Australian Government

Australian Pesticides and Veterinary Medicines Authority

CHLORPYRIFOS

PRELIMINARY REVIEW FINDINGS REPORT ON ADDITIONAL RESIDUES DATA

A reconsideration of the active constituent approvals of chlorpyrifos, the registration of products containing chlorpyrifos and their associated labels

August 2009

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Comments and enquiries may be directed to:

Manager Chemical Review
Australian Pesticides and Veterinary Medicines Authority
PO Box 6182
KINGSTON ACT 2604
AUSTRALIA

Telephone: +61 2 6210 4700
Facsimile: +61 2 6210 4776
Email: chemrev@apvma.gov.au
Web site: http://www.apvma.gov.au

Typesetting by Rebecca Booth, Canberra

FOREWORD

The Australian Pesticides and Veterinary Medicines Authority (APVMA) is an independent statutory authority with responsibility for the regulation of agricultural and veterinary chemicals in Australia. Its statutory powers are provided in the Agvet Codes scheduled to the *Agricultural and Veterinary Chemicals Code Act 1994*.

The APVMA can reconsider the approval of an active constituent, the registration of a chemical product or the approval of a label for a container for a chemical product at any time. This is outlined in Part 2, Division 4 of the Agvet Codes.

The basis for the current reconsideration is whether the APVMA is satisfied that continued use of the active constituent chlorpyrifos and products containing chlorpyrifos in accordance with the instructions for their use:

- would not be an undue hazard to the safety of people exposed to it during its handling;
- would not be likely to have an effect that is harmful to human beings;
- would not be likely to have an unintended effect that is harmful to animals, plants or things or to the environment; and
- would not unduly prejudice trade or commerce between Australia and places outside Australia.

The APVMA also considered whether product labels carry adequate instructions and warning statements.

A reconsideration may be initiated when new research or evidence has raised concerns about the use or safety of a particular chemical, a product containing that chemical, or its label.

The reconsideration process includes a call for information from a variety of sources, a review of that information and, following public consultation, a decision about the future use of the chemical or product. The information and technical data required by the APVMA to review the safety of both new and existing chemical products must be derived according to accepted scientific principles, as must the methods of assessment undertaken.

In undertaking reconsiderations (hereafter referred to as reviews), the APVMA works in close cooperation with advisory agencies including the Office of Chemical Safety and Environmental Health (OCSEH) within the Department of Health and Ageing, the Department of the Environment, Water, Heritage and the Arts (DEWHA) and State departments of agriculture, as well as other expert advisers as appropriate.

The APVMA has a policy of encouraging openness and transparency in its activities and community involvement in decision-making. The publication of review reports is a part of that process.

The APVMA also makes these reports available to the regulatory agencies of other countries as part of bilateral agreements. The APVMA recommends that countries receiving these reports will not utilise them for registration purposes unless they are also provided with the raw data from the relevant applicant.

This document sets out the preliminary review findings relating to chlorpyrifos containing products (and their labels) intended for use in agricultural situations; these have been nominated for review by the APVMA. The preliminary review findings and proposed recommendations are based on information collected from a variety of sources.

The review summary (Volume 1) and the technical reports (Volume 2) for all registrations and approvals relating to chlorpyrifos are available from the APVMA web site <http://www.apvma.gov.au>.

SUBMISSIONS FROM THE PUBLIC ARE INVITED

This Supplementary Preliminary Review Findings (PRF) report:

- outlines the APVMA review process;
- summarises the technical assessments from the reviewing agencies;
- outlines the proposed regulatory action to be taken in relation to the continued registration of chlorpyrifos products; and
- advises interested parties how to respond to the review.

The APVMA invites persons and organisations to submit their comments and suggestions on this Preliminary Review Findings report directly to the APVMA. Your comments will assist the APVMA in preparing the Review Findings report, which is the second report in the three-stage review reporting process. The final report is the Final Review Report and Regulatory Decision.

PREPARING YOUR COMMENTS FOR SUBMISSION

You may agree or disagree with or comment on as many elements of the preliminary review findings as you wish.

When making your comments:

- clearly identify the issue and clearly state your point of view;
- give reasons for your comments, supporting them, if possible, with relevant information and indicating the source of the information you have used; and
- suggest to the APVMA any alternative solution you may have for the issue.

Please try to structure your comments in point form, referring each point to the relevant section in the preliminary review findings. This will help the APVMA assemble and analyse all of the comments it receives.

Finally please tell us whether the APVMA can quote your comments in part or in full.

Please note that subject to the *Freedom of Information Act 1982*, the *Privacy Act 1988,* and the Agvet Codes all submissions received may be made publicly available. They may be listed or referred to in any papers or reports prepared on this subject matter.

The APVMA reserves the right to reveal the identity of a respondent unless a request for anonymity accompanies the submission. If no request for anonymity is made, the respondent will be taken to have consented to the disclosure of their identity for the purposes of Information Privacy Principle 11 of the *Privacy Act 1988.*

The contents of any submission will not be treated as confidential or confidential commercial information unless they are marked as such and the respondent has provided justification such that the material is capable of being classified as confidential or confidential commercial information in accordance with the *Freedom of Information Act 1982* or the Agvet Codes as the case may be.

THE CLOSING DATE FOR SUBMISSIONS IS 30 October 2009.

Submissions can be sent either by email to chemrev@apvma.gov.au or by mail to:

Manager Chlorpyrifos Review
Australian Pesticides and Veterinary Medicines Authority
PO Box 6182
KINGSTON ACT 2604

Telephone: 61 2 6210 4700
Facsimile: 61 2 6210 4776
Email: chemrev@apvma.gov.au

ACRONYMS AND ABBREVIATIONS

µg	Microgram
ADI	Acceptable Daily Intake (for humans)
ac	active constituent
ai	active ingredient
APVMA	Australian Pesticides and Veterinary Medicines Authority
ARfD	Acute Reference Dose
ChE	cholinesterase
Codex	FAO/WHO Codex Alimentarius Commission
DT50	time required for 50% of a chemical to degrade
EC	emulsifiable concentrate
EC50	concentration at which 50% of the test population are affected
ECRP	Existing Chemicals Review Program
GAP	Good Agricultural Practice
GC-MS	Gas Chromatography-Mass Spectrometry
ha	hectare
HPLC	High Performance Liquid Chromatography
IPM	Integrated Pest Management
JMPR	Joint FAO/WHO Meeting on Pesticide Residues
LOD	Limit of Detection
LOEL	Lowest Observable Effect Level
LOQ	Limit Of analytical Quantitation, also referred to as limit of determination
LOR	Limit of Reporting
LV	Low Volume
m	metre
ME	Micro-encapsulated
mg	Milligram
mL	Millilitre
MFL	maximum feeding level
MRL	maximum residue limit
MSDS	Material Safety Data Sheet
NEDI	National Estimated Dietary Intake
NESTI	National Estimated Short-Term Intake
NHMRC	National Health and Medical Research Council
NOEAL	No Observable Adverse Effect Level
NOEL	No Observable Effect Level
NRA	National Registration Authority for Agricultural and Veterinary Chemicals (now APVMA)
OCSEH	Office of Chemical Safety and Environmental Health (previously OCS)
OP	Organophosphorus insecticide
OPIDN	Organophosphorus-induced delayed neuropathy
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
RBC	Red Blood Cell (Erythrocyte)
SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons
TGAC	technical grade active constituent (now called AC)
TMRL	Temporary MRL
TWA	Time weighted average
USEPA	US Environmental Protection Agency
ULV	Ultra Low Volume
WHP	withholding period

CONTENTS

EXECUTIVE SUMMARY

INTRODUCTION

Chlorpyrifos is a broad spectrum, non-systemic organophosphorus insecticide with contact, stomach and respiratory action. It acts by cholinesterase inhibition and was first introduced and used in Australia in the mid 1960s.

In 1996, there were eight approved chlorpyrifos active constituents (ACs) or manufacturing concentrates and 80 registered chlorpyrifos products. When the Interim Review Report was published in September 2000, there were 13 approved chlorpyrifos active constituents (ACs) or manufacturing concentrates and 165 products. At the time of finalising this Preliminary Review Finding (PRF) report (mid August 2009), there were 16 active constituents and 85 products (Appendices A and B).

In Australian agriculture, chlorpyrifos is used to control a broad range of insect pests in many crops including cotton, sugarcane, vegetables, pome and stone fruit, pastures, turf and ornamental crops. It is also registered for control of some insects in domestic situations, a range of insect pests in home gardens and termites in housing (pre- and post-construction).

Agricultural application is mainly by boom spray onto foliage, but there are also use-patterns for aerial application (e.g. cotton), drenching (e.g. the base of fruit trees) and as a seed dressing. Domestic uses principally employ foliar application (in gardens), crack/crevice treatment in buildings and enclosed bait stations (e.g. for cockroaches). It is also applied to soil immediately under a proposed building for termite protection (i.e. pre-construction), and injected into soil underneath existing buildings as well as sprayed as a barrier spray where walls enter the soil (post-construction).

Originally chlorpyrifos product registrations and label approvals were placed under review as part of the APVMA's Review Program, due to specific concerns about toxicology, worker safety (OHS), residues, trade, environment, efficacy and crop safety. All of these risk areas were assessed and appropriate risk management strategies implemented in the Interim Review Report of 2000 e.g. during 2000/2001, labels of registered products were revised based on the report's recommendations.

The outstanding issue from the 2000 Report was a requirement for further residue data to confirm temporary Maximum Residue Limits (or TMRLs) for a number of plant and animal commodities. These TMRLs were set on the basis of limited residue data available for the 2000 Interim Review Report.

The required residue data has been received and assessed by the APVMA, and the assessment and its recommendations are summarized below. An assessment has also been undertaken to confirm whether the human health toxicological endpoints from the 2000 report are still appropriate. A summary of this updated toxicology assessment is also presented below.

Note that this PRF only applies to chlorpyrifos products with food-related use patterns on their label. There are 37 such products and they are listed in Table 24.

PRELIMINARY REVIEW FINDINGS

Updated Toxicological Assessment

The updated toxicological assessment for the review of chlorpyrifos was undertaken by the Office of Chemical Safety and Environmental Health (OCSEH). OCSEH considered all the publicly available toxicological data and information which has been published since the 2000 Interim Review Report, which related to toxicological endpoints for human health.

To achieve this, all relevant databases and documentation from international regulatory agencies were searched for studies on chlorpyrifos, which were published since 1999 e.g. PUBMED, Tomes Plus, JMPR, WHO/IPCS and the US EPA.

The reasons for differing toxicological end points (e.g. ADI, ARfD) between different countries are also explained in the updated toxicological assessment.

No new toxicity studies on chlorpyrifos were retrieved that were considered to impact on the toxicological endpoints selected for either the public health or occupational health risk assessments performed by OCSEH in 1999–2000.

As no new information was available, OCSEH concluded that the existing end points used in their 2000 report were still valid. Hence, no changes were recommended at this stage, i.e. no changes were proposed for either the no-observed-effect-level (NOEL) or the dermal absorption factor.

Therefore, the ADI[1], ARfD[2], first aid instructions and recommended safety directions, including personal protective equipment, remain unchanged.

The APVMA has considered the advice received from the OCSEH and accepts the recommendations.

Residues Assessment

Introduction

This residue assessment for the review of chlorpyrifos was undertaken by the APVMA Residue team, which considered all the residue data and information submitted to the APVMA since the 2000 report. Note that this assessment only considered those crops or commodities with TMRLs that were set in the 2000 Interim Review Report[3].

Residue data were submitted and assessed for 27 fruit and vegetable crops and 21 broadacre crops (including pastures). The new residue assessment examined:

- confirmation or amendment of these TMRLs to permanent MRLs, as supported by the data and information submitted, or removal of TMRLs if not supported;
- the amendment of use-patterns to conform with the extent/nature of the residue data submitted (e.g. residue data only provided for use at seeding, so foliar application not supported);
- appropriate withholding periods for harvest and grazing, associated with the MRLs set in this assessment;
- residues in animals likely to be fed on produce immediately after it is treated with chlorpyrifos (e.g. plague locust situations);
- appropriate export intervals for export crop and animal commodities; and
- dietary risks posed by all chlorpyrifos uses, both short term and chronic, given the confirmed or new MRLs set in the assessment.

Residue Monitoring

The residues assessment also presented statistics on monitoring of chlorpyrifos in various food commodities, which were reported by some states and the NRS.

These statistics show that between 1987 and 2008, there were very few MRL violations detected in plant commodities (cereal grains, oil seeds, fruit, vegetables and nuts). The diverse state and federal testing programs recorded 84 MRL violations from the 55,833 samples tested over this time period (i.e. 0.15% of all samples tested)

Similarly, the statistics show that between 2004 and 2008, there were no MRL violations in 9,056 samples of cattle, sheep, goats and pig meat tested by the NRS monitoring programs. In fact in only two samples was chlorpyrifos detected, albeit below the MRL.

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1 ADI = Acceptable Daily Intake
2 ARfD = Acute Reference Dose
3 The MRLs were of the following crops confirmed in 2000 and for which extra residue data were not required: avocado, cottonseed, ginger, kiwifruit, passion fruit, potato and strawberry.

Use-patterns and Crops Supported or Not-supported

As a result of the residue data assessment, it is recommended that the registration of chlorpyrifos continue for most use-patterns on most fruit, vegetable and broadacre crops, for which data were submitted. Situations where inadequate or insufficient data did not support specific use-patterns in a crop, or use in a crop at all, are presented below.

It is recommended that the following uses of chlorpyrifos be restricted to specific application timings or removed, as indicated below:

- no post-planting foliar applications to asparagus, celery, carrot, lettuce, onion and sweet potato. Treatment at or before planting, and baiting for crickets, still permitted;
- no use on pulses, canola, linseed and safflower beyond the 4–10 leaf stage;
- no use on sugarcane after the 3 months following planting or ratooning;
- no application to bananas after the exposure of the fingers;
- no use for the control of spur throated locust in rice; and
- no use on peaches, tree nuts or tomatoes, other than tomatoes used for processing or use of cracked grain baits (for earwig control) in peaches.

Note that it is also recommended that the generic 'vegetable' category in the current Directions for Use (DFU) tables be deleted, and that only specific vegetable crops be specified on the label (as supported by the residue data). Hence the range of vegetable crops that can be treated with chlorpyrifos is less than labels would have implied in the past e.g. use on turnips or swedes may have occurred in the past, where it will now be specifically prohibited, as there are no residue data to support continued use.

Associated MRLs and WHPs for Supported Use Patterns

Nine of the TMRLs from the 2000 Interim Review Report were confirmed by new data[4] and it is recommended they be made permanent MRLs, based on the crop/use-pattern restrictions or deletions above. Another thirteen TMRLs were amended to a higher[5] MRL and another 6 to lower[6] MRLs. For three crops an MRL was set where there had not been one before[7]. In all cases, appropriate withholding periods (WHPs) were derived from the residue data for inclusion on labels.

For five fruit and vegetable crops, because of the resulting application timings e.g. only at or before planting, the proposed withholding period is less[8] than the current label WHP. For nine other fruit and vegetable crops, the WHPs remained unchanged[9]. For the remaining seven fruit and vegetable crops a higher[10] WHP is recommended. Notably, these come from the generic 'vegetables' category on current labels, which currently have a nil WHP.

For field or broadacre crops, including animal feed crops, the majority of harvesting and/or grazing WHPs are longer. Harvest WHPs proposed are 14 days or 28 days after application, compared to 7 days or 10 days or an implied nil WHP on labels currently. Examples of the crops whose WHP changed in this way are cereals (except rice and sorghum), soybeans, peanuts, legume animal feeds, grass pastures and sugarcane. Only rice has an unchanged harvest WHP and sorghum a shorter harvest WHP.

Similarly, grazing WHPs proposed are 14 days or 28 days after application, compared to 2 days currently for all crops.

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4 TMRLs confirmed: bananas, carrots, grapes, lettuce, onions, peppers, pineapples, stone fruit (except peaches) and sweet potato.
5 New MRLs higher than TMRLs: chard (silver beet), citrus fruits, cucumber, eggplant, garden peas, green beans, lima beans, mangoes, pome fruits, tomatoes, cereals (except rice and sorghum), rice and soy beans.
6 New MRLs lower than TMRLs: asparagus, celery, brassicas, dried fruits, sorghum and sugarcane.
7 No previous MRLs or TMRLs: pulses (grain), legume animal feeds (other than pulses) and grass pastures.
8 New WHP shorter: asparagus, celery, bananas, celery and pineapples.
9 WHP unchanged: carrots, citrus fruits, grapes, lettuce, mangoes, onions, pome fruits, stone fruits [except peaches], sweet potato and tomatoes.
10 New WHP longer: chard (silver beet), cucumber, eggplant, garden peas, green peas, lima beans and peppers.

Dietary risk Assessment

Using the proposed MRLs, the dietary risk assessment showed that:

- the chronic dietary exposure to chlorpyrifos (the NEDI) was 55% of the ADI and therefore acceptable; and
- the highest estimate of acute dietary exposure to chlorpyrifos (the NESTI) was 55% of the ARfD for silver beet, for children in the 2 years plus age group. Therefore there were no short term dietary intake concerns for chlorpyrifos residues in foods amongst high consumers.

Potential Trade Risks

There are 14 major export plant and animal commodities potentially affected by chlorpyrifos use. These are citrus, grapes, wine, pome fruit, stone fruit, sugar, cereals, oilseeds, pulses, oaten hay, cattle and dairy products, pig products, sheep products and poultry products. Depending on the seasonal conditions in Australia and competing export production in other countries, these exports were estimated to be worth approximately $17 billion in 2005.

After comparing the proposed MRLs in this assessment with those of Codex and MRLs in major export destinations (2004–08) for the commodities listed above, the following conclusions were made about potential trade risks for these commodities:

- no identified trade risk for the following 13 commodities in any major export destination:

edible goat offal	edible poultry offal	field peas	
sugar cane		cherries	chickpeas
oilseeds	eggs	nectarines[11]	lentils
poultry meat	plums	faba beans	

- potential trade risk for 20 commodities in some of their major export destinations:

citrus fruits (Singapore)	lupins (EU, Japan)	milks (Singapore)
grapes (EU),	barley (Japan)	goat meat (USA)
wine (USA, UK)	rice (Japan)	pig meat (Singapore, Japan)
apples (EU)	sorghum (Japan)	edible pig offal (Japan)
pears[12] (USA, Japan Korea, EU)	wheat (Korea, Japan)	edible sheep offal (Japan, Saudi Arabia, UAE)
	oaten hay (Japan)	cattle meat (Japan, USA, Korea, EU)
apricots[13] (Japan)	edible cattle offal (Korea, EU)	sheep meat (USA, EU, Japan, Saudi Arabia, UAE)

Management of Potential Trade Risks

There is a potential trade risk for some export destinations, as the Australian MRL is higher than the destination's import tolerance/MRL. However, this rarely applies to all the export destinations for an Australian commodity.

Depending on the crop stage at which chlorpyrifos is applied, growers can achieve residues below the Australian MRL, via crop and harvest management (e.g. not harvesting the commodity until well after the Australian WHP). Hence the list above may be an overstatement of trade risk. This tends to be supported by the monitoring results of the NRS, where very low (or no) frequency of residue violations were found for the selection of commodities monitored.

Note that chlorpyrifos residues in wheat decline below the Codex MRL within the proposed domestic harvesting WHP of 14 days and rice. For sorghum however, it takes 28 days to reach the Codex MRL, whereas the domestic harvesting WHP is 7 days.

Nevertheless, monitoring data from the NRS indicate good compliance with the former Australian MRL of 0.1 mg/kg for these three cereal crops (the currently proposed MRLs are higher than this).

11 Note the residues report recommends that Australian use on peaches be removed from labels, as an MRL could not be set for this crop. Hence, trade risk for peach exports is not considered here.
12 It is believed that these are very minor markets for pears, and that pear exports are very small in their own right.
13 It is believed that Japan is a very minor market for cherries and that cherry exports are very small in their own right.

The situation is similar for barley, oats and pulses. For some of these crops, there is no Codex MRL or export destination MRL, and residues are still present for a period after the Australian WHP. However, NRS data indicate that residues in samples of these products are either non-detectable in a significant majority of samples (e.g. >98%), or well below the Australian MRL.

For oaten hay, an Export Harvest Interval (EHI) of 21 days is proposed, together with an appropriate label statement to this effect.

The impact of forage, straw and grain residues in animal fat and milk was assessed. As a result of this assessment, the following Export Slaughter Intervals (ESIs) are proposed: 56 days for grazing livestock (e.g. cattle, sheep and goats) and 7 days for pigs (provided the affected animals are removed onto or given clean feed, for the period equivalent to the ESI). A suitable label statement to this effect is also proposed.

There is a special situation with treatment of spur-throated locust, where animals and their grazing areas may be over-sprayed, and it is not possible to move them to untreated pasture. Following assessment of pasture data and assuming the worst case exposure (highest residues and slowest decline for forages treated at 675 g-ai/ha), a 49-day Export Grazing Interval (EGI) is proposed for grazing animals.

Note these export intervals have been in place since 2000 through Safemeat's awareness program for locust control, with no export violations detected.

Turf/lawn as stockfeed

Historically, there has been a 2-day grazing/cutting for stockfeed WHP for treated turf/lawn and a prohibition on feeding clippings to poultry or stock.

No data have been submitted for this use. Note that the maximum application rate for turf/lawn is 3000 g-ai/ha, compared to a maximum of 750 g-ai/ha for grass or legume pasture.

Consequently it is recommended that there be a label prohibition on grazing, or cutting for stockfeed, of treated turf/lawn. The prohibition of feeding clippings to poultry/stock would also remain.

PROPOSED REVIEW RECOMMENDATIONS

After consideration of all data including the new and additional assessments, the APVMA proposes the following regulatory actions:

(a) affirm all active constituent approvals (Appendix A);

(b) vary label approvals for the 37 chlorpyrifos products affected by the residues assessment (see Table 24).

To satisfy the requirements for continued registration of products, the APVMA proposes the following label variations:

- delete crops where the residues assessment does not support any use of chlorpyrifos;
- delete use patterns within crops where the residues assessment does not support use of chlorpyrifos;
- amend use patterns within crops, as supported by the residues assessment;
- amend withholding periods for harvest and grazing, as supported by the residues assessment; and
- add export intervals and associated text in the General Instructions.

(c) Affirm product registrations

If the proposed label variations above are made, then the product registrations and label approvals of the 37 products with agricultural and turf uses (Table 24) can be affirmed.

(d) Cancel product label approvals

Once varied labels are approved, it is proposed that all prior approved labels are cancelled (Table 27), with a 2-year phase out period for supply and use of existing wholesale, retail and on-farm products with such labels.

(e) Amend the MRL Standard (Tables 1 and 4) for chlorpyrifos, as supported by the residues assessment (Section 5.10).

(f) Monitor the 11 stopped chlorpyrifos products with use patterns related to the outcomes proposed in this PRF (Table 28), in case they are re-registered before their stop/sell period expires. Should any of these 11 products become re-registered, their labels will be amended in accordance with the review outcomes proposed in this PRF. The full list of stopped products is presented in Appendix C.

PROPOSED CANCELLATION AS A CONSEQUENCE OF REVIEW FINDINGS

There are no recommendations for the APVMA to cancel any current chlorpyrifos active approvals or product registrations, providing the label changes above are implemented for the relevant chlorpyrifos products.

PREVIOUS APVMA PRODUCT CANCELLATIONS

Twelve products were cancelled by the APVMA when the Interim Review Report was published in 2000. These products are listed in Appendix D.

PRODUCTS VOLUNTARILY CANCELLED BY REGISTRANTS DURING THE REVIEW

Eighteen products were voluntarily cancelled by registrants during the review and are listed in Appendix E.

1 INTRODUCTION

The APVMA has reviewed the approval of the active constituent chlorpyrifos, registered products containing chlorpyrifos and the associated label approvals for products containing chlorpyrifos.

Previous assessments and interim recommendations in the areas of toxicology, OHS, residues, trade, environment, efficacy and crop safety were published in September 2000. There are no changes in the previous assessments, and their conclusions and their recommendations can be accessed from the APVMA website at <http://www.apvma.gov.au/chemrev/chlorpyrifos.shtml>.

The interim recommendations were implemented over 2000–01. The major outstanding issue from the 2000 report was the requirement for supplementary residue data, to confirm the temporary MRLs set in 2000.

This document summarises an updated toxicology report, a new assessment of supplementary residue data generated since the 2000 report, and the proposed recommendations for this part of the review. Note that this PRF only applies to products with food-related use patterns on their label. There are 37 such products and they are listed in Table 24.

REGULATORY STATUS OF CHLORPYRIFOS IN AUSTRALIA

Chlorpyrifos is a broad spectrum, non-systemic organophosphorus insecticide with contact, stomach and respiratory action. It acts by cholinesterase inhibition and was first introduced and used in Australia in the mid 1960s. At the time this review commenced on 3 December 1996, it was widely used in Australian agriculture, at building sites and in domestic applications. Not that this review does not include chlorpyrifos-methyl, which has a much more restricted use pattern.

In 1996 chlorpyrifos was used In Australian agriculture to control a broad range of insect pests in many crops including cotton, sugarcane, vegetables, pome and stone fruit, pastures, turf and ornamental crops. At that time, it was also registered for control of some insects in domestic situations, a range of insect pests in home gardens, termites in housing (pre- and post-construction) and flea control in cats and dogs.

Agricultural application was mainly by boom spray onto foliage, but there were also use-patterns for aerial application (e.g. cotton), drenching (e.g. the base of fruit trees) and as a seed dressing. Domestic uses were principally foliar application (in gardens), surface sprays inside the house, dusting of cracks/crevices in buildings, enclosed bait stations (e.g. for cockroaches) and localised sprays, shampoos and/or treated collars for pets. It was also applied to soil immediately under a proposed building for termite protection (i.e. pre-construction), and injected into soil underneath existing buildings, as well as sprayed as a barrier spray where walls enter the soil (post-construction). Detailed representative information on the uses of chlorpyrifos products can be found in Table 3.

The chlorpyrifos products available at 3 December 1996 numbered 80, with 8 approved actives (sources) for the formulation of chlorpyrifos products. The products comprised a wide range of formulation types as presented in Table 1.

Table 1: Formulation types for chlorpyrifos products at commencement of review

Formulation type	Level of active constituent	Product type
wettable powder (WP)	250 g/kg	Horticultural crops, field crops, macrocarpa hedges, container plants
	500 g/kg	Horticulture crops, cereals, macrocarpa hedge, container plants
dust (DU)	50 g/kg	Domestic ant control
	250 g/kg	Seed dressing (horticulture and field crops)
emulsifiable concentrate (EC)	20 g/L	Commercial industrial, public and food processing areas insect control
	200 g/L	Domestic lawns
	225 g/L	Commercial and industrial areas
	240 g/L	Domestic insect control
	480 g/L	Domestic insect control
	450 g/L 500 g/L	450/500:Field crops, horticultural crops, turf, domestic uses, polluted water catchments and vegetation for mosquito control, commercial and industrial areas, hides/skins and/or termiticide treatment/protection (pre- and post-construction)
aqueous concentrate (AC)	2.1 g/L	Flea/tick spray on dogs
	10 g/L	Domestic lawns
slow release (generator) treated pet collars (SR)	80 g/kg	Dog flea/tick collar
	40 g/kg	Cat flea collar
slow release (SR) impregnated paper	73 g/kg	Domestic wardrobe moth (etc) control
pelleted bait (PE)	20 g/kg	Bait for cereal pest control
labyrinth bait (BA)	5 g/kg	Domestic internal-house insect control
granules (GR)	30 g/kg	Domestic garden ant/beetle control
	40 g/kg	Domestic garden ant/beetle control
	50 g/kg	Domestic garden ant/beetle control
	140 g/kg	Sugar cane
ultra low volume (ULV[14])	300 g/L	Cotton, maize, sorghum, sunflower, forage
	500 g/L	Cereals, cotton, forage, sorghum, sugar cane

Note that as a result of the interim recommendations in 2000, some chlorpyrifos formulation types ceased production, and their associated products are now (2009) no longer registered in Australia.

