NATIONAL ENVIRONMENTAL HEALTH FORUM

Pesticide use in schools and school grounds

National Environmental Health Monographs

General Series No. 1

1997

Pesticide use in schools and school grounds

Kevin J Buckett and Peter N Di Marco

National Environmental Health Forum Monographs
General Series No. 1

National Environmental Health Forum

SOUTH AUSTRALIA
TERRITORY HEALTH SERVICES
NORTHERN TERRITORY GOVERNMENT
Commonwealth Department of Health and Family Services
COMMUNITY AND HEALTH Services
Tasmania
QUEENSLAND HEALTH
Human Services
People*first*
Department of Health and Community Care
AUSTRALIAN CAPITAL TERRITORY
NSW HEALTH DEPARTMENT
Western Australia
Health Department of Western Australia

1997

Printed by Openbook Publishers.

Published for the National Environmental Health Forum
by the Department of Human Services

Prepared for publication by Sandra Sowerby and Andrew Langley.
Environmental Health Branch
Department of Human Services

Price available on application.

National Library of Australia Cataloguing-in-Publication

Buckett, Kevin J.

Pesticide use in schools and school grounds.

ISBN 0 642 26667 0.

ISSN 1328-2867

1. Pesticides - Australia. 2. School buildings -

Environmental aspects - Australia . 3. School grounds -

Environmental aspects - Australia. I. Di Marco, Peter N.

II. National Environmental Health Forum. III. Title.

(Series: National Environmental Health Forum monographs.

General series; No. 1).

371.620994

Foreword

This booklet has been prepared by the Environmental Health Service of the Health Department of Western Australia, in conjunction with the Education Department of Western Australia and the Western Australian Department of Agriculture, to provide guidance on pest management for anyone using pesticides in or near schools. It has been reviewed by the Directors of Environmental Health of each State and Territory, and the Commonwealth and, to expedite publication, they have undertaken targeted consultation only.

This document can be used as an information base, a reference document and a guide to the practical control of pests in and around schools.

The booklet is not an exhaustive treatise intended to cover all aspects of pest management in schools and school grounds, but rather a guide to the approach which should be taken to control pests while minimising risk to the school community and environment.

Comments on the booklet should be forwarded to:

Toxicology Section
Environmental Health Service
Health Department of Western Australia
PO Box 8172
Stirling Street
PERTH WA 6849

Acknowledgments

This document used two primary sources: 'Guidelines for use of pest control agents in schools', produced by the WorkCover Authority, NSW, 1992; and 'Handbook of integrated pest control and management for Western Australia', produced by Stanford Associates, 1990. The authors acknowledge the major contribution of these documents to the preparation of the monograph.

Critical review and advice by Mr Lindsay Gillam (Pesticide Safety, WA); Mr Keith Hughes of the Education Department, WA; Mr Chris Sharpe of AgWest; Dr Julian White of the Toxinology Department, Adelaide Women's and Children's Hospital; Dr Pipi Mottram, Medical Entomologist, Queensland Health; and Mr Robert Taylor of the South Australian Health Commission are much appreciated.

The illustrations of booklice and ticks on pages 20 and 22 respectively are reproduced, with permission, from 'Urban Pest Control in Australia' by P Hadlington and J Gerozisis, NSW University Press, 1985.

Disclaimer

CONTENTS

Executive Summary

This monograph has been developed to address some of the community concern over the use of pesticides in schools. They aim to provide information on pests and pesticides, and how pesticides can be used safely as a component of integrated pest management.

The document is intended for school principals, teachers, parent organisations and pest management technicians. They may also be useful for people involved in pest management in buildings other than schools, to local government officers, and to interested members of the public.

The monograph includes:

- suggested practices for integrated pest management;
- information on pesticides, including their toxicity and safe use;
- a list of pests and the pesticides which may be used against them;
- a code of practice for pest management technicians;
- a list of organisations which can be contacted for more information or advice.

Published Monographs

Water Series

1. Guidance for the control of Legionella (1996)
2. Guidance on water quality for heated spas (1996)
3. Guidance on the use of rainwater tanks (1998)

Soil Series

1. Health-based soil investigation levels, 2nd edition (1998)
2. Exposure scenarios and exposure settings, 2nd edition (1998)
3. Composite sampling (1996)

Metal Series

1. Aluminium, 2nd edition (1998)
2. Zinc (1997)
3. Copper (1997)

Air Series

1. Ozone (1997)
2. Benzene (1997)
3. Nitrogen Dioxide (1997)
4. Sulfur dioxide (1999)

General Series

1. Pesticide use in schools and school grounds (1997)
2. Paint film components (1998)
3. Guidelines for the control of public health pests – Lice, fleas, scabies, bird mites, bedbugs and ticks (1999)
4. National Standard for licensing pest management technicians (1999)

Indigenous Environmental Health Series

1. Indigenous Environmental Health No. 1 (1999)

Exposure Series

1. Child activity patterns for environmental exposure assessment in the home (1999)

Counter Disaster series

1. Floods: An environmental health practitioner's emergency management guide (1999)

1. Introduction

Pesticides are important tools in pest control. However, there is considerable community concern over their use. Some of this concern is well founded, but some is based on lack of knowledge and inadequate information.

This monograph has been developed to address this concern by providing information on pests and pesticides, their toxicities and how they can be used safely. They also describe a system of integrated pest management which advocates other methods of pest control and, when these are not enough, the rational use of pesticides as a component of pest control.

1.1 Scope

The monograph is intended for, but not restricted to, school principals, teachers, parent organisations and pest management technicians. They also offer guidance for pesticide applications near or around schools and may, therefore, be of interest to local government officers and the general public.

The monograph is not a manual for pesticide use, but rather a guide to practices which are recommended for the control of pests in and around schools.

The monograph is not intended to promote any particular pesticides and they should not be taken to recommend any particular product.

The document includes:

- suggested practices for integrated pest management;
- information on pesticides, including their toxicity and safe use;
- a list of pests and pesticides which may be used against them;
- a code of practice for pest management technicians;

2. Integrated pest management

Integrated pest management includes a range of options to control pests. These include prevention as well as physical, chemical and biological control.

2.1 Prevention

Whenever possible, infestation by pests should be prevented by eliminating the environment and conditions they prefer (e.g. low standards of hygiene may encourage cockroaches and rats) or by creating barriers (e.g. simple fly screens; removing brush and leaf litter from around buildings to prevent spiders; screening or removing pooled water to inhibit mosquitoes).

Food, including small scraps, can support large populations of some pests. All foodstuffs should therefore be stored in resealable containers with close-fitting lids. Food scraps should be cleaned up regularly and thoroughly.

Rubbish bins and waste food bins should have tight-fitting lids and be cleaned regularly. Waste materials should not be left in or near buildings where other products which are liable to infestation are stored.

Appropriate physical barriers will also reduce indoor infestations. Screen the bottom of doors and ensure window fly screens are in good repair. Cracks in floor boards and around skirting should be sealed. Waste pipes through walls and floors are common entry points for a number of pests and these should also be properly sealed. However, sealing should not interfere with the normal ventilation of the building.

Unless they are needed for security reasons do not leave lights on at night as they attract insects such as moths, which in turn attract spiders.

2.2 Control

Sometimes pests get out of control, despite all good intentions and precautions. In such cases it is important to consider all options available to control them. Follow these simple steps for good pest management practice:

- Identify the pest correctly.
- Determine the range of options to discourage or control the pest (physical, chemical, biological).
- Select the best option suited to your needs.

When pesticides are needed, use as little as is necessary for effective control of the pests. 'General' chemical spraying to form a barrier against a range of pests is generally not recommended.

If pesticide baits are used, it is important that these be presented as the most readily available source of food for the target.

2.3 Pesticide treatment

Following these simple steps will go a long way towards reducing or avoiding concern about the application of pesticides:

- Identify the range of pesticides registered for your needs. Information on this can be obtained from the Education Department or your pest management technician.
- Ask for the Material Safety Data Sheet (MSDS) and any additional toxicological information available from the pest management technician or the manufacturer of the product.
- Where possible, select the least dangerous pesticide that will do the job effectively.
- Read the directions and precautions on the label and ensure that they are followed closely.
- Ensure staff are trained adequately to use pesticides (e.g. gardeners, cleaners).
- Inform the school community (teachers, children, parents) of your intentions and involve them in the decision making process.
- Inform the school community and, when appropriate, neighbours of the school when the pesticide will be applied.
- Consider signposting areas to be sprayed to ensure that people, and especially children, are kept a safe distance away during pesticide use.
- Apply the pesticide so that children, teachers and the public are not exposed or exposed as little as possible (e.g. during the school holidays or weekends).
- If a spillage occurs, it should be cleaned up quickly and effectively. If a spillage has occurred, the principal or supervisor should be warned of what has happened before the area is reoccupied.
- After application inside a building, ensure that any 'no-entry period' given on the pesticide label has elapsed and that the rooms are thoroughly ventilated prior to reoccupation. Re-entry into a building while a pesticide smell persists remains one of the most common reasons for concern after treatment.

Remember, whether warranted or not, pesticide use can cause stress or even outrage when people feel they have not been kept informed or that safety concerns have not been fully addressed.

---

3. Pesticides

3.1 What is a pesticide?

A pesticide is a chemical which kills or controls pests - for example, insects, weeds, rodents, fungi, spiders and snails. The major pesticide groups are:

- Insecticides
- Herbicides
- Rodenticides
- Fungicides
- Molluscicides
- Algicides

Typical insecticides

- Pyrethrins or pyrethroids: often supplied in aerosol cans.
- Organophosphates: diazinon, chlorpyrifos - found in home garden products and some pet collars, although some products are restricted to authorised people only.
- Carbamates: bendiocarb, propoxur, carbaryl - found in rose and tomato dusts and flea powders as well as in restricted products.

Typical herbicides

- Non-selective: glyphosate, a general all-purpose weedkiller.
- Selective: bromoxynil, dicamba, 2,4-D, MCPA, used for weed control.

Typical rodenticides

- Anticoagulants: warfarin, bromadiolone, brodifacoum: rat and mouse killer.

Typical fungicides

- Chlorothalonil, copper, mancozeb: used on plants and home grown vegetables.

Typical molluscicides

- Metaldehyde, methiocarb: snail killers.

Typical algicides

- Benzalkonium chloride, chlorine, copper, hydrogen peroxide: used to control algae in swimming pools.

3.2 Safe pesticide use

Pesticides are intended to kill or control pests (the target organisms) by interfering with some of their biological processes. As the processes may be the same or similar in other organisms, including humans, these non-target organisms can also be affected. Generally, however, pesticides are designed to be more toxic to the pest than to other organisms; nevertheless, they must be treated with respect.

If pesticides are used carelessly, there may be a risk of damaging health, as well as obtaining less than optimal effects on the pest.

No pesticide can be regarded as completely safe in all circumstances and pesticides should always be used carefully. However, the risks are low when they are used according to the directions given on the label. These directions are designed, among other reasons, to avoid or minimise exposure to the user and

bystanders. Exposure, or the amount that comes into contact with the body, is a very important contributor to risk, and therefore an important factor in the safe use of pesticides.

Pesticides can be used safely by applying the following principles:

- Select the right pesticide.
- Buy the right amount.
- Always read and heed the label.
- Take care in preparing and applying pesticides.
- Store pesticides safely.
- Dispose of unwanted pesticides and empty containers properly.

Selecting the right pesticide

Buy the least dangerous chemical for the proposed use. The proposed use must be described on the label.

An indication of how dangerous a pesticide may be is found on the main label.

Pesticides labelled **DANGEROUS POISON** are the most dangerous and are only allowed to be purchased and used by licensed pest management technicians and other authorised persons.

Pesticides labelled **POISON** are moderately toxic and are more freely available.

Pesticides labelled **WARNING** or **CAUTION** have low toxicity and have no restrictions on their sale or use.

Pesticides with no such heading have very low toxicity, although they also need to be handled with care.

A range of pesticide products is available for most pests and the information on the label and the MSDS (Material Safety Data Sheet) will help you select the least toxic.

However, toxicity is not the only factor which should be considered.

It is also important to consider how the pesticide is presented and how it is to be used, since these may increase the risk of exposure of people to the pesticide during or after its use.

For example, herbicides packaged as granules which are spread on the ground are often safer than liquid forms which must be sprayed because spraying increases the risk of exposing the operator or bystanders, particularly if spray drift occurs. Granules, however, may be more easily ingested by some non-target organisms such as birds, and small children may also pick them up. Therefore, they may not always be appropriate, particularly around pre- schools and child care centres.

Similarly, some pesticides are made to be persistent to provide long term control of a pest. The increased time these pesticides are present may increase the risk of exposure. However, their use may be preferred because they avoid the need for repeated applications necessary with some short-lasting pesticides.

It is also important to consider how toxic the pesticide is to the pest compared to other organisms. Some pesticides are particularly toxic to their target species, but not so to humans, making them very useful for safe pest control. In addition, because they are so potent to target species, only very small amounts need to be used.

For example, while most synthetic pyrethroids are generally of low toxicity to mammals, some are very toxic .However, all are more toxic to insects than to mammals. In fact, they may be hundreds of times more toxic to insects than mammals, and can be effective in controlling insects at very low concentrations. This is because mammals have enzymes which are able to break down pyrethroids before they have an effect, whereas insects do not. Thus, pyrethroids are effective when used in very small amounts, and this group of pesticides has a very good safety record.

Synthetic pyrethroids have become probably the most common pesticides found in aerosols around the home. Because of their widespread use and the perception that they are safer than other pesticides, synthetic pyrethroids are described more fully in Appendix 2.

When in doubt, seek expert advice to help you choose the most appropriate pesticide for the job. A list of names, addresses and telephone numbers of the organisations you can contact is included at the end of this booklet (Appendix 3).

Buying the right amount

Buy only as much as you need for a particular task. This is not only economical but avoids problems with storage or disposal of unused material.

Pesticides may be available in a range of quantities and packaging. Generally, pesticides considered safe for domestic use are packaged in smaller quantities than those available to authorised persons only.

Reading and heeding the label

The label is the most important source of information for safe pesticide use. Read it carefully and familiarise yourself with all instructions and warnings before you use the pesticide.

The label tells you all you need to know about the product, including usage, mixing and safety instructions.

The information found on the label is the result of careful research and testing to determine how much pesticide should be used to obtain the required effect on the pest with least harm to non-target organisms.

A typical label will indicate:

Toxicity:	indicated by one of the following three warning signs written in large letters:
DANGEROUS POISON -	indicating high toxicity
POISON -	indicating moderate toxicity
WARNING or **CAUTION -**	indicating low toxicity

If there is no warning on the label this means that the pesticide is of very low toxicity (Note: some manufacturers label such products with 'WARNING' although this is not required by law).

Ingredients	a list of the active ingredients and their concentrations in the product
Use	describes where the pesticide should be used - crops, pests, situations
Application	describes how and how much of the pesticide should be used - strength of mixture, time to use, weather conditions, method of application
Protection	lists the appropriate protective apparatus to ensure safety to the user, e.g. gloves, boots, overalls, hat, goggles, respirator
Precautions	a number of precautions will be given, e.g. 'do not eat, smoke or drink while using'; 'wash hands and equipment thoroughly after use'
Irritation	a warning will be included if the product could cause skin or eye irritation on contact
First-aid	instructions for the appropriate first-aid steps to take if the product is swallowed, spilt on skin, or if vapour or spray mist is inhaled
Manufacturer	name and address of manufacturer and sometimes a contact telephone number for additional information

The label is a legal document which has been approved and registered by the National Registration Authority (for agricultural and veterinary chemicals). Inquiries about pesticide registration should be directed to this body, whose address is listed in Appendix 3.

Taking care in preparing and applying pesticides

Without doubt, the people most at risk from the harmful effects of pesticides are those who are responsible for their preparation and application. However, others may also feel concerned about or threatened by this activity, particularly when they see technicians wearing protective clothing and equipment ('moon suits').

Many pesticides are sold as concentrates which must be diluted in water or some other solvent before they are applied. Instructions on how to do this are included on the label. It is of utmost importance that these instructions, including the use of appropriate protective clothing, are followed.

To ensure safe and worry-free use:

- Have soap, water and towels available.
- Wear protective clothing and equipment as required.
- Open containers carefully with proper tools on a stable surface where they will not tip or spill easily.
- Open, pour and mix pesticides in a well ventilated area, free from obstructions and where bystanders cannot be contaminated.
- Be careful to pour properly or decant from the container avoiding splashing and spurting. **NEVER** use your mouth to siphon liquids or to blow out an obstructed spray nozzle.
- Clean up any spills promptly. This can be done by covering with sand, sawdust or 'kitty litter' before sweeping up and disposing in a bin. Make sure you have these materials available in case of spills.
- Follow the additional procedures for mixing and applying pesticides as described in the code of conduct for pest management technicians (section 6).

Storing pesticides safely

Information on special conditions for pesticide storage will be found on the label. In general, however:

- Store only in original containers, which should be resealed and still have an intact label.
- Do not decant into drink bottles or containers used for food.
- Keep out of the reach of children and pets.
- Do not store under the sink or with foodstuffs.
- Store aerosols away from sunlight.
- When pesticides are stored in a school shed, ensure that the shed is in good repair and that windows and doors are adequately secured.

Disposing of unwanted pesticides and empty containers properly

- Do not dispose of pesticides down the drain; they should be finished, or disposed of, according to the instructions on the label.
- Dispose of old pesticides, which are no longer needed, by arrangement with the environmental health officer of your local council or shire.
- Do not incinerate aerosol cans.
- Wrap up and dispose of small empty containers in the rubbish bin. Larger containers (e.g. over 2 L) may be rinsed three times and the washings used for dilution of further spray solutions. The larger containers should then be perforated and placed in a rubbish bin.

Specific disposal instructions may be found on the label of some pesticides. Disposal by licensed pest management technicians is governed by specific State and Territory regulations.

3.3 Poisoning

Poisoning occurs when pesticides enter the body following exposure either through the mouth by swallowing, through the lungs by inhalation or through the skin.

The extent of poisoning depends on the amount that is absorbed into the blood stream and the internal organs of the body. This may be all or only a fraction of the amount to which one is exposed.

