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# Compilation of agrochemicals registered for use in Victoria and their physical-chemical properties

# **Compilation of agrochemicals registered for use in Victoria and their physical-chemical properties**

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## Introduction

There are a diverse range of agricultural landscapes in Victoria, including irrigated horticulture, irrigated pastures, dryland cropping, animal production, and forestry. These primary industries rely on the use of agricultural chemicals (agrochemicals; including insecticides, fungicides, herbicides and veterinary medicines) to ensure production, quality, and economic objectives are achieved. However, it is known that agrochemicals can be transported off-site via air, soil, and water to surface and groundwater (Kookana et al. 1998; Radcliffe, 2002). This, in turn, can cause adverse impacts on aquatic ecosystems as a result of toxic effects, both lethal and sub-lethal, to aquatic species. However, despite these potential risks, there have been relatively few studies in Australia and even fewer in Victoria (Radcliffe, 2002). As such the Victorian Department of Primary Industries (DPI) has identified a need for further studies to understand the risks to water quality posed by agrochemical use within agricultural areas of Victoria.

Nationally, there are over 6000 agricultural chemicals (using over 2000 active constituents) registered for use in Australian agriculture (Radcliffe, 2002), each of which behave differently in the environment. Likewise, agrochemical use and subsequently risk differs according to land use, with most agricultural areas in Victoria having a mix of crop types/land uses. It is, therefore, a significant challenge to identify the likely high risk agrochemicals which need to be targeted in field monitoring programs.

Information on land use, environmental factors (i.e. soil types, topography), and farm management practices (i.e. chemical application practices, irrigation practices) combined with information on the agrochemicals registered for use and their physical-chemical properties is essential for predicting the fate and risk of agrochemicals under different scenarios and to thus prioritise the high risk agrochemicals to be targeted in different catchments. Information on the physical-chemical properties of agrochemicals is published in various sources such as the '*The pesticide manual*' (Tomlin, 2000) and '*The ARS pesticide properties database*' (Wauchope, 2005), however such information is not readily available in one source and it is typically necessary to search a number of information sources in order to collect data on all the agrochemicals of interest. Likewise the Australian Pesticides and Veterinary Medicines Authority (APVMA) has a searchable database (PUBCRIS) of all the agricultural and veterinary chemicals registered in Australia which can be interrogated a number of ways including by crop type (APVMA, 2008); however it can prove time consuming to extract information on registered chemicals for the crops/land uses of interest.

To serve as a future reference in assisting researchers and natural resource managers to identify high risk agrochemicals in agricultural areas of Victoria this publication provides a compilation of agrochemicals currently registered for use in Victorian agriculture by crop type/land use and their physical chemical properties. The physical-chemical properties included in the data tables for each active ingredient are: chemical group, molecular weight, vapour pressure, water solubility, log Kow (octanol-water partition coefficient), log Koc (soil sorption coefficient) and half-life in both soil and water.

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**Table 1 Herbicides (active constituents) registered for use in Victoria**

Crop	Herbicide (active constituent)		
Almonds	carfentrazone-ethyl glufosinate-ammonium	napropamide norflurazon	oxyfluorfen simazine
Asparagus	glyphosate bromacil	oryzalin diuron	sethoxydim
Avocado	2,2-DPA 2,4-D clethodim diquat	diuron fluazifop-p glyphosate haloxyfop	oryzalin oxyfluorfen paraquat
Brassicas	chlorthal dimethyl	oxyfluorfen	sethoxydim
Carrot	chorthal dimethyl fluazifop-p linuron	pendimethalin prometryn quizalofop-p-ethyl	sethoxydim trifluralin
Cereals	2,4 D atrazine bromoxynil butafenacil carfentrazone-ethyl chlorsulfuron clopyralid dicamba	diclofop-methyl diflufenican diquat diuron fenoxaprop-p-ethyl flumetsulam fluroxypyr glyphosate	MCPA mefenpyr-diethyl metosulam metsulfuron methyl monosodium methylarsonate oxyfluorfen tralkoxydim trifluralin
Citrus	2,2-DPA-sodium (dalapon sodium) amitrole ammonium thiocyanate bromacil dichlobenil diquat	diuron fluazifop-P glufosinate-ammonium glyphosate haloxyfop-R methyl ester norflurazon	oryzalin paraquat pendimethalin simazine trifluralin

**Table 1 continued**

Crop	Herbicide (active constituent)		
Grapes	2,2-DPA-sodium amitrole ammonium thiocyanate bromoxynil carfentrazone-ethyl dichlobenil diflufenican diquat diuron oryzalin	fluazifop-P fluometuron glufosinate-ammonium glyphosate haloxyfop-R methyl ester isoxaben methabenzthiazuron napropamide norflurazon	oxadiazon oxyfluorfen paraquat pendimethalin quizalofop-P-ethyl simazine trifluralin
Lettuce	clethodim fluazifop-p	pendimethalin propyzamide	sethoxydim
Lucerne	2,2-DPA-sodium (dalapon sodium) 2,4-D atrazine bromoxynil butroxydim chlorthal dimethyl diquat diuron ethyl dipropylthiocarbamate	fluazifop-P flumetsulam fluroxypyr 1-methyl heptyl ester glyphosate haloxyfop-R methyl ester imazamox imazethapyr methabenzthiazuron paraquat	pendimethalin propaquizafop propyzamide quizalofop-P-ethyl sethoxydim simazine terbacil trifluralin
Melon	clomazone fluazifop-p	quizalofop-p-ethyl sethoxydim	
Olive	carfentrazone-ethyl clethodim glufosinate-ammonium	glyphosate isoxaben	oryzalin pendimethalin

**Table 1 continued**

Crop	Herbicide (active constituent)			
Pasture	2,2-DPA-sodium	fluazifop-P	pendimethalin	
	2,4-D	flumetsulam	picloram	
	amitrole	flupropanate	prometryn	
	ammonium thiocyanate	fluroxypyr 1-methyl heptyl ester	propaquizafop	
	atrazine	glyphosate	quizalofop-P-ethyl	
	bromoxynil	haloxyfop-R methyl ester	sethoxydim	
	butroxydim	hexazinone	simazine	
	carfentrazone-ethyl	imazamox	sodium chloride	
	chlorthal dimethyl	imazapic	tebuthiuron	
	clopyralid	imazethapyr	terbacil	
	dicamba	MCPA	terbutryn	
	diclofop-methyl	Methabenzthiazuron	thiobencarb	
	diflufenican	Metolachlor	tribenuron-methyl	
	diquat	metsulfuron-methyl	triclopyr	
	diuron	molinate	trifluralin	
	ethofumesate	paraquat		
	Pistachio	carfentrazone-ethyl	glyphosate	
		glufosinate-ammonium	oxyfluorfen	
Pome fruit	2,2 DPA	diquat	oryzalin	
	ametryn	diuron	oxyfluorfen	
	amitrole	fluazifop-p	paraquat	
	ammonium thiocyanate	glufonisate-ammonium	quizalofop-p-ethyl	
	asulam	glyphosate	simazine	
	bromacil	haloxyfop	trifluralin	
	carfentrazone-ethyl	isoxaben		
	clethodim	norflurazon		
	dichlobenil			