When the interim chlorpyrifos report was issued in September 2000, there were 161 products containing chlorpyrifos registered in Australia and 20 approved actives or sources of chlorpyrifos.

Just before this document was finalised (mid August 2009), the number of registered chlorpyrifos products was 85 (see Appendix B), with 16 active constituent approvals (see Appendix A).

REASONS FOR CHLORPYRIFOS REVIEW

The active constituent chlorpyrifos, all products containing chlorpyrifos and their associated labels were placed under review by the (then) NRA[15] Board because of concerns over public health, occupational health and safety, and environment.

14 Chlorpyrifos ULVs can also be applied as an EC

15 The APVMA was called the National Registration Authority, or NRA, at this time.

In summary, the concerns about the chemical were:

- its very high toxicity to birds;
- water pollution potential and US restrictions imposed to reduce hazards to fish, birds and other wildlife
- worker exposure scenarios;
- demonstrated potential for adverse effects in users; and
- high potential chronic and moderate potential acute toxicity risk.

Whilst the selection process ranked chlorpyrifos as high priority due to certain issues, the review was not confined only to those issues, but covered **all aspects** of registration and approval of chlorpyrifos i.e. the review included registrations of products containing chlorpyrifos and associated labels, and active constituent approvals (see Section 1.3 below).

SCOPE OF THE REVIEW

The basis for a reconsideration of the chemical and the registration of its products' approvals, is whether the APVMA is satisfied that the requirements prescribed by the Agvet Codes for continued approval and registration are able to be met. These requirements are that the use of chemical products in accordance with the instructions for use:

- would not be an undue hazard to the safety of people exposed to it during its handling;
- would not be likely to have an effect that is harmful to human beings;
- would not be likely to have an unintended effect that is harmful to animals, plants or things or to the environment; and
- would not unduly prejudice trade or commerce between Australia and places outside Australia.

The APVMA also considers whether the use of products, in accordance with the instructions for use that the APVMA has approved, would be effective according to the criteria demanded by the APVMA for the products. Hence, the APVMA reviewed the toxicological, occupational health and safety, environmental, residue, trade and efficacy conditions of registration and approval for chlorpyrifos.

The APVMA also considered whether product labels carry adequate instructions and warning statements. Such instructions include:

- the circumstances in which the product should be used;
- how the product should be used;
- times when the product should be used;
- frequency of the use of the product;
- the withholding period after the use of the product;
- disposal of the product and its container; and
- safe handling of the product.

Active constituent approvals, product registrations and label approvals for chlorpyrifos were subject to reconsideration under Part 2, Division 4 of the Agvet Codes.

REGULATORY OPTIONS

There can be three possible outcomes to the reconsideration of the active constituent chlorpyrifos, registration of products containing chlorpyrifos, and all associated label approvals. Based on the information reviewed, the APVMA may be:

- satisfied that the products and their labels continue to meet the prescribed requirements for registration and approval and it therefore affirms the approvals and registrations.
- satisfied that the conditions to which the registration or approval is currently subject can be varied in such a way that the requirements for continued registration and approval will be complied with and therefore it varies the conditions of approval or registration.
- not satisfied that the requirements for continued registration and approval continue to be met and therefore it suspends or cancels the approval and/or registration.

2 APPROVED CHLORPYRIFOS USE PATTERNS

AGRICULTURAL USES

Chlorpyrifos has several strategic uses in Australian agriculture. At 3 December 1996, it was registered for the following crops, for a range of insect pests.

Fruits and vegetables Apples, avocado, bananas, bulb vegetables, carrots, cassava, citrus, cole crops or brassica vegetables (including cabbage, cauliflower, brussels sprouts and broccoli), capsicum, cucurbits, custard apple, egg plant, ginger, grape vines, kiwifruit, leafy crucifers, lettuce, loquat, mango, pears, pineapple, pome fruit, root and tuber vegetables, silver beet, stalk and stem vegetables, stone fruit, strawberries, tomatoes, and vegetables (includes specific vegetable entries found on some labels). Seed dressings are also specified for some commodities.

Field crops and pasture barley, broad beans, cereals, chickpeas, clover seed crops, coffee (non bearing), cotton, establishing perennial pastures, field peas, forage crops, hops, improved annual pastures, lucerne, lucerne pastures and seed crops, lupins, maize, millet, oats, oilseeds, pasture, pulses, rice, rye, sorghum, sugarcane, tobacco, triticale, wheat, and young plants of oil seeds. Seed dressings are allowed for cereal and oil seeds.

Miscellaneous (non-food) uses animal hides and skins, container plants, insect control in agricultural, domestic, commercial, and industrial areas, mosquito control in vegetation and polluted water impoundments, protection of existing buildings and reticulation systems against termites, soil treatments as termite protection, soil baits, termite protection of buildings (houses, factories, industrial and commercial buildings public premises, and farm buildings) under construction, macrocarpa hedges, turf and lawn insect protection. These non-food uses are not considered in detail in this report. Application of chlorpyrifos for these uses and non-food crops can be ground or aerially applied foliar sprays, soil applied, bait, or seed dressing.

The percentage use of chlorpyrifos in late 1990 is shown below in Table 2.

Table 2. Estimate of chlorpyrifos usage by crop or application grouping in late 1990s

Crop/Application Grouping	**% of chlorpyrifos used in each**
anti-termite	28.6
cotton	20.9
sugar cane	18.8
vegetables	5.9
pome & stone fruit	4.7
general pests	4.5
other cereals	2.9
turf, home garden, other	2.4
pasture	2.3
tropical fruit	2.1
grape	2.1
canola	1.6
citrus	1.4
rice	1.4
subtropical fruit	0.3

It should be noted in relation to these estimates that seasonal factors play a role in determining pest population levels, pest complexes and the area planted to crops.

Hence the volume of chlorpyrifos used for each registered use pattern can vary significantly from year to year.

There are no comparable figures for chlorpyrifos uses in 2009. With the prolonged seasonal drought in a number of production areas, such figures would be misleading. Also the introduction of new termite control chemicals since 2000 (e.g. fipronil) are very likely to have an effect on chlorpyrifos use in that sector. Further, chlorpyrifos is now rarely used in cotton production, if at all. A similar situation is believed to be the case for sugar cane. Hence the top three crop/application areas in the table above are far less prominent now.

A representative sample of chlorpyrifos use patterns at the time of the new residues assessment (with rates, frequency, application methods etc.) is presented in Table 3. Application methods for agricultural uses have been mentioned above. However, generally chlorpyrifos labels are not specific about spray frequency, referring to 're-treat as necessary'.

NON-AGRICULTURAL USES

Domestic applications of chlorpyrifos were significantly reduced by restrictions on the application of domestic/home garden products in 2000–01. Domestic products must now be not greater than 50 g/L in concentration, and cannot be used inside houses/buildings, except as crack/crevice treatments. Most domestic products are granular for outside ant/insect control, ready-to-use products for spraying onto lawns for the control of grubs etc., or enclosed bait stations for cockroach control inside houses/buildings. There are now no registered pet sprays or impregnated pet collars.

A non-agricultural application and quasi-domestic situation is termite control under/in housing, but this is applied by commercial operators and not householders. For pre-construction situations, chlorpyrifos is applied to soil immediately under a proposed building. For post-construction situations, it is injected into soil underneath existing buildings as well sprayed a barrier spray where walls enter the soil.

Note that products used for pre-construction application of chlorpyrifos are Restricted Chemical Products (RCPs) in all states and territories. That is, operators must be trained, have attained certification for appropriate use and be licensed.

3 UPDATED TOXICOLOGY ASSESSMENT 2009

INTRODUCTION

In 2006, the APVMA requested the Office of Chemical Safety and Environmental Health (OCSEH) to assess whether the toxicological endpoints and conclusions for chlorpyrifos, contained in the 2000 Chlorpyrifos Interim Review Report, were still valid. All relevant databases and documentation from international regulatory agencies were searched for studies on chlorpyrifos which had been published since the 1999 assessment. The databases searched included PUBMED, Tomes Plus, JMPR, WHO/IPCS and the US EPA.

No new toxicity studies on chlorpyrifos were retrieved that impact on the toxicological end points selected, for either the public or occupational health risk assessments of 2000. OCSEH confirmed that there were no changes in the chlorpyrifos toxicological end points since 1999. The details of their assessment are presented below.

IS THE ACETYLCHOLINESTERASE (ACHE) INHIBITION ENDPOINT PROTECTIVE FOR DEVELOPMENTAL AFFECTS?

Based on recent epidemiology studies reporting associations between chlorpyrifos levels and foetal weight decreases, Zhao et al (2006) discussed the need to re-evaluate the basis for setting the reference dose[16] i.e. the choice of appropriate species and study, the selection of uncertainty factors and whether it should be based on cholinesterase inhibition or developmental effects. The authors concluded that based on animal and human studies, the most sensitive indicator of adverse effects is inhibition of cholinesterase in various target tissues, and that erythrocyte cholinesterase inhibition is the critical end-point.

The authors stated that overall weight-of-evidence on foetal developmental toxicity in animal studies suggested that developmental effects do not precede erythrocyte cholinesterase inhibition. Humans appear less than or equally sensitive to dogs, and at least as sensitive as rodents to erythrocyte cholinesterase inhibition, but are up to three-fold more sensitive to plasma cholinesterase inhibition than rodents.

The authors concluded that the selection of human data from repeated dosing for determining NOELs[17] is further supported by longer term studies in animals (multiple species).

DIFFERENCES IN END-POINTS SELECTION BETWEEN AUSTRALIA AND THE US, CANADA OR EU

At the time this OCSEH report was drafted (October 2006), the toxicological end points selected for use in the OCSEH toxicity and occupational health and safety (OHS) assessment reports were NOT different to those of the US Environmental Protection Agency (EPA). However, they are different to those of Health Canada and the EU[18].

The differences in various risk assessment approaches for chlorpyrifos (for these and other agencies/bodies) are discussed in detail in the next section. This section compares and contrasts the approaches adopted, including the underlying rationale employed in the determination of critical end-points.

16 The “Reference Dose” in the US is equivalent to the ADI or “Acceptable Daily Intake” in Australia

17 NOEL = No Observed Effect Level

18 The EU ADI (Acceptable Daily Intake) is 0.01 mg/kg bw/day *vs* Australia’s 0.003 mg/kg bw/day. However, the EU’s ARfD (Acute Reference Dose) is the same as Australia’s *viz*. 0.1 mg/kg.

Background

The toxicology of the organophosphorus (OP) insecticide chlorpyrifos was comprehensively reviewed by the Chemicals and Non-Prescription Drugs Branch of the Therapeutic Goods Administration (TGA) [now called OCSEH], as part of the Existing Chemicals Review Program (ECRP) [managed by the APVMA].

In 1999 several issues arising from this toxicology and public health review were considered by the Advisory Committee on Pesticides and Health (ACPH[19]). As a result of that review, a number of recommendations were made regarding public health standards, including the Acceptable Daily Intake (ADI) and the Acute Reference Dose (ARfD). The toxicity of chlorpyrifos has also been reviewed by the US EPA, the WHO/FAO[20] Joint Meeting on Pesticide Residues (JMPR) and by Health Canada.

There are differences in the public health standards that have been established by the various agencies/bodies. As a consequence, different risk mitigation measures have been proposed in Australia and other countries, most notably the USA. This issue was the focus of considerable comment during the public consultation phase for chlorpyrifos in the APVMA Chemical Review Program.

There are a number of technical and policy approaches to the regulation of chemicals that vary between different national authorities, and these have contributed to differences in risk management strategies for chlorpyrifos between the USA (and Canada) compared with Australia. The basis for these differences, in terms of differences in approach and rationale, are summarised below.

Issues

In the APVMA review of chlorpyrifos, a number of technical and scientific policy approaches were taken into account by the OCSEH, in drafting the public health risk assessment for chlorpyrifos. The Australian approach to several of these issues is different to other overseas agencies. Issues where differences arose, as outlined below.

The use of human data to derive public health standards, such as the ADI

To establish the ADI value for chlorpyrifos, the OCSEH and the JMPR (JMPR, 1998) used doses of chlorpyrifos that caused no toxicological effects in **human** volunteer studies. In the USA, on the other hand, the EPA used data from **animal** studies to establish their chronic reference dose (or RfD, which is analogous to an ADI).

As a matter of policy (see below), the US EPA does not use data from studies conducted on human volunteers.

Australia does not have a formal policy on the use of human studies in deriving health endpoints. However, it does not dismiss human data when they are available, provided that they are scientifically acceptable, meet appropriate quality standards, and have been conducted according to an acceptable code of ethics. This position is similar to that currently taken by the JMPR (WHO/FAO).

The OCSEH considers that the use of appropriate human data to establish public health standards:

- reduces the uncertainty associated with inter-species extrapolation (using animal data to predict possible health effects in humans); and
- may permit greater certainty in establishing safe exposures for humans.

For chlorpyrifos, the OCSEH used a no-observed-effect-level (NOEL) from a study in human subjects, applying a 10-fold safety factor to account for intra-individual variability, to derive the ADI of 0.003 mg/kg bw/day.

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[19] ACPH was an expert committee of the Department of Health, and has now been replaced by the Advisory Group on Chemical Safety (AGCS)

[20] WHO = World Health Organization; FAO = Food and Agriculture Organization (of the United Nations)

No human test data have been used by the US EPA for any final decisions about acceptable levels of pesticide under their food safety law, which mandates that, 'The protection of public health from adverse effects of pesticides can be achieved through reliance on animal testing and use of the highest ethical standards.'

It appears that the US EPA will no longer consider studies which have used volunteers for pesticide testing for ethical reasons. For chlorpyrifos, the US EPA used doses that caused no effects in animals, along with a 100-fold uncertainty factor to derive the reference dose (RfD).

The use of the most sensitive toxicological endpoint for regulating chlorpyrifos

The OCSEH and the US EPA have established an ADI/RfD for chlorpyrifos on the basis of its inhibition of **plasma** cholinesterase activity. This is the most sensitive measure of toxicity for chlorpyrifos and for a number of related organophosphorus compounds.

The JMPR derived their ADI based on effects of chlorpyrifos on **brain** acetylcholinesterase activity in animal studies, and erythrocyte acetylcholinesterase inhibition in human subjects. Both of these measures of toxicity are less sensitive than the inhibition of plasma cholinesterase activity, and hence the JMPR ADI is higher (i.e. less conservative) than that set by the OCSEH.

No toxicological effects were observed at doses lower than those that resulted in inhibition of plasma cholinesterase activity. On the basis of this effect in humans at a dose of 0.1 mg/kg bw/day, with no effects seen at 0.03 mg/kg bw/day, the OCSEH established the ADI at 0.003 mg/kg bw/day. A 10-fold safety factor was used to account for inter-individual variability.

The US EPA similarly used the inhibition of plasma cholinesterase activity as the most sensitive indicator of toxicity for chlorpyrifos. The NOEL in animal studies (0.03 mg/kg bw/day) with an uncertainty factor of 100 resulted in an ARfD of 0.0003 mg/kg bw/day, which is 10-fold lower than the Australian ADI.

The Canadian Pest Management Regulatory Agency (PMRA) used erythrocyte acetylcholinesterase (AChE) inhibition as the endpoint for establishing the ADI for different populations (Health Canada, 2003). As is the policy in the USA, PMRA policy is not to use toxicity studies in which humans are intentionally dosed with pesticides for the purpose of identifying a human NOAEL[21]. For the chlorpyrifos assessment, human studies were only used in a supplementary manner, to confirm that use of the animal data (AChE inhibition) was appropriate for human risk assessment purposes. The Canadian ADI for the general adult population is 0.01 mg/kg bw/day, based on a NOAEL of 1 mg/kg bw/day derived from numerous repeat dose studies in 3 species, and using a standard 100-fold safety factor.

In 1999 the JMPR used the inhibition of brain AChE in mice, rats and dogs (NOAELs of 1 mg/kg bw/day) with a 100-fold safety factor and a NOAEL of 0.1 mg/kg bw/day for inhibition of erythrocyte AChE in a study using human volunteers, with a 10-fold safety factor, to derive an ADI of 0.01 mg/kg bw/day (JMPR, 1999).

The sensitivity of children to the toxicological effects of chlorpyrifos

There was some evidence that neonatal rats were more sensitive to the lethal effects of high doses of chlorpyrifos. However, the OCSEH did not consider that young animals were any more sensitive to repeated exposure to lower levels of chlorpyrifos than adult animals. Furthermore, at doses below those that inhibited plasma cholinesterase activity, there was no evidence that significant developmental or neurological effects were caused by chlorpyrifos in young animals.

In the USA, the EPA has operated under the *Food Quality Protection Act* (FQPA) since 1996. This Act requires the use of an extra ten-fold safety factor in setting an intake standard for children when considering intake of pesticide residues, to allow for their presumed extra sensitivity (unless, for any particular chemical, there is unequivocal evidence that this is not the case).

[21] NOAEL = No-Observed-Adverse-Effect-Level

For chlorpyrifos, the EPA decided to impose an extra 10-fold uncertainty factor to satisfy FQPA requirements. This contributes to the EPA Population Adjusted Dose (PAD) for infants, children and females aged 13-50 years, which is 10-fold lower than the US RfD (and 100-fold lower than the Australian ADI).

In a published study (Zheng *et al.*, 2000), neonate (7 days old) and juvenile (21 days old) rats were more sensitive to the acute lethal toxicity of chlorpyrifos. However, when exposure was extended over a 14-day period the neonatal animals were usually no more sensitive, if not less sensitive, to the effects of chlorpyrifos than the adults (based on the inhibition of cholinesterase activity).

The authors concluded that while immature animals can be markedly more sensitive to the lethal effects of high doses of chlorpyrifos, no age-related differences were apparent for **non-lethal** endpoints, particularly after repeated exposures.

Based on these findings, it is considered that the normal safety factor for inter-individual variability, and used in combination with the NOEL in humans for the most sensitive toxicological endpoint (inhibition of plasma cholinesterase activity), is adequate for setting public health standards for the repeated exposure of humans to low levels of chlorpyrifos.

Hence, no additional safety factors were used to derive a separate chlorpyrifos ADI for infants or children. The OCSEH considered that they are adequately covered by the existing Australian ADI.

OVERALL CONCLUSIONS

Overall, the selection of a critical toxicological end-point (i.e. cholinesterase inhibition) for determining the NOAEL and the ADI is in agreement between different agencies/bodies, including OCSEH. The critical factor is whether these values should be based on plasma or erythrocyte cholinesterase inhibition. As discussed above, it is current OCSEH policy to use the end point of plasma cholinesterase inhibition, as it is the most sensitive effect. This is consistent with US EPA regulatory policy, but not with Health Canada or the JMPR.

Furthermore, differences in risk assessment outcomes arise from differences in policy on species selection (animal or human) for the determination of NO(A)ELs and the use of additional safety factors (for protecting sensitive populations e.g. children).

The policy in Australia, particularly with respect to a number of human studies carried out using low doses of organophosphorus pesticides, is that studies carried out with humans are acceptable, provided that they were done:

- on informed volunteers;
- under medical supervision; and
- according to an acceptable code of ethics.

The former Advisory Committee of Pesticides and Health (ACPH) considered that the use of additional safety factors for children (or other sensitive sub-populations) could only be justified if the data supported a conclusion that the standard 100 fold safety/uncertainty factor was not adequate to encompass sensitive sub-populations.

Additionally, the use of inhibition of non-specific plasma cholinesterase (butylcholinesterase) as the regulatory endpoint for setting the ADI for organophosphorus pesticides adds a degree of conservatism compared to those agencies/organisations which have a policy of setting ADIs based on inhibition of erythrocyte or brain acetylcholinesterase. The latter is an brain enzyme which is less sensitive than the non-specific plasma cholinesterase inhibition by organophosphorus pesticides. Note however that acetylcholinesterase inhibition is the endpoint used to set Acute Reference Dose (ARfD) values for OPs, not plasma cholinesterase inhibition.

SUMMARY

All relevant databases and documentation from international regulatory agencies were searched for studies on chlorpyrifos, which were published since 1999. The databases searched included: PUBMED, Tomes Plus, JMPR, WHO/IPCS and the US EPA.

No new toxicity studies on chlorpyrifos were retrieved that were considered to impact on the toxicological endpoints selected for either the public health, or occupational health risk assessments performed by OCSEH in 1999/2000.

The findings in a paper by Zhao *et al.,* (2006), published in the *Journal of Regulatory Toxicology & Pharmacology*, which reviewed the basis for the reference dose for chlorpyrifos, confirmed the appropriateness of the toxicology endpoint used by OCSEH to set health exposure standards.

Thus, the existing end points used in the OCSEH (2000) report were considered to be still valid. Hence there are no changes recommended at this stage, i.e. no changes are proposed for either the NOEL or the dermal absorption factor. Therefore the recommended safety directions, including personal protective equipment, remain unchanged.

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4 RESIDUES AND TRADE ASSESSMENT 2009

INTRODUCTION

Background to the evaluation

In the 2000 chlorpyrifos review, wherever residue data were insufficient to support MRLs, those MRLs were made temporary. This was to encourage submission of further residue data to support the continued registration of chlorpyrifos in certain commodities.

Since the report in 2000, Dow AgroSciences submitted data or argument for consideration for the following crops or crop-groups:

Fruits and vegetables

asparagus	celery	peas (fresh)
banana	citrus	pea haulm
beans	dried fruits	peppers
beans (black)	egg plant	pineapple
beans (field)	grapes	pome fruits
bean haulm	lettuce	silver beet (chard)
brassica	mango	stone fruits
carrots	onions	sweet potatoes
cassava	peas (dried)	tomatoes (fruiting vegetables)

Broadacre crops

barley	grasses	peanuts
canola	lentils	safflower
cereal forages	linseed	sorghum
chickpeas	lucerne	soybeans
clovers	lupins	sugarcane (foliar applications)
faba beans	oats	vetch
field peas	oil seeds	wheat

The residue data for these crops were evaluated by the APVMA's residues section in 2005/6, and that assessment is summarised below.

Currently-registered products

As at 15 June 2005 (when the supplementary residue assessment commenced), there were 147 registered chlorpyrifos products. At the time of finalising this Preliminary Review Findings (PRF) document (mid-August 2009), there were 85 registered chlorpyrifos products and 16 approved sources of chlorpyrifos active constituent.

Of these 85 registered products:

- one is a cattle ear tag;
- two are a banana bag or ribbon product;
- 33 are for control of lawn grubs/beetles, ants, slaters, etc in and/or around domestic and/or public premises; and
- 49 are for agricultural use and/or termiticide control (may also include turf, mosquito, Argentine Ant and related use patterns) [3 products are for termiticide control only].

Label and maximum treatment regime

The most common uses in fruits, vegetables and field crops at the time of drafting this supplementary residue assessment (2005–06) were as follows:

Table 3: Registered use patterns on fruit, vegetables and field crops (2005)[22]

Crop	Critical Pest[1]	Maximum Application Rate			Comments	WHP
		Concentration	No.	Interval (days)		(days)
Fruits						
Avocado	Leafrollers and scale	50 g ai/100L	ns	ns	Apply at first sign of activity, and repeat as necessary	7
Bananas	Scab moth and flower thrips	100 g ai/100L	ns	ns	Apply to flower bell until fingers are exposed.	14[2]
Citrus	California red scale	50 g ai/100L	2	7	Apply during Nov-Mar period. Two sprays may be required with heavy infestations	14
Custard apples	Ants	100 g ai/100L	2	na	Apply to tree trunk and ground – no direct treatment	14
Grapes	Light brown apple moth	50 g ai/100L	ns	ns	Make first application just after berry set. Repeat as required.	14
Kiwifruit	Scale insects	25 g ai/100L	ns	ns	Apply when pests evident. Repeat when necessary	14
Loquats	Queensland fruit fly	200 g ai/100L	na	na	Apply in a strip or patch low on tree. Avoid contact with fruit.	14
Mangoes	Common mango scale	50 g ai/100L	ns	ns	Apply to coincide with crawler activity.	21
Passionfruit	QLD fruit fly	60 g ai/30L	ns	7-10	Apply 30L spray mixture per hectare in a strip along the bottom of the vines	14
Pineapples	Pineapple scale	50 g ai/100L	2	90	Apply when insects first appear	14
Pome fruit	San Jose scale, mealy bugs	50 g ai/100L	≥ 2	10-14	Apply at petal fall and again 10-14 days later. If necessary, apply 2-3 weeks before harvest	14
Stone fruit	San Jose scale	50 g ai/100L	na	na	Apply to coincide with crawler activity	14
Strawberries	Crickets, by baiting	50 g ai/10 kg bran bait/ha	na	na	Apply to base of plants and inter-row in recently ratooned strawberry patches.	14
Vegetables						
Bulb vegetables	Vegetable weevil	400 g ai/ha	na	na	Apply at first sign of pests	NIL
Cole vegetables	*Helicoverpa spp.*	1000 g ai/ha	ns	10-14	Spray at 10-14-day intervals	5
Cucurbits	*Helicoverpa spp*; White fly.	100 g ai/100L; 25 g ai/100L	ns	7-10; 10-14	Apply every 7-10 days from flowering; Apply when pest first detected – repeat 10-14 days	3; 5
Eggplant	Vegetable weevil	400 g ai/ha	na	na	Apply at first sign of pests. Apply as band over young plants and adjacent soil.	NIL
Fruiting vegetables	*Helicoverpa spp*; Green vegetable bug.	100 g ai/100L	7	7-10; na	Apply every 7-10 days from flowering; Spray at first sign of bug activity.	3

22 Sourced from two labels, of the pioneer products Lorsban* 500 EC (32887) and Nufarm Chlorpyrifos 500 EC (32902).

Crop	Critical Pest[1]	Maximum Application Rate			Comments	WHP
		Concentration	No.	Interval (days)		(days)
Ginger	Cutworm	400 g ai/ha	ns	ns	Apply when damage is observed	NIL
Leafy vegetables	Vegetable weevil	400 g ai/ha	na	na	Apply at first sign of pests. Apply as band over young plants and adjacent soil.	NIL
Potatoes	African black beetle, white fringed weevil	3,000 g ai/ha	na	na	Apply to soil immediately prior to planting and incorporate to 15 cm.	NIL
Tomatoes	*Helicoverpa spp*; Green vegetable bug.	100 g ai/100L	7	7-10; na	Apply every 7-10 days from flowering; Spray at first sign of bug activity.	3
Legume vegetables	Vegetable weevil	400 g ai/ha	na	na	Apply at first sign of pests. Apply as band over young plants and adjacent soil.	NIL
Root and tuber vegetables	Vegetable weevil	400 g ai/ha	na	na	Apply at first sign of pests. Apply as band over young plants and adjacent soil.	NIL
Stalk and stem vegetables	Vegetable weevil	400 g ai/ha	na	na	Apply at first sign of pests. Apply as band over young plants and adjacent soil.	14
Field crops, pastures etc						
Cereals	Spur-throated locust	750 g ai/ha	ns	7	Spray areas of crop infested with locust.	10 (H); 2 (G)
Clover seed	Mites	150 g ai/ha	1	na	Apply as ground spray immediately prior to seedling emergence.	2 (G)
Coffee	Mealy bugs	100 g ai/100L	ns	ns	Apply at base of seedlings and surrounding area to disrupt ants which attend bugs.	NIL
Cotton	Spur-throated locust	750 g ai/ha	ns	7	Spray infested areas of crop.	4w (H); 4w (G)
Hops	Light brown apple moth	80 g ai/100L	ns	ns	Apply as required	NIL
Lucerne	Spur-throated locust	750 g ai/ha	ns	7	Spray areas of crop infested with locust.	10 (H); 2 (G)
Pasture	Spur-throated locust	750 g ai/ha	ns	7	Spray areas of crop infested with locust.	10 (H); 2 (G)
Forage	Spur-throated locust	750 g ai/ha	ns	7	Spray areas of crop infested with locust.	10 (H); 2 (G)
Rice	Brown planthopper	750 g ai/ha	ns	7	Apply when pest numbers reach 1-2 per tiller. Repeat as required.	10 (H); 2 (G)
Sorghum	Spur-throated locust; False wireworm	750 g ai/ha; 7.5g ai/100 m row	ns	7	Spray areas of crop infested with locust; Apply as in furrow band spray.	10 (H); 2 (G)
Sugarcane	Spur-throated locust	750 g ai/ha	ns	7	Spray infested areas of crop.	7 (H); 2 (G)

