



**Australian Pesticides &
Veterinary Medicines Authority**

**The reconsideration of registrations of products
containing carbaryl and their approved associated labels**

Part 1:

**Uses of carbaryl in home garden, home veterinary,
poultry and domestic situations**

**FINAL REVIEW REPORT
AND
REGULATORY DECISION**

VOLUME 1: REVIEW SUMMARY

JANUARY 2007

Review Series 4

**Australian Pesticides &
Veterinary Medicines Authority**

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Australia**

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FOREWORD

The Australian Pesticides & 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 products containing carbaryl 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 or people using anything containing its residues; and/or
- would not be likely to have an effect that is harmful to human beings.

The requirements for continued approval of a label for containers for a chemical product are that the label contains adequate instructions. 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
- safe handling of the product.

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

In undertaking reconsiderations (hereafter referred to as reviews), the APVMA works in close cooperation with advisory agencies including the Department of Health and Ageing's Office of Chemical Safety, the Department of the Environment and Heritage, 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

* Prior to March 2003, the APVMA was known as the National Registration Authority for Agricultural and Veterinary Chemicals (NRA). In this report, the name APVMA is generally used even when referring to the organisation prior to March 2003.

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 final review findings and regulatory decision relating to products containing carbaryl and their approved labels used in home garden, home veterinary, poultry and domestic situations, that have been reviewed by the APVMA.

The final review report and regulatory decision containing the APVMA assessments (Volume 1, January 2007) and the technical reports from its advisory agencies (Volume 2) are available from the APVMA website: <http://www.apvma.gov.au/chemrev/chemrev.shtml>.

ACRONYMS AND ABBREVIATIONS

ac	active constituent
ACPH ¹	Advisory Committee on Pesticides and Health
ADI	Acceptable daily intake
ai	Active ingredient
ARfD	Acute Reference Dose
BA	2-bromoacrolein
CCPR	Codex Committee on Pesticide Residues
ChE	Cholinesterase
CODEX	FAO/WHO Codex Alimentarius Commission
CRP	Chemistry and Residues Program
DEH	Department of the Environment and Heritage (previously Environment Australia)
DoC	Declaration of composition
EHC	Environmental health criteria
F0	Parental generation
F1	Filial generation, first
F2	Filial generation, second
FAISD	Handbook of First Aid Instructions, Safety Directions, Warning Statements and General Safety Precautions for Agricultural and Veterinary Chemicals
FAO	Food and Agriculture Organization
FSANZ	Food Standards Australia New Zealand
GAP	Good agricultural practice
GLP	Good laboratory practice
ha	hectare
HG	Home garden
HR	Highest residue
HV	Home veterinary
IRED	Interim re-registration eligibility decision
JMPR	Joint FAO/WHO Meeting on Pesticide Residues
LD ₅₀	Median lethal dose
LOAEL	Lowest observable adverse effect level
LOEL	Lowest observable effect level
mg/kg bw/d	milligrams/ kilogram bodyweight/day
MOE	Margin of Exposure
MoS	Margin of safety
MRL	Maximum residue limit
NEDI	National estimated daily intake
NESTI	National estimated short-term intake
NHMRC	National Health and Medical Research Council
NOAEL	No observed adverse effect level
NOEC	No observed effect concentration
NOEL	No observed effect level
NOHSC ²	National Occupational Health and Safety Commission
NRS	National Residue Survey
OCS	Office of Chemical Safety
OHS	Occupational health and safety
PACSC	Pesticide and Agricultural Chemical Standing Committee
PHED	Pesticide Handlers Exposure Database
PHI	Post harvest interval
POEM	Predictive Operator Exposure Model
PPE	Personal protective equipment

¹ The ACPH last sat in 2003. It has recently been superseded by the Advisory Group on Chemical Safety (AGCS)

² Occupational health and safety assessments that were conducted by NOHSC are now conducted by OCS

ppm	Parts per million
RAC	Raw agricultural commodity
RBC	Red blood cell
SC	Suspension concentrate
STMR	Supervised Trial Median Residue
SUSDP	Standard for the Uniform Scheduling of Drugs and Poisons
T/A	Trading as
TMRL	Temporary MRL
TRR	Total radioactive residues
WHO	World Health Organization
WHP	Withholding period
WP	Wettable powder

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EXECUTIVE SUMMARY

INTRODUCTION

The APVMA has reviewed registered products containing carbaryl and the associated label approvals. This Final Review Report and Regulatory Decision summarises the data evaluated and the recommendations from the review of the uses of carbaryl in home garden, home veterinary, poultry and domestic products. One commercial use of carbaryl—in poultry—is also included in this report. The poultry use is included because the product label includes home veterinary uses.

The carbaryl review has been split into two parts. Part 1 of the review is looking at products that are used in the home garden, home veterinary, poultry and domestic situations. Part 2 of the review is looking at the products used in agriculture. The review has been split into two parts, because the consideration of carbaryl agricultural products required further assessments to be undertaken. The APVMA has been able to progress the review for products used in home garden, home veterinary, poultry and domestic situations ahead of completing the assessment of agricultural products.

All references to carbaryl in this document refer to carbaryl products used in home garden, home veterinary, poultry and domestic situations. A Preliminary Review Findings (PRF) report on the uses of carbaryl in agricultural situations (Part 2) was released in July 2006 and is available on the APVMA web site www.apvma.gov.au.

Carbaryl is a carbamate insecticide that is used for the control of insect pests in home garden and domestic situations, on ornamentals, lawns, fruit and vegetables and around public buildings. To a lesser extent it is also used in the control of insects on domestic animals. Formulations of carbaryl include emulsifiable concentrates, suspension concentrates, aqueous concentrates, wettable powders, ready-to-use dusts, ready-to-use liquids and solid formulations. At the finalisation of the review there were 21 registered products containing the active constituent carbaryl that are used in home garden and domestic situations (refer Appendix A).

The review of carbaryl was initiated in 1995 to reconsider the maximum residue limits (MRLs) in cereals and also to establish MRLs for animals that may be fed on treated cereal products. In 1999, the toxicology review identified the potential for excessive human exposure to carbaryl. This was considered to have implications for exposure of consumers through use of carbaryl in the home garden. The scope of the review was extended to reconsider whether the uses of products containing carbaryl as home garden or home veterinary applications would have an effect that was harmful to human beings. This extension included associated product labels. The scope of the review was extended a second time in June 2003, when concerns over the implications of acute dietary intake of carbaryl were identified following the establishment of a new acute reference dose (ARfD) for carbaryl.

TOXICOLOGICAL ASSESSMENT

The toxicological assessment for the review of carbaryl was undertaken by the Office of Chemical Safety (OCS), which considered all the toxicological data and information submitted for the review. The APVMA has considered the advice received from the OCS and makes the following recommendations relating to the continued use of home garden, home veterinary, poultry and domestic products containing carbaryl.

An assessment of the toxicological data provided to the review has concluded that pet shampoos, 1% ready to use liquid sprays and home veterinary ear drop carbaryl products would not be likely to be an undue hazard to the safety of people exposed to it during its handling or have an effect that is harmful to human beings. Registrants of these products have elected to voluntarily cancel their products before the completion of the review and therefore, are no longer being considered in the review.

Based on the data provided it was found that user exposure from home veterinary dust preparations for the treatment of companion animals and birds is likely to exceed the acceptable daily intake (ADI) and recommended acute reference dose (ARfD). Revised warning statements and enhanced personal protective equipment are not likely to be effective in protecting users from absorbing systemic doses of carbaryl. Therefore, the APVMA is not satisfied that home veterinary dust preparations intended for the treatment of companion animals and birds would not be an undue hazard to the safety of people exposed to it during its handling and would not have an effect that is harmful to human beings. Therefore, the registrations and label approvals of these products have been cancelled.

Insufficient data were received and no further data were provided or generated to enable an assessment of householder exposure and ensure an adequate margin of safety for carbaryl dusts for treatment of carpets, rugs and animal bedding. Therefore, the APVMA is not satisfied that products containing carbaryl for these domestic uses would not be an undue hazard to the safety of people exposed to it during its handling and would not have an effect that is harmful to human beings. Therefore, the registrations and label approvals of these products have been cancelled.

The APVMA considers that any product with an acute oral LD₅₀ of 1500 mg/kg bw or less is not suitable for domestic/home garden use, because of the toxicological risk. It was found that products containing carbaryl and marketed as 800 g/kg wettable powder and liquids containing 400 and 500 g/L carbaryl are above this safety threshold. Therefore, the APVMA cannot be satisfied that domestic/home garden products with a maximum carbaryl concentration of greater than 160 g/kg (or g/L), would not be an undue hazard to the safety of people exposed to it during its handling and would not be likely to have an effect that is harmful to human beings. Therefore, because of the unacceptable risk, the registrations and label approvals of these products have been cancelled. The concentration of domestic/home garden products will be restricted to a maximum carbaryl concentration of 160 g/kg (or g/L).

The toxicological assessment concluded that insufficient data were received and no further data were provided or generated to determine user exposure from home garden uses of carbaryl on food-producing plants. There were also insufficient data available to ensure dietary intake would not exceed the acute reference dose. Therefore, the APVMA is not satisfied that such uses would not be an undue hazard to the safety of people exposed to it during its handling and would not be likely to have an effect that is harmful to human beings. Therefore, the uses of carbaryl on food-producing plants in the home garden have been deleted and product labels be varied. Products registered exclusively for these uses have had their registrations and label approvals cancelled.

RESIDUES ASSESSMENT

The residues assessment for the review of carbaryl was undertaken by the APVMA Chemistry and Residues Program (CRP), which considered all the residue data and information submitted for the review of carbaryl. The APVMA has considered the advice received from

the CRP and makes the following recommendations relating to the continued use of home garden and poultry products containing carbaryl.

One carbaryl product is registered for a direct treatment to poultry. Insufficient data were received and no further data were provided or generated to assess residues in poultry from direct animal treatment. Therefore, the APVMA is not satisfied that the use of the product in accordance with the instructions for its use would not result in residues in poultry commodities exceeding the limits established or that the use of the product would not be an undue hazard to the safety of people using anything containing its residues. Other uses of the product as companion animal dust are also not supported on toxicological grounds. Therefore, the registration and label approvals of this products has been cancelled.

