ha) x shortcut value

DDD multiple applications = DDD one application x MAF<sub>90</sub>

Tier 1 assessment uses the same general approach as the screening assessment but requires more specific exposure scenarios. The first step is to identify all general focal species listed in Table I.1 (Annex I) of EFSA's technical guidance document that are relevant for the intended use(s).

In the Tier 1 acute assessments exposure is calculated for generic focal species, applicable to particular crops. Such assessments refine the screening step assessments in that:

- there are more bird 'species' (19) and crop options (21);
- the growth stage of the crop is taken into account, affecting the residues on the feed;
- more than one bird species may be considered for any one crop;
- a bird's diet can be calculated to include more than one food item.

The larger number of bird species, crop types and growth stages of the crops leads to a total of 138 RUD shortcut options, each with a mean and 90<sup>th</sup> percentile value. For the acute risk assessment the EPA used 90<sup>th</sup> percentile values.

### **Bird risk assessment**

The toxicity-exposure-ratio (TER) is calculated:

$$\text{TER} = \frac{\text{LD}_{50}}{\text{DDD}}$$

This TER is compared to the respective trigger value depending on the risk assessed (acute or long-term).

#### **Acute risk assessment:**

All TERs  $\geq 10$  No refinement required

One or more of the TERs  $< 10$  Higher tier risk assessment required

#### **Long-term risk assessment:**

This was not conducted in this review, however, for completeness the EPA methodology is included below.

All TERs  $\geq 5$  No refinement required

One or more of the TERs  $< 5$  Higher tier risk assessment required

### **Determination of levels of exposure for granular applications**

Birds may be exposed to granules in different ways:

#### **1. Birds ingesting granules as a source of food**

If there is a possibility that birds will mistake granules for food, it is appropriate to run the same procedure as for contaminated food (e.g. oversprayed). For this type of assessment it is necessary to



know the caloric value of the granular material. With this value and the daily caloric demand of a bird of concern, the number of granules and therefore the amount of active substance to which the animal will be exposed can be calculated. Species of concern, appropriate for the first-tier assessment are an omnivorous bird (e.g. house sparrow weighing 27.7 g).

## **2. Birds ingest granules with/as grit**

Grit consumption by farmland birds is an important constituent of dietary intake both for mineral content and grinding food. Significant differences exist between granivorous and non-granivorous species with respect to the size of grit ingested, with non-granivorous generally taking in grit indiscriminately with soil particles, while granivorous species pick up grit particles selectively. Accordingly, the type of soil and its constituent composition can substantially influence the extent to which birds may be exposed to granular products. For seed-eating birds, e.g. finches, pigeons, partridges and pheasants that need grit for mastication of their food, the method for assessing the potential risk for the ingestion of granules follows the method proposed in the OEPP/EPPO (2003).

## **3. Birds ingesting granules when seeking seeds as food**

If it appears possible that the granules could be mistaken for weed seeds by seed-eating birds, then the potential risk can be illustrated by estimating a TER in a manner analogous to that used for ingestion of granules accidentally as part of soil ingestion, i.e. by assuming that granules and seeds are ingested in proportion to their availability

## **4. Birds ingesting granules when they eat food contaminated with soil**

The method for assessing the potential risk for the ingestion of granules follows the method proposed in the OEPP/EPPO (2003).

### **Risk assessment for birds ingesting granules as food, with/as grit**

#### **Acute risk**

##### **Step 1**

Calculation of the acute daily grit dose ( $D_{GritD_{acute}}$ ) for small and large granules.

$$D_{GritD_{acute}} \text{ (small granules)} = 651 \times (G_{density} / (15200 + G_{density})) \times G_{loading}$$

$$D_{GritD_{acute}} \text{ (large granules)} = 2453 \times (G_{density} / (71 + G_{density})) \times G_{loading}$$

With

$G_{density}$  = number of granules on soil surface (per  $m^2$ ) (this number should be based on real practice and not on theoretical incorporation efficiencies)

$G_{loading}$  = the amount of the active substance in one granule (mg)

##### **Step 2**

Taking the appropriate  $LD_{50}$  value

**Step 3**

Calculation of the toxicity-exposure ratio for the relevant granule size and comparison of the TER to the respective trigger value (10).

$$TER_{acute} = LD_{50}/DGRITD_{acute}$$

$TER_{acute} > 10$  no refinement, acute risk assessment required

$TER_{acute} \leq 10$  refinement acute risk assessment required

**Risk assessment for birds ingesting granules when seeking seeds as food****Acute risk****Step 1**

Calculation of the acute daily granule dose ( $DGD_{acute}$ ) for a small granivorous bird.

$$DGD_{acute} = 620 \times (G_{density}/(100+G_{density})) \times G_{loading}$$

With

$G_{density}$  = number of granules on soil surface (per m<sup>2</sup>)

$G_{loading}$  = the amount of the active substance in one granule (mg)

**Step 2**

Taking the appropriate  $LD_{50}$  value

**Step 3**

Calculation of the toxicity-exposure ratio and comparison of the TER to the respective trigger value (10)

$$TER_{acute} = LD_{50}/DGD_{acute}$$

$TER_{acute} > 10$  no refinement acute risk assessment required

$TER_{acute} \leq 10$  refinement acute risk assessment required

**Risk assessment for birds ingesting granules when eating soil-contaminated food****Acute risk****Step 1**

Calculation of the acute daily dry soil dose ( $DDSD_{acute}$ ) for a small omnivorous bird.

$$DDSD_{acute} = 0.283 \times \text{dosage (kg a.i./ha)}$$

**Step 2**

Taking the appropriate  $LD_{50}$  value

### Step 3

Calculation of the toxicity-exposure ratio and comparison of the TER to the respective trigger value (10)

$$TER_{acute} = LD_{50}/DDSD_{acute}$$

$TER_{acute} > 10$  no refinement acute risk assessment required

$TER_{acute} \leq 10$  refinement acute risk assessment required

To normalise these RQ values so that the threshold for the level of concern is 1 (to simplify comparison with the other risk assessments) 10 was divided by the RQ value.

### Higher tier bird risk information

A submitter has provided the EPA with additional information regarding the hazard of chlorpyrifos to birds. This information was reviewed by the EPA which resulted in a change of the toxicity value used.

## Bees

Risk assessments on bees were carried out for all pesticides sprayed outdoors. The risk assessment was performed according the European model (European Commission, 2002) which uses the application rate as an indicator of exposure.

The risk to bees is assessed as:

$$HQ_{bees} \text{ (contact or oral)} = \text{Application rate (g a.i./ha)} / LD_{50} \text{ (contact or oral) } (\mu\text{g ai./bee})$$

According to the European guidance document when HQs are below the trigger value of 50, it indicates that the substance presents a low oral/contact risk to honeybees. To normalise these RQ values so that the threshold for the level of concern is 1 (to simplify comparison with risk assessments to other organisms) the RQ values were divided by 50.

## References

APVMA, 2010. Standard Spray Drift Risk Assessment Scenarios.

[http://www.apvma.gov.au/use\\_safely/spray\\_drift/scenarios.php](http://www.apvma.gov.au/use_safely/spray_drift/scenarios.php) Retrieved 04/03/10.

California Environmental Protection Agency, 2007. Guidance for the preparation of human pesticide exposure assessment documents. <http://pestreg.cdpr.ca.gov/docs/whs/pdf/hs1612.pdf> Retrieved 16/08/10.

Chemicals Regulation Directorate, 2010a. Operator Granule Exposure Model

[www.pesticides.gov.uk/.../PSD/PHED%20GRANULE%20MODEL.XLS](http://www.pesticides.gov.uk/.../PSD/PHED%20GRANULE%20MODEL.XLS) Retrieved 22/08/11.

Chemicals Regulation Directorate, 2010b. Guidance for post-application (re-entry worker) exposure assessment. [http://www.pesticides.gov.uk/uploadedfiles/Web\\_Assets/PSD/Re-entry%20worker%20guidance\\_final%20version.pdf](http://www.pesticides.gov.uk/uploadedfiles/Web_Assets/PSD/Re-entry%20worker%20guidance_final%20version.pdf) Retrieved 16/08/10.

Chemicals Regulation Directorate, 2010c. Bystander Exposure Guidance.

[http://www.pesticides.gov.uk/uploadedfiles/Web\\_Assets/PSD/Bystander%20exposure%20guidance\\_final%20version.pdf](http://www.pesticides.gov.uk/uploadedfiles/Web_Assets/PSD/Bystander%20exposure%20guidance_final%20version.pdf) Retrieved 27/01/10.

Chemicals Regulation Directorate, 2011a. PSD's interpretation of the German Operator Exposure Model. [http://www.pesticides.gov.uk/uploadedfiles/Web\\_Assets/PSD/German\\_Model\\_PSD1.xls](http://www.pesticides.gov.uk/uploadedfiles/Web_Assets/PSD/German_Model_PSD1.xls) Retrieved 27/01/10.

ECHA, 2010. Guidance on information requirements and chemical safety assessment Chapter R.16: Environmental Exposure Estimation, May 2010.

ERMA, 2010 Application for the Reassessment of a Hazardous Substance under Section 63 of the Hazardous Substances and New Organisms Act 1996 Name of Substance(s): Dichlorvos  
[http://www.epa.govt.nz/search-databases/HSNO%20Application%20Register%20Documents/HRC08004\\_Dichlorvos%20application%20form%20\(2010.11.24\).pdf](http://www.epa.govt.nz/search-databases/HSNO%20Application%20Register%20Documents/HRC08004_Dichlorvos%20application%20form%20(2010.11.24).pdf) Retrieved 16/03/12.

EFSA, 2005a. Final addendum to the Draft Assessment Report (DAR), Triclopyr.

EFSA, 2005b. Draft Assessment Report (DAR) Pirimiphos methyl.

EFSA, 2008b. Initial Risk assessment provided by the rapporteur member state The Netherlands for the existing active substance didecyldimethylammonium chloride of the fourth stage of the review programme referred to in Article 8(2) of the Council Directive 91/414/EEC Volume 3, Annex B, Part 6

EFSA, 2008a. Project to assess current approaches and knowledge with a view to develop a guidance document for pesticide exposure assessment for workers, operators, bystanders and residents, final report 28 November 2008 <http://www.efsa.europa.eu/en/scdocs/doc/26e.pdf> Retrieved 27/01/10.

EFSA, 2009a. Guidance of European Food Safety Authority. Risk assessment to birds and mammals, 17/12/09.

EFSA, 2009b. European Food Safety Authority; Calculator tool for the risk assessment to birds and mammals. [www.efsa.europa.eu/en/efsajournal/pub/1438.htm](http://www.efsa.europa.eu/en/efsajournal/pub/1438.htm) Retrieved 27/01/10.

European Commission, 2002. Guidance Document on terrestrial ecotoxicology under Council Directive 91/414/EEC, SANCO/ 10329/2002 rev. 2 final, 17/10/02.  
[http://ec.europa.eu/food/plant/protection/evaluation/guidance/wrkd09\\_en.pdf](http://ec.europa.eu/food/plant/protection/evaluation/guidance/wrkd09_en.pdf) Retrieved 27/01/10.

EUROHAIR, 1997. Occupational indicators  
[http://www.rivm.nl/rvs/Images/HAIR\\_OCCUPATIONAL\\_INDICATORS\\_tcm35-40135.pdf](http://www.rivm.nl/rvs/Images/HAIR_OCCUPATIONAL_INDICATORS_tcm35-40135.pdf) Retrieved 23/8/11.

EUROPOEM II project, 2002. Post application exposure of workers to pesticides in agriculture, report of the re-entry working group. FAIR-CT96-1406. Retrieved 22/09/11.

FOCUS, 1997. Soil persistence models and EU registration.  
[http://ec.europa.eu/food/plant/protection/evaluation/guidance/soil\\_en.pdf](http://ec.europa.eu/food/plant/protection/evaluation/guidance/soil_en.pdf) Retrieved 03/02/10

FOCUS, 2003. Working Group on Surface Water Scenarios, Focus surface water scenarios in the EU evaluation process under 91/414/EEC SANCO/4802/2001-rev.2 final.

NOHSC, 2011. Re-entry exposure model.

Nuytens, D. Braekman, P. Windey, S. Sonck, B. 2009. Potential dermal pesticide exposure affected by greenhouse spray application technique *Pest Manag Sci*; **65**: 781–790

OEPP/EPPO (Organisation Europeene et Mediterraneenne pour la Protection des Plantes/European and Mediterranean Plant Protection Organisation), 2003. Environmental risk assessment scheme for plant protection products. Environmental risk assessment scheme for plant protection products.

TNO, 2007. Effective Personal Protective Equipment (PPE).  
[http://www.bozpinfo.cz/priloha/euroshnet\\_02.pdf](http://www.bozpinfo.cz/priloha/euroshnet_02.pdf) Retrieved 03/08/10.

USEPA, 2007. Reregistration Eligibility Decision for Carbofuran.  
[http://www.epa.gov/opp00001/reregistration/REDs/carbofuran\\_red.pdf](http://www.epa.gov/opp00001/reregistration/REDs/carbofuran_red.pdf) Retrieved 03/08/2010.

US EPA, 1997. Standard Operating Procedures (SOPs) for Residential Exposure Assessments. Contract No. 68-W6-0030, Work Assignment No. 3385.102.

## Section 2 Critical values used in the risk modelling

The EPA collected data from overseas risk assessments to determine which endpoints to use in the risk assessment. The EPA used data from regulatory authorities in the EU (EFSA), US (USEPA), Canada (PRMA) and Australia (APVMA) and from databases from USEPA and the EU Footprint database. When possible information from the jurisdiction with the most complete dataset was used not necessarily that with the lowest toxicity values. However, in most cases more than one source was needed to obtain all the endpoints necessary for the risk assessment. In the tables below the endpoints per substance and the source are provided.