Crop	Critical Pest[1]	Maximum Application Rate			Comments	WHP
		Concentration	No.	Interval (days)		(days)
Tobacco	Wireworm, cutworms	1,500 g ai/ha	1	na	Apply as pre-plant spray to cultivated soil surface.	NIL
Oilseeds	Cutworm	450 g ai/ha	ns	7	Apply at first sign of pests. Repeat as required.	2 (G)

Notes: [1] "Critical pest": A pest which requires the maximum rate of application to a food commodity.
[2] Use for the control of Lepidopterous caterpillars in NSW is associated with a NIL WHP.

ns : not specified **na**: not applicable

Permit approvals

There were 33 chlorpyrifos-related permits current as at 3 January 2006 when the new residues assessment was completed. At the time of compiling this consolidated review report (mid-July 2009), there were 26 food-related[23] permits in force, as listed below:

Table 4: Food-related chlorpyrifos permits as at 25 July 2009

Permit No.	State	Description	Expiry Date
4321	All (-Vic)	Longans/ants	31/03/2010
5851	NSW, NT, WA	Sweet Potato / sweet potato weevil, bean spider mite, wireworm	12/02/2012
6552	ACT, NT, Qld, SA, Tas, WA	Pumpkin / African Black Beetle	30/09/2009
6766	Qld	Ginger / Symphylids	30/09/2010
7253	SA, Tas	Stonefruit /European earwigs	30/09/2009
8379	Tas	Oilseed poppy / Wilbies and black headed cockchafers	30/09/2009
8387	NSW, Qld	Coffee / scales, mealy bugs, ants and avocado leaf-roller	30/09/2009
8490	All	Various Vegetables[24] / African Black Beetle and Wireworms	06/02/2011
8522	All	Pulse Crops and Grain Legumes[25] / wireworm, black field earwig, field crickets, false wireworm	09/03/2016
8557	All (-Vic)	Olives / ants, African black beetle & light brown apple moth	30/09/2009
9074	SA	Grapevines / European Earwig	30/09/2009
9217	NT	Compost heaps, ground under infested trees (etc) / Qld fruit fly	31/03/2010
9343	ACT, NSW, SA, Tas, Vic, WA	Mustard (*Brassica juncea*) (Various Pesticides for various pests, as for canola)	03/03/2012
9694	All	Taro / African Black Beetle	05/03/2012
9830	NSW	Compost heaps and ground under infested trees / Qld Fruit Fly	31/03/2012
9840	All	Capsicum / Cluster Caterpillar	01/02/2010
9852	Qld	Pineapple / White Grub Complex	31/03/2010
9938	SA, WA	Grapevines / African Black Beetle	31/03/2012
10089	ALL (-Vic)	Parsley & Potato / Vegetable Weevil & Black beetle	30/09/2013
10162	WA	Grapevines / European earwigs (*Forficula auricularia*)	30/04/2013
10570	ACT, NSW, NT, Qld, Tas, WA	Persimmons / Cluster grub (*Spodoptera litura*)	30/04/2013
10578	Qld	Chlorpyrifos / Banana / Sugarcane bud moth, Banana scab moth & Banana rust thrips	30/09/2013
10700	NSW	Banana bunches / Caterpillars, Rust, thrips & mealy bugs	30/09/2013

23 Permits for insect control in forestry, seed production (for sowing) or control of Red Imported Fire Ant (RIFA) in ornamentals or turf, are not included in the table as there are no residues-related issues with their use.
24 8490 crops: beans, swede, turnip, and brassica leafy vegetables, celery, silverbeet, spinach, snow peas and sugar snap peas
25 8522 crops include adzuki beans, cowpeas, mung beans, faba beans, lentils and navy beans

Permit No.	State	Description	Expiry Date
10887	NSW	Blueberries / Scarabs	31/10/2009
11243	NSW	Cucurbits and Olives (non fruit - bearing only) / Australian Plague Locust	31/05/2009
11306	WA	Various actives / Apple orchards or Vineyards / Apple Looper	30/06/2012

Use Patterns

Food and non-food use patterns for chlorpyrifos were identified for:

Fruits and vegetables: Apples, avocado, bananas, bulb vegetables, carrots, cassava, citrus, cole crops or brassica vegetables (including cabbage, cauliflower, brussels sprouts and broccoli), capsicum, cucurbits, custard apple, egg plant, ginger, grape vines, kiwifruit, leafy crucifers, lettuce, loquat, mango, pears, pineapple, pome fruit, root and tuber vegetables, silver beet, stalk and stem vegetables, stone fruit, strawberries, tomatoes, and vegetables (includes specific vegetable entries found on some labels). Seed dressings are also specified for some commodities.

Field crops and pasture: barley, broad beans, cereals, chickpeas, clover seed crops, coffee (prior to bearing), cotton, establishing perennial pastures, field peas, forage crops, hops, improved annual pastures, lucerne, lucerne pastures and seed crops, lupins, maize, millet, oats, oilseeds, pasture, pulses, rice, rye, sorghum, sugarcane, tobacco, triticale, wheat, and young plants of oil seeds. Seed dressings are allowed for cereal and oil seeds.

Miscellaneous (non-food) uses: animal hides and skins, container plants, insect control in agricultural, domestic, commercial, and industrial areas, mosquito control in vegetation and polluted water impoundments, protection of existing buildings and reticulation systems against termites, soil treatments as termite protection, soil baits, termite protection of buildings (houses, factories, industrial and commercial buildings public premises, and farm buildings) under construction, macrocarpa hedges, turf and lawn insect protection. Application of chlorpyrifos can be foliar, soil applied, as a bait, or as a seed dressing.

Current Australian MRLs and residue definition

For ease of reference, the outstanding TMRLs from the original residues report (of 2000) are in bold. TMRLs since then will be assessed separately and are not addresses here.

Table 1 of the APVMA's MRL Standard: Maximum Residue Limits (MRLs) of agricultural and veterinary chemicals and associated substances in food commodities

Compound			Food	MRL (mg/kg)
Chlorpyrifos				
	VS	0621	**Asparagus**	**T0.5**
	FI	0326	Avocado	0.5
	FI	0327	**Banana**	**T0.5**
	FB	0200	Blueberries[#]	T1
	VB	0040	**Brassica (cole or cabbage) vegetables, Head cabbages, Flowerhead brassicas**	**T0.5**
	VR	0463	**Cassava**	**T*0.02**
	VS	0624	**Celery**	**T5**
	GC	0080	**Cereal grains [except sorghum]**	**T0.1**
	FC	0001	**Citrus fruits**	**T0.5**
	SB	0716	**Coffee beans**	**T0.5**
	SO	0691	Cotton seed	0.05
	OC	0691	Cotton seed oil, crude	0.2
	DF	0167	**Dried fruits**	**T2**
	MO	0105	**Edible offal (mammalian)**	**T0.1**

Compound	Food			MRL (mg/kg)
	PE	0112	**Eggs**	**T*0.01**
	HS	0784	Ginger, root	*0.02
	FB	0269	**Grapes**	**T1**
	FI	0341	Kiwifruit	2
	VA	0384	Leek	T5
	FI	0345	Mango	*0.05
	MM	0095	**Meat (mammalian)[in the fat]**	**T0.5**
	ML	0106	**Milks [in the fat]**	**T0.2**
	SO	0089	**Oilseed, except peanut**	**T0.01**
	FT	0305	Olives	T*0.05
	HH	0740	Parsley#	0.05
	FI	0351	Passion fruit	*0.05
	SO	0697	**Peanut**	**T*0.01**
	VO	0445	Peppers, Sweet [capsicums]	T1
	FT	0307	Persimmon, Japanese	0.5
	FI	0353	**Pineapple**	**T0.5**
	TN	0675	**Pistachio nut**	**T*0.05**
			Pitaya (dragon fruit)	T*0.05
	FP	0009	**Pome fruits**	**T0.5**
	VR	0589	Potato	0.05
	PO	0111	**Poultry, Edible offal of**	**T0.1**
	PM	0110	**Poultry meat [in the fat]**	**T0.1**
	GC	0651	**Sorghum**	**T3**
	FS	0012	**Stone fruits**	**T1**
	FI	0367	Star apple	T*0.05
	FB	0275	Strawberry	0.05
	GS	0659	**Sugar cane**	**T0.1**
	VR	0497	Swede#	T0.3
	VR	0508	**Sweet Potato**	**T0.05**
	VR	0505	Taro#	0.05
	VO	0448	**Tomato**	**T0.5**
			Vegetables [except asparagus; brassica vegetables; cassava; celery, leek; peppers, sweet [capsicums]; potato; tomato]	**T*0.01**

: the TMRLs or MRLs for these four crops were established after the new residue assessment in 2005/6

Table 3 of the APVMA's MRL Standard: Residue definition

Compound	Residue
Chlorpyrifos	Chlorpyrifos

Table 4 MRL APVMA's Standard: Maximum residue limits for pesticides in animal feed commodities

Compound	Animal feed commodity			MRL (mg/kg)
Chlorpyrifos				
	AM	0691	Cotton fodder, dry	30
			Cotton meal and hulls	0.05
	AL	1270	Peanut forage (green)	T10
			Peanut hay	T2

Table 5 of the APVMA's MRL Standard: Uses of substances where maximum residue limits are not necessary

Compound	Use
Chlorpyrifos	When used for the control of fire ants in horticultural situations

Toxicological information

A supplementary toxicology report in 2006 confirmed the health standards used in this report (see Dietary Risk Assessment section).

Monitoring and survey information

The NRS[26], NSW DPI[27], Primary Industries and Resources South Australia (PIRSA), and the Victorian Department of National Resources and Environment (DNRE) have all published residue monitoring data for various commodities. The results from these programs are summarised in Table 5 below.

Table 5: Produce monitoring for chlorpyrifos in plant commodities by various authorities (1987–2008).

Authority	Years	Commodity	Total samples for chlorpyrifos	Total exceeding the MRL (commodities)
NRS[28]	1999-2008	Grains	40,748	11 (wheat grain, wheat bran, oats)
		Apple/pear	3,314	5 (apple)
		Macadamias	1,045	0
		Onion	968	0
		Canola	2,317	0
		Pecan	165	0
Vic DNRE[29]	1987-2006	Fruit & nuts	913	20 (grapes, strawberry, apple)
		Vegetables & herbs	1,708	10 (carrot, Chinese cabbage, spinach, celeriac, coriander, lettuce, fennel, mint)
		Grain	147	0
NSW DPI[30]	1995-2005	Fruit	1689	13 (apple, banana, custard apple, mango, rockmelon)
		Vegetables	2199	15 (beans, bok choy, capsicum, celery, cucumber, lettuce, silver beet, snow pea)
PIRSA[31]	1998-2002	Fruit	219	2 (grapes, rockmelon)
		Vegetables	401	8 (Lettuce, grapes, parsley, coriander)

1997– 2008: Total samples = 55,833 ; No. of samples exceeding MRL = 84 ; Percentage violations = 0.15%

In 2003, two samples of exported celeriac were found to contain residues of chlorpyrifos of 0.15 and 0.03 mg/kg.

The results for the NRS sampling of chlorpyrifos-related animal commodities from 2004 to 2008 are summarised in Table 6 below.

26 NRS = National Residue Survey
27 DPI = Department of Primary Industries
28 Data collated from the National Residue Survey Annual Reports from 1999-2004
29 Data collated from Victorian Produce Monitoring Reports 1987-2004
30 Data collated from NSW DPI Monitoring Pesticide Residues Reports for the period 1995-2005
31 Data collated from the Pooraka Food-Care Project Reports 1998-2002)

Table 6: Produce monitoring for chlorpyrifos in animal commodities by the NRS (2004-2008).

Authority	Years	Commodity	Total samples for chlorpyrifos	Total exceeding the MRL	Total with detection below the MRL
NRS[32]	2004-2008	Cattle	4,432	0	0
		Goat	399	0	0
		Pig	1,198	0	0
		Sheep	3,027	0	2 (2008)

2004–2008: Total samples = 9.056; No. of samples exceeding MRL = 0; Percentage violations = 0%

No residue violations in meat commodities were reported for the period 2004 - 2008.

ASSESSMENT OF RESIDUES DATA

Analytical methods

Analytical methods were considered in the *NRA Review of Chlorpyrifos* (2000) and do not need to be reconsidered here, as no substantial changes to methodology have changed.

Residue definition

This was considered previously, and there were no changes to the residue definition of chlorpyrifos.

Residues in food commodities

The 2000 chlorpyrifos residue report in *The NRA Review of Chlorpyrifos* identified that no further consideration was needed for avocado, ginger, passion fruit, strawberry, cottonseed, kiwifruit, and potato, and that their MRLs would remain in place.

The crops below were identified as having insufficient residue data to support their MRLs and so were set as TMRLs. The residue data submitted to support these crops and associated issues are considered below.

FRUIT AND VEGETABLE CROPS

Stalk and stem vegetables

Asparagus—foliar application: Data for asparagus, generated in the USA, indicated that a maximum residue of 0.54 mg/kg could occur in spears, when treated one day before harvest. The data indicate an MRL of 1 mg/kg would be required to support a WHP of 1 day for foliar application. However, data from only one trial are not sufficient to allow the establishment of an MRL, even for a minor crop such as asparagus. Therefore, the ongoing use of foliar sprays of chlorpyrifos on asparagus spears is **not** supported, as the uncertainty about any proposed MRL on the basis of data from one trial, is not acceptable from a regulatory perspective.

Celery—foliar application: There were no data available for foliar/stalk application to celery which corresponded to the maximum use pattern for control of vegetable weevil. Therefore, this use is **not** supported, due to lack of appropriate data.

Asparagus and Celery— soil treatment and/or baits: Dow AgroSciences submitted argument that (a) soil treatments for cutworms and (b) baiting for crickets would not produce residues in the harvestable commodity. Therefore it was argued that data were not required for asparagus or celery for these uses.

This argument is acceptable, as the treatment for cutworms occurs when the plants are extremely small and growth dilution would reduce all residues to very low levels at harvest of the mature crop.

32 Data collated from the National Residue Survey Annual Reports from 1999–2004

Baiting for crickets is by distribution of baits to the soil surface, and these should not come in contact with the plant or harvestable commodity. Therefore, the use of chlorpyrifos for the control of cutworms and the baiting of crickets in asparagus and celery crops is **supported**. This would be accompanied by a change in the relevant MRLs to *0.01 mg/kg. A WHP is not needed with this use, and a statement "WHP: Not required when used as directed" should be included on the label.

Public Responses: The vegetable-growing industry through the HRDC indicated that the industry sought only to retain the use of chlorpyrifos for cutworm and other soil-borne insects on asparagus (prior to spears appearing) and celery. This is acceptable to the APVMA, as spears only appear from the transplanted crowns.

Bananas

Foliar application: Data generated in the Philippines (1976) corresponded with the Australian use pattern. When chlorpyrifos is applied to the bunch in bud, maximum residues at harvest (0.19 mg/kg) would comply with the present MRL of 0.5 mg/kg. The approved use of chlorpyrifos is for application until fingers are exposed, or as a soil/butt application and the Philippines data therefore closely approximate Australian GAP.

Data generated in Spain and a second trial in the Philippines did not address the Australian use pattern. These other data indicated that when the plants were sprayed without a bag and without spraying the bunch directly, residues still occurred in the fruit, with a maximum level of 0.22 mg/kg. None of the data addressed the WHP of 14 days, although the minimum time from treatment of the immature bananas to harvest is about 2 months in the tropical growing areas (D Astrich, QDPI[33] – personal communication). The data **confirmed** compliance with the temporary MRL of 0.5 mg/kg. The maximum residue that occurred in the edible pulp was 0.011 mg/kg.

Since the *NRA Review of Chlorpyrifos* was released in 2000, a product with a new route of application has been registered[34]. This is *Pyritilene Banana Bags* (APVMA No. 54546): bags which contain chlorpyrifos are applied to the banana bunches no later than when the majority of the bracts have fallen, for the control of a number of pests. Residues data were evaluated for this application and confirmed compliance with the present temporary MRL of 0.5 mg/kg, with a harvest withholding period of 10 weeks. The use of chlorpyrifos dusts in bananas (via permit approval) is **supported** from a residues perspective, as data previously considered demonstrated compliance with the MRL.

Soil and butt treatment: Dow AgroSciences argued that soil and butt treatment for banana weevil borer was not a residue issue. This argument is acceptable and this use is **supported** from a residues perspective. A withholding period is not required for these uses.

Reviewing all the data for bananas, including that which was previously considered, the uses of chlorpyrifos as a bell treatment, soil/butt treatment, bag dust, and treated banana bag[35] are **supported** with application timing being up until the exposure of fingers, in the development of the bell. Current withholding periods remain appropriate and the temporary MRL of 0.5 mg/kg should be confirmed as permanent.

Public Responses: Received from Queensland Fruit and Vegetable Growers, the QDPI and the NSW Banana Industry Committee. Some concerns were expressed about the dusting treatment from an OH&S perspective, as well as support for the continued availability of chlorpyrifos in banana production.

Brassica vegetables

Trial data submitted were mostly generated overseas.

The Australian data did not address the maximum rate of 1000 g ai/ha for control of cabbage moth.

33 QDPI = Queensland Department of Primary Industries

34 Since the new residues assessment report was completed, another new application route was registered: "Suscon Ribbon Insecticide" [APVMA No: 54963]. It is ribbon impregnated with chlorpyrifos, which is placed around the bunch around 2 weeks after bell emergence. The bunch is then enclosed immediately in a polythene bunch-cover. The WHP is NIL.

35 As well as use of the new impregnated ribbon.

Comparison against Australian GAP left only 1x cabbage, 1x Chinese cabbage, 1x savoy cabbage, 1x cauliflower and 1x Brussels Sprout trials to consider. No broccoli data were relevant. Consequently, because of insufficient data, post-planting uses on any Brassica vegetable crops, either individually or as a group, are **not** supported.

However, use at planting or pre-planting, or for baiting for crickets, is **supported**, and no WHP is required when used as directed. An MRL of *0.01 mg/kg would be appropriate.

Public Responses: Dow AgroSciences indicated that they were prepared to support the use of chlorpyrifos on seedling and transplant stages only, for which residues data were not required.

Citrus fruits

Residues data submitted for consideration included only one trial from Australia, generated in oranges in 1972. Considering all data presented, residues in citrus following foliar application of chlorpyrifos ranged from 0.04 to 0.52 mg/kg 14 days after application, when compared to GAP, with a median residue of 0.105 mg/kg. However, the *NRA Review of Chlorpyrifos* identified that relevant Australian data needed to be generated to support the temporary MRL. The single Australian trial did not address GAP, therefore the data were of limited use.

Overseas data were useful and showed that an increase of the MRL from 0.5 mg/kg to 1 mg/kg would be required for citrus fruit as a group, at the present withholding period of 14 days. When the citrus fruits were processed, there were no quantifiable residues in either the pulp or the juice (<0.01 mg/kg) at 14 days. There were residues present in the peel and dried pulp, and the processing factors for these commodities are 1.27–2.06 and 2.1–4.8 respectively. An MRL would be required for dried pulp as a stockfeed, and this will be considered in the *Residues in Animal Feeds* section.

Monitoring data available through the National Residues Survey indicated that 62 of 300 samples contained chlorpyrifos residues, with none of those exceeding 0.25 mg/kg. This indicates that use of chlorpyrifos on citrus has not raised any residues issues or violations of MRLs. Considering all data in this evaluation of citrus, there is **support** for the use of chlorpyrifos for foliar applications, with an MRL of 1 mg/kg and a WHP of 14 days. Uses of chlorpyrifos as butt and soil treatments are also **supported**, as there are no residues concerns with such treatments as chlorpyrifos is not applied to the fruit.

Public Responses: Apart from the data submitted, there were no other public responses.

Grapes

Table grapes: In the *NRA Review of Chlorpyrifos (2000)*, it was identified that a harvest-withholding period of 14 days was inappropriate with respect to the timing of application for mealy bug control (a critical use for the grape industry). It was assumed that the first application, to be applied before bbunch closure, takes place no later than 8 weeks before harvest, and that a second spray (as per the label) is made no later than 6 weeks before harvest.

Data considered in the *NRA Review of Chlorpyrifos* showed that residues in grapes treated at 50 g ai/100L could exceed the MRL of 1 mg/kg at 28–35 days after application, with maximum residues recorded at 1.4 mg/kg. However, the spray was not applied to the grapes prior to bunch closure, so its applicability to mealy bug control is uncertain.

Applications of chlorpyrifos to grape vines can occur during the development of the berries to full maturity, including when mealybugs would be present. Residues of chlorpyrifos in grapes from overseas data indicated a range of residue in grapes. When compared to Australian GAP of 50 g ai/100L and a WHP of 14 days, the residue range was 0.16 to 0.88 mg/kg, with a median value of 0.2 mg/kg. These values indicate compliance with the temporary MRL of 1 mg/kg at 14 days. The use of chlorpyrifos for the control of mealybug, light brown apple moth and grapevine moth is **supported** from this data, with a withholding period of 14 days and an MRL of 1 mg/kg.

The use of chlorpyrifos for the control of grapevine scale is also **supported**, as this is carried out on dormant vines.

Wine grapes: The residues data available to determine the effect of wine-making on chlorpyrifos residues was only generated from grapes harvested at 44–116 days after treatment. The residues in the grapes ranged from 0.03 to 0.26 mg/kg.

In one batch of wine the skins remained in the "wine" for 3 days prior to fermentation. In another batch, the skins were removed earlier. There were no quantifiable residues in the wine made from either of those methods. This is partially supported by data made available by the Australian Wine Research Institute (AWRI).

In 5,000 samples of wine analysed over a ten-year period, only one sample contained a residue of chlorpyrifos, the value of which was <LOQ[36] but greater than the LOD[37]. In comparison, residues occurred in 16 of 536 samples of fresh grapes analysed[38].

It appears that chlorpyrifos residues are removed during the fermentation of must. Other information available indicated that the secondary malolactic fermentation, carried out during "aging" in oak casks, can also reduce any residues of chlorpyrifos that remain following the primary fermentation[39]. There were no data submitted that determined chlorpyrifos residues in grape marc or pomace.

Dried grapes: Residues in whole grapes of 0.45 and 1.6 mg/kg decreased to 0.08 and 0.3 mg/kg respectively in raisins, following harvest on the day of treatment and drying for 14 days. Raisin trash contained residues up to 0.53 mg/kg.

The harvesting of grapes immediately following treatment does not reflect the normal label use pattern as there is a 14-day withholding period. No data were available to assess residues in raisins or trash when harvested 14 days after treatment.

Public Responses: The Australian Wine Research Institute and the Australian Dried Fruits Association have both indicated to the APVMA that chlorpyrifos continues to be useful in their pest control programs. They believe that they can manage residues better by the use of longer withholding periods than that stated on labels. Their monitoring data indicate good compliance with existing MRLs.

Dried fruits

The *NRA Review of Chlorpyrifos* identified that unless data for other dried fruits were submitted, the MRL for dried fruits would be deleted and one for "dried grapes (currants, raisins, sultanas)" would be established from the data available. Chlorpyrifos can be used in grape production up until 14 days before harvest, for control of light brown apple moth, and can also be used in stone fruit for the control of San Jose scale, again until late in the growing cycle, with a 14-day post-harvest interval (PHI).

The Australian Wine Research Institute, in its publication *Agrochemicals Registered for Use in Australian Viticulture 2005/2006*, recommends that chlorpyrifos not be used later than 80% capfall, which is early in the development of the grape, and approximately 3–4 months prior to harvest. It is not known if the dried fruit industry follows the same guidelines. Previously, limited residues data were evaluated in dried grape commodities only. These are summarised in Table 7.

36 LOQ = Limit of Quantitation
37 LOD = Limit of Detection
38 Mark Gishen (AWRI) – personal communication (2005)
39 Fate of Pesticides during the Winemaking Process in relation to Malolactic Fermentation. Ruediger GA et al (2005). J Agric Food Chem 53:3023-3026.

Table 7: Residues of chlorpyrifos in grapes and sultanas – from 2000 report

Final application rate (g ai/100L)	Final volume (L/ha)	Commodity	PHI (days)	Residue (mg/kg)
~20	~6000	Grape	7	1.1, 5.4
		Sultana	7	1.3, 4.4
50	5800 ?	Grape	7	1.9-2.9
			14	1.5-2.4
			21	1.3-1.8
		Sultana	7+21	0.43-1.4
			21+21	0.68-1.8
25	1500	Grape	14	0.16-0.30 [0.32-0.60]#
		Sultana	14+	0.06-0.13 [0.12-0.26]#

#: residues (mg/kg) after accounting for GAP

None of the data were produced with spray volumes that could be considered as typical for the Australian industry. Only the last trial reported above addressed the PHI of 14 days for both grape and sultana. Further data submitted for consideration in this evaluation include those in Table 8.

Table 8: Residues of chlorpyrifos in raisins and prunes – Supplementary data

Final application rate (g ai/100L)	Final volume (L/ha)	Commodity	PHI (days)	Residue (mg/kg)
479	234	Grape	3	0.45
		Raisin	3+14	0.08
72	4683	Plum	7	0.38, 0.50, 0.41, 0.35 [0.32, 0.42, 0.34, 0.29]#
		Prune	7+?	0.09, 0.11, 0.08, 0.06 [0.08, 0.09, 0.07, 0.05]#

#: residues (mg/kg) after accounting for GAP

The data for grape and raisin indicate a decrease in residues following drying. However, the data do not address the GAP for the Australian industry and residues could be more prone to reduction at 3 days after application. The general indication from these data is that residues in raisins and prunes are less than those of whole grapes before drying. Therefore, the residues in dried grape and plum commodities should fall within a dried fruit MRL of 1 mg/kg.

The dried fruit industry, through the Australian Dried Fruits Association (ADFA), tests dried fruits each year as part of its ongoing commitment to quality products through a quality management program. A summary of these data over the period 2003-2005 is shown in Table 9.

Table 9: Results of monitoring for chlorpyrifos in Australian grown dried fruits, 2003-05

Dried fruit group	Number of tests	Chlorpyrifos residues		Fruit with highest residue
		Positive detections	Highest residue (mg/kg)	
Stone/pome fruit	2231	40	0.20	Pear
Grape commodities	3967	86	0.36	Raisin

These data demonstrate that residues of chlorpyrifos in dried fruits have not exceeded the MRL for dried fruits over the previous 3 years (2003–05). In fact residues found in dried fruits were well below the temporary MRL of 2 mg/kg, set following *The NRA Review of Chlorpyrifos*. The current withholding period associated with the use of chlorpyrifos in grapes, stone and pome fruits is 14 days. On the basis of these monitoring data, an MRL of 1 mg/kg is proposed in dried fruits.