The extent of poisoning also depends on what happens to the chemical once it is absorbed from the exposed surfaces. For example, whether it broken down quickly, excreted, retained in the body or changed into a more dangerous chemical.

There are two types of pesticide poisoning:

Acute - usually the result of a single heavy exposure.

Chronic - resulting from numerous low exposures to a chemical over a period of time.

Chronic poisoning is usually harder to detect as the effects may take a long time to develop and it is more difficult to establish a cause-and-effect relationship.

Both acute and chronic poisoning may occur from improper use, or when appropriate protective equipment has not been worn.

What are the symptoms?

Symptoms vary according to the pesticide used and the degree of exposure or the amount that gets into the body. They are often non-specific; there are a number of diseases which may produce similar symptoms.

Nevertheless, some or all of the following symptoms soon after contact with a pesticide should be investigated further as they may indicate poisoning.

Mild poisoning	headache, fatigue, skin irritation, loss of appetite, dizziness, weakness, nervousness, nausea, sweating, diarrhoea, eye irritation, insomnia, thirst, restlessness, irritation of the nose or throat, sore joints, changes of mood
Severe poisoning	vomiting, loss of reflexes, difficulty in breathing, involuntary muscular twitching, visual disturbances, convulsions, unconsciousness, severe secretion or salivation, fever, thirst, increased rate of breathing

If you have any of these symptoms after being exposed to a pesticide, you are advised to contact the Poisons Information Centre(tel 131126 from anywhere in Australia) or see a doctor. Whenever possible, take the label or pesticide container with you so that the chemical can be easily identified and appropriate treatment given.

3.4 Pesticide toxicity

Pesticides can be grouped according to their chemical types (e.g. organophosphates, synthetic pyrethroids). Chemicals within these groups, or types, generally have similar pesticidal properties and broadly similar toxic effects on humans. Although there are exceptions, classifying pesticides in these groups is a useful and simple way to assess the relative hazards of products before selecting which is the most appropriate to use.

Although pesticidal and toxic effects are generally similar in quality within each type, it is important to recognise that potency can vary considerably. For example, all organophosphate insecticides act by interfering with a chemical found in nerve cells and produce toxic effects which are similar in nature. However, some do this at very low concentrations and have very high toxicity (e.g. fenamiphos) while others are effective only at higher doses and have only low toxicity (e.g. malathion).

As for poisoning, pesticide toxicity can be either acute (single high dose) or chronic (frequent low doses over a long period). Because pesticide applications in schools are likely to be infrequent, the potential for acute poisoning is the most important consideration of toxicity.

Acute toxicity

The dangers to health associated with short term exposure to high concentrations of pesticide are indicated by the results of studies on animals which measure the lethal dose (LD_{50}, see Appendix 1), and which assess skin and eye irritation, skin sensitisation and allergic responses. This information is found on the label or in the MSDS.

Commonly used pesticides (according to a survey of pest management technicians) are listed in the following table. Their types and their hazard rating are included in the table. The pesticides are classified into groups of increasing hazard. Within the groups pesticides are listed in alphabetical order.

The table is based on the International Programme on Chemical Safety 'WHO Recommended Classification of Pesticides by Hazard and Guidelines to Classification 1994-1995', produced by the United Nations Environment Programme, the International Labour Organisation, and the World Health Organisation.

The WHO hazard classification system depends on the acute oral and dermal toxicities (LD_{50} values) and the physical form (solid or liquid) of the pure technical active ingredient. The nature of the hazard, for example whether poisoning produces permanent damage or only short term effects, is also considered.

The hazard rating in the table does not take into consideration mixtures of active ingredients with other ingredients in the products as purchased or used. The LD_{50} values of these products may be much lower because the active ingredients are diluted with a number of additives, thus reducing the hazard.

Additives may include propellants, solvents, emulsifiers, or a number of other chemicals. These chemicals can make the toxic properties of the product different from the active ingredient, particularly the irritant properties to the skin and airways.

As well as the oral LD_{50}, the dermal and inhalational LD_{50} values are also found in the MSDS. These give an indication of how dangerous the pesticide may be when absorbed through the skin or inhaled.

The numerical value of the LD_{50} is generally higher for dermal exposure than for oral intake because less chemical is absorbed through the skin than after ingestion.

Inhalational toxicity is generally expressed as the lethal concentration of the chemical in the air rather than the lethal dose, and is therefore called the LC_{50}. Inhaling pesticides can be hazardous during mixing and spraying as the chemicals are easily taken into the body through the lungs.

When a pesticide is purchased it normally consists of a mixture of the active pesticidal ingredient and a number of additives. This formulation is often diluted with a solvent or water before it is used in the pest treatment. Because of this dilution, the risk of poisoning from the pesticide as used in the treatment will be much lower than for either the pure active ingredient or the commercial product formulation.

ACUTE TOXICITY

Hazard rating	*Chemical*	*Type*	*Class*
Unlikely to present acute hazard in normal use	Amitrole	Triazole type	Herbicide
	Boric acid	Miscellaneous	Insecticide
	Chlorothalonil	Miscellaneous	Fungicide
	Cyromazine	Insect growth regulator	Insecticide
	Dithiopyr	Miscellaneous	Herbicide
	Fluazifop	Miscellaneous	Herbicide
	Glyphosate	Phosphonic acid type	Herbicide
	Hydroprene	Insect growth regulator	Insecticide
	Mancozeb	Dithiocarbamate	Fungicide
	Methoprene	Insect growth regulator	Insecticide
	Piperonyl butoxide	Synergist	Insecticide
	Propyzamide	Amide type	Herbicide
	Tetramethrin	Synthetic pyrethroid	Insecticide
Slightly hazardous	Allethrin	Synthetic pyrethroid	Insecticide
	Dicamba	Plant hormone type	Herbicide
	Hydramethylnon	Miscellaneous	Insecticide
	MCPA	Plant hormone type	Herbicide
	Malathion	Organophosphate	Insecticide
	Mecoprop	Plant hormone type	Herbicide
	Metaldehyde	Miscellaneous	Molluscicide
Moderately hazardous	Bendiocarb	Carbamate	Insecticide
	Bromoxynil	Miscellaneous	Herbicide
	Carbaryl	Carbamate	Insecticide
	Copper sulphate	Inorganic	Algicide
	Chlordane	Organochlorine	Insecticide
	Chlorpyrifos	Organophosphate	Insecticide
	Cypermethrin	Synthetic pyrethroid	Insecticide
	Cyfluthrin	Synthetic pyrethroid	Insecticide
	2,4-D	Plant hormone type	Herbicide
	Deltamethrin	Synthetic pyrethroid	Insecticide
	Diazinon	Organophosphate	Insecticide
	Fenthion	Organophosphate	Insecticide
	Heptachlor	Organochlorine	Insecticide
	Permethrin	Synthetic pyrethroid	Insecticide
	Methiocarb	Carbamate	Molluscicide
	Propoxur	Carbamate	Insecticide
	Pyrethrins	Pyrethrum derivatives	Insecticide
Highly hazardous	Dichlorvos	Organophosphate	Insecticide
	Fenthion	Organophosphate	Insecticide
	Omethoate	Organophosphate	Insecticide
	Warfarin	Anticoagulant	Rodenticide
Extremely hazardous	Arsenic trioxide	Arsenical	Insecticide
	Brodifacoum	Anticoagulant	Rodenticide
	Bromadiolone	Anticoagulant	Rodenticide
	Fenamiphos	Organophosphate	Insecticide

Chronic toxicity

It is possible to compare pesticides according to their chronic toxicity; however, this is more difficult to do than acute toxicity. There are limitations because long-term exposure to chemicals can affect different organs, at different times, to different extents, and with different outcomes. Some effects may be marked but reversible, some long-lasting, and some may be fatal.

Nevertheless, pesticides can be compared based on an amount which does **not** cause an effect, provided the limitations of this approach are kept in mind (see Appendix 1).

Information on safe levels of exposure is obtained from long-term studies using animals, the results of which are used to set an Acceptable Daily Intake (ADI) or a Tolerable Daily Intake (TDI) for humans.

The ADI and TDI are the amounts which, when taken into the body every day for a lifetime, are not expected to cause adverse health effects. To account for differences in weights between people, and between adults and children, the values are given as a certain amount per kilogram of body weight.

ADI values are only set for pesticides which are used in food-producing crops or crops used as stock feed because residues may be found in food. However, they also allow assessment of how much pesticide can be taken into the body from sources other than food without harm. TDI values are set for other pesticides (see Appendix 1).

Pesticides may thus be ranked according to their ADI or TDI values as shown in the following table. The higher the value, the lower the toxicity of the substance.

Acceptable Daily Intake (ADI) (mg/kg body weight/day)

more than 0.1	*0.1 - 0.01*	*0.01 - 0.001*	*less than 0.001*
Copper (TDI)*	Bromoxynil	Arsenic (TDI)	Amitrole
2,4-D	Carbaryl	Bendiocarb	Chlordane
Glyphosate	Chlorothalonil	Methiocarb	Fenamiphos
Methoprene	Chlorpyrifos	Diazinon	Heptachlor
Propyzamide	Cyfluthrin	Dichlorvos	Omethoate
	Cyromazine	Dithiopyr	
	Deltamethrin	Fluazifop	
	Dicamba		
	Permethrin		
	Piperonyl butoxide		
	Propoxur		
** provisional value*	Pyrethrins		

4. Risks to health

Health risks associated with pesticides are dependent on two factors: hazard and exposure, ie how dangerous the pesticides are and how much gets into the body.

As it is generally not possible to change how dangerous a particular pesticide is, risk can be reduced by avoiding or minimising exposure. When exposure is zero, there are no risks to health, no matter how dangerous the pesticide is.

Hazard

Hazard is the capacity of a pesticide to cause harm to a person, animal or the environment. For example, leukaemia is one hazard of benzene; intellectual impairment is one hazard of lead for infants.

Exposure

As already mentioned in section 3.3, people may be exposed through skin contact, by inhaling or by swallowing the pesticide. Care should always be taken to reduce the possibility of exposure as far as practicable. Even highly toxic chemicals can be used safely providing they are controlled in such a way as to ensure minimal exposure.

Exposure can be affected by the amount and concentration of the pesticide, the form the pesticide is in (eg granules, dust, liquid), how it is used, and how long it is present (see also section 3.2).

Risk

Risk is determined by both the toxicity of a chemical (i.e. the amount required to cause an adverse effect) ***and*** the degree of exposure. If there is no exposure there will be no risk.

The concentration of the pesticide in the product is important when considering the potential for exposure. Pesticides are often present at a range of concentrations in different products and care should be taken that only the products intended for the target pests are used.

Although generally the intention is to package products, especially those for the home market, in forms which minimise the possibility of exposure, hence harm, this is not always possible.

For example, metaldehyde, a relatively low oral toxicity pesticide is packaged in the form of pellets to attract and kill snails. However, because it is in pellet form, it may be easy for a small child to eat a dangerous amount before he or she can be stopped. For the same reason and because the pellets are attractive to them, dogs are also at risk of poisoning from snail pellets.

This makes metaldehyde pellets potentially more dangerous than some other more toxic pesticides, which are not so easily ingested.

5. Pests

This section describes the more common pests, how they may be controlled in and around schools, and the types of pesticides which can be used.

The information in this section has been adapted from the 'Guidelines for use of pest control agents in schools' with permission from the WorkCover Authority NSW.

5.1 Insects and spiders

Before embarking on a program of chemical treatment against insects or spiders, it is important to consider that they are essential components of the natural environment. Spiders are important predators of flies and mosquitoes (and other spiders) and are also prey for birds and other species. Similarly, cockroaches, ants and flying insects play important parts in the ecosystem.

Low levels of infestation by these species can be tolerated. However, sometimes they do become a nuisance, or the infestations can become dangerous and control becomes necessary.

Infestations can often be inhibited by non-chemical means, for example by sealing cracks in walls or floors, using fly screens and removing potential breeding sites. When these strategies have failed, pesticides may be needed.

Cockroaches

Indoor control

Cockroach infestations are most common in areas where food is stored, prepared or consumed. Canteens, cafeterias and staff common rooms often require treatment. Low level infestations can also occur in offices.

Cockroaches generally prefer dark, warm and moist environments. They thrive in areas where there is a food and water source, and where there are cracks, crevices and gaps. Examining these areas may reveal signs of cockroach activity, such as faeces (like large fly droppings), cast off skins and egg sacs, and live cockroaches (feelers or legs protruding from gaps). A musty odour may be detected when there is a heavy infestation.

Indoor environments can be made less favourable for cockroaches by removing their sources of food and reducing their available shelter. Stored food should be sealed and bench tops should be cleaned to remove all traces of food and grease. Ensure floors, particularly surfaces under refrigerators and cupboards, are cleaned. Fill cracks and holes in walls and floors, particularly around ovens and hot pipes, with cement or other hard filler. Repair broken or cracked tiles, peeling lino, and damaged skirting boards. Ensure old cardboard boxes are removed.

Insecticides used for cockroach control are usually applied as crack and crevice treatments or baits. The frequency of application will be determined by the rate of reinfestation and the level at which cockroaches are perceived to be a problem. Reinfestation can be prevented by locating and treating all the breeding and living areas available to the cockroaches.

Registered pesticides:

Bendiocarb
Boric acid (dust)
Chlorpyrifos
Diazinon
Dichlorvos
Fenthion
Hydroprene
Methoprene
Propoxur
Pyrethrins
Synthetic pyrethroids

Minor cockroach infestations may be controlled by using baits (eg hydramethylnon, boric acid), particularly where other foodstuffs are not available, such as in staff rooms and offices or clean kitchens and canteens.

Sticky traps are useful for monitoring cockroach infestations but are rarely sufficient on their own to eradicate infestation.

Outdoor control

Cockroaches can form persistent infestations in outdoor areas such as stormwater and sewerage openings, grease traps, in waste disposal areas, compost heaps and gardens. Under the right conditions, cockroaches will move from these areas into buildings. This likelihood can be reduced by appropriate hygiene and sanitation standards.

The wood or bush cockroach is usually found in outdoor areas, under leaves, bark, rockeries and wood piles, and is an important species in the ecology of these areas. This species is black with a white margin around the edge of the body and is about 30 mm in length. As this is a beneficial species, outdoor areas should not be treated with insecticide unless absolutely necessary.

Ants

There is a large number of ant species in Australia, only a few of which have become pests in and around buildings. Most ant species nest outdoors and only move into buildings in search of food.

Argentine, Singapore and coastal brown ants are introduced species. Other species are native and are an integral part of the Australian environment and an important component of the food chain. They should not be destroyed if they do not pose a particular problem.

Ants are attracted by rubbish, decomposing material and spilled food or drink. Ensuring high standards of hygiene can inhibit ants from entering and establishing themselves in buildings.

When they build nests under buildings or pavement, large quantities of soil can be removed resulting in subsidence and structural damage.

Important pest species in Western Australia are the Argentine ant, Singapore ant, coastal brown ant, black house ant and white-footed house ant. These are small ants, less than 3 - 4 mm in length, which can be distinguished on the basis of colour and life style. The Argentine and Singapore ants are the most troublesome and difficult to control. Argentine ants have the potential to cause very serious infestations as they have multiple nest sites and are therefore difficult to destroy. In appearance they may be mistaken for coastal brown ants. Sighting of Argentine ants should be reported to the relevant local government, State and Territory authorities.

Outdoors, the larger meat ant (up to 14 mm) can be a problem as this species forms large colonies and gives a painful bite.

Jumper (or hopping) ants are found in South Eastern Australia including Tasmania. Their sting is painful for several days and some people will suffer severe allergic reactions to the sting.

Indoor control

Many species of ants enter buildings in search of food but only a small number will nest within the structure. Every attempt should be made to locate the nest before starting any control measures. Where the ants are nesting inside the building, an application of residual insecticide may be required in the roof, wall or floor cavity.

Only short term control is possible by treating the ant trail alone; the nest should also be located and treated.

Currently available ant baits generally control only minor ant infestations, and some species will not accept the baits at all. However, some baits are effective against some species.

The nest should, if possible, be located by following the ant trails. If the nest is in a dry area, an insecticidal dust or granules may be used. If in a wet area, baits or liquid formulations are more appropriate.

Registered pesticides:

Bendiocarb
Boric acid
Carbaryl
Chlorpyrifos
Diazinon
Dichlorvos
Fenthion
Hydramethylnon
Propoxur
Synthetic pyrethroids

Outdoor control

If necessary, outdoor ant control should concentrate on finding the nest or nests and direct treatment of these and adjacent areas. Some species (eg Argentine ants) form a series of interconnected nests which may be found along the edges of concrete paths and between paving bricks. These may require the insecticide to be applied over a more extensive nesting area. The pesticides listed under 'Indoor control' may be used.

Fleas

Fleas feed on the blood of host animals. Hosts may be cats, dogs, rats, birds, rabbits and people. The bite causes itching and can become infected.

Sometimes feral cats, dogs or rats may deposit fleas in sub-floor areas of buildings or in outdoor play areas. School and domestic pets may also be a source of fleas which can be inadvertently carried into buildings.

Fleas can be prevented by removing access to the sub-floor by cats or rats, and by minimising feral animal activity in and around the school. School pets should be kept free of fleas by regular inspection and treatment. Consult a veterinarian for advice on how to do this. Ensure that animal cages are regularly

cleaned and that carpet and upholstery are vacuumed. Insecticides may occasionally be needed to remove flea infestation.

Registered pesticides:

Bendiocarb
Carbaryl
Diazinon
Dichlorvos
Fenthion
Hydroprene
Methoprene
Propoxur
Synthetic pyrethroids

Flies


Flies are the vectors for a number of human diseases. Each fly may carry a number of human pathogens and these may be spread from feeding matter (eg faeces, rotting flesh or vegetation) to humans. Therefore, flies pose a particular hazard to public health.

The best way to control flies is to inhibit their breeding. Flies lay eggs in material which will be suitable for the hatched maggots to use as food. This may be human or animal faeces, rotting vegetation, decaying matter, and meat or fish, with different species of fly showing different preferences.