Insufficient data were received and no further data were provided or generated to enable the assessment of residues in some fruit and vegetables grown in the home garden, including tropical fruit (both edible and inedible peel varieties), citrus fruits (except oranges), brassica vegetables (except cabbage, broccoli and cauliflower), cucurbit vegetables (except cucumber, cantaloupe, bottle gourd and zucchini), carrots and parsnips, pulses, bulb vegetables and stalk and stem vegetables. Therefore, the APVMA is not satisfied that use of carbaryl products on the above fruit and vegetable crops would not be an undue hazard to the safety of people using anything containing its residues. Instructions for use on the above crops identified as having insufficient data have been deleted from labels and some product labels have been varied. For products registered exclusively for these uses their registrations and label approvals have been cancelled.

Sufficient data were received to enable the assessment of residues in some fruit and vegetables grown in the home garden including grapes, oranges, pome fruit (late pre-harvest applications only), stone fruits, cabbage, broccoli and cauliflower, cucumber, cantaloupe, bottle gourd and zucchini, leafy vegetables and fruiting vegetables. Because of unacceptable residues and acute dietary risk, the APVMA is not satisfied that use of carbaryl products on these fruit and vegetable crops would not be an undue hazard to the safety of people using anything containing its residues and product labels have been varied. For products registered exclusively for these uses their registrations and label approvals have been cancelled.

Based on the submitted data the APVMA is satisfied that continued use of registered carbaryl products on raspberries, beetroot, potato, sugarbeet, turnips (Swede) would not be an undue hazard to the safety of people using anything containing its residues. However, because of the potential for unrestricted use in the home garden, these products could pose a toxicological hazard and therefore, these use patterns have been removed from home garden product labels.

FINAL REVIEW OUTCOMES

After consideration of all data, the APVMA has undertaken the following regulatory actions:

a) Vary label approvals.

Label variations to satisfy the requirements for continued registration of products are as follows:

- update warning statements and safety directions
- delete uses where unacceptable risks were identified

- add new label statements to home garden products as a result of unacceptable exposure risk.

b) Affirm product registrations.

Three products labels have been varied in accordance with the requirements in part (a) above therefore, three products would not be an undue hazard to the safety of people exposed to it during its handling or people using anything containing its residues and have been affirmed.

c) Cancel product registrations and label approvals.

- Registrations of carbaryl based home veterinary dusts registered for the treatment of animals and birds.
- Registration of a carbaryl based treatment for poultry.
- Registrations of carbaryl dusts for treatment of carpets, rugs and animal bedding.
- Products containing 800 g/kg wettable powder and liquids containing 400 and 500 g/L carbaryl for use in domestic/home garden situations.
- Use of carbaryl (all forms) for indoor use on domestic premises.

The APVMA is not satisfied that the requirements for continued registration of 18 products continue to be met and variations can not be made so that the requirements for continued registration will be complied with; hence it is proposed that these 18 registrations and approvals have been cancelled.

1 INTRODUCTION

The APVMA has reviewed registered products containing carbaryl and their associated label approvals. This Review Findings document summarises the data evaluated and the proposed regulatory action arising as a result of the review of carbaryl products used in home garden, home veterinary, poultry and domestic situations. One commercial use of carbaryl in poultry, is also included in this report. The poultry use is included because the product label includes home veterinary uses. All references to carbaryl in this document refer to carbaryl products used in home garden, home veterinary, poultry and domestic situations. A Preliminary Review Findings (PRF) report on the uses of carbaryl in agricultural situations (Part 2) was released in July 2006 and is available on the APVMA web site www.apvma.gov.au.

1.1 REGULATORY STATUS OF CARBARYL IN AUSTRALIA

Carbaryl has been registered in Australia for over 30 years. As at 20 November 2006 there were 21 registered products containing the active constituent carbaryl for use in home garden, home veterinary, poultry and domestic situations (Appendix A). Product formulations contain carbaryl either as the sole active constituent or in combination with other active constituents. Formulations of carbaryl include emulsifiable concentrates, suspension concentrates, aqueous concentrates, wettable powders, ready-to-use dusts, ready-to-use liquids and solid formulations. The formulation types are set out in Table 1. Section 2 of this report provides information on the uses of carbaryl products.

Table 1: Registered formulations of carbaryl under review

Formulation type	Level of active constituent	Product type
Emulsifiable concentrate	500 g/L	Agricultural and home garden insecticide concentrate
	100 g/L	Home garden insecticide concentrate
Suspension concentrate	400–500 g/L	Agricultural and home garden insecticide concentrate
	100 g/L	
Wettable powder	800 g/kg	Agricultural and home garden insecticide
	80–120 g/kg	
Ready-to-use dust	40–50 g/kg	Home garden and commercial bird dusting powder
	50 g/kg	Pet grooming, carpet and pet bedding treatment powder
	18–50 g/kg	Home garden insect bait
	20 g/kg	Agricultural and home garden vegetable dust
	19 g/kg	Home garden flower and vegetable dust
Ready-to-use liquid	0.96 g/L	Home garden insecticide
	2–40 g/L	Pet shampoo
Aqueous concentrate	60 g/L	Domestic lawn insecticide concentrate
	100 g/L	Home garden insecticide concentrate
	400 g/L	
	18 g/kg	Bait pellet
Liquid	10 mg/mL	Ear drop

1.2 REASONS FOR CARBARYL REVIEW

In 1993 the maximum residue limits (MRLs) for carbaryl use on cereal crops were withdrawn following a residue assessment that showed that the available Australian residue data were inadequate to support the existing MRLs. Temporary MRLs were put in place at that time to allow trials to be carried out.

Insufficient residue data were subsequently provided to support ratification of the temporary MRLs in relation to the use of carbaryl in cereals, either by field application or for stored grain use. A review was initiated in 1995 to reconsider residues in cereals and also to establish MRLs for animals that may be fed on treated cereal products.

In 1999, toxicology reviewers also identified the potential for excessive human exposure to carbaryl. This was considered to have serious implications for exposure of consumers through use of carbaryl in the home garden. The scope of the review was therefore extended to reconsider whether the uses of products containing carbaryl as home garden and home veterinary applications (and the products' associated labels) would have an effect that was harmful to human beings.

More recently (June 2003) the APVMA extended the scope of the review a second time when concerns over the implications of acute dietary intake of carbaryl were identified.

1.3 REGULATORY OPTIONS

There can be three possible outcomes to the reconsideration of the registration of products containing carbaryl and their labels. 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 therefore affirms the registrations and approvals
- 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 varies the conditions of registration or approval
- not satisfied that the requirements for continued registration and approval continue to be met and suspends or cancels the registration and/or approval.

1.4 SCOPE OF THE REVIEW

The scope of the review considered the reasons for the nomination of carbaryl, the information already available on this chemical, and the approved uses of the product in Australia.

In light of concerns raised by the Office of Chemical Safety (OCS) and the APVMA, it did not appear that the APVMA could be satisfied that the continued use of or any other dealing with products containing carbaryl in accordance with the approved instructions for use:

- would not be an undue hazard to the safety of people exposed to it during its handling or people using anything containing its residues; and/or
- would not be likely to have an effect that is harmful to human beings.

The APVMA also considered whether product labels carry adequate instructions and warning statements. The requirement for product labels is that the label contains adequate instructions. Such instructions include:

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

On the basis of these concerns, it was appropriate that the registrations and label approvals for carbaryl be subject to reconsideration under Part 2, Division 4, of the Agvet Codes.

The APVMA reviewed the following aspects of product registrations and label approvals for home garden and domestic uses of carbaryl:

- toxicology, including:
 - the potential for home garden, home veterinary and domestic products to cause acute and chronic toxicity, that could be an undue hazard to the safety of people exposed to it during its handling and could have an effect that is harmful to human beings
- residues in food, including:
 - the potential for carbaryl residues
 - the potential for acute and chronic dietary exposure to carbaryl residues in food commodities
 - the potential for consumption of carbaryl residues in food to exceed the ARfD, that may be an undue hazard to the safety of people exposed to carbaryl residues in food.

The APVMA also considered whether product labels carry adequate instructions and warning statements as outlined in Section 1.4 above.

2 APPROVED CARBARYL USE PATTERNS

2.1 INTRODUCTION

Carbaryl is a broad spectrum, general purpose carbamate insecticide effective against a range of insects, mites, lice, millipedes and other pests. It is used in home garden, home veterinary, poultry and domestic situations and has a very short persistence.

2.2 HOME GARDEN AND DOMESTIC USE PATTERNS OF CARBARYL PRODUCTS IN AUSTRALIA

Comments received at the commencement of the review indicated that carbaryl is the insecticide of choice for the management of most chewing insect pests in gardens including leafminers, caterpillars, grubs, grasshoppers, mites, aphids and lacewings. It is selectively active and very effective against millipedes, earwigs and pear and cherry slugs. Carbaryl was also highlighted as one of the few chemical products available for the control of Lepidoptera in the home garden and also considered an extremely important chemical for control of black Portuguese millipede (*Ommatoiulus moreletii*), found in home gardens in South Australia and Western Australia.

Home garden products (Table 2) are also reported as being used in nurseries, mainly due to the small amount of chemical used on each occasion with the small pack size also minimising the need for storage of chemicals.