Public Responses: The Angus Park Company (a producer of dried fruits) expressed concern about the deletion of the dried fruits MRL and the generation of a dried grape MRL only.

Their concern was that chlorpyrifos could be used in stone fruits, so that an MRL should apply to the dried stone fruits. The ADFA was concerned that the use of chlorpyrifos in fruits destined for drying should not be withdrawn. In correspondence to Angus Park in 2001, it was indicated that data would need to be generated to maintain the use.

No data were received to support the use in fruit destined for drying. However, the ADFA has supplied monitoring data that has allowed the consideration of an MRL for chlorpyrifos in all dried fruits, including grape, pome- and stone fruit commodities.

Mangoes

Data from two Australian trials were submitted for consideration. These data show that residues range from 0.09 - 0.71 mg/kg in mangoes, 21 days after application, which exceeds the temporary MRL of *0.05 mg/kg. Previous data following application at 100 g ai/100L using the EC formulation showed residues of 0.04 at 21 days, well below those reported here. No data were submitted to demonstrate the distribution of residues between skin and edible flesh/pulp.

The data **support** the ongoing use of chlorpyrifos in mangoes according to the current use pattern. An MRL of 1 mg/kg at the present withholding period of 21 days is recommended.

Public Responses: There were no public responses to the draft proposals for mangoes in The NRA Review of Chlorpyrifos (2000).

Pineapples

Data from Australia, Kenya and the Philippines were submitted for consideration. At the present WHP of 0 days, residues in the whole pineapple ranged from 0.17 to 0.43 mg/kg in the Australian trials.

The overseas data do not address the Australian use pattern for pineapples, so were not able to be used to compare against the current MRL of 0.5 mg/kg. However, the Philippines and Kenyan data demonstrated that no residues occurred in the pulp of pineapples, even when there were significant residues in the skin. The data **support** the continued use of chlorpyrifos in pineapples according to the approved use pattern on the label, including pre-plant usage. An MRL of 0.5 mg/kg at a WHP of NIL days is recommended.

Public Responses: There were no public responses received regarding the use of chlorpyrifos in pineapples.

Pome fruits

Data from a number of trials were submitted for evaluation, including Australian data that had not been seen before. Overseas data were also submitted. The Australian data was generated from a single trial, in which chlorpyrifos was applied at varying rates, and sampling occurred over a period of 14 days.

Residues ranged from 0.04 to 0.14 mg/kg at 14 days after the last application, when corrected for application rate.

In data generated in the USA and Canada, maximum residues in apples, following application at 45-60 g ai/100L, were 3.7 mg/kg at 14 days after the last application, with many samples exceeding 1 mg/kg at 14 days. These data were generated using spray volumes exceeding 3000 L/ha, which could give higher residues in fruit. However, the use pattern basically matched GAP in Australia, therefore these data are able to be used in the MRL estimation. Residues of chlorpyrifos in apples and pears at the present WHP of 14 days ranged from 0.02 to 0.72 mg/kg. Therefore, an MRL of 1 mg/kg is recommended for a WHP of 14 days.

The use of chlorpyrifos for the control of San Jose scale, Woolly aphid, Mealybugs, Queensland fruit fly and Wingless grasshopper on pome fruit is **supported**, with a withholding period of 14 days and an MRL of 1 mg/kg.

Public responses: The Queensland DPI submitted some data from a trial investigating residues in apples following application of chlorpyrifos to tree trunks as a bait spray. A maximum residue of 0.04 mg/kg occurred in apples from the outer perimeter of the apple tree, which is well below the proposed MRL of 1 mg/kg.

Stone fruits

Data were generated for apricots and cherries in 2000, and submitted to the APVMA, supported by data from New Zealand and other countries. However, the data submitted did not always adequately reflect Australian GAP, and some could not be used in MRL and WHP determination. There were no adequate data for peaches. The maximum residue in stone fruit at a withholding period of 14 days after application of chlorpyrifos was 0.89 mg/kg, with a median residue of 0.065 mg/kg.

The foliar use of chlorpyrifos for the control of scale, earwig and fruit fly in stone fruits (**except peaches**) is **supported** from a residues perspective, with an MRL of 1 mg/kg and a withholding period of 14 days. The foliar use of chlorpyrifos in **peaches** for the control of scale, earwig and fruit fly is **not** supported.

The continued use of cracked grain baits for earwig control in all stone fruits (including peaches) is **supported**. In the case of peaches, for this use pattern an MRL of 0.05 mg/kg and a nil WHP is appropriate.

Public responses: The Australian Fresh Stone Fruit Growers' Association have expressed concerns about the removal of chlorpyrifos, taking away from them a useful tool in their IPM strategies. The assessment above indicated that chlorpyrifos would be supported from a residues perspective, so that the Association's concerns have been addressed. However, trade could still be an issue to be resolved and is addressed below.

Tomatoes

Four contemporary Australian trials, along with two less-recent Australian trials and some overseas data were considered. At 3 days after application (the current WHP), residues in tomatoes ranged from 0.06 to 0.59 mg/kg, with a median residue of 0.10 mg/kg. A longer WHP could not be considered. Fruit are continually ripening and would be present at all stages of ripeness when spraying, and tomatoes almost ready for harvest could not wait more than 3 days. There were no relevant data for cherry or other small tomatoes.

There is **suppor**t from a residues perspective for the ongoing use of chlorpyrifos in standard tomatoes when used as directed, but not in small tomatoes, such as cherry tomatoes. The latter, because of their greater surface area to mass ratio, could be expected to have higher residues than standard-sized fruit. Therefore, the data support an MRL of 1 mg/kg at a WHP of 3 days. However, this is in conflict with MRLs/tolerances overseas, where the MRL is 0.5 mg/kg at 3 days PHI and could prejudice trade if there was significant trade in this commodity. The use pattern in Australia is not changing, so therefore the magnitude of residues in the treated commodity should also not change.

The recommendation therefore will apply only to field grown tomatoes used for processing and does **not** include fresh tomatoes.

The reason for this restriction is that there is no clear, legally-effective label statement to exclude small tomatoes from chlorpyrifos use on fresh market tomatoes in general. For example, there are now "mini", "cocktail" and "mini-truss" fresh-market tomatoes, as well as "cherry" tomatoes. The size range for these different tomatoes is variable, and it is not clear if they are "small" or "large" (i.e. non-"small"), potentially leading to inappropriate use of chlorpyrifos.

Public Responses: The tomato industry consulted with the then NRA regarding the design of trials that were considered above. There were no other responses from the public.

Tree Nuts

No data were submitted. The Tasmanian DPIWE contacted walnut growers in Tasmania, and the growers indicated that they no longer required this use and that the MRL could be deleted. Therefore the continued use of chlorpyrifos on tree nuts is **not** supported.

Vegetables

The *NRA Review of Chlorpyrifos* (2000) identified that specific data on vegetables were needed, to validate MRLs for individual crops or crop groupings. There was concern that if the use pattern for chlorpyrifos on vegetables included the possibility of applications in a late growth stage, residues would most certainly exceed the MRL of *0.01 mg/kg, at a NIL withholding period.

The supplementary data submitted for consideration included Australian data for eggplant and supporting data from overseas. The range of residues and the median for each commodity are shown in Table 10.

Table 10: Residues of chlorpyrifos in vegetables following application of chlorpyrifos

Commodity/ days PHI	Total trials	Chlorpyrifos residues (mg/kg) [compared to Australian GAP]									
		Range					Median				
		0 days	3-4 days	7 days	14 days	21+	0 days	3-4 days	7 days	14 days	21+
Eggplant	3	0.02-0.17		<0.01-0.07			0.07		0.02		
Peppers	30	0.04-0.36	0.02-0.82	0.01-0.67			0.18	0.49	0.16		
Tomato	27	0.63, 1.06	0.08-0.90	0.01-1.8	<0.01-0.68		-	0.55	0.12	0.12	
Green Beans	8	0.27, 0.50	0.09-1.0	0.07-0.35	0.02-0.07		-	0.18	0.12	0.03	
Garden peas	10	-	0.07-0.38	0.01-0.19	<0.01-0.11		-	0.15	0.07	0.02	
Carrot	1				0.07, 0.08						
Onions^	3					<0.01					
Spinach	9			0.07-7.1	0.02-2.5				1.4	0.24	
Sweet potato^	10					<0.01					<0.01
Cucumber	9		0.09-1.4	<0.01-0.73	<0.01-0.17			0.29	0.13	0.05	
Lettuce	4		1.4, 0.97, 9.4, 0.13	1.2, 0.05, 8.7, 0.48	0.21, 0.02, 1.1, 0.08	<0.01					
Lima beans	9		0.02-1.4	0.07-0.72	0.02-0.15			0.53	0.40	0.10	

Data were insufficient or inappropriate for carrots, lettuce, onions and sweet potatoes to allow the estimation of a suitable WHP and MRL for application at growth stages other than at planting.

Therefore, the use of chlorpyrifos for direct application to the crop to control grasshoppers, light brown apple moth (carrots only) and vegetable weevils on carrots, lettuce, onions and sweet potatoes is **not** supported from a residues perspective.

Use prior to, or at, planting of carrots, lettuce, onions and sweet potatoes is **supported** and no withholding period is required when used as directed. For the other vegetables evaluated, the proposed MRLs and WHPs shown in Table 11. Note that tomatoes have been addressed separately (before "Tree Nuts", above).

Table 11: Proposed MRLs and WHPs for vegetable crops

Commodity	MRL (mg/kg)	WHP (days)	Notes
Eggplant	0.2	3	
Peppers	1	4	This will confirm the temporary MRL set wrt Permit 7379.
Tomato	-	-	Tomatoes are considered separately (above), as extra data were submitted from Australian trials.
Green Beans	1*	7	
Garden peas	1*	7	
Silver beet (chard)	10	7	
Cucumber	1	7	
Lima beans	1*	7	

Note: * It is proposed that these legume vegetables be grouped, with an MRL of 1 mg/kg.

Registration is **not** supported in any vegetables other than those listed separately in the *MRL Standard* and those listed above. The data available for parsley associated with Permit 6885 was reconsidered. This indicated that the MRL for parsley should be confirmed at 0.05 mg/kg when chlorpyrifos is used at or prior to planting.

Public Response: Only one response was received. This was from Dow AgroSciences, which dealt with tomatoes. That response has been considered in the separate "Tomatoes" section above.

FIELD CROPS AND PASTURES

Cereal Grains (including wheat, sorghum and rice)

Barley, oats and wheat: Twenty-six Australian trials were conducted in barley, oats and wheat, after the publication of the 2000 review report.

The maximum treatment was a single application at 675 g ai/ha. This was below the maximum treatment rate for spur-throated locust of 750 g ai/ha, but equivalent to GAP for control of armyworm. No data addressed the present WHP of 10 days, although residues were present at both 7 and 14 days. A summary of residues in the grain is shown in Table 12.

Table 12: The decline of chlorpyrifos residues in cereal grains following treatment at 675 g ai/ha

	Range of chlorpyrifos residues (mg/kg)				
Grain	0 days	7 days	14 days	28 days	100+ days
Barley	0.37-12	0.17-1.2	0.08-1.1	0.04-0.53	<0.05
Oats	0.47-9.4	0.15-0.47	0.10-0.50	0.06-0.19	<0.05-0.14
Wheat	0.27-21	0.05-0.58	0.02-0.09	0.03-0.11	<0.05-0.12

The maximum chlorpyrifos residues in grain were 1.2 mg/kg at 7 days after application, 1.1 at 14 days and 0.14 mg/kg at 100+ days.

Delay of harvest did not result in extensive reduction of residues in the grain. At none of these sampling times do the residues in grain comply with the present temporary MRL of 0.1 mg/kg. An MRL of 2 mg/kg would be required for cereal grains, with either a 7-day or 14-day WHP. No processing data were received, but the 2000 JMPR Report[40] on chlorpyrifos indicated a processing factor for wheat bran of 2.5.

Sorghum: Sorghum is discussed separately, as data indicates a sorghum MRL that is lower than the proposed cereal MRL above.

Data from 6 trials were submitted following application of chlorpyrifos at 450 and 750 g ai/ha (maximum label rate). Results were reported for grain, straw and forage, up to 28 days after application. No data were available that addressed the current WHP of 2 days.

In one trial, maximum residues of chlorpyrifos in sorghum grain at 3, 7, 14 and 28 days were 7.4, 9.9, 7.6 and 8.1 mg/kg respectively, following treatment at 750 g ai/ha. Maximum residues at 450 g ai/ha for the same time points were 3.5, 3.0, 4.8, 4.2 and 3.3 mg/kg respectively.

These residues data were all generated in one trial only, conducted out-of-season in a temperate climate zone. For this trial, planting occurred in February and application of chemical occurred very late in May, with sampling continuing into late June. The residues did not decline at either rate of application, nor did they decline in the straw portion of the crop. These data are not considered appropriate in determining an MRL and WHP, as they were generated out of season and produce a residue profile that is unrealistic i.e. the data are from a situation that is not typical of normal growing conditions.

Data from the other five trials indicated that the maximum residue at 7 days was 0.66 mg/kg and at 14 days was 0.54 mg/kg.

In discussions with the NSW DPI, it was identified that the main pests of concern to sorghum growers are midge, armyworm and heliothis, as far as late crop stage chemical application is concerned. Chlorpyrifos is not registered for heliothis control in sorghum. From a general use perspective, the control of armyworm is the critical use pattern and requires an application rate of 450 g ai/ha chlorpyrifos. However, the control of spur-throated locust using 750 g ai/ha is still a registered use and could be required when locusts are swarming. Therefore, the data **support** an MRL of 1 mg/kg and a withholding period of 7 days.

Public responses: No responses were received concerning the use of chlorpyrifos in sorghum.

Rice: There were no specific data received for rice. However, the 2000 JMPR[9] considered some contemporary Australian data, as well as some from Columbia, Vietnam, the Philippines, and Thailand. The relevant data recorded in the JMPR 2000 Evaluation are shown below:

Table 89. Residues of chlorpyrifos in rice from supervised trials in Australia and Colombia.

Country, year	Application			PHI, days	Residues, mg/kg [1]	Reference
	Form.	kg ai/ha	No.			
GAP-Australia	500 EC	0.75		10		
Australia, 1998						
Rice grain	500 EC	0.45	1	10	0.17	GHF-P 1790
					0.13	
Rice straw, dry weight	500 EC	0.45	1	10	1.26	
					1.25	
GAP-Columbia	480 EC	0.8		15		
Colombia, 1998						
Rice grain	480EC	0.96+0.72+ 0.38	3	20	0.09, 0.09, 0.19	GHB-P 406

40 Pesticide Residues in Food – 2000. Evaluations 2000 Part I – Residues. FAO Plant Production and Protection Paper. No 165.

Table 90. Residues of chlorpyrifos in rice from supervised trials in the Philippines, Vietnam and Thailand.

Country, year	Application			PHI, days	Residues, mg/kg [1]	Reference/ Comments
	Form.	kg ai/ha	No.			
GAP- Philippines	300 EC	0.30	3	7		160-192 l water/ha
Philippines, 1998						
Rice grain	300 EC	0.30	3	25	0.02	GHF-P 1791
					0.06	
Rice straw, dry weight	300 EC	0.30	3	25	0.19	
					0.45	
GAP-Vietnam- NONE						
Vietnam, 1998						
Rice grain	300 EC	0.42	1	10	0.15	GHF-P 1792
					0.28	
Rice straw, dry weight	300 EC	0.42	1	10	1.83	
					2.33	
GAP-Thailand	200 EC	0.4		7		
Thailand, 1998						
Rice grain	400 EC	0.4	1	44	<0.01, <0.01	GHF-P 1793
				62	<0.01, <0.01	

The Australian and Vietnamese data were generated at the rate used for control of armyworm, but did not address the higher rate required for spur-throated locust control.

The data indicate that residues do occur in rice and that an MRL in excess of 0.4 mg/kg could be required, associated with a WHP of 10 days. The JMPR recommended the withdrawal of the rice MRL in 2000, because of inadequate data. However, the JMPR further considered chlorpyrifos in 2004 and recommended an MRL of 0.5 mg/kg, with an STMR of 0.12 mg/kg and a maximum residue of 0.28 mg/kg.

Summary for cereal grains, sorghum and rice: The full data set for cereal grains, sorghum and rice **support** the ongoing use of chlorpyrifos in these crops, and further support the establishment of the following MRLs and WHPs (respectively):

- cereal grains [except sorghum and rice] at 2 mg/kg with a 14 day harvest WHP;
- sorghum at 1 mg/kg with a 7 day harvesting WHP; and
- rice at 0.5 mg/kg with a 10 day harvesting WHP.

An MRL of 5 mg/kg in wheat bran would also be required. The data do **not** support the use of chlorpyrifos at 750 g-ai/ha for spur-throated locust in rice.

Public Responses: The rice industry has indicated that they require the ongoing use of chlorpyrifos for armyworm and bloodworm control only. The above data would support these uses. No response was received from the cereal grain industry.

Legume animal feeds and pasture grasses

Data were submitted for legume and pasture crops following application of chlorpyrifos at 675 g ai/ha. Maximum residues in the forage were 136 mg/kg at 7 days, 81 mg/kg at 14 days, and 19.5 mg/kg at 28 days. An MRL of 25 mg/kg is proposed for legume animal feeds and grass fodder/forage.

Oilseed Crops

Thirteen studies were submitted, including data from 9 Australian trials. They included peanut, linseed, safflower and soybean. Some data from soybean oil were also included, but no oil data from other commodities. Cottonseed is not included here as it has an MRL of 0.05 mg/kg which was assessed in the 2000 Interim Review Report.

Chlorpyrifos is currently registered for the control of cutworms, wingless grasshopper, mites, false wireworm and wireworm in oilseeds. Use for cutworm, wireworm and mite control usually occurs in the seedling stage, and so use of chlorpyrifos at this stage should leave no residues at harvest.

Therefore, wingless grasshopper (250 g ai/ha) control is the critical use pattern for possible residues, and it will determine the appropriate MRL and WHP.

Linseed and safflower: Treatment of linseed and safflower plants occurred at an early stage (4-10 leaf), about 4 months before harvest. Therefore, the data do **not** support late-crop applications of chlorpyrifos for control of pests such as wingless grasshopper. No residues of chlorpyrifos were found in safflower and linseed grain when treated at 450 g ai/ha. Lower residues (0.07 mg/kg) were found in linseed at an application rate of 675 g ai/ha, 123 - 126 days after application. An MRL of 0.05 mg/kg is **supported** for these early treatments and a withholding period would not be required. No information was available about the oil from these crops.

Canola: A residue of 0.06 mg/kg was found in canola grain on the day of treatment at 250 g ai/ha, but there were no quantifiable residues present in the grain from 3 days after application. Data from only one trial were submitted and included no oil data. NRS monitoring data over a period of 6 years (see Table 2) demonstrated that no residues of chlorpyrifos were found in canola grain from 1570 samples. However, it is not known what proportion of samples arise from treated canola.

The use on canola should be removed, for pests other than mites, as it is **not** supported, because the data comes from a single trial only.

For the sole use that is **supported** (mites), an MRL of *0.01 mg/kg with a WHP of 0 days are appropriate.

Soybeans: Although soybeans are included in the Codex group VP-pulses, data from soybeans are supportive for other oilseeds. Residues in soybeans from one of the four Australian trials were much higher than expected, especially as chlorpyrifos is not systemic. Residues were around 2 mg/kg at 8 days after application and then declined to only 0.59 mg/kg at 28 days. These soybeans were planted late summer and harvested in winter, which is out of season. At the final application of insecticide, the pods were partially open and this would explain the presence of residues in the seed. These data are not considered further in this evaluation.

Contrary to these data, data from Italian and Brazilian trials showed a maximum residue of 0.04 mg/kg for all bean samples up to 32 days after last application. Residues in soybean oil were 0.07 mg/kg at 30 days after application at 740 g ai/ha, but this residue included the pyridinol metabolite. Comparing data to an application rate of 250 g ai/ha, the data would **support** an MRL of 0.05 mg/kg in soybeans, with a withholding period of 28 days.

Peanuts: Residues of 0.03 mg/kg were found in peanut kernels over the period 14–49 days after their final treatment, from an application rate of 1,121 g ai/ha. This is 4.5 times the Australian rate. However, previously the crops had been treated with a granular formulation, which is outside GAP in Australia. Therefore, a maximum residue of less than 0.01 mg/kg would be expected in peanuts at 14 days or longer following treatment for wingless grasshoppers. Consequently, an MRL of *0.01 mg/kg and a WHP of 14 days is **supported**. There were no processing data submitted for peanut oil, which is used widely in the commercial cooking industry.

Processing data: No processing data for linseed, safflower, peanut or canola were submitted for consideration. However, in 2000 the JMPR examined some data[41] and determined processing factors in oil seed crops, when extracting crude oil from the seed. Information was available for soybeans, cottonseed, peanuts and sunflowers. The processing factors for these commodities were 0.5, 1.4, 2.3 and 0.7 respectively. However, as residues do not occur in linseed, safflower, canola and peanuts, MRLs are not required in the crude oil. As the processing factor for soybeans to soybean oil is 0.5, no separate MRL for soybean oil, crude is required. An MRL for cottonseed oil already exists, and therefore does not require further discussion.

Summary: The use of chlorpyrifos in linseed and safflower is **supported** for control of mites, but **not supported** for control of cutworms or wingless grasshoppers. Use in canola is **supported** for control of mites only, as is use in soybeans for wingless grasshopper, false wireworms and cutworms. There is also **support** for the use of chlorpyrifos in peanuts for cutworms and wingless grasshoppers.

41 Their report is titled Pesticide Residues in Food – 2000

Public Responses: There were no public responses to consider.

Pulse grains

Data for pulse grains were submitted, the crops being treated up to the 3–4 leaf stage, 80–136 days prior to harvest. Residues in the grains varied from <0.05 to 0.08 mg/kg, with the median value being <0.05 mg/kg. The only treatment that a WHP of this length would **support** is for mites, which is applied around planting at 150 g ai/ha. This would require an MRL of 0.1 mg/kg in the grain, and a withholding period of "Not required when used as directed".

Treatments after the 3–4 leaf stage of the crops could **not** be supported, as data were not available for grain. Use of chlorpyrifos after the 3–4 leaf stage could only be considered if the crop was grown for forage only. However, this is feasible only if there was a way to control usage, such that grain crops were **only** treated at planting (whereas forage crops could be treated at any stage up to the grazing/stockfeed withholding period). From a control-of-use perspective this is not possible.

Therefore the use on pulse crops at a stage of development later than the 3–4 leaf stage is **not** supported.

Sugarcane

The original review supported the on-going use of granular and other formulation types that were applied to the soil. There were no data available which addressed the application of chlorpyrifos to the foliage of sugarcane at later stages of growth.

The label use of non-granular formulations of chlorpyrifos on sugarcane continues to include the crop at any stage of development. These formulations are used for control of armyworm and locusts, at a rate of up to 750 g ai/ha, applied directly to or over the crop.

Data were available which demonstrated that residues in sugarcane leaves and stalks were below the quantifiable limit at 185 days after treatment. Trash ranged from 0.03 –0.44 mg/kg at 185 days and trash ranged from 1.82–2.73 mg/kg at 14 days. No leaves (cane tops) and stalk data were available for a 14-day WHP. No data were available for sugar or sugar products or for sugarcane stalks at 14 days after application.

On the basis of these data, use of chlorpyrifos on sugarcane for the control of armyworm and locusts, where direct application to the plant can occur, is **supported** for 3 months following planting or ratooning only. The appropriate MRL would be *0.01 mg/kg for sugarcane and there would be no need for a WHP, if this timing of application is specified on the label and the product used as directed.

Treatment of later stages of crop growth using non-granular formulations is **not** supported, as there are no relevant data available to determine an appropriate MRL or WHP.

Control of spur-throated locust or armyworms can be required as late as 3-4 months before harvest[42], and data for this use pattern were not available. Soil-based treatments continue to be **supported** for applications of spray or granule directly to the soil, for control of symphylids, wireworm and black beetle.

It is recognised that for the control of spur-throated locusts, only chlorpyrifos and diazinon are registered for use on sugarcane. Removal of chlorpyrifos would weaken the industry's ability to control spur-throated locusts and also armyworm, when problems arose. However, if data were produced from a chlorpyrifos application in March at the rate used for spur-throated locust, and sugar cane analysed at a July harvest, it would be possible for the use to be considered. This would require an extension-of-use application, following completion of this review.

Public Responses: The data considered was from a submission from the Bureau of Sugar Experimental Stations (BSES). No other responses were received.

42 K Chandler, BSES – personal communication

Residues in animal feeds

Data were submitted for cereal, oilseed and pulse grains, forages and straws, and pasture. Previously data were available for citrus pulp, apple pomace and sugarcane tops.

At the maximum treatment rates for each commodity, the following residues occurred at 7, 14 and 28 days, as shown in Table 13 below:

Table 13: Chlorpyrifos residues in animal feeds following application of chlorpyrifos to the crop

Crop Group	Commodity	Rate (g ai/ha)	Chlorpyrifos residues (mg/kg) [Median (Range)] 7 days	14 days	28 days	100+ days
Cereal	Forage	675	26 (17-52)	5.2 (1.4-15)	0.66 (0.1-1.0)	-
	Straw		2.65 (1.2-4.1)	1.7 (0.06-5.5)	0.85 (<0.05-1.5)	0.30, <0.02
	Grain		0.18 (0.05-1.2)	0.10 (<0.01-0.47)	0.10 (0.03-0.48)	<0.05 (<0.01-0.11)
Sorghum	Forage	750	1.79, 0.94	<0.67, 0.94	-	-
	Straw		3.1, 14, 8.1	1.8, 11, 1.9	4.2, 7.5, 0.98	-
	Grain		0.66, 0.41, 0.49	0.54, 0.43, 0.30	0.29, 0.39, 0.18	-
Oilseed	Forage	675	29 (15-126)	5.7 (<0.51-26)	0.55 (<0.05-2.2)	-
	Straw					0.85 (<0.05-1.1)
	Grain					<0.03 (<0.01-0.07)
Pulses	Forage	150	3.8 (1.5-11)	1.4 (0.72-8.2)	0.29 (0.08-2.2)	
	Straw	450, 675				0.41, 0.25, <0.07
	Grain	450				<0.05 (<0.05-0.08)
Lucerne	Forage	675	6.2 (1.0-69)	1.7 (<0.2-36)	0.25 (<0.04-10)	
Clovers	Forage	675	65 (19-136)	29 (2.9-81)	13.5 (0.24-19.5)	
Ryegrass	Forage	675	29	5.6	0.42	
	Straw	675	1.2, 7.6	1.1, 1.4, 2.2	1.9, 1.0	
Vetch	Forage	675	15, 37	10	2.1	
	Straw	675				0.17
	Grain	675				0.03
Grass pasture	Forage	675	42	5.5		
Citrus	Pulp	50 g ai/100L		1.6, 0.66, 1.6, 2.3		0.08, 0.43
Apple	Pomace	50 g ai/100L	0 days: 9.4, 9.0, 8.2, 8.0	(estimate only) 0.6		
Sugarcane	Trash	750		2.7, 1.8, 2.0		

Hence MRLs and WHPs are recommended as shown in Table 14.