Adult flies can travel many kilometres from their breeding site under appropriate conditions. It is therefore not possible, nor ecologically desirable (flies are an important part of the food web) to eradicate them completely. However, flies should not be tolerated inside buildings.

Numbers can be reduced in and around buildings by cleaning or removing any material which they may use as sources of food and for breeding. Store foodstuffs in airtight containers and clean up food scraps quickly. It is also important to ensure fly screens are in good repair.

Outside, rubbish bins should be cleaned regularly and secured with tight-fitting lids. Leaf mould and fallen fruit should be cleared, and any animal carcasses or faeces removed. Any material which may decompose should be cleaned quickly as very little time is required for it to become fly-blown.

Open compost heaps containing food scraps and lawn clippings, which can be the source of many flies, are illegal in some States. Use a proprietary compost bin where the high temperatures of the composting material prevent housefly breeding. Additional information on composting is available from the Environmental Health Section of your local government.

Fly traps can be used to control flies outdoors. These are available commercially through outlets such as hardware stores. Flies are gregarious insects; once a few flies are trapped, others will join them.

For indoor fly control, try using a fly swat. If this fails, use household sprays which kill flying insects. Insecticide use will be reduced if the flies are sprayed when they have landed. However, only use for localised control when flies are present and do not use repeatedly as a preventative treatment or over large areas.

Registered pesticides:

Diazinon
Dichlorvos
Fenthion
Malathion
Propoxur
Pyrethrins
Synthetic pyrethroids

Additional information on ways to control breeding of flies is available from the State and Territory Environmental Health Services or your local council (see Appendix 2).

Mosquitoes

Mosquitoes are responsible for the transmission of several serious human diseases, including malaria, Ross River virus (RRV) and Australian Encephalitis (AE). However, they are also an important food source for a number of native fauna, including lizards, frogs, fish, insects and birds, and are therefore important in Australia's ecology.

Adult mosquitoes rest in sheltered and shaded areas such as under eaves and in the lee of walls, and are found particularly in humid shade such as the underside of leaves and in shrubbery.

Mosquitoes require water in which to breed. The larvae (wrigglers) live under the surface of still water and breathe air through the surface meniscus. Removing or periodically flushing static water, e.g. around plant pots, roof gutters, bird baths and drains, will destroy the larvae and reduce the numbers of adult mosquitoes.

Additional information on mosquito breeding and control is available from the State and Territory Environmental Health Services or from your local government.

Mosquitoes are slow flying and are easy to swat. However, they often go undetected until they have punctured the skin in order to feed. Wearing loose-fitting clothing can prevent this and it may be advisable to keep children indoors during times of peak mosquito activity.

Personal insect repellents are the best chemical method of preventing mosquito bites. Diethyl toluamide (DEET) is the most effective and widely used ingredient and is available in gels, aerosols, sprays and lotions in concentrations up to 80%. Wash off repellents at the end of the day and don't use products with concentrations greater than 20% DEET on infants and children. Mosquitoes may be attracted by light coloured clothing and some perfumes and aftershaves.

Indoors, mosquitoes may be killed by using household space sprays.

Registered pesticides:

Insect repellents
Diazinon
Dichlorvos
Fenthion
Malathion
Propoxur
Pyrethrins
Synthetic pyrethroids

Spiders

All spiders are predators and almost all produce venom to help subdue their prey. Most spiders are not dangerous to humans and should not be killed as they are important animals in the environment. A few species are dangerous to humans and it may be necessary to kill these when they are found in school buildings.

The huntsman spider and, very occasionally, the garden orb weaving spider may be found indoors. Although they seldom bite people, medical advice may be required if they do as some people may be allergic to their venom.

The redback spider bite has caused death in susceptible individuals and this spider should be treated with caution. Redbacks produce characteristic wispy nests with extended strands close to the ground.

Funnel web spiders are found in South East Queensland, through New South Wales to Victoria with a small pocket in the Mount Lofty and Southern Flinders Ranges in South Australia. Many, if not all, are dangerous to humans.

The bite of the white tail spider is often blamed for skin destruction over a large area as well as a range of other symptoms (eg headache, diarrhoea and vomiting). However this is controversial and the effects may, in fact, be due to the recluse spider which has been introduced recently from North America. (The white tail spider is indigenous yet problems have only been described in recent years suggesting a new agent is responsible.) Most reported bites are minor.

The white tail spider normally lives outside, where it actively hunts insects and other spiders. However, it often enters homes and may hide under cloth and material on the floor. Clothing should always be hung up off the floor.

The black house spider bite is painful and may cause swelling, but it is not fatal. This spider builds a 'tunnel' type web, generally outside in tree bark and rocks, but also in vents, skirting board and ceiling corners inside.

The impact of spiders can be greatly reduced by changing their environment to make it less favourable. Leafy rockeries and damp overgrown gardens are the preferred habitat of white tails, while redbacks prefer to nest in dark containers or under loose wall sheeting, close to ground level.

If insecticides are necessary, apply directly to the webbing, into the burrow or into the cracks and crevices where spiders shelter. Once the insecticide breaks down areas tend to be rapidly recolonised. The 'general' spraying of outdoor areas or the exterior of buildings as a preventive measure is not recommended.

Registered pesticides:

Bendiocarb
Chlorpyrifos
Diazinon
Dichlorvos
Fenthion
Synthetic pyrethroids

Silverfish

Silverfish are fast moving and agile insects which can be found throughout a building, particularly in roof or wall voids and in sub-floor areas. Favoured habitats are undisturbed dark areas, such as store rooms and cupboards. They feed on a wide range of starchy products and often damage clothes, paper or paper products such as book bindings, photographs and wallpaper. They are most active at night and are seen only occasionally during the day.

Silverfish have a secretive lifestyle and infestations may go undetected until damage is noticed. Control may require the removal and fumigation of smaller objects as well as treatment of the affected area.

Registered pesticides:

Bendiocarb
Diazinon
Dichlorvos
Propoxur
Pyrethrins
Synthetic pyrethroids

Carpet beetles and clothes moths

These pests will normally be restricted to carpets, although they may also be found in soft furnishings and curtains. Clothes moths will also be found in cupboards and wardrobes.

Thorough vacuuming around the edges of carpets and under seldom-moved furniture will greatly reduce the impact of these pests. Application of a small amount of insecticide to badly infested areas of carpet may be necessary.

Registered pesticides:

Naphthalene
Propoxur
Pyrethrins
Synthetic pyrethroids

Booklice

Booklice (psocids) are small insects which feed on microscopic moulds and other fungi growing on materials such as books, woodwork, paper and leather. In buildings, booklice are most abundant in damp, dark rooms with poor ventilation; conditions which favour the growth of moulds.

Thoroughly cleaning, drying and airing the area is all that is normally needed to clear these pests. A light application of insecticide may be required for heavy infestations.

Registered pesticides:

Pyrethrins
Synthetic pyrethroids

Bees and papernest wasps

Bees and papernest wasps are found in most parts of Australia. They are generally not aggressive unless their nest or the area immediately adjacent to it is disturbed.

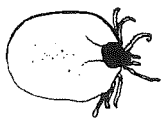
Control is only warranted where the bees or wasps build their hives or nests near doors or window sills or on low branches of trees or shrubs where they can be disturbed by children at play. If the nest is not obstructing activities, then children can be educated to keep away rather than resorting to chemical control.

It is advisable to contact an apiarist before tackling a bee hive. Papernest wasps may be controlled by direct application of insecticide to the nest, preferably in the late afternoon or early evening when all the wasps are on the nest.

Registered pesticides:

Carbaryl
Propoxur
Synthetic pyrethroids

Ticks



Bush (or Paralysis) ticks are found along the eastern coast of Australia in moist vegetated habitats. Their principal hosts are bandicoots but they will attach to other hosts such as livestock, cats, dogs and humans. Their bites may cause severe symptoms, including paralysis, in people.

Kangaroo ticks are blood sucking arachnids which grip onto the skin of kangaroos. They are found in many areas across Australia where there are sand plains covered with uncleared scrub and significant populations of bush kangaroos. They will also infest dogs, sheep and other animals under appropriate conditions. Their bites cause less severe symptoms than bush ticks.

When a tick has become gorged with blood, it falls from its host and shelters amongst foliage while the blood is digested. It then waits under foliage and will attach to a new host animal that brushes against it. This could be a school child or member of staff.

New school grounds, fringe metropolitan suburbs and country schools are most likely to be affected. Discouraging bandicoots and bush kangaroos, reducing undergrowth, wearing loose, baggy clothing and applying repellents can control the problem. Tick infestations can be severe enough to warrant pesticide treatment to areas of school grounds adjacent to bush.

Repellents against ticks are available. These contain dibutylphthalate (DBP) and they are smeared onto clothing. Repellents of this nature are useful for bushwalking in known tick-infested areas.

Registered pesticides:

Fenthion
Malathion
Pyrethrins

European wasp

The European wasp is an introduced insect which scavenges for food in and around urban areas. It is strongly attracted to meat products, sweets and other foods scraps, and soft drinks. These wasps are often very aggressive when disturbed.

Nests of the European wasp are usually concealed in the ground, in wall or ceiling voids or behind retaining walls. In most cases the only sign of a nest is the constant stream of wasps into and out of the nest opening. European wasps are particularly aggressive if the nest is disturbed and individual wasps can sting repeatedly.

In their native countries, winter conditions and natural predators limit the wasp populations. Australian conditions are such that there is a potential for the European wasp population to increase uncontrolled. It is therefore important that these pests are destroyed by the appropriate authorities as soon as they are positively identified.

Control involves direct application of insecticide dust or liquid into the nest opening, and it may take up to two weeks for all wasp activity to cease. An active European wasp nest can present some risk to the operator during treatment. An effective knockdown aerosol may be required to reduce activity around the nest opening while the treatment is carried out.

Registered pesticides:

Dichlorvos
Malathion
Propoxur

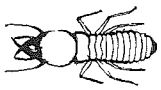
When a European wasp nest is identified, local government should be notified immediately. It will organise the treatment and removal of the nest.

Itchy caterpillars

Caterpillars of several species of moths shed hairs which are irritant to the skin and eyes. The most important cause of 'caterpillar dermatitis' in Australia arises from the caterpillar form of the mistletoe brown tail moth. The moth is found widely in south-eastern Australia. The caterpillar feeds on species of mistletoe which tend to be parasites on Eucalyptus species. The problem can be controlled by removing mistletoe growth from affected trees.

Another species, the bag shelter moth (or processionary caterpillar) forms silky 'nests' in Eucalypt (gum) or Acacia (wattle) trees and shrubs in many parts of Australia. If there are problems, the nests need to be removed by someone wearing appropriate skin protection. The nest and any silken threads attached to the trunk and the base of the trunk need to be removed and burnt to destroy the irritant hairs. If there is a recurrent problem the trees or shrubs (particularly those near playgrounds, classrooms and parking areas) may need to be replaced with other species.

Termites ('White ants')



The treatment of termite infestations and the installation of chemical barriers for termite protection must be done strictly according to the Australian Standard *'Protection of Buildings from Subterranean Termites'* (which may be modified by State and Territory regulations) and the NHMRC *'Code of Practice for the Safe Use of Termiticides'*.

Treatment against active termite infestation should only be undertaken by licensed pest management technicians.

The only chemicals currently allowed to be used in buildings are the organophosphate insecticide, chlorpyrifos (e.g. Dursban™, Deter™) the synthetic pyrethroid, bifenthrin (Biflex™) ; and arsenic trioxide. For the time being, organochlorines are allowed in the Northern Territory.

Particular care should be taken when these chemicals are used against termites. Treatment should not be undertaken during school hours when staff and students are present. All those not directly involved should be excluded from the area during treatment and warning notices should be placed at all entrances or approaches to the potential risk area. These notices must remain in place until treatment and clean-up are completed.

It is essential that sub-floor ventilation is checked before chlorpyrifos or bifenthrin is applied under floor boards, that all spillages are adequately cleaned and that treated rooms are thoroughly ventilated before they are reoccupied.

While arsenic trioxide is hazardous, only very small amounts (several grams) are needed by an experienced technician to control termites who must place it into active termite passages. It must be used at least two weeks before any other spraying as other sprays will repel termites so that they will not be exposed to the arsenic.

5.2 Mammals, birds and reptiles

Rats and mice

Rats are nocturnal and their presence may not be known unless particular signs are recognised. These include noises in roof spaces (although possums or birds may also be responsible), droppings found in corners, cupboards or roof spaces, tracks or signs of gnawing. Mice are generally active during the night but may also feed, and therefore be sighted, during the day if they feel safe.

A proper inspection of the premises will be needed to determine the presence of the rodents and their method of entry into the building.

Rodent infestation can be prevented by good hygiene and sanitation practices, and by using structural barriers. Rubbish bins should be regularly emptied and their storage areas cleaned. Scrap material (wood, bricks, anything that may form a cover) should be removed from the immediate vicinity of a building. Similarly, unwanted undergrowth which may allow safe access for rodents to a building should be removed.

Mice are able to enter a building through a gap as small as 6 mm, so check under door spaces and gaps around waste and service pipes and fill if necessary.

Rodents may be controlled in and around buildings by using baits, spring-back traps or a combination of both, depending on the particular circumstances. Successful control will depend on a knowledge of the rodents' trackways and feeding areas.

Where traps (sticky pads or spring-back) are used, they should be checked daily and any trapped rodents should be sealed in plastic bags and disposed of in the rubbish bin. Traps should not be set where children may accidentally set them off.

Baits should be placed in properly designed bait boxes, clearly marked 'POISON.' They should be inaccessible to children, pets and other non-target animals.

Place outdoor baits in clearly labelled, lockable bait stations. Remove and dispose of all baits and bait stations when they are no longer required.

Single dose rodenticides (such as metallic phosphides) are not recommended for use in and around schools. Liquid baits and gels are also inappropriate for use in the school environment because of the risk of young children finding and consuming the poison.

Because of the toxicity of rodenticides, it is advisable for schools to contact the Environmental Health Section of local government for help if a rat infestation is found.

Registered pesticides:

Sticky pad traps
Spring traps
Anticoagulants (bromadiolone, cholecalciferol, coumatetralyl)

Birds, snakes, possums and feral cats

Birds, snakes, possums or feral cats should be handled by experienced personnel only. Snakes, in particular, require expert removal by a trained 'snake-catcher'. The Environmental Health Section of local government will provide advice on trapping and removal.

5.3 Weeds

As well as in the control of animal pests, integrated pest management is important in the control of weeds.

Weeds in ovals and flower beds can be a nuisance but can often be controlled by cultivation. For example, grass allowed to grow longer will 'out-compete' many broad-leaf weeds, which will be starved of sunlight and will die In flower beds, mulches will inhibit weeds; they will also help keep the soil moist and reduce the amount of watering needed. Small areas of lawn or flower beds can be weeded or the soil turned manually with little more effort than would be required to apply a pesticide.

To control weeds in sports ovals (where grass cannot be left to grow longer), larger flower beds and on footpaths, the use of herbicides may be required. As with other pesticides, before using herbicides it is important to identify the pest (in this case, the weed) which is to be controlled and to select the most suitable and least toxic chemicals.

The timing of weed control is important. You should attempt to control weeds before they flower and set seeds. This will reduce the need for control in future years. Bindii is a good example of a weed which, if not controlled before seeds are dispersed, can cause a persistent and widespread problem.

Herbicides can be categorised as selective (acting against specific species) or non-selective (acting against all plants), and pre-emergent (acting before the plant emerges from the soil) or post-emergent (acting on established plants). Herbicides may work by attacking plant tissue at their point of contact (contact herbicides) or by being absorbed by the plant roots or leaves and transported (translocated) through the plant attacking tissue elsewhere (translocated herbicides).

Herbicides are generally less toxic to humans and other animals than insecticides because they act on different biological functions. Insect biology is broadly similar to humans and other animals and this accounts for the increased toxicity of insecticides to non-target species. However, *paraquat* is an example of a herbicide with marked human toxicity and should not be used in schools.

The choice of herbicide depends on a number of factors including the species of weed, the time of year, presence of other plants and the toxicity of the chemical. Use only those herbicides approved for a particular use. Instructions on the label of the herbicides will assist in selecting the most appropriate one for the job. Some herbicides are harmful to wildlife and should not be used near ponds or streams. The label will inform how the herbicides should be used safely. As a general rule, Schedule 7 herbicides should not be used around schools if Schedule 5 or 6 herbicides are available.

Do not spray on windy days. When possible, use a herbicide spot applicator or 'wand' rather than spray. Dyes can be added to identify sprayed areas.

An appropriate 'no-entry' period will need to be identified before treated areas such as ovals can be re-used. The 'withholding period' stated on the label refers to the period before food crops can be marketed after spraying but this can be used to establish the no-entry period. Substances with a short withholding period (1-5 days) can have a short no-entry period. If spraying is necessary, consider using signposting during the spraying and no-entry period. Keep the school community, users of the playing fields and immediate neighbours informed of the intention to spray.

Herbicides commonly used for turf or borders

Dicamba	Selective translocated pre- and post-emergent herbicide for the control of annual and perennial broad-leaf weeds.
MCPA	Selective translocated post-emergent herbicide for annual and perennial weeds.
Bromoxynil	Selective contact post-emergent herbicide for broad-leaf weeds.
Mecoprop	Selective contact post-emergent herbicide for broad-leaf weeds in grass.
Propyzamide	Selective pre- and post-emergent herbicide for broad-leaf and some grass species.
Dithiopyr	Selective pre-emergent broad-leaf herbicide and post-emergent herbicide for some grass species.
Fluazifop	Selective translocated post-emergent herbicide for grasses.
Glyphosate	Non-selective, non-residual, post-emergent herbicide absorbed through non-woody tissue and translocated through a plant.
Amitrole	Selective pre- and post-emergent herbicide for annual weeds.

Dicamba, bromoxynil and MCPA may be present in the same proprietary formulation to produce a mixture which will kill unwanted growth and inhibit seedling development.

Herbicide commonly used for kerbing and footpaths

Glyphosate
Amitrole

6. Code of Conduct for Pest Management Technicians

Most criticism over the use of pesticides has related to concern about the potential hazard to the environment and the general public. While some of this criticism has been ill-founded and emotive, excessive use and misuse of pesticides could endanger people's health and damage the environment.