**Table 1 continued**

Crop	Herbicide (active constituent)		
Potato	2,4-D amitrole ammonium thiocyanate atrazine carfentrazone-ethyl chloridazon chlorthal dimethyl clomazone dicamba dichlobenil diquat diuron	fluoroxypyr glufonisate-ammonium glyphosate ioxynil isophorone linuron MCPA methabenzthiazuron Metolachlor Metribuzin Napropamide	norflurazon oxyfluorfen paraquat pendimethalin phenmedipham prometryn propachlor rimsulfuron simazine sodium chloride trifluralin
Pumpkin	clomazone fluazifop-p	quizalofop-p-ethyl sethoxydim	
Stone fruit	ammonium thiocyanate diquat fluazifop-p glufosinate-ammonium	glyphosate haloxyfop napropamide	norflurazon paraquat trifluralin
Tobacco <sup>d</sup>	2,2-DPA clomazone	metolachlor oxyfluorfen	pebulate trifluralin
Tomato	fluazifop-p glufonisate-ammonium metribuzin napropamide	pebulate pendimethalin quizalofop-p	rimsulfuron sethoxydim trifluralin
Walnut	carfentrazone-ethyl	glufosinate-ammonium	glyphosate

a, biological; b, for use in post-harvest storage; c, no longer available for use; d, crop no longer grown in Victoria

**Table 2 Insecticides (active constituents) registered for use in Victoria**

Crop	Insecticide (active constituent)		
Almonds	dicofol paraffinic oil	petroleum oil	sulfur
Asparagus	chlorpyrifos cypermethrin dimethoate	paraffinic oil petroleum oil pirimicarb	spinosad tau-fluvalinate
Avocado	acephate bendiocarb betacyfluthrin bifenthrin cadusafos carbaryl chlorpyrifos clofentezine diazinon dichlorvos	dicofol dimethoate endosulfan fenamiphos fenbutatin oxide fenthion fipronil hydramethylnon methidathion	omethoate oxamyl paraffinic oil petroleum oil prothiofos pyridaben spinosad terbufos trichlorfon
Brassicas	Bacillus thuringiensis <sup>a</sup> betacyfluthrin bioallethrin bioresmethrin carbaryl chlorfenapyr chlorpyrifos cyhalothrin	deltamethrin dimethoate esefenvalerate fenamiphos imidacloprid maldison methamidophos methomyl	parathion-methyl rotenone spinosad tau-fluvinatate thiodicarb triadimenol trichlorfon
Carrot	carbaryl chlorpyrifos diazinon dimethoate	endosulfan fenamiphos maldison	parathion-methyl phorate spinosad

Table 2 continued

Crop	Insecticide (active constituent)			
Cereals	aluminium phosphide <sup>b</sup>	diatomaceous earth	methyl bromide <sup>b,c</sup>	
	amorphous silica	diazinon <sup>b</sup>	omethoate	
	azamethiphos <sup>b</sup>	dichlorvos <sup>b</sup>	paraffinic petroleum oil	
	Bacillus thuringiensis <sup>a</sup>	dimethoate	permethrin <sup>b</sup>	
	betacyfluthrin	endosulfan	phosmet	
	bifenthrin <sup>b</sup>	esfenvalerate	piperonyl butoxide <sup>b</sup>	
	carbaryl <sup>b</sup>	fenitrothion <sup>b</sup>	pirimicarb	
	chloropicrin	imidacloprid	pirimiphos-methyl <sup>b</sup>	
	chlorpyrifos-methyl	maldison <sup>b</sup>	pyrethrins	
	cypermethrin <sup>b</sup>	methidathion	trichlorfon	
	deltamethrin	methoprene <sup>b</sup>		
	Citrus	aldicarb	endosulfan	paraffin oil
		azinphos-methyl	fenamiphos	permethrin
bifenthrin		fenbutatin oxide	petroleum oil	
buprofenzin		fenthion	piperonyl butoxide	
cadusafos		imidacloprid	pirimicarb	
carbaryl		maldison	potassium laurate	
chlorpyrifos		methidathion	spinosad	
diazinon		methomyl	sulfur	
dicofol		omethoate	tebufenozide	
dimethoate		parathion-methyl		
Grapes		azinphos-methyl	fenamiphos	piperonyl butoxide
		Bacillus thuringiensis <sup>a</sup>	fenitrothion	pirimicarb
		benalaxyl	fenthion	prothiofos
	bifenthrin	fipronil	pyrethrins	
	buprofenzin	indoxacarb	pyridaben	
	carbaryl	maldison	rotenone	
	chlorpyrifos	methidathion	spinosad	
	cypermethrin	methomyl	sulfur	
	diazinon	omethoate	tau-fluvalinate	
	dicofol	parathion-methyl	tebufenozide	
	dimethoate	permethrin	tetradecenyl acetate	
	emamectin	petroleum oil	trichlorfon	
	Lettuce	bioallethrin	dimethoate	methomyl
bioresmethrin		emamectin	permethrin	

Table 2 continued

Crop	Insecticide (active constituent)			
Lucerne	carbaryl chlorpyrifos cypermethrin ciazinon	fenitrothion fenamiphos indoxacarb maldison	pirimicarb rotenone trichlorfon spinosad	
	Bacillus thuringiensis <sup>a</sup>	cypermethrin	Metarhizium anisopliae	
	bendiocarb	diazinon	methidathion	
	betacyfluthrin	dimethoate	methomyl	
	bifenthrin	disulfoton	phosmet	
	carbaryl	fenitrothion	pirimicarb	
	chlorpyrifos	imidacloprid	trichlorfon	
	cyhalothrin	maldison		
	Melon	bioallethrin	endosulfan	parathion-methyl
		bioresmethrin	fenamiphos	petroleum oil
carbaryl		imidacloprid	pirimicarb	
chlorpyrifos		maldison	propineb	
diazinon		oxythioquinox	spinosad	
dimethoate		paraffinic oil	trichlorfon	
Olive	dicofol			
	hydramethylnon			
Pasture	Bacillus thuringiensis <sup>a</sup>	dimethoate	maldison	
	betacyfluthrin	disulfoton	Metarhizium anisopliae <sup>a</sup>	
	carbaryl	esfenvalerate	methidathion	
	chlorpyrifos	fenitrothion	methomyl	
	cyhalothrin	fipronil	omethoate	
	cypermethrin	gamma-cyhalothrin	pirimicarb	
	diazinon	imidacloprid		
Pistachio	endosulfan	sulfur		

Table 2 continued

Crop	Insecticide (active constituent)			
Pome fruit	8,10 dodecadien-1-ol	etoxazole	paraffin oil	
	abamectin	fenamiphos	parathion-methyl	
	azinphos-methyl	fenbutatin oxide	petroleum oil	
	bifenazate	fenitrothion	pirimicarb	
	bifenthrin	fenoxycarb	potassium laurate	
	buprofezin	fenpyroximate	propargite	
	carbaryl	fenthion	pyridaben	
	chlorfenapyr	hexythiazox	spinosad	
	chlorpyrifos	imidaclorpid	sulfur	
	clofentezine	indoxacarb	tau-fluvalinate	
	cypermethrin	maldison	tebufenozide	
	diazinon	methidathion	tetradecenyl acetate	
	dicofol	methomyl	thiacloprid	
	dimethoate	omethoate	trichlorfon	
	endosulfan	oxythioquinox		
	Potato	abamectin	dichlorvos	piperonyl butoxide
		acephate	disfulton	primicarb
Bacillus thuringiensis <sup>a</sup>		endosulfan	pyrethrin	
bioallethrin		maldison	rotenone	
bioresmethrin		methamidophos	spinosad	
carbaryl		methomyl	sulfur	
diazinon		permethrin	thiodicarb	
Pumpkin	bioallethrin	endosulfan	parathion-methyl	
	bioresmethrin	fenamiphos	petroleum oil	
	carbaryl	imidaclorpid	pirimicarb	
	chlorpyrifos	maldison	spinosad	
	diazinon	oxythioquinox	sulfur	
	dimethoate	paraffinic oil	trichlorfon	