Table 2: Summary of home garden uses of carbaryl products

Crop	Pest	Product description	Application instructions
FRUIT			
Apple, apricot, avocado, citrus, fruit (general), grape, nectarine, peach, pear, plum, prune, stone fruit	Codling moth, light brown apple moth, pearleaf blister mite, borer, native budworm, oriental fruit moth, monolepta beetle, bronze orange bug, weevils, scale, grapeleaf blister mite, pear and cherry slug, green treehopper	WP 80–120 g/kg	Either packed in 60 g measure packs to be diluted into 5L water or use 0.8–1 g/L water.
		AC/SC 100 g/L	Dilute to 1g/L. Spray when insects first appear then every 7–10 days.
		AC 400–500 g/L	Use 1 g/L Spray 3 weeks after petal fall; repeat every 3–4 weeks.
		WP 800 g/kg	Use 1 g/L in water. Apply every 3 weeks from mid September.
VEGETABLES			
Tomato, vegetable (general), broccoli, bean, Brussels sprouts, cabbage, carrot, cauliflower, cucurbit, leafy vegetable, potato, root vegetable, turnip	Aphid, caterpillar, cutworm, blight, mite, leafhopper, thrips, tomato grub, ladybird, cabbage moth, earwig, cabbage white butterfly, weevil, Rutherglen bug, green vegetable bug, leaf spot, russet mite, harlequin bug, helicoverpa, lace bug, potato moth, pumpkin beetle, grasshopper	20 g/kg	Dust lightly over all surfaces every 7–10 days.
		WP 80–120 g/kg	Either packed in 60g measure packs to be diluted into 5L water or use 0.8–1 g/L water. Apply at 7–14 day intervals.
		Ready-to-use liquid 0.96 g/L	Spray plants thoroughly every 7 days.
		AC/SC 100 g/L	Dilute to 1 g/L. Spray when insects first appear then every 7–10 days.

Crop	Pest	Product description	Application instructions
		AC 400–500 g/L	Use 1 g/L ai. Apply at first signs of pest activity.
		WP 800 g/kg	Spray when insects first appear then every 7–10 days.
ORNAMENTALS			
Ornamentals, including: flowers, elm tree in non-crop situations, rose.	Lace bug, budworm, cabbage moth, cabbage white butterfly, caterpillar, cutworm, blight, earwig, green vegetable bug, harlequin bug, helicoverpa, leafhopper, lace bug, ladybird, leafroller, potato moth, pumpkin beetle, Rutherglen bug, tomato grub, grasshopper, caterpillar, fungus, leaf spot, thrips, elf leaf beetle, aphid	20 g/kg	Dust lightly over all surfaces every 7–10 days.
		WP 80–120 g/kg	Either packed in 60 g measure packs to be diluted into 5L water or use 0.8–1 g/L water. Apply at 7–14 day intervals.
		AC/SC 100 g/L	Dilute to 1 g/L. Spray when insects first appear then every 7–10 days.
		AC 400–500 g/L	Use 1 g/L ai. Apply at first signs of pest activity.
		WP 800 g/kg	Spray when insects first appear then every 7–10 days. Elf leaf beetle – apply to trunk of tree in December. Repeat 4–6 weeks later. Apply in 0.5m wide band around trunk.
DOMESTIC USES			
Carpet, garden, general home, general non-crop area, rug, animal bedding	Flea, louse, mite, millipede, grasshopper, cricket, earwig	18–50 g/kg dusts	Dust area where insects seen.
		50 g/kg (animal houses, bedding, carpet)	Apply 2 kg/100sq m dust through muslin bag or by powder or hand dust. Sprinkle on floor. Sprinkle over carpet and leave for at least 1 hour then vacuum. Repeat every 14 days.
		Bait 18 g/kg	Scatter bait in garden or fill tray and place wherever pests are present.
DOMESTIC LAWN AND TURF			
Lawn	Lawn grub, black-headed cockchafer, armyworm, budworm	Ready-to-use liquid 60 g/L	Use with a hose-on applicator. Spray at the first signs of infestation.
Turf	Black-headed cockchafer	AC/SC 100 g/L	Turf: dilute to 2.5 g/L. Spray 8L over 50 sq m.

2.3 HOME VETERINARY USES OF CARBARYL PRODUCTS IN AUSTRALIA

The majority of veterinary uses for carbaryl are for control of ectoparasites on domestic animals, including birds. The pests controlled include fleas, mites, mange and ticks. The products available for control of these pests are in the form of shampoos and dusting powders. There are also registered carbaryl products used to control earmites and bacterial/fungal ear infections in dogs and cats (see Table 3).

Table 3: Summary of home veterinary uses of carbaryl

Animal	Pest/condition	Product description	Application instructions
Dogs, cats, birds, rabbits, guinea pigs, mice and animal housing	Lice, ticks, mites, black beetles	Dusting powder containing 40 g/kg carbaryl and 10 g/kg of maldison	Apply directly to bird or animal and rub into coat, feathers or fur 50 g squeeze pack: Squeeze container quickly and firmly directing the resulting cloud of powder towards the bird. Liberally dust cage floor and perches
Dogs and cats	Earmites, mild bacterial and fungal ear infections	Ear drop containing 10 mg/mL carbaryl with 20 mg/mL salicylic acid and 2 mg/mL chlorocresol	Apply several drops to both ear canals twice daily for at least 14 days
	Brown dog ticks, mange mites, lice	Shampoo containing 10–40 g/L carbaryl (some products with other active constituents)	Wet coat and lather well with foam. Massage in and after 5 minutes rinse and dry thoroughly
Dogs, cats, rabbits, mice, guinea pigs	Fleas, ticks (except paralysis tick), lice	Grooming powder containing 50 g/kg carbaryl dust (some products with other active constituents)	Shake powder on to animal and work in well. Apply 0.25 g carbaryl brushed into the fur of the animal and excess removed with a damp cloth Brush off excess dust. Repeat each week

2.4 POULTRY USE OF A CARBARYL PRODUCT IN AUSTRALIA

There is one registered product—KEYDUST Dusting Powder—used on poultry in Australia. A summary of the use patterns for KEYDUST Dusting Powder is shown in Table 4.

Table 4: Currently registered use patterns for KEYDUST Dusting Powder on poultry and poultry housing

Pest	Product description	Application instructions	Withholding period
Poultry lice (order Mallophaga) Ticks (<i>Argasidae sp.</i> , <i>Dermanyssus sp.</i>) and mites (<i>Cnemidocoptes mutans</i> , <i>C. gallinae</i>).	Dusting powder containing 40 g/kg carbaryl and 10 g/kg maldison	Apply at a rate of 2 kg product/100 m ² (equivalent to 80 g carbaryl/100 m ²) Dust through muslin bag or by powder or hand duster evenly over litter, nest boxes, under perches or on birds direct	Meat: Nil Eggs: Nil
Black beetle (<i>Alphitobius</i>)		Apply at a rate of 1.7 kg product/100 m ² (equivalent to 68 g carbaryl/100 m ²). A 25 kg bag of product will cover an average broiler shed of 100 × 15 m Cast the dust against the walls, allowing the excess to fall to the floor. Pay particular attention to the base of the walls and any uprights from the floor	

3 ACTIVE CONSTITUENT ASSESSMENT

The active constituent assessment for the review of carbaryl was undertaken by the APVMA Chemistry and Residues Program. The active constituent assessment is summarised below.

3.1 CHEMICAL IDENTITY

Common name:	carbaryl (BSI, E-ISO, ANSI, ESA, BAN, SA)
Synonyms and code number:	Sevin; UC 7744; OMS 629; OMS 29; ENT 23 969
Chemical name:	1-naphthyl methylcarbamate (IUPAC) 1-naphthalenyl methylcarbamate (CAS)
CAS number:	63-25-2
Molecular formula:	C ₁₂ H ₁₁ NO ₂
Molecular weight:	201.2
Chemical structure:	

3.2 PHYSICAL AND CHEMICAL PROPERTIES OF THE ACTIVE CONSTITUENT

Carbaryl is manufactured to a high purity standard (minimum 980 g/kg).

Physical state:	Solid
Colour:	Colourless to light tan crystals
Odour:	Essentially odourless
Melting point:	142°C
Boiling point:	Decomposes
Solubility in water:	120 mg/L (20°C)
Density/specific gravity:	1.232 (20°C)
Solubility in organic solvents:	dimethylformamide and dimethyl sulfoxide 400–450 g/kg; acetone 200–300 g/kg; cyclohexanone 200–250 g/kg; isopropanol and xylene 100 g/kg (all at 25°C)
Octanol/water partition coefficient:	log P = 1.59
Vapour pressure:	4.1 × 10 ⁻² mPa
Flash point:	193°C
Corrosion characteristics:	Not corrosive
Thermal stability:	Stable to heat up to 70°C
Solution stability:	Stable under neutral and weakly acidic conditions. Hydrolysed in alkaline media to 1-naphthol; DT ₅₀ 12 days (pH 7), 3.2 hours (pH 9).
Storage stability:	Stable for at least 12 months at ambient temperature
Chemical type:	insecticide
Chemical family:	carbamate

3.3 COMPOSITION OF CARBARYL ACTIVE CONSTITUENT

3.3.1 Declaration of composition

The APVMA has previously evaluated declarations of composition (DoC) for all approved sources of carbaryl and found them to be acceptable. In each case the DoC lists the minimum carbaryl content and the maximum content of each relevant impurity present in the active constituent.

3.3.2 Food and Agriculture Organization (FAO) specification

The FAO specification for technical grade carbaryl (FAO Specification 26/TC/S (1989)) is as follows:

Carbaryl	Not less than 980 g/kg
2-Naphthol	Maximum 0.5 g/kg
2-Naphthyl methylcarbamate	Maximum 0.5 g/kg
Loss on vacuum drying	Maximum 10 g/kg

All APVMA-approved sources of carbaryl active constituent comply with the FAO specification.

3.3.3 APVMA minimum compositional standard

The APVMA minimum compositional standard for carbaryl is as follows:

Carbaryl	980 g/kg minimum
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All currently approved sources comply with the APVMA minimum compositional standard.

3.4 MANUFACTURE OF CARBARYL ACTIVE CONSTITUENT

All approved sources of carbaryl are manufactured by the same basic process. 1-Naphthol is reacted with methyl isocyanate in the presence of a catalyst. Carbaryl is crystallised from the reaction mixture at a purity of >980 g/kg.