Table 67 Critical values used in the human health risk assessment

Substance	EPA AOEL (mg/kg bw/day)	Dermal absorption (%)	Basis for the values	References
Acephate	0.0012	5  NB value changed since the EPA Call for information (EPA 2011a) was circulated.	<p><b>AOEL</b></p> <p>NOAEL of 0.12 mg/kg bw/day from a 90 day rat study (the toxic effect at the LOAEL of 0.15 mg/kg bw/day was brain acetyl cholinesterase inhibition) with an uncertainty factor of 100 and assuming oral absorption in the study of 100% (US EPA, 2001). The same value was used by the US EPA (US EPA, 2001) to derive the dietary chronic reference dose. The AOEL calculation becomes:</p> $\text{AOEL} = (0.12/100) \times 1.0 = 0.0012 \text{ mg/kg bw/day.}$ <p><b>Dermal absorption</b> 5 % based on studies supplied by a manufacturer (Anonymous, 2001). Please note that this value has changed from the original call for information (EPA, 2011b) where a value of 30 % was used (FAO/WHO, 2002).</p>	USEPA, 2001. FAO/WHO, 2002. Anonymous, 2001.
Carbaryl	0.01	10 for the diluted spray  0.5 for the concentrate	<p><b>AOEL</b></p> <p>Based on the EFSA value (2006a).</p> $\text{AOEL} = (1.0/100) \times 1.0 = 0.01 \text{ mg/kg bw/day.}$ <p><b>Dermal absorption</b></p> <p>EFSA (Footprint) 0.5 – 10%</p>	EFSA, 2006a. Footprint, 2011.
Chlorpyrifos	0.01	1	<p><b>AOEL</b></p> <p>EFSA (2005a) set an AOEL of 0.01 mg/kg bw/day based on a NOAEL 1 mg/kg bw/day from 90 day rat, mice and dog studies. The critical effect was neurological effects (inhibition of acetyl cholinesterase). The total uncertainty factor used was 100, and the oral absorption was 100%.</p>	EFSA, 2005a

Substance	EPA AOEL (mg/kg bw/day)	Dermal absorption (%)	Basis for the values	References
			<p>AOEL = <math>(1.0/100) \times 1.0 = 0.01</math> mg/kg bw/day.</p> <p><i>Dermal absorption</i></p> <p>EFSA (2005a) applied a 1% dermal absorption based on human data.</p>	
Diazinon	0.0002	3	<p><i>AOEL</i></p> <p>NOEL of 0.02 mg/kg bw/day from a 90 day oral study in rats and dogs based on erythrocyte cholinesterase inhibition used by EFSA (2006b). An uncertainty factor of 100 and an oral absorption proportion of 1.0.</p> <p>AOEL = <math>(0.02/100) \times 1.0 = 0.0002</math> mg/kg bw/day.</p> <p><i>Dermal absorption</i></p> <p>EPA Application used 3% based on FAO/WHO, (1998).</p>	EFSA, 2006b FAO/WHO, 1998.
Dichlorvos	0.0014	30	<p><i>AOEL</i></p> <p>Based on a NOAEL of 0.014 mg/kg bw/day from a human study in adult males, based on plasma cholinesterase inhibition at higher dose <math>\geq 0.021</math> mg/kg bw/day). An uncertainty factor of 10 to allow for difference in human sensitivity within the population was applied and the oral absorption was assumed to be 100% (1.0). (APVMA, 2008)</p> <p>AOEL = <math>(0.014/10) \times 1.0 = 0.0014</math> mg/kg bw/day.</p> <p><i>Dermal absorption</i></p> <p>The dermal absorption was assumed to be 30% based on information from APVMA, 2008.</p>	APVMA, 2008.
Dimethoate	0.001	2 (dilute spray) 0.15 (formulated)	<p><i>AOEL</i></p> <p>The EFSA (2006c) AOEL was set based on NOAEL of 0.1 mg/kg</p>	EFSA, 2006c



Substance	EPA AOEL (mg/kg bw/day)	Dermal absorption (%)	Basis for the values	References
		product)	<p>bw/day from a developmental neurotoxicity study and interim cholinesterase measurements from a 2 year rat study. A total uncertainty factor of 100 was applied. The oral absorption in the study was assumed to be 100%.</p> <p>AOEL = <math>(0.1/100) \times 1.0 = 0.001</math> mg/kg bw/day.</p> <p><i>Dermal absorption</i></p> <p>The dermal absorption values are set out in the EFSA (2006c) report as 2% for the diluted spray and 0.15% for the formulated product.</p>	
Fenamiphos	0.0008	50 %(dilute spray)  6 % (formulated product) NB Value changed since the call for information	<p><i>AOEL</i></p> <p>EFSA (2006d) derived an AOEL of 0.0008 mg/kg bw/day.</p> <p><i>Dermal absorption</i></p> <p>6% for the concentrate and 50% for the dilution based on an EFSA scientific report (EFSA 2006g). Note this has changed from previous assessments where it was assumed that the formulated product also had a dermal absorption of 50 %.</p>	<p>EFSA, 2006d</p> <p>EFSA, 2003a</p>
Fenitrothion	0.0013	21 (dilute spray)  3.9 (formulated product)	<p><i>AOEL</i></p> <p>An EFSA AOEL of 0.013 mg/kg bw/day was derived in 2006 (EFSA, 2006f) based on a NOEL in a 90 rat study of 1.32 mg/kg bw/day, but the listing in the Annex was subsequently withdrawn. The most appropriate data for derivation of the AOEL is considered to be from the 1 year dog study (NOAEL = 0.125 mg/kg bw/day) used by the US EPA to derive the chronic reference dose (US EPA, 2000). The duration of the study is longer than ideal, but was preferred to the NOEL of 0.282 mg/kg bw/day from a 90 day rats study also documented in the RED as this value was used by the US EPA for the derivation of their reference dose. An</p>	<p>USEPA, 2000</p> <p>EFSA, 2006f.</p>

Substance	EPA AOEL (mg/kg bw/day)	Dermal absorption (%)	Basis for the values	References
			<p>uncertainty factor of 100 was applied (as was used by the US EPA for their CRfD). Oral absorption in the study was assumed to be 100%.</p> <p>AOEL = <math>(0.125/100) \times 1.0 = 0.0013</math> mg/kg bw/day (rounded)</p> <p><i>Dermal absorption</i></p> <p>The value of 21% for dilute spray and 3.9% for formulated product was selected from EFSA, 2006f.</p>	
Maldison (malathion)	0.03	15	<p><i>AOEL</i></p> <p>The EFSA (2010) AOEL value of 0.03 used together with the dermal absorption value.</p> <p><i>Dermal absorption</i></p> <p>Dermal absorption value of 15% was reported in Footprint (2011)</p>	<p>EFSA, 2010</p> <p>Footprint, 2011.</p>
Methamidiphos	0.0001	5	<p><i>AOEL</i></p> <p>NOAEL of 0.03 mg/kg bw/day from an eight week study in rats (based on brain acetyl cholinesterase inhibition at higher doses). An uncertainty factor of 300 [taken from the US EPA, 2006b] and assuming an absorption factor of 1.0</p> <p>AOEL = <math>(0.03/300) \times 1.0 = 0.0001</math> mg/kg bw/day.</p> <p><i>Dermal Absorption</i></p> <p>The EPA selected the dermal absorption value of 5% established by EFSA (2004a)</p>	<p>US EPA, 2006b.</p> <p>EFSA, 2004a</p>
Methomyl	0.0025	15	<i>AOEL</i>	EFSA, 2009

Substance	EPA AOEL (mg/kg bw/day)	Dermal absorption (%)	Basis for the values	References
			EFSA (2009) derived an AOEL of 0.0025 mg/kg bw/day. <i>Dermal absorption</i> 15% from EFSA, 2009	
Oxamyl	0.001	5	<p><i>AOEL</i></p> <p>The EFSA (2005b) AOEL was selected as this is current and does not expire till 2016. The NOAEL of 0.1 mg/kg bw/day was from an acute neurotoxicity study to which an uncertainty factor of 100 and an absorption factor of 1.0.</p> <p><math>AOEL = (0.1/100) \times 1.0 = 0.001 \text{ mg/kg bw/day.}</math></p> <p><i>Dermal absorption</i></p> <p>EFSA (2005b) agrees on a value of 0.04% but this only applies to granular formulation.</p> <p>EFSA (2003b), reviewed data for absorption of solid and liquid formulations of oxamyl and comparative <i>in vitro</i> studies in rats, rabbits and human. Based on these data the EPA has used a dermal absorption value of 5%, noting that this may be precautionary as the studies show lower penetration of human skin (in vitro) than rat skin. Less than 5% was absorbed in an 8 hour period in rats (<i>in vivo</i>).</p>	<p>EFSA, 2005b</p> <p>EFSA, 2003b</p>
Phorate	0.0005	10 for granular formulations	<p><i>AOEL</i></p> <p>The chronic dog NOAEL of 0.05 with an MOE of 100 from the US EPA, (2006a) was used to support the AOEL, assuming oral absorption of 100%.</p> <p><math>AOEL = (0.05/100) \times 1.0 = 0.0005</math></p> <p><i>Dermal absorption</i></p>	<p>USEPA, 2006a</p> <p>UK PSD 1994</p>

Substance	EPA AOEL (mg/kg bw/day)	Dermal absorption (%)	Basis for the values	References
			In the absence of data the default (50%) applies, but since the only product in use is a granular formulation a dermal absorption value of 10% was used based on the PSD guidance (UK PSD, 1994).	
Pirimicarb	0.035	13(dilute spray) 0.1 (concentrated product)	<p><i>AOEL</i></p> <p>The EFSA (2006e) AOEL was selected as this is current and does not expire till 2017.</p> <p><i>Dermal absorption</i></p> <p>Footprint (2011) reports dermal absorption as 0.1 – 13% (attributed to EFSA) so the EPA used the upper range reported.</p>	<p>EFSA, 2006e</p> <p>Footprint, 2011</p>
Pirimiphos-methyl	0.02	10 diluted spray 1 for formulation	<p><i>AOEL</i></p> <p>The EFSA (2011) review set an AOEL of 0.02 mg/kg bw/day.</p> <p><i>Dermal absorption</i></p> <p>Footprint (2011) reports dermal absorption values below (attributed to EFSA) so the EPA used these values.</p> <p>10% diluted spray 1% for formulation</p>	<p>EFSA, 2011.</p> <p>Footprint, 2011.</p>
Prothiofos	0.0001	50 (default)	<p><i>AOEL</i></p> <p>APVMA (2012) set an ADI in 1993 set an ADI based on a NOEL of 0.01 mg/kg bw/day by applying an UF of 100. ADI of 0.0001 mg/kg bw/day.</p> <p>This value was used as the AOEL by the EPA in the absence of other values.</p> <p><i>Dermal absorption</i></p>	APVMA, 2012

Substance	EPA AOEL (mg/kg bw/day)	Dermal absorption (%)	Basis for the values	References
			No data were found so the default value of 50% applied.	
Terbufos	0.0002	10 for granular formulations	<p><i>AOEL</i></p> <p>No published AOEL for terbufos was identified. The EPA therefore used the APVMA (2012) ADI of 0.0002 mg/kg bw/day set in 2002 as the AOEL.</p> <p><i>Dermal absorption</i></p> <p>In the absence of data the default (50%) applies, but since the only product in use is a granule a value of 10% was used based on the PSD guidance (UK PSD, 1994).</p>	<p>APVMA, 2012</p> <p>UK PSD, 1994</p>



## References

Anonymous, 2001. <sup>14</sup>C-Acephate Comparative *In vitro* dermal penetration study using human and rat skin, Huntingdon Research Centre, Woolley Road, Cambridgeshire, Huntingdon PE28 4HS, England

APVMA, 2012. ADI List: Acceptable Daily Intakes for Agricultural and Veterinary chemicals, current as of 30 June 2011.

Document accessible from this web page:

<http://www.health.gov.au/internet/main/publishing.nsf/content/ocs-adi-list.htm> (Retrieved November 2012).

APVMA, 2008. DICHLORVOS - Toxicology Assessment: The reconsideration of approvals of the active constituent, registrations of products containing dichlorvos and approvals of their associated labels. [http://www.apvma.gov.au/products/review/docs/dichlorvos\\_tox.pdf](http://www.apvma.gov.au/products/review/docs/dichlorvos_tox.pdf) (Retrieved September, 2011).

EFSA, 2003a. Fenamiphos. Draft assessment report.

[http://turin/sites/felix/pol/1/sdm/hsp/Fenamiphos\\_DAR\\_01\\_Volume%201\\_public%5b1%5d.pdf](http://turin/sites/felix/pol/1/sdm/hsp/Fenamiphos_DAR_01_Volume%201_public%5b1%5d.pdf) (Retrieved September, 2011, see p84)

EFSA, 2003b. Draft assessment report - Public version – provided by the rapporteur Member State Ireland for the existing active substance oxamyl. Volume 3, Annex B.

EFSA, 2004a Opinion of the Scientific Panel on Plant Health, Plant Protection Products and their Residues on a request from the Commission related to the evaluation of methamidophos in toxicology in the context of Council Directive 91/414/EEC/. EFSA Journal 2004;95:1-15.

EFSA, 2005a EU Restricted. Chlorpyrifos. SANCO/3059/99 – rev. 1.5.

EFSA, 2005b. Conclusion regarding the peer review of the pesticide risk assessment of the active substance oxamyl, 14 January 2005, EFSA Scientific Report (2005) 26, 1-78.  
<http://www.efsa.europa.eu/en/efsajournal/doc/26r.pdf> (Retrieved September, 2011).

EFSA, 2006a. Conclusion regarding the peer review of the pesticide risk assessment of the active substance carbaryl. Scientific Report Vol. 80, p1 – 71.

EFSA, 2006b. Conclusion on the peer review of diazinon. EFSA Scientific Report 85, 1-73

EFSA, 2006c. Conclusion regarding the peer review of the pesticide risk assessment of the active substance dimethoate, EFSA Scientific Report (2006) 84, 1-102  
<http://www.efsa.europa.eu/en/scdocs/doc/84r.pdf> (Retrieved September, 2011)

EFSA, 2006d. Final. Review for the active substance fenamiphos SANCO/10017/2006 – rev.3  
[http://ec.europa.eu/food/plant/protection/evaluation/existactive/list\\_fenamiphos.pdf](http://ec.europa.eu/food/plant/protection/evaluation/existactive/list_fenamiphos.pdf) (Retrieved September 2011)

- EFSA, 2006e Review report for the active substance pirimicarb SANCO/10529/05 rev 5 Final [http://ec.europa.eu/food/plant/protection/evaluation/existactive/list-pirimicarb\\_en.pdf](http://ec.europa.eu/food/plant/protection/evaluation/existactive/list-pirimicarb_en.pdf) (Retrieved September, 2011)
- EFSA, 2006f. Conclusion on the peer review of fenitrothion Scientific Report Vol 59, p1-80. <http://www.efsa.europa.eu/en/efsajournal/doc/59r.pdf> (Retrieved October 2012).
- EFSA, 2006g Conclusion on the peer review of fenamiphos Scientific Report Vol 62, p1 - 81
- EFSA, 2009. Final. Review report for the active substance methomyl. SANCO/5449/2009. [http://ec.europa.eu/food/plant/protection/evaluation/existactive/list\\_methomyl\\_en.pdf](http://ec.europa.eu/food/plant/protection/evaluation/existactive/list_methomyl_en.pdf) (Retrieved September 2011)
- EFSA, 2010. Review report for the active substance malathion. SANCO/10668/2009 final
- EFSA, 2011. Review report for the active substance pirimiphos-methyl. SANCO/00760/2007 final.
- FAO/WHO, 1998. Environmental Health Criteria No 198. Diazinon. <http://www.inchem.org/documents/ehc/ehc/ehc198.htm> (Retrieved September, 2011)
- FAO/WHO, 2002. Joint meeting on Pesticide Residues Part II Toxicology – Acephate. <http://www.inchem.org/documents/jmpr/jmpmono/2002pr02.htm> (Retrieved September, 2011)
- Footprint, 2011. PPDB: Pesticide Properties DataBase <http://sitem.herts.ac.uk/aeru/footprint/index2.htm> (Retrieved September 2011)
- UK PSD, 1994. Evaluation on phorate. [www.pesticides.gov.uk/psd\\_pdfs/Evaluations/098\\_phorate.pdf](http://www.pesticides.gov.uk/psd_pdfs/Evaluations/098_phorate.pdf) Retrieved 23 August 2011
- US EPA, 2000. Re-assessment Eligibility Decision for Fenitrothion, [http://www.epa.gov/pesticides/reregistration/REDs/fenitrothion\\_red.pdf](http://www.epa.gov/pesticides/reregistration/REDs/fenitrothion_red.pdf), (p7) (Retrieved September, 2011).
- US EPA, 2001. Re-registration Eligibility Decision for Acephate. [http://www.epa.gov/opp00001/reregistration/REDs/acephate\\_red.pdf](http://www.epa.gov/opp00001/reregistration/REDs/acephate_red.pdf) (p8) (Retrieved, September, 2011)
- US EPA, 2006a. Re-assessment Eligibility Decision for Phorate (revised, 2008). [http://www.epa.gov/pesticides/reregistration/REDs/phorate\\_red.pdf](http://www.epa.gov/pesticides/reregistration/REDs/phorate_red.pdf) (Retrieved September, 2011)
- US EPA, 2006b. Re-registration Eligibility Decision for Methamidophos (revised, 2006). [http://www.epa.gov/pesticides/reregistration/REDs/methamidophos\\_red.pdf](http://www.epa.gov/pesticides/reregistration/REDs/methamidophos_red.pdf) (Retrieved September, 2011).