Table 2 continued

Crop	Insecticide (active constituent)		
Stone fruit	bifenthrin	fipronil	pirimicarb
	carbaryl	hexythiazox	potassium laurate
	chlorpyrifos	imidacloprid	propargite
	clofentezine	maldison	pymetrozine
	cypermethrin	methidathion	spinosad
	diazinon	methomyl	sulfur
	dicofol	parathion-methyl	thiacloprid
	dimethoate	paraffin oil	trichlorfon
	fenthion	petroleum oil	
Tobacco <sup>d</sup>	acephate	deltamethrin	maldison
	alpha-cypermethrin	dichlorvos	methomyl
	Bacillus thuringiensis <sup>a</sup>	dicofol	parathion-methyl
	cadusafos	dimethoate	permethrin
	carbaryl	endosulfan	thiodicarb
	carbofuran	esfenvalerate	trichlorfon
	chlorpyrifos	fenamiphos	
Tomato	abamectin	dicofol	paraffinic oil
	acephate	dimethoate	parathion-methyl
	Bacillus thuringiensis <sup>a</sup>	emamectin	permethrin
	bifenthrin	endosulfan	petroleum oil
	bioallethrin	esfenvalerate	phorate
	bioresmethrin	fenamiphos	piperonyl butoxide
	botanical oil	fenitrothion	pirimicarb
	cadusafos	fenthion	propargite
	carbaryl	imidacloprid	pyrethins
	chlorpyrifos	maldison	spinosad
	cyfluthrin	methamidophos	sulfur
	cyhalothrin	methidathion	tau-fluvalinate
	cypermethrin	methomyl	thiodicarb
	deltamethrin	methoxyfenozone	trichlorfon
	diazinon	oxamyl	
Walnut	sulphur		

a, biological; b, for use in post-harvest storage; c, no longer available for use; d, crop no longer grown in Victoria

**Table 3 Fungicides (active constituents) registered for use in Victoria**

Crop	Fungicide (active constituent)		
Almonds	Agrobacterium radiobacter <sup>a</sup> chlorothalonil copper hydroxide	copper oxychloride copper sulphate cuprous oxide	iprodisone mancozeb sulfur
Asparagus	metiram	propamocarb	
Avocado	azoxystrobin carbendazim chlorothalonil copper ammonium acetate copper hydroxide copper oxychloride copper sulphate	difenoconazole epoxiconazole fenbuconazole fosetyl iodine mancozeb	metalaxyl phosphorous acid prochloraz propiconazole tebuconazole thiabendazole trifloxystrobin
Brassicas	copper ammonium acetate copper hydroxide	copper oxychloride copper sulphate	mancozeb zineb
Carrot	chlorothalonil copper hydroxide copper oxychloride copper sulphate	difenoconazole iodine mancozeb metalaxy	metiram thiram zineb
Cereals	tebuconazole triadimenol		
Citrus	abamectin carbendazim copper ammonium acetate copper hydroxide copper oxychloride copper sulphate cuprous oxide	cyproconazole fenarimol guazatine imazalil iodine mancozeb metiram	phosphorous acid propineb sodium ortho-phenylphenate tetrahydrate sulfur thiabendazole zineb

Table 3 continued

Crop	Fungicide (active constituent)		
Grapes	8 – hydroxyquinoline azoxystrobin benalaxyl benomyl boscalid captan carbendazim chlorothalonil copper ammonium acetate copper hydroxide copper oxychloride copper sulphate cuprous oxide cyproconazole cyprodinil dimethomorph dithianon	fenarimol fenhexamid fluazinam fludioxonil flusilazole guazatine hexaconazole imazalil iodine iprodione mancozeb metalaxyl metiram myclobutanil oxadixyl penconazole peroxyacetic acid	phosphorous acid potassium bicarbonate procymidone propineb pyraclostrobin pyrimethanil quinoxifen spiroxamine sulfur tebuconazole thiram triadimefon triadimenol trichoderma harzianum trifloxystrobin zineb ziram
Lettuce	copper ammonium acetate copper hydroxide copper oxychloride dimethomorph iprodione	metriam mancozeb metalaxyl prochloraz	propineb quintozene thiram
Lucerne	iprodione	metalaxyl	
Melon	azoxystrobin benalaxyl bupirimate carbendazim chlorothalonil copper hydroxide copper octanoate	copper oxychloride copper sulphate dimethomorph fenarimol guatizine imazalil iodine	mancozeb metalaxyl metriam phosphorous acid triadimefon triadimenol zineb
Olive	copper oxychloride		
Pasture	carbendazim metalaxyl phosphorous acid		
Pistachio	Agrobacterium radiobacter <sup>a</sup>	sulfur	

Table 3 continued

Crop	Fungicide (active constituent)		
Pome fruit	bupirimate	fluquinconazole	phosphorous acid
	captan	flusilozole	prochloraz
	carbendazim	fosetyl	propiconazole
	copper ammonium acetate	hexaconazole	pyrimethanil
	copper hydroxide	imazalil	quintozene
	copper oxychloride	iodine	sulfur
	copper sulphate	iodocarb	thiabendazole
	cyproconazole	iprodione	thiram
	cyprodinil	kresoxim-methyl	triadimefon
	difenoconazole	mancozeb	trifloxystrobin
	diphenylamine	metalaxyl	triforine
	dithianon	metriam	zineb
	fenarimol	penconazole	ziram
	Potato	azoxystrobin	dimethomorph
chlorothalonil		fludioxonil	quintozene
copper hydroxide		iprodione	sulfur
copper oxychloride		mancozeb	zineb
copper sulfate		metalaxyl	
cuprous oxide		metriam	
Pumpkin	azoxystrobin	cuprous oxide	oxadixyl
	benalaxyl	dimethomorph	phosphorous acid
	carbendazim	fenarimol	propineb
	chlorothalonil	iodine	sulfur
	copper ammonium acetate	mancozeb	triadimefon
	copper hydroxide	metalaxyl	triadimenol
	copper oxychloride	metriam	zineb
Stone fruit	Agrobacterium radiobacter <sup>a</sup>	dithianon	propiconazole
	captan	iodine	sulfur
	carbendazim	iprodione	thiram
	copper hydroxide	mancozeb	ziram
	copper oxychloride	metiram	
	cyproconazole	procymidone	

**Table 3 continued**

Crop	Fungicide (active constituent)		
Tobacco <sup>d</sup>	captan	copper sulphate	metiram
	chlorothanil	copper ammonium acetate	propineb
	copper hydroxide	copper oxychloride	zineb
Tomato	azoxystrobin	cuprous oxide	metiram
	chlorothalonil	difenoconazole	procymidone
	copper ammonium acetate	guatazine	propineb
	copper hydroxide	iodine	pyrimethanil
	copper octanoate	iprodione	quintozene
	copper oxychloride	mancozeb	sulfur
	copper sulphate	metalaxyl	zineb
	mancozeb		
	metalaxyl		
Walnut	Agrobacterium radiobacter <sup>a</sup>	copper oxychloride	cuprous oxide
	copper hydroxide	copper sulphate	sulfur

a, biological; b, for use in post-harvest storage; c, no longer available for use; d, crop no longer grown in Victoria