4 SUMMARY OF DATA ASSESSMENTS

4.1 TOXICOLOGY

4.1.1 Introduction

The toxicological assessment examined:

- studies intended to elucidate the mechanism of tumour formation
- multi-generation and reproduction and developmental studies in rats and rabbits
- addenda to a previously evaluated developmental neurotoxicity study in rats
- a short-term repeat-dose study and a one-year study in dogs
- exposure studies undertaken on persons using American registered carbaryl products in simulated domestic settings.

The systemic doses likely to be delivered to users of registered carbaryl products under Australian conditions have also been estimated. These estimates have been related to toxicological benchmarks and recommendations made on the continued registration and conditions of use of carbaryl products. The Acceptable Daily Intake (ADI) of 0.008 mg/kg bw/d, was based on vascular tumour formation and the Acute Reference Dose (ARfD) of 0.01 mg/kg bw was based on ChE inhibition, clinical signs, and reduced bw gain.

4.1.2 Toxicology hazard profile

Absorption, distribution, metabolism and excretion in mammals

Rate and extent of oral absorption	Oral absorption is rapid and extensive in humans, rodents and other species. Dermal absorption from aqueous media is slow and saturable in rodents but enhanced in the presence of organic solvents. Pulmonary absorption is rapid.
Distribution	Small amounts in carcass, kidney and liver.
Potential for accumulation	Very low.
Rate and extent of excretion	Rapid, extensive, predominantly via urine in all species except dog.
Metabolism	Rapid. Proceeds via hydrolysis, alkyl oxidation, arene oxide formation, epoxide hydrolysis and glutathione conjugation. Pathways similar in humans, rodents and other species investigated.
Toxicologically significant compounds (animals, plants and environment)	Reactive epoxide intermediates may be formed in mice and rats.

Acute toxicity

Rat oral LD ₅₀ (mg/kg bw)	246
Worst oral LD ₅₀ in other species	150 mg/kg bw in cats
Rat dermal LD ₅₀ (mg/kg bw)	No data
Worst dermal LD ₅₀ in other species	>2000 mg/kg bw in rabbits
Rat inhalation LC ₅₀ (mg/m ³)	2500 (4h) as aerosol
Worst inhalation LC ₅₀ in other species	No data
Skin irritation	Classified as slight in rabbits

Eye irritation	Classified as not irritating in rabbits
Skin sensitiation	None in guinea pigs

Metabolites of carbaryl

Rat oral LD ₅₀ (mg/kg bw)	
4-hydroxycarbaryl	1190
5-hydroxycarbaryl	297
7-hydroxycarbaryl	4760
hydroxymethylcarbaryl	>5000
1-naphthol	2570

Short-term toxicity

Target/critical effect	ChE depression, cholinergic symptoms
Lowest relevant oral NOEL (mg/kg bw/d)	1 in rats (13-wk neurotoxicity study by gavage)
Lowest relevant dermal NOEL (mg/kg bw/d)	No data
Lowest relevant inhalation NOEC (mg/m ³)	10 in rats (90-d study, highest dose tested)

Genotoxicity

Genotoxicity	Clastogenic <i>in vitro</i> but not <i>in vivo</i> . Interrupts spindle formation <i>in vitro</i> . Overall weight of evidence lies against mutagenicity or genotoxic activity by other mechanisms.
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Long-term toxicity and carcinogenicity

Target/critical effect	Kidney: cloudy swelling of tubules
Lowest relevant NOEL (mg/kg bw/d)	1.8 in 1-yr dog study by gavage

Carcinogenicity	<p>Vascular tumours in male mice in a 2-yr dietary study at 16 mg/kg bw/d, the lowest dose tested. At the highest dose (1350 mg/kg bw/d), there was also development of renal adenoma and carcinoma in males, while hepatic adenoma and carcinoma became elevated in females.</p> <p>At the high dose of 420 mg/kg bw/d in a 2-yr rat dietary study, there was treatment-related formation of urinary bladder papilloma/carcinoma in both sexes, renal carcinoma and thyroid adenoma/carcinoma in males, and hepatic adenoma in females.</p>
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Reproductive toxicity

Reproduction target/critical effect	Decreased parental bw gain, bw, feed consumption and conversion efficiency, depressed gestation and lactation bw in rat dams, and increased pup mortality.
Lowest relevant reproductive NOEL (mg/kg bw/d)	4.7 in rats
Developmental target/critical effect	Skeletal and visceral abnormalities in dogs at and above 6.3 mg/kg bw/d in the absence of maternal toxicity.
Lowest relevant developmental NOEL (mg/kg bw/d)	3.1 in dogs

Delayed neurotoxicity

No effects

Immunotoxicity

No data

Dermal absorption

Dermal absorption	<p>In rat: Up to 2% of applied dose over 30 min, rising to a maximum of 25% at 24 h. Results obtained with formulated product applied in aqueous CMC vehicle.</p> <p>In humans: Up to 4.4% over 4 h and 16% over 8 h, applied in acetone vehicle.</p>
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Summary

ADI 0.008 mg/kg bw/d, based on vascular tumour formation.
Acute RfD 0.01 mg/kg bw based on ChE inhibition, clinical signs, and reduced bw gain.

NOEL (mg/kg bw/d)	Study	Safety factor
16 mg/kg bw/d*	2-yr dietary study in mice	2000 [#]
1 mg/kg bw/d	13-wk neurotoxicity and developmental neurotoxicity studies by gavage in rats	100

*LOEL value.

[#]The safety factor incorporates a 10-fold component for interspecies extrapolation, a 10-fold component for intraspecies variability, a 5-fold component for adequacy of the database, and a 4-fold component for seriousness of the carcinogenic response. (This 4-fold component comprises a 1-fold factor (low degree of confidence that carbaryl is genotoxic), a 4-factor (medium degree of confidence that carbaryl causes malignant tumours) and a further 1-fold factor (metastases not reported)).

Health value in drinking water

Current: 0.03 mg/L

4.1.3 Metabolism and toxicokinetics

The absorption, excretion and toxicokinetics of carbaryl are typical of the carbamate class. Carbaryl is extensively absorbed by the oral route and excreted rapidly in the urine by humans and experimental animals except dogs, in which the faeces are also a significant route of excretion. There is little tendency for carbaryl or its metabolites to accumulate in body tissues, even after subchronic administration.

4.1.4 Cholinesterase (ChE) inhibition

Carbaryl possesses anticholinesterase activity typical of members of the carbamate class. In rats, ChE inhibition reaches its maximum between 0.5 and one hour following carbaryl administration by gavage. The subsequent time course of ChE inhibition is both dose- and tissue/site-dependent. Recovery of plasma and red blood cell (RBC) cholinesterase activity is rapid (within two hours post dosing at 10 mg/kg, and within 24 hours at 50 mg/kg). At higher doses reversibility is more prolonged.

4.1.5 Genotoxicity

No new studies were presented for the review. Previous reviews of the genotoxic potential of carbaryl have concluded that carbaryl does not damage DNA and is unlikely to be mutagenic in humans.

4.1.6 Neurotoxicity and behavioural studies

The effects of carbaryl on the nervous system of rats, chickens, monkeys and humans are primarily related to ChE inhibition and are usually transitory. In a developmental neurotoxicity study, carbaryl had no adverse effects on foetal or pup survival, growth or development at up to and including the highest dose of 10 mg/kg bw/d. In both subchronic and developmental neurotoxicity studies, no adverse findings were made with respect to neuropathology in the adults or offspring.

4.1.7 Reproduction and development

New developmental studies in rats and rabbits were submitted for the review. Maternotoxicity was seen as cholinergic signs in rats, inhibition of plasma and RBC ChE activity in rabbits, and depressed weight gain in both species. Foetal development was retarded at maternally toxic doses, but there were no treatment-related visceral anomalies or malformations.

4.1.8 Carcinogenicity

In chronic rodent studies by Hamada (1993a and 1993b)³ carbaryl caused tumours of the thyroid, urinary bladder and liver in rats, and kidney, liver and vascular systems in mice.

³ Hamada NN (1993a) Combined chronic toxicity and oncogenicity study with carbaryl technical in Sprague-Dawley rats Study No. 656-139 Lab: Hazleton Washington Inc, USA Report date: August 06, 1993 Unpublished [RP, sub 10824]

Hamada NN (1993b) Combined chronic toxicity and oncogenicity study with carbaryl technical in CD-1 mice Study No. 656-138 Lab: Hazleton Washington Inc, USA Report date: May 20, 1993 Unpublished [RP, sub 10824]

However with the exception of vascular tumours, carcinogenicity did not occur below the highest doses administered (8000 and 7500 ppm in the diet to mice and rats, respectively).

Since carbaryl has not shown any convincing evidence of genotoxic activity, and because no observed effect levels (NOELs) of 1000 and 1500 were demonstrated in the respective species for bladder, hepatic, thyroid and renal tumours, these high dose tumours have not been considered a barrier to continuing registration of carbaryl, subject to adequate safeguards that would limit public exposure to the chemical.

However, the vascular system tumours are of significantly greater concern. Although these did not develop in female mice below the 8000 ppm feeding level, they occurred in males even at the lowest dose of 100 ppm. Despite the fact that carbaryl did not cause cancer to develop in a short-term bioassay in genetically engineered male mice that are highly sensitive to genotoxic carcinogens, there are still limitations in the understanding of carbaryl's carcinogenic properties and its mode or mechanism of action remain uncharacterised. Under the circumstances it is considered that the use of an enhanced safety factor should be maintained and public exposure should be reduced to the lowest extent reasonably achievable. From the data assessed there is no evidence that carbaryl is carcinogenic in humans.

4.1.9 Human studies

The current submission included human exposure studies which measured the amount of carbaryl deposited on the skin and clothing of volunteers using USA carbaryl products under simulated home garden and veterinary conditions. The concentration of carbaryl in the breathing zone air was also measured. The product that had by far the greatest potential for human exposure was a 5 per cent carbaryl veterinary dusting powder. In decreasing order of exposure potential were 10 per cent vegetable dusts, a 22 per cent liquid concentrate applied to vegetables or trees by spray, and a 0.1 per cent ready-to-use vegetable spray. In all cases the majority of exposure occurred via the hands. The veterinary dusting powder also caused significant exposure by inhalation whereas inhalation exposure by vegetable dusting and application of carbaryl sprays was negligible. In general, only about 5 per cent or less of carbaryl that became deposited on the external clothing penetrated to the skin, and comparison between gloved and un-gloved subjects showed that gloves effected a 95 per cent reduction in exposure.

