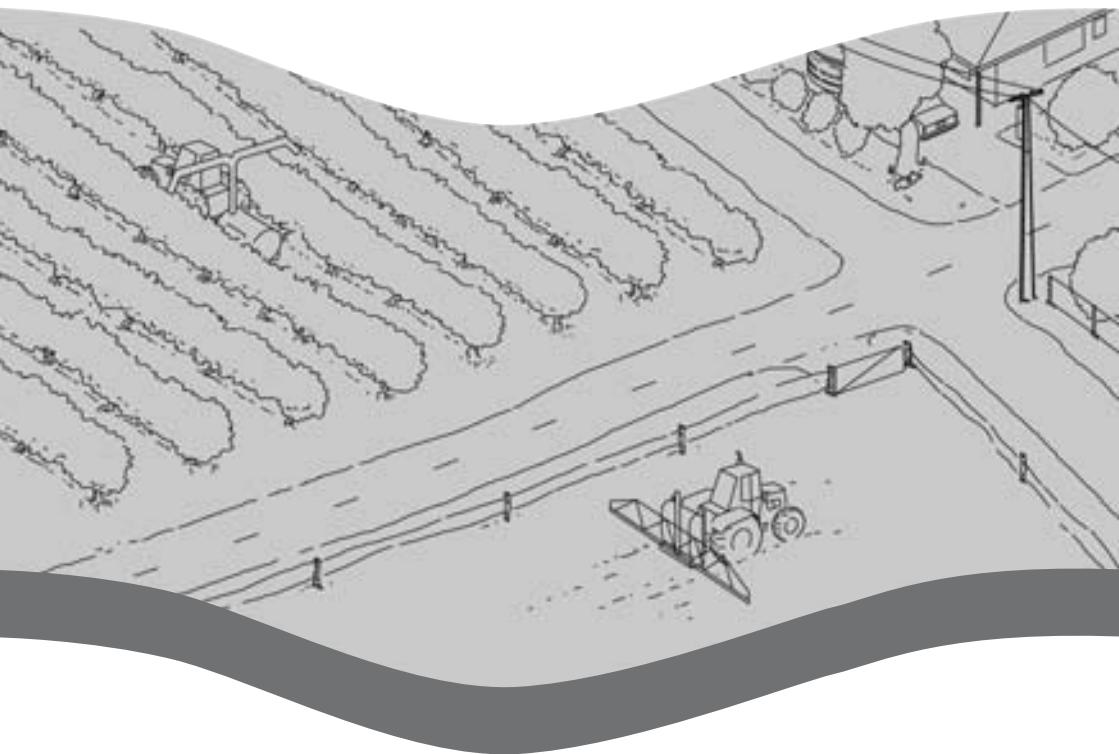


SAFE AND EFFECTIVE PESTICIDE USE

*A handbook for commercial
spray operators*

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INTRODUCTION

INTRODUCTION

This handbook has been developed for use by commercial spray operators who use pesticides on private or public land to control environmental pests, or pests associated with primary production. It is intended both for licensed operators and those who are exempt from licensing. For the purpose of this handbook the term ‘commercial spray operator’ (often shortened to ‘spray operator’ in the text) is used for those who work in one or more of the following expert categories:

- ▶ broadscale environmental contractors
- ▶ broadacre agricultural contractors
- ▶ landscape and garden maintenance operators
- ▶ ‘bush care’ operators.

When not used according to best management practices, pesticides can: expose commercial spray operators and their business to litigation and legal penalties

This handbook provides information on the safe handling and responsible use of pesticides to minimise human health risks and reduce the likelihood of pesticide contamination in the environment. When not used according to best management standards that meet legal requirements, pesticides can:

- ▶ pollute land and water, damaging ecosystems by affecting biodiversity
- ▶ harm non-target organisms, including native and ornamental plants, crops, animals, and micro-flora and fauna
- ▶ cause illness or harm to the spray operator or other humans who are exposed to them
- ▶ contaminate agricultural produce, causing legal and trade problems and human health risks
- ▶ expose commercial spray operators and their business to litigation and legal penalties.