In accepting the benefits of pesticides, there is a responsibility to use them with care and respect. By incorporating safe practices into daily work habits, much of the risk is removed.

Just as important as safe practices is ensuring that everyone is kept informed. This is particularly relevant in a school community.

Following this Code of Conduct will go a long way in minimising pesticide exposure and ensuring the well-being of staff and students, as well as allaying any fears or concerns about the proposed pesticide application by parents.

6.1 Prior to pesticide application

- Know clearly the purpose of the treatment - that is, the pest to be controlled. 'General sprays' are not recommended.
- Know the habits and biology of the pest concerned.
- Thoroughly inspect the problem areas with the appropriate person.
- Where appropriate, draw up an integrated pest management strategy to control the pest and prevent its re-occurrence.
- Choose only registered pesticides that are appropriate and effective and which have the lowest toxicity rating.
- Check whether the pesticide chosen is controlled by any specific regulation and ensure compliance with the regulations.
- Make sure everyone is informed of the strategy including parents, teachers and administration. When possible, allow plenty of time for groups such as parent organisations to discuss the proposal.

- Make sure that the school and school community have a copy of the MSDS for the chemical you recommend.
- Be available to discuss your proposal and answer any questions or concerns fully and frankly.
- Read the label carefully and be familiar with it.
- Inform the school community whether or not there is likely to be any lingering smell and explain the cause.

6.2 When to treat

- Do not use pesticides during school hours or when school buildings and/or grounds are occupied, other than in exceptional circumstances.
- Ideally, treat with pesticide during school holidays.
- Otherwise, treat on Friday afternoon, when students and staff have left, or on weekends.

6.3 Pesticide application

- Thoroughly survey the area to be treated and implement any necessary safety measures, including signposting, before applying a pesticide.

> *Remember, it may be easier to replace some wooden equipment than to use a pesticide on it.*

- Localise treatment to as small an area as practicable for effective treatment
- If treating food preparation areas, make sure that all food and food utensils are removed or adequately covered.
- Remove any pets from the treatment area. Schools, particularly lower primary, may have fish, guinea pigs or birds. Be very careful to check where they are housed. (Fish are very sensitive to the synthetic pyrethroids)
- Do not treat where children have ready access, such as playground equipment and sandpits unless absolutely necessary (eg for red back spiders, which pose a bigger risk to children than pesticides).
- Read the label and follow the application directions, safety directions and precautions.
- Calculate and mix only the amount of chemical needed for the job.
- Wear protective clothing as indicated on the label.
- All persons not wearing appropriate protective clothing should be excluded from areas being treated.
- Do not spray in windy conditions when spray drift is likely.
- Pesticides should not be applied in ducts or near air-conditioning intakes. If this is unavoidable the air-conditioning must be turned off and all precautions must be taken to prevent solvents or pesticide being disseminated through the system when it is turned on again.
- Only use insecticides on those areas where insect pests shelter.
- Make sure all pesticides are well secured and out of reach of children. Don't leave unsecured pesticides unattended.

6.4 After the treatment

- Ensure that adequate time has elapsed before allowing people to re-occupy a treated area. Post warning signs and give instructions about ventilating the area before re-occupation.
- To ventilate the area, open all doors and windows and allow fresh air in for at least two hours, or turn on the air conditioning with maximum fresh air intake for at least two hours. (Ensure that the airconditioning system does not distribute affected air to other occupied areas during this time.)

> *Adequate ventilation is particularly important as the building will be securely locked after you leave and chemicals may not dissipate as you might normally expect.*

- Make sure there is adequate ventilation beneath floor boards when an organophosphate termiticide has been used to treat stumps.

APPENDIX 1 ~ How toxic are pesticides?

Safety assessment

Before a pesticide can be marketed in Australia, it must pass an extensive assessment process. Each pesticide is evaluated for its effectiveness against the pest species, and its safety for the environment and the human population. Special studies are carried out by the manufacturer and results are evaluated by agriculturalists and scientists employed by the government.

Safety assessment of pesticides is carried out using animals in toxicology studies. These studies examine how acutely and chronically toxic the pesticide is.

Some older chemicals did not undergo the same stringent and extensive testing procedures to which new chemicals are subjected. Consequently, the National Registration Authority is undertaking an extensive review of these chemicals and, where safety information is found lacking, the sponsor company is asked to provide it.

Acute toxicity

Hazards to health associated with short term exposure to high concentrations of pesticide are indicated by the results of studies on animals which measure the lethal dose, and which assess skin and eye irritation, and skin sensitisation.

Although the potential for skin and eye irritation is important when considering the acute toxicity of chemicals, pesticides are usually classed according to the results of the lethal dose studies. These studies identify the dose likely to kill half of the animals given the chemical. This dose is called the LD_{50} (LD_{50} stands for **L**ethal **D**ose in **50%** of animals). The classification and corresponding LD_{50} is given below. The higher the LD_{50} the lower the toxicity.

Warning on label	*Toxicity class*	*LD_{50} (mg/kg body weight)*
DANGEROUS POISON*	High toxicity	less than 50
POISON	Moderate toxicity	50 - 2000
WARNING or CAUTION	Low toxicity	2000 - 5000
No warning necessary	Very low toxicity	more than 5000

** In New Zealand, this is split into "Deadly" (less than 10) and "Dangerous" (10-50)*

Chronic toxicity

In chronic or long term studies, animals are given doses of the chemical every day for periods from a few months to their whole life. These studies examine effects on specific organs, on life expectancy, birth and fertility, and on offspring.

Other studies are also performed to identify any effects of the pesticide may have on DNA and genes, and to measure how much is absorbed and retained in the body.

The studies are designed to detect toxic effects, hence very high doses are used, usually referred to as the Maximally Tolerated Dose (MTD). The concentration of a pesticide in the body after a MTD is many times higher than the concentration that would be expected to occur in people if exposure occurred during pesticide application.

A complete toxicological profile of a chemical will identify the type of adverse effect, the target organs of toxicity, the extent of the adverse effects and the time at which they occur, and the consequences of the observed effects.

The studies also identify a dose level which does not cause any observed adverse effects to the test animal. A safe level for humans can then be estimated by using this No-Observed-Adverse-Effect-Level (NOAEL) and dividing it by a safety factor.

The safety factor is usually 100 and is included because it is assumed that humans are ten times more sensitive than animals, and that there is a tenfold variation in human sensitivity.

The safe level for humans, based on the NOAEL divided by 100 is called the Acceptable Daily Intake (ADI). This is the amount which, when taken into the body every day for a lifetime, is not expected to cause adverse health effects.

The ADI is usually only set for pesticides which are used on food producing crops or crops used for stock feed.

Chemicals which are not used in this way but for which there may be the potential for substantial human exposure are assigned a Tolerable Daily Intake (TDI) or Tolerable Weekly Intake (TWI) above which people should not be exposed. These are calculated in the same way as the ADI, but the different terms are used to avoid the implication that intake of non-food crop pesticides is 'acceptable'.

For example, arsenic trioxide is a pesticide used against termites but is not used on food crops. Arsenic is also a naturally occurring substance found widely in the environment. No ADI is set for arsenic but the World Health Organisation has set a TDI of 0.002 mg/kg body weight/day.

When pesticides are used properly, human exposure should be minimal. Exposure is not expected to exceed the ADI, and would normally be much lower.

If, through misapplication or accidental spillage, the ADI is exceeded, this does not mean that exposed people will necessarily be at risk. Each incident would need to be assessed on a case-by-case basis by considering the toxicity of the pesticide and the degree of exposure. In the majority of cases, it is expected that greater amounts than the ADI can be taken in without causing harm - provided this occurs only for a short time and the amounts are not high enough to cause acute effects.

The ADI values provide a simple way of comparing the safety of pesticides. Pesticides with low ADI values may be considered more dangerous or more likely to accumulate in the body than those with higher ADI values.

Since comparison by ADI values is based on long term exposure and since for most members of the public or school community, any exposure to pesticides will be only of short duration, acute toxicity provides a better indicator of the potential for harm.

APPENDIX 2 ~ Synthetic pyrethroid insecticide

Synthetic pyrethroid insecticides are similar in chemical structure to pyrethrins which are natural insecticides produced by Chrysanthemum flowers.

Pyrethrins extracted from Chrysanthemums have been used as insecticides for many years. Features of pyrethrins are lack of persistence in the environment, and a rapid "knock down" activity which kills insects quickly.

In the past, pyrethrins were expensive to produce and had poor stability in light, resulting in loss of activity during storage. Synthetic versions of the pyrethrins have now been made and these have the advantages of being more stable, cheaper to produce, and have stronger activity against insects. In modern products it is common for synthetic pyrethroids formulations to contain other chemicals which increase their activity. Such chemicals, for example piperonyl butoxide, are called synergists.

There are a number of different but related chemicals in the synthetic pyrethroid class. All act in the same way by interfering with nerve impulses. Many of the synthetic pyrethroids have been made to have particular properties. For example, some are intended to act particularly quickly to knock down flying insects; others are intended to be sprayed on to surfaces on which insects crawl, killing them some time after spraying.

Synthetic pyrethroids commonly used include:

Allethrin	α-Cypermethrin	Permethrin
Bifenthrin	Deltamethrin	Phenothrin
Bioallethrin	Esfenvalerate	Pyrethrin I
Bioresmethrin	Fenfluthrin	Pyrethrin Ii
Cismethrin	Fenvalerate	Resmethrin
Cyfluthrin	Fluvalinate	Tetramethrin
Cyhalothrin		

Like all pesticides, pyrethroids are toxic to humans and other mammals. However, they are far more toxic to insects (and fish). This is because mammals have particular enzymes which break down the synthetic pyrethroids into less toxic chemicals. Insects lack these enzymes and so the pyrethroids persist longer in their bodies and have greater effects on their nerves and other tissue. Because of this, these chemicals tend to have a large safety margin although this varies from pyrethroid to pyrethroid.

The safety margin is the ratio of the toxic dose in mammals compared to the toxic dose in insects. Some synthetic pyrethroids have very large safety margins. For example, the synthetic pyrethroid deltamethrin is 2500 - 5500 times more toxic to flies than it is to rats, and natural pyrethrum is 60 - 90 times more toxic to flies than rats. In comparison, the organochlorine insecticide DDT, which is no longer used in Australia, is only 11 time more toxic to flies than to rats.

Because synthetic pyrethroids are so much more toxic to insects, the amounts needed to control pests are generally too low to have any particular health risks for humans (provided they are used according to instructions on the label). This makes this class of pesticide the first choice in many situations, particularly in the home and in school buildings.

Although these chemicals are often the pesticides of choice for many pests, they are not always the most appropriate. Under some circumstances and against some pests, other types of pesticide may be preferred. It is therefore important to use the chemicals against only those pests included on the label. For large infestation or for infestations which are proving difficult to control, consult your pest management technician who will be able to advise on the most appropriate pesticide for the job.

APPENDIX 3 ~ Addresses and contact numbers (March 1997)

Poisons Information Centre

This is a national service and the Australia-wide 24-hour telephone number is **131126**.

Public Health Units

New South Wales
Environmental Health Unit, New South Wales Health Department,
PO Box 798, Gladesville. NSW 2111.
Phone: (02) 9816 0373 Facsimile: (02) 9816 0345

Victoria
Environmental Health Unit, Department of Human Services
GPO Box 4057, Melbourne. 3001
Phone: (03) 9616 7777 (switchboard)

Queensland
Drugs and Poisons Services, Environmental Health Unit, Queensland Health,
GPO Box 48, Brisbane. QLD 4001
Phone: (07) 3234 0938 Facsimile: (07) 3234 1480

Tasmania
Public and Environmental Health Branch, Department of Community and Health Services,
GPO Box 125B, Hobart. TAS 7001.
Phone: (03) 6233 3762 Facsimile: (03) 6233 6620

South Australia
Environmental Health Branch, Department of Human Services,
PO Box 6 Rundle Mall, Adelaide. SA 5000.
Phone: (08) 8226 7100 Facsimile: (08) 226 7102

Western Australia
Environmental Health Service, Health Department of Western Australia
PO Box 8172, Stirling Street, Perth. WA 6849.
Phone: (09) 388 4997 Facsimile: (09) 388 4975

Northern Territory
Environmental Health Branch, Territory Health Services,
PO Box 40596, Casuarina. NT 0811
Phone: (08) 8922 7340 Facsimile: (08) 8922 7200

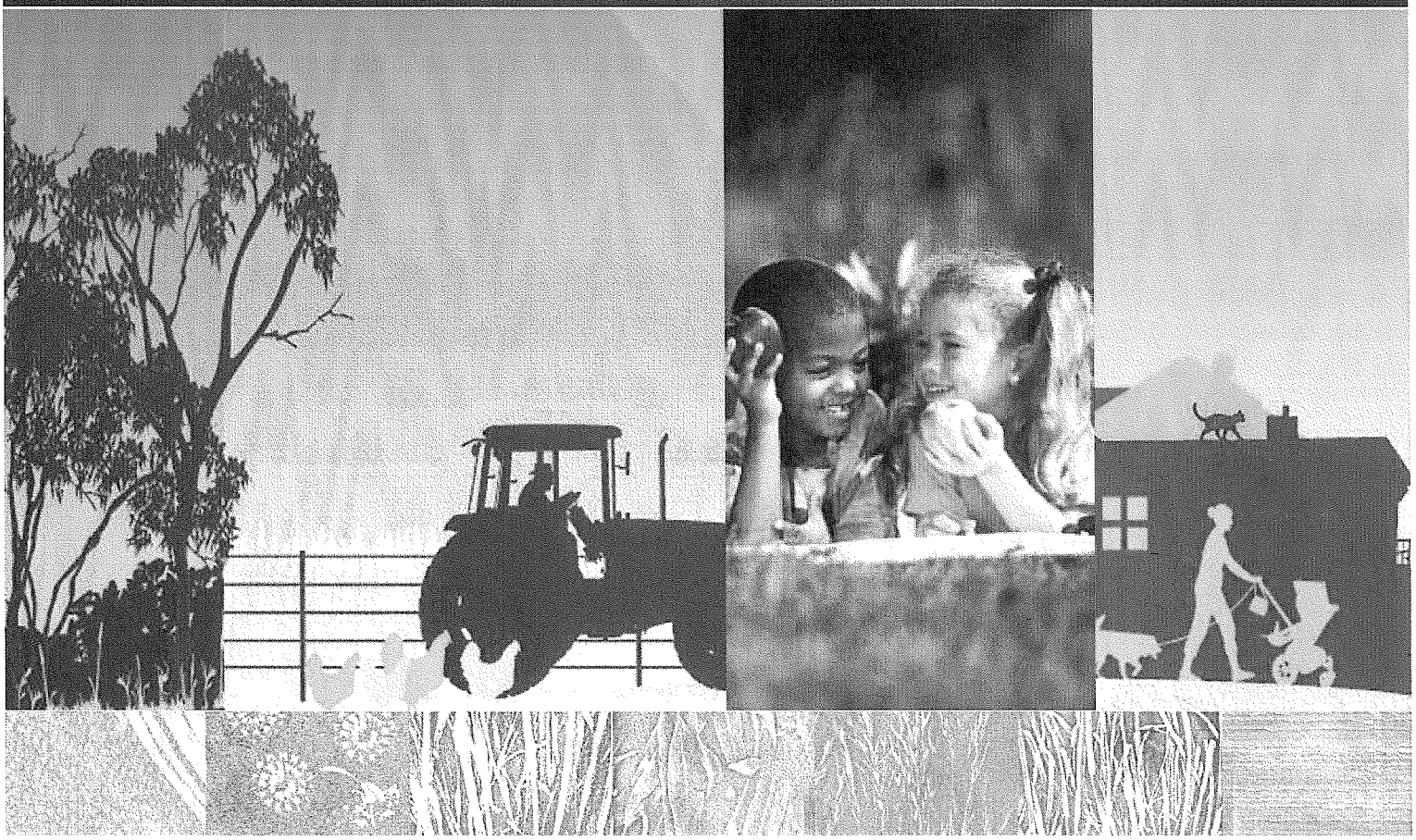
ACT
Health Protection Service, ACT Department of Health & Community Care,
Frewin Place, Scullin. ACT 2614.
Phone: (06) 205 1700 Facsimile: (06) 205 1705

National Registration Authority - who licence the use of pesticides in Australia.
PO Box E240, Kingston. ACT 2604
Phone: (06) 272 5158 Facsimile: (06) 272 4753

Attachment to LC4977 (Part 1)

Australian Government

Australian Pesticides and Veterinary Medicines Authority



PEST MANAGEMENT IN SCHOOLS

AUGUST 2008

This document was produced by APVMA Chemical Review.
Comments and enquiries may be directed to:
The Manager, Chemical Review
APVMA
PO Box 6182
Kingston ACT 2604
Telephone: +61 2 6210 4765
Fax: +61 2 6210 4776

Publication date: August 2008

Australian Pesticides and Veterinary Medicines Authority

Guidance on Pesticide Management in Schools

ISBN 9780977576623

1. School buildings — Pest control — Australia — Safety measures.

2. Pests — Integrated control — Australia.

371.60994

CONTENTS

INTRODUCTION

Schools must manage pests to prevent injury, disease and damage to property, maintain buildings in sound condition, prevent the loss of aesthetic amenity, minimise disruption to teaching and sporting activities, and arrest the spread of pests from the school into the surrounding community and environment.

This web publication has been prepared by the APVMA to address community concerns about the use of pesticides in schools, and provide guidance and information on the safe and effective use of pesticides in this situation. It is intended for managerial and teaching staff, students, parents, school councils, pest control operators, local government officers and the general public.

This publication is based on similar guidelines published previously by the Health Department of Western Australia[1] , the National Environmental Health Forum[2] , the NSW WorkCover Authority[3], and the US Environmental Protection Agency[4] . Some of the material presented here was originally derived from the *Handbook of integrated pest control and management for Western Australia*[5]. In 2000 the Australian Total Environment Centre (TEC) also published a book by Jo Immig, which provides a guide to reducing the chemical load in schools and childcare centres[6].