Table 14: Proposed MRLs and WHPs for animal feeds following application of chlorpyrifos

Crop Group	Commodity description	Codex Number	Rate (g ai/ha)	MRL (mg/kg)	WHP (days)
Cereal	Cereal Forage	-	675	20	14(G*)
	Straw and fodder (dry) of cereal grains	AS 0081	675	10	14(H)
	Cereal grain [except rice and sorghum]	GC 0080	675	2	14(H)
Sorghum	Sorghum forage (green)	AF 0651	750	2	7(G)
	Sorghum straw and fodder, dry	AS 0651	750	20	7(H)
	Sorghum	GC 0651	750	1	7(H)
Oilseed	Forage		675	30	14(G)
	Straw		675	20	14(H)
	Grain		675	See individual grains	
Pulses	Pulse forages		150	5	28(G)**
	Pulse straw		150	0.5	**
	Pulse grains	VD 0070	150	0.1	Not required
Lucerne, clovers, vetch	Legume animal feeds	AL 0157	675	25	28(G)(H)
Grass pastures	Grass forage		675	25	14(G)
	Hay and fodder (dry) of grasses	AS 0162	675	25	14(H)
Citrus	Citrus pulp, dry	AB 0001	50 g ai/100L	5†	14(H)
Apple	Apple pomace, dry	AB 0226	50 g ai/100L	10‡	14(H)
Sugarcane	Sugarcane fodder	AM 0659	750	4	14(H)

Notes:
* G = grazing and also cutting-for-stockfeed
** later use in crop not supported. Use at planting for mites does not require a harvest WHP.
† MRL based on citrus fruit MRL x 3.0, the processing factor determined by JMPR, and the result rounded up.
‡ MRL based on pome fruit MRL x 6.6, the processing factor determined by JMPR, and the result rounded up.

Using the above data, the exposure levels for different livestock can be calculated. The results are shown in Table 15 below.

Table 15: Determination of maximum feeding levels and daily dietary intakes of livestock feeds containing chlorpyrifos

	Cattle	Sheep	Pig	Chicken
Maximum anticipated dietary exposure (**mg/animal/day**)	600	75	6	0.315
equivalent to **mg/kg bw**	1.2	1.25	0.1	0.1575
equivalent to **ppm** in the diet	30	30	2.4	2.1
Maximum Feeding Level (**MFL**) (Based on the available animal feeding data) (**ppm in the diet**)	30	30	10	10
Equivalent acceptable Daily Dietary Intake for Livestock (**DDIL**) (**mg/kg bw**)	1.2	1.25	0.4167	0.75

Animal transfer studies and required animal commodity MRLs

No new studies were submitted, as livestock transfer studies were considered previously in the *NRA Review of Chlorpyrifos (2000)* and also by the JMPR in 2000. There were data for cattle, dairy cows, pigs, and poultry.

Cattle – meat fat and milk: Cattle dosed at the equivalent of 100 ppm of chlorpyrifos in the feed for 30 days had the highest residues in the fat, with maximum residues being:

- 0.03 mg/kg at 3 ppm in the feed;
- 0.14 mg/kg for a feeding level of 10 ppm;
- 0.99 mg/kg at 30 ppm; and
- 4.2 mg/kg at 100 ppm.

Residues of chlopryrifos were determined in whole milk and cream, following feeding at 0.3, 1, 3, 10 or 30 ppm for 14 days. Residues in whole milk were a maximum of 0.02 mg/kg following feeding at 30 ppm. Residues in cream were 0.15 mg/kg (45% butterfat content), therefore residues in milk fat would be 0.33 mg/kg.

After 1 days removal from dosing, residues in whole milk were 0.01 mg/kg. On the basis of the dairy animal study, MRLs of 0.02 mg/kg and 0.5 mg/kg are recommended for whole milk and milk fat respectively.

Pigs and poultry – fat and eggs: For 28 days, pigs and poultry were both fed diets containing up to 10 ppm of chlorpyrifos. Again fat was the tissue with highest residues of chlorpyrifos, with 0.18 mg/kg occurring in pig fat, and 0.05 mg/kg occurring in poultry fat.

Following withdrawal from treated feed (depuration), residues in pig fat declined to 0.03 mg/kg after 7 days depuration and <0.01 after 21 days. For poultry fat, residues declined to <0.01 mg/kg after 7 days depuration. Egg residues did not exceed 0.01 mg/kg during feeding.

Animal meat and offal: Cattle kidney and liver samples contained a maximum residue of 0.01 mg/kg at 30 ppm in the feed. Cattle muscle samples had a maximum residue of 0.02 mg/kg chlorpyrifos. Pig liver and kidney contained no more than 0.01 mg/kg chlorpyrifos, whilst muscle samples contained a maximum residue of 0.03 mg/kg, following feeding at 10 ppm. There were no quantifiable residues in muscle and offal of poultry when fed at 10 ppm.

Currently the temporary MRLs in animal commodities are 0.1 mg/kg in mammalian edible offal, *0.01 mg/kg in eggs, 0.5 mg/kg in mammalian fat, 0.2 mg/kg in milk fat, 0.1 mg/kg in poultry fat and poultry offal. Consequently it is recommended that:

- the MRLs for eggs and poultry fat remain appropriate;
- the MRL for poultry offal should be reduced to *0.01 mg/kg; and
- the MRL for mammalian fat should be set at 2 mg/kg.

The data support an MRL in:

- mammalian edible offal of 0.02 mg/kg;
- whole milk of 0.02 mg/kg; and
- milk fat of 0.5 mg/kg.

DIETARY RISK ASSESSMENT

As stated previously, the following health standards have been established by the Office of Chemical Safety and Environmental Health (OCSEH) and were confirmed in 2006.

Compound	Dietary Standard, mg/kg bw		No Observable Effect Level (NOEL), mg/kg bw	Safety Factor	Reference
Chlorpyrifos	ADI[43]	0.003	0.03 (H)	10	17/12/1998
	ARfD[44]	0.1	1	10	5/12/2000

Chronic dietary exposure assessment

The chronic dietary exposure to chlorpyrifos is estimated by the National Estimated Daily Intake (NEDI) calculation. This calculation encompasses all registered/temporary uses of the chemical, and the mean daily dietary consumption data derived from the 1995 National Nutrition Survey of Australia.

The NEDI calculation is made in accordance with WHO Guidelines[45] and is a conservative estimate of a life-long dietary exposure to chemical residues in food. The NEDI for chlorpyrifos is equivalent to 54.7% of the ADI and therefore is considered acceptable.

Acute dietary exposure assessment

The acute dietary exposure is estimated by the National Estimated Short Term Intake (NESTI) calculation. The NESTI calculations are made in accordance with the deterministic method used by the JMPR[5], with 97.5th percentile food consumption data derived from the 1995 National Nutrition Survey of Australia. NESTI calculations are conservative estimates of acute exposure over a 24-hour period to chemical residues in food.

The NESTIs for all relevant commodities have been calculated. The maximum value was 54.8% of the ARfD for silver beet in the 2 years plus age group (41% for the 2-6 years group). There are no acute dietary intake concerns for chlorpyrifos residues in foods amongst high consumers.

RESIDUE RELATED ASPECTS OF TRADE

Commodities exported

Commodities which are included in Appendix 1 of *Part 5B: Overseas trade aspects of residues in food commodities*, found in Volume 3 of the *Manual of Requirements and Guidelines (Edition 2)* are listed below in Table 16:

Destination and Value of Exports

The major export markets for Australian citrus fruit, grapes and wine, stone fruit and sugar by value are shown below in Table 16 (from the *Australian Commodity Statistics 2004-8*, and *The Australian Horticulture Statistics Handbook 2004* and industry related websites). Total value of exports in 2005 was ~$17b p.a.

Table 16: Major Export Markets for Chlorpyrifos treated/affected commodities, 2004–2008

Commodity	Major Destinations 2004–2008	Total Value $ million p.a
Citrus fruit	USA, Hong Kong, Malaysia, Japan, Singapore, Indonesia	202
Grapes	Hong Kong, Singapore, Malaysia, Indonesia	95
Wine	UK, USA, Canada	2,552
Pome fruit	UK, Malaysia, India, Singapore, Sri Lanka, Taiwan, Indonesia, NZ, Canada	63
Stone fruit	Hong Kong, Taiwan, Singapore, United Arab Emirates	69
Sugar	Malaysia, Korea, Japan, Canada, Saudi Arabia	3,801

43 http://www.tga.gov.au/docs/pdf/adi.pdf
44 http://www.tga.gov.au/docs/pdf/arfd.pdf
45 Guidelines for predicting dietary intake of pesticide residues, WHO, 1997

Commodity	Major Destinations 2004–2008	Total Value $ million p.a
Cereals	Egypt, Indonesia, Japan, Korea, Iraq	3,657
Oilseeds	Japan, Pakistan, Bangladesh	540
Pulses	Unknown	421
Oaten hay[46]	Japan	232
Cattle	USA, Japan, Korea	3,840
Sheep	Saudi Arabia, Taipei, Japan	1,300
Pigs	Singapore, Japan, New Zealand	87
Poultry	Unknown	27
Goats	USA, Taiwan, Caribbean, Canada	55

Overseas registration and approved label instructions

Chlorpyrifos is registered overseas in many countries, with similar use patterns to those of Australia.

Comparison of Australian MRLs with Codex and overseas MRLs

The Codex Alimentarius Commission (Codex) is responsible for establishing Codex Maximum Residue Limits (CXLs) for pesticides. Codex CXLs are primarily intended to facilitate international trade, and accommodate differences in Good Agricultural Practice (GAP) employed by various countries.

Some countries may accept Codex CXLs when importing foods. Chlorpyrifos was reconsidered by Codex, in 2005 and any CXL changes are reflected in the table below. Tables 17 and 18 compare the proposed Australian MRLs with the MRLs (CXLs, tolerances) of Codex, Japan, USA, Korea, the EU, Taiwan and other significant Australian export markets. Note that any export destination with MRL/import-tolerance values that are less than the proposed Australian MRL are highlighted in ***bold, italic red***. However, not all 14 commodities are sent to all export destinations. Hence only a few export destinations are relevant to each export commodity, as presented in the far right-hand column. The **specific** Australian export destinations that may have some risk for each commodity, because the destination's MRLs are lower than the proposed Australian MRLs, are also highlighted in ***bold, italic red***.

Table 17: Comparison of proposed and current Australian MRLs/tolerances for chlorpyrifos with international standards, for plant commodities, as at 14 July 2009

PLANT COMMODITIES

Commodity	MRL/tolerance							Major Aust export market 2004 - 2008
	New MRL Aust.	Codex Mar-09	Japan May-06	USA Jul-09	Korea Nov-08	EU Sept-08	Taiwan July-07	
Citrus fruit	1	1	1	1	***0.3 . orange, lemon***	***0.3 except 0.2 lemons*** 2 mandarins	2	HK, Malaysia, ***Singapore*****. USA, Japan, Indonesia
Grapes	1	***0.5***	1	***0.01***	1.0	***0.5***	***0.5***	**Fresh:** HK, Singapore**, Malaysia, Indonesia **Wine:** ***UK, USA***, Canada

46 1.66m tonnes was exported. There are few specific figures on value of export oaten hay, but an average value is considered to be ~$140/t. Given this, the export would be worth $232 m on average

Commodity	MRL/tolerance							Major Aust export market 2004 - 2008
	New MRL Aust.	Codex Mar-09	Japan May-06	USA Jul-09	Korea Nov-08	EU Sept-08	Taiwan July-07	
Pome fruit	1	1	1 apple ***0.5 pear***	***0.01 apple 0.05 pear***	1 apple ***0.5 pear***	***0.5***	1	***UK, EU,*** Japan, Taiwan, Malaysia, India, Singapore**, Sri Lanka, Indonesia, NZ, Canada ***(only pears to Japan a potential problem)***
Stone fruit	1 EXCEPT peach 0.05 peach only	***0.5*** peach, ***plum only***	1 peach, nectarine plum cherry ***0.05 apricot***	1 cherry ***0.05 plum*** peach ***nectarine***	1 plum apricot ***0.05*** peach, ***cherry***	***0.05-0.3***	-	Taiwan, HK, Singapore**, UAE, Japan ***(only apricots to Japan a potential problem)***
Sugarcane	*0.01	-	0.1	-		*0.05	-	Korea, Malaysia, Japan, Indonesia, Taiwan, Canada, Saudi Arabia
Cereal grain	2	-	-	-	-	-	-	
Barley		-	**0.2**	-	***0.1***	***0.2***	***0.5***	**Malt:** China, ***Japan*** **Feed:** Saudi Arabia, **Japan**
Rice	0.5	0.5	***0.1***	-	***0.1***	****0.05***	***0.1***	Middle East, ***Japan***, HK
Sorghum	1	***0.5***	***0.75***	***0.5***	***0.1***	****0.05***	***0.5***	***Japan***
Wheat		***0.5***	***0.5***	***0.5***	***0.1***	****0.05***	***0.5***	Indonesia, ***Korea, Japan,*** Egypt, Iraq
Oilseeds		-	-	-	-	-	-	
Linseed	0.05	-	0.1	-	-	*0.05	0.5	(Negligible exports)
Rape [canola]	*0.01	-	0.1	-	-	*0.05	0.5	Japan (seed), NZ (oil), Korea (meal)
Peanut	*0.01	-	0.2	0.2	0.5	*0.05	0.1	(Negligible exports)
Safflower	0.05	-	0.1	-	-	*0.05	0.5	Southern & eastern Asia (exports very low in vol)

Commodity	MRL/tolerance							Major Aust export market 2004 - 2008
	New MRL Aust.	Codex Mar-09	Japan May-06	USA Jul-09	Korea Nov-08	EU Sept-08	Taiwan July-07	
Soybean	0.05	0.1	0.3	0.3	0.3	*0.05	0.5	Asia (exports very low in vol)
Pulses	0.1	-	***0.05***	***0.05***$^{+}$	-	****0.05***	0.5	**Lupins:** ROK, ***EU, Japan***, Egypt **Field (dried) peas:** India, Bangladesh, Korea, Taiwan **Chickpeas:** India, Bangladesh **Lentils:** India, Middle East **Faba beans:** Egypt
Oaten hay	20	-	***13***	-	-	-	-	***Japan,*** Taiwan, Korea

** : For **Singapore,** there are few chlorpyrifos MRLs (2006) that relate to Australian plant commodity exports. The ones of relevance are: ***Citrus fruit 0.3*** mg/kg; grapes 1 mg/kg; apples 1 mg/kg; ***rice 0.1*** mg/kg and oilseeds 0.05 mg/kg.

NOTE:

Any potential export destination with MRL/import-tolerance values that are less than the proposed Australian MRL are highlighted in ***bold, italic red***..

The **specific** Australian export destinations that may have some risk for each commodity, because the destination's MRLs are lower than the proposed Australian MRLs, are also highlighted in ***bold, italic red***.

HK = Hong Kong
UAE = United Arab Emirates
ROK = Republic of Korea (South Korea)

Table 18: Comparison of proposed and current Australian MRLs/tolerances for chlorpyrifos with international standards, for animal commodities, as at 14 July 2009

ANIMAL COMMODITIES

Commodity	MRL/tolerance							Major Aust export market 2004 - 2008
	New MRL Aust.	Codex Mar-09	Japan May-06	USA Jul-09	Korea Nov-08	EU Sept-08	Taiwan July-07	
Mammalian fat (or mammalian meat, in the fat)	2	-	-	-	-	-	-	
Cattle, fat		***1***	***1***	***0.3***	***1***	***0.01(#)***	2	***Japan***, ***USA***, ***Korea, EU,*** Russia^, Taiwan,
Goat, fat		-	***1***	***0.2***	-	***0.01(#)***	-	***USA***, Taiwan, Caribbean, Canada

Commodity	MRL/tolerance							Major Aust export market 2004 - 2008
	New MRL Aust.	Codex Mar-09	Japan May-06	USA Jul-09	Korea Nov-08	EU Sept-08	Taiwan July-07	
Pig, fat		***0.02***	***0.02***	***0.2***	***0.02***	***0.01(#)***		***Singapore*****, ***Japan***
Sheep, fat		***1***	***1***	***0.2***	***1***	***0.01(#)***	***0.2***	***USA, EU, Japan, UAE$, Saudi Arabia$***, China^,Russia^
Edible offal, mammalian	0.02	-	-	-	-	-	-	
Cattle, mbp%		***0.01***	0.4	0.05	***0.01 (kidney, liver)***	***0.01(#)***	-	Japan, USA, ***Korea, EU*** Russia^,Taiwan
Goat, mbp		-	***0.01***	0.05	-	***0.01(#)***	-	USA, Taiwan, Caribbean, Canada
Pig, mbp		****0.01***	***0.01***	0.05	-	***0.01(#)***	-	Singapore**, ***Japan,***
Sheep, mbp		***0.01***	***0.01***	0.05	***0.01***	***0.0(#)1***	-	USA, ***EU, Japan, Saudi Arabia$, UAE$***, China^,Russia^
Milks (in the fat)	0.02	0.02 (whole milk)	0.02 (whole milk)	***0.01*** (whole milk)	0.02 (whole milk)	****0.01*** (whole milk) [fat soluble]	-	Japan, ***Singapore*****, Malaysia, Indonesia, Saudi Arabia$, China^
Milk fat	0.5	-	-	***0.25***	-	-	***F0.01***	
Poultry fat (or meat in the fat)	0.1	***0.01***	***0.01***	0.1	***0.01***	****0.05***	0.1	South Africa, the Philippines, HK, South Pacific Islands
Edible offal, poultry	*0.01	*0.01	0.01	0.1	0.01	*0.05	-	
Egg	*0.01	*0.01	0.01	0.01	0.01	*0.01	0.05	Singapore**, USA, Philippines

****** : For **Singapore,** there are few chlorpyrifos MRLs (2006) that relate to Australian animal commodity exports. The ones of relevance are: ***Fat of meat (other than poultry) 0.2*** mg/kg [the Singapore regulations are ambiguous, as there is also a 2 mg/kg MRL for "fat of meat": the more conservative value is used here: Note the Codex MRL is 0.02 mg/kg); fat of poultry 0.1 mg/kg; eggs (shell free basis) 0.05 mg/kg and ***milk and milk-products 0.01*** mg/kg

$: The **UAE and Saudi Arabia** are understood to accept CODEX MRLs.

^ : It is understood that chlopryrifos animal commodity MRLs are not established in **China** and **Russia**.

NOTE:

Any potential export destination that may have some risk for each commodity, because the destination's MRLs are lower than the proposed Australian MRLs, are highlighted in ***bold, italic red***.

The **specific** Australian export destinations that may have some risk for each commodity, because the destination's MRLs are lower than the proposed Australian MRLs, are also highlighted in ***bold, italic red***.

Export markets listed for Milks/Milk-fat are for dairy products in general (e.g. butter, cheeses, skim milk etc), not just milk.

 # : EU animal commodity MRLs are set at a default level of 0.01 mg/kg, as there are no current MRLS set for them.

%: mbp = meat by-products

HK = Hong Kong

UAE = United Arab Emirates

Potential risks to trade from chlorpyrifos-treated export commodities

Export of treated produce containing finite (measurable) residues of chlorpyrifos may pose a risk to Australian trade in situations where:

- no residue tolerance (import tolerance) is established in the importing country or
- where residues in Australian produce are likely to exceed a residue tolerance (import tolerance) established in the importing country.

Although there has been no change in the use pattern of chlorpyrifos on crops, the review of the Australian MRLs demonstrates that there is possible undue prejudice to trade across a wide range of trading partners. This applies especially to the USA, EU, South-East Asia and the Middle East.

Citrus: Trade in citrus fruit in this region should not cause undue prejudice, as MRLs either match the Australian proposal, or the importer may default to Codex standards, which has the same standards as Australia. Singapore is the only export citrus market with an MRL lower than the prosed Australian MRL.

Grapes and pome fruits: There could be some potential for undue prejudice for export of grapes and pome fruit to European markets. NRS monitoring data for apples and pears over the period 1999-2004 indicated that, of 1,538 samples tested, 181 had residues and 2 samples exceeded the then current MRL of 0.5 mg/kg. These violations of the MRL occurred in 1999-2000 and none have occurred since then. Furthermore, of the trial data listed in the *Report Summaries* of this Evaluation, only one sample in 39 exceeded 1 mg/kg, with the other 38 having a median value of 0.21 mg/kg.

As the use pattern has not changed, the magnitude of residues should not change. Hence the risk to the industry of a higher MRL is no more than when the MRL was the same as Australia's trading partners. However, it is recognised that an increase in the standard could alert trading partners to increase their surveillance of imported Australian pome fruit.

Data quoted elsewhere regarding the monitoring of grapes for winemaking demonstrate compliance with the MRL of our overseas markets of 0.5 mg/kg. The Australian Wine Research Institute has in place extra management practices, including longer periods between treatment and harvest to minimise residues in the grapes. This information is publically available through its website at <http://www.awri.com.au/agrochemicals/agrochemical_booklet/booklet.pdf>. This publication could well address the apparent risk for Australian wines to the UK and US, as presented in Table 17.

Sugar: Trade in sugar should not cause any undue prejudice, as sugar is unlikely to contain any residues after extraction from the crop.

Other commodities: The other commodities where possible undue prejudice could occur are cereal grains, pulses, and cattle, goat, pig and sheep meats.

Wheat, sorghum and rice: There are no Codex MRLs for barley and oats, only for wheat, sorghum and rice.

The data available for wheat indicate that residues decline below the Codex MRL of 0.5 mg/kg within 14 days of treatment (see Table 12) [14 days is the proposed and recommended WHP for cereals]. Residues in sorghum complied with the Codex MRL of 0.5 mg/kg at 28 days after application (the proposed domestic harvesting WHP is 7 days). Residues of chlorpyrifos in rice comply with the proposed Codex MRL at 10 days (the proposed domestic harvesting WHP).

Monitoring data from the NRS indicate good compliance of tested samples with the former Australian TMRL of 0.1 mg/kg for wheat and rice, and 3 mg/kg for sorghum (*cf.* proposed MRLs are 2 mg/kg for wheat, 1 mg/kg for sorghum and 0.5 mg/kg for rice). Therefore, as industry is already managing residues in export cereals, and appropriate monitoring programs are in place, the risks to trade are being managed.

Barley and oats: Chlorpyrifos residues in barley and oats are still present at 28 days after application, and there is no Codex MRL for either.

However, data available from the NRS monitoring program indicate that chlorpyrifos residues in barley and oats have not exceeded 0.2 mg/kg, in the 6000 samples taken in the 10-year period 1996–2005 inclusive. Further, for all barley samples, >99.8% were free of chlorpyrifos residues, and for all oats samples, >98% were free from chlorpyrifos residues.

The actual use pattern in barley and oats would seem to favour low residues, although this is impacted by the presence and need to control a particular insect pest in any year. However, the monitoring data would indicate that there should not be a problem in traded barley or oats meeting the standard of Australia's trading partners.

Pulses: No MRLs/tolerances for pulses are listed by Australia's trading partners or by Codex, except for Japan, which lists an MRL for "Other legumes" at 0.05 mg/kg.

Data available from the NRS' reports on its web site over the period 1999-2004 show that, of 1,784 samples of pulses analysed for chlorpyrifos residues, none contained residues above the level of reporting (0.1 mg/kg). Again, these monitoring data would indicate that there should not be a problem in traded pulses meeting the standard of Australia's trading partners.

A consideration of export intervals may give some guidance as to management of such possible prejudice, in both crops and animals fed on treated crops.

Management of potential prejudice to trade

Export Intervals (EIs) are important tools in the management of undue prejudice to trade. EIs are advisory (non-statutory) periods, proposed in conjunction with the affected grower/ producer industries and the agricultural/veterinary chemical industry.

EIs will normally be set to ensure that export product meets the lower of either the Codex MRL or the residue standard set by a major trading partner. Some major trading partners have no MRL set, so that a NIL tolerance is applicable. Where this occurs, EIs will be based on the time required for residues to deplete to the limit of quantification (LOQ).

Four different types of EIs have been defined[47] according to the nature of the chemical product and the type of food commodity involved:

1. Export slaughter interval (ESI);
2. Export harvest interval (EHI);
3. Export animal feed interval (EAFI); and
4. Export grazing interval (relating to continuous grazing) (EGI).

Oaten hay: The export of oaten hay would require the establishment of an EHI[48] to ensure that the exported hay meets the standards of the importing country.

No data were submitted for oaten hay, but data were available for forage and straw. It is considered that the forage data would be the equivalent of hay, as the only difference is that the hay has been dried.

Japan is the major export destination for oaten hay, and the Japanese chlorpyrifos standard for pasture grass is 13ppm (13 mg/kg). On the basis of the 13ppm standard, an export harvest interval of 21 days is recommended.

Management of trade risk following plague or spur-throated locust treatments

In certain situations such as spraying to control plague or spur-throated locusts, spraying could occur without animals being removed from the pasture or forage crop, as there is nowhere else to transfer them. In these situations, grazing cattle or sheep would be exposed to much higher residues than exposure followed a grazing withholding period.

Therefore, it is necessary to estimate how long cattle would need to be held back from slaughter, where grazing has continued on the treated crop or pasture from the time of application of chlorpyrifos.

[47] Registering Agricultural Products – Manual of Requirements and Guidelines. APVMA (2005). Part 5B; Overseas trade aspects of residues in food commodities

[48] An EHI is required and not an EAFI, as the commodity exported is the oaten hay, not export animals fed with the oaten hay. EAFIs apply to grazing crops and/or stockfeed that is fed to animals that are destined for export.

If data were modeled for the pastures/forage crops, an estimate could be determined of the time required (Export Grazing Interval [EGI]) until they complied with the most sensitive export market. In this case it is the EU, where the tolerance for chlorpyrifos in mammalian meat fat is 0.01 mg/kg.

Data were available for legume, grass, sorghum, cereal, oilseed and pulse forages.

For ease of management, from information present on any label it was considered that the worst-case scenario should be modeled, and should then be representative of all forages and feeds. Therefore, the data for legume and grass forages were combined, as they were considered to give the highest residues and slowest rate of decline. The average data for legume and grass forages were subject to a graphical representation, and then the average daily intake of chlorpyrifos in the feed was determined on a 7-day basis (as this was accepted as a reasonable period when a plateau in residues should occur).

From the animal transfer data, the resulting residue in cattle fat was estimated, and then the time required for residues to decline to the target value was determined for each 7-day component. For the Day 7 result, the decline time to 0.01 mg/kg was estimated using the half-life determined in cattle fat (5.41 days). The calculation was undertaken for a treatment rate of 675 g ai/ha, almost equivalent to that used for spur-throated locust control.

The result is a proposed EGI of 49 days for grazing animals (e.g. cattle, sheep and goats). Note that export intervals shorter than those proposed here have been in place in the market since 2000, with no export violations reported.

Animal fat and milk: The impact of forage, straw and grain residues on residues in animal fat, were addressed by a number of studies. These studies show that:

- chlorpyrifos residues in cattle fat decline with a half-life of 5.41 days;
- residues in whole milk, following exposure to chlorpyrifos at 30 ppm in the feed, never exceed 0.02 mg/kg in individual cows. Further, they decline to <0.01 mg/kg after 1 day on clean feed;
- chlorpyrifos residues in pig fat declined from a maximum of 0.18 mg/kg at 10 ppm in the feed, to:
  - a max of 0.03 mg/kg at 7 days following withdrawal of contaminated feed; and
  - <0.01 mg/kg at 21 days.
- residues in poultry fat declined from a maximum of 0.05 mg/kg to <0.01 mg/kg, seven days after withdrawal of contaminated feed.

To comply with the target MRL/tolerance of the most sensitive export destination for animal commodities (in this case, the EU's 0.01 mg/kg MRL), it is necessary to set the time required on clean feed (ESIs) for the different animal species.

An ESIs is an estimation of time that would allow the animal production industries to export animal product from animals that had been exposed to chlorpyrifos-contaminated feeds, provided that grazing or lot-fed animals are removed onto or given clean feed for a period equivalent to the ESI. The ESIs that are applicable to each species are: grazing animals (e.g. cattle, sheep and goats) 56 days and pigs 7 days.