This handbook is one in a series of three. The others are:

- ▶ *Safe and effective pesticide use: a handbook for lifestyle landholders*
- ▶ *Safe and effective herbicide use: a handbook for near-water applications.*

When used appropriately, pesticides can control environmental pests efficiently and be of significant economic benefit to primary production

Definitions

Pesticides are substances or organisms used to kill, incapacitate, inhibit the growth of, or repel, pests. They can be natural or synthetic chemicals. Some living organisms that act as biological control agents can also be regarded as pesticides.

Common environmental pests include vertebrate pests (e.g. rabbits), insect pests (e.g. locusts and millipedes), and plant pests (weeds). Many weeds, pests, and diseases affect primary production.

Commercial spray operators have access to a wide range of pesticides, including baits, insecticides, herbicides, fungicides, bactericides, post-harvest fruit dips, and products applied to animals. When used appropriately, pesticides can control environmental pests efficiently and be of significant economic benefit to primary production. However, if they are misused, pesticides can put human health, trade and the environment at risk.

A **herbicide** is a chemical substance that will kill or inhibit the growth of plants. Herbicides may kill virtually all plants or be quite selective in the way they work. Herbicides are commonly used to control the growth and spread of weeds.

An **insecticide** is a chemical substance designed to kill insects.

A **fungicide** is a chemical substance designed to kill fungi.

Spray drift is the airborne movement of agricultural chemicals away from the target area during, or shortly after, its application.

An **ecosystem** is a self-sustaining association of plants and animals and the physical environment in which they live.



INTRODUCTION

Legislation

When dealing with pesticides, commercial spray operators must comply with their common law duty of care and the following general legislative provisions that apply for the storage, transport, application and disposal of pesticides.

General environmental duty

To minimise the potential for environmental harm, pesticide use by commercial spray contractors and other operators whose business involves the use of pesticides must be consistent with provisions in the *Environment Protection Act 1993* and the *Environment Protection (Water Quality) Policy 2015* (Water Quality Policy).

The ‘General Environmental Duty’ under Section 25 of the Environment Protection Act reads:

A person must not undertake any activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.

The EPA considers that allowing pesticides to enter surface or ground waters, escape from a property, cause harm to the environment, or cause harm to other people would be a breach of the Act.

Other relevant legislation

Pesticides must also be used in accordance with the general duties under the:

- ▶ *Agricultural and Veterinary Products (Control of Use) Act 2002*
- ▶ *Controlled Substances Act 1984*
- ▶ *Dangerous Substances Act 1979*
- ▶ *Occupational Health, Safety and Welfare Act 1986*
- ▶ *Public and Environmental Health Act 1987.*

The EPA considers that allowing pesticides to enter surface or ground waters, escape from a property, cause harm to the environment, or cause harm to other people would be a breach of the Environment Protection Act

Acts, regulations and relevant codes of practice can be accessed from the state government website <www.parliament.sa.gov.au>. Printed copies can be purchased from the Services SA counter at the Lands Titles Office, 101 Grenfell St, Adelaide (phone 13 23 24).

Further information on a broad range of environmental regulation can be obtained from PIRSA's website <www.pir.sa.gov.au/lego/>.

Quality assurance

A quality assurance (QA) program has been developed for the commercial spray application industry in South Australia. While not mandatory, commercial spray operators are encouraged to adopt this QA program for their own businesses as a means of demonstrating compliance with environmental and controlled substances legislation.

The Quality Assurance Management System (QAMS) consists of a management manual, procedures, forms and specification standards that if followed properly should produce a consistent, high quality service with minimised environmental risks. The QAMS should be used as the basis for hiring a commercial spray contractor as this indicates that the operator is using best practice in that industry. The Landscape Industry Association also has a QA program to demonstrate compliance with relevant legislation.

Training

The *Agricultural and Veterinary Products (Control of Use) Act 2002* specifies qualifications required for people using prescribed classes of chemicals or methods of application. Currently this provision applies to Schedule 7 pesticides and to pesticides containing mevinphos, endosulfan or acrolein. Use of these products is limited to people who hold a 'prescribed qualification'.