These guidelines provide information on integrated pest management (including non-chemical approaches), pests and their behaviour, chemicals used in pest management, and discussion on minimising the risks that chemicals present to the school community and environment.

The APVMA does not intend this publication to be used for promotion of any specific pesticide product, or to be used as a detailed pest management manual or regulatory standard. The publication is also not intended to provide detailed commentary about pesticide regulation and related legislation. It should be used to supplement existing guidelines and operating procedures promulgated by State and Territory Governments (see section on 'Controlling the Use of Pesticides'), school management organisations and individual schools. The publication does not apply to childcare centres, which are subject to different Government standards than those applying to schools. The APVMA will develop separate guidance for the use of pesticides within childcare centres.

Acknowledgements

The APVMA would like to thank the following:

- members of APVMA's consultancy group who provided initial guidance to the primary author;
- members of APVMA's Community Consultative Committee (CCC) who expressed a keen interest in the project and provided valuable input; and
- members of APVMA's Registration Liaison Committee (RLC) who provided helpful information about State/Territory documentation, guidance and codes of practice.

In addition, education departments in the States/ Territories passed comment on later drafts, helping to ensure that this document will provide information, guidance and advice relevant to all jurisdictions in Australia.

The APVMA would also like to thank the primary author, Mark Jenner, a consultant toxicologist who has had wide experience in agricultural and veterinary chemicals regulation. His expertise and patience as he responded to the many comments provided by a range of different stakeholders meant that APVMA's task in finalising this document was relatively straightforward.

1. Health Department of Western Australia (1995) *Guidelines for pesticide use in schools and school grounds.* Environmental Health Service, Health Department of WA ISBN 0 7309 6176 1
2. National Environmental Health Forum (1997) *Pesticide use in schools and school grounds.* National Environmental Health Forum Monographs General Series No 1 Available at http://enhealth.nphp.gov.au/council/pubs/ecpub.htm
3. NSW WorkCover Authority (1992) *Guidelines for use of pest control agents in schools.*
4. United States Environmental Protection Agency (1993) Pest control in the school environment: Adopting integrated pest management. US EPA Office of Pesticide Programs Publication No EPA 735-F-93-012 August 1993 Available at http://www.epa.gov/pesticides/ipm/brochure
5. Stanford Associates (1990) *Handbook of integrated pest control and management for Western Australia.*
6. Jo Immig (2000) The Toxic Playground: *A guide to reducing the chemical load in schools and childcare centres.* Total Environment Centre, Sydney, NSW

GUIDANCE ON PEST MANAGEMENT IN SCHOOLS

- Schools are encouraged to adopt an Integrated Pest Management (IPM) approach (see section on 'Integrated Pest Management'), and use it as a conceptual framework for preventing pests from interfering with the school's amenity and operations. Educate the entire school community about the basic concepts of IPM, and how they can be applied within your particular school. Students can learn about IPM as part of their biology curriculum.
- Designate a pest manager, who has overall responsibility for managing pests within the school. A pest manager could be the principal or a teacher, a member of the maintenance staff or someone from outside the school, such as a local government officer or pest control operator. If the pest manager is from outside, nominate a contact person within the school to facilitate liaison and provide the pest manager with any information they need.
- The pest manager will observe and evaluate the site (or direct others to do so) and produce a pest management plan, which will set objectives and outline the procedures the school will follow if there is a pest presence. Plans will vary from school to school, depending on their size, human and material resources and the types of pest management issues they face. A relatively simple plan may be sufficient for smaller schools or those which delegate pest management activities to an outside service provider. For examples of pest management plans, see www.epa.gov/pesticides/ipm/brochure/ or the Total Environment Centre publication Safer Solutions. IPM for Schools and Childcare Centres at www.safersolutions.org.au/ipm/download/safersolutions.pdf
- Pest managers also obtain, keep and circulate information about pests, chemicals and other pest management measures, and initiate decision-making and coordinate action against pests. They maintain records of pest management activities and pesticides stored or used within the school.
- Establish clear lines of communication between the pest manager and those who will be concerned about the safety and effectiveness of pest management activities. The pest manager should provide information about pest management activities and planning to students, parents, teachers, canteen managers, volunteers, administrators, governing bodies, and staff who apply pesticides within the school. The pest manager will also be the focal point for information and opinion from the school community, who will naturally wish to participate in decision-making.
- Liaison between the pest manager and school health officers or committees will be important, because schools are obliged to protect children with known medical conditions. For example, there may be concerns that exposure to a particular chemical could aggravate a child's existing medical condition. The pest management plan could include a voluntary registry of individuals who may be adversely affected by exposure to pesticides.
- Set pest management objectives for the school. These will vary from site to site, but will include preventing personal injury and disease, minimising damage to buildings and property, preserving visual appeal, avoiding disruption to teaching and sporting activities, and arresting the spread of pests from the school into the surrounding community and environment.
- Inspect the school regularly. Look for pests (see section on 'Pests') and conditions that may encourage them. Students, teachers and staff can participate – the more eyes, the better! Use the information in this guide to create a pest inspection audit form.
- If there is evidence of pest activity, locate entry points and sources of food, water and shelter. Confirm the identity of pest species. Correct identification is vital for effective pest management, especially of weeds, insects, spiders and rodents. Obtain information about the pest's biology and behaviour. These steps will ensure that the most effective management measures are taken.
- Set action thresholds, based on public health standards and the sensitivities of the school community. Action thresholds are levels of pest populations or environmental conditions that require remedial action. Thresholds will vary from species to species, and from location to location. An ant trail across the bike shed may be acceptable, but not a rat in the canteen!
- Using physical and biological management measures (see section on 'Physical and Biological Controls'), manage the environmental conditions in the school to prevent pests from being attracted, obtaining

food and reproducing. These measures will include maintaining hygiene, creating barriers against the entry of pests into buildings, denying shelter, ensuring effective drainage and ventilation and employing appropriate garden and turf management practices.

- When an action threshold is exceeded, act before the problem has become severe or persistent. A timely response will minimise disruption to normal activities, decrease the time and costs involved in controlling the outbreak, and reduce the amount of pesticide that must be applied.
- If physical and biological methods have become ineffective or cannot be implemented in time, consider supplementing them with chemical pesticides (further information contained in section on 'Pests').
- Staff should not bring their own pesticides onto the site. Acquisition and use of pesticides must be controlled only by the pest manager.
- Consult any relevant State and Territory guidelines or standards (see section on 'Controlling the Use of Pesticides'), guidelines set by other school governing bodies, and the school's pest management plan. These will clarify the range of available options, and the procedures you need to follow.
- Consider obtaining professional advice from a pest control operator (PCO). Brief the PCO about the problem, and accompany them when they visit the site. PCOs should be made aware of any pest management standards or guidelines that apply to the school. Discuss with the PCO any special sensitivities or concerns that the school community may have. When choosing a PCO (see section on 'Choosing a Pest Control Operator'), make sure that they will accommodate any concerns about medical issues involving children or staff members. There may also be concerns relating to the environment – for example, the treatment site may be adjacent to a waterway or some other area which must not be contaminated.
- Examine options for selecting the least hazardous and most effective and target-specific pesticide that is suitable for controlling the outbreak. The range of options will depend on the school's pest management plan, the guidelines applying to the school, and whether the pesticide will be applied by school staff or a PCO. (Some products can be purchased and used only by licensed persons). The choice of pesticide treatment will also depend on the severity and timing of the outbreak, and the situation it has occurred in.
- Information about pesticides registered in Australia is available from the APVMA's PUBCRIS database, which can be used to search for specific active constituents, products and pests (go to www.apvma.gov.au and click on 'Search PUBCRIS for Registered Chemicals'). The database also includes product labels (see section on 'Pesticide Labels') and information on whether products are subject to Poisons Scheduling (see further information in the section on 'Minimising the Risks to Students and Staff'). This information is a valuable guide to a product's toxicity and suitability for the intended purpose.
- Additional information on toxicity and environmental protection is contained in the product's Material Safety Data Sheet (MSDS). Obtain one from the manufacturer and keep copies accessible to the school community.
- Inform the entire school community (including staff, health officers, students, volunteers and parents) of the proposed pest management strategy. If you are acting according to a pest management plan that they have already approved, this will streamline their involvement in decision-making.
- Where appropriate, also inform the school's neighbours. Some States and Territories require that notice is given of pesticide application adjacent to sensitive sites, including schools and childcare centres.
- Use the minimum amount of pesticide required to control the outbreak.
- Time the application to minimise human exposure to the pesticide. School holidays or weekends are ideal, but check whether outside groups are using school facilities at these times.
- Signpost treated areas to keep people away until it is safe.
- If a PCO is applying the pesticide, they are encouraged to follow the 'Recommendations for Pest Control Operators Working in Schools' (see section below), in addition to complying with relevant State or Territory standards.
- If school staff apply pesticides, ensure that they have the MSDS and the proper equipment and training to use pesticides (consistent with the requirements of the relevant State or Territory

government, or non-government school management body) and are also trained in first aid (see section on 'Poisoning'). Minimise the quantity of pesticides stored within the school. The storage area must be secured to prevent access by unauthorised persons. Keep records of stored chemicals (this is required by some State and Territory governments).

- Pesticides must be applied according to the manufacturer's instructions for use on the product label, including precautions and safety directions. Pesticide applicators should wear the recommended personal protective equipment and clothing (PPE) and wash themselves and their PPE after use (see 'Minimising the Risks to Students and Staff').
- Use extreme caution when siting rat and mouse baits. Rodenticides are highly toxic and should never be placed where children have access. If used, baits should be presented as the most readily available source of food for the target pest.
- Clean up any spills quickly and thoroughly, as recommended on the MSDS. If an incident occurs, inform the principal and do not re-occupy the area until it is safe.
- Dispose of empty pesticide containers as directed on the label.
- Do not re-occupy treated areas before it is safe. Obey any re-entry intervals stated on the product label. If the pesticide has been applied indoors, ventilate the area thoroughly and do not allow re-occupation if there is any chemical odour.
- Keep records of all pest management activities. This includes the results of pest monitoring, and diagrams showing where pesticides have been applied, including the location of traps and bait stations. Records must be up-to-date and accurate if IPM is to work! Evaluate the effectiveness of measures taken, and use the experience to help prevent a recurrence of the outbreak.

INTEGRATED PEST MANAGEMENT

Integrated pest management (IPM) is an environmentally sensitive approach to pest control which takes into account the behaviour and biology of pests, their interaction with the environment, and the available physical, biological and chemical methods for controlling them. Its aim is to prevent unacceptable levels of pest damage by the most economical means, and with the least hazard to people, property and the environment (US EPA, 1993)[7].

In a school setting, the key steps involved in an IPM strategy are:

- Understanding the conditions pests need to survive, reproduce and spread.
- Predicting which pests may create problems, and the time and location where these problems are most likely to occur.
- Using physical and biological controls (see section on 'Physical and Biological Controls') to prevent pests from being attracted to, obtaining food from and reproducing within the school environment.
- Establishing "action thresholds", or levels below which pests can be tolerated.
- Monitoring for the presence of pests, and identifying outbreaks that exceed the action threshold at an early stage.
- If physical and biological control methods are ineffective, selecting the least hazardous chemical control options which will be effective against the pest.
- Applying only the minimum amount of pesticide necessary to control the pest, while creating the least possible hazard to humans and the environment (see section on 'Minimising the Risks to Students and Staff').
- Evaluating the effectiveness of all measures taken.

Further discussion about IPM in schools and links to resources are available from the US EPA at http://www.epa.gov/pesticides/ipm/index.htm or the Total Environment Centre publication *Safer Solutions. IPM for Schools and Childcare centres* at www.safersolutions.org.au/ipm/download/safersolutions.pdf

General information about IPM can be obtained at www.ipmworld.umn.edu

7. United States Environmental Protection Agency (1993) Pest control in the school environment: Adopting integrated pest management. US EPA Office of Pesticide Programs Publication No EPA 735-F-93-012 August 1993 Available at http://www.epa.gov/pesticides/ipm/brochure

PHYSICAL AND BIOLOGICAL CONTROLS

Human behaviour

- In school buildings and grounds, the most effective pest management strategies involve human behaviour, especially ensuring good standards of tidiness and hygiene. Rodents and most common insect pests are attracted to waste food, and even small scraps can support large populations of some species.
- All foodstuffs should be stored in resealable containers with close-fitting lids. Each day, clean away food scraps in eating facilities, food preparation areas, desks and lockers, and other indoor and outdoor areas. Cleaning should include bench tops and counters, food display equipment, floors and spaces under microwaves and refrigerators.
- Have designated eating areas, outside of which food and drinks are prohibited.
- Waste bins should have tight fitting lids and be emptied and disinfected regularly.
- Vacuum carpets and soft furnishings regularly and thoroughly.
- Encourage students and staff to report pests, or lapses in hygiene, to the pest manager. An atmosphere of shared responsibility will maximise the effectiveness of these measures.

Buildings and grounds

- The design and maintenance of buildings and grounds are highly important. Physical barriers will reduce indoor infestations. As far as possible, keep doors closed. Screen the bottom of doors and install flywire screens over windows, and ensure these are kept in good repair. Install air curtains across entrances through which there is heavy traffic.
- Deny pests access, shelter and track ways by closing gaps between floorboards, around footings, pipes and skirting boards. Replace worn lino and other floor coverings. Place screens on vents, ducts and drains.
- Prevent grease accumulating in sinks, pipes and drains.
- Eliminate damp within buildings and cupboards. Clean and dry mops after use, prevent water condensation, fix water leaks and ensure adequate ventilation and drainage. Prevent the accumulation of stagnant water outdoors in gutters, drains and similar situations.
- Deprive pests of shelter and breeding sites by tidying away cardboard boxes and waste building materials including bricks, rubble and sheet metal. Repair cracks in buildings, footings and paths.
- Any lights that are not required for security should be turned off at night, as they attract insects and spiders.

Sports and garden areas

- Turf management practices can be optimised to minimise the growth of weeds. Select the grass most suited to the climate and soil. Do not mow the grass too frequently or cut it too short. Leave grass clippings in the turf. Longer grass will compete more effectively with flat weeds such as dandelions and burrs. Vary mowing patterns to reduce soil compaction. Do not water turf too frequently or apply excessive fertiliser.
- Apply mulch to garden beds, but ensure that there is no excess leaf litter or vegetation immediately adjacent to buildings. Prune branches that possums or rodents may use as track ways into buildings. If some plants are susceptible to disease or insects and require repeated treatment with pesticides, consider replacing them with other, more resistant species.
- If there are indoor plants, keep them healthy. When small insect infestations appear, remove them manually.

School pets and laboratory animals

- Store animal food in tightly sealed containers, and clean cages and bedding regularly. Check animals for fleas and lice and if found, treat them with an approved insecticidal wash.

CHEMICAL PESTICIDES

Pesticide chemicals are introduced into the environment with the intention of killing, repelling or inhibiting the growth or reproduction of pests, including insects, weeds, rodents, fungi, molluscs (snails) and algae. Pesticides can be produced synthetically or originate from natural sources (eg. pyrethrins are produced by daisies).

Pesticides are classified in terms of the type of living organism they are effective against: insecticides, herbicides, fungicides, rodenticides, molluscicides or algaecides. Within each broad classification, pesticides may be grouped according to chemical class (eg. carbamate or organophosphate insecticides, triazine or phenoxyacetic acid herbicides).

Insecticides

The most commonly used classes of insecticides are:

- *Pyrethrins* and their synthetic derivatives, pyrethroids, which interfere with the nerve function of their target pests. These chemicals are of low to moderate toxicity to humans and animals, and are common active constituents of aerosol sprays and other products intended for household use. They have relatively low potential to form persistent residues in the environment.
- *Carbamates* act by inhibiting cholinesterase, an enzyme required for the normal functioning of nerves. Some products containing carbamates are of moderate toxicity and are registered for home garden or home veterinary use, while others are restricted to professional users because of their high toxicity. Most carbamates do not form persistent residues in the environment. Examples include bendiocarb, carbaryl and propoxur.
- *Organophosphates* also inhibit cholinesterase enzymes. These chemicals tend to be more toxic than pyrethrins, pyrethroids and carbamates. However, some low strength organophosphate preparations are suitable for home garden/veterinary use. Most organophosphates are not highly persistent in the environment.

Herbicides

There are a large number of different types of herbicide, which can be selective (agents killing either broad-leaf plants or grasses, but not both) or non-selective types that act against all plants. Some herbicides *(called pre-emergent types)* act before the weed has emerged from the soil, while *post-emergent* types kill only established plants.

Herbicides vary widely in their environmental persistence and toxicity to mammals. Some are of very low toxicity, while others are too hazardous to be used except by trained, licensed operators. Examples of herbicides commonly used in home garden and urban settings include glyphosate (an all-purpose agent), and bromoxynil, dicamba and MCPA (selective broad-leaf herbicides).

Fungicides

There are numerous classes of fungicide, but most inhibit fungal growth by preventing cell division. Some (including fluorine and copper compounds) are applied by impregnation as wood preservatives, while others (such as chlorothalonil and mancozeb) may be sprayed directly onto plants, vegetables and fruit.

Rodenticides

Most rodenticides (including warfarin, bromadiolone and brodifacoum) are mixed with grain or other edible material to form baits attractive to mice and rats. They are cumulative poisons and cause death by uncontrolled internal bleeding, even if low doses are taken in succession. Rodenticides are highly toxic to humans when swallowed, and baits should be used with extreme care to avoid access by children.

Molluscicides

These are the familiar snail and slug baits used in the home garden, most of which contain the active constituent methiocarb (a carbamate) or metaldehyde (a cyclic polymer of acetaldehyde). In humans and animals, metaldehyde causes toxicity to the nervous system, liver and kidney. Cases of poisoning have occurred in infants and dogs who have eaten pelleted snail baits, and although some manufacturers now add a bittering agent to deter ingestion, pellets should be applied with caution.

Algaecides

Chemicals used to control algae in swimming pools, ponds and similar situations include benzalkonium chloride, chlorine, copper and hydrogen peroxide (bleach). Most are highly irritating to the eyes, skin and mucous membranes, and their concentrated preparations should be handled with care. Other chemicals (e.g. dichlorophen, mancozeb) can be used to control algae and moss on paths and in lawns, synthetic turf, and greenhouses.

