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Australian Pesticides and
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PEST MANAGEMENT IN SCHOOLS

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Guidance on Pesticide Management in Schools

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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

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- members of APVMA's Community Consultative Committee (CCC) who expressed a keen interest in the project and provided valuable input; and
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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.

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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

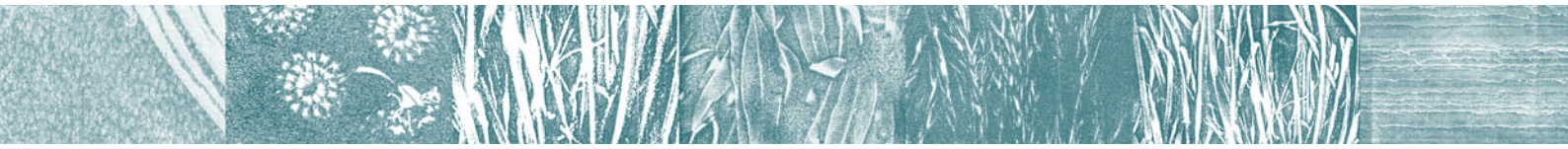
Under the *Poisons and Dangerous Drugs Act*, all pest management procedures (including veterinary treatment) must be carried out in accordance with the "Code of Practice for Pest Management Technicians", as set out in the NEHF/enHealth *Pesticide use in schools and school ground*s publication. The NT 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



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