4.1.10 Exposure from home garden and home veterinary products

The APVMA *Guidelines for Pesticides Used by Householders* stipulate that any domestic pesticide formulation that may be ingested should not be expected to be acutely toxic to a child at doses up to 1500 mg/kg bw and should not be acutely toxic at dermal doses up to 1000 mg/kg bw. The irritancy to skin and eye of domestic pesticide formulations should be low. Several carbaryl products currently sold in home garden pack sizes are unlikely to comply with the above safety threshold. Only products containing 160 g/kg or less of carbaryl would comply with the cut-off value for acute oral toxicity.

The majority of Australian home garden/home veterinary (HG/HV) products were found to be capable of delivering systemic doses to users in excess of the ADI for carbaryl. The only products that were not likely to deliver a toxicologically significant dose of carbaryl were 10g/L pet shampoos, 20 g/kg garden dusts, wettable powder, 1 g/L ready-to-use liquid sprays and HV ear drops.

4.1.11 Conclusions

Recommendations have been formulated with a view to constraining the upper limit of carbaryl intake to the ADI and ARfD, through the use of label hazard warning statements and modifications to protective clothing and equipment. Home garden/veterinary products that have the potential to cause carbaryl intake above the ADI and ARfD under anticipated conditions of use and are not amenable to risk reduction by means of protective clothing/equipment are considered unsuitable for continued registration. Also regarded as unsuitable are products for which there are insufficient data to estimate the extent of household exposure.

The most hazardous products are veterinary dusts. Given that carbaryl shampoos are available and have a lower potential for use exposure than dusts, the most effective course of action would be to remove carbaryl based pet dusts and powders from the home veterinary market.

Although capable of delivering systemic doses two to 12 times higher than the ADI, carbaryl home garden vegetable dusts, wettable powders and liquids would cause much less user exposure than pet dusts. This is primarily because garden use often entails discharge at or below waist height and manual contact with treated vegetation is not required. Inhalation exposure from these products is negligible. Therefore, these products may be used safely provided appropriate warning statements and safety directions appear on the product labels.

Contact with carbaryl applied on turf or around the external areas of the home may result in delivery of a systemic dose above the ADI if the carbaryl was not washed off the contaminated skin within one hour. The appropriate risk reduction strategy here is to recommend that householders keep off treated surfaces.

It is impossible to determine the extent of householder exposure following indoor treatment with carbaryl. Label warnings are considered insufficient to ensure safety. As such it is recommended that carbaryl should not be registered for indoor use.

Insufficient information was provided to ensure that the use of carbaryl products on food producing plants in the home garden would not result in householder exposure exceeding the ARfD for most uses. Some minor uses in the home garden were considered acceptable. Concerns have been raised that if any uses for food-producing plants remain on the labels householders will continue to use products where uses have been identified as not acceptable and removed from labels. As such it is recommended that carbaryl should not be registered for use on food-producing plants in the home garden.

4.2 RESIDUES

4.2.1 Introduction

In evaluating the human dietary exposure to carbaryl residues it was necessary to examine the intake from consumption of food commodities other than grains and animal commodities, in particular fruits and vegetables. To do this, national estimated daily intake (NEDI) and national estimated short-term intake (NESTI) calculations were undertaken. As a result, the residues assessment has enabled recommendations to be developed for amended MRLs to cover all food crop uses of carbaryl.

4.2.2 Dietary intake

The toxicology review recommended an increase in the ADI from 0.004 mg/kg bw/day to 0.008 mg/kg bw/day. In addition an ARfD of 0.01 mg/kg bw/day was established for carbaryl. It is therefore necessary to determine that the current use patterns will not result in a dietary intake that will exceed the revised ADI for lifetime exposure (chronic dietary intake), or the ARfD for short-term exposure (acute dietary intake).

Carbaryl has not been included in any of the Food Standards Australia New Zealand (FSANZ) market basket surveys or total diet surveys of the last decade and so there is no information on actual dietary exposure. In such cases conservative models that overestimate dietary intake are used to establish human safety. The model used in Australia and recommended by the joint consultation of the WHO and FAO on dietary exposure to pesticides is the NEDI and NESTI calculations.

In the NEDI calculation use is made of survey results for agricultural commodities, processing factors for commodities such as washing, peeling or cooking, and median or maximum residues for 'worst-case' trials. If there are no data to allow any reduction in the residue level it is assumed that residues are present at levels corresponding to the MRL (worst-case).

The NEDI calculation using the recommended MRLs together with those already established accounts for approximately 89 per cent of the ADI of 0.004 mg/kg bw/day. As the NEDI calculation is widely recognised as a gross overestimate of the likely intake and the estimated exposure is less than the ADI it is concluded that the risk to human health from exposure to carbaryl residues in the diet is minimal.

Where insufficient residue trial data were available, the highest residue (HR) from trials of a similar crop or the current MRL was used as the HR value in the NESTI calculations. A minimum of 41 consumers is required in the dietary survey results to adequately determine the 97.5th percentile consumption figure. Where the number of consumers was less than 41, large portion sizes of similar commodities were used. Where the number of consumers was still less than 41, the consumption figure for the entire crop group was used as a conservative estimate.

Of the crops and commodities for which there were sufficient residues data available to allow the establishment of an MRL, the NESTI calculation did not exceed the ARfD for the following:

- raspberries
- beetroot, potato, sugarbeet, turnips (Swede)
- pome fruit (fruit thinning use pattern only)
- macadamia nuts, pecan nuts
- cottonseed
- cereal grains
- animal commodities.

4.2.3 Changes to MRL standard

Sufficient data were available to allow revision of the current MRLs for a number of commodities.

4.3 INTERNATIONAL REGULATORY STATUS

4.3.1 *JMPR activity*

Carbaryl was reviewed by the JMPR in 1963, 1965, 1966, 1967, 1969 and 1973. The original ADI of 0–0.02 mg/kg bw/d was set in 1963 on the basis of a no observed adverse effect limit (NOAEL) of 1.8 mg/kg bw/d in a one-year dog study. This was revised to 0–0.01 mg/kg bw/d in 1969 because of concern about effects on the male reproductive system seen in a one-year gavage study in rats with a NOAEL of 2 mg/kg bw/d, and because a dose of 0.12 mg/kg bw/d may have affected renal function in a six-week study in humans. In 1973, the JMPR established a full ADI of 0–0.01 mg/kg bw/d.

The JMPR carried out a further toxicological review of carbaryl in 1996, and decreased the ADI to 0.003 mg/kg bw/d by application of a 5000-fold safety factor to the lowest observable effect limit (LOEL) for vascular tumours in male mice. The JMPR again considered carbaryl in 2001. The ADI was revised upwards to 0.008 mg/kg bw/d; while the basis for the ADI was unchanged, the safety factor was relaxed to 2000. The JMPR also established an ARfD for carbaryl of 0.2 mg/kg bw, based on an NOAEL for ChE inhibition of 125 ppm (equal to 3.8 mg/kg bw/d) in a five-week dietary study in dogs. A safety factor of 25 was applied because ChE inhibition by carbaryl (in rats) is ‘rapidly reversible and driven by the peak concentration in plasma’.

4.3.2 *United States Environmental Protection Agency (USEPA) activity*

In October 1996, the USEPA imposed exposure mitigation measures on carbaryl based products. Pending the submission of user exposure studies to the agency, approval was suspended for using dust formulations on trees and ornamental plants where application was intended to be higher than chest height, and some applications to pets. The conditions of use of household liquid and dust products were amended to prohibit use more than once per week, and to mandate that gloves be worn during application.

In June 2003 the USEPA released an Interim Re-registration Eligibility Decision (IRED) for carbaryl. The report stated that ‘although all uses of carbaryl may not meet current safety standards and some uses may pose unreasonable risks to human health and the environment these effects could be mitigated’.

Outcomes

The report supported the continued registration of carbaryl products.

Dietary risk

Both the acute and chronic risks of exposure to carbaryl from food were found to be below the USEPA’s level of concern.

The USEPA ADI is 0.008 mg/kg bw/d, in accordance with the JMPR level outlined in Section 4.3.1 above. (As is recommended in this Review Findings report, the ADI for Australia as set by OCS has been revised from 0.004 mg/kg bw/d to 0.008 mg/kg bw/d in accordance with the relaxing of the safety factor to 2000.)

The USEPA acute and chronic reference doses are both 0.01 mg/kg/d. The ARfD was based on a NOAEL of 1 mg/kg/d in a rat developmental neurotoxicity study, to which an uncertainty factor of 100 was applied. The chronic RfD was derived by applying a 300-fold

uncertainty factor to a LOAEL of 3.1 mg/kg/d for inhibition of plasma and brain ChE activity in a chronic dog study.

Residential risk

The USEPA was concerned about the exposure of householders using carbaryl lawn, garden, ornamental plant and pet flea control products as well as adults doing garden work and toddlers playing on treated lawns. As an outcome of these concerns the registrant cancelled all liquid and dust uses on pets, except flea collars. Other risks were mitigated by changes to the amount of active ingredient, packaging and size of residential products and the cancelling of liquid board casts on lawns (pending the results of data being developed).

4.3.3 *United Kingdom Department of Environment, Food and Rural Affairs*

An initial review conducted in 1996 by the UK identified toxicological concerns about worker exposure to carbaryl. At this time the regulatory actions taken included:

- revocation of use in poultry houses
- prohibition of application via hand-held or similar equipment
- revocation of home garden uses of carbaryl
- modification to application equipment
- strengthening of label protective equipment requirements.

In 1998 the UK commenced a review of anticholinesterase compounds that included examination of carbaryl. Registrants were not prepared to support the continued registration of carbaryl through such a review and therefore all carbaryl products were phased out.