However, the magnitude of residues in animal feeds should not change as the use pattern has not changed. There will be required export interval statements on products containing chlorpyrifos that encompass the ongoing use patterns for the commodities used as major feeds. Therefore, the following label statements (or similar) should be added to labels of chlorpyrifos-containing products as part of the strategy to address trade issues of chlorpyrifos residues in commodities:

> **Livestock Destined for Export Markets:** The label withholding periods for grazing only apply to stock slaughtered for the domestic market. Some export markets apply different standards. To meet these standards, ensure that the Export Slaughter Interval (ESI) is observed before stock are sold or slaughtered.

Export Slaughter Intervals (ESIs):

Grazing animals: Grazing animals that have been grazing on or fed treated crops should be placed on clean feed for 56 days prior to slaughter for export.

Pigs: Pigs that have been fed treated crops should be placed on clean feed for 7 days prior to slaughter for export.

CONCLUSIONS

Residues data from some crops were considered in support of the ongoing registration of chlorpyrifos in those crops. All data were submitted by Dow AgroScience.

Residue aspects relating to the Review

From a residues perspective, the following conclusions can be made about application of chlorpyrifos.

Fruit, Vegetable and Nut Crops

Data were included for asparagus, bananas, Brassica vegetables, citrus, grapes, mango, parsley, pineapple, pome and stone fruits, tomato and some vegetables, with other data relating to dried fruits and sugarcane.

Asparagus and celery: use for in controlling cutworms at planting and baiting crickets is supported, with an MRL of *0.01 mg/kg and no withholding period required, but foliar application is not supported

Bananas: uses as: a bell treatment, a soil/butt treatment, a bag dust, and a treated banana bag[49], are all supported, with application timing being up to exposure of fingers in the bell's development, and confirmation of the MRL of 0.5 mg/kg no withholding period required for any of these treatments when used according to the approved use pattern.

Brassica vegetables: use at or prior to planting is supported, with an MRL of *0.01 mg/kg and no WHP required, but foliar applications applied later in the crop production cycle are not supported.

Citrus fruits: uses as a foliar spray and butt and soil treatment are supported, with an MRL of 1 mg/kg, a WHP of 14 days for the foliar application and no withholding period required for the soil and butt treatments.

Grapes: use for the control of: light brown apple moth, mealybug and grapevine moth on grapes is supported, with an MRL of 1 mg/kg and a withholding period of 14 days use for the control of grapevine scale is also supported with no withholding period required for the control of grapevine scale. Industry data indicate compliance with the MRL for dried grape commodities.

Mangoes: foliar application to mangoes is supported for the control of scale, with an MRL of 1 mg/kg and a withholding period of 21 days.

Parsley: use on parsley at or prior to planting is also supported, with an MRL of 0.05 mg/kg, and no WHP is required.

Pineapples: use for the control of: mealybug, ants and white grub in pineapples is supported, with an MRL of 0.5 mg/kg and no WHP required.

Pome fruit: use for the control of San Jose scale, Woolly aphid, Mealybugs, Queensland fruit fly and Wingless grasshopper on pome fruit is supported, with an MRL of 1 mg/kg and a withholding period of 14 days.

Stone fruit: foliar use for the control of scale, earwigs and fruit fly in stone fruits, except peaches, is **supported**, with an MRL of 1 mg/kg and a withholding period of 14 days.

[49] Or an impregnated ribbon

Continued use of cracked grain baits for earwig control is also **supported** in all stone fruits (including peaches[50]). Foliar use in peaches for the control of scale, earwigs and fruit fly is **not** supported.

Industry data indicated compliance of dried fruits with the MRL of 1 mg/kg.

Tomatoes: ongoing use for the patterns prescribed on current labels is **supported** by the data, for processing tomatoes only. An MRL of 1 mg/kg and a WHP of 3 days are recommended.

Vegetables: Carrots, lettuce, onions and sweet potatoes: use for direct application to the crop to control grasshoppers, light brown apple moth (carrots only) and vegetable weevils by direct (foliar) application to carrots, lettuce, onions and sweet potatoes is **not** supported.

Vegetables: Eggplant, peppers, green beans and peas, cucumber, silver beet and lima beans: uses are **supported** with MRLs to be established as described in Table 7 above and withholding periods of: nil for eggplant, 4 days for peppers and 7 days for green beans, green peas, cucumber, spinach and lima beans.

Sugarcane: use on sugarcane for the control of: armyworm and locusts, where direct application to the plant can occur, is supported for 3 months following planting or rationing with an MRL of *0.01 g/kg and no withholding period is required when used this way, but treatment of later stages of crop growth for spur-throated locusts is not supported.

Tree Nuts: continued use on tree nuts was not supported.

Field Crops and Animal Commodities

Residue data from barley, oats, wheat, oilseeds, canola, peanuts, soybeans, sorghum, cereal forages, chickpeas, clovers, faba beans, field peas, grasses, lentils, linseed, lucerne, lupins, safflower, and vetch were considered in support of the ongoing registration of chlorpyrifos in those crops.

All data were again submitted by Dow AgroScience. Data were also considered for the transfer of residues to animals from their feeds. From a residues perspective, the following conclusions can be made.

Cereals: use in cereals for the control of all pests described on current labels, except for *Spur-throated locusts* in rice, is supported, with the establishment of MRLs for: cereals (except rice and sorghum) at 2 mg/kg, rice at 0.5 mg/kg, and sorghum at 1 mg/kg and associated WHPs supported by the data of 14 days in cereals, 10 days in rice, and 7 days in sorghum.

Linseed and safflower: all early-crop or at-planting applications for control of mites in linseed and safflower were supported, with an MRL of *0.01 mg/kg and no WHP required. but later applications to linseed and safflower crops are not supported.

Canola: use of chlorpyrifos in canola is supported for mite control **only**, with an MRL of *0.01 mg/kg and a nil WHP.

Soybeans: Use in soybeans is supported, with an MRL of 0.05 mg/kg and a WHP of 28 days.

Peanuts: use in peanuts is supported with an MRL of *0.01 and a WHP of 14 days

Animal Commodities: data considered in animal transfer studies supported MRLs for animal commodities as follows:

Poultry fat	0.1 mg/kg
Poultry edible offal	*0.01 mg/kg
Eggs	*0.01 mg/kg
Mammalian fat	2 mg/kg
Mammalian edible offal	0.02 mg/kg
Milks	0.02 mg/kg
Milk fat	0.5 mg/kg

[50] For peaches only, the appropriate MRL is 0.05 mg/kg and a nil WHP.

Pastures and other forage/fodder crops: use for the control of pests in pastures and other forage and fodder crops is supported, with various MRLs and WHPs recommended as in Table 14. Crops considered were cereals, sorghum, oilseeds, pulses, pastures, sugarcane, and fruit wastes.

Dietary exposure

The estimated dietary intake of chlorpyrifos arising from residues in food is unlikely to exceed the health standards, with the NEDI being only 54.7% of the ADI.

The estimation of acute exposure for all commodities was acceptable, with all being less than the acute reference dose.

Residue related aspects of trade

Use of the product in accordance with the label instructions has potential to cause undue prejudice to Australian trade in stone fruit (except peaches) to SE-Asian markets, as the proposed MRL is higher than that of Australia's trading partners.

Although there has been no change in the use pattern of chlorpyrifos on crops, the review of the Australian MRLs demonstrated that there is possible undue prejudice to trade across a wide range of trading partners, but especially the USA, South-East Asia and the Middle East. Use of the chemical in accordance with the label instructions is likely to cause undue prejudice to Australian trade in cereal grains, pulses, and cattle, goat, pig and sheep meats.

Export Slaughter Intervals (ESIs) [grazing animals 56 days and pigs 7 days] have been determined for animals grazed on contaminated crops, where appropriate.

An Export Harvest Interval (EHI) of 21 days has also been determined for oaten hay.

An Export Harvest Interval (EHI) was determined as not necessary for wheat, as the domestic WHP is sufficient to manage residues for export markets. EHIs could not be determined for sorghum, rice, barley, oats and pulses. However, residue monitoring data for these crops clearly show the industry already manages this aspect and so EHIs are not necessary.

Export grazing intervals (EGIs) of grazing animals have also been determined for all forage crops, to represent the situation where animals are unable to be removed from treated paddocks during and after treatment for locusts.

As a consequence of the supplementary residues assessment, the following tables summarise changes to use patterns, MRLs and WHPs for fruit and vegetables. For ease of visual reference, note that uses not supported, old MRLs and old WHPs are in ***bold, italic red***. In contrast, uses supported, proposed MRLs and proposed WHPs are in **bolded green**.

Table 19: Summary of Fruit and Vegetable Uses Supported/Not-supported and proposed MRLs and WHPs

Commodity	Uses NOT supported	Uses supported	MRL (mg/kg)		WHP (days)	
			Old	Pro-posed	Old	Pro-posed
Asparagus, celery	***Wingless grasshopper, vegetable weevil***	**Cutworms, baiting of crickets**	***T0.5 (A), T5 (C)***	***0.01**	***14***	**NR**
Bananas	***None***	**Bell treatment, soil/butt treatment, bag dust, and treated banana bag**	***T0.5***	**0.5**	***14***	**NR**

Commodity	Uses NOT supported	Uses supported	MRL (mg/kg)		WHP (days)	
			Old	Pro-posed	Old	Pro-posed
Brassica	*Moths, butterflies, caterpillar, budworm, grasshopper, African black beetle, corn earworm*	Mites, cutworms, crickets (baiting), weevils	*T0.5*	*0.01	*5*	NR
Carrots	*Light brown apple moth, grasshopper, weevil*	Cutworms, crickets	**0.01*	*0.01	*NR*	NR
Chard (Silver beet)	*None*	Red-legged earth mite, grasshoppers, cutworms, crickets and weevil	**0.01*	10	*NR*	7
Citrus fruits	*None*	Scale, grasshoppers, thrips, mealybug and weevils	*T0.5*	1	*14*	14
Cucumber	*None*	White flies, ants, mealybug, cutworm, aphids, Helicoverpa, grasshopper, green vege bug, wireworms, weevils, African black beetle	**0.01*	1	*5*	7
Dried fruits	*As for fresh fruit*	As for fresh fruit	*T2*	1		See fruits
Eggplant	*None*	Cutworm, grasshopper, weevil, crickets	**0.01*	0.2	*NR*	3
Garden peas	*None*	Cutworm, grasshopper, weevil, crickets	**0.01*	1	*NR*	7
Grapes	*None*	Moths, scale, mealybug	*T1*	1	*14*	14
Green beans	*None*	Cutworm, grasshopper, weevil, crickets	**0.01*	1	*NR*	7
Lettuce	*Red-legged earth mite, grasshopper, weevil*	Cutworms, crickets	**0.01*	*0.01	*NR*	NR
Lima beans	*None*	Cutworm, grasshopper, weevil, crickets	**0.01*	1	*3*	7
Mangoes	*None*	Scale	**0.05*	1	*21*	21
Onions	*Grasshopper, weevil*	Cutworms	**0.01*	*0.01	*NR*	NR
Peaches	*Any foliar application.*	Cracked-grain baits for earwig control	*T1*	0.05	*14*	Nil
Peppers	*None*	Cutworm, crickets, grasshopper, weevil,	*T1*	1	*3*	4
Pineapples	*None*	Mealybug, ants, white grubs	*T0.5*	0.5	*14*	Nil

Commodity	Uses NOT supported	Uses supported	MRL (mg/kg)		WHP (days)	
			Old	Pro-posed	Old	Pro-posed
Pome fruits	*None*	Scale, grasshopper, aphid, fruit fly	*T0.5*	1	*14*	14
Stone fruits (except peaches[51])	*None*	Earwigs, scale, fruit fly	*T1*	1	*14*	14
Sweet potato	*Grasshopper, weevil*	Cutworms, crickets	**0.01*	*0.01	*NR*	NR
Tomatoes	*Use on fresh market tomatoes*	Processing tomatoes only: Tomato grubs, budworm, green vegetable bug, aphids, wireworm, black beetle	*T0.5*	1	*3*	3
Vegetables	*Remove crop group*	See individual entries				

Note:
NR – Not Required when used according to label directions.

Furthermore, as a consequence of the above conclusions, the following summarises changes to use patterns, MRLs and WHPs for field crops to which chlorpyrifos is applied.

Table 20: Summary of Field Crop Uses Supported/Not-supported and proposed MRLs and WHPs

Commodity	Uses NOT supported	Uses supported	MRL (mg/kg)		WHP (days)	
			Old	Pro-posed	Old	Pro-posed
Cereals (except rice and sorghum)	*None*	Armyworm, webworm, cutworms, curculio, locusts, mites, fleas, grasshoppers	*T0.1*	2	*10 (H)* *2 (G)*	14(H) 14 (G)
Rice	*Spur-throated locusts*	Armyworm, webworm, cutworms, curculio, locusts, mites, fleas, grasshoppers, bloodworm, planthopper	*T0.1*	0.5	*10 (H)* *2 (G)*	10 (H) 10 (G)
Sorghum	*Spur-throated locusts*	Armyworm, webworm, cutworms, curculio, plague and migratory locusts, mites, fleas, grasshoppers, aphids, midges, wireworm	*T3*	1	*7 (H)* *7 (G)*	7 (H) 7 (G)
Linseed, safflower	*Wingless grasshopper*	Cutworms, mites	*T0.01*	*0.01	*ns (H)* *2 (G)*	NR (H) 14 (G)
Rapeseed [canola]	*Cutworms, wireworm, wingless grasshopper*	Mites	*T0.01*	*0.01	*ns (H)* *2 (G)*	0 (H) 14 (H)
Soybeans	*None*	Cutworms, mites, wireworm, wingless grasshopper, cockroaches, crickets	*T0.01*	0.05	*ns (H)* *2 (G)*	28 (H) 28 (G)
Peanuts	*None*	Cutworms, wingless grasshopper	*T*0.01*	*0.01	*ns (H)* *2 (G)*	14 (H) 14 (G)

[51] For peaches, there is only **one** chlorpyrifos use that is supported: cracked grain baits for earwig control.

Commodity	Uses NOT supported	Uses supported	MRL (mg/kg)		WHP (days)	
			Old	Pro-posed	Old	Pro-posed
Pulses	*Armyworm, locusts, underground grass grub, looper, webworm*	Mites	*None*	0.5 (grain)	*10 (H)* *2 (G)*	NR (H) 28 (G)
Legume animal feed crops (other than pulses)	*None*	Armyworm, locusts, mites, lucerne flea, cutworms, caterpillars, leaf roller, aphids	*None*	25	*10 (H)* *2 (G)*	28 (H) 28 (G)
Grass pastures	*None*	Armyworms, cutworms, locusts, mites, fleas, wingless grasshopper, webworm, cockchafer, grass grubs, loopers	*None*	25	*10 (H)* *2 (G)*	14 (G)
Sugarcane	*Any foliar treatment applied later than 3 months after planting or ratooning*	Armyworm and locusts, for 3 months following planting or ratooning	*T0.1*	*0.01	*7 (H)* *2 (G)*	NR (H) 14 (G)

Note:
NR – Not Required when used according to label directions. **ns** : not specified on label.

Turf/lawn as stockfeed

Historically, there has been a 2-day grazing/cutting-for-stockfeed WHP for treated turf/lawn and a prohibition on feeding clippings to poultry or stock. There is no data to support this WHP, and the maximum application rate for turf/lawn is 3000 g-ai/ha, compared to a maximum of 750 g-ai/ha for grass or legume pasture. Consequently it is recommended that there be a label prohibition on grazing, or cutting for stockfeed, of treated turf/lawn. The prohibition of feeding clippings to poultry/stock would remain.

RECOMMENDATIONS

Residue issues

The APVMA is satisfied, as per Section 34(1)(a)(i) of the AgVet Code Act, that the use of chlorpyrifos, following some changes to the registered use patterns, would not be an undue hazard to the safety of people exposed to its residues in food. Both chronic and acute dietary calculations indicated that exposure of consumers to chlorpyrifos residues in food is acceptable.

In summary, data were presented that **support** the on-going registration of chlorpyrifos for use on:

asparagus (non-foliar applications)
bananas (all treatments up until exposure of fingers in the bell development)
brassica vegetables (at or prior to planting only)
sugarcane (for 3 months following planting)
stone fruits (except peach[52])
tomatoes (processing only)

citrus fruits	cucumber	eggplant	peppers
grapes	green beans	green peas	mango
pome fruit	pineapple		

[52] For peaches, there is only **one** chlorpyrifos use that is supported: cracked grain baits for earwig control. Foliar application on peached is **not** supported.

Data were also submitted that **support** the on-going registration of chlorpyrifos for use on:

barley	canola	cereal forages	chickpeas
clovers	faba beans	field peas	grasses
lentils	lima beans	linseed	lucerne
lupins	oats	oil seeds	peanuts
safflower	sorghum	soybeans	vetch
wheat.			

Because of inadequate or inappropriate data, uses of chlorpyrifos are **not** supported for foliar applications to:

asparagus	celery	carrot	lettuce
onion	sweet potato	peaches	

along with use on:

tree nuts
fresh market tomatoes
late-crop use on sugarcane
late-crop use on pulses.

Also not supported are uses of chlorpyrifos for:

the control of spur-throated locusts in rice
late-crop applications in linseed and safflower crops
late crop applications in canola.

The following recommendations pertain to these changes and will be implemented as part of the finalisation of the chlorpyrifos review:

1. All labels of chlorpyrifos products used on plants will be changed to list only individual vegetable crops for those vegetables for which data support continuing registration, namely eggplant, peppers, green beans and peas, cucumber, silver beet (chard), tomatoes and lima beans for all their current uses.
2. There is ongoing support for uses of chlorpyrifos on carrots, onions, and lettuce either prior to or at planting, but not foliar applications beyond planting time.
3. Foliar applications to asparagus and celery are not supported and should be removed from the label. Treatments at or prior to planting are supported, as is baiting of crickets.
4. Any treatments of bananas after exposure of fingers are not supported and should be removed from the label.
5. The use of chlorpyrifos on sugarcane is supported only for the three months following planting or ratooning; later treatments are not supported and should be removed from the label.
6. Foliar application to peaches are not supported and should be removed from the label. Use of cracked grain bait In peaches is supported.
7. The use of chlorpyrifos on fresh market tomatoes is **not** supported and label statements should be changed accordingly. Use on processing tomatoes only is **supported**.
8. Late-crop applications to canola, linseed and safflower crops are also not supported, and should be removed from the label.
9. The use of chlorpyrifos on cereals, oilseeds (other than canola, linseed and safflower), pastures and legumes is supported, except for spur-throated locust control in rice.
10. Use of chlorpyrifos on pulses at or prior to planting is supported. Use in later stages of the crop is not supported.
11. The withholding period statements on the label of chlorpyrifos products for fruit and vegetable uses should be altered to reflect the following:
    Asparagus – not required when used as directed.
    Celery – not required when used as directed.
    Bananas – not required when used as directed.
    Brassica vegetables – not required when used as directed.
    Carrots - not required when used as directed.
    Citrus fruit – 14 days for foliar treatments.
    Citrus fruit – not required for soil and butt treatments.
    Grapevines – 14 days for foliar applications.
    Grapevines – not required for the control of grapevine scale during the dormant period.

Lettuce - not required when used as directed.
Mangoes – 21 days.
Onions - not required when used as directed.
Peaches nil.
Pome fruit – 14 days for foliar applications.
Pome fruit – not required when used to control Queensland fruit fly as directed.
Plums, apricots, nectarines, cherries – 14 days.
Stone fruit – 14 days for foliar applications.
Stone fruit – not required when used to control Queensland fruit fly, or earwigs with cracked grain baits, according to label directions.
Sweet potato – not required when used as directed
Tomatoes – 3 days.
Eggplant – 3 days.
Peppers – 4 days
Beans, peas, cucumber, silver beet, lima beans – 7 days

12. The statements on the labels of chlorpyrifos products used on field crops should be altered to reflect the following harvest and grazing withholding periods:
Cereals (except rice and sorghum)– 14 days.
Sorghum – 7 days.
Rice – 10 days.
Linseed and safflower – WHP not required when used as directed.
Rapeseed [canola] – nil.
Soybeans – 28 days.
Peanuts – 14 days.
Cereal forage crops – 14 days grazing and harvest.
Sorghum forage crops – 7 days grazing and harvest.
Oilseed forage crops – 14 days grazing and harvest
Legume forage crops (except pulses) – 28 days grazing and harvest.
Pulses – 28 days grazing.
Pastures – 14 days grazing and harvest.
Sugarcane – Not required when used as directed.
13. The *MRL Standard* should be altered as indicated below to reflect the proposed changes to MRLs supported by data.

The following two tables summarise changes to use patterns and WHP for fruit and vegetables and field crops. Again, for ease of visual reference, note that uses, MRLs and WHPs to be deleted are in ***bold, italic red***. In contrast, uses supported, new MRLs and new WHPs are in **bolded green**.

Table 21: Summary of Fruit and Vegetable Uses Supported/Not-supported and proposed MRLs and WHPs

Commodity	Uses NOT supported and recommended for DELETION from label	Uses supported	MRL (mg/kg)		WHP (days)	
			Old DELETE	NEW	Old DELETE	NEW
Asparagus, celery	***Wingless grasshopper, vegetable weevil***	**Cutworms, baiting of crickets**	***T0.5 (A), T5 (C)***	***0.01**	***14***	**NR**
Bananas	***None***	**Bell treatment, soil/butt treatment, bag dust, and treated banana bag**	***T0.5***	**0.5**	***14***	**NR**
Brassica	***Moths, butterflies, caterpillar, budworm, grasshopper, African black beetle, corn earworm***	**Mites, cutworms, crickets (baiting), weevils**	***T0.5***	***0.01**	***5***	**NR**
Carrots	***Light brown apple moth, grasshopper, weevil***	**Cutworms, crickets**	****0.01***	***0.01**	***NR***	**NR**

Commodity	Uses NOT supported and recommended for DELETION from label	Uses supported	MRL (mg/kg)		WHP (days)	
			Old DELETE	NEW	Old DELETE	NEW
Chard (Silver beet)	*None*	Red-legged earth mite, grasshoppers, cutworms, crickets and weevil	*0.01	10	NR	7
Citrus fruits	*None*	Scale, grasshoppers, thrips, mealybug and weevils	T0.5	1	14	14 (foliar) 0 (butt)
Cucumber	*None*	White flies, ants, mealybug, cutworm, aphids, *Helicoverpa,* grasshopper, green vege bug, wireworms, weevils, African black beetle	*0.01	1	5	7
Dried fruits	*As for fresh fruit*	As for fresh fruit	T2	1		See fruits
Eggplant	*None*	Cutworm, grasshopper, weevil, crickets	*0.01	0.2	NR	3
Garden peas	*None*	Cutworm, grasshopper, weevil, crickets	*0.01	1	NR	7
Grapes	*None*	Moths, scale, mealybug	T1	1	14	14 (foliar) 0 (dormant)
Green beans	*None*	Cutworm, grasshopper, weevil, crickets	*0.01	1	NR	7
Lettuce	*Red-legged earth mite, grasshopper, weevil*	Cutworms, crickets	*0.01	*0.01	NR	NR
Lima beans	*None*	Cutworm, crickets, grasshopper, weevil,	*0.01	1	3	7
Mangoes	*None*	Scale	*0.05	1	21	21
Onions	*Grasshopper, weevil*	Cutworms	*0.01	*0.01	NR	NR
Peaches	*Any foliar application.*	Cracked-grain baits for earwig control	T1	0.05	14	Nil
Peppers	*None*	Cutworm, grasshopper, weevil, crickets	T1	1	3	4
Pineapples	*None*	Mealybug, ants, white grubs	T0.5	0.5	14	Nil
Pome fruits	*None*	Scale, grasshopper, aphid, fruit fly	T0.5	1	14	14 (foliar) 0 (Q-fly bait)
Stone fruits (except peaches[53])	*None*	Earwigs, scale, fruit fly	T1	1	14	14 (foliar) 0 (Q-fly & earwig bait)
Sweet potato	*Grasshopper, weevil*	Cutworms, crickets	*0.01	*0.01	NR	NR

[53] For peaches, there is only **one** chlorpyrifos use that is supported: cracked grain baits for earwig control. Foliar application on peached is not supported.

Commodity	Uses NOT supported and recommended for DELETION from label	Uses supported	MRL (mg/kg) Old DELETE	MRL (mg/kg) NEW	WHP (days) Old DELETE	WHP (days) NEW
Tomatoes	*Use fresh market tomatoes*	Processing tomatoes only: Tomato grubs, budworm, green vegetable bug, aphids, wireworm, black beetle	*T0.5*	1	*3*	3
Vegetables	*Remove crop group*	See individual entries				

Note:
NR – Not Required when used according to label directions.

The following summarises changes to use patterns and WHPs for field crops to which chlorpyrifos is applied.

Table 22: Summary of Field Crop Uses Supported/Not-supported and proposed MRLs and WHPs

Commodity	Uses NOT supported and recommended for DELETION from label	Uses supported	MRL (mg/kg) Old DELETE	MRL (mg/kg) NEW	WHP (days) Old DELETE	WHP (days) NEW
Cereals (except rice and sorghum)	*None*	Armyworm, webworm, cutworms, curculio, locusts, mites, fleas, grasshoppers	*T0.1*	2	*10 (H)* *2 (G)*	14(H) 14 (G)
Rice	*Spur-throated locusts*	Armyworm, webworm, cutworms, curculio, locusts, mites, fleas, grasshoppers, bloodworm, planthopper	*T0.1*	0.5	*10 (H)* *2 (G)*	10 (H) 10 (G)
Sorghum	*Spur-throated locusts*	Armyworm, webworm, cutworms, curculio, plague and migratory locusts, mites, fleas, grasshoppers, aphids, midges, wireworm	*T3*	1	*7 (H)* *7 (G)*	7 (H) 7 (G)
Linseed, safflower	*Wingless grasshopper*	Cutworms, mites	*T0.01*	*0.01	*ns (H)* *2 (G)*	NR (H) 14 (G)
Rapeseed [canola]	*Cutworms, wireworm, wingless grasshopper*	Mites	*T0.01*	*0.01	*ns (H)* *2 (G)*	0 (H) 14 (G)
Soybeans	*None*	Cutworms, mites, wireworm, wingless grasshopper, cockroaches, crickets	*T0.01*	0.05	*ns (H)* *2 (G)*	28 (H) 28 (G)
Peanuts	*None*	Cutworms, wingless grasshopper	*T*0.01*	*0.01	*ns (H)* *2 (G)*	14 (H) 14 (G)
Pulses	*Armyworm, locusts, underground grass grub, looper, webworm*	Mites	*None*	0.5 (grain)	*10 (H)* *2 (G)*	NR (H) 28 (G)
Legume animal feed crops (other than pulses)	*None*	Armyworm, locusts, mites, lucerne flea, cutworms, caterpillars, leaf roller, aphids	*None*	25	*10 (H)* *2 (G)*	28 (H) 28 (G)

Commodity	Uses NOT supported and recommended for DELETION from label	Uses supported	MRL (mg/kg)		WHP (days)	
			Old DELETE	NEW	Old DELETE	NEW
Grass pastures	*None*	**Armyworms, cutworms, locusts, mites, fleas, wingless grasshopper, webworm, cockchafer, grass grubs, loopers**	*None*	**25**	*10 (H)* *2 (G)*	**14 (G)**
Sugarcane	*Any foliar treatment applied later than 3 months after planting or ratooning*	**Armyworm and locusts, for 3 months following planting or ratooning**	*T0.1*	***0.01**	*7 (H)* *2 (G)*	**NR (H)** **14 (G)**

G = WHP for grazing (as forage or straw) and cutting-for-stockfeed **ns** : not specified on label

The special situation of turf/lawn

The issue of a grazing withholding period for treated turf/lawn, or feeding of turf/lawn clippings could not be resolved as no data for this situation were submitted for assessment. Some current labels state a 2-day grazing/cut-for-stockfeed WHP for treated turf/lawn with a prohibition on feeding of clippings from treated turf/lawn to poultry or livestock. Some other labels prohibit grazing, cutting-for-stockfeed and feeding of turf/lawn clippings from treated turf/lawn to stock/poultry.