**Table 4 The veterinary antibiotics most frequently used in Australian animal industries\***

<b>Animal industry</b>	<b>Active constituent</b>	
Aquaculture	amoxicillin	trimethoprim
	oxytetracycline	
Cattle	avoparcin	oleandomycin
	ceftiofur	polyethers
	cephalosporins	salinomycin
	cloxacillin	tetracyclines
	erythromycin	tilmicosin
	monensin	trimethoprim
	neomycin	tylosin
Pigs	3-nitro-arsonic acid	procaine
	amoxicillin	salinomycin
	apramycin	spectinomycin
	dimetridazole	tetracyclines
	flavomycin	tiamulin
	kitasamycin	tilmicosin
	lincomycin	trimethoprim
	neomycin	tylosin
	olaquinox	virginamycin
	penicillin	
Poultry	3-nitro-arsonic acid	erythromycin
	amoxicillin	flavomycin
	avoparcin	lincomycin
	bacitracin	virginamycin
Sheep	virginamycin	

\* Information extracted from JETACAR (1999) and Dairy Food Safety Victoria (2007)

**Table 5 Physical-chemical properties of the herbicides registered for use in Victoria\***

Active constituent	Chemical group	MW	Vapour press. (mPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
2,2-DPA-sodium (dalapon sodium)	acid-alkonic	NR	NR	soluble	NR	NR	NR	90
2,4 D	phenoxy acids	221.04	0.02	900	2.81	1.30	7 - 30	<7
ametryn	triazine	227.3	0.37	185	2.83	NR	NR	70 - 250
amitrole	triazole	84.08	<1.00	$2.80 \times 10^5$	NR	100	40	14
ammonium thiocyanate	cyanide	NR	not volatile	soluble	NR	NR	NR	14
asulam	carbamate	252.23	$<1.30 \times 10^{-2}$	$4.00 \times 10^3$	0.76	1.53 – 2.48	NR	10
atrazine	triazine	215.69	0.04	28.0	2.34	2.00	NR	60 - >100
bromacil	uracil	261.1	0.03	815	NR	32.0	60	60 - 240
bromoxynil	nitrile	276.93	<1.00	130	NR	NR	NR	10
butafenacil	pyrimidine	474.8	$7.40 \times 10^{-6}$	10.0	3.20	NR	3 - 4	1 - 2
butoxydim	cyclohexanediones	399.5	$1.00 \times 10^{-3}$	6.90	1.90	0.78 – 3.10	NR	9
carfentrazone-ethyl	triazolinone	412.2	$1.60 \times 10^{-2}$	12.0	3.30	1.17 – 1.54	8	2 - 5
chloridazon	pyridazinone	221.65	$6.65 \times 10^{-3}$	400	1.19	2.08	NR	NR
chlorsulfuron	sulfonyl urea	357.8	$3.07 \times 10^{-6}$	$3.18 \times 10^5$	-1.00	NR	NR	13 - 88
chlorthal dimethyl	phthalate	303.9	0.33	0.50	NR	3.78	>7	14 - 100
clethodim	cyclohexanediones	359.9	<1.00	NR	NR	0.49	128 - 300	3
clomazone	oxazolidinone	239.7	19.2	$1.10 \times 10^3$	2.54	2.48	1 - 7	28 - 84
clopyralid	pyridine carboxylic acid	192	1.70	$9.00 \times 10^3$	1.81 - 2.63	1.56	NR	26
dicamba	phenoxy acid	221.04	4.50	$6.50 \times 10^3$	-0.538	0.30	NR	1 - 30
dichlobenil	benzene	172.02	73.0	21.2	2.70	2.23	NR	NR
diclofop-methyl	phenoxy acids	341.2	NR	50.0	NR	NR	NR	10 - 30
diflufenican	anilide/aniline	394.3	$4.25 \times 10^{-3}$	<0.05	4.90	NR	NR	105 - 210
diquat	bipyridilium herbicides	344.06	negligible	$7.00 \times 10^5$	-4.60	6.00	<2	>1000
diuron	urea	233.1	0.41	42.0	2.85	2.68	NR	30 - 365
ethofumesate	nitrile	286.3	0.65	50.0	2.70	2.44	NR	143
ethyl dipropylthiocarbamate	carbamate	NR	NR	NR	NR	NR	NR	NR
fenoxaprop-p-ethyl	phenoxy acids	361.8	$4.0 \times 10^{-3}$	0.90	4.28	3.98	NR	1
fluzifop-p	phenoxy acids	383.4	0.05	1.10	4.50	3.75	NR	<7

**Table 5 continued**

Active constituent	Chemical group	MW	Vapour press. (mPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
flumetsulam	pyrimidine - sulfonamide	325.3	$4 \times 10^{-10}$	$5.65 \times 10^3$	0.21	1.45	NR	51
fluometuron	urea-substituted	232.29	0.07	105	2.23	2.00	770 - 1008	12 - 171
fluoroxypyr	pyridinoxy acid	NR	20.0	0.14	5.04	NR	NR	36
flupropanate	acid-alkonic	168.0	<40.0	$3.90 \times 10^3$	<-1.90	NR	NR	NR
fluroxypyr 1-methyl heptyl ester	pyridine carboxylic acid	367.2	$1.35 \times 10^{-3}$	0.09	4.53	NR	NR	5 - 7
glufonisate-ammonium	amine acid	198.19	<0.10	$1.37 \times 10^6$	<0.10	2.63	NR	7
glyphosate	glycine	169.08	negligible	$1.20 \times 10^4$	-3.22	4.38	12 - 70	47
haloxyfop-R methyl ester	phenoxy acids	361.7	NR	0.50	NR	4.47	33	55 - 100
hexazinone	triazine - triazinones	252.32	30.0	$3.30 \times 10^4$	-4.40	1.73	NR	90
imazamox	imidazolinone	305.3	<0.01	$4.41 \times 10^3$	5.36	NR	NR	NR
imazapic	imidazolinone	275.3	$<1.00 \times 10^{-2}$	$2.15 \times 10^3$	0.39	NR	NR	NR
imazethapyr	imidazole	289.3	<0.01	0.14	1.04	1.04	NR	30 - 90
ioxynil	nitrile	370.9	<1.00	50.0	0.89	NR	NR	10
isophorone	ungrouped	NR	NR	NR	NR	NR	NR	NR
isoxaben	amide	332.4	$5.50 \times 10^{-4}$	1.42	0.94	3.15	NR	NR
linuron	urea	249.11	2.00	81.0	3.00	2.60	NR	60
MCPA	phenoxy acids	200.62	0.20	825	NA	2.00	14 - 30	1 - 30
mefenpyr-diethyl	pyrazoline	373.2	$6.30 \times 10^{-3}$	0.02	3.83	NR	NR	NR
methabenzthiazuron	urea	221.3	$5.90 \times 10^{-3}$	59.0	2.64	NR	NR	NR
metolachlor	anilide/aniline	238.8	4.20	488	2.60	1.84	NR	26
metosulam	sulfonamide	NR	$4.00 \times 10^{-10}$	200	2.46	NR	84	6 - 47
metribuzin	triazine - triazinones	214.29	0.06	$1.05 \times 10^3$	1.60	1.78	7	30 - 120
metsulfuron-methyl	sulfonyl urea	381.4	$3.30 \times 10^{-7}$	$2.79 \times 10^3$	-1.74	1.54	29	14 - 180
molinate	carbamate	187.3	746	880	2.88	2.28	NR	5 - 21
monosodium methylarsonate	mineral - arsenic	NR	NR	NR	NR	NR	NR	NR
napropamide	amine/amide	271.36	0.53	73.0	3.36	2.84	<1	56 - 84
norflurazon	pyridazinone	303.7	$3.87 \times 10^{-3}$	34.0	2.45	2.55	NR	130
oryzalin	anilide/aniline	346.36	<0.01	2.50	3.73	2.78	NR	20 - 128
oxadiazon	pyridazinone	345.23	0.02	0.70	4.70	3.52	NR	180