4.4 PROTECTED DATA

At the commencement of the review and after the extensions of the scope of the review, registrants were required under s32 of the Agvet Code to provide data and information to the APVMA that is relevant to the reconsideration. The Agvet Codes provide that a person who authorised the use of protected information by the APVMA in conducting the review of the continued approvals, or registration a product of another party, may be eligible to receive compensation from that other party. Protected information remains protected for a period of time determined by the regulations to the Agvet Codes. The APVMA must not use protected information to support the approval (or the continued approval) of another, active constituent for a proposed or existing chemical product or registration (or the continued registration) of another chemical product, unless the two parties have agreed as to the terms of compensation to be paid by the registrant of that other chemical product to the owner of the protected information. Data that was relied on for the reconsideration and for which a protection period remains is listed in Table 5.

Table 5: Protected data that was relied on for the reconsideration.

Data Number	Author (s)	Title	Date	Data Protected Until	Authorising Party
DPS 5622	Hamada, N.	One-Year Oral Toxicity Study In Beagle Dogs With Carbaryl Technical	1997	10 December 2007	Bayer CropScience Pty Ltd
DPS 7730	Rice, F. and Grant, J.	Measurement Of Pesticide Exposure Of Suburban Residents Associated With The Residential Use Of Carbaryl	2003	21 May 2007	Bayer CropScience Pty Ltd

5 REVIEW OUTCOMES AND REGULATORY DECISIONS

On the basis of the evaluation of the submitted data and information (including protected information), the following regulatory actions have been taken with regard to the continued registrations and approvals of carbaryl products for home garden, home veterinary, poultry and domestic use in Australia:

- 1) Vary conditions of label approval.
- 2) Affirm product registrations.
- 3) Cancel product registrations

5.1 SUMMARY OF REVIEW OUTCOMES

5.1.1 Review Outcomes

A summary of the review outcomes is shown in Table 6.

Table 6: Summary of review outcomes by situation and pest

Situation	Pest	Recommendation
Dusts - Home veterinary use for the treatment of animals and birds	Fleas, mites, ticks, lice	User exposure is likely to exceed the ADI and recommended ARfD. Cancel products
Dust formulations - treatment of carpets, rugs and animal bedding	Fleas, mites, ticks, lice	Insufficient data were received to enable the assessment to estimate householder exposure and ensure an adequate margin of safety. Cancel products
Poultry	Mites, ticks, lice	Insufficient data were available to assess residues in poultry from direct animal treatment. Cancel product
Food-producing plants	Various insect pests	Data provided to the review showed uses exceeded the MRL, and for other food-crop uses insufficient data was not available to establish an MRL. Delete from labels
Ornamentals, lawns, elm trees (in non-crop areas), kenaf, duboisia and rosella	Variety of leaf eating insects	No concerns associated with use. Retain use

5.1.2 Additional label statements

A maximum carbaryl concentration of 160 g/kg (or g/L) has been set for home garden products, as more concentrated preparations are expected to have acute oral LD₅₀ above 1500 mg/kg bw and therefore exceed the safety threshold for registration of home garden products. Products affected by the changes are listed in Table 10.

Labels of home garden products have been varied to ensure that uses of the products comply with registration restrictions. The following label statement has been added to all home garden products.

Insert: DO NOT apply to food producing plants.

The following warning statement has been added to products applied on and around the exterior of domestic premises:

Insert: Avoid Bare Skin Contact With Treated Surfaces for 7 days.

5.2 VARY CONDITIONS OF LABEL APPROVAL

The APVMA is SATISFIED that the conditions to which three label approvals are currently subject can be varied in the way outlined in Section 5.1, to ensure that the requirements for continued label approval will be complied with. Therefore the APVMA has varied the conditions of label approval for the labels listed in Table 7.

Table 7: Products registrations that have been affirmed and label approval numbers varied as an outcome of the review

Product number	Product name	Registrant	Label approval number to be varied
31995	CRG Liquid Carbaryl Insect Spray	Chemical Recovery Co Pty Ltd	31995/0798
42261	David Grays Cricket & Grasshopper Killer Bait	David Gray & Co. Pty Limited	42261/1202
52493	Richgro Garden Products Carbaryl Caterpillar & Grasshopper Insecticide	A Richards Pty Ltd T/A Richgro Garden Products	52493/0300

The APVMA is NOT SATISFIED that the currently approved labels for containers of Kendon Carbaryl Wettable Powder Insecticide (49326) contain adequate instructions relating to the matters referred to in s.14(3)(g) of the Agvet Codes as well as those referred to in regulations 11 and 12 of the Agvet Code Regulations where the product is used in the home garden, as the amount of carbaryl exceeds the safety threshold of 160 g/kg (or g/L).

However, the APVMA is SATISFIED that the currently approved labels for containers of Kendon Carbaryl Wettable Powder Insecticide (49326) can be varied in such a way that they contain adequate instructions relating to the matters referred to in s.14(3)(g) of the Agvet Codes as well as those referred to in regulations 11 and 12 of the Agvet Code Regulations.

Thus the APVMA has VARIED the approved label by deleting pack sizes 200 g, 500 g and 1 kg as well as the instructions for use in the home garden on the approved labels of Kendon Carbaryl Wettable Powder Insecticide (49326).

5.3 AFFIRM PRODUCT REGISTRATIONS

The APVMA is SATISFIED that the labels of products listed in Table 7 have been varied and that the products meet the prescribed requirements for continued registration.

On this basis the APVMA is SATISFIED that continued registration of the products in accordance with their instructions for use:

- would not be an undue hazard to the safety of people exposed to them during their handling or people using anything containing their residues; and
- would not be likely to have an effect that is harmful to human beings,

and therefore has AFFIRMED the product registrations.

5.4 CANCELLATIONS OF PRODUCT REGISTRATIONS AND LABEL APPROVALS

The APVMA is NOT SATISFIED that the labels for products in Table 8 contain adequate instructions in relation to the criteria set out in section 14 (3)(g) of the Agvet Codes as well as

those referred to in Regulations 11 and 12 of the Agvet Code Regulations. Product labels also contain use patterns that have been deleted.

The APVMA is NOT SATISFIED that the conditions of registration of these products can be varied in such a way that the requirements for continued registration will be complied with. On this basis the APVMA is NOT SATISFIED that continued registration of the products in accordance with their instructions for use:

- would not be an undue hazard to the safety of people exposed to them during their handling or people using anything containing their residues; and
- would not be likely to have an effect that is harmful to human beings.

On this basis the registrations of products and all approved labels in Table 8 have been CANCELLED.

Table 8: Products and label approvals that have been cancelled

Product number	Product name	Registrant	Label approval numbers
31997	Chemspray Carbaryl Insecticide	Envirogreen Pty Ltd	31997/0802 31997/0903
33576	Saint Bernard Flea Powder For Dogs And Cats	Saint Bernard Pet Care Pty Ltd	33576/01 33576/0402 33576/0801
37434	Fido's Free-Itch CPP Flea Powder For Cats And Dogs	Mavlab Pty Ltd	37434/0101
39864	Yates Lanosan Tomato Spray Insecticides And Fungicide	Orica Australia Pty Ltd	39864/0500 39864/0598
40080	Fido's Fre Itch Flea Powder	Mavlab Pty Ltd	40080/0402
41244	David Skatta-7 Tick Flea Louse Powder	Bocko P/L & Flexsky P/L (in partnership) T/A Pharmachem	41244/0901
42054	David Grays Tomato Dust	David Gray & Co. Pty Limited	42054/02
42055	David Grays Vegetable Dust	David Gray & Co. Pty Limited	42055/02
46851	Keydust Dusting Powder	International Animal Health Products Pty Ltd	46851/0100
48753	Tomato Dust Insecticides And Fungicide	Crop Care Australasia Pty Ltd	48753/01
49325	Kendon Carbaryl Liquid Insecticide	Kendon Plant Care Pty Ltd	49325/1098 49325/0400
49937	Garden King Carbaryl Liquid Insecticide	Envirogreen Pty Ltd	49937/0802 49937/1097
51206	Family Pets Flea And Tick Pet Grooming Powder For Dogs, Cats Puppies And Kittens	Aristopet Pty Ltd T/A Family Companion Pet Products	51206/0998
52472	Garden King Tomato & Vegetable Dust Insecticide & Fungicide	Envirogreen Pty Ltd	52472/0100 52475/0702
53260	Hortico Tomato Dust	Orica Australia Pty Ltd	53260/0700
53912	Yates Ready To Use Tomato Gun Pest & Disease Spray	Orica Australia Pty Ltd	53912/0702 53912/0304
54949	David Grays Carbaryl Liquid Insecticide	David Gray & Co. Pty Limited	54949/0102

5.5 WITHDRAWN AND NON-RENEWED CARBARYL PRODUCTS AND APPROVED PRODUCT LABELS

Since the commencement of the review 32 carbaryl products (Table 9) have been voluntarily withdrawn or not renewed (once cancellation of registration is formally effected, reconsideration is no longer required).