Note that turf/lawn can be treated at up to 3000 g-ai/ha, compared to a 750 g-ai/ha maximum for grass and legume pasture. Also that the grazing withhold for grass pastures has been increased in this report from 2 days to 14 days and for legume pasture from 2 days to 28 days. Consequently it is recommended that grazing of treated turf/lawn, its cutting for livestock or feeding of its clippings to poultry or stock be prohibited, and the label amended accordingly.

Residues in Trade Issues

There is some potential for undue prejudice to trade for export of grapes and pome fruits as the standards of Australia's trading partners and Codex differ to those proposed. There is also potential for undue prejudice to trade in cereal grains, pulses, and cattle, goat, pig and sheep meats.

A consideration of export grazing intervals and export slaughter intervals should give some guidance as to the management of potential trade issues. This issue does not arise from a changing use pattern but a review of the present use patterns and the review of standards both in Australia and overseas.

Export slaughter intervals (ESIs) were recommended for animal tissues in animals fed commodities containing chlorpyrifos residues and the following label statements should be added onto labels:

> **Livestock Destined for Export Markets:** The label withholding periods for grazing only apply to stock slaughtered for the domestic market. Some export markets apply different standards. To meet these standards, ensure that the Export Slaughter Interval (ESI) is observed before stock are sold or slaughtered.
>
> **Export Slaughter Intervals (ESIs)**
>
> **Grazing Animals:** Grazing animals that have been grazing on or fed treated crops should be placed on clean feed for 56 days prior to slaughter for export.
>
> **Pigs:** Pigs that have been fed treated crops should be placed on clean feed for 7 days prior to slaughter for export.

An Export Grazing Interval (EGI) of 49 days for grazing animals has also been recommended for all forages. An Export Harvest Interval (EHI) of 21 days has been recommended for oaten hay.

It was concluded that export harvest intervals (EHIs) are not required for the grain crops treated with chlorpyrifos. Note that these export intervals have been in place in the market since 2000, with no export violations detected in the NRS residue monitoring program.

MRL amendments

Upon finalisation of this review, the following amendments (below) will be made to the *MRL Standard,* and be recommended for inclusion in the Food Standards Code, where appropriate:

For easier visual reference, MRL entries to be ***deleted*** from the APVMA's MRL Standard are in ***bold italic red*** and MRL entries to be **added** are in **bolded green**.

Table 1 of the APVMA's MRL Standard: Maximum Residue Limits (MRLs) of agricultural and veterinary chemicals and associated substances in food commodities

Compound			Food	MRL (mg/kg)
Chlorpyrifos				
DELETE:	***VS***	***0621***	***Asparagus***	***T0.5***
	FI	***0327***	***Banana***	***T0.5***
	VB	***0040***	***Brassica (cole or cabbage) vegetables, Head cabbages, Flowerhead brassicas***	***T0.5***
	VR	***0463***	***Cassava***	***T*0.02***
	VS	***0624***	***Celery***	***T5***
	GC	***0080***	***Cereal grains [except sorghum]***	***T0.1***
	FC	***0001***	***Citrus fruits***	***T0.5***
	DF	***0167***	***Dried fruits***	***T2***
	MO	***0105***	***Edible offal (mammalian)***	***T0.1***
	PE	***0112***	***Eggs***	***T*0.01***
	FB	***0269***	***Grapes***	***T1***
	VA	***0384***	***Leek***	***T5***
	FI	***0345***	***Mango***	****0.05***
	MM	***0095***	***Meat (mammalian) [in the fat]***	***T0.5***
	ML	***0106***	***Milks [in the fat]***	***T0.2***
	SO	***0089***	***Oilseed, except peanut***	***T0.01***
	HH	***0740***	***Parsley***	***T0.05***
	SO	***0697***	***Peanut***	***T*0.01***
	VO	***0445***	***Peppers, Sweet [capsicums]***	***T1***
	FI	***0353***	***Pineapple***	***T0.5***
	TN	***0675***	***Pistachio nut***	***T*0.05***
	FP	***0009***	***Pome fruits***	***T0.5***
	PO	***0111***	***Poultry, Edible offal of***	***T0.1***
	PM	***0110***	***Poultry meat [in the fat]***	***T0.1***
	GC	***0651***	***Sorghum***	***T3***
	FS	***0012***	***Stone fruits***	***T1***
	GS	***0659***	***Sugar cane***	***T0.1***
	VR	***0508***	***Sweet Potato***	***T0.05***
	VO	***0448***	***Tomato***	***T0.5***
			Vegetables [except asparagus; brassica vegetables; cassava; celery, leek; peppers, sweet [capsicums]; potato; tomato]	***T*0.01***
ADD:				
	VS	**0621**	**Asparagus**	***0.01**
	FI	**0327**	**Banana**	**0.5**
	VB	**0040**	**Brassica (cole or cabbage) vegetables, Head cabbages, Flowerhead brassicas**	***0.01**
	VR	**0577**	**Carrot**	***0.01**
	VR	**0463**	**Cassava**	***0.02**
	VS	**0624**	**Celery**	***0.01**
	GC	**0080**	**Cereal grains [except rice and sorghum]**	**2**
	VL	**0464**	**Chard (silver beet)**	**10**

Compound	Food			MRL (mg/kg)
	FC	0001	Citrus fruits	1
	VC	0424	Cucumber	1
	DF	0167	Dried fruits	1
	MO	0105	Edible offal (mammalian)	0.02
	PE	0112	Eggs	*0.01
	VO	0440	Eggplant	0.2
	FB	0269	Grapes	1
	VP	0060	Legume vegetables	1
	VL	0482	Lettuce, Head	*0.01
	VL	0483	Lettuce, Leaf	*0.01
	SO	0693	Linseed	0.05
	FI	0345	Mango	1
	MM	0095	Meat (mammalian)[in the fat]	2
	ML	0106	Milks	0.02
	FM	0183	Milk fat	0.5
	SO	0088	Oilseed [except cotton, linseed and safflower]	*0.01
	VA	0385	Onion, Bulb	*0.01
	HH	0740	Parsley	0.05
	FS	0247	Peaches	0.05
	VO	0051	Peppers	1
	FI	0353	Pineapple	0.5
	FP	0009	Pome fruits	1
	PO	0111	Poultry, Edible offal of	*0.01
	PM	0110	Poultry meat [in the fat]	0.1
	VD	0070	Pulses [dry]	0.1
	GC	0649	Rice	0.5
	SO	0699	Safflower seed	0.05
	GC	0651	Sorghum	1
	VD	0541	Soya bean (dry)	0.05
	FS	0012	Stone fruits	1
	GS	0659	Sugar cane	*0.01
	VR	0508	Sweet Potato	*0.01
	VO	0448	Tomato	1
	CM	0654	Wheat bran, unprocessed	5

Table 4 of the APVMA's MRL Standard: Maximum residue limits for pesticides in animal feed commodities

Compound	Animal feed commodity			MRL (mg/kg)
Chlorpyrifos				
DELETE				
	AL	*1270*	*Peanut forage (green)*	*T10*
			Peanut hay	*T2*
ADD				
	AB	0226	Apple pomace, dry	1
			Cereal forage	20
	AB	0001	Citrus pulp, dry	5
			Grass pasture forage and hay	25

Compound	Animal feed commodity			MRL (mg/kg)
	AL	0157	Legume animal feeds (except pulses)	25
			Oilseed forage	30
			Oilseed straw	20
			Pulse forage	5
			Pulse straw	0.5
	AS	0651	Sorghum straw and fodder (dry)	20
	AS	0081	Straw and fodder (dry) of cereal grains [except sorghum]	10
	AM	0659	Sugarcane fodder	4

5 PROPOSED REVIEW FINDINGS

On the basis of the evaluation of the submitted data and information, the following recommendations are made with regard to the continued approval of the active constituent chlorpyrifos, registration of chlorpyrifos products and label approvals in Australia.

AFFIRM APPROVALS OF THE ACTIVE CONSTITUENT

The APVMA is satisfied that, provided the conditions to which an approval is currently subject are complied with, the continued use of, or any other dealings with, the active constituent chlorpyrifos would not be likely to have an effect that is harmful to human beings, the environment or trade.

The APVMA recommends that all currently approved active constituents listed in Table 23 be affirmed.

Table 23: Active constituent approvals to be affirmed

Product number	Product name	Registrant
44005	Chlorpyrifos Active Constituent	Farmoz Pty Limited
44111	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
44112	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
44113	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
44160	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
46888	Chlorpyrifos Active Constituent	Gharda Australia Pty Ltd
47155	Chlorpyrifos Active Constituent	Excel Industries (Australia) Pty Ltd
48521	Chlorpyrifos Active Constituent	Ospray Pty Ltd
49124	Chlorpyrifos Manufacturing Concentrate	Dow Agrosciences Australia Limited
49340	Chlorpyrifos Manufacturing Concentrate	Dow Agrosciences Australia Limited
50886	Chlorpyrifos Active Constituent	Imtrade Australia Pty Ltd
55457	Chlorpyrifos Active Constituent	Agrogill Chemicals Pty Ltd
56174	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
58019	Chlorpyrifos Active Constituent	Sabero Australia Pty Ltd
60079	Chlorpyrifos Active Constituent	Agrogill Chemicals Pty Ltd
62025	Chlorpyrifos Active Constituent	Agspray Chemical Co Pty Ltd

VARY CONDITIONS OF LABEL APPROVAL

The APVMA is not satisfied that the labels of the products in Table 24 contain adequate instructions in relation to the criteria set out in 14(3)(g) of the Agvet Codes as well as those referred to in Regulations 11 and 12 of the Agvet Code Regulations.

Table 24: Products affected by the proposed review findings

NCRIS Number	Product name	Company Name	Current Label Approval Number
32887	Lorsban 500 EC Insecticide	Dow Agrosciences Australia Limited	0108
32902	Nufarm Chlorpyrifos 500 EC Insecticide	Nufarm Australia Limited	1207
39267	Pyrinex 250 WP Insecticide	Makhteshim-Agan (Australia) Pty Limited	0701
42284	David Grays Chlorpyrifos 500	David Gray & Co. Pty Limited	0901
45486	Farmoz Strike-out 500 EC Insecticide	Farmoz Pty Limited	1008
45518	Country Chlorpyrifos 500 Insecticide	Accensi Pty Ltd	0307
47538	Suscon Blue Soil Insecticide	Crop Care Australasia Pty Ltd	1206
48448	Agchem Chlorpyrifos 500 EC Insecticide	Imtrade Australia Pty Ltd	01
48770	Farmoz Strike-out PC Termiticide and Insecticide	Farmoz Pty Limited	0609
48998	Cyren 500 EC Insecticide	Ospray Pty Ltd	0507
49869	4Farmers Chlorpyrifos 500 Insecticide	4 Farmers Pty Ltd	0402
50232	Farmoz Instinct 300 Cotton Insecticide	Farmoz Pty Limited	0801
50387	Titan Chlorpyrifos 500 Termiticide and Insecticide	Titan Ag Pty Ltd	0307
50416	Suscon Green Soil Insecticide	Crop Care Australasia Pty Ltd	1102
51107	Suscon Ultra Soil Insecticide	Crop Care Australasia Pty Ltd	0501
51190	Chemag Chlorpyrifos 500 Insecticide	Imtrade Australia Pty Ltd	0502
51211	Lorsban 750 WG Insecticide	Dow Agrosciences Australia Limited	0306
51513	Cyren 500 WP Insecticide	Ospray Pty Ltd	0406
51624	Prowler 300 Insecticide	Imtrade Australia Pty Ltd	0502
51875	Pidgeon's Pest Controller 500 Termiticide and Insecticide	Superway Garden Ag & Pest Products Pty Ltd	1206
52045	Cyren 300 ULV/EC Insecticide	Ospray Pty Ltd	0501
52235	Farmoz Cyren 500 WP Insecticide	Farmoz Pty Limited	0405
52596	United Farmers Chlorpyrifos 500 Insecticide and Termiticide	UnitedFarmers Co-operative Company Ltd	0203
53428	Generifos 500EC Insecticide	Grow Choice Pty Limited	0202
53771	Suscon Plus Soil Insecticide	Crop Care Australasia Pty Ltd	0905
54546	Pyritilene Banana Bags	Makhteshim-Agan (Australia) Pty Limited	0205

NCRIS Number	Product name	Company Name	Current Label Approval Number
54957	WSD Chlorpyrifos 500 EC Insecticide	Rebop Holdings Pty Ltd t/a Western Stock Distributors	0502
54963	Suscon Ribbon Insecticide	Crop Care Australasia Pty Ltd	0803
55213	Kenso Agcare Kensban 500 Insecticide	Kenso Corporation (M) Sdn Bhd	0302
55755	Fortune 500 Multi-Purpose Insecticide and Termiticide	PCT Holdings Pty Ltd	0502
55897	Conquest Chlorpyrifos 500 Insecticide	Conquest Agrochemicals Pty Ltd	0408
60188	Genfarm Chlorpyrifos 500 Insecticide	Genfarm Crop Protection Pty Ltd	1106
60611	Agspray Chlorpyrifos 500EC Insecticide	Agspray Chemical Co Pty Ltd	0806
61071	Farmoz Strike-Out 500 WP Insecticide	Farmoz Pty Limited	0906
63145	AW Chop 500 Insecticide and Termiticide	Agri West Pty Limited	0908
63451	Grass Valley Chlorpyrifos 500 Insecticide	Grass Valley Formulators Pty Limited	0109
63548	Chemforce Chlorpyrifos 500 Insecticide	Frank Vanderkley & Paul Richards t/a Chemforce Australia	1108

However, the APVMA is satisfied that the conditions of label approval for the products in Table 24 can be varied in such a way that they do contain adequate instructions in accordance with section 14(3)(g) of the Agvet Codes. The changes required for labels to contain adequate instructions are summarised below, as recommended in the residues assessment.

Changes to Fruit and Vegetable Use Patterns and WHPs

For ease of visual reference, note that uses and old WHPs to be deleted from labels are in ***bold, italic red***. In contrast, new WHPs for addition to labels are in **bolded green**.

Table 25: Summary of Fruit and Vegetable Label Changes

Commodity	Uses recommended for	WHP (days)	
	DELETION from label	Old DELETE	NEW ADD
Asparagus, celery	***Wingless grasshopper, vegetable weevil***	***14***	**NR**
Bananas	***None***	***14***	**NR**
Brassica	***Moths, butterflies, caterpillar, budworm, grasshopper, African black beetle, corn earworm***	***5***	**NR**
Carrots	***Light brown apple moth, grasshopper, weevil***	***NR***	**NR**
Chard (Silver beet)	***None***	***NR***	**7**

Commodity	Uses recommended for DELETION from label	WHP (days) Old DELETE	WHP (days) NEW ADD
Citrus fruits	*None*	*14*	14 (foliar) 0 (butt)
Cucumber	*None*	*5*	7
Dried fruits	*As for fresh fruit*		See fruits
Eggplant	*None*	*NR*	3
Garden peas	*None*	*NR*	7
Grapes	*None*	*14*	14 (foliar) 0 (dormant)
Green beans	*None*	*NR*	7
Lettuce	*Red-legged earth mite, grasshopper, weevil*	*NR*	NR
Lima beans	*None*	*3*	7
Mangoes	*None*	*21*	21
Onions	*Grasshopper, weevil*	*NR*	NR
Peaches	*Any foliar application.*	*14*	0
Peppers	*None*	*3*	4
Pineapples	*None*	*14*	Nil
Pome fruits	*None*	*14*	14 (foliar) 0 (Q-fly bait)
Stone fruits (except peaches*)	*None*	*14*	14 (foliar) 0 (Q-fly, earwig bait)
Sweet potato	*Grasshopper, weevil*	*NR*	NR
Tomatoes (processing)	*Use on fresh market tomatoes*	*3*	3
Vegetables	*Remove crop group from labels*		

Note:

NR – Not Required when used according to label directions.

*** :** **Foliar** use on peaches must be specifically prohibited, on the label. Only cracked-grain baits (for earwig control) is permitted on peaches.

Changes to Field Crop Use Patterns and WHPs

The following table summarises changes to use patterns, MRLs and WHPs for field crops to which chlorpyrifos is applied.

Table 26: Summary of Field Crop Label Changes

Commodity	Uses recommended for DELETION from label	WHP (days) Old DELETE	WHP (days) NEW ADD
Cereals (except rice and sorghum)	*None*	*10 (H)* *2 (G)*	14(H) 14 (G)
Rice	*Spur-throated locusts*	*10 (H)* *2 (G)*	10 (H) 10 (G)
Sorghum	*Spur-throated locusts*	*7 (H)* *7 (G)*	7 (H) 7 (G)
Linseed, safflower	*Wingless grasshopper*	*ns (H)* *2 (G)*	NR (H) 14 (G)

Commodity	Uses recommended for DELETION from label	WHP (days) Old DELETE	 NEW ADD
Rapeseed [canola]	***Cutworms, wireworms, wingless grasshopper***	***ns (H)*** ***2 (G)***	**0 (H)** **14 (G)**
Soybeans	***None***	***ns (H)*** ***2 (G)***	**28 (H)** **28 (G)**
Peanuts	***None***	***ns (H)*** ***2 (G)***	**14 (H)** **14 (G)**
Pulses	***Armyworm, locusts, underground grass grub, looper, webworm***	***10 (H)*** ***2 (G)***	**NR (H)** **28 (G)**
Legume animal feed crops (other than pulses)	***None***	***10 (H)*** ***2 (G)***	**28 (H)** **28 (G)**
Grass pastures	***None***	***10 (H)*** ***2 (G)***	**14 (G)**
Sugarcane	***Any foliar treatment applied later than 3 months after planting or ratooning***	***7 (H)*** ***2 (G)***	**NR (H)** **14 (G)**

ns : Not specified on label

Turf/lawn as stockfeed

It is recommended that a prohibition on grazing, or cutting for stockfeed, or treated turf/lawn be included on labels. The prohibition of feeding clippings to poultry/stock will remain.

Addition of Export Intervals and Associated Text to General Instructions

As a consequence of the proposed MRLs and potential trade risk in some export markets for animal commodities, the following summarises additional general instructions which need to be added to labels to manage residues in these commodities.

Livestock Destined for Export Markets: The label withholding periods for grazing only apply to stock slaughtered for the domestic market. Some export markets apply different standards. To meet these standards, ensure that the appropriate Export Slaughter Interval (ESI) and/or Export Grazing Interval (EGI) is observed before stock are sold or slaughtered.

Export Slaughter Intervals (ESIs):

Grazing Animals: Grazing animals that have been grazing on or fed treated crops should be placed on clean feed for 56 days prior to slaughter for export.

Pigs: Pigs that have been fed treated crops should be placed on clean feed for 7 days prior to slaughter for export.

Export Grazing Interval (EGI):

Grazing animals: Grazing animals that do not have access to clean feed as a result of locust-control application and are destined for export, should not be exported until 49 days after the last chlorpyrifos application to the treated forage or crop.

Oaten Hay Destined for Export Market: The label withholding periods for cutting treated fodder for stockfeed only apply to stock feed destined for the domestic market. Some export markets apply different standards.

To meet these standards, ensure that the Export Harvest Interval (EHI) is observed before cutting oaten hay for export.

Export Harvest Interval (EHI): DO NOT harvest oaten hay for export for 21 days after application.

AFFIRM PRODUCT REGISTRATIONS AND LABEL APPROVAL

Section 6.2 above identifies various changes to labels as an outcome of the review. These variations to label instructions would satisfy the requirements for continued registration of products identified in Table 24 of Section 5.2 and the APVMA recommends that product registrations be affirmed.

PROPOSED REGISTRATION CANCELLATION AS AN OUTCOME OF THE REVIEW FINDINGS

As all product labels can be varied to satisfy the APVMA requirements for continued registration of all products registered at the time this review was conducted, it is not proposed that the registration of any product be cancelled under section 41 of the Agvet Codes.

CANCELLATION OF ALL BUT THE MOST-RECENTLY-APPROVED LABEL

The APVMA proposes to find that it is NOT SATISFIED that old previously-approved product labels for currently registered products listed in Table 24 contain adequate instructions in relation to the criteria set out in s.14(3)(g) of the Agvet Codes, and contain use patterns recommended to be deleted. Consequently the following label approvals should be cancelled.

Table 27: The following label approvals are deemed not to contain adequate instructions and thus are to be cancelled

NCRIS Number	Product name	Label Approval Numbers
32887	Lorsban 500 EC Insecticide	0108; 1107; 0107; 0306; 0803; 0601; 0401; 0301
32902	Nufarm Chlorpyrifos 500 EC Insecticide	1207; 1208; 0305; 0104; 0903; 0303; 0902; 0801
39267	Pyrinex 250 WP Insecticide	0701
42284	David Grays Chlorpyrifos 500	0901
45486	Farmoz Strike-out 500 EC Insecticide	1008; 0107; 0903; 0602; 0701
45518	Country Chlorpyrifos 500 Insecticide	0307; 0304; 0301; 0300
47538	Suscon Blue Soil Insecticide	1206; 0501; 0100
48448	Agchem Chlorpyrifos 500 EC Insecticide	01
48998	Cyren 500 EC Insecticide	0507; 1006; 0706; 0501
48770	Farmoz Strike-out PC Termiticide and Insecticide	0609; 1205; 0201
49869	4Farmers Chlorpyrifos 500 Insecticide	0402
50232	Farmoz Instinct 300 Cotton Insecticide	0801
50387	Titan Chlorpyrifos 500 Termiticide and Insecticide	0307; 0402; 0801
50416	Suscon Green Soil Insecticide	1102; 0501; 0800; 0600
51107	Suscon Ultra Soil Insecticide	0501
51190	Chemag Chlorpyrifos 500 Insecticide	0502
51211	Lorsban 750 WG Insecticide	0306; 0501; 0401

NCRIS Number	Product name	Label Approval Numbers
51513	Cyren 500 WP Insecticide	0406; 1101
51624	Prowler 300 Insecticide	0502
51875	Pidgeon's Pest Controller 500 Termiticide and Insecticide	1206; 0406; 0402; 1100; 0100
52045	Cyren 300 ULV/EC Insecticide	0501
52235	Farmoz Cyren 500 WP Insecticide	0405; 0301
52596	United Farmers Chlorpyrifos 500 Insecticide and Termiticide	0203; 0102; 0300
53428	Generifos 500EC Insecticide	0202
53771	Suscon Plus Soil Insecticide	0905; 0801
54546	Pyritilene Banana Bags	0205; 0404
54957	WSD Chlorpyrifos 500 EC Insecticide	0502
54963	Suscon Ribbon Insecticide	0803; 0203; 1002
55213	Kenso Agcare Kensban 500 Insecticide	0302
55755	Fortune 500 Multi-Purpose Insecticide and Termiticide	0502
55897	Conquest Chlorpyrifos 500 Insecticide	0408; 0702
60188	Genfarm Chlorpyrifos 500 Insecticide	1106; 0905
60611	Agspray Chlorpyrifos 500EC Insecticide	0806
61071	Farmoz Strike-Out 500 WP Insecticide	0906
63145	AW Chop 500 Insecticide and Termiticide	0908
63451	Grass Valley Chlorpyrifos 500 Insecticide	0109
63548	Chemforce Chlorpyrifos 500 Insecticide	1108

Ψ Labels transitioned from the states and not having and approval number.

VOLUNTARILY WITHDRAWN CHLORPYRIFOS PRODUCTS

Eighteen chlorpyrifos products have been voluntarily withdrawn since the commencement of the review (once cancellation of registration is formally effected, reconsideration is no longer required). A list of these products is presented in Appendix E.

CANCELLED CHLORPYRIFOS PRODUCTS FROM THE 2000 REPORT

Twelve chlorpyrifos products were specifically cancelled by the APVMA as an outcome of the interim review-decisions of 2000. In all cases, their expiry date for retail sale, and use of product purchased before 29 August 2000 and during the cancellation period, was 31 December 2001. Remaining wholesale stock was recalled and manufacture ceased at 29 August 2000. A list of these cancelled products is presented in Appendix D.

STOPPED CHLORPYRIFOS PRODUCTS

Note that under the review-related legislation of the APVMA, the outcomes of a review can only be implemented for:

- currently approved actives
- currently registered products
- applications for either that are still under screening or assessment
- any future applications for either.

Whilst stopped products[54] are not subject to the outcomes of a review, they can be re-registered at any time during their 2-year stop/sell period. Once re-registered, these products are subject to the outcomes of the review.

As at 25 July 2009, there were 23 stopped chlorpyrifos products (Appendix C). The table below lists the 16 of these products with use patterns that would be affected by the review outcomes, should they become re-registered (including cancellation of all prior approved labels, once the review-amended label was approved).

"Stopped" products have the review outcomes applied by the registration-related legislation of the APVMA, and so are implemented by the registration stream of the APVMA (if it is required).

Table 28: Stopped Products with Use Patterns Affected by the Review Outcomes, if they are Re-registered before their Expiry Date

NCRIS Number	Stopped Product's Name	Company Name	Label Approval Numbers	Expiry Date
32889	Dursban Micro-Lo Termiticide and Insecticide	Dow Agrosciences Australia Limited	0501	30/6/2010
40812	Campbell Pyrinex 500 WP Insecticide	Colin Campbell (Chemicals) Pty Ltd	0502	30/6/2010
49055	Predator 300 Insecticide	Dow Agrosciences Australia Limited	0905; 0501	30/6/2010
49809	Empire Insecticide	Dow Agrosciences Australia Limited	0301	30/6/2010
50560	Rescue Insecticide	Dow Agrosciences Australia Limited	0102; 1100	30/6/2010
52870	Snare Termiticide and Insecticide	Dow Agrosciences Australia Limited	0501	30/6/2010
55186	Kenso Agcare Kensban 300 Duo Insecticide	Kenso Corporation (M) Sdn Bhd	0202	30/6/2011
55208	Halley Chlorpyrifos 500 Insecticide	Halley International Enterprise (Australia) Pty Ltd	0203	30/6/2011
59804	Ospray Chlorpyrifos 500 EC Insecticide	Ospray Pty Ltd	0705	30/6/2010
60410	Tradelands Chlorpyrifos 500 EC Insecticide	Ospray Pty Ltd	1105	30/6/2010
62909	Allfire Chlorpyrifos 500 Insecticide	Ospray Pty Ltd	0308	30/6/2011

Ψ Labels transitioned from the states and not having and approval number.

54 Stopped products are products whose registration is not renewed. This means that the product may no longer be manufactured. However, there is 2-year period during which (a) wholesale and retail stock may be sold and (b) product purchased before and during the 2-year period may be used.

AMENDMENTS TO STANDARDS

There are no changes to the Public Health Standards for chlorpyrifos which were presented in the 2000 Interim Review Report, with respect to:

- the Acceptable Daily Intake (ADI)
- the Acute Reference Dose (ARfD)
- health value for Australian drinking water
- poisons scheduling
- first aid instruction
- warning statements and general safety precautions
- safety directions and personal protective equipment (PPE)
- impurity limits in the active constituent.

MRL STANDARDS

Upon finalisation of the review, the following amendments will be made to the *MRL Standard,* and be recommended for inclusion in the Food Standards Code, where appropriate.