Table 5 continued

Active constituent	Chemical group	MW	Vapour press. (mPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
oxyfluorfen	diphenyl ether	361.7	0.03	0.10	4.46	5.00	NR	30 - 40
paraquat	bipyridilium	257.2	negligibile	$7.00 \times 10^5$	4.46	6.00	<1 - 30	>1000
pebulate	carbamate	203.36	$1.18 \times 10^3$	100	4.00	2.63	NR	NR
pendimethalin	anilide/aniline	281.31	4.00	0.30	5.18	3.70	NR	40
phenmedipham	carbamate	300.32	$1.20 \times 10^{-6}$	6.00	3.59	3.87	NR	20
picloram	pyridine carboxylic acid	241.48	0.08	430	0.14	1.20	3	20 - 300
prometryn	triazine	241.37	0.13	48.0	3.34	2.60	NR	30 - 90
propachlor	anilide/aniline	211.69	30.6	613	1.62 - 2.30	1.90	NR	NR
propaquizafop	phenoxy acids	443.9	$4.4 \times 10^{-7}$	NR	4.78	NR	20	15 - 26
propyzamide	phenoxy acids	256.13	0.06	12.9	3.30	2.87	NR	25 - 136
quizalofop-p-ethyl	phenoxy acids	372.8	$1.10 \times 10^{-5}$	0.40	NR	2.70	NR	60
rimsulfuron	sulfonyl urea	431.45	$1.47 \times 10^{-3}$	$7.3 \times 10^3$	-1.47	1.11 - 1.80	NR	4 - 11
sethoxydim	cyclohexanediones	327.5	<0.10	$4.70 \times 10^3$	1.65	2.00	<1	5 - 25
simazine	triazine	201.7	$8.10 \times 10^{-4}$	5.00	1.96	2.11	30	60
sodium chloride	mineral	106.4	NR	$7.90 \times 10^5$	NR	NR	NR	NR
Sulfometuron-methyl	sulfonylurea	364.4	8.00	70.0	-0.509	78.0	1 - 60	20 - 28
tebuthiuron	urea	228.31	0.27	$2.50 \times 10^3$	1.78	1.90	>33	365 - 450
terbacil	uracil	216.7	0.06	710	1.89	1.74	NR	50 - 180
terbuthyalazine	triazine	229.71	NR	0.012	3.21	NR	1 - 5	73 - 138
terbutryn	triazine	241.4	0.23	25.0	3.49	NR	180 - 240	14 - 28
thiobencarb	dithiocarbamate	257.8	3.00	28.0	NR	2.95	NR	21
tralkoxydim	cyclohexanediones	329.4	NR	7.00	2.10		6.3 - 594	2.4
tribenuron-methyl	urea	395.39	$5.30 \times 10^{-5}$	$48.0 - 1.80 \times 10^4$	-0.44	1.72	NR	1 - 16
triclopyr	pyridine carboxylic acid	256.48	0.17	440	0.42	1.30	<1	30 - 90
Trifluralin	anilide/aniline	335.5	13.7	<1.00	5.07	3.90	NR	45 - 60

\* Compiled using data from: EXTOWNET (1998), US EPA (2006a), Wauchope (2005), Tomlin (2000)

NR – not reported

**Table 6 Physical-chemical properties of the insecticides, molluscides and nematicides registered for use in Victoria\***

Active constituent	Chemical group	MW	Vapour press (MPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
8,10 dodecadien-1-ol	biological pheromone	NR	NR	NR	NR	NR	NR	NR
abamectin	macrocyclic lactone	873.11	negligible	insoluble	4.40	3.70	<4	1 - 60
acephate	organophosphate	183.17	0.27	650	-1.87	0.48	NR	<3 - 6
aldicarb	carbamate	190.27	13.0	$6.00 \times 10^3$	1.13	1.48	5 - 10	NR
aluminium phosphide	mineral	57.95	negligible	insoluble	NR	NR	not persistent	not persistent
azamethiphos	organophosphate	324.7	$4.9 \times 10^{-3}$	$1.00 \times 10^3$	1.05	NR	NR	0.25
azinphos-methyl	organophosphate	317.33	<1.00	30.0	2.80	3.00	>2	5 - 21
<i>Bacillus thuringiensis</i>	biological	NA	NA	NA	NA	NA	NR	> 120
bendiocarb	carbamate	223.33	0.66	40.0	1.69	2.75	NR	<7 - 30
beta-cyfluthrin	pyrethroid	NR	$1.00 \times 10^6$	NR	6.18	immobile	NR	NR
bifenazate	carbazate	300.36	$<1.00 \times 10^{-2}$	3.80	3.40	NR	<1	5
bifenthrin	pyrethroid	422.9	0.02	0.10	6.00	NR	NR	7 - 240
bioallethrin	pyrethroid	302.4	43.9	4.60	4.68	NR	NR	NR
bioresmethrin	pyrethroid	338.4	18.6	<0.30	>4.70	NR	NR	NR
botanical oil	plant extract	NR	NR	NR	NR	NR	NR	NR
buprofezin		305.4	1.25	0.90	4.30	NR	NR	80 - 104
cadusafos	organophosphate	270.4	$1.20 \times 10^2$	248	3.90	2.16 – 2.54	NR	45
carbaryl	carbamate	201.23	<5.30	40.0	1.59	2.48	10	7 - 28
chlorfenapyr	pyrroles	407.6	NR	0.13	4.83	NR	NR	NR
chloropicrin	gas	164.38	18.3	1.60	NR	NR	<2	<5
chlorpyrifos	organophosphate	350.62	2.50	2.00	4.69	3.78	3 - 78	60 - 120
clofentezine	tetrazine	303.1	$1.30 \times 10^{-4}$	$2.50 \times 10^{-3}$	3.10	4.65	NR	3 - 7
cyfluthrin	pyrethroid	434.3	$9.60 \times 10^{-4}$	$2.00 \times 10^{-3}$	6.00	5.62	1	2 - 3
cyhalothrin	pyrethroid	449.9	$2.0 \times 10^{-4}$	$5.00 \times 10^{-3}$	7.00	5.26	NR	NR
cypermethrin	pyrethroid	416.3	NR	0.01	6.60	5.00	>50	4 - 56
deltamethrin	pyrethroid	505.25	$1.24 \times 10^{-5}$	<0.10	4.60	NR	NR	7 - 14
diazinon	organophosphate	304.35	0.10	40.0	NR	3.00	< 1 - 180	14 - 30
dichlorvos	organophosphate	220.98	290	$1.00 \times 10^4$	NR	1.48	4	7
dicofol	organophosphate	370.51	negligible	0.80	4.27	3.70	47 - 85	60