Table 68 Critical values used in the environmental risk assessment

Substance	Aquatic organism Acute EC50 (mg/L)	Bird Acute LD50 (mg a.i./kg bw)	Bee Acute LD50 (µg/bee)	Water DT50 (day)	Soil DT50 (day)	K <sub>oc</sub>	log K <sub>ow</sub>	Potentially bio- accumulative	Source
Acephate	0.35 (HC <sub>5</sub> ) <sup>a</sup>	162 (geometric mean)	1.2	40	2.3	2.73	-0.9	no	USEPA 2006c
Carbaryl	0.0064	>2000	0.14	9.9	115.5	211	2.36	no	EFSA 2006a
Chlorpyrifos <sup>b</sup>	0.0001 <sup>23</sup>	13.3	0.059	51	74	8151	5.27	yes	EFSA 2005a
Diazinon <sup>b</sup>	0.001 <sup>1</sup>	1.44	0.09	11.8	23	643	3.69	no	EFSA 2006b <sup>1</sup> NRA 2002
Dichlorvos	0.00007	9.18 (geometric mean)	0.029 <sup>1</sup>	1 <sup>1</sup>	1 <sup>1</sup>	K <sub>d</sub> = 0.41	1.9 <sup>1</sup>	no	USEPA 2006d <sup>1</sup> EFSA 2005b
Dimethoate	2.0	10.5	0.1	17.2	2.6	30	0.7 <sup>1</sup>	no	EFSA 2004a <sup>1</sup> EFSA 2006c
Fenamiphos	0.0019 <sup>1</sup>	0.8	0.28	111	0.85 <sup>1</sup>	754	3.3	no	EFSA 2003a <sup>1</sup> Footprint database
Fenitrothion	0.0023	34.5	0.02	1.57 <sup>1</sup>	2.7 <sup>1</sup>	322	3.3	no	USEPA 1995 <sup>1</sup> Footprint PPDB
Maldison <sup>b</sup>	0.005 <sup>1</sup>	359	0.2 <sup>1</sup>	0.38 <sup>1</sup>	0.17 <sup>1</sup>	217	2.75	no	EFSA 2009

<sup>23</sup> this value has changed since the call for information based on information provided by an applicant. This is a NOEC (No Observed Effect Concentration) value. For the risk assessment the risk quotient was estimated by directly comparing the ratio of the Predicted Environmental Concentration (PEC) to the NOEC.

Substance	Aquatic organism Acute EC50 (mg/L)	Bird Acute LD50 (mg a.i./kg bw)	Bee Acute LD50 (µg/bee)	Water DT50 (day)	Soil DT50 (day)	K <sub>oc</sub>	log K <sub>ow</sub>	Potentially bio- accumulative	Source
									<sup>1</sup> PMRA 2010
Methamidophos	0.000003 (geometric mean)	12.82 (geometric mean)	1.37 <sup>1</sup>	23.5 <sup>2</sup>	4.8 <sup>3</sup>	0.88	-0.66 <sup>3</sup>	no	USEPA 2007 <sup>1</sup> PED 2000 <sup>2</sup> Footprint PPDB <sup>3</sup> California EPA 2005
Methomyl	0.00761	15.9	0.1 <sup>1</sup>	5 <sup>1</sup>	45 <sup>1</sup>	25.2	1.33	no	USEPA 1998 <sup>1</sup> PMRA 2009
Oxamyl	0.319	3.16	0.38	1	11.5	17	-0.44	no	EFSA 2004b
Phorate	0.004	0.62 <sup>1</sup>	0.32 <sup>1</sup>	Not modelled	Not modelled	Not modelled	3.92 <sup>1</sup>	yes	Footprint PPDB <sup>1</sup> PMRA 2003a <sup>2</sup> USEPA 2006a
Pirimicarb	0.017	20.9	4	195 <sup>1</sup>	143	290	1.7	no	EFSA 2004c <sup>1</sup> Footprint PPDB
Pirimiphos- methyl	0.00021	40	0.36 <sup>1</sup>	1 <sup>2</sup>	12 <sup>3</sup>	1100	3.9	yes	EFSA 2003b <sup>1</sup> USEPA database <sup>2</sup> Barooah, AK et al., 1985. <sup>3</sup> USEPA 2006b
Prothiofos	0.0014	100	ND	126 <sup>1</sup>	60 <sup>2</sup>	24158	5.67 <sup>2</sup>	yes	Footprint PPDB <sup>1</sup> McDougall et al,

Consultation Report for OPC plant protection insecticides (APP201045)

Substance	Aquatic organism Acute EC50 (mg/L)	Bird Acute LD50 (mg a.i./kg bw)	Bee Acute LD50 (µg/bee)	Water DT50 (day)	Soil DT50 (day)	K <sub>oc</sub>	log K <sub>ow</sub>	Potentially bio- accumulative	Source
									1994 <sup>2</sup> Tomlin, 1997
Terbufos <sup>4</sup>	0.00031 <sup>1</sup>	28.6 <sup>2</sup>	4.09 <sup>2</sup>	Not modelled	Not modeled	Not modeled	3.68 <sup>3</sup>	no	<sup>1</sup> USEPA, 1998b <sup>2</sup> USEPA, 2000  <sup>3</sup> Hansch, et al, 1985. <sup>4</sup> PMRA 2003b

a = hazardous concentration for which 95% of the species theoretically are protected

b= Information changed since the call for information

## References

Barooah, AK and Jain, HK (1985) Persistence of methidathion and pirimiphos methyl in soil, water and sediment.; *J Entomol Res* 9: 19-25. [Retrieved from Ecotox and Fate Databank (EFDB)]

California EPA, 2005. Reregistration Eligibility Decision for methamidophos 2005

EFSA, 2003a. Draft Assessment Report for fenamiphos

EFSA, 2003b. Draft Assessment Report for pirimiphos-methyl

EFSA, 2004a. Draft Assessment Report for dimethoate

EFSA, 2004b. Draft Assessment Report for oxamyl

EFSA, 2004c. Draft Assessment Report for pirimicarb

EFSA, 2005a. Draft Assessment Report for chlorpyrifos

EFSA, 2005b. Draft Assessment Report for dichlorvos

EFSA, 2006a. Draft Assessment Report for carbaryl

EFSA, 2006b. Conclusion on the peer review of diazinon. EFSA Scientific Report 85, 1-73

EFSA 2006c Conclusion on the peer review of dimethoate, EFSA Scientific report 84, 1-102

EFSA 2009, Peer review of the pesticide risk assessment of the active substance malathion, EFSA Scientific report 333, 1-118

Footprint PPDB: Pesticide Properties DataBase <http://sitem.herts.ac.uk/aeru/footprint/index2.htm>  
Retrieved 1 September 2011

Hansch, C et al, 1985. Medchem Project Issue No 26 Claremont, CA [Accessed from HSDB]

McDougall, K W et al, 1994 The stability of dieldrin, aldrin, lindane, chlorpyrifos and prothiofos in stored roof water. *J Env. Sci. and Health PART B Pest. Food Cont. and Agricultural Wastes* 29 (2): 293-301. [Retrieved from TOXLINE]

NRA, 2002. National Registration Authority for Agricultural and Veterinary Chemicals, Australia, Review of diazinon, September 2002

PED, 2000. Pesticide Ecotoxicity Database for methamidophos  
<http://www.ipmcenters.org/Ecotox/index.cfm> Retrieved 1 September 2011

PMRA, 2003a. Proposed Acceptability for PACR2003-01 Continuing Registration for phorate

PMRA, 2003b. Proposed Acceptability for PACR2003-02 Continuing Registration for terbufos

PMRA, 2009. Proposed Acceptability for PACR2003-01 Continuing Registration for methomyl

PMRA, 2010. Proposed Acceptability for PACR2003-01 Continuing Registration for maldison (malathion)

Tomlin C D S, ed, 1997 The Pesticide Manual, British Crop Protection Council. BCPC Publications Sales, Bear Farm, Brinfield, Bracknell, Berks RG42 5QE.

USEPA, 1995. Reregistration Eligibility Decision for fenitrothion

USEPA, 1998a. Reregistration Eligibility Decision for methomyl

USEPA, 1998b Pesticide Fact Sheet no 5.2 Terbufos [Cited by EXTOKNET]

USEPA, 2006a. Reregistration Eligibility Decision for phorate

USEPA, 2006b. Reregistration Eligibility Decision for pirimiphos-methyl

USEPA, 2006c. Reregistration Eligibility Decision for acephate

USEPA, 2006d. Reregistration Eligibility Decision for dichlorvos

USEPA, 2007. Reregistration Eligibility Decision for methamidophos

USEPA database pirimiphos-methyl

## Appendix E: Selection of Acceptable Daily intake values

### Background

The evaluation of ADI values from overseas jurisdictions has favoured selection of Australian Pesticide and Veterinary Medicines Agency (APVMA) ADIs for the following reasons:

- Provides a consistent set of values from one regulator
- APVMA is also undertaking a review programme which includes several of these organophosphates and carbamates
- Harmonisation advantages in aligning assessments between Australia (APVMA) and New Zealand (EPA and MAF ACVM), including in relation to the inputs used for the calculation of food MRL values.

When no APVMA value is available or is not considered appropriate, a value has been derived from other sources and an explanation is provided.

Table 69 Substance threshold values (mg/kg bw/d)

Substance	EFSA (ADI)	JMPR (ADI)	USEPA (Chronic Reference Dose [CRfD])	APVMA (ADI)	EPA (ADI)	Rationale for choice of the EPA value
Acephate	0.005*	0.03	0.0012	0.003	0.0012	Corrected from value in application ERMA 200399; based on US EPA CRfD (US EPA, 2001); same value chosen as for AOEL.
Carbaryl	0.0075* (2006)	0.008 (2001)	No CRfD set as acute exposure is main duration of concern due to rapid recovery of ChE activity.	0.008 (2002, 2 year mouse study, vascular tumour formation, uncertainty factor 2000 from Lowest Observed Effect Level (LOEL))	0.008	APVMA value used (APVMA, 2011a); equivalent to JMPR and recent EFSA values.
Chlorpyrifos	0.01 (2005)	0.01 (2004)	0.0003	0.003	0.003	APVMA value used (APVMA, 2011a).
Diazinon	0.0002*	0.005	0.0002	0.001	0.0002	Corrected from value in application ERMA 200398; based on EFSA ADI (EFSA, 2006a); same as value used for AOEL; equivalent to US EPA CRfD.
Dichlorvos	0.00008*	0.004	0.0005	0.001	0.001	Value taken from ERMA application HRC08004; (APVMA, 2008).
Dimethoate	0.001 (2006)	0.002 (2003)	0.0022	0.001 (2010)	0.001	APVMA value used (APVMA, 2011b); equivalent to AOEL value selected.
Fenamiphos	0.0008 (2006)	0.0008 (2002)	0.0001	0.0001 (2005)	0.0001	APVMA value used (APVMA, 2011a).



Substance	EFSA (ADI)	JMPR (ADI)	USEPA (Chronic Reference Dose [CRfD])	APVMA (ADI)	EPA (ADI)	Rationale for choice of the EPA value
Fenitrothion	0.005* (2006)	0.005 (2000)	0.0013	0.002 (1997)	0.002	APVMA value used (APVMA, 2011a).
Maldison	0.03 (2006)	0.3 (2003)	0.07	0.02 (2005)	0.02	APVMA value used (APVMA, 2011a).
Methamidophos	0.001*	0.004	0.0001	0.0003	0.0001	Corrected from value in application ERMA 200399; taken from US EPA cPAD value (US EPA, 2006); same as AOEL value.
Methomyl	0.0025 (2006)	0.02 (2001)	0.008 (1998, Food Quality Protection Act (FQPA) safety factor of 3)	0.01 (1991)	0.01	APVMA value used (APVMA, 2011a).
Oxamyl	0.001 (2005)	0.009 (2002)	No CRfD set as Cholinesterase (ChE) inhibition reverses rapidly.	0.002 (1993)	0.002	APVMA value used (APVMA, 2011a).
Phorate	*	0.0007 (2004)	0.00017	0.0005 (1991)	0.0005	APVMA value used (APVMA, 2011a); equivalent to AOEL value selected.
Pirimicarb	0.035 (2006)	0.02 (2004)	No value set. No products registered	0.002 (1987)	0.035	EFSA value chosen as more recent and is equivalent to the AOEL value selected (EFSA, 2006b).
Pirimiphos-methyl	0.004 (2005)	0.03 (2006)	0.000067	0.02 (1991)	0.02	APVMA value used (APVMA, 2011a); similar to recent JMPR value; equivalent to AOEL value selected.
Prothiofos	*	-	-	0.0001 (1993)	0.0001	APVMA value used (APVMA, 2011a); no other regulatory value available;

Substance	EFSA (ADI)	JMPR (ADI)	USEPA (Chronic Reference Dose [CRfD])	APVMA (ADI)	EPA (ADI)	Rationale for choice of the EPA value
						same as AOEL value selected.
Terbufos	*	0.0006 (2003)	0.00005	0.0002 (1992)	0.0002	APVMA value used (APVMA, 2011a); same as AOEL value selected.