For easier visual reference, MRL entries and/or MRLs to be ***deleted*** from the APVMA's MRL Standard are in ***bold italic red*****.** **M**RL entries and/or MRLs to be **added** are in **bolded green.**

Table 1 of the APVMA's MRL Standard: Maximum Residue Limits (MRLs) of agricultural and veterinary chemicals and associated substances in food commodities: chlorpyrifos

		Food	MRL	(mg/kg)
			DELETE	**ADD**
VS	0621	Asparagus	***T0.5***	***0.01**
FI	0327	Banana	***T0.5***	**0.5**
VB	0040	Brassica (cole or cabbage) vegetables, Head cabbages, Flowerhead brassicas	***T0.5***	***0.01**
VR	**0577**	**Carrot#**	**-**	***0.01**
VR	0463	Cassava	***T*0.02***	***0.02**
VS	0624	Celery	***T5***	***0.01**
GC	0080	Cereal grains [except sorghum and rice]	***T0.1***	**2**
FC	0001	Citrus fruits	***T0.5***	**2**
VL	**0464**	**Chard# (silver beet)**	**-**	**10**
FC	**0001**	**Citrus fruits**	**-**	**1**
VC	**0424**	**Cucumber#**	**-**	**1**
DF	0167	Dried fruits	***T2***	**1**
MO	0105	Edible offal (mammalian)	***T0.1***	**0.02**
PE	0112	Eggs	***T*0.01***	***0.01**
VO	**0440**	**Eggplant#**	**-**	**0.2**
FB	0269	Grapes	***T1***	**1**
VA	***0384***	***Leek***	***T5***	**-**
VP	**0060**	**Legume vegetables#**	-	**1**
VL	**0482**	**Lettuce, Head#**	-	***0.01**
VL	**0483**	**Lettuce, Leaf#**	-	***0.01**
SO	**0693**	**Linseed**	-	**0.05**
FI	0345	Mango	****0.05***	**1**
MM	0095	Meat (mammalian)[in the fat]	***T0.5***	**2**
ML	0106	Milks [in the fat]	***T0.2***	**0.02**

		Food	MRL	(mg/kg)
			DELETE	ADD
FM	**0183**	**Milk fat**	**-**	**0.5**
SO	***0089***	Oilseed, except ***peanut cotton, linseed and safflower***	***T0.01***	***0.01**
	0088			
VA	**0385**	**Onion[#], bulb**	**-**	***0.01**
HH	0740	Parsley	T0.05	**0.05**
FS	**0247**	**Peaches**	***T1***	**0.05**
SO	**0697**	**Peanut**	***T*0.01***	**-**
VO	0445	Peppers, Sweet [capsicums]	***T1***	**1**
FI	0353	Pineapple	***T0.5***	**0.5**
TN	**0675**	**Pistachio nut**	***T*0.05***	**-**
FP	0009	Pome fruits	***T0.5***	**1**
PO	0111	Poultry, Edible offal of	***T0.1***	***0.01**
PM	0110	Poultry meat [in the fat]	***T0.1***	**0.1**
VD	**0070**	**Pulses [dry]**	-	**0.1**
GC	**0649**	**Rice**	-	**0.5**
SO	**0699**	**Safflower seed**	-	**0.05**
GC	0651	Sorghum	***T3***	**1**
VD	**0541**	**Soya bean (dry)**	**-**	**0.05**
FS	0012	Stone fruits **(except peaches)**	T1	**1**
GS	0659	Sugar cane	T0.1	***0.01**
VR	0508	Sweet Potato	T0.05	***0.01**
VO	0448	Tomato	T0.5	**1**
		Vegetables [except asparagus; brassica vegetables; cassava; celery, leek; peppers, sweet [capsicums]; potato; tomato]	***T*0.01***	**-**
CM	**0654**	**Wheat bran, unprocessed**		**5**

: Previously carrot, chard (silver beet), cucumber, eggplant, legume vegetables (green beans, green peas and lima beans), onion bulbs and lettuce (both head and leaf) were contained within the general "Vegetables" MRL of T*0.01 mg/kg

Table 4 of the APVMA's MRL Standard: Maximum residue limits for pesticides in animal feed commodities: chlorpyrifos

	Animal feed commodity		MRL	(mg/kg)
			DELETE	ADD
AB	**0226**	**Apple pomace, dry**	-	**1**
		Cereal forage	-	**20**
AB	**0001**	**Citrus pulp, dry**	-	**5**
		Grass pasture forage and hay	-	**25**
AL	**0157**	**Legume animal feeds (except pulses)**	-	**25**
		Oilseed forage	-	**30**
		Oilseed straw	-	**20**
		Pulse forage	-	**5**
		Pulse straw	-	**0.5**
AL	***1270***	***Peanut forage (green)***	***T10***	**-**
		Peanut hay	***T2***	**-**
AS	**0651**	**Sorghum straw and fodder (dry)**	-	**20**
AS	**0081**	**Straw and fodder (dry) of cereal grains [except sorghum]**	-	**10**
AM	**0659**	**Sugarcane fodder**	-	**4**

APPENDIX A: ACTIVE CONSTITUENT APPROVALS INCLUDED IN THE REVIEW

Product number	Product name	Registrant
44005	Chlorpyrifos Active Constituent	Farmoz Pty Limited
44111	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
44112	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
44113	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
44160	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
46888	Chlorpyrifos Active Constituent	Gharda Australia Pty Ltd
47155	Chlorpyrifos Active Constituent	Excel Industries (Australia) Pty Ltd
48521	Chlorpyrifos Active Constituent	Ospray Pty Ltd
49124	Chlorpyrifos Manufacturing Concentrate	Dow Agrosciences Australia Limited
49340	Chlorpyrifos Manufacturing Concentrate	Dow Agrosciences Australia Limited
50886	Chlorpyrifos Active Constituent	Imtrade Australia Pty Ltd
55457	Chlorpyrifos Active Constituent	Agrogill Chemicals Pty Ltd
56174	Chlorpyrifos Active Constituent	Dow Agrosciences Australia Limited
58019	Chlorpyrifos Active Constituent	Sabero Australia Pty Ltd
60079	Chlorpyrifos Active Constituent	Agrogill Chemicals Pty Ltd
62025	Chlorpyrifos Active Constituent	Agspray Chemical Co Pty Ltd

16 actives

APPENDIX B: FULL LIST OF REGISTERED PRODUCTS INCLUDED IN THE CHLORPYRIFOS REVIEW

(as at 13 August 2009)

NCRIS Number	Product name	Company Name	Label Approval Numbers*
32887	Lorsban 500 EC Insecticide	Dow Agrosciences Australia Limited	0108; 1107; 0107; 0306; 0803; 0601; 0401; 0301; ~~0698; 02; Ψ~~
32902	Nufarm Chlorpyrifos 500 EC Insecticide	Nufarm Australia Limited	1207; 1208; 0305; 0104; 0903; 0303; 0902; 0801; ~~1199; 03; 02; 01; Ψ~~
33198	CRG Ban Ant	Heiniger Home & Garden Care Pty Ltd	0402; 1100; ~~00; Ψ~~
39222	David Grays Antex Granules	David Gray & Co. Pty Limited	1000; ~~0698; 03; 02; Ψ~~
39267	Pyrinex 250 WP Insecticide	Makhteshim-Agan (Australia) Pty Limited	~~0701; 1199; Ψ~~
39885	Nufarm Chlorpyrifos PCO Insecticide	Nufarm Australia Limited	0801; ~~03; Ψ~~
42032	David Grays Lawn Beetle Granules	David Gray & Co. Pty Limited	0802; 1100; ~~00; Ψ~~
42039	David Grays PCO Chlorpyrifos 500	David Gray & Co. Pty Limited	0501; ~~01; Ψ~~
42284	David Grays Chlorpyrifos 500	David Gray & Co. Pty Limited	0901; ~~01; Ψ~~
45068	Brunnings Lawn Beetle Destroyer	Brunnings Garden Products Pty Ltd	0302; 0102; ~~2~~
45227	Antout Granular Insecticide	PCT Holdings Pty Ltd	0501; ~~03; /02; 02~~
45449	Brunnings Lawn Grub Destroyer	Brunnings Garden Products Pty Ltd	0502; 0102; ~~00~~
45486	Farmoz Strike-out 500 EC Insecticide	Farmoz Pty Limited	1008; 0107; 0903; 0602; 0701; ~~0699; 02~~
45518	Country Chlorpyrifos 500 Insecticide	Accensi Pty Ltd	0307; 0304; 0301; 0300; ~~01~~
47528	CRG Lawn Beetle Blitz Insecticide	Heiniger Home & Garden Care Pty Ltd	1200; ~~01~~
47538	Suscon Blue Soil Insecticide	Crop Care Australasia Pty Ltd	1206; 0501; 0100; ~~02; 3944~~
47760	Master 250 CS Insecticide	Makhteshim-Agan (Australia) Pty Limited	0801; ~~0998;~~
48051	David Grays Micro-Lo Chlorpyrifos Termiticide and Insecticide	David Gray & Co. Pty Limited	0601; ~~0298~~
48146	David Grays Pre-Construction Chlorpyrifos Termiticide	David Gray & Co. Pty Limited	0601; 0600; ~~0998; 01~~
48448	Agchem Chlorpyrifos 500 EC Insecticide	Imtrade Australia Pty Ltd	01

NCRIS Number	Product name	Company Name	Label Approval Numbers*
48625	Cyren PC Insecticide	Ospray Pty Ltd	1201; ~~01~~
48770	Farmoz Strike-out PC Termiticide and Insecticide	Farmoz Pty Limited	1205; 0201; ~~0599; 01~~
48998	Cyren 500 EC Insecticide	Ospray Pty Ltd	0507; 1006; 0706; 0501; ~~01~~
49315	Richgro Garden products Lawn Beetle and Grub Killer	A Richards Pty Ltd t/a Richgro Garden Products	0206; ~~01~~
49399	Hortico Lawn Beetle & Slater Killer Granules	Orica Australia Pty Ltd	1201; ~~01~~
49666	Barmac Chlorpyrifos G Granular Insecticide	Barmac Industries Pty Ltd	0402; ~~1097~~
49869	4Farmers Chlorpyrifos 500 Insecticide	4 Farmers Pty Ltd	0402; ~~1197~~
50232	Farmoz Instinct 300 Cotton Insecticide	Farmoz Pty Limited	0801; ~~1197~~
50246	Garden King Fix Ant Granular	Ecofertiliser Pty Ltd	0802; 1200; ~~1297~~
50387	Titan Chlorpyrifos 500 Termiticide and Insecticide	Titan Ag Pty Ltd	0307; 0402; 0801; ~~0198~~
50416	Suscon Green Soil Insecticide	Crop Care Australasia Pty Ltd	1102; 0501; 0800; 0600; ~~0399~~
50452	Titan Chlorpyrifos PC 450 Insecticide	Titan Ag Pty Ltd	0407; 0302; 0701; ~~0898; 0198~~
50639	Barmac Killmaster Insecticide	Barmac Industries Pty Ltd	0801; 0601
50644	S.C. Johnson Wax Raid Maxkill the Total Cockroach System	S.C. Johnson & Son Pty Ltd	0899; ~~0998; 0798~~
50956	Creofos Pre-Construction - Post-Construction Termiticide & Insecticide	Creepy Crawly Pest Control Pty Ltd	0601; ~~0998~~
51107	Suscon Ultra Soil Insecticide	Crop Care Australasia Pty Ltd	0501; ~~1299~~
51151	Country Pre-Construction/Post-Construction Termiticide and Insecticide	Accensi Pty Ltd	0103; 0301; ~~1299; 1098~~
51190	Chemag Chlorpyrifos 500 Insecticide	Imtrade Australia Pty Ltd	0502; ~~1198~~
51211	Lorsban 750 WG Insecticide	Dow Agrosciences Australia Limited	0306; 0501; 0401; ~~0499~~
51513	Cyren 500 WP Insecticide	Ospray Pty Ltd	0406; 1101; ~~0599~~
51524	YTex Warrior Insecticidal Cattle Ear Tags	Flycam Pty Ltd	0303; 0202; ~~0999~~
51592	Prefos Termiticide	Imtrade Australia Pty Ltd	0899 ; ~~0199~~
51624	Prowler 300 Insecticide	Imtrade Australia Pty Ltd	0502; ~~0799~~
51769	Garrards Ant Killer 50	Garrards Pty Ltd	0402; ~~0699~~

NCRIS Number	Product name	Company Name	Label Approval Numbers*
51875	Pidgeon's Pest Controller 500 Termiticide and Insecticide	Superway Garden Ag & Pest Products Pty Ltd	1206; 0406; 0402; 1100; 0100; ~~1199; 0599~~
51908	Terminova Micro-Lo Insecticide	Ospray Pty Ltd	0203
52045	Cyren 300 ULV/EC Insecticide	Ospray Pty Ltd	0501; ~~0899~~
52167	Munns Lawn Grubs, Lawn Beetle Grubs & Sater Killer with Long Life Organically Advanced Weta-Lawn	Munns Lawn Company Pty Ltd	0999
52235	Farmoz Cyren 500 WP Insecticide	Farmoz Pty Limited	0405; 0301; ~~1099~~
52317	Rentokil Chlorpyrifos Paste	Rentokil Initial Pty Ltd	0301
52564	David Grays Antex 50 Granular Professional Insecticide	David Gray & Co. Pty Limited	0401; 0200
52596	United Farmers Chlorpyrifos 500 Insecticide and Termiticide	UnitedFarmers Co-operative Company Ltd	0203; 0102; 0300
53013	Optem Duo Termiticide and Insecticide	PCT Holdings Pty Ltd	0302
53192	Country Micro-Lo Pre-Construction/Post-Construction Termiticide and Insecticide	Accensi Pty Ltd	0103; 0301
53428	Generifos 500EC Insecticide	Grow Choice Pty Limited	0202
53771	Suscon Plus Soil Insecticide	Crop Care Australasia Pty Ltd	0905; 0801
54546	Pyritilene Banana Bags	Makhteshim-Agan (Australia) Pty Limited	0205; 0404
54957	WSD Chlorpyrifos 500 EC Insecticide	Rebop Holdings Pty Ltd t/a Western Stock Distributors	0502
54963	Suscon Ribbon Insecticide	Crop Care Australasia Pty Ltd	0803; 0203; 1002
55213	Kenso Agcare Kensban 500 Insecticide	Kenso Corporation (M) Sdn Bhd	0302
55444	Searles Ant Kill 50 Granules	J C & A T Searle Pty Ltd	0206; 0602
55755	Fortune 500 Multi-Purpose Insecticide and Termiticide	PCT Holdings Pty Ltd	0502
55897	Conquest Chlorpyrifos 500 Insecticide	Conquest Agrochemicals Pty Ltd	0408; 0702
55961	Searles Lawn Grub Killer Granules	J C & A T Searle Pty Ltd	0206; 0702
56209	Superway Grub, Ant and Pest Controller	Superway Garden Ag & Pest Products Pty Ltd	0103
56495	Richgro Home Garden Ant Killer	A Richards Pty Ltd t/a Richgro Garden Products	0206; 0304

NCRIS Number	Product name	Company Name	Label Approval Numbers*
56616	Garden King Lawn Grub & Beetle Killer Granules	Ecofertiliser Pty Ltd	0303
56817	Searles Kill Ant 50 Granules	J C & A T Searle Pty Ltd	0103
56818	Searles Dead Ant 50 Granules	J C & A T Searle Pty Ltd	0103
57758	David Grays Lawn Beetle & Grub Killer Insecticide	David Gray & Co. Pty Limited	0903
58188	Surefire Lawn Grub,Ant and Outdoor Pest Insecticide	PCT Holdings Pty Ltd	1103
58286	Richgro Ant Killer	A Richards Pty Ltd t/a Richgro Garden Products	0206; 0304
58287	Richgro Slater Killer	A Richards Pty Ltd t/a Richgro Garden Products	0206; 0506; 1004
58294	Richgro Lawn Beetle Killer	A Richards Pty Ltd t/a Richgro Garden Products	0206; 0304
58479	Grass Gard Lawn Beetle & Grub Spray	Heiniger Home & Garden Care Pty Ltd	0205; 1208
60188	Genfarm Chlorpyrifos 500 Insecticide	Genfarm Crop Protection Pty Ltd	1106; 0905
60611	Agspray Chlorpyrifos 500EC Insecticide	Agspray Chemical Co Pty Ltd	0806
61071	Farmoz Strike-Out 500 WP Insecticide	Farmoz Pty Limited	0906
61257	Garden King Grubkil Lawn Grub & Beetle Killer	Ecofertiliser Pty Ltd	1106
61354	Searles Lawn Grub Killer Hose On	J C & A T Searle Pty Ltd	1006
61533	Amgrow Sir Walter Buffalo Lawn Pest Control	Ecofertiliser Pty Ltd	0808; 1206
62909	Allfire Chlorpyrifos 500 Insecticide	Ospray Pty Ltd	0308
63145	AW Chop 500 Insecticide and Termiticide	Agri West Pty Limited	0908
63451	Grass Valley Chlorpyrifos 500 Insecticide	Grass Valley Formulators Pty Limited	0109
63548	Chemforce Chlorpyrifos 500 Insecticide	Frank Vanderkley & Paul Richards t/a Chemforce Australia	1108

Ψ Labels transitioned from the states and not having an approval number.

***** : Label numbers with a line through them were cancelled in 2001-2003, as a result of implementing the recommendations of the 2000 Interim Review Report.

85 products

APPENDIX C: STOPPED PRODUCTS[55]

(as at 13 August 2009)

NCRIS Number	Stopped Product's Name	Company Name	Label Approval Numbers	Expiry Date
32889	Dursban Micro-Lo Termiticide and Insecticide	Dow Agrosciences Australia Limited	0501	30/6/2010
40812	Campbell Pyrinex 500 WP Insecticide	Colin Campbell (Chemicals) Pty Ltd	0502	30/6/2010
49055	Predator 300 Insecticide	Dow Agrosciences Australia Limited	0905; 0501	30/6/2010
49809	Empire Insecticide	Dow Agrosciences Australia Limited	0301	30/6/2010
50560	Rescue Insecticide	Dow Agrosciences Australia Limited	0102; 1100	30/6/2010
50740	Baygon (Bayer) Cockroach Stopper Killing Gel	S.C. Johnson & Son Pty Ltd	0201	30/6/2011
51140	Exelpet Fleaban no Fleas Flea & Paralysis Tick Spray for Dogs	Exelpet Products a Div of Mars Australia Pty Ltd	0998	30/6/2010
52870	Snare Termiticide and Insecticide	Dow Agrosciences Australia Limited	0501	30/6/2010
53012	Protem Micro Lo Termiticide and Insecticide	PCT Holdings Pty Ltd	0302	30/6/2011
54126	Baygon Cockroach Micro Baits	S.C. Johnson & Son Pty Ltd	0601	30/6/2011
54209	Mortein Lure 'n' Kill Cockroach Baits 3 Months Continuous Control 12 Baits	Reckitt Benckiser (Australia) Pty Limited	0405; 0501	30/6/2011
54210	Mortein Lure 'n' Kill Cockroach Baits 3 Months Continuous Control 6 Baits	Reckitt Benckiser (Australia) Pty Limited	0405; 0501	30/6/2011
54211	Mortein Nest Kill Cockroach Baits	Reckitt Benckiser (Australia) Pty Limited	0102	30/6/2011
55186	Kenso Agcare Kensban 300 Duo Insecticide	Kenso Corporation (M) Sdn Bhd	0202	30/6/2011
55208	Halley Chlorpyrifos 500 Insecticide	Halley International Enterprise (Australia) Pty Ltd	0203; 0203; 0702	30/6/2011
55423	Baygon Cockroach Stopper Baits	S.C. Johnson & Son Pty Ltd	0302	30/6/2011
57780	Baygon Cockroach Stopper	S.C. Johnson & Son Pty Ltd	0603	30/6/2011
57802	Raid Protector Maxkill Baits Cockroach Baits	S.C. Johnson & Son Pty Ltd	0503	30/6/2011
59414	Yates Insect Control Blitzem Lawn Bettle & Slater Killer Granules	Yates Australia a Div of Orica Australia Pty Ltd	0105	30/6/2010

55 Stopped products are those products where registration of the product is not renewed. This means that the product may no longer be manufactured, but there is 2-year period during which (a) wholesale and retail stock may be sold and (b) product purchased before and during the 2-year period may be used.

NCRIS Number	Stopped Product's Name	Company Name	Label Approval Numbers	Expiry Date
59804	Ospray Chlorpyrifos 500 EC Insecticide	Ospray Pty Ltd	0705	30/6/2010
60410	Tradelands Chlorpyrifos 500 EC Insecticide	Ospray Pty Ltd	1105	30/6/2010
62909	Allfire Chlorpyrifos 500 Insecticide	Ospray Pty Ltd	0308	30/6/2011

22 products

APPENDIX D: PRODUCTS CANCELLED BY THE APVMA ON 29 AUGUST 2000

These products were specifically cancelled as an outcome of the interim review decisions of 2000. In all cases, their expiry date for retail sale, and use of product purchased before 29 August 2000 and during the cancellation period, was 31 December 2001. Remaining wholesale stock was recalled and manufacture ceased at 29 August 2000.

NCRIS Number	Product Name	Company Name	Label Approval Numbers	Comments
32882	CRG Grass-Gard Lawn Insecticide	Heiniger Home & Garden Care Pty Ltd	Ψ	240 g/L EC for use in domestic[56] areas, on domestic lawn and on domestic turf.
32883	Chemspray Ant, Spider & Cockroach Killer Insectcide	Garden King Products Pty Ltd	0598 Ψ	480 g/L EC for use in domestic areas and home garden.
32884	Chemspray Chlorban Insecticide	Garden King Products Pty Ltd	01 Ψ	240 g/L EC for use in domestic areas and on domestic lawn.
32897	David Gray's Chlorpyrifos 200 Termite Spray	David Gray & Co. Pty Limited	Ψ	240 g/L EC for use in domestic areas.
32905	Garden King Peskil C Insecticide	Garden King Products Pty Ltd	01 Ψ	240 g/L EC for use in domestic areas.
41073	CRG Terminant Plus ant and Termite Killer	Heiniger Home & Garden Care Pty Ltd	Ψ	240 g/L EC for use in domestic areas.
42033	David Gray's Lawn Beetle Spray	David Gray & Co. Pty Limited	Ψ	200 g/L EC for use on domestic lawn
48958	Richgro Garden Products Ant, Spider & Cockroach Killer Insecticide	A Richards Pty Ltd t/a Richgro Garden Products	1298 01	240 g/L EC for use in domestic areas.
49454	Garden King Fix Ant Insecticide	Garden King Products Pty Ltd	1297	240 g/L EC for use in domestic areas.
50318	Garden King Grub Kill Insecticide	Garden King Products Pty Ltd	0298	240 g/L EC for use on domestic lawn.
50335	Richgro Garden Products Lawn Grub and Beetle Killer Insecticide	A Richards Pty Ltd t/a Richgro Garden Products	0298	240 g/L EC for use on lawn both domestically and in a commercial setting.
50566	David Gray's Grubkiller Insecticide	David Gray & Co. Pty Limited	0598	240 g/L EC for use on domestic lawn.

Ψ Labels transitioned from the states and not having and approval number.

12 products

56 The interim review decisions of 2000 included restriction of chlorpyrifos domestic products (which can include home garden and internal home/shed uses) to a maximum concentration of 50 g/L. Also domestic use inside buildings was restricted to crack and crevice treatment only i.e. broadcast application inside buildings, or internal walls/ceilings etc., was no longer permitted.

APPENDIX E: PRODUCTS VOLUNTARILY CANCELLED BY REGISTRANTS DURING THE COURSE OF THE REVIEW

Unless otherwise stated, the expiry date for the voluntarily cancelled products is 2 years after the cancellation date.

NCRIS Number	Product Name	Company Name	Label Approval Numbers	Comments
32890	Dursban PC Termiticide and Insecticide	Dow Agrosciences Australia Limited	1199; 1297; Ψ	500 g/L EC for commercial pest control, including termite and mosquito control. Voluntarily cancelled 26 February 2002.
32894	Lorsban 500 W Insecticide	Dow Agrosciences Australia Limited	0399; 0798; 0698; 0498; 02; 01; Ψ	500 g/L WP for pest control in commercial field and horticultural crops. Voluntarily cancelled 19 March 2001.
33605	Zodiac Long Life Flea Cat Collar	Novartis Animal Health Australasia Pty.Limited	Ψ	40 g/kg flea/tick collar for cats. Voluntarily cancelled 14 August 2000.
38930	Vet-Kem Long Life Flea Cat Collar	Novartis Animal Health Australasia Pty.Limited	0198; 01; Ψ	40 g/kg flea/tick collar for cats. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
38933	Zodiac Long Life Flea & tick Dog Collar	Novartis Animal Health Australasia Pty.Limited	01; Ψ	80 g/kg flea/tick collar for dogs. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
40117	Vet-Kem Long Life Flea and Tick Dog Collar	Novartis Animal Health Australasia Pty.Limited	0198; Ψ	80 g/kg flea/tick collar for dogs. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
41818	Addimix Chlorpyrifos Insecticide 500 EC	Addimix Pty Ltd	Ψ	500 g/L EC for commercial pest control, including termite and mosquito control. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
42062	Hygrain Beetle Baits	Hygrain Pty Ltd	Ψ	20 g/kg bait for soil insect control in commercial field crops. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
48029	Dursban Pre-Construction Termiticide	Dow Agrosciences Australia Limited	1297; 1199; 4821	450 g/L EC for commercial termite control of buildings under construction. Voluntarily cancelled 26 February 2002
48624	Blattanex (Bayer) Cockroach Baits	Bayer Australia Ltd (Animal Health)	01	5 g/kg baits for commercial cockroach control in buildings/public/domestic areas. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
48764	Iban 500 EC Insecticide	United Phosphorus Ltd	01	500 g/L EC for pest control in commercial field and horticultural crops (including ornamentals in pots), turf, and commercial pest control of industrial, commercial, public, domestic and agricultural areas. Voluntarily cancelled 12 June 2002

NCRIS Number	Product Name	Company Name	Label Approval Numbers	Comments
48774	Lief Chlorpyrifos Insecticide	Lief Resources Pty Ltd	01	500 g/L EC for pest control in commercial field and horticultural crops, turf, and commercial pest control of industrial, commercial, public, domestic and agricultural areas. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
49944	Proficid (Bayer) Cockroach Paste	Bayer Australia Ltd (Animal Health)	0898	16 g/kg paste for commercial cockroach control in agricultural, domestic, office, school, commercial and industrial premises and transport vehicles. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
50002	Proficid (Bayer) Cockroach Baits	Bayer Australia Ltd (Animal Health)	01	5 g/kg baits for domestic cockroach control in domestic and public areas, and in commercial and industrial premises. Voluntarily cancelled 30 November 2000 (expiry date 29 November 2001).
51286	Snare Termiticide	Dow Agrosciences Australia Limited	0998	450 g/L EC for commercial termite control of buildings under construction. Voluntarily cancelled 19 March 2001
51448	Superfos Termiticide and Insecticide	Superway Garden Ag & Pest Products Pty Ltd	0200; 0799; 0299; 1198	450 g/L EC for commercial termite control of buildings under construction, mosquito control, and general pest control in and around commercial, industrial, domestic and public areas. Voluntarily cancelled 13 December 2001
51792	JWK Chlorpyrifos 450 Termiticide and Insecticide	JWK Services Pty Ltd	0599; 0499	450 g/L EC for commercial termite control of buildings under construction, mosquito control, and general pest control in and around commercial, industrial, domestic and public areas. Voluntarily cancelled 12 June 2002 (expiry date 12 June 2002).
52038	Kensban 500EC Insecticide	Chin-Huat Teo for Kenso Corporation (M) Sdn Bhd	1099	500 g/L EC for pest control in commercial field and horticultural crops. Voluntarily cancelled 12 February 2001

Ψ Labels transitioned from the states and not having and approval number.

18 products