Table 6 continued

Active constituent	Chemical group	MW	Vapour press (MPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
dimethoate	organophosphate	229.28	1.10	25.0	0.69	1.30	8	20
disulfoton	organophosphate	274.4	24.0	25.0	3.95	2.78	NR	7
emamectin	macrocyclic lactone	NR	NR	NR	NR	NR	NR	NR
endosulfan	organochlorine	406.96	$1.20 \times 10^3$	0.32	3.13	4.09	1	50
esfenvalerate	pyrethroid	419.9	0.07	<0.30	6.22	3.72	21	15 - 90
etoxazole	ungrouped	359.4	$2.18 \times 10^{-3}$	0.08	5.59	NR	NR	19
fenamiphos	organophosphate	303.4	0.12	700	NR	2.00	<1	50
fenbutatin oxide	organotin	1052.7	$2.40 \times 10^{-6}$	0.01	5.10	3.43	NR	>365
fenitrothion	organophosphate	277.25	18.0	30.0	3.38	NR	<50	<7
fenoxycarb	carbamate	301.3	$7.8 \times 10^{-3}$	6.00	4.30	3.18	<1	1
fenpyroximate	ungrouped	421.5	$7.5 \times 10^{-3}$	$1.46 \times 10^{-2}$	5.01	NR	NR	26 - 50
fenthion	organophosphate	278.33	4.00	2.00	4.09	3.18	14	34
fipronil	nitrile	437.2	$3.70 \times 10^{-4}$	1.90	4.00	NR	NR	NR
gamma-cyhalothrin	pyrethroid	NR	NR	NR	NR	NR	NR	NR
hexythiazox	thiazole	352.9	$3.4 \times 10^{-3}$	0.50	2.53	3.79	NR	8
hydramethylnon	hydrazide	494.5	$2.7 \times 10^{-3}$	0.01	2.31	5.86	10	10
imidacloprid	neonicotinoid	255.7	$2.0 \times 10^{-4}$	0.51	0.57	NR	>31	48 - 190
indoxacarb	oxadiazine	527.8	$2.5 \times 10^{-5}$	0.20	4.65	3.52 - 3.98	NR	3 - 693
maldison	organophosphate	330.36	5.30	130	2.74	3.26	<7 - 21	1 - 25
metaldehyde	aldehyde	176.2	negligibile	260	NR	2.38	NR	<7
metarhizium anisopliae	biological	NR	NR	NR	NR	NR	NR	NR
methamidophos	organophosphate	141.12	NR	$9.0 \times 10^4$	-1.74	NR	27 - 309	2 - 12
methidathion	organophosphate	302.33	186	240	4.72	2.60	NR	5 - 23
methiocarb	carbamate	225.31	0.03	24.0	3.34	2.77	NR	64
methomyl	carbamate	162.21	6.65	$5.79 \times 10^4$	0.093	1.86	6	14
methoprene	terpene	310.48	3.15	1.40	>6.00	NR	1 - 2	10
methoxyfenozide	hydrazide	368.5	$<1.48 \times 10^{-3}$	3.30	3.70	NR	77	23 - 268
methyl bromide	gas	94.94	$2.27 \times 10^8$	$13.4 \times 10^4$	NR	1.34	<1 - 20	30 - 60
omethoate	organophosphate	213.2	3.30	NR	-0.74	NR	NR	<7
oxamyl	carbamate	219.36	31.0	$2.80 \times 10^5$	-0.44	1.39	1 - 2	4 - 20

**Table 6 continued**

Active constituent	Chemical group	MW	Vapour press (MPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
oxythioquinox	quinoline	NR	0.03	NR	3.78	NR	NR	NR
paraffinic oil	petroleum derivat	NR	NR	NR	NR	NR	NR	NR
parathion-methyl	organophosphate	263.21	1.30	55.0 – 60.0	3.51	3.7	8 - 38	1 - 30
permethrin	pyrethroid	391.3	0.05	0.20	6.10	5.00	<3	30 - 38
petroleum oil	petroleum derivat	NR	NR	NR	NR	NR	NR	NR
phorate	organophosphate	260.38	110	50.0	3.92	3.00	NR	2 - 173
phosmet	organophosphate	317.33	133	25.0	3.04	2.91	9	4 - 20
piperonyl butoxide	benzodioxole	339.4	$2.00 \times 10^{-2}$	14.3	4.75	2.6 – 2.92	NR	NR
pirimicarb	carbamate	238.3	0.97	$3.00 \times 10^3$	1.70	1.36	NR	NR
pirimiphos-methyl	organophosphate	305.34	2.00	9.00	4.20	4.37	NR	NR
potassium laurate	mineral	NR	NR	NR	NR	NR	NR	NR
propargite	organosulfur	350.5	$6.0 \times 10^{-3}$	0.60	3.73	4.6	NR	40
prothiofos	organophosphate	345.2	$1.00 \times 10^6$	0.07	5.67	NR	NR	30 - 60
pymetrozine	ungrouped	217.2	$<4.00 \times 10^{-3}$	290	-0.18	NR	NR	2 - 69
pyrethins	pyrethroid	316 - 374	NR	insoluble	NA	NA	NR	NR
pyridaben	pyridazinone	364.9	0.25	0.01	6.37	NR	NR	<3
rotenone	plant extract	394.43	<1.00	15.0	4.16	4.00	1 - 3	1 - 3
spinosad	ungrouped	732.0	$3.0 \times 10^{-5}$	89.4	2.80	NR	>200	9 - 17
sulfur	mineral	32.064	NR	insoluble	NR	NR	NR	NR
tau-fluvalinate	pyrethroid	502.93	0.08	0.01	4.26	5.41	NR	25
tebufenozide	hydrazide	352.2	$<1.56 \times 10^{-4}$	0.83	4.25	2.54 – 2.95	80	42 - 180
terbufos	organophosphate	288.43	34.6	5.00	4.50	2.70	4 - 9	15 - 30
tetradecenyl acetate		252.4	NR	NR	NR	NR	NR	NR
thiacloprid	neonicotinoid	NR	NR	0.19	1.26	NR	NR	<1 - 4
thiodicarb	carbamate	354.47	4.30	19.1	1.40	2.54	NR	<2
trichlorfon	organophosphate	257.44	0.21	$1.20 \times 10^5$	5.75	1.00	<1	3 - 27

\* Compiled using data from: EXTOWNET (1998), US EPA (2006a), Wauchope (2005), Tomlin (2000)