INTRODUCTION

The Regulations of this Act define 'prescribed qualification' as a valid ChemCert accreditation, or other qualification approved by the Minister by notice in the Gazette.

Remember to keep a record of your training

Recommended training

In addition to the training involved in acquiring mandatory licences, operators should receive training in some or all of the following topics:

- ▶ thorough induction into chemical applications specific to their business
- ▶ health and safety issues, employment conditions, reporting structure, maintenance of spray equipment
- ▶ conducting and recording environmental risk assessment interviews with clients prior to accepting jobs
- ▶ conducting and recording on-site environmental risk assessments before commencing jobs
- ▶ pesticide application techniques for different pest control situations, to minimise risk to the operator and the environment
- ▶ protection of native and other desirable vegetation, including identification of relevant plants, and methods of selective weed control
- ▶ accessing and interpreting meteorological data and weather forecasts
- ▶ safe use of pesticides near waterways
- ▶ changes, as they occur, to the laws which apply to commercial spray operators.

This training can be obtained either through participation in courses, or through on-the-job upgrading of knowledge and skills. It is also important to be aware of changing legislation. Each operator should keep a record of their training.

Licensing

The licensing requirements are regulated under the Controlled Substances (Pesticides) Regulations, issued by the Department of Health.

Under the Controlled Substances Act:

- ▶ The owner of a commercial spray business must have a Pest Controller's Licence.
- ▶ People who apply pesticides for fee or reward (i.e. commercial spray operators) must hold a current Pest Management Technician's Licence.
- ▶ People who apply pesticides for a fee or reward as a secondary or lesser part of their business (e.g. landscape, maintenance gardeners) may be granted an exemption from holding a licence, in which case they must possess a Statement of Exemption from that licence.
- ▶ In addition to the Pest Controller's and Pest Management Technicians Licences, aerial sprayers must also hold a commercial pilot's licence with a chemical rating endorsement.

A Pest Management Technician's Licence may be issued in Full or Limited form. A Full Licence is issued when the person has the appropriate qualifications as set by the Licensing Authority. A Limited Licence may be issued to those in training, or willing to train, who must also agree to work under direct supervision of a fully trained operator.

Further information on licensing can be obtained from the Department of Health (08 8226 7100).



SAFETY FIRST

SAFETY FIRST



Occupational health and safety

The *Occupational Health, Safety & Welfare Act 1986* (OHS&W Act) requires employers to provide information, instruction, training and supervision to employees when performing any hazardous activity, including storing, handling and using pesticides.

Self-employed people, employers and employees each have responsibilities under the OHS&W Act and its Regulations.

Health and safety directions on pesticide labels must be read, understood and followed by operators. Employers must provide appropriate personal protective equipment (PPE) to employees, who are obliged to use the equipment.

Health and safety directions on pesticide labels must be read, understood and followed by operators

Transport and storage

Transporting pesticides

When transporting and storing pesticides, care must be taken to protect the operator, other people and the environment.

Containers of pesticide concentrate must be secure while in transit and during short-term storage at mixing sites. Security may be via a locked cage or cabinet on the tray of the spray vehicle.



When purchasing pesticide ensure the container is in good condition and not leaking

Safe transport advice:

- ▶ When purchasing pesticide ensure the container is in good condition and not leaking.
- ▶ Purchase only the amount of pesticide you need as this reduces the amount being transported and the subsequent risk associated with storage.
- ▶ Always check product labels to ensure they are present and intact.
- ▶ Ensure your risk of spill is minimised by transporting the pesticide on a bunded tray, inside another container, or in a strong plastic bag with the opening closed securely.
- ▶ If possible, secure the pesticide in the utility tray of your vehicle.
- ▶ Carry personal protective equipment (PPE) with you in the vehicle, including gloves so you will be prepared to deal with a spill in transit. Do not carry contaminated PPE in the cabin of the vehicle. Store PPE in a manner that prevents contamination from pesticides.
- ▶ Carry a spare plastic bag or absorbent material, such as sawdust or cat litter with you to help contain any spill.
- ▶ When working near waterbodies, plan to transport mixed (diluted) pesticide rather than concentrates.
- ▶ If the spray tank contains dilute pesticide while the spray vehicle is travelling on public roads, display the pesticide name on the outside of the spray tank.