\* = not approved in European Union



## References

APVMA, 2011a. ADI List: Acceptable Daily Intakes for Agricultural and Veterinary chemicals, current as of 30 June 2011.

[http://www.health.gov.au/internet/main/publishing.nsf/Content/E8F4D2F95D616584CA2573D700770C2A/\\$File/ADI-report-july11.pdf](http://www.health.gov.au/internet/main/publishing.nsf/Content/E8F4D2F95D616584CA2573D700770C2A/$File/ADI-report-july11.pdf) (Retrieved September, 2011).

APVMA, 2011b. APVMA Human Health Risk Assessment of Dimethoate, 2nd revision January 2010, current as of January 2011-09-27.

[http://www.apvma.gov.au/products/review/docs/dimethoate\\_human\\_health\\_tox.pdf](http://www.apvma.gov.au/products/review/docs/dimethoate_human_health_tox.pdf) (Retrieved September, 2011).

APVMA, 2008. DICHLORVOS - Toxicology Assessment: The reconsideration of approvals of the active constituent, registrations of products containing dichlorvos and approvals of their associated labels.

[http://www.apvma.gov.au/products/review/docs/dichlorvos\\_tox.pdf](http://www.apvma.gov.au/products/review/docs/dichlorvos_tox.pdf) (Retrieved September, 2011).

EFSA, 2006a. Conclusion on the peer review of diazinon. EFSA Scientific Report 85, 1-73

<http://www.efsa.europa.eu/en/efsajournal/doc/85r.pdf> (Retrieved September, 2011).

EFSA, 2006b. Review report for the active substance pirimicarb SANCO/10529/05 rev 5 Final

[http://ec.europa.eu/food/plant/protection/evaluation/existactive/list-pirimicarb\\_en.pdf](http://ec.europa.eu/food/plant/protection/evaluation/existactive/list-pirimicarb_en.pdf) (Retrieved September, 2011).

US EPA, 2001. Re-registration Eligibility Decision for Acephate.

[http://www.epa.gov/opp00001/reregistration/REDs/acephate\\_red.pdf](http://www.epa.gov/opp00001/reregistration/REDs/acephate_red.pdf) (p8) (Retrieved, September, 2011).

US EPA, 2006. Re-registration Eligibility Decision for Methamidophos (revised, 2006).

[http://www.epa.gov/pesticides/reregistration/REDs/methamidophos\\_red.pdf](http://www.epa.gov/pesticides/reregistration/REDs/methamidophos_red.pdf) (Retrieved September, 2011).

## Appendix F: Additional controls for organophosphate and carbamate formulated substances used for plant protection purposes

[illegible]

[illegible]

Active Ingredient	Affected approvals	R-1: Phase-in	R-2: Phase-out	R-3: Application parameters	R-4: Buffer zones	R-5: Cover granules	R-6: Droplet size	R-7: Method restrictions	R-8: Label: OP / carbamate	R-9: Label: bees	R-10: PPE / RPE	R-11: Notification	R-12: REI	R-13: Approved Handler	R-14: Signage	R-15: Transportation	R-16: Authorised person
	HSR000965 HSR100129																
Fenamiphos	HSR000198 HSR000956 HSR002480 HSR007769 HSR007894 HSR100282	18 months	5 years	Max. rate = 8000 g / ha.  Frequency = 1 time / year	Y	-	Y - coarse	Prohibit aerial application	Y	Y	Full PPE; RPE	Y	48 hours	Y	-	-	-
Fenitrothion	HSR000201	-	3 years	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maldison / malathion	HSR000189	18 months	-	-	-	-	-	Only for use in making baits;  Baits must be dyed blue or green.	Y	-	Full PPE; RPE	Y	-	Y		-	-
	HSR000190 HSR100380	18 months	-	Max. rate = 4500 g / ha.  Frequency = 2 times / year	Y	-	-	-	Y	Y	Full PPE; RPE	Y	24 hours	Y	-	-	Y
	HSR100407	18 months	-	-	-	-	-	-	Y	-	Full PPE; RPE	-	-	Y	-	-	-
Methamidophos	HSR000203 HSR000226	18 months	5 years	Max. rate = 900 g / ha.	Y	-	-	-	Y	Y	Full PPE; RPE	Y	48 hours	Y	-	-	-
Methomyl	HSR000584 HSR007761	18 months	-	Max. rate = 480 g / ha.	-	-	-	Prohibit ALL outdoor use;  Indoor use only (excl. handgun)	Y	-	Full PPE; RPE	-	48 hours	Y	Y (when used indoors)	-	-
Oxamyl	HSR000791	18 months	-	Max. rate = 6720 g / ha.	Y	-	-	Prohibit aerial application;  Automatic application only (when used indoors)	Y	Y	Full PPE; RPE	Y – for outdoor use	24 hours (for all application methods except dosing via irrigation)	Y	-	-	-

[illegible]



## Phase-out periods for active ingredient approvals

Active Ingredient	Approval Number	Approval retained?	R-2: phase-out period
Acephate	HSR002724	Y	N/A
Benomyl	HSR002816	N	6 months
Carbofuran	HSR002928	N	6 months
Carbosulfan	HSR003451	N	6 months
Chlorpyrifos-methyl	HSR004064	Y	N/A
Dichlofenthion	HSR003685	N	6 months
Dimethoate	HSR002841	N	3 years
Ethion	HSR002985	N	6 months
Famphur	HSR002847	N	6 months
Isazofos	HSR002857	N	6 months
Methamidophos	HSR002863	N	3 years
Omethoate	HSR002842	N	6 months
Phorate	HSR003058	N	3 years
Phoxim	HSR003195	N	6 months

## Appendix G: Description of additional controls for the mitigation of risk arising from organophosphate and carbamate plant protection substances.

Control Code	Intent of control	Example wording
R-1	<p><b>PHASE-IN OF NEW CONTROLS</b></p> <p>Where new controls are imposed on a substance, the revised control package comes into effect after a transition period in order to allow for compliance with the revised controls to be arranged.</p>	<p><b>CONTROL</b></p> <p>The controls listed below will apply to the substance from [date]:</p> <p>[R-2, R-3,.....,R-16]</p>
R-2	<p><b>PHASE-OUT OF APPROVAL</b></p> <p>For approvals for substances that are to be phased out, a period of time is established to allow for use or disposal of the substance. After the Phase-out Period has elapsed, the approval for the substance will no longer be a valid approval and the substance may no longer be present in New Zealand under that approval.</p>	<p><b>CONTROL</b></p> <p>No person may import, manufacture, store, use or otherwise hold the substance after the expiry of [date].</p>
R-3	<p><b>APPLICATION PARAMETERS</b></p> <p>Where restrictions in the use of a substance are required to manage exposure to human health and/or the environment, restrictions are imposed on application of a substance being used as a plant protection insecticide (including maximum application rates, frequencies or intervals as relevant).</p>	<p><b>CONTROL</b></p> <p>(1) The person in charge of the application of a substance and any person applying the substance must ensure that application of the substance is carried out in accordance with the following application restrictions:</p> <p>(a) The substance may be applied at a maximum rate of [quantity][active ingredient substance] / ha, with a maximum application frequency of [# times] per [time interval].</p> <p>(b) A minimum of [# days] days must elapse between day of completion of an application of the substance and any subsequent application of the substance to any area to which the substance has previously been applied.</p> <p><b>LABEL STATEMENT</b></p> <p>(2) A person must not supply a hazardous substance to any other person unless the substance label shows the following information:</p> <p>(a) the maximum application rate;</p>

Control Code	Intent of control	Example wording														
		<p>(b) the maximum application frequency [if set];</p> <p>(c) the minimum application interval [if set].</p> <p>(3) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (2).</p>														
R-4	<p><b>BUFFER ZONES</b></p> <p>In order to protect bystanders and/or sensitive areas from exposure arising from off-target deposition of the substance, application of the substance is permitted provided that sensitive areas are protected by a buffer zone, in the downwind direction from the application area. The Buffer Zone criteria reproduce the distances specified in New Zealand Standard NZS:8409 Management of Agrichemicals.</p>	<p><b>CONTROL</b></p> <p>(1) The person in charge of the application and any person applying the substance shall ensure that a buffer zone is set for each application.</p> <p>(2) A buffer zone, as referred to in (1), is the area between the downwind edge of a target application area and a sensitive area, where the minimum separation distance between the downwind edge of a target application area and a sensitive area is specified in the following table:</p> <table border="1"> <thead> <tr> <th rowspan="2">Application method</th><th colspan="2">Distance / m</th></tr> <tr> <th>With shelter belt</th><th>Without shelter belt</th></tr> </thead> <tbody> <tr> <td>Boom sprayer</td><td>2</td><td>10</td></tr> <tr> <td>Air blast sprayer</td><td>10</td><td>30</td></tr> <tr> <td>Aerial application</td><td>100</td><td>300</td></tr> </tbody> </table> <p><b>LABEL STATEMENT</b></p> <p>(3) A person must not supply a hazardous substance to any other person unless the substance label shows the buffer zone in requirements in accordance with (1) and (2).</p> <p>(4) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (3).</p>	Application method	Distance / m		With shelter belt	Without shelter belt	Boom sprayer	2	10	Air blast sprayer	10	30	Aerial application	100	300
Application method	Distance / m															
	With shelter belt	Without shelter belt														
Boom sprayer	2	10														
Air blast sprayer	10	30														
Aerial application	100	300														
R-5	<p><b>COVER GRANULES AFTER APPLICATION</b></p> <p>In order to protect birds from exposure to pesticide granules after application, granules must be covered with soil immediately after</p>	<p><b>CONTROL</b></p> <p>(1) Any person applying the substance shall ensure that, at the time of application, all granules are completely covered with soil</p>														

Control Code	Intent of control	Example wording
	application.	<p>such that granules are no longer visible.</p> <p><b>LABEL STATEMENT</b></p> <p>(2) A person must not supply a hazardous substance to any other person unless the substance label specifies that all granules must be completely covered with soil immediately after application.</p> <p>(3) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (2).</p>
R-6	<p><b>DROPLET SIZE</b></p> <p>In order to better manage exposure arising from spray drift of a substance, use of spray droplets of specific diameter distribution is required in order to protect sensitive areas (such as places where bystanders or aquatic environments may be exposed). Use of particular equipment types or specific nozzle types may be options for users to achieve the specified nozzle types.</p>	<p><b>CONTROL</b></p> <p>(1) Any person applying the substance shall ensure that the substance is only be applied using equipment that produces droplets that are not less than [e.g. coarse] in size, (as specified in NZS:8409 Management of Agrichemicals in accordance with British Crop Production Council (BCPC) classification).</p> <p><b>LABEL STATEMENT</b></p> <p>(2) A person must not supply a hazardous substance to any other person unless the substance label specifies the minimum droplet size for the application method required by (1), and as specified in NZS:8409 Management of Agrichemicals in accordance with BCPC classification.</p> <p>(3) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (2).</p>
R-7	<p><b>RESTRICTION ON METHOD OF APPLICATION</b></p> <p>Where restrictions on application method are required to manage the exposure risk to human health or to the environment, application of a substance will be restricted to specific application methods. This may include specifying particular equipment that may be used, locations or environments in which the substance can be applied, or particular use patterns to be avoided. For example:</p> <p>aerial application may be prohibited;</p> <p>use of a substance outdoors may be prohibited.</p>	<p><b>CONTROL</b></p> <p>(1) A person [may only / may not] apply the substance, unless applied in accordance with the following:</p> <p>[detail specific allowed equipment type or method:</p> <p>eg ground-based/non-dispersive;</p> <p>ground-based application only;</p> <p>Knapsack application only;</p> <p>Remotely operated fogging equipment;</p> <p>Treated wheat baits made from the substance must be dyed blue or green].</p> <p><b>LABEL STATEMENT</b></p>

Control Code	Intent of control	Example wording
	<p>Use under this control may be limited to delivery of the substance using automatic systems. An automatic system is a delivery system that is operated remotely and does not require an operator to be present in the application area during release of the substance. This means that operators will not be exposed to the substance during application.</p> <p>Additionally, this control will be used to specify conditions or considerations for use of a particular substance. In the particular instance of maldison used to make insecticide wheat baits, the treated wheat bait must be coloured blue or green to reduce the risks posed to birds by the bait substance.</p>	<p>(2) A person must not supply a hazardous substance to any other person unless the substance label specifies the application equipment or techniques that may be used to apply the substance, in accordance with (1).</p> <p>(3) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (2).</p>
R-8	<p><b>IDENTIFICATION AS AN ORGANOPHOSPHATE OR CARBAMATE SUBSTANCE</b></p> <p>To ensure that users of the substance are aware of the chemical class of the substance being handled, the substance must be labelled in a manner that clearly indicates the chemical class to which the substance belongs. This will identify to users that the substance they are handling contains an organophosphate or a carbamate, which will alert the user to the risks of handling such substances.</p>	<p><b>CONTROL/LABEL STATEMENT</b></p> <p>(1) A person must not supply a hazardous substance to any other person unless the substance label clearly states that the substance is [an organophosphate][a carbamate]-containing substance.</p> <p>(2) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (1).</p>
R-9	<p><b>LABEL WARNING OF EFFECTS ON BEES</b></p> <p>Where use of a substance may result in risks of adverse effects on bees visiting treated plants, to ensure that users of the substance are aware of the toxic effects of the substance to bees, an additional label statement is required to highlight this concern and detail circumstances to be avoided or restrictions required to reduce the risks of use on bees. Such measures could include avoidance of application to flowering plants, or carrying out application in the early morning or late evening when bees are no longer active. This control is more prescriptive than the requirements of the default identification regulations for class 9.4 ecotoxic substances. This control also refers to non-application periods that apply to substances containing</p>	<p><b>CONTROL/LABEL STATEMENT</b></p> <p><i>For acephate, methamidophos, methomyl or oxamyl containing substances:</i></p> <p>(1) A person must not supply a hazardous substance to any other person unless the substance label shows the following statement (or equivalent):</p> <p><i>This product is highly toxic to bees. Do not apply this product to any plant or tree likely to be visited by bees—</i></p> <p>(a) <i>at the time of application; or</i></p> <p>(b) <i>immediately after application; or</i></p> <p>(c) <i>between the period of [X] days before flowering until petal fall; or</i></p> <p>(d) <i>in areas where bees are foraging.</i></p>