NR – not reported

**Table 7 Physical-chemical properties of the fungicides registered for use in Victoria\***

Active constituent	Chemical group	MW	Vapour press (MPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
8 - hydroxyquinoline	quinoline	NR	NR	NR	NR	NR	NR	NR
<i>Agrobacterium radiobacter</i>	biological	NR	NR	NR	NR	NR	NR	NR
azoxystrobin	stobilurin	403.4	$1.10 \times 10^{-7}$	6.00	2.5	NR	11 - 17	72 - 164
benalaxyl	phenylamide	325.4	0.67	37.0	3.54	3.54	NR	77
benomyl	benzimidazole	290.62	<1.00	2.00	NA	3.28	<1	60 - 365
boscalid	carboxamide	NR	7.20	4.60	2.96	NR	NR	27 - 372
bupirimate	pyrimidine	316.4	0.10	22.0	3.90	NR	NR	35 - 90
captan	phthlamide	300.61	1.30	3.30	2.78	2.30	<2	1 - 10
carbendazim	carbamate-benzimidazole	191.19	0.09	8.00	1.77	2.54	NR	NR
chlorothalonil	chloronitrile	265.92	1.30	0.60	2.64	3.14	40	30 - 90
copper ammonium acetate	mineral	NR	NR	NR	NR	NR	NR	NR
copper hydroxide	mineral copper	97.6	NR	2.90	NR	NR	NR	NR
copper octanoate	mineral	350.0	NR	NR	NR	NR	NR	NR
copper oxychloride	mineral copper	427.1	NR	$<1.00 \times 10^{-5}$	NR	NR	NR	NR
copper sulphate	mineral	249.68	nonvolatile	$2.30 \times 10^4$	NR	NR	NA	NA
cuprous oxide	mineral copper	NR	NR	NR	NR	NR	NR	NR
cyproconazole	triazole	291.8	$3.46 \times 10^{-2}$	140	2.91	NR	NR	90
cyprodinil	pyrimidine - amine	225.3	$5.10 \times 10^{-1}$	13.0	4.00	NR	NR	20 - 60
difenoconazole	triazole	406.3	$3.30 \times 10^{-5}$	15.0	4.20	NR	NR	145
dimethomorph	morpholine	387.9	$9.70 \times 10^{-4}$	>50.0	NR	NR	NR	NR
diphenylamine	amine/amide	169.2	NR	NR	NR	NR	NR	NR
dithianon	quinone	296.3	$2.70 \times 10^{-6}$	0.14	3.20	NR	NR	NR
epoxiconazole	triazole	329.8	<0.10	$6.63 \times 10^{-4}$	3.44	2.98 – 3.42	NR	60 - 90
fenarimol	pyrimidine	331.2	0.03	14.0	3.69	2.88	NR	840
fenbuconazole	thiazole	336.8	0.01	0.20	3.23	3.32 – 3.95	NR	NR
fenhexamid	amide	302.2	302	20.0	3.51	NR	NR	<1
fluazinam	anilide/aniline	465.1	1.50	0.07	3.56	NR	6 - 42	33 - 62

Table 7 continued

Active constituent	Chemical group	MW	Vapour press (MPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
fludioxonil	phenylpyrrole	248.2	$3.90 \times 10^{-4}$	1.80	4.12	NR	9 - 10	10 - 25
fluquinconazole	azole	376.2	$6.40 \times 10^{-6}$	1.00	3.24	>2.87	NR	50 - 300
flusilazole	triazole	315.4	$3.90 \times 10^{-2}$	45.0	3.75	2.99 – 3.3	NR	420
fosetyl-aluminium	phosphorous acid	354.1	<1.30	$1.2 \times 10^5$	-2.53	2.22	NR	0.01
guatazine	guanidine	NR	$<1.00 \times 10^{-2}$	$> 3.00 \times 10^3$	-1.20	NR	NR	NR
hexaconazole	triazole	314.2	0.02	17.0	3.90	NR	NR	NR
imazalil	imidazole	297.18	0.01	$1.40 \times 10^3$	3.82	3.60	56	150
iodine	mineral iodine	NR	NR	NR	NR	NR	NR	NR
iodocarb	butylcarbamate	NR	NR	NR	NR	NR	NR	NR
iprodione	carboximide	330.17	<0.13	13.0	3.10	700	NR	14
kresoxim-methyl	strobilurin	313.8	$2.30 \times 10^{-3}$	2.0	NR	NR	34	<1
mancozeb	dithiocarbamate	266.31	negligibile	6.00	NR	>3.30	1 - 2	1 - 7
metalaxyl	benzenoid	279.34	0.29	$7.10 \times 10^3$	NR	1.70	> 30	70
metiram	dithiocarbamate	1088.7	0.01	<1.00	0.30	5.70	NR	NR
myclobutanil	triazole	288.78	0.21	142	2.94	2.70	NR	NR
oxadixyl	hydrazide	278.3	$3.3 \times 10^{-3}$	NR	0.65 – 0.80	NR	NR	60 - 90
penconazole	triazole	284.2	0.17	NR	3.72	NR	NR	133 - 343
peroxyacetic acid	acid	NR	NR	NR	NR	NR	NR	NR
phosphorous acid	phosphorous acid	NR	NR	NR	NR	NR	NR	NR
potassium bicarbonate	potassium salt	NR	NR	NR	NR	NR	NR	NR
prochloraz	carbamate-azole	376.7	0.15	34.4	4.38	3.87	NR	130
procymidone	carboximide	284.1	18.0	4.50	3.14	3.18	NR	NR
propamocarb	carbamate	224.7	0.80	$1.00 \times 10^6$	-2.60	2.49	NR	12
propiconazole	triazole	343.2	0.06	100	2.80	2.82	NR	53
propineb	dithiocarbamate	289.8	$<1.60 \times 10^{-7}$	$1.00 \times 10^{-5}$	-0.26	NR	NR	NR
pyraclostrobin	strobilurin	NR	NR	NR	NR	NR	NR	NR
pyrimethanil	pyrimidine	199.3	2.20	121	2.84	2.42 – 2.87	NR	7 - 54
quinoxifen	quinoline	308.1	$1.20 \times 10^{-5}$	0.12	4.66	NR	NR	123 - 494
quintozene	benzene	295.34	6.60	0.44	4.46	3.70	2 - 5	<21 - >365

Table 7 continued

Active constituent	Chemical group	MW	Vapour press (MPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
sodium ortho-phenylphenate tetrahydrate	ungrouped	NR	NR	NR	NR	NR	NR	NR
sulfur	mineral	32.064	NR	insoluble	NR	NR	NR	NR
spiroxamine	amine	297.5	9.70	NR	2.79	NR	NR	35 - 64
tebuconazole	triazole	307.8	$1.70 \times 10^{-3}$	36.0	3.70	NR	60 - 90	NR
thiabendazole	triazole	201.2	negligible	<50.0	NR	3.4	NR	403
thiram	dithiocarbamate	240.44	negligible	30.0	NR	2.83	NR	15
triadimefon	triazole	293.76	<0.10	260.0	3.17	2.48	>196	14 - 60
triadimenol	triazole	295.8	$4.10 \times 10^{-6}$	32.0 – 95.0	3.08 - 3.28	2.70	NR	NR
<i>Trichoderma harzianum</i>	biological	NR	NR	NR	NR	NR	NR	NR
trifloxystrobin	strobilurin	408.4	$3.40 \times 10^{-3}$	0.61	4.50	3.43	NR	NR
triforine	amine/amide	435	80	30.0	2.20	NR	NR	21
zineb	dithiocarbamate	275.74	<0.01	10.0	<1.30	3.00	NR	16
ziram	dithiocarbamate	305.83	negligible	65.0	1.23	2.6	NR	30

\* Compiled using data from: EXTOWNET (1998), US EPA (2006a), Wauchope (2005), Tomlin (2000)