PESTICIDE LABELS

The label on a pesticide product is a legal document which has been approved and registered by the APVMA. It is the single most important source of information on the product's safe and effective preparation and use. The information it contains is the result of extensive scientific research on the pesticide's effects on the target pest, the environment, and on laboratory animals. Read it carefully and familiarise yourself with all the instructions and warnings before opening the container.

Labels indicate:

Toxicity: The level of toxicity is indicated by the heading **DANGEROUS POISON, POISON,** or **CAUTION.**

Ingredients: The pesticidal active constituents and their concentrations in the product. The list may also include organic solvents or other additives.

Use: The range of pests the product is intended to kill or control, and the situations of use, including plants that will be protected.

Application: Describes how the product should be diluted or prepared for use, and how and when it should be applied.

Safety Directions: Includes hazard statements (warning of particular hazards such as irritation), precautions (such as "Avoid contact with eyes and skin"), recommendations on clothing and protective equipment (eg. overalls, hat, gloves), and after use statements (such as "Wash hands after use").

First Aid Instructions: Measures to follow if poisoning has occurred or if the pesticide has been swallowed, inhaled or has contaminated the skin. Includes the telephone number of Poisons Information Centres.

Manufacturer: The name, address and contact details of the manufacturer.

MINIMISING THE RISKS TO STUDENTS AND STAFF

Toxicity, hazard, exposure and risk

Pesticides kill or control pests by interfering with their normal biological processes. This is known as *toxicity*. If non-target species (including humans) share the same biological processes as the pest, they too will be at risk of toxicity if they are exposed to the pesticide.

Some pesticides have additional properties (such as causing irritation or allergic reactions) which are not related to their toxicity to the target pests, but make them hazardous to humans. Furthermore, most pesticides are sold in **formulations**, or mixtures of chemicals such as water, organic solvents, emulsifying agents, propellants and stabilisers. These **additives** may make the product's toxicological characteristics different from those of the **active constituent** itself.

The **risk** to humans arising from the use of a pesticide depends on the **hazard** created by the chemical, and the extent of **exposure** to the chemical. In this context, *hazard* means the chemical's toxicity, which directly relates to its intrinsic properties, while *exposure* is the amount of the chemical that is inhaled, swallowed or contaminates the skin.

Risk means the likelihood that the hazard will cause harm. No pesticide is unconditionally dangerous, or completely safe in all circumstances. Even a very hazardous chemical may cause negligible risk if it used in a way that will not cause humans to become exposed. On the other hand, a moderately hazardous chemical could cause significant risk if humans became heavily exposed to it. Therefore, if hazard and exposure can be minimised (by using a less toxic chemical, and minimising possible exposure), the likelihood of harm will also be minimised.

Thus, the basic approach to chemical risk assessment can be expressed by the following formula:

Risk = hazard x exposure

Thus, if either the hazard (intrinsic toxicity) of the chemical can be reduced (by choosing a safer chemical) and/or the extent of exposure to the chemical can be reduced, then the risk or likelihood of harm can be reduced.

Hazard minimisation

Before a pesticide can be used in Australia, it must be assessed and registered by the APVMA. The APVMA registers pesticides only if they will cause negligible risk when used as directed, and ensures that pesticide products are packaged and labelled as appropriate to the hazards they present. Based on studies performed by the manufacturer, the APVMA's assessment process includes rigorous evaluations by government scientists of the chemical's effectiveness against pests, and its potential to cause toxicity to humans and the environment (see http://www.apvma.gov.au/about_us/pdf/overview_agvet_national_system.pdf). Additional information about the role of toxicology assessment in protecting human health through is available from the Commonwealth Department of Health and Ageing at http://www.tga.gov.au/docs/html/chemtox.htm

The APVMA recommends that before purchasing and applying pesticides, users should consider the various options and choose the least hazardous product that will be effective in managing the pest. The APVMA's registered product search engine, PUBCRIS can be used to find products that are effective against particular pests, view product labels, or find products that contain a particular active constituent. Entries in PUBCRIS include the Poisons Schedule applying to the product, which can be used as a guide to the level of hazard and risk it presents.

Poisons Scheduling

As part of the assessment process, pesticides are classified by the National Drugs and Poisons Schedule Committee, a statutory committee administered by the Commonwealth Department of Health and Ageing. Pesticides are placed in *Poisons Schedules* according to their purpose, the risk they present and the precautions required for them to be used safely. These precautions include packaging, labelling and controls over availability to the public. The committee takes account of the chemical's potential to cause toxicity arising from a single episode of exposure (*acute* toxicity) and from repeated exposures *(chronic* toxicity), including effects such as cancer, reproductive toxicity and injury to the unborn. The Poisons Schedule applying to a product is often based on the toxicity of the active pesticide it contains, but may also depend on the toxicity of additives, and the concentration of the various ingredients in the formulation.

Pesticides are placed in Schedules 7, 6, 5 or Appendix B, in order of greatest to least restriction. Schedule 7 substances, labelled **DANGEROUS POISON,** have a high potential for toxicity at low exposure levels and require special precautions. They can be purchased only by authorised persons who have the training and skills required to handle them safely. Schedule 7 chemicals are not allowed to be formulated in products intended for home or garden use. Schedule 6 substances, labelled **POISON**, have a moderate potential for causing harm, the extent of which can be reduced by using distinctive packaging with strong warnings and safety directions on the label. Schedule 5 substances, labelled **CAUTION**, have a lower potential for causing harm, the extent of which can be reduced by using appropriate packaging with simple warnings and safety directions. Substances that have been exempted from Scheduling are placed in Appendix B. These substances have very low toxicity and pose negligible risk when used as directed, but should nevertheless be used carefully and in accordance with any safety directions on their labels.

Material Safety Data Sheets

More detailed information about a product's toxicological properties will be included on its MSDS, which should be obtained from the manufacturer before purchase and kept readily available. This information may include a guide to the severity of irritation caused by the product, and measures of acute toxicity known as LD50s and LC50s. An LD50 is the lethal dose (expressed as milligrams of product per kilogram bodyweight) that kills 50 per cent of a group of laboratory animals (usually mice or rats) when given *orally* (by mouth) or applied *dermally* (on the skin). An LC50 is the lethal concentration in the atmosphere (expressed as milligrams of product per litre or cubic metre of air) that kills 50 per cent of a group of laboratory animals. The lower the LD- or LC50, the more toxic the product.

The MSDS will also include some details of the chemical's potential to cause chronic toxicity (repeated exposure to low doses of the chemical), or specific hazards such as toxicity to the nervous or reproductive systems[8] . Information on toxicity to the ecosystem and spill cleanup procedures will also be present.

Exposure minimisation

The amount and pattern of exposure to a pesticide depends on a number of factors. The most important of these are the physical state of the product, whether the product contains volatile chemicals, the method of application, the situation in which the product is applied, and whether persistent chemical residues are formed on treated surfaces.

Physical state of the product, and application methods

Pesticide products are available in different forms, such as liquids, powders, gels and granules. The methods involved in preparing and applying products depend on their form, as well as the purpose for which they are being used. Application methods have a considerable bearing on the potential exposure of operators and bystanders. Of all application methods, spraying, fogging and misting have the greatest potential for spreading the chemical over large areas, intentionally or otherwise, but may be the only feasible option. Herbicides can sometimes be applied in liquid form by wiping them over weeds with a wand or similar device. Granules and gels have a comparatively low potential for causing exposure, but granules may be eaten by birds, and small children may pick them up. Therefore, they may not always be appropriate, particularly around elementary schools.

8. It should be noted that MSDSs are based on the hazards of the chemical, not the risks at the likely levels of exposure when the chemical is diluted down into a product and used according to the label. Some MSDSs may mention eg. cancer possibilities and foetal malformations seen in animal studies, but the APVMA will not allow such chemicals to be used unless it is satisfied that the risk in use is negligible.

Volatile chemicals

Some liquid pesticide products contain active constituents that are poorly soluble in water, and include organic solvents to keep them in solution when the liquid is diluted for spraying. Common organic solvents include xylene and petroleum hydrocarbons. The solvents remain in the spray mixture and then become deposited on treated surfaces. When solvents evaporate, their vapour may be dispersed over considerable distances and can accumulate within poorly ventilated spaces. Many organic solvents have a powerful and distinctive odour and can irritate the eyes, skin and respiratory tract. If the airborne concentration is high enough, solvents can be toxic to the central nervous system[9]. Even at airborne levels that are not toxic, solvent odours can be unpleasant. Complaints about exposure to pesticides often result from people smelling the solvent vapours, rather than the active constituent. A common situation leading to problems is when a solvent-based product has been applied in a poorly ventilated sub-floor area, and rooms above have been re-occupied before the vapour has completely dissipated.

Inhalation exposure to solvent vapours is difficult to control. However, an increasing number of chemical manufacturers are re-formulating their products so they have less potential to create odour. Wherever possible, choose one of these products for use in a school setting. The MSDS, product label and the PUBCRIS database will indicate whether solvents are present. It is important to discuss this issue when negotiating with a PCO. When spray operations are complete, treated rooms must be ventilated for a minimum of two hours. If the product label specifies a longer re-entry interval, comply with it! Open all doors and windows. If there is an air conditioning system, run it at full capacity but take care to avoid recirculating vapours into untreated parts of the building. Do not permit re-occupation if a chemical odour remains.

Exposure of Applicators and Bystanders

The people who are exposed most heavily to pesticides are usually those who prepare them for use and apply them. Most exposure occurs via the skin. However, exposure by inhalation can occur when aerosols form during spraying, or if the chemical is formulated as a fine dust or powder.

As discussed in the previous section, volatile chemicals and gases can cause heavy exposure by inhalation, especially if they are being applied within a confined or poorly ventilated space.

The likelihood of an applicator exposing themselves or others to pesticides can be minimised by following the label directions, taking care to avoid contact with the product or spray mixture, and exercising common sense from the time they purchase a product until they dispose of the empty container!

- Store only the quantity of pesticides required in the immediate future. Do not stockpile. Keep pesticides in a dedicated, secure storage area that cannot be accessed by unauthorised persons. The area should be protected from moisture and the sun, as the elements can damage containers or cause decomposition of the chemicals inside them. Check stored pesticides regularly and dispose of any containers that have exceeded their use-by date, or are showing evidence of deterioration. Store pesticides only in their original container. If part-full, containers should be re-sealed and still have an intact label. Keep records of pesticides bought, stored, applied and disposed of.
- As far as possible, plan ahead of the application itself. Remember, in an IPM program, applying the pesticide is part of a larger, ongoing operation. Notify the school community of the date, time and place where pesticide treatment will occur.
- Under most circumstances, it should be possible to apply a pesticide in a school without exposing anyone. The single most effective way of achieving this is to perform application after school hours or on weekends. If the pest outbreak does not require urgent attention, delay treatment until the holidays.
- If you are performing the application, familiarise yourself with the directions for use before opening the container. Ensure you have the correct equipment needed to prepare and apply the product, and all the recommended protective clothing and equipment (PPE). These items are essential to limit your exposure and risk to acceptable levels. If the PPE has been stored since its last use, check that it

9. In industrial situations, inappropriate use of certain organic solvents in enclosed spaces (eg. fuel tanks) can lead to airborne concentrations which are toxic to the central nervous system, leading to dizziness, fatigue, unconsciousness or possibly death.

is in good condition. Pay particular attention to gloves or other items made from rubber or plastic. Spray equipment should also be checked for leaks or deterioration.

- Have water and soap available to remove any pesticide or spray mixture from the skin or eyes in the event of an accidental splash or spill.
- Open containers and mix products with proper equipment on a stable surface and in a well-ventilated area. Avoid splashing liquids when decanting, mixing and transferring them. Never siphon by mouth.
- Clean up spills promptly, as instructed in the MSDS. Ensure a supply of absorbent material (sand, sawdust or kitty litter) is available.
- Make sure the application site is clear, and signpost treated areas.
- Special care is required when spraying. Fine aerosols created during spraying can spread over considerable distances even under still conditions, or indoors. Wherever possible, do not spray in areas where food is prepared, stored or eaten. If spray application cannot be avoided, ensure that foodstuffs, preparation surfaces and utensils are not contaminated.
- Take care not to contaminate the environment outside the target area, especially waterways. Ensure that school pets, including birds and fish, are removed from the treatment area.
- If the treatment area is inside a building, ensure adequate ventilation during application, and that adequate time has elapsed before allowing re-occupation (see above).
- Dispose of empty containers as directed on the label. Ensure that they cannot be accessed by children, as some residues may remain inside.

Residues

Some pesticides are more persistent in the environment than others. A relatively persistent chemical may provide longer-term control of the target pest, so avoiding the need for repeated application. This may be desirable in a situation where humans are not likely to be exposed (for example, under a floor), but may not be acceptable on a sports oval or playground. If a pesticide must be applied to a surface that is likely to be touched, it should be of a type that breaks down quickly. Alternatively, it should be applied during school holidays to allow breakdown to occur before the school is re-occupied. Information on a pesticide's environmental persistence should be obtained from its manufacturer.

POISONING

Poisoning occurs when a toxic dose of a chemical has entered the body after being swallowed, inhaled, or absorbed through the skin. The severity of poisoning depends on the amount that is absorbed into the bloodstream and the internal organs of the body. This may be all or only a fraction of the amount to which a person has been exposed. The effect also depends on what happens to the chemical once it is absorbed, for example, whether it is metabolised, excreted quickly, or retained in the body.

Poisoning may occur when a person has mixed or applied a pesticide without wearing the protective clothing or equipment recommended on the product label, has used improper methods when performing these activities, or has re-entered a treated area before it is safe to do so.

Symptoms vary depending on the type of chemical and its biological effects, and also on the dose that has been absorbed. Nevertheless, some or all of the following symptoms soon after contact with a pesticide should be investigated further as they may indicate poisoning:

- Irritation or redness of the skin, eyes, nose or throat
- Blistering, allergic-type skin reaction
- Numbness of the skin
- Headache, fatigue or dizziness
- Pinpoint pupils, blurred vision or other visual disturbances
- Muscular weakness, nausea or vomiting, severe salivation, diarrhoea
- Difficulty breathing, or asthmatic- type reaction
- Tremors, convulsions, or loss of reflexes
- Irregular, fast or slow heartbeat
- Loss of consciousness.

If poisoning has occurred or is suspected, contact a doctor or Poisons Information Centre on 131126. Wherever possible, use the container, label or MSDS to identify the chemical, and check these for additional First Aid Instructions and Safety Directions.

ARE CHILDREN AND ADOLESCENTS AT GREATER RISK FROM PESTICIDES THAN ADULTS?

The APVMA and other national and international chemical control organisations recognise the need to protect children's health. The Intergovernmental Forum on Chemical Safety (IFCS) Meeting IV, held in Bangkok in 2003, recommended that "Governments should promote education and training on children's chemical safety, and where risks are identified, should commit to taking action to prevent or reduce exposure.[10]"

There is increasing awareness that children and adults may differ in their susceptibility to chemicals, including pesticides[11]. The development of many body tissues occurs throughout the first 18 years of life, especially the brain, immune and endocrine systems and reproductive organs. Immature tissues, organs and hormonal systems may display enhanced vulnerability to the effects of chemicals, compared with those of adults.

Children have a relatively high rate of inhalation and surface area to volume ratio. These factors could enhance the intake of chemicals by inhalation and dermal absorption, compared with the level that would be experienced by adults exposed under equivalent conditions. Children of school-going age also have different behavioural patterns than adults, spending more time at ground and floor level. They are more likely to make prolonged bare skin contact with surfaces upon which pesticides can be deposited, including earth, grass, plants and flooring. Infants are also more likely to ingest residues on surfaces through hand-to-mouth transfer.

Physiological differences between children and adults, including the content of water and fat as a proportion of bodyweight, may affect the metabolism and excretion of a chemical. In general, children have a higher metabolic rate than adults, and are likely to metabolise and excrete foreign compounds more rapidly.

Children have a higher need for nutrients and a higher energy demand than adults, and so consume more food and drink per kilogram bodyweight. This could lead children to have an enhanced dietary intake of some chemicals. However, the dietary risk assessment process undertaken by the APVMA and FSANZ[12] takes children's and infant's patterns of food intake into account, and ensures that there will be no effect on their health from chemical residues in food.

The toxicity of chemicals to the unborn and young is covered by experimental protocols for testing developmental toxicity, neurotoxicity and multi-generation reproduction toxicity of pesticides in experimental animals. The APVMA requires chemical companies to provide these studies and it must be satisfied that products containing these chemicals can be used safely before it will allow product registration. The special susceptibility of children is assessed on a case-by-case basis, and together with its partnering agencies, the APVMA ensures that children will be protected by appropriate safety margins incorporated into exposure standards and other regulatory conditions.

Although there is little scientific evidence that the current risk assessment procedures do not protect children adequately[13], the OECD is currently developing and updating guidelines for screening endocrine disrupting chemicals[14] and methods for testing and assessing developmental and reproductive toxicity[15], so they will be better able to detect specific concerns for children. The APVMA is closely monitoring scientific developments in this area and will adopt and contribute to any future advances in risk assessment for children.

---

10. See http://www.who.int/ifcs/documents/forums/forum4/en/f4_exs_en.doc
11. Wolterink G et al (2002): Risk assessment of chemicals: What about children? RIVM [Dutch Ministry of Health, Welfare and Sports] Report 613340005/2002
12. See www.foodstandards.gov.au
13. World Health Organization JMPR (1999): Pesticide residues in food – 1999. *Report of the Joint Meeting of the FAO Panel of Experts on Pesticide Residues in Food and the Environment and the WHO Core Assessment Group on Pesticide Residues, Rome, Italy, 20-29 September 1999*. FAO Plant Production and Protection Paper 153.
14. Organisation for Economic Co-operation and Development (2002): *Detailed Review Paper. Appraisal of test methods for sex hormone disrupting chemicals*. OECD Environment Directorate, 7 March 2002 ENV/JM/MONO(2002)8
15. Organisation for Economic Co-operation and Development: *Draft guidance document on reproductive toxicity testing and assessment*. At www.oecd.org/dataoecd/38/46/34030071.pdF

PESTS

Pests are living organisms (including plants, animals and insects) that cause adverse effects on or interference with human activity. Organisms can be pests because they spread disease or are venomous, eat food intended for human consumption, damage buildings and property or compete with desirable plants and animals, including those important to agriculture or ecosystems. Many species have become "pests" after being introduced by humans into ecosystems within which they were not naturally present. Others are natural inhabitants that have an ecologically important role but become "pests" by colonising places where humans live, build, or grow food. You will find examples of all of these types of pest in the following section which describes the more common pests of school environments, methods for managing them, and the types of pesticides that can be used.