Control Code	Intent of control	Example wording										
	acephate, methamidophos, methomyl or oxamyl under regulation 49 of the Hazardous Substances (Classes 6, 8, and 9 Controls) Regulations 2001.	<p>Note: For the purposes of (c), [X] is replaced by the specified number of days from the table below for the corresponding active ingredient:</p> <table><tr><th>Active ingredient</th><th>Days</th></tr><tr><td>Acephate</td><td>7</td></tr><tr><td>Methamidophos</td><td>7</td></tr><tr><td>Methomyl</td><td>10</td></tr><tr><td>Oxamyl</td><td>10</td></tr></table> <p>(2) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (1).</p> <p><i>For all other organophosphate or carbaryl containing substances:</i></p> <p>(1) A person must not supply a hazardous substance to any other person unless the substance label shows the following statement (or equivalent):</p> <p><i>This product is highly toxic to bees. Do not apply this product to any plant or tree likely to be visited by bees—</i></p> <p>(a) <i>at the time of application; or</i></p> <p>(b) <i>immediately after application; or</i></p> <p>(c) <i>in areas where bees are foraging.</i></p> <p>(2) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (1).</p>	Active ingredient	Days	Acephate	7	Methamidophos	7	Methomyl	10	Oxamyl	10
Active ingredient	Days											
Acephate	7											
Methamidophos	7											
Methomyl	10											
Oxamyl	10											
R-10	<p>PERSONAL PROTECTIVE EQUIPMENT</p> <p>If certain PPE or RPE is required to reduce exposure risk whilst handling a substance, the minimum levels of PPE will be specified as a control.</p>	<p>CONTROL</p> <p>(1) Any person who is mixing, loading or applying the substance, or entering an application area within the Restricted Entry Interval (REI), must meet the following minimum standards for personal protective equipment by wearing the following:</p> <p>[Full PPE:</p> <p>Chemical resistant coveralls, over a long-</p>										

Control Code	Intent of control	Example wording
		<p>sleeved shirt, long-legged trousers.</p> <p>Chemical resistant gloves.</p> <p>Chemical resistant footwear plus socks.</p> <p>Protective eyewear.</p> <p>Chemical resistant headgear for overhead exposures.</p> <p>RPE:</p> <p>Respirator with either an organic vapour-removing cartridge with a pre-filter approved for pesticides, or a canister approved for pesticides]</p> <p><b>LABEL STATEMENT</b></p> <p>(2) Where PPE is prescribed under (1), a person must not supply a hazardous substance to any other person unless the substance label specifies the PPE and RPE required to be worn during the following lifecycle stages, in accordance with (1) and (2): mixing, loading, application, re-entry into treated areas.</p> <p>(3) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (2).</p>
R-11	<p><b>NOTIFICATION</b></p> <p>If application of a substance presents a risk to bystanders or neighbours (for example from off-target application), notification in advance of application of the substance will be required. The information required to be provided is specified in the control, in addition to timeframes for carrying out the notification. Reasonable steps to avoid exposure may include, but are not limited to, things like:</p> <p>Closing windows and doors;</p> <p>Moving laundry indoors prior to application commencing;</p> <p>Staying indoors during the application.</p>	<p><b>CONTROL</b></p> <p>(1) No person may apply, or engage another person to apply, the substance unless that person has given written notice of the proposed application to occupiers and owners of land, dwellings or buildings immediately abutting the application area or buffer zone.</p> <p>(2) The notice referred to in subclause (1) must—</p> <p>(a) be given at least 2 working days but no more than 4 weeks in advance of each application; and</p> <p>(b) specify the following:</p> <p>(i) the location of application area that the substance will be applied to;</p> <p>(ii) the date and approximate duration of each application;</p> <p>(iii) the steps to be taken by the notified parties to take to avoid</p>

Control Code	Intent of control	Example wording
		<p>exposure;</p> <p>(iv) the name of the organisation/s undertaking the application;</p> <p>(v) contact details for the person in charge of the application (phone, email or postal address, including a contact number for immediate contact during application).</p> <p><b>LABEL STATEMENT</b></p> <p>(3) A person must not supply a hazardous substance to any other person unless the substance label shows that notification of affected parties and neighbours, in accordance with the requirements of (1) and (2), must be carried out in advance of the application.</p> <p>(4) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (3).</p>
R-12	<p><b>RESTRICTED ENTRY INTERVAL (REI)</b></p> <p>A Restricted Entry Interval (REI) is the period of time which must elapse after application of a substance before entry into the treated area is permitted without use of PPE or RPE. Entry into an application area before the REI has elapsed is only permitted if the same level of PPE and RPE required for application of the substance is worn. Where a substance is used in an indoor setting (such as a greenhouse, pack house or mushroom house), the atmosphere may present an exposure risk for a period of time after application has been completed. In such instances, the REI commences when the ventilation of the building or structure commences, which may be by mechanical or passive means. The person in charge of the place where a substance is applied is responsible for ensuring that no-one enters the application area until the end of the REI.</p>	<p><b>CONTROL</b></p> <p>(1) The REI for this substance is [X] hours.</p> <p>(2) The person in charge of the application area shall ensure that no person who may legally be in that place enters the application area until the end of the REI.</p> <p>(3) Despite (2), a person may enter the application area before the end of the REI—</p> <p>(a) if PPE and RPE is worn as if that person is applying the substance; and</p> <p>(b) if entering an indoor treated area, for the purpose of carrying out tasks associated with ventilation of the building or structure.</p> <p><b>LABEL STATEMENT</b></p> <p>(4) A person must not supply a hazardous substance to any other person unless the substance label shall show the requirements for the REIs and corresponding PPE, in accordance with (1) to (3).</p> <p>(5) A person who is in charge of a hazardous substance must ensure that the substance label shows the information required by (4).</p>
R-13	<b>APPROVED HANLDER</b>	<b>CONTROL</b>



Control Code	Intent of control	Example wording
	<p>Approved handler requirements are used to ensure that persons handling the substance have the required level of knowledge and expertise to safely use the substance.</p> <p>Existing controls for approved handler requirements for organophosphate and carbamate substances have been modified to different extents, such as only wide dispersive use or use by a commercial contractor requires an approved handler.</p> <p>This control replaces the existing approved handler requirements imposed on a substance (if any). The substance must be under the control of an approved handler, or securely stored at all times, with the exception of transportation of the substance.</p>	<p>(1) The requirements of regulation 9 of Hazardous Substances (Classes 6, 8, and 9 Controls) Regulations 2001, and regulations 4 to 6 Hazardous Substances (Personnel Qualifications) Regulations 2001 apply to this substance.</p> <p>(2) The following regulation is inserted immediately after regulation 9 of the Hazardous Substances (Classes 6, 8, and 9 Controls) Regulations 2001:</p> <p>9A Exception to approved handler requirement for transportation of packaged pesticides</p> <p>(1) Regulation 9 is deemed to be complied with if:</p> <p>(a) when this substance is being transported on land—</p> <p>(i) by rail, the person who drives the rail vehicle that is transporting the substance is fully trained in accordance with the approved safety system referred to in an approved safety case under the Railways Act 2005; and</p> <p>(ii) other than by rail, the person who drives, loads, and unloads the vehicle that is transporting the substance has a current dangerous goods endorsement on his or her driver licence; and</p> <p>(iii) in all cases, Land Transport Rule: Dangerous Goods 1999 (Rule 45001) is complied with; or</p> <p>(b) when this substance is being transported by sea, one of the following is complied with:</p> <p>(i) Maritime Rules: Part 24A – Carriage of Cargoes – Dangerous Goods (MR024A):</p> <p>(ii) International Maritime Dangerous Goods Code; or</p> <p>(c) when this substance being transported by air, Part 92 of the Civil Aviation Rules is complied with.</p>

Control Code	Intent of control	Example wording
		<p>(2) Subclause (1)(a)—</p> <ul style="list-style-type: none"> <li>(a) does not apply to a tank wagon or a transportable container to which the Hazardous Substances (Tank Wagons and Transportable Containers) Regulations 2004 applies; but</li> <li>(b) despite paragraph (a), does apply to an intermediate bulk container that complies with chapter 6.5 of the UN Model Regulations.</li> </ul> <p>(3) Subclause (1)(c)—</p> <ul style="list-style-type: none"> <li>(a) applies to pilots, aircrew, and airline ground personnel loading and managing this substance within an aerodrome; but</li> <li>(b) does not apply to— <ul style="list-style-type: none"> <li>(i) the handling of this substance in any place that is not within an aerodrome; or</li> <li>(ii) the loading and managing of this substance for the purpose of aerial spraying or dropping.</li> </ul> </li> </ul> <p>(4) In this regulation, UN Model Regulations means the 17th revised edition of the Recommendation on the transport of Dangerous Goods Model Regulations, published in 2011 by the United Nations.</p>
R-14	<p><b>SIGNAGE</b></p> <p>This control will be imposed on use of a substance when used indoors. Where a substance is applied in an indoor environment, and present a risk to persons entering the location either during or after application, a sign must be placed at the entrances to the application area that has been treated with the substance, to inform people when safe entry into the location is allowed. The responsibility for ensuring that this occurs lies with the person in charge of the application area and the person in charge of the application.</p>	<p><b>CONTROL</b></p> <ul style="list-style-type: none"> <li>(1) The person in charge of the application area and the person in charge of the application of the substance must ensure that signs are erected outside of the application area, at every routine point of entry into the application area. Signs must be posted from the start of commencement of application, until the end of the application or Restricted Entry Interval (REI), whichever is the later.</li> <li>(2) Signs erected in accordance with subclause (1) must – <ul style="list-style-type: none"> <li>(a) state that application is being carried out using a substance that is toxic to humans; and</li> <li>(b) state that entry into the application area is not permitted unless PPE and RPE is</li> </ul> </li> </ul>

Control Code	Intent of control	Example wording
		<p>worn.</p> <p>(3) Signs erected in accordance with subclauses (1) and (2) must –</p> <p>(a) comply with regulation 34(1), (2), and (4) and regulation 35(1), (3), and (5) of the Hazardous Substances (Identification) Regulations 2001, but as if the distances referred to in regulation 35(3) were a distance of not less than 10 metres; and</p> <p>(b) identify the person in charge of the application; and</p> <p>(c) state the day on which the application commenced; and</p> <p>(d) state the time and date of the end of the REI.</p> <p>(4) Signs must be removed within 3 days (72 hours) of the end of the application or REI, whichever is the later.</p>
R-15	<p><b>TRANSPORTATION RESTRICTION</b></p> <p>Volatilization of toxic substances may generate hazardous atmosphere within a vehicle if the substance is not contained in sealed packaging and transported inside of the vehicle. In order to prevent exposure of persons travelling in the vehicle, substance transported in opened packaging must be carried in a manner that will not expose passengers in the vehicle to a toxic atmosphere. This control is in addition to the default packaging and transportation controls.</p>	<p>(1) Any person may only transport the substance in a vehicle if the substance is contained in—</p> <p>(a) a sealed, unopened sachet; or</p> <p>(b) an airtight container.</p>
R-16	<p><b>AUTHORISED PERSON</b></p> <p>Where a substance is required to be used at higher use rates than the additional controls allow in order to control a biosecurity incursion, certain additional controls do not apply when the substance is used by an appropriate person acting under the Biosecurity Act. The requirements to protect operators from exposure (such as PPE and Restricted Entry Intervals) will still apply, while allowing use in exceptional circumstances outside of normal operating parameters.</p>	<p>The following additional controls [as relevant] do not apply to use of the substance by an authorised person:</p> <p>[R-3, R-4, R-5, R-6, R-7, R-11, R-14]</p>

## Interpretation

Term	Definition
Any plant or tree likely to be visited by bees	<b>Any plant or tree likely to be visited by bees</b> includes any flowering plant, tree or weed.
Application area	<b>Application area</b> means the area within the boundary defined by the outer extremity of all soil to which the substance has been applied.
Authorised person	An <b>authorised person</b> means a person with a relevant appointment as an authorised person under section 103 of the Biosecurity Act 1993.
Person in charge of application	<b>Person in charge of application</b> means a person who is in effective control or possession of the substance, and responsible for application of the substance from the commencement of application until the end of the REI.
Person in charge of application area	<b>Person in charge of application area</b> means a person who is in effective control or possession of the application area from the commencement of application until the end of the REI.
Restricted Entry Interval (REI)	<p><b>Restricted Entry Interval (REI)</b> means the period of time which must elapse from the latter of—</p> <ul style="list-style-type: none"> <li>(a) when the substance was last applied to the application area; or</li> <li>(b) where the application area is within a building or enclosed structure, when ventilation of the structure is commenced.</li> </ul>
Sensitive area	<p><b>Sensitive area</b> means a place which may be adversely affected by application of a substance. Sensitive areas include, but are not limited to, the following:</p> <ul style="list-style-type: none"> <li>• Places where members of the public are likely to be present and are unable to readily evacuate themselves, such as a school, playground, early childhood centre, prison, hospital or long-term care facility;</li> <li>• Water bodies, including public water supply catchments and intakes catchment;</li> <li>• Sensitive habitats, such as wetlands, indigenous vegetation habitat areas and reserves;</li> <li>• Public roads, public places and amenity areas.</li> </ul>
Shelter belt	<p><b>Shelter belt</b> means a live, vegetative shelter that is—</p> <ul style="list-style-type: none"> <li>• at least 3 metres high and 1 metre thick;</li> <li>• complete across the entire profile width of a sensitive area in the downwind direction without gaps at the base; and</li> <li>• located between the application area and the sensitive area.</li> </ul>

## Appendix H: International Context

### Overseas status and concerns for substances included in this application

The regulatory concerns identified in this section are the key concerns referred to in completed reviews by major international regulators. The Chief Executive recognises this does not include all concerns which may have been identified, and in particular it does not include concerns identified by recent research which have not yet been addressed in the completed assessments by overseas regulators including the United States' Environmental Protection Agency (US EPA), Australian Pesticides and Veterinary Medicines Authority (APVMA), the European Union's Standing Committee on the Food Chain and Animal Health (EU), and the Canadian Pest Management Regulatory Agency (PMRA).