Table 9: Voluntarily withdrawn and non-renewed products and approved labels

Product number	Product name	Registrant	Label approval number
32000	Defender Home Garden Grasshopper Caterpillar Carbaryl Insecticide	Scotts Australia Pty Ltd	Ψ
32002	Yates Carbaryl Caterpillar & Grasshopper Insect Spray	Arthur Yates & Co Limited	32002/0202 32002/0301 32002/0498 32002/1001
33194	Hortico Carbaryl Cabbage Dust	Orica Australia Pty Ltd	Ψ
33575	Fido's Fre-itch Flea Shampoo for Cats and Dogs	Mavlab Pty Ltd	33575/1002 33575/1200
33957	Hortico Carbaryl Tomato Dust	Orica Australia Pty Ltd	Ψ
36387	Watch Cat Flea Powder For Cats	Go-Pet Petcare Solutions A Div Of Nestle Australia Ltd	36387/0299 36387/1198
36388	Watch Dog Flea Powder For Dogs	Go-Pet Petcare Solutions A Div Of Nestle Australia Ltd	36388/0299 36388/1198
39082	Hortico Hose-On Lawn Grub Killer	Orica Australia Pty Ltd	39082/0700
39876	Yates Garden Spray Insecticide Fungicide	Arthur Yates & Co Limited	39876/0998
39879	Yates Carbaryl Cabbage Dust	Arthur Yates & Co Limited	39879/0802
39998	Fido's Ear Drops	Mavlab Pty Ltd	39998/0101
40754	Defender Home Garden European Wasp and Insect Dust	Scotts Australia Pty Ltd	Ψ
41250	Vetapet Coalfoam Medicated Foam With Ectoparasitic Control For Dogs And Cats	Bocko P/L & Trademarketing Solutions P/L T/A Pharmachem	41250/1101
42029	David Grays Flower Dust	David Gray & Co. Pty Limited	42029/0702
42041	David Grays Rose Dust	David Gray & Co. Pty Limited	42041/02
45944	Garden King Multipest SCC General Purpose Insecticide-Fungicide-Miticide	Envirogreen Pty Ltd	Ψ 45944/0503
46303	Masterpet Flea Powder For All Dogs And Cats 100gm	Masterpet Australia Pty Limited	46303/001
47108	Chemspray Carbaryl Flowable Insecticide	Envirogreen Pty Ltd	47108/0599 47108/0998 47108/3260
47855	I Love My Pet Flea Powder For Cats And Dogs	My Pet Products Australia Pty Ltd	47855/01
47966	I Love My Pet Ear Drops Ear Cleaner For Cats And Dogs	My Pet Products Australia Pty Ltd	47966/01
49133	Defender Trouble Shooter Tomato Spray	Scotts Australia Pty Ltd	49133/01
49870	Defender Tomato Doctor Insecticide/Fungicide	Scotts Australia Pty Ltd	49870/01
50102	Friskies Kill Flea Carpet Deodoriser	Go-Pet Petcare Solutions A Div Of Nestle Australia Ltd	50102/0798
50664	I Love My Pet Flea Rid Powder For Cats & Dogs	My Pet Products Australia Pty Ltd	50664/0598
50741	I Love My Pet Flea Rid Shampoo For Dogs & Cats	My Pet Products Australia Pty Ltd	50741/0598

51625	Richgro Garden Products Ready To Use Pest-Stop Tomato	A Richards Pty Ltd T/A Richgro Garden Products	51625/0499
53231	Hortico Cabbage Dust	Orica Australia Pty Ltd	53231/0700
54634	Richgro Garden Products Armyworm, Cockchafers & Lawn Grub Killer	A Richards Pty Ltd T/A Richgro Garden Products	54634/0402 54634/0603
57952*	Go-Pet Kill Flea Carpet Deodoriser	Go-Pet Petcare Solutions a division of Nestle Australia Ltd	57952/0903
58127*	Yates Insect & Disease Control Blitzem Tomato Gun	Orica Australia Pty Ltd	58127/0903
58135*	Yates Insect & Disease Control Blitzem Tomato Tomato Dust	Orica Australia Pty Ltd	58135/0903
59431*	Yates Insect & Disease Control Blitzem Lanosan Tomato Spray	Orica Australia Pty Ltd	59431/0105

* Products registered after the commencement of the review that were subject to the outcomes of the review

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

6 AMENDMENTS TO STANDARDS

Arising from the assessment of data submitted to the review of carbaryl, and based on the advice of the 20th and 23rd meetings of the Advisory Committee on Pesticides and Health and consideration of the expanded toxicological database on carbaryl, the following advice is provided by the OCS.

6.1 PUBLIC HEALTH STANDARDS

6.1.1 *Acceptable daily intake*

At the commencement of the review, the ADI for carbaryl was 0.004 mg/kg bw/d, derived by applying a 4000-fold safety factor to a LOEL of 100 ppm (16 mg/kg bw/d) for vascular tumours occurring in male mice in a two-year dietary study. The review recommended that the ADI be revised to 0.008 mg/kg bw/d derived by applying a 2000-fold safety factor to the same LOEL of 100 ppm for vascular tumour formation.

6.1.2 *Acute reference dose*

Arising from the assessment of the data submitted to the review the OCS set an ARfD of 0.01 mg/kg bw, applying a 100-fold safety factor to NOELs of 1 mg/kg bw/d, established in rat 13-week subchronic and developmental neurotoxicity studies, and based on behavioural indications of autonomic neurotoxicity and brain, plasma and erythrocyte ChE depression (LOEL=10 mg/kg bw/d).

6.1.3 *Water quality guidelines*

The current health value for carbaryl of 0.03mg/L in drinking water remains unchanged.

6.1.4 *Poisons scheduling*

Carbaryl is classified as a Schedule 6 poison in the Standard for Uniform Scheduling of Drugs and Poisons (SUSDP), with Schedule 5 entries for preparations containing 10 per cent or less of carbaryl, or when impregnated into plastic resin material containing 20 per cent or less of carbaryl. Carbaryl preparations for human therapeutic use are listed in Schedule 4, but none are currently on the Australian market. Based on the decisions of the National Drugs and Poisons Schedule Committee at its 36th meeting, no changes are recommended to the Poisons Schedule status of carbaryl.

6.1.5 *First aid instructions*

The following amended standard statements for carbaryl (Table 10) is specified in the *Handbook of First Aid Instructions, Safety Directions, Warning Statements and General Safety Precautions for Agricultural and Veterinary Chemicals* (FAISD Handbook) (OCS, 30 September 2006), see <http://www.tga.gov.au/docs/pdf/faisd.pdf>.

Table 10: Current first aid instructions for carbaryl

Concentration	Code	First aid instruction
12% or less	a	If poisoning occurs, contact a doctor or Poisons Information Centre. Phone Australia 131126; New Zealand 03 4747000
In plastic resin strips		
In pressurised spray packs	o	If sprayed on skin, wash thoroughly. If sprayed in mouth, rinse mouth with water.

6.1.6 Safety directions

The current safety directions for carbaryl products are as listed in Tables 11 and 12.

Table 11: Safety directions for carbaryl products for products affirmed as an outcome of the review (FAISD Handbook 30 September 2006)

Formulation	Safety direction	Statement
HG BA 18 g/kg or less	120, 130, 131, 132, 133,	Product is poisonous if absorbed by skin contact or inhaled or swallowed.
	210, 211	Avoid contact with eyes and skin.
	220, 221,	Do not inhale dust.
	351	Wash hands after use.
HG SC LD 100 g/L or less	120, 130, 131, 132, 133	Product is poisonous if absorbed by skin contact, inhaled or swallowed.
	160, 162, 163, 164,	May irritate the eyes and nose and throat and skin.
	210, 211	Avoid contact with eyes and skin.
	220, 223	Do not inhale spray mist.
	279, 281, 282 283, 290, 292b, 312	When opening the container, preparing spray and using the prepared spray, wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and rubber gloves.
	340, 342	If product on skin, immediately wash area with soap and water.
	350	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
360, 361. 366	After each day's use, wash gloves and contaminated clothing.	

HG = home garden;

BA = Bait

LD = Liquid

SC = Suspension Concentrate

The current safety directions listed in Table 12 are for products that are no longer registered as an outcome of the review. These entries in the FAISD Handbook are to be deleted.

Table 12: Safety directions for carbaryl products no longer registered as an outcome of the review (FAISD Handbook 30 September 2006)

Formulation	Safety direction	Statement
HG AC 60 g/L or less in hose-end sprayers	120, 130, 131, 132, 133	Product is poisonous if absorbed by skin contact or inhaled or swallowed.
	160, 162	May irritate the eyes.
	210, 211,	Avoid contact with eyes and skin.
	220, 223	Do not inhale spray mist.

	279, 283, 290, 292b, 312	When using the product wear rubber apron and rubber gloves.
	340, 341, 342	If product or spray on skin, immediately wash with soap and water.
	350	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
	360, 361, 366-	After each day's use, wash gloves and contaminated clothing.
HG DU 20 g/kg or less with maldison 10 g/kg or less and mancozeb 40 g/kg or less and sulfur 300 g/kg or less	120, 130, 131, 132, 133	Product is poisonous if absorbed by skin contact or inhaled or swallowed.
	160, 162, 163, 164,	May irritate the eyes and nose and throat and skin.
	180, 181	Repeated exposure may cause allergic disorders; sensitive workers should use protective clothing.
	210, 211	Avoid contact with eyes and skin.
	220, 221	Do not inhale dust.
	279, 280, 283, 290, 292b, 312	When opening the container and using the product wear cotton overalls buttoned to the neck and wrist (or equivalent clothing).
	350,	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
360, 361, 366	After each day's use, wash gloves and contaminated clothing.	
HG DU 20 g/kg or less with copper oxychloride 85 g/kg or less and sulfur 420 g/kg or less with calcium carbonate 215 g/kg or less	120, 130, 131, 132, 133	Product is poisonous if absorbed by skin contact or inhaled or swallowed.
	161, 162, 163, 164	May irritate the eyes and nose and throat and skin.
	180,	Repeated exposure may cause allergic disorders.
	210, 211	Avoid contact with eyes and skin.
	220, 221	Do not inhale dust.
	279, 280, 283, 290, 292b, 312	When opening the container and using the product wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and rubber gloves.
	340, 343	If product in eyes, wash it out immediately with water.
	350	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
	360, 361, 366	After each day's use, wash gloves and contaminated clothing.
HG WP 100 g/kg or less with mancozeb 135 g/kg or less and sulfur 300 g/kg or less	120, 130, 131, 132, 133	Product is poisonous if absorbed by skin contact, inhaled or swallowed.
	160, 162, 163, 164	May irritate the eyes, nose and throat and skin.
	180	Repeated exposure may cause allergic disorders.
	210, 211	Avoid contact with eyes and skin.
	220, 221, 223	Do not inhale dust or spray mist.
	279, 280, 281, 282, 290, 292b, 312	When opening the container, preparing spray and using the prepared spray wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and rubber gloves.
	340, 342	If product on skin, immediately wash area with soap and water.
	350	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
	360, 361, 366	After each day's use, wash gloves and contaminated clothing.
HG WP 115 g/kg or less with copper oxychloride 435 g/kg or less and sulfur 285	120, 130, 131, 132, 133	Product is poisonous if absorbed by skin contact, inhaled or swallowed.
	160, 162, 164	May irritate the eyes and skin.
	180	Repeated exposure may cause allergic disorders.