Insects

Before using chemical treatments against insects, it is important to consider that they are essential components of the natural environment. Some species prey on flies, mosquitoes and other pest species, while insects are an important source of food for birds. Additional information on the biology of insects is available from the Commonwealth Scientific and Industrial Research Organisation Division of Entomology web site at http://www.ento.csiro.au/about_insects/index.html.

Low levels of infestation may be tolerable, but several species can become a nuisance or health hazard. Infestations can often be inhibited by non-chemical means, such as sealing cracks in walls or floors, installing fly screens, ensuring hygiene or removing potential breeding sites.

Cockroaches

Cockroach infestations are most common in areas where food is prepared, stored or eaten. Canteens, kitchens and staff common rooms often require treatment. Low level infestations can also occur in offices. Cockroaches can also form persistent infestations in outdoor areas such as stormwater and sewerage openings, grease traps, waste disposal sites and compost heaps. Under the right conditions, they will move from these places into buildings.

Cockroaches prefer dark, warm and moist environments. They thrive in areas where there is a water and food source, and there are cracks, crevices and gaps. Signs of cockroach activity include faeces (like large fly droppings), cast off skins, egg sacs and a musty odour.

Indoor environments can be made less favourable by sealing openings where cockroaches shelter, especially around ovens and hot pipes, and under skirting boards, cracked tiles and lino. Clear away old cardboard boxes. Remove sources of food and water. Food should be kept in sealed containers and all traces of food, grease and oil must be removed from floors and bench tops. Clean all surfaces under microwaves, refrigerators and cupboards.

Infestations in outdoor areas can be managed by removing rubbish and maintaining hygiene. However, avoid killing or disturbing Australian native wood or bush cockroaches under leaf litter, bark or in rockeries, as they play an important part in the ecology of these areas.

Insecticides used for cockroach control are generally applied as crack and crevice treatments or baits. Baits are most effective in areas where there are no other sources of food. The frequency of application will depend on the rate of reinfestation and the level at which cockroaches are perceived to be a problem. Sticky traps are useful for monitoring but are rarely sufficient on their own to eradicate infestations.

Pesticides registered for cockroach control include:

- Bendiocarb
- Boric acid
- Chlorpyrifos
- Diazinon
- Fenthion
- Fipronil
- Hydroprene
- Methoprene
- Propoxur
- Pyrethrins
- Synthetic pyrethroids

Ants

There are many species of ants in Australia but only a few of them have become pests in and around buildings. Most ant species nest outdoors and only enter buildings in search of food. Because

they are an important part of the ecosystem, most ant nests should not be destroyed unless they pose a problem. However, when ants build nests under pavements or buildings, they can be remove large quantities of soil resulting in subsidence and structural damage. Outdoor meat ants form large colonies and give painful bites. Singapore and Argentine ants can be very troublesome and should be controlled whenever they are detected. Argentine ants must be reported to State and Territory Departments of Agriculture or Urban Services.

Ants are attracted by rubbish, decomposing material and spilled food or drink. Their movement into buildings and prevalence outdoors can be inhibited by the same hygiene practices that control cockroaches.

If chemical management is required, the most effective method is to locate and treat the nests, rather than just spraying the ant trail. If the nest is in a dry area, insecticidal dust may be used. If in a wet area, baits or liquids may be more appropriate. When used, baits should be presented as the most readily available source of food. However, some species will not accept baits. Where ants are nesting inside a building, it may be necessary to spray a residual insecticide in the roof, wall or floor cavities.

Pesticides registered for ant control include:

- Bendiocarb
- Boric acid
- Carbaryl
- Chlorpyrifos
- Diazinon
- Fenthion
- Fipronil
- Hydromethylnon
- Propoxur
- Synthetic pyrethroids

Termites

Termites (often called white ants) feed on wood and serve an important function in nature by converting dead trees into organic matter. However, they also eat sound wood in buildings, and can cause serious damage which is expensive to repair or even dangerous to building occupants.

Termites require a humid environment for survival and nest underground, creating tunnel networks that may extend up to 100 metres from the nest. To reach food sources above ground level, termites construct mud tubes. Termites often go undetected until significant damage has occurred because the mud tubes may be concealed, and because termites minimise the damage to the outer surface of infested wood to maintain humidity (see www.tga.gov.au/docs/html/termite.htm).

Buildings under construction can be protected by physical and/or chemical barriers that will prevent termites from entering them. Many local building authorities require the incorporation of such measures. To prevent or eradicate infestation of existing buildings, insecticidal treatment of cavities, sub-floor and sub-slab areas is usually required. This often involves injecting or spraying liquid insecticide into holes drilled through concrete slabs, footings and into wall cavities. Published Australian Standards outline the procedures that must be followed to protect new and existing buildings. Strategically placed bait stations can be used to attract and destroy termites, or for monitoring purposes.

Timber intended for use in buildings, fences and other outdoor structures is often termite-proofed with chemicals by dipping or vacuum impregnation. The APVMA has recently restricted the use of copper chrome arsenate (CCA) timber treatments, which are no longer permitted for timber intended for use as exterior seating, decking and children's play equipment (see http://www.apvma.gov.au/chemrev/downloads/arsenic_summary.pdf).

Termiticide treatment should only be carried out by licensed pest control operators, in accordance with current Australian Standards and State or Territory regulations.

The Victorian Department of Education and Training has published a Protocol for Use of Termiticides in Schools, which contains further information about the biology of termites and methods for preventing and controlling them in a school setting. (see www.eduweb.vic.gov.au/edulibrary/public/ohs/Termiticides.pdf).

More detailed information on chemical termiticides is available from the Therapeutic Goods Administration, at www.tga.gov.au/docs/html/termite.htm

Bees and wasps

Bees and Australian wasps are beneficial insects, but can inflict painful stings that may cause a hazardous allergic reaction. They are generally not aggressive unless their nest or an adjacent area is disturbed. Management is only warranted if a hive or nest is present in an area likely to be disturbed by playing children, or is within a building, roof or wall cavity. Unless the nest is obtrusive, it may be more appropriate to educate children to keep away than resorting to chemical control. Apiarists may be helpful in removing swarms of bees. Paper nest wasps may be killed by applying an insecticide directly to the nest, preferably in the late afternoon or early morning when the wasps are present but relatively torpid.

European wasps, recognisable by their prominently yellow-barred abdomen, are an introduced species whose nests must be reported to State and Territory Departments of Agriculture or Urban Services. These wasps scavenge for food and are attracted to meat products, sweet foods and soft drinks. They are often very aggressive when disturbed and are dangerous because of their habit of entering soft drink cans, from which they can be swallowed.

European wasp nests are usually concealed in the ground, within wall or ceiling cavities or behind retaining walls. Their eradication should only be attempted by a professional operator, as the wasps will present some risk. Destruction involves application of insecticide dust or liquid into the nest opening, and it may take up to a fortnight for before all wasp activity ceases. A knockdown aerosol may be required to reduce activity around the nest opening during treatment.

Pesticides registered for bee and wasp control include:

- Carbaryl
- Dichlorvos
- Maldison
- Propoxur
- Synthetic pyrethroids

Flies

Flies feed on and breed in faeces and decomposing animal and plant tissue, and can transmit pathogens from these sources to humans. Therefore, they pose a particular hazard to public health. The best way to manage flies is to inhibit their breeding. Flies lay eggs in material suitable for their larvae (maggots) to use as food, so maintenance of good hygiene is essential. Rubbish bins and skips should be emptied and disinfected regularly, and secured with tight-fitting lids. Compost should be stored in closed compost bins, in which the temperature of decomposition will prevent houseflies from breeding.

Remove animal carcasses, faeces, litter, decomposing vegetation and fallen fruit from school grounds. This needs to be done frequently, because very little time is required for such material to become flyblown. Fly traps can be used to control flies in outdoor areas that may be attractive to them.

Adult flies can travel many kilometres from their breeding site and it is neither possible nor ecologically desirable to eradicate them. However, they should not be tolerated inside buildings. Ensure flyscreens are installed and maintained in good repair. Indoors, follow the hygiene guidelines outlined for controlling ants and cockroaches. Fly swats can be used for localised control. Chemical sprays should not be used repeatedly as a preventative measure or over large areas.

Pesticides registered for fly control include:

- Diazinon
- Fenthion
- Maldison
- Propoxur
- Pyrethrins
- Synthetic pyrethroids

Fleas

Fleas feed on the blood of host animals, including rodents, cats, dogs, rabbits and people. The bite causes itching and can become infected. Sometimes rats or feral cats may deposit fleas in outdoor play areas or building sub-floor spaces. School or domestic pets may also be a source of fleas.

Fleas can be prevented by blocking sub-floor access by rodents and feral animals, and minimising activity of feral animals around the school by maintaining effective waste food and rubbish control. Within buildings, regular and thorough vacuuming will assist in preventing fleas from breeding in upholstery and carpets. School pets should be kept free of fleas by regular inspection and treatment. Clean their cages and change their bedding material frequently.

Flea control on pets can be achieved by using insecticidal washes, medallions or collars. If fleas have become established within a building, it may be necessary to spray carpets and other places with an insecticide.

Pesticides registered for flea control include:

- Bendiocarb
- Diazinon
- Fenthion
- Hydroprene
- Methoprene
- Propoxur
- Synthetic pyrethroids

Further information about the biology of fleas and methods for controlling them is available from the enHealth (1999) *Guidelines for the control of public health pests – Lice, fleas, scabies, bird mites, bedbugs and ticks.* NEHF Monographs General Series No 3. Available at http://enhealth.nphp.gov.au/council/pubs/ecpub.htm

Headlice

Headlice are a social pest living within human scalp hair. They feed on blood and can be transmitted by direct head-to-head contact, or via hats and other headwear. Outbreaks of headlice within schools are not uncommon, and may require a co-ordinated treatment campaign by staff, parents and students.

Detailed information about the biology of headlice and methods for controlling them is available from the enHealth (1999) *Guidelines for the control of public health pests – Lice, fleas, scabies, bird mites, bedbugs and ticks.* NEHF Monographs General Series No 3. Available at http://enhealth.nphp.gov.au/council/pubs/ecpub.htm

Mosquitoes

Mosquitoes are slow flying and relatively easy to swat, but often go undetected until they have bitten. It is essential to control mosquitoes because they transmit several serious human diseases, including dengue fever, Ross River virus and Australian encephalitis.

Mosquitoes breed in still water, in which the eggs are laid and the larvae (wrigglers) live until they develop into adults. Therefore, the most effective means of control is to ensure effective drainage and remove or flush any still water deposits around gutters, drains, plant pots and similar places.

Adult mosquitoes rest in moist, shaded and sheltered locations such as under eaves, within water tanks or drains, on walls, underneath leaves and in shrubbery. It is sometimes feasible to prevent mosquitoes from gaining access to such areas, or to make them less attractive to the insects by removing shelter.

Flywire screens are the most effective method of excluding mosquitos from indoor environments. If they have gained entry, they can be killed using household space sprays.

Citronella candles or lamps, long loose-fitting clothing and personal insect repellents are the most effective methods outdoors, but during times of peak mosquito activity it may be advisable to keep children indoors. Mosquitoes may be attracted to light coloured clothing and some perfumes and aftershaves. Repellents should be applied only to exposed skin, and washed off the skin as soon as they are no longer required. Avoid applying repellents to irritated, cut or wounded skin, or around the eyes and mouth. High strength repellents should not be used on infants and children.

Pesticides registered for mosquito control include:

- Diazinon
- Fenthion
- Maldison
- Propoxur
- Pyrethrins
- Synthetic pyrethroids

Carpet beetles and clothes moths

Larvae of carpet beetles and clothes moths feed on natural fibres and are often present in carpets, fabrics, soft furnishings, curtains, cupboards and other storage places. Carpet beetle larvae also eat dead insects and dried animal specimens and can destroy collections kept for scientific purposes.

Regular, thorough vacuuming around carpets and furniture will greatly reduce the impact of these pests, although insecticide may have to be applied to badly infested areas of carpet. Sealed boxes and cabinets can be protected with mothballs (naphthalene) or pest strips containing dichlorvos.

Other pesticides registered for control of clothes moths and carpet beetles include propoxur, pyrethrins and synthetic pyrethroids.

Itchy caterpillars

Caterpillars of several species of moths shed hairs which irritate the eyes and skin. The most important cause of "caterpillar dermatitis" arises from caterpillars of the mistletoe brown tail moth, which is found widely in south-eastern Australia. The problem can be managed by removing mistletoe from trees in affected areas.

Another species, the bag shelter moth (or processionary caterpillar) forms silky "nests" in gum and wattle trees in many parts of Australia. If there are problems, someone wearing appropriate skin protection should remove the nests and silken threads from the tree trunks. The material should then be incinerated to destroy the irritant hairs. If there is a recurrent problem, the trees and shrubs near playgrounds, classrooms and parking areas may need to be replaced with other species.

Silverfish

Silverfish can be found within buildings, roofs or wall voids and in sub-floor areas. Favoured habitats are in undisturbed dark areas, such as store rooms and cupboards. They feed on a wide range of starchy materials and often damage clothes or paper products including books, photographs and wallpaper. They are most active at night and infestations may go undetected until damage has occurred.

Maintenance of a clean and tidy indoor environment may assist in management, but significant infestations may require the removal and fumigation of smaller objects and treatment of affected areas with insecticide sprays.

Pesticides registered for silverfish control include:

- Bendiocarb
- Diazinon
- Propoxur
- Pyrethrins
- Synthetic pyrethroids

Booklice

Booklice (psocids) feed on microscopic moulds and other fungi growing on books, woodwork, paper and leather. They are most abundant in damp, dark rooms with poor ventilation, where conditions favour fungal growth.

Thoroughly cleaning, drying and airing the area is normally sufficient to clear these pests but a light application of insecticide may be required for heavy infestations.

Pesticides effective against booklice include pyrethrins and synthetic pyrethroids.

Spiders

Spiders are predators and most produce venom to subdue their prey. Many species are not dangerous to humans and do not need to be killed. However, dangerous species (including funnelweb, redback and black- or white-tailed house spiders) cannot be tolerated if present in or around school buildings.

The prevalence of spiders can be reduced by making the environment less favourable for them. Spiders often build webs near lights to catch the insects they attract. Exterior lights not required for security should be turned off after premises have been vacated. Leafy rockeries and damp, overgrown garden areas are the preferred habitat of white-tails, while redbacks tend to remain in darkened, sheltered places near ground level. The areas around buildings and sheds should be kept tidy to reduce the available habitat.

When spiders enter buildings, they may build webs in vents, corners and skirting boards, or seek refuge under items on the floor. For this reason, clothing should always be stored above floor level. Regular and effective cleaning will minimise the number of spiders indoors.

If insecticides are necessary, apply them directly to the webbing, into the burrow or the cracks and crevices where spiders shelter. However, once the insecticide breaks down, treated areas tend to be re-colonised rapidly. General preventative surface spraying is not recommended.

Pesticides registered for spider control include:

- Bendiocarb
- Chlorpyrifos
- Diazinon
- Fenthion
- Propoxur
- Pyrethrins
- Synthetic pyrethroids

Snails and slugs

These may cause damage to plants in garden beds and are often controlled using bait pellets containing methiocarb or metaldehyde as the active constituent. The use of pellets may not be advisable in infant and primary schools where small children may pick them up. There are a range of non-chemical methods to limit snails, including a layer of mulch (materials with rough and jagged edges); inter-planting of herbs (slugs are thought to dislike spiky or aromatic plants); and thinning-out of plants, allowing air to circulate and reducing shady moist spots preferred by slugs and snails.

Ticks

Ticks are parasites that attach to and bite animals, from which they suck blood. When a tick has become engorged with blood, it falls from its host and shelters amongst foliage until it has digested its meal. It will then attach to another animal – or human – that brushes against it.

Bush (or paralysis) ticks are found along the eastern coast of Australia in moist vegetated habitats. Their principal hosts are bandicoots but they will attach to other hosts such as livestock, cats, dogs and humans. Their bites can cause severe symptoms in people and dogs, including paralysis.

Kangaroo ticks are found where there are significant populations of their principal hosts. They will also infest dogs, sheep and other animals. In humans, their bites cause less severe symptoms than bush ticks.

Schools on the fringe of metropolitan suburbs and in country districts are most likely to be affected. Discouraging bandicoots and kangaroos and reducing undergrowth may control the problem but tick infestations can be severe enough to warrant pesticide treatment of school grounds adjacent to bush. Loose, baggy clothes and tick repellents (which are smeared onto clothing) may be required for personal protection.

Fenthion, maldison and pyrethrins are registered for the control of ticks.

Rodents

Mice and rats are most active during the night and their presence is usually revealed by droppings, tracks or signs of gnawing. Rodent infestation can be prevented by good hygiene and sanitation practices, by structural barriers, trapping and baiting. For persistent or large infestations, a pest control operator should be consulted.

Food containers should be kept closed and storage areas cleaned. Rubbish should be cleared frequently and kept in closed bins until disposal. Keep building surrounds clear of unwanted undergrowth and scrap material (such as wood, metal sheeting or bricks) that may provide cover. Mice can squeeze through gaps as small as 6 mm, so check for and seal potential track ways through gaps surrounding pipes and under doors and skirting boards.

The choice between mechanical traps or chemical methods will depend on the extent of the infestation, and its situation. Extreme caution is advisable when using rodenticides. Single dose rodenticides (such as strychnine and aluminium phosphide) are not recommended for use in schools, as they pose unacceptable risks. Even the more suitable anticoagulant rodenticides (chemicals that prevent blood clotting) are highly toxic and have a cumulative effect if non-lethal doses are taken in succession. If swallowed by humans, they can cause fatal poisoning.