Jurisdiction	Main uses	Regulatory concern	Reference
<b>Acephate</b>			
US EPA	Cotton, tobacco, cranberries, ornamentals, non-bearing fruit trees, Christmas trees, and cut flowers	Operator (mixer/loader/applicator) Bystander (homeowners, children) Birds, mammals, non target arthropods	US EPA 2006 Reregistration Eligibility Decision for Acephate <a href="http://www.epa.gov/oppsrrd1/REDs/acephate_red.pdf">http://www.epa.gov/oppsrrd1/REDs/acephate_red.pdf</a>
PMRA	Cabbages, celery, corn, potato, berries, tobacco, tomato, sweet pepper, trees and ornamentals	Re entry worker (major residual concern) in 2007 interim measures proposed in the review (2004) were implemented: buffer zones and amended re-entry intervals	Proposed Acceptability for Continuing Registration, Re-evaluation of Acephate, PACR2004-40 <a href="http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_pacr2004-40/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_pacr2004-40/index-eng.php</a>  Acephate, interim measures 2007 <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/re_v2007-02/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/re_v2007-02/index-eng.php</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	Consumer exposure Birds, mammals, aquatic organisms, non target arthropods Overall conclusion: the information available is	European Commission 2002 Acephate SANCO/3057/99-final 31 May 2002 <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>

		insufficient to satisfy the requirements set out in Annex II and Annex III Directive 91/414/EEC in particular with regard to acute consumer exposure and non-target organisms.	
APVMA	Bananas, crucifers, macadamias, ornamentals, potatoes, tomatoes and tobacco	Human health Consumer exposure Acephate has been nominated for review (priority 1).	APVMA, review programme <a href="http://www.apvma.gov.au/products/review/nominated/priority_1.php">http://www.apvma.gov.au/products/review/nominated/priority_1.php</a>

### Bendiocarb

US EPA	Household pests, ornamental plant pests, mosquitoes and fire ants	Bendiocarb has had its registration voluntarily cancelled  the registrants have been granted a 14 month existing stocks provision for products used in or around the home and a 28 month existing stocks provision for other products.	US EPA R.E.D Facts Bendiocarb 1999 <a href="http://www.epa.gov/oppsrrd1/REDs/factsheets/0409fact.pdf">http://www.epa.gov/oppsrrd1/REDs/factsheets/0409fact.pdf</a>
PMRA	No information on uses	No assessment report available	PMRA Bendiocarb under review <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/review2002-06/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/review2002-06/index-eng.php</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC		PPDB – Bendiocarb <a href="http://sitem.herts.ac.uk/aeru/footprint/en/index.htm">http://sitem.herts.ac.uk/aeru/footprint/en/index.htm</a>
APVMA	No information on uses	No assessment report available	APVMA Active Registration for Bendiocarb <a href="http://services.apvma.gov.au/PubcrisWebClient/details.do?view=summary&amp;pcode=44467">http://services.apvma.gov.au/PubcrisWebClient/details.do?view=summary&amp;pcode=44467</a>

### Benomyl

US EPA	Almonds, apples, anise, apricots,	Because of the voluntary	Benomyl RED, 2002
--------	-----------------------------------	--------------------------	-------------------

	asparagus, avocado, banana, barley, bean vine, blueberries, brassica (broccoli, brussels sprouts, cabbage, chicory, chinese cabbage, cauliflower, collards, kale, kohlrabi, mustard greens, rutabagas, and turnips), caneberries (raspberries, blackberries, boysenberries, loganberries, and dewberries), cardoon, carrots, celery, cherries, citrus, conifers, corn, cucurbits (cucumber, melons, pumpkins, and squash), currants, dandelions, dill, figs, grapes, macadamia nuts, mangoes, mushrooms, nectarines, onions, oats, papayas, peaches, peanuts, pears, peas, pecans, peppers, pineapple, pistachio, plums, prunes, rape, rice, rye, soybeans, spinach, strawberry, sugar beets, tomatoes, wheat, and yams	cancellation decision, USEPA did not complete risk assessments for benomyl  Sale and distribution of existing stocks of products already in the channels of trade is permitted until December 31, 2002 (period almost 1 year). EPA expects that use of any remaining benomyl products will end in 2003.	<a href="http://www.epa.gov/oppsrrd1/REdDs/benomyl_red.pdf">http://www.epa.gov/oppsrrd1/REdDs/benomyl_red.pdf</a>
PMRA	There are no products containing benomyl registered for use in Canada	Approval has been discontinued	Propoxur proposed re-evaluation decision 2011  <a href="http://www.oecd.org/chemicalsafety/agriculturalpesticide/sandbiocides/1944058.pdf">http://www.oecd.org/chemicalsafety/agriculturalpesticide/sandbiocides/1944058.pdf</a>  Pesticide Product Information Database  <a href="http://pr-rp.hc-sc.gc.ca/pi-ip/actives-eng.php?p_letter=B">http://pr-rp.hc-sc.gc.ca/pi-ip/actives-eng.php?p_letter=B</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC		Review report for the active substance benomyl, 2002 <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=73">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=73</a> <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=73">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=73</a>
APVMA	There are no products containing benomyl registered for use in Australia	Causes birth defects in laboratory animals	Media Release, 2009 <a href="http://www.apvma.gov.au/news_media/our_view/2009/2009-02-">http://www.apvma.gov.au/news_media/our_view/2009/2009-02-</a>

04\_benomyl.php

**Carbaryl**

US EPA	Fruit trees, vegetables, pasture	<p>Bystander (toddlers- turf)</p> <p>Operator</p> <p>Non target arthropods (esp. bees)</p> <p>Further: vascular cancers in mice, but these are not seen as primary drivers of risk assessment as they are below the US EPA's level of concern</p> <p>The following application methods are prohibited hand, spoon, shaker can, backpack spreaders, power backpack sprayers, tree injection and all handheld foggers, aerial applications</p>	<p>US EPA, 2007 <a href="http://www.epa.gov/oppsrrd1/REDs/carbaryl_red.pdf">http://www.epa.gov/oppsrrd1/REDs/carbaryl_red.pdf</a></p> <p>US EPA, 2008 (Amendment): <a href="http://www.epa.gov/oppsrrd1/REDs/carbaryl-red-amended.pdf">http://www.epa.gov/oppsrrd1/REDs/carbaryl-red-amended.pdf</a></p>
PMRA	Cereals, vegetables, corn, potato, tobacco, pipfruit, stonefruit, berries, trees and ornamentals, turf, poultry, cattle, sheep, horses, goats, hogs	<p>Bystander (vegetable, pick your own operations and turf)</p> <p>Re entry worker</p> <p>Birds, mammals, aquatic organisms, non target arthropods</p> <p>Specific uses of carbaryl do not meet the current standard for health protection and are proposed for phase out. These uses are turf, golf courses and sod farms, residential ornamentals, fruit trees and vegetable gardens, tobacco and pick-your-own orchard operations</p>	<p>PMRA 2009 Consultation document on carbaryl, proposed re-evaluation decision PRVD2009-14</p> <p><a href="http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_prvd2009-14/carbaryl-eng.php">http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_prvd2009-14/carbaryl-eng.php</a></p>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	<p>Human health</p> <p>Birds, mammals, aquatic organisms, non target</p>	<p>European Commission 2002, Acephate SANCO/3057/99-final 31 May 2002</p>



		<p>arthropods</p> <p>information available is insufficient to satisfy the requirements in particular with regard to consumer exposure and toxicity of breakdown products</p>	<a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>
APVMA	Tree and vine crops, fruit, vegetables, field crops, pasture and stored grain, ornamentals	<p>Bystander (domestic use)</p> <p>Human health</p> <p>Review completed August 2012.</p> <p>Uses deleted from approved labels: berry fruits, citrus (excl. oranges, lemons) cherries, kiwifruit, grapes, sunflower, linseed, vegetable crops (excl. potatoes, beetroot, turnip) sweet corn, stored cereal grains</p> <p>Withholding periods have been set for several crops</p> <p>uses of carbaryl on food-producing plants in the home garden have been deleted</p>	<p>APVMA 2012 Carbaryl final review report</p> <p><a href="http://www.apvma.gov.au/products/review/docs/carbaryl_report_1.pdf">http://www.apvma.gov.au/products/review/docs/carbaryl_report_1.pdf</a></p> <p>APVMA review programme: carbaryl</p> <p><a href="http://www.apvma.gov.au/products/review/current/carbaryl.php">http://www.apvma.gov.au/products/review/current/carbaryl.php</a></p>
<b>Carbofuran</b>			
US EPA	Control pests in soil and on leaves in a variety of field, fruit, and vegetable crops	<p>USEPA's revocation of carbofuran tolerances became effective on December 31, 2009. USEPA continues to find that dietary exposures to carbofuran from all sources combined are not safe</p> <p>US EPA allowed 4 year phase out for crops which have moderate benefits to growers</p>	<p>Carbofuran Cancellation Process</p> <p><a href="http://www.epa.gov/opp00001/reregistration/carbofuran/carbofuran_noic.htm">http://www.epa.gov/opp00001/reregistration/carbofuran/carbofuran_noic.htm</a></p>
PMRA	Canola, mustard, sunflower, corn (sweet, field and silage), sugar beet, green pepper, potato, raspberry and strawberry	All products being phased out	<p>Re-evaluation decision for Carbofuran 2010</p> <p><a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rvd2010-16/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rvd2010-16/index-eng.php</a></p>

EU	No uses, not included in Annex I of the Directive 91/414/EEC		PPDB – Carbofuran <a href="http://sitem.herts.ac.uk/aeru/footprint/en/index.htm">http://sitem.herts.ac.uk/aeru/footprint/en/index.htm</a>
APVMA	Rice, tobacco, sugarcane, wheat and barley, garlic industry.	Concerns for people applying the chemical  With negligible current use and the very limited permit uses coming to an end, the APVMA will consider the review status of carbofuran in the near future and look at options for formally closing the review	Nominated for review (priority 2)  <a href="http://www.apvma.gov.au/products/review/nominated/carbofuran_update.php">http://www.apvma.gov.au/products/review/nominated/carbofuran_update.php</a>

### Carbosulfan

US EPA	No uses	No records could be found	
PMRA	No registered uses	Carbosulfan degrades to carbofuran	Carbofuran Re-Evaluation Decision, 2010  <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rvd2010-16/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rvd2010-16/index-eng.php</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	Operator Bystander  Birds, mammals, aquatic organisms	Review report for the active substance carbosulfan, 2007  <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=131">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=131</a>
APVMA	<b>Citrus fruit</b>	<b>No records could be found</b>	PUBCRIS Active Summary  <a href="http://services.apvma.gov.au/PubcrisWebClient/details.do?view=summary&amp;pcode=48828">http://services.apvma.gov.au/PubcrisWebClient/details.do?view=summary&amp;pcode=48828</a>

### Chlorpyrifos

US EPA	Berries, citrus, pipfruit, stonefruit, nuts, grapes, brassicas, onions, cucurbits, asparagus, roots/tubers, corn, lentils, beans, peas, sorghum, tobacco, wheat, alfalfa, peanuts, soybeans, sunflower, cotton, sugar beets, mint, bananas, pasture, cattle ear tags, christmas trees, woodland, timber treatment, ant bait, hard surfaces	Operator Birds, mammals, aquatic organisms  Voluntary agreement to withdraw virtually all domestic uses (as at 2006)  FIFRA report is under review by the EPA	Reregistration Eligibility Decision for chlorpyrifos 2006  <a href="http://www.epa.gov/oppsrrd1/REDs/chlorpyrifos_red.pdf">http://www.epa.gov/oppsrrd1/REDs/chlorpyrifos_red.pdf</a>  FIFRA Scientific peer review of chlorpyrifos for the EPA 2012  <a href="#">SAP Minutes No. 2012-04</a>
--------	--	--	--

PMRA	Cereals, canola, corn, potato, sugarbeet, sunflower, tobacco, fruit and vegetable crops, turf, ornamentals (professional use) around non residential buildings	Human health (possible increased sensitivity to neurotoxic effects of chlorpyrifos)	Reevaluation note, PMRA, 2000 <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rev2000-05/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rev2000-05/index-eng.php</a>
EU	Grape vines, cereals, brassicas, berries, ornamentals	Human health (polyneuropathy after acute poisonings)  Birds, mammals, aquatic organisms, non target arthropods  EFSA was requested to review the additional information and the conclusions on the risk assessment for birds and mammals. They concluded that a high acute risk to birds and small herbivorous mammals cannot be excluded. Risk mitigation measures (no spray buffer zones) are needed to protect fish eating birds and mammals.	European Commission 2005, Chlorpyrifos  SANCO/3059/99 - rev. 1.5 3 June 2005  <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>  EFSA (2011) Conclusion on pesticide peer review of the pesticide risk assessment of the active substance chlorpyrifos, EFSA Journal 2011; 9(1):1961  <a href="http://www.efsa.europa.eu/en/efsajournal/pub/1961.htm">http://www.efsa.europa.eu/en/efsajournal/pub/1961.htm</a>
APVMA	Cotton, sugarcane, vegetables, pome and stone fruit, pasture, turf, ornamentals	Human health (anticholinesterase agent)  Birds  Based on the residue data assessment published August 2009 APVMA recommended to restrict uses.	NRA review, 2000 (Predecessor of the APVMA)  <a href="http://www.apvma.gov.au/products/review/current/chlorpyrifos.php">http://www.apvma.gov.au/products/review/current/chlorpyrifos.php</a>  Chlorpyrifos: Preliminary review findings report on additional residues data August 2009  <a href="http://www.apvma.gov.au/products/review/docs/chlorpyrifos_prf_sep09.pdf">http://www.apvma.gov.au/products/review/docs/chlorpyrifos_prf_sep09.pdf</a>

### Chlorpyrifos-methyl

US EPA	Stored grain, seed treatment, grain bin and warehouse	Operator  The registrants have requested a voluntary cancellation of chlorpyrifos-methyl  Phased out was 3 years	Chlorpyrifos-Methyl Facts, 2000  <a href="http://www.epa.gov/oppsrrd1/REDs/factsheets/cpm_fs.htm">http://www.epa.gov/oppsrrd1/REDs/factsheets/cpm_fs.htm</a>
--------	---	--	--

		and was extended with 1 year recognising the importance for grain storage	
PMRA	No registered uses	No review documents	Health Canada <a href="http://www.hc-sc.gc.ca">www.hc-sc.gc.ca</a>
EU	Grapes and stored grain	Birds and mammals Non-target arthropods	Review report for Chlorpyrifos-methyl, 2005 <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=139">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.ViewReview&amp;id=139</a>
APVMA	Grain	No review documents	Standard for chlorpyrifos-methyl, 2004 <a href="http://www.apvma.gov.au/products/constituents/standards/standard_chlorpyrifos-methyl.php">http://www.apvma.gov.au/products/constituents/standards/standard_chlorpyrifos-methyl.php</a>

**Diazinon**

US EPA	Many fruit, nut, vegetable, forage, and field crops, indoor uses	Operator (handlers, operators, field workers) Birds, mammals, aquatic organisms, non target arthropods Contamination of surface water	US EPA, 2006. Interim Reregistration Eligibility Decisions of Diazinon, July 31 2006 <a href="http://www.epa.gov/oppsrrd1/reregistration/REDs/diazinon_red.pdf">http://www.epa.gov/oppsrrd1/reregistration/REDs/diazinon_red.pdf</a>
PMRA	Pipfruit, stonefruit, berries, vegetables, potato, ornamentals	Operator (mixer/loader/applicator) Re entry worker Birds, mammals, aquatic organisms, non target arthropods	PRMA, 2007. Proposed Re-evaluation Decision Diazinon, 10 December 2007 <a href="http://turin/sites/felix/pol/1/sdm/AIR/Canada%20Diazinon%20RED.pdf">http://turin/sites/felix/pol/1/sdm/AIR/Canada%20Diazinon%20RED.pdf</a> PMRA, 2009. Re-evaluation Decision Diazinon, 4 November 2009 <a href="http://turin/sites/felix/pol/1/sdm/AIR/Canada%20Diazinon%20Re-evaluation%20Decision.pdf">http://turin/sites/felix/pol/1/sdm/AIR/Canada%20Diazinon%20Re-evaluation%20Decision.pdf</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	Bystander Operator	EFSA 2006. Conclusion on the peer review of diazinon, Scientific report (2006) 85,