NR – not reported

**Table 8 Physical-chemical properties of the veterinary antibiotics registered for use in Victoria\***

Active constituent	Chemical group	MW	Vapour press (mPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
3,5-dinitro-o-toluamide	arsenicals	255.16	$9.04 \times 10^{-3}$	$1.00 \times 10^3$	0.19	NR	NR	NR
3-nitro-4-hydroxyphenylarsonic acid	organoarsenic	NR	NR	NR	NR	NR	NR	NR
amoxicillin	$\beta$ -lactams	365.41	$6.25 \times 10^{-12}$	$3.43 \times 10^3$	0.87	NR	NR	NR
ampicillin	$\beta$ -lactams	349.4	$1.61 \times 10^{-14}$	1.01	1.35	NR	NR	NR
amprolium	thiamine	NR	NR	NR	NR	NR	NR	NR
apramycin	aminoglycoside	539.57	NR	NR	-8.12	NR	NR	NR
avilamycin	oligosaccharide	NR	NR	NR	NR	NR	NR	NR
bacitracin	polypeptides	NR	NR	NR	NR	NR	NR	12 – 22.5
benthasine penicillin	$\beta$ -lactams	NR	NR	NR	NR	NR	NR	NR
bromhexine	NR	460.43	NR	$4.00 \times 10^3$	4.88	NR	NR	NR
ceftiofur	cephalosporin	523.57	$7.87 \times 10^{-15}$	23.0	1.60	3.57	49	22 - 49
cefuroxime sodium	cephalosporin	424.38	$2.29 \times 10^{-16}$	145	-0.16	NR	NR	22.2 - 49
cephalexin	cephalosporin	347.39	$4.32 \times 10^{-10}$	$1.79 \times 10^3$	0.65	NR	NR	NR
cephapirin	cephalosporin	423.47	NR	NR	NR	NR	NR	NR
cephalonium dihydrate	cephalosporin	NR	NR	NR	NR	NR	NR	NR
chloramphenicol	fenicoles	323.13	$2.27 \times 10^{-7}$	$2.50 \times 10^4$	1.14	1.99	18.4	NR
chlorotetracycline	tetracycline	478.9	$2.09 \times 10^{-23}$	600	NR	3.11 – 3.38	NR	> 30
clindamycin	lincosamide	424.98	$7.04 \times 10^{-12}$	30.6	2.16	NR	NR	NR
cloxacillin	$\beta$ -lactams	435.88	$1.83 \times 10^{-10}$	13.9	2.44	NR	NR	NR
diaveridine	pyrimidine	NR	$6.79 \times 10^{-3}$	$3.08 \times 10^3$	0.97	NR	NR	NR
difloxacin	quinolones	NR	$3.0 \times 10^{-9}$	$1.33 \times 10^3$	0.89	NR	NR	NR
dihydrostreptomycin	aminoglycosides	NR	NR	NR	-7.51	NR	NR	NR
dimetridazole	nitroimidazole	NR	74.4	$1.83 \times 10^4$	0.31	NR	NR	NR
dinitolmide	NR	NR	NR	$1.00 \times 10^3$	0.19	NR	NR	NR
doxycycline	tetracycline	462.46	$1.89 \times 10^{-18}$	630	-0.02	NR	NR	NR
enrofloxacin	fluoroquinolones	359.4	$2.80 \times 10^{-8}$	$1.30 \times 10^5$	2.53	4.22 – 5.00	NR	NR
erythromycin	macrolides	733.9	NR	$2.00 \times 10^3$	NR	NR	NR	11.5
ethopabate	NR	NR	NR	NR	1.90	NR	NR	NR
florfenicol	NR	NR	NR	NR	NR	NR	NR	4 - 5
gentamicin	aminoglycoside	NR	NR	NR	-1.88	NR	NR	NR
imidocarb dipropionate	NR	NR	NR	NR	NR	NR	NR	NR

Table 8 continued

Active constituent	Chemical group	MW	Vapour press (mPa)	Water sol. (mg/L)	Log Kow	Log Koc	Half-life (water) (d)	Half-life (soil) (d)
kitasamycin	macrolides	NR	NR	NR	NR	NR	NR	NR
lincomycin	linosamides	406.5	$1.79 \times 10^{-12}$	900	0.86	NR	NR	NR
marbofloxacin	quinolones	NR	NR	NR	NR	NR	NR	NR
methyl parahydroxybenzoate	hydroxybenzoate	NR	NR	NR	NR	NR	NR	NR
metronidazole	imidazole	171.15	0.04	$1.10 \times 10^4$	-0.02	1.36	NR	9.7 – 26.9
monensin	polyethers	670.88	$4.27 \times 10^{-18}$	$3 \times 10^{-3}$	5.43	1	NR	<20
narasin	polyethers	NR	NR	NR	NR	NR	NR	NR
neomycin	aminoglycoside	614.6	NR	$2.50 \times 10^5$	-3.70	NR	NR	NR
novobiocin	aminocoumarine	612.62	$6.53 \times 10^{-22}$	4.00	2.50	NR	NR	NR
oleandomycin	macrolides	785.9	$4.53 \times 10^{-20}$	16.0	1.69	2.3	NR	23
olaquinox	quinoxalines	263.25	NR	NR	-2.13	1.66 – 2.06	NR	5.8 – 8.8
orbifloxacin	quinolones	NR	NR	NR	NR	NR	NR	NR
oxytetracycline	tetracyclines	460.4	$1.29 \times 10^{-19}$	$1.00 \times 10^3$	-0.09	2.29 – 4.96	NR	16 - 79
penethamate hydriodide	diethylaminoethyl ester	NR	NR	$9.60 \times 10^3$	0.25	NR	NR	NR
prilocaine hydrochloride	amino amide	220.31	NR	NR	2.11	NR	NR	NR
procain	$\beta$ - lactams	236.31	NR	$9.45 \times 10^3$	1.92	NR	NR	NR
robenidien hydrochloride	NR	NR	NR	NR	NR	NR	NR	NR
ronidazole	dinitroimidazole	NR	0.33	$2.90 \times 10^3$	-0.38	NR	NR	NR
salinomycin	polyethers	751.00	NR	NR	8.53	NR	NR	5
spiramycin	macrolides	NR	NR	NR	NR	NR	NR	NR
sulfadimidine	sulfonamides	NR	NR	NR	NR	1.90 – 2.23	NR	NR
sulfamerazine	sulfonamides	NR	$2.57 \times 10^{-3}$	202	0.14	NR	NR	NR
sulfadiazine	sulfonamides	250.3	NR	77.0	-0.09	1.57 – 2.10	NR	NR
sulfathiazole	sulfonamides	255.32	$5.63 \times 10^{-3}$	373	0.05	NR	NR	NR
sulfaquinoxaline	sulfonamides	NR	$4.00 \times 10^{-5}$	7.50	1.68	2.30	NR	NR
tetracycline hydrochloride	tetracyclines	NR	NR	NR	NR	3.06 – 3.37	NR	NR
tiamulin	diterpene	493.75	NR	NR	4.75	NR	NR	26
tilmicosin	macrolides	869.1	$6.13 \times 10^{-27}$	0.02	3.80	3.45	NR	NR
toltrazuril	triazinetrione	NR	NR	NR	NR	NR	NR	NR
trimethoprim	sulphonamides	290.32	$1.32 \times 10^{-3}$	400	0.91	1.87	75 - 100	75 - 100
tylosin	macrolides	917.1	$2.67 \times 10^{-29}$	5.00	1.63	2.74 – 3.90	9.5 - 40	2 – 8.1
virginiamycin	streptogramins	NR	NR	NR	NR	NR	NR	87 - 173

\* Data from: Halling-Sorensen et al, 1998; Rabolle and Spliid, 2000; US National Library of Medicine, 2005; Blackwell et al, 2007; Sarmah et al, 2006

NR – not reported