If used, baits should be presented as the most readily available source of food, and placed in clearly labelled, lockable bait stations that will prevent children and non-target animals from removing or touching the bait. Bait stations and traps should be sited in areas where children do not have access, and checked daily. The school community should be warned not to interfere with traps, baits or dead rodents. A good strategy would be to place traps or baits in the evening and collect them in the morning before students arrive.

Pesticides registered for rodent control include brodifacoum, bromadialone, cholecalciferol, coumatetralyl, difenacoum, difenthialone and warfarin.

Birds, snakes, possums and feral cats

These pests should be captured and handled only by experienced personnel such as pest control operators and local government employees.

Several introduced species of birds – especially starlings, sparrows, common mynas and feral domestic pigeons – perch, roost and nest on buildings. Heavy deposits of bird droppings may cause problems associated with hygiene and aesthetic amenity, while nests within eaves and wall cavities may introduce lice into buildings. Birds can be denied access simply by ensuring that roofs, gutters and eaves are well maintained, and installing fine mesh wire barriers or bird spikes on or around sensitive areas.

Snakes may sometimes enter school grounds adjacent to undeveloped land, particularly when there is little human activity to disturb them. They may be attracted to areas where rodents are a source of food. Given that most of the common Australian species are venomous, a swift response to sightings is required. Children and staff should be kept away until Parks and Wildlife or other experienced personnel can capture and remove the snake.

Brushtail possums are well known for their habit of sheltering within wall and roof cavities, and will enlarge crevices or gaps in roofs or eaves to gain entry. Their urine and faeces are unhygienic, can stain ceilings and even damage electrical systems! Possums can be captured in baited cage traps, but will return to their territory if possible. Access denial is the only effective means of long-term management, and can be achieved by regular building inspection and maintenance. Overhanging branches can be cut back and tree trunks fitted with metal collars to prevent the animals from climbing where they are unwanted. Brushtails may also be encouraged away from buildings by providing them with artificial box habitats.

Feral domestic cats also can use buildings as a source of shelter, preferring enclosed underfloor areas. They are attracted to places where rats and mice are available as food but will also hunt wildlife, scavenge among rubbish or take advantage of human kindness, so children should be discouraged from feeding them. Feral cats are highly destructive to birds, can injure unwary children who attempt to touch them, and can introduce fleas which will bite humans even though they are not the normal host. Cat faeces may contain *Toxoplasma*, a parasite capable of infecting humans. Cats can be captured in baited cage traps, but inspection and maintenance of buildings and effective rodent management and litter disposal will reduce the likelihood that they will create problems.

Weeds

Weeds grow in a variety of situations within school grounds. These include garden areas, sandpits, bark areas under play equipment, gaps within and around paved surfaces, and in turf on ovals and other sportsgrounds.

Weed growth can be suppressed by use of mulch on garden beds. Ensure that leaks in pipes and drains are not creating a water supply that can be exploited by weeds. Appropriate turf management practices (including watering and mowing) can inhibit the growth of broadleaf weeds. Longer grass will out-compete shorter weeds by depriving them of sunlight. Prompt repair of damaged turf areas can prevent weeds from establishing. Mowing can be used to remove flower heads, but check that weed seeds are not being spread via mowing equipment.

Decisions to remove weeds should take into account whether areas of bare soil will be created (and if so, how they will be managed), the food weeds may supply to insects and birds, and the educative value of observing the behaviour of weed populations in the environment. When removal is required, weeds can often be removed by hand pulling or chipping. Small areas can be weeded or turned manually with little more effort than would be required to apply a herbicide. Weeds can also be killed with boiling water.

However, herbicides may be required to kill weeds in larger areas, or on turf that has to be kept short for sports use. Before using herbicides, it is essential to identify the species of weeds involved. This will dictate whether the herbicide should be a selective type (one that kills specific species) or a non-selective type acting against all plants. Herbicides that destroy only broad-leaf weeds are often the best choice for use on turf.

Timing of herbicide application is also important. Weeds should be killed before they flower and set seed. This will reduce the need for control in future years. Some herbicides (called pre-emergent types) act before the weed has emerged from the soil, while post-emergent types kill only established plants.

All reasonable precautions should be taken to reduce the likelihood that children will be exposed to the chemicals, both during and after application. Apply herbicides during school holidays or after school hours when children are not present. Wherever possible, apply herbicide by wiping or use a herbicide spot applicator or wand that does not create spray drift. If the situation does require use of spray apparatus, do not apply on windy days. Take care not to contaminate wanted plants, ponds or streams.

Given that children are likely to make contact with treated turf and play areas, their exposure to chemical residues should be minimised. Treated areas can be signposted or dyes can be added to the spray mixture to identify treated areas. Product manufacturers can advise on the appropriate time interval between treatment and re-occupation. Choose the least persistent herbicide that will be effective against the species requiring management.

Commonly used herbicides include:

- Amitrole – selective pre-and post-emergent herbicide for annual weeds.
- Bromoxynil, MCPA, Mecoprop – Selective post-emergent agents for annual and perennial weeds.
- Dicamba – selective pre-and post-emergent herbicide for control of annual and perennial broad-leaf weeds.
- Dithiopyr – selective pre-emergent broad-leaf herbicide and post-emergent herbicide for some grass species.
- Fluazifop – Selective post-emergent herbicide effective against grasses.
- Glyphosate - non-selective post-emergent herbicide used on kerbing, footpaths and borders.
- Propyzamide – selective pre-and post-emergent herbicide for broad-leaf plants and some grass species.

CHOOSING A PEST CONTROL OPERATOR

When considering whether to engage the services of a PCO, pest managers are encouraged to approach several different companies and obtain their advice and quotes. Ensure that they are licensed and insured. Check their understanding of State/Territory and other standards or guidelines that may apply to the use of pesticides in schools.

Be guided by their willingness to

- recognise the value of IPM,
- appraise the pest problem thoroughly,
- compare the likely effectiveness of different treatment options,
- provide copies of product labels or MSDSs
- consider non-chemical options,
- act in accord with the school's pest management plan (or assist in creating one), and
- discuss and accommodate your safety-related concerns.

Prices will be influenced by the product(s) to be used and the PCO's estimate of the time required. Do not feel obliged to accept the cheapest quote. Considerations of safety, effectiveness, target-specificity, and a low potential to create odours may make a dearer pesticide product a better option than a cheaper one. Non-chemical options may be more expensive than chemical treatments. Over time, one extensive or time-consuming treatment may cost less than a simpler procedure that has to be repeated.

Above all, go with the PCO who offers the best long-term solution to your pest management needs.

Further information can be obtained from the Australian Pest Controllers' Association at www.pestcontrol.org.au

RECOMMENDATIONS FOR PEST CONTROL OPERATORS WORKING IN SCHOOLS

Prior to pesticide application

- Know clearly the purpose of the treatment – that is, the pest to be managed. 'General sprays' are not recommended.
- Know the habits of the pest concerned.
- Thoroughly inspect the problem areas with the school's pest manager.
- Where appropriate, create an integrated pest management strategy to control the pest and prevent its recurrence.
- Choose the least toxic registered pesticide that will be effective.
- Check whether the chosen pesticide is controlled by any specific Australian Standard or State or Territory regulation, and ensure compliance. (Refer to State/Territory information at end of this document for further information.)
- Inform the school's pest manager of your proposed treatment plan, and when possible, allow time for the school community to discuss the proposal.
- Be available to discuss your proposal and answer any questions or concerns fully and frankly. Accommodate any special sensitivities arising from concerns over health or environmental issues. A positive approach will ensure the goodwill of the school community.
- Make sure that you and the school community have copies of the MSDS for the product you recommend.
- Inform the school community whether there is likely to be any lingering smell, and explain its cause, but...
- Unless there is absolutely no alternative, do not apply products containing volatile organic solvents indoors, or in other places where people are likely to be exposed to the vapour.

When to treat

- Avoid applying pesticides during school hours or when school buildings and/or grounds are occupied.
- Ideally, apply the pesticide during school holidays.
- Otherwise, treat on Friday afternoon, when students and staff have left, or on weekends.

Pesticide application

- Survey the area to be treated and implement any necessary safety measures, including signposting, before application.
- Confine treatment to as small an area as practicable for effective treatment.
- If treating food preparation areas, ensure that all foods, food utensils and bench tops are removed or covered to avoid contamination.
- Schools may have pets such as guinea pigs, fish or birds. Fish, in particular, are sensitive to synthetic pyrethroids. Ask where pets are housed and remove them from the area.
- Unless absolutely essential, do not treat areas to which children have ready access, such as playground equipment or sandpits.
- Do not spray under conditions likely to create spray drift.
- Use extreme caution when siting traps or baits, to ensure that they are located only in areas where children do not have access.
- Baits should be placed in clearly labelled containers that prevent the bait from being touched or removed.

After application

- Ensure that no pesticide containers have been left within the school buildings or grounds.
- Ensure that adequate time has elapsed before allowing people to re-occupy a treated area. It may be necessary to leave warning signs.
- Adequate ventilation is particularly important because the building will be locked after you leave, and chemicals may not dissipate as you might normally expect.

- Ensure compliance with any re-entry interval and instructions for ventilation that are shown on the product label. Discuss these with the school pest manager.
- As a minimum, open all doors and windows for two hours, or turn on the air conditioning with maximum fresh air intake for two hours. Check that the air conditioning system will not distribute affected air to untreated or occupied areas.
- Make sure that there is sufficient ventilation beneath floorboards when under-floor areas have been treated.

CONTROLLING THE USE OF PESTICIDES

Commonwealth Government

Under the National Registration Scheme for Agricultural and Veterinary Chemicals, the APVMA registers and regulates the manufacture and supply of all pesticides and veterinary medicines used in Australia, up to the point of wholesale sale. The registration process covers all aspects of the product's use, including the pests it can be used on, application methods, and the crops, animals or situations in which the product can be applied. It is illegal to use a pesticide for another purpose unless a permit is granted by the APVMA.

Before being registered, products must undergo risk assessment. Companies must provide the APVMA with information about the product to allow independent evaluators to decide whether it is effective and safe for people, animals and the environment, and not a trade risk. Further information about pesticide registration and assessment is available at: http://www.apvma.gov.au/about_us/pdf/overview_agvet_national_system.pdf

State and Territory Governments

State and Territory governments regulate the use of agricultural and veterinary chemicals after they have been sold. The regulations cover basic training for users, licensing of commercial pest control operators and ground and aerial spray operators, residue monitoring, and arrangements to enforce the safe use of chemicals.

Standards and guidelines for use of pesticides in schools

Most State and Territory governments have special standards or guidelines for the storage and use of pesticides and other chemicals in schools. These are summarised below, together with links or contact details to facilitate access to the source documents, where available to the public.

New South Wales

NSW Department of Education and Training (DET) policies on chemical management are contained in their publication *(Chemical safety in schools: The safe use and storage of workplace chemicals in schools (1999).* Guidelines for pesticide use in DET school buildings and grounds are posted on the Departmental intranet. The DET's general policy is that use of chemical treatments for the control of pests on school grounds should only be undertaken as a last resort after considering all alternative methods using IPM principles. Pesticide application is performed only by outside contractors. All significant pesticide use is restricted to times when facilities are not occupied by staff and students.

The NSW Department of Environment and Climate Change (DECC) web page *Information for Pest Management* Technicians (at www.environment.nsw.gov.au/pesticides/technicians.htm) recommends that application of pesticides in schools or childcare centres be performed during holidays or weekends, and cites the NEHF/enHealth *Pesticide use in schools and school grounds publication* (www.enhealth.nphp.gov.au/council/pubs/ecpub.htm) as a reference guide. DECC's 'chemicals and pesticides' website at www.environment.nsw.gov.au/pesticides/index.htm contains useful information about chemical use and regulations in NSW, including their use in and around the home.

From 1 February 2007, the NSW *Pesticides Regulation* 1995 will make it compulsory for prior notice to be provided when PCOs treat common areas of multiple occupancy residential complexes and when public authorities apply pesticides in outdoor public places. Public authorities must prepare a pesticides notification plan, which should include any special notification measures for pesticide applications near sensitive sites (including schools and childcare centres). The *Draft DET pesticide use notification plan* is available at www.det.nsw.edu.au/media/downloads/reviews/assets/pesticide_plan.pdf

Victoria

Section 4.4 of the *Victorian Government Schools Reference Guide* (at http://www.eduweb.vic.gov.au/referenceguide/enviro/4_4.htm) sets out detailed requirements for keeping hazardous substances and using herbicides and insecticides within schools. Schools are required to keep a register of hazardous substances, obtain MSDSs, undertake risk assessment and control procedures, label containers and provide information and training to staff. Any pesticides registered for use in domestic premises can be used in schools, including pyrethrins, synthetic pyrethroids, garlic spray, white oil, rotenone and soap flakes spray. Termiticides, 2,4-D, paraquat and diquat may also be used but can be applied only by licensed persons. There is a separate *Protocol for Use of Termiticides in Schools* (2001) available at www.eduweb.vic.gov.au/edulibrary/public/ohs/Termiticides.pdf

Queensland

The Queensland Department of Education requires schools to maintain a hazardous substances register, and their Education Manual (at http://www.education.qld.gov.au/corporate/doem/healthsa/healthsa.html) includes guidelines for the control of headlice (HS-19) and for managing occupational risks with chemicals (HS-16). The latter covers pesticides and includes risk assessment, labelling, MSDSs, disposal, storage, training and monitoring.

South Australia

The South Australian Department of Education and Children's Services does not permit the use of S7 chemicals in schools. Its occupational health, safety and welfare guidelines for agricultural education provide comprehensive guidance on all aspects of storing and applying pesticides, together with a list of approved products. Additional guidance on pest management (including physical and hygiene measures) is provided in the OHS&W guidelines for home economics. See http://www.decs.sa.gov.au/ohs/files/links/2003_03_OHS_W_Manual_Agric.pdf and

www.decs.sa.gov.au/ohs/files/links/2003_03_OHS_W_Manual_Manua.pdf

The SA Environment Protection Authority references NEHF/enHealth's *Pesticide use in schools and school grounds* publication in their Guidelines for Responsible Pesticide Use (http://www.epa.sa.gov.au/pdfs/guide_pesticides.pdf).

Western Australia

The WA Department of Education and Training requires that all chemicals within a school should be recorded on a central register, and has developed its own *Guidelines for pesticide use in schools and school grounds* in conjunction with the WA Department of Health and WA Department of Agriculture. Topics include prevention, control and pesticide treatment, the different types of pesticides and their safe use, action to take if poisoning occurs, a list of pests and measures for managing them, and a code of conduct for pest control officers. The guidelines are referenced at www.eddept.wa.edu.au/hr/POD%20Layers/OccSafety/Policies/Policies_Introduction.htm Although not available in electronic format, they can be ordered from the WA Department of Education and Training Safety Officers (Phone: 08 9264 8634 Fax: 08 9264 8463).

Tasmania

The Tasmanian government guidelines for chemical spraying and fumigation in Tasmanian government schools requires non-chemical methods to be used wherever possible, and that workplace, parental and community representatives are involved in decisions to use chemicals. Responsible officers must give notice to the immediate community, employees and students at least 24 hours in advance of fumigation or spraying in or around buildings, and of the product to be sprayed. Signposting must include information on the duration of product retention in soil, on plants, or on accessible surfaces.

Northern Territory

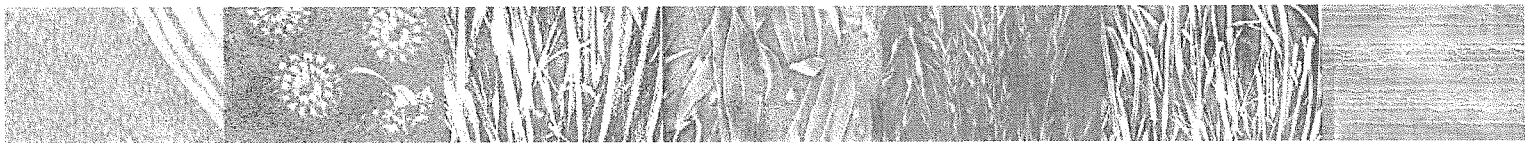
Under the *Poisons and Dangerous Drugs Act*, all pest management procedures (including veterinary treatment) must be carried out in accordance with the "Code of Practice for Pest Management Technicians", as set out in the NEHF/enHealth *Pesticide use in schools and school grounds* publication. The NT Department of Health and Community Services Poisons Control contact numbers are 08 8922 7341 (Phone) and 08 8922 7200 (Fax).

Australian Capital Territory

In the ACT public education system, school principals are responsible for pest management. Section 7 of the *School Management Manual 2001* contains guidelines and specifications for pest

control servicing. ACT Department of Education and Training policy is to minimise the use of agvet chemicals for plant and animal pest control through taking preventative measures wherever possible, consistent with Integrated Pest Management practices. Manual or mechanical methods of control should be evaluated before agvet chemicals are used. Only a limited range of chemicals can be used for pest management in ACT government schools. Arsenic trioxide, unregistered pest control substances and Schedule 7 poisons should not be used. Treatments can be applied only outside school hours, preferably at the beginning of holidays but emergency applications against wasps, bees, termites and spiders are permitted during weekends. The guidelines include examples of warning signage to be posted around the treatment area prior to pest control work. Service providers are responsible for "airing" treated buildings before re-occupation.

Under Schedule 1 of the *Environment Protection Act* 1997, an environmental authorisation is required in relation to the commercial use of chemical products registered under the Commonwealth Agricultural and Veterinary Chemicals Code Act 1994. The holder of an authorisation must meet certain training and operational requirements to keep this authorisation current. One of the requirements is that PCOs have to notify the ACT community of their intention to apply Schedule 7 chemicals on public land, including school grounds.
See www.tams.act.gov.au



Australian Pesticides and
Veterinary Medicines Authority
18 Wormald St
Symonston ACT 2604

PO Box 6182
Kingston ACT 2604 Australia
www.apvma.gov.au