		<p>Consumer exposure</p> <p>Birds, mammals, aquatic organisms, non target arthropods</p> <p>Further lack of data: on very toxic impurities, a maximum level of these impurities could not be set on fate and behaviour of the substance in the environment and its ecotoxicological properties</p>	<p>1-73</p> <p><a href="http://www.efsa.europa.eu/en/scdocs/doc/s85r.pdf">http://www.efsa.europa.eu/en/scdocs/doc/s85r.pdf</a></p> <p>EU, 2006. Final, review report for the active substance diazinon, SANCO/10052/06-rev 0 12 September 2006</p> <p><a href="http://ec.europa.eu/sancopesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sancopesticides/public/index.cfm?event=activesubstance.detail</a></p>
APVMA	Bananas, mushrooms, ornamentals, onions and pineapples	<p>Bystanders</p> <p>Operator</p> <p>Re entry worker</p> <p>Birds, mammals, aquatic organisms (esp. invertebrates) , non target arthropods (esp. bees)</p>	<p>APVMA, 2011. consolidation of toxicological hazard assessments of diazinon.</p> <p><a href="http://www.apvma.gov.au/products/review/docs/diazinon_hh_tox_part_2.pdf">http://www.apvma.gov.au/products/review/docs/diazinon_hh_tox_part_2.pdf</a></p> <p>APVMA, 2006. Review of diazinon based on new information and the preliminary findings of Part 2.</p> <p><a href="http://www.apvma.gov.au/products/review/docs/diazinon_PRf_vol1.pdf">http://www.apvma.gov.au/products/review/docs/diazinon_PRf_vol1.pdf</a></p> <p>APVMA, 2003. The reconsideration of registrations of products containing diazinon and their labels , April 2003</p> <p><a href="http://www.apvma.gov.au/products/review/current/diazinon.php">http://www.apvma.gov.au/products/review/current/diazinon.php</a></p>
<b>Dichlofenthion</b>			
US EPA	No registered uses	No records found	<p><b>Dichlofenthion</b></p> <p><a href="http://iaspub.epa.gov/apex/pesticides/f?p=CHEMICALSEARCH:3:0::NO:1,3,31,7,12,25:P3_XCHEMICAL_ID:2099">http://iaspub.epa.gov/apex/pesticides/f?p=CHEMICALSEARCH:3:0::NO:1,3,31,7,12,25:P3_XCHEMICAL_ID:2099</a></p>
PMRA	No registered uses	No records found	

EU	No uses, not included in Annex I of the Directive 91/414/EEC	No records found	<b>Dichlofenthion status</b> <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>
APVMA	No registered uses	No records found	
<b>Dichlorvos</b>			
US EPA	Indoor uses, grain	Bystander Birds, mammals and freshwater invertebrates	US EPA, 2006. Interim Reregistration Eligibility Decision for dichlorvos (DDVP), June 2006 <a href="http://www.epa.gov/oppsrrd1/reregistration/REDs/ddvp_red.pdf">http://www.epa.gov/oppsrrd1/reregistration/REDs/ddvp_red.pdf</a> US EPA, 2006. Factsheet dichlorvos, May 2006 <a href="http://www.epa.gov/oppsrrd1/reregistration/ddvp/ddvp_changes.htm">http://www.epa.gov/oppsrrd1/reregistration/ddvp/ddvp_changes.htm</a>
PMRA	Indoor and outdoor uses (non residential buildings)	Re-evaluation of dichlorvos is ongoing. PMRA is requiring registrants to make changes to their product labels to limit operator exposure.	PRMA, 2008. Re-evaluation note Dichlorvos Interim Measures, REV2008-04, March 2008 <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rev2008-04/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rev2008-04/index-eng.php</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	Bystander Operator Re entry worker Uncertainties of the genotoxic and carcinogenic properties of the substance Indoor use ( using fogging vaporising equipment) only therefore no environmental risk assessment	EU 2006. Review report for the active ingredient dichlorvos, Sanco/10031/2006 final 04 July 2006 <a href="http://ec.europa.eu/food/plant/protection/evaluation/exist_active/dichlorvos.pdf">http://ec.europa.eu/food/plant/protection/evaluation/exist_active/dichlorvos.pdf</a> EU 2007. Commission decision dichlorvos, Official Journal of the European Union, 6 June 2007 <a href="http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:145:0016:0017:EN:PDF">http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:145:0016:0017:EN:PDF</a> EFSA Scientific report, 2006. Conclusion on the peer review of dichlorvos, 12 May

			2006 <a href="http://www.efsa.europa.eu/en/efsajournal/doc/77r.pdf">http://www.efsa.europa.eu/en/efsajournal/doc/77r.pdf</a>
APVMA	Grain, cereals stores	Bystander Operators Consumer exposure Birds, mammals, aquatic organisms, non target arthropods	APVMA, 2011. Dichlorvos Final review report and regulatory decision, March 2011 <a href="http://www.apvma.gov.au/products/review/docs/dichlorvos_final_2011.pdf">http://www.apvma.gov.au/products/review/docs/dichlorvos_final_2011.pdf</a> <a href="http://www.apvma.gov.au/products/review/completed/dichlorvos.php">http://www.apvma.gov.au/products/review/completed/dichlorvos.php</a>

### Dimethoate

US EPA	Alfalfa, asparagus, beans, brassicas, celery, cherries, christmas trees, cotton, endive, field corn, grass grown for seed, ornamentals citrus, lettuce, lentils, melons, mustard greens, pears, peas, pecans, peppers, popcorn, potatoes, safflower, sorghum, soybeans, Swiss chard, tangerines, tangelos, tomatoes, turnips, watermelons, wheat, cottonwood grown for pulp	Bystander Operators Re entry worker Consumer exposure Birds, mammals	US EPA 2006, Revised interim Reregistration eligibility decisions for dimethoate <a href="http://www.epa.gov/oppsrrd1/REDs/dimethoate_ired_revised.pdf">http://www.epa.gov/oppsrrd1/REDs/dimethoate_ired_revised.pdf</a>
PMRA	Fruit crops, vegetables, field crops, trees and ornamentals, indoor uses non-residential	Operator Consumer exposure Birds, mammals, aquatic organisms, non target arthropods	PRMA 2011 Proposed re evaluation decision PRVD2011-12, dimehtoate <a href="http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/prvd2011-12/prvd2011-12-eng.php">http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/prvd2011-12/prvd2011-12-eng.php</a>
EU	Sugar beet, lettuce	Operator Consumer exposure Birds, mammals, aquatic organisms, non target arthropods	European Commission 2006, dimethoate, SANCO/10047/2006 final <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>
APVMA	Orchard and field crops (200 registered uses)	Consumer exposure (uses suspended to 5 Oct 2013)	APVMA 2011 dimethoate review in progress <a href="http://www.apvma.gov.au/products/review/current/dimethoate.php">http://www.apvma.gov.au/products/review/current/dimethoate.php</a>

### Ethion

US EPA	Cattle and citrus	Operators (mixing / loading / applying) Aquatic organisms Voluntary cancellation 2004	Ethion Fact Sheet, 2001 <a href="http://www.epa.gov/oppsrrd1/reregistration/REDs/factsheets/ethionfactsheet.pdf">http://www.epa.gov/oppsrrd1/reregistration/REDs/factsheets/ethionfactsheet.pdf</a>
PMRA	No uses	Voluntary cancellation 2001	Re-evaluation Note: Discontinuation of the Organophosphate Insecticide Ethion <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rev2001-03/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rev2001-03/index-eng.php</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	No records found	Ethion status <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>
APVMA	Cattle	No review documents found	List of registered products <a href="http://services.apvma.gov.au/PubcrisWebClient/search.do">http://services.apvma.gov.au/PubcrisWebClient/search.do</a>

### Famphur

US EPA	No uses	No records found	
PMRA	No uses	No records found	
EU	No uses	No records found	
APVMA	No uses	No records found	

### Fenamiphos

US EPA	No uses	Human health (possibly overstimulating the nervous system) Operator Consumer exposure Birds, mammals, aquatic organisms, non target arthropods incl. endangered species	US EPA 2011, Fenamiphos : Amendments to Use Deletion and Product Cancellation Orders: Fenamiphos: <a href="http://www.regulations.gov#!documentDetail;D=EPA-HQ-OPP-2003-0200-0007">http://www.regulations.gov#!documentDetail;D=EPA-HQ-OPP-2003-0200-0007</a>
PMRA	No uses	Not registered. No assessment documents could be found	
EU	Drip irrigation in greenhouses	Human health Birds, mammals, aquatic	EFSA Scientific report, 2006 Conclusion on the peer



		<p>organisms</p> <p>Further: high potential for ground water contamination by the metabolites of fenamiphos.</p>	<p>review of fenamiphos:</p> <p><a href="http://www.efsa.europa.eu/en/efsajournal/pub/62r.htm">http://www.efsa.europa.eu/en/efsajournal/pub/62r.htm</a></p> <p>European Commission - Fenamiphos</p> <p>SANCO/10017/2006- rev 3</p> <p><a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a></p>
APVMA	Root vegetables, aloe vera, pineapples, bulbs and corms, vegetables, citrus, grapes, pineapples, strawberries, ornamentals, sugar cane, tobacco and turf	<p>Human health</p> <p>Consumer exposure</p> <p>Environment (leaching)</p> <p>Review ongoing</p>	<p>The Reconsideration of Approvals and Registrations Relating to Fenamiphos:</p> <p><a href="http://www.apvma.gov.au/products/review/docs/fenamiphos_scope.pdf">http://www.apvma.gov.au/products/review/docs/fenamiphos_scope.pdf</a></p>
<b>Fenitrothion</b>			
US EPA	Use in bait stations only	Given the containerized ant and roach baits the exposure to humans and the environment will be limited	<p>US EPA 2006 Reregistration Eligibility Decision for Fenitrothion:</p> <p><a href="http://www.epa.gov/oppsrrd1/reregistration/REDs/fenitrothion_red.pdf">http://www.epa.gov/oppsrrd1/reregistration/REDs/fenitrothion_red.pdf</a></p>
PMRA	Forest and woodlands (includes tree nurseries)	<p>PMRA has concluded that the use of fenitrothion and its associated end-use product in accordance with the label does not entail an unacceptable risk of harm to human health or the environment.</p> <p>(Label: maximum 2 applications per season, buffer zones)</p>	<p>Re-evaluation Decision Document – Fenitrothion (RRD2004-13):</p> <p><a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rrd2004-13/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rrd2004-13/index-eng.php</a></p>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	<p>Bystander</p> <p>Operator</p> <p>Re entry worker</p> <p>Consumer exposure</p> <p>Birds, mammals, aquatic organisms, non target arthropods</p> <p>Further: explosive properties with respect to thermal sensitivity.</p>	<p>EFSA 2006. Conclusion regarding the peer review of the pesticide risk assessment of the active substance Fenitrothion:</p> <p><a href="http://www.efsa.europa.eu/en/efsajournal/pub/59r.htm">http://www.efsa.europa.eu/en/efsajournal/pub/59r.htm</a></p> <p>European Commission – Fenitrothion</p> <p>SANCO/10026/2006 final</p> <p><a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a></p>

			<a href="#">vent=activesubstance.detail</a>
APVMA	Rice, cereals, lucerne, pastures, fruits, vegetables, stored grain, and on structures	Human health Re entry worker Bird, aquatic invertebrates	The reconsideration of approvals of the active constituent fenitrothion, registrations of products containing fenitrothion and their associated labels. DRAFT REVIEW REPORT. March 2004:  <a href="http://www.apvma.gov.au/products/review/docs/fenitrothion_2004.pdf">http://www.apvma.gov.au/products/review/docs/fenitrothion_2004.pdf</a>  <a href="http://www.apvma.gov.au/products/review/current/fenitrothion.php">http://www.apvma.gov.au/products/review/current/fenitrothion.php</a>
<b>Isazofos</b>			
US EPA	No uses	No records found	
PMRA	No uses	No records found	
EU	No uses, not included in Annex I of the Directive 91/414/EEC	No records found	Isazofos status  <a href="http://ec.europa.eu/sancopesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sancopesticides/public/index.cfm?event=activesubstance.detail</a>
APVMA	No uses	No records found	
<b>Maldison (malathion)</b>			
US EPA	Berries, pipfruit, grapes, brassicas, other vegetables, nuts, citrus, cotton, indoor stored commodity treatment and empty storage facilities for barley, corn, oats, rye, and wheat, ornamentals, hard surfaces	Human health (Immunological effects) Consumer exposure (pick your own activities) Birds, mammals, aquatic organisms, non target arthropods Drinking water and residential bystander risk estimates were revised based on refinements to the assessments and/or mitigation measures, such as reduced maximum application rates and number of applications permitted per	US EPA, 2009 <a href="http://www.epa.gov/oppsrrd1/REDs/malathion-red-revised.pdf">http://www.epa.gov/oppsrrd1/REDs/malathion-red-revised.pdf</a>  US EPA, 2006. <a href="http://www.epa.gov/oppsrrd1/REDs/malathion_red.pdf">http://www.epa.gov/oppsrrd1/REDs/malathion_red.pdf</a>