g/kg or less	210, 211	Avoid contact with eyes and skin.
	220, 221, 223	Do not inhale dust or spray mist.
	279, 280, 281, 282, 290, 292b, 312	When opening the container, preparing spray and using the prepared spray wear cotton overalls buttoned to the neck and wrist (or equivalent clothing) and rubber gloves.
	340, 342	If product on skin, immediately wash area with soap and water.
	340, 343	If product in eyes, wash it out immediately with water.
	350	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
	360, 361, 366	After each day's use, wash gloves and contaminated clothing.
HV Ear drops 10 g/L or less	120, 130, 131, 133	Product is poisonous if absorbed by skin contact or swallowed.
	161, 162, 164	May irritate the eyes and skin.
	210, 211	Avoid contact with eyes and skin.
	340, 342	If product on skin, immediately wash area with soap and water.
	340, 343	If product in eyes, wash it out immediately with water.
	351	Wash hands after use.
HV Foam 10 g/L or less with pyrethrins 1.0 g/L or less and piperonyl butoxide 10 g/L or less and coal tar 10 g/L or less with quaternary ammonium compounds 100 g/L or more	120, 130, 131, 133	Product is poisonous if absorbed by skin contact or swallowed.
	161, 162, 163, 164	May irritate the eyes and nose and throat and skin.
	210, 211	Avoid contact with eyes and skin.
	279, 280, 283, 290, 312	When opening the container and using the product wear rubber gloves.
	340, 342	If product on skin, immediately wash area with soap and water.
	340, 343	If product in eyes, wash it out immediately with water.
	350	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
HV Shampoo 10 g/L or less	120, 130, 131, 133	Product is poisonous if absorbed by skin contact or swallowed.
	161, 162, 164	May irritate the eyes and skin.
	210, 211	Avoid contact with eyes and skin.
	279, 280, 283, 290, 312	When opening the container and using the product wear rubber gloves.
	340, 342	If product on skin, immediately wash area with soap and water.
	340, 343	If product in eyes, wash it out immediately with water.
	350	After use and before eating, drinking or smoking, wash hands, arms and face thoroughly with soap and water.
	360, 361, 366	After each day's use, wash gloves and contaminated clothing.

AC = Aqueous Concentrate
DU = dust;
EC = emulsifiable concentrate;
LC = liquid concentrate,
HV = home veterinary,
WP = Wettable Powder

APPENDICES

6.2 APPENDIX A

Table A1: Products and associated label approvals considered as part of the reconsideration of carbaryl home garden, home veterinary, poultry and domestic products

Product number	Product name	Registrant	Label approval number to be varied
31995	CRG Liquid Carbaryl Insect Spray	Chemical Recovery Co Pty Ltd	31995/0798
31997	Chemspray Carbaryl Insecticide	Envirogreen Pty Ltd	31997/0802 31997/0903
33576	Saint Bernard Flea Powder For Dogs And Cats	Saint Bernard Pet Care Pty Ltd	33576/01 33576/0402 33576/0801
37434	Fido's Free-Itch CPP Flea Powder For Cats And Dogs	Mavlab Pty Ltd	37434/0101
39864	Yates Lanosan Tomato Spray Insecticides And Fungicide	Orica Australia Pty Ltd	39864/0500 39864/0598
40080	Fido's Fre Itch Flea Powder	Mavlab Pty Ltd	40080/0402
41244	David Skatta-7 Tick Flea Louse Powder	Bocko P/L & Flexsky P/L (In Partnership) T/A Pharmachem	41244/0901
42054	David Grays Tomato Dust	David Gray & Co. Pty Limited	42054/02
42055	David Grays Vegetable Dust	David Gray & Co. Pty Limited	42055/02
42261	David Grays Cricket & Grasshopper Killer Bait	David Gray & Co. Pty Limited	42261/1202
46851	Keydust Dusting Powder	International Animal Health Products Pty Ltd	46851/0100
48753	Tomato Dust Insecticides And Fungicide	Crop Care Australasia Pty Ltd	48753/01
49325	Kendon Carbaryl Liquid Insecticide	Kendon Chemicals & Mnfg Co Pty Ltd	49325/1098 49325/0400
49326	Kendon Carbaryl Wettable Powder Insecticide (HG labels and pack sizes only)	Kendon Chemicals & Mnfg Co Pty Ltd	49326/1098 49326/0400
49937	Garden King Carbaryl Liquid Insecticide	Envirogreen Pty Ltd	49937/0802 49937/1097
51206	Family Pets Flea And Tick Pet Grooming Powder For Dogs, Cats Puppies And Kittens	Aristopet Pty Ltd T/A Family Companion Pet Products	51206/0998
52472	Garden King Tomato & Vegetable Dust Insecticide & Fungicide	Envirogreen Pty Ltd	52472/0100 52475/0702
52493	Richgro Garden Products Carbaryl Caterpillar & Grasshopper Insecticide	A Richards Pty Ltd T/A Richgro Garden Products	52493/0300
53260	Hortico Tomato Dust	Orica Australia Pty Ltd	53260/0700
53912	Yates Ready To Use Tomato Gun Pest & Disease Spray	Arthur Yates & Co Limited	53912/0702 53912/0304
54949	David Grays Carbaryl Liquid Insecticide	David Gray & Co. Pty Limited	54949/0102

Table A2: Voluntarily withdrawn and non-renewed products and approved labels that were included in the review of carbaryl.

Product number	Product name	Registrant	Label approval number
32000	Defender Home Garden Grasshopper Caterpillar Carbaryl Insecticide	Scotts Australia Pty Ltd	Ψ
32002	Yates Carbaryl Caterpillar & Grasshopper	Arthur Yates & Co Limited	32002/0202

Product number	Product name	Registrant	Label approval number
	Insect Spray		32002/0301 32002/0498 32002/1001
33194	Hortico Carbaryl Cabbage Dust	Orica Australia Pty Ltd	Ψ
33575	Fido's Fre-itch Flea Shampoo for Cats and Dogs	Mavlab Pty Ltd	33575/1002 33575/1200
33957	Hortico Carbaryl Tomato Dust	Orica Australia Pty Ltd	Ψ
36387	Watch Cat Flea Powder For Cats	Go-Pet Petcare Solutions A Div Of Nestle Australia Ltd	36387/0299 36387/1198
36388	Watch Dog Flea Powder For Dogs	Go-Pet Petcare Solutions A Div Of Nestle Australia Ltd	36388/0299 36388/1198
39082	Hortico Hose-On Lawn Grub Killer	Orica Australia Pty Ltd	39082/0700
39876	Yates Garden Spray Insecticide Fungicide	Arthur Yates & Co Limited	39876/0998
39879	Yates Carbaryl Cabbage Dust	Arthur Yates & Co Limited	39879/0802
39998	Fido's Ear Drops	Mavlab Pty Ltd	39998/0101
40754	Defender Home Garden European Wasp and Insect Dust	Scotts Australia Pty Ltd	Ψ
41250	Vetapet Coalfoam Medicated Foam With Ectoparasitic Control For Dogs And Cats	Bocko P/L & Trademarketing Solutions P/L T/A Pharmachem	41250/1101
42029	David Grays Flower Dust	David Gray & Co. Pty Limited	42029/0702
42041	David Grays Rose Dust	David Gray & Co. Pty Limited	42041/02
45944	Garden King Multipest SCC General Purpose Insecticide-Fungicide-Miticide	Envirogreen Pty Ltd	Ψ 45944/0503
46303	Masterpet Flea Powder For All Dogs And Cats 100gm	Masterpet Australia Pty Limited	46303/001
47108	Chemspray Carbaryl Flowable Insecticide	Envirogreen Pty Ltd	47108/0599 47108/0998 47108/3260
47855	I Love My Pet Flea Powder For Cats And Dogs	My Pet Products Australia Pty Ltd	47855/01
47966	I Love My Pet Ear Drops Ear Cleaner For Cats And Dogs	My Pet Products Australia Pty Ltd	47966/01
49133	Defender Trouble Shooter Tomato Spray	Scotts Australia Pty Ltd	49133/01
49870	Defender Tomato Doctor Insecticide/ Fungicide	Scotts Australia Pty Ltd	49870/01
50102	Friskies Kill Flea Carpet Deodoriser	Go-Pet Petcare Solutions A Div Of Nestle Australia Ltd	50102/0798
50664	I Love My Pet Flea Rid Powder For Cats & Dogs	My Pet Products Australia Pty Ltd	50664/0598
50741	I Love My Pet Flea Rid Shampoo For Dogs & Cats	My Pet Products Australia Pty Ltd	50741/0598
51625	Richgro Garden Products Ready To Use Pest-Stop Tomato	A Richards Pty Ltd T/A Richgro Garden Products	51625/0499
53231	Hortico Cabbage Dust	Orica Australia Pty Ltd	53231/0700
54634	Richgro Garden Products Armyworm, Cockchafers & Lawn Grub Killer	A Richards Pty Ltd T/A Richgro Garden Products	54634/0402 54634/0603
57952*	Go-Pet Kill Flea Carpet Deodoriser	Go-Pet Petcare Solutions a division of Nestle Australia Ltd	57952/0903
58127*	Yates Insect & Disease Control Blitzem Tomato Gun	Orica Australia Pty Ltd	58127/0903
58135*	Yates Insect & Disease Control Blitzem Tomato Dust	Orica Australia Pty Ltd	58135/0903
59431*	Yates Insect & Disease Control Blitzem Lanosan Tomato Spray	Orica Australia Pty Ltd	59431/0105

Ψ Labels transitioned from the States and so not having an approval number

*Products registered after the commencement of the extended scope of the review, that are subject to the outcomes of the review.