		<p>year for many use sites. Occupational risks have been mitigated through personal protective equipment or engineering control requirements on the labels and extending re-entry intervals for some sites, and ecological risks have been reduced, but not eliminated, through adding buffer zone and spray drift requirements to the labels, and amending use patterns for many uses.</p>	
PMRA	Vegetables, fruit crops, field crops, ornamentals, garden and yards, standing water, in and around buildings, stored cereals	<p>Bystander</p> <p>Operator</p> <p>Birds, aquatic organisms</p>	PMRA, 2010 <a href="http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_prvd2010-18/prvd2010-18-eng.php">http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_prvd2010-18/prvd2010-18-eng.php</a>
EU	Strawberries, ornamentals	<p>Bystander</p> <p>Operator</p> <p>Re entry worker</p> <p>Consumer exposure</p> <p>Birds, aquatic organisms, non target arthropods</p>	<p>EFSA Scientific report 2009</p> <p>Peer review of the pesticide risk assessment of the active substance malathion.</p> <p>EFSA report 2009 333.1-118</p> <p><a href="http://www.efsa.europa.eu/de/scdocs/doc/333r.pdf">http://www.efsa.europa.eu/de/scdocs/doc/333r.pdf</a></p> <p>EU 2010. Malathion</p> <p>SANCO/10668/2009 final</p> <p>14 January 2010</p> <p><a href="http://ec.europa.eu/food/plant/protection/evaluation/existactive/list_malathion.pdf">http://ec.europa.eu/food/plant/protection/evaluation/existactive/list_malathion.pdf</a></p>
APVMA	Aquatic areas, flowers, fruit, vegetables, trees/forests, stored cereals, oil seed crops, ornamentals, lucerne/pasture, citrus, fruit trees, roses, grapevines, animal housing, industrial and home garden situations, non-crop and recreation areas, tobacco	Human health	<p>The Reconsideration of Approvals and Registrations Relating to maldison</p> <p><a href="http://www.apvma.gov.au/products/review/current/maldison.php">http://www.apvma.gov.au/products/review/current/maldison.php</a></p>

Methamidophos			
US EPA	No uses (cancelled in 2009)	Operator Re entry worker Birds, mammals, aquatic invertebrates	Interim Reregistration Eligibility Decision for Methamidophos <a href="http://www.epa.gov/oppsrrd1/REDs/methamidophos_red.pdf">http://www.epa.gov/oppsrrd1/REDs/methamidophos_red.pdf</a>  US EPA 2009 Methamidophos Final Work Plan for Reregistration review (EPA-HQ-OPP-2008-0842-0011) <a href="http://www.regulations.gov/#!docketDetail;rpp=10;po=10;D=EPA-HQ-OPP-2008-0842">http://www.regulations.gov/#!docketDetail;rpp=10;po=10;D=EPA-HQ-OPP-2008-0842</a>
PMRA	Brassica, lettuce, potato, canola	Operator Re entry worker Consumer exposure Birds, mammals, aquatic invertebrates Approvals expire end of 2012	Re-evaluation Note REV2007-11 Preliminary Risk and Value Assessments of Methamidophos <a href="http://publications.gc.ca/collections/collection_2007/hc-sc/H113-5-2007-11E.pdf">http://publications.gc.ca/collections/collection_2007/hc-sc/H113-5-2007-11E.pdf</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	Human health Birds, mammals	Commission Directive 2006/131/EC of 11 December 2006 amending Council Directive 91/414/EEC to include methamidophos as an active substance <a href="http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:349:0017:0021:EN:PDF">http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:349:0017:0021:EN:PDF</a>  EFSA 2004 the EFSA journal regarding methamidophos <a href="http://www.efsa.europa.eu/en/efsajournal/doc/opinion_pr06_ej95_methamidophos_en1,2.pdf">http://www.efsa.europa.eu/en/efsajournal/doc/opinion_pr06_ej95_methamidophos_en1,2.pdf</a>
APVMA	Vegetables, lupins, ornamentals, peaches, peanuts, potatoes, tomatoes	Human health (delayed neurotoxicity of methamidophos)	APVMA 2002 Reconsideration of Approvals and Registrations Related to Methamidophos

			<p>Voluntary cancellation</p> <p>On 15 June 2012, all approvals of the active constituent methamidophos were cancelled at the request of the approval holder. In addition, registrants have voluntarily cancelled all products containing methamidophos.</p> <p>A two-year phase out period, ending on 15 June 2014, applies to the supply and use of existing stock of methamidophos products.</p>	<p>Review Scope Document</p> <p><a href="http://www.apvma.gov.au/products/review/current/methamidophos.php">http://www.apvma.gov.au/products/review/current/methamidophos.php</a></p> <p><a href="http://www.apvma.gov.au/products/review/docs/methamidophos_scope.pdf">http://www.apvma.gov.au/products/review/docs/methamidophos_scope.pdf</a></p> <p>Voluntary cancellation</p> <p><a href="http://www.apvma.gov.au/products/review/not_required/methamidophos.php">http://www.apvma.gov.au/products/review/not_required/methamidophos.php</a></p>
<b>Methomyl</b>				
USEPA	Huge ranges of brassicas, other vegetables, citrus, stonefruit, pipfruit, hard surfaces	<ul style="list-style-type: none"> <li>Operator</li> <li>Re entry worker</li> <li>Mammals, aquatic invertebrates</li> </ul>	<p>USEPA RED 1998 Methomyl</p> <p><a href="http://www.epa.gov/oppsrrd1/REDS/0028red.pdf">http://www.epa.gov/oppsrrd1/REDS/0028red.pdf</a></p>	
PMRA	<p>Used on a range of different crops</p> <p>Fly bait (non-residential)</p>	<ul style="list-style-type: none"> <li>Re entry worker</li> <li>Birds, mammals, aquatic organisms, non target arthropods</li> </ul> <p>Further: concerns for ground water and surface water</p> <p>Insufficient information available to assess the risks to bystanders from use in public parks</p>	<p>PMRA, 2009 Preliminary Risk and Value Assessments of Methomyl</p> <p>PMRA, 2010. Re-evaluation Note REV2010-08 Methomyl</p>	
EU	Cucumber, courgette, tomato, aubergine	<ul style="list-style-type: none"> <li>Operators</li> <li>Birds, aquatic organisms, non target arthropods (esp.</li> </ul>	<p>EU Review report for the active substance methomyl, SANCO/5449/2009/final September 2009</p> <p><a href="http://ec.europa.eu/food/plant/protection/evaluation/existactivel/methomyl_en.pdf">http://ec.europa.eu/food/plant/protection/evaluation/existactivel/methomyl_en.pdf</a></p> <p>EFSA 2008 Peer review of the pesticide risk assessment of</p>	

		bees)	the active substance methomyl, Scientific report 222 <a href="http://www.efsa.europa.eu/en/efsajournal/doc/222r.pdf">http://www.efsa.europa.eu/en/efsajournal/doc/222r.pdf</a>
APVMA	Cereals, cotton, fruit, ginger, legumes, mint, oil seed crops, tobacco, potatoes, vegetables, pastures, peanuts	<ul style="list-style-type: none"> <li>Human health</li> <li>Consumer exposure</li> </ul> Methomyl has been nominated for review (priority 1)	APVMA review programme <a href="http://www.apvma.gov.au/products/review/nominated/priority_1.php">http://www.apvma.gov.au/products/review/nominated/priority_1.php</a>
<b>Omethoate</b>			
USEPA	No uses	No records found	APVMA - The Reconsideration of Approvals and Registrations Relating to Dimethoate and Omethoate, 2004 <a href="http://www.apvma.gov.au/products/review/docs/dimethoate_scope.pdf">http://www.apvma.gov.au/products/review/docs/dimethoate_scope.pdf</a>
PMRA	No uses	No records found	
EU	No uses, not included in Annex I of the Directive 91/414/EEC	No assessment report available	Omethoate status <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>
APVMA	Horticulture, agriculture and home garden	<ul style="list-style-type: none"> <li>Human health</li> </ul>	Omethoate review status <a href="http://www.apvma.gov.au/products/review/current/omethoate.php">http://www.apvma.gov.au/products/review/current/omethoate.php</a>
<b>Oxamyl</b>			
USEPA	Vegetables, fruit, cotton	<ul style="list-style-type: none"> <li>Operator</li> <li>Re entry worker</li> <li>Birds, mammals, aquatic organisms, bees</li> </ul>	USEPA, RED, 2007 <a href="http://www.epa.gov/opp00001/reregistration/REDs/oxamyl_red.pdf">http://www.epa.gov/opp00001/reregistration/REDs/oxamyl_red.pdf</a>
PMRA	Potatoes, raspberry, apple	<ul style="list-style-type: none"> <li>Operators</li> <li>Re-entry workers</li> <li>Aquatic organisms</li> </ul>	PMRA 2008 <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rvd2008-05/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rvd2008-05/index-eng.php</a>
EU	Potatoes	<ul style="list-style-type: none"> <li>Aquatic</li> </ul>	EFSA DAR 2004

		organisms, bees	<a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>
APVMA	Bananas, capsicum, tomatoes	No assessment report available	
<b>Phorate</b>			
US EPA	Potatoes, corn, peanuts, cotton, sugarcane, wheat, soybeans, beans, sorghum, sugar beets, lilies (field grown), daffodils, and radishes grown for seed	<ul style="list-style-type: none"> <li>• Re-entry worker (soil contact)</li> <li>• Consumer exposure</li> <li>• Birds, mammals, aquatic organisms, non target arthropods</li> </ul>	USEPA, 2006 Phorate RED. <a href="http://www.epa.gov/opp00001/reregistration/REds/phorate_red.pdf">http://www.epa.gov/opp00001/reregistration/REds/phorate_red.pdf</a>
PMRA	Phased out (2006)	<ul style="list-style-type: none"> <li>• Operator (loading)</li> <li>• Birds, mammals, aquatic organisms, non target arthropods</li> </ul>	PMRA, 2003 and 2004. Re-evaluation of phorate <a href="http://dsp-psd.pwgsc.gc.ca/Collection/H113-18-2003-1E.pdf">http://dsp-psd.pwgsc.gc.ca/Collection/H113-18-2003-1E.pdf</a> <a href="http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rrd2004-11/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/rrd2004-11/index-eng.php</a>
EU	No uses, not included in Annex I of the Directive 91/414/EEC	No assessment report available	
APVMA	Cotton, certain ornamentals and certain vegetables	No assessment report available	Nominated for review (priority 2) <a href="http://www.apvma.gov.au/products/review/nominated/priority_2.php#Phorate">http://www.apvma.gov.au/products/review/nominated/priority_2.php#Phorate</a>
<b>Phoxim</b>			
US EPA	No uses	No records found	
PMRA	No uses	No records found	
EU	No uses, not included in Annex I of	No assessment report available	Phoxim status <a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a>

	the Directive 91/414/EEC		
APVMA	No uses	No records found	
<b>Pirimicarb</b>			
US EPA	No uses	<p>No registered products under FIFRA section 3</p> <p>US EPA will take separate actions to cancel any remaining FIFRA section 24(c) Special Local Needs registrations with this active ingredient and to propose revocation of any affected tolerances that are not supported for import purposes only</p>	<a href="http://www.epa.gov/oppsrd1/registration_review/pirimicarb/">http://www.epa.gov/oppsrd1/registration_review/pirimicarb/</a>
PMRA	Phased out ( 2009)	No assessment report available	
EU	Wheat	<ul style="list-style-type: none"> <li>Human health ( Haematological effects, anaemia, lung tumours in mice)</li> <li>Birds, aquatic organisms</li> </ul>	<p>European Commission – Pirimicarb:</p> <p><a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a></p> <p>EFSA scientific report 2005. Conclusion regarding the peer review of the pesticide risk assessment of the active substance Pirimicarb:</p> <p><a href="http://www.efsa.europa.eu/en/efsajournal/pub/43r.htm">http://www.efsa.europa.eu/en/efsajournal/pub/43r.htm</a></p>
APVMA	Vegetables, fruit crops, cereals, cotton	No assessment report available	
<b>Pirimiphos-methyl</b>			
US EPA	Post-harvest use	<ul style="list-style-type: none"> <li>Operator</li> <li>Birds, aquatic organisms</li> </ul>	<p>US Environmental Protection Agency Office of Pesticide Programs: Reregistration Eligibility Decision for Pirimiphos-methyl</p> <p><a href="http://www.epa.gov/oppsrd1/reregistration/REDs/pirimiphos_methyl_red.pdf">http://www.epa.gov/oppsrd1/reregistration/REDs/pirimiphos_methyl_red.pdf</a></p>
PMRA	No uses	No assessment report available	



EU	Empty cereal stores	<ul style="list-style-type: none"> <li>Operator</li> <li>Consumer exposure</li> </ul>	<p>European Commission Health &amp; Consumer Protection Directorate-General: Review report for the active substance pirimiphos-methyl</p> <p><a href="http://ec.europa.eu/food/plant/protection/evaluation/existactivel1_pirimiphos-methyl_en.pdf">http://ec.europa.eu/food/plant/protection/evaluation/existactivel1_pirimiphos-methyl_en.pdf</a></p> <p>EFSA 2005 Conclusion regarding the peer review of the pesticide risk assessment of the active substance pirimiphos-methyl</p> <p><a href="http://www.efsa.europa.eu/en/efsajournal/doc/44r.pdf">http://www.efsa.europa.eu/en/efsajournal/doc/44r.pdf</a></p>
APVMA	Buildings and stored grain	No assessment report available	
<b>Prothiofos</b>			
US EPA	No uses	No assessment report available	
PMRA	No uses	No assessment report available	
EU	No uses, not included in Annex I of the Directive 91/414/EEC	No assessment report available	
APVMA	Bananas, brassicas, grapes, pears	No assessment report available	
<b>Pyrazophos</b>			
US EPA	No uses	No assessment report available	
PMRA	No uses	No assessment report available	
EU	No uses, not included in Annex I of the Directive 91/414/EEC	No assessment report available	<p>Pyrazophos status</p> <p><a href="http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail">http://ec.europa.eu/sanco_pesticides/public/index.cfm?event=activesubstance.detail</a></p>
APVMA	No uses	No assessment report available	
<b>Terbufos</b>			
US EPA	Corn, sorghum, sugar beet	<ul style="list-style-type: none"> <li>Operator (even with closed mixing and</li> </ul>	<p>US EPA 2001 Terbufos IRED Facts</p> <p><a href="http://www.epa.gov/oppsrrd1/REDs/factsheets/terbufos_ired_fs.htm">http://www.epa.gov/oppsrrd1/REDs/factsheets/terbufos_ired_fs.htm</a></p>

		enclosed cabs) <ul style="list-style-type: none"> <li>• Consumer exposure</li> <li>• Birds, aquatic organisms</li> </ul>	US EPA 2006 terbufos RED <a href="http://www.epa.gov/opp00001/reregistration/REDs/terbufos_red.pdf">http://www.epa.gov/opp00001/reregistration/REDs/terbufos_red.pdf</a>
PMRA	Phased out 2006	<ul style="list-style-type: none"> <li>• All groups of organisms (aquatic and terrestrial), especially for birds</li> </ul>	PRMA 2008. Re-evaluation of terbufos <a href="http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_pacr2003-02/index-eng.php">http://www.hc-sc.gc.ca/cps-spc/pest/part/consultations/_pacr2003-02/index-eng.php</a>
EU	No uses	No assessment report available	
APVMA	Maize, sunflowers, sorghum and sweet corn, cereals, bananas, peanuts	No assessment report available	Nominated for review (priority 2) <a href="http://www.apvma.gov.au/products/review/nominated/priority_2.php#Terbufos">http://www.apvma.gov.au/products/review/nominated/priority_2.php#Terbufos</a>