When transporting pesticides that are classified as Dangerous Substances (products that display a dangerous goods diamond on the label), ensure that the requirements of the Australian Code of Practice for the Transport of Dangerous Goods by Road and Rail are followed.



Storing pesticides

Pesticides should be locked in either an isolated, stand-alone building; a partitioned section of a multipurpose, uninhabited building; or, a cupboard within a multipurpose building. They should be stored in a cool area, away from sunlight.

In addition:

- ▶ Keep pesticides in a bunded area, so that leaks and spills cannot contaminate surrounding areas.
- ▶ Store pesticides in original containers only, making sure labels are protected and readable. If some pesticide is decanted into a smaller container for ease of transport and handling you must ensure that:
 - the new container is made of a suitable material to hold the pesticide safely, preferably the same material as the original container
 - the new container must be labelled with the name of the product and the active constituent(s)
 - warning statements on the original label are also written on the new container.
- ▶ Keep PPE near the storage facility so that it can be accessed easily for use in the event of a spill or accident, but not in the same airspace as the pesticides.
- ▶ Keep a spills kit and absorbent material close to the pesticide storage location.
- ▶ Write the date of purchase of the pesticide on the container, and use older product first.
- ▶ Do not store products after their use-by date has expired. Where no use-by date is specified it is a general rule that pesticides should be disposed of after two years.
- ▶ Do not store volatile or reactive products together.
- ▶ Store pesticides away from waterbodies and areas subject to flooding.

Keep a spills kit and absorbent material close to the pesticide storage location

Personal protective equipment (PPE) is designed to safeguard against both acute and chronic pesticide poisoning.

Legislation relating to transport and storage

In addition to the above best-practice principles, the following pieces of legislation have sections that apply to storage and transport of pesticides:

- ▶ *Agricultural and Veterinary Products (Control of Use) Act 2002*
 - Agricultural and Veterinary Products (Control of Use) Regulations 2004
- ▶ *Controlled Substances Act 1984*
 - Controlled Substances (Pesticides) Regulations 2003
 - Controlled Substances (Poisons) Regulations 1996
- ▶ *Dangerous Substances Act 1979*
 - Dangerous Substances Regulations 2002
- ▶ *Occupational Health, Safety and Welfare Act 1986*
 - Occupational Health, Safety and Welfare Regulations 1995

Personal protective equipment

Personal protective equipment (PPE) is designed to safeguard against both acute and chronic pesticide poisoning and generally includes products that prevent absorption of pesticide through the skin, eyes or through inhalation.

Personal protective equipment commonly recommended for use when applying pesticides includes:

- ▶ goggles/face shield to protect the eyes
- ▶ chemical resistant gloves to protect hands
- ▶ overalls to protect legs, arms, torso and groin
- ▶ respirator with correct filter cartridges to prevent inhalation of pesticide in gas, mist or droplet form
- ▶ rubber or PVC boots to protect feet
- ▶ washable or chemical-resistant hat to protect head and scalp
- ▶ PVC apron for use during mixing.



Guidance on what PPE to wear for each application situation can be obtained from product labels and Material Safety Data Sheets (MSDS).

Mixing pesticides

Pesticides should be measured and mixed in areas that are well-ventilated, level, well-lit, and with a supply of clean water. Operators should wear appropriate personal protective equipment while mixing pesticides, and follow all instructions on the pesticide label.

Safe mixing advice:

- ▶ Always read and make sure you understand label instructions for mixing before opening pesticide containers.
- ▶ Use recommended PPE when mixing pesticides (see label or MSDS).
- ▶ Use appropriate utensils when transferring pesticides between containers and application equipment. Containers should measure volumes of concentrate accurately and allow the transfer of pesticides without spilling.
- ▶ Measure and mix pesticides on a stable surface and at a comfortable height.
- ▶ Mix in an area with an impervious floor which allows for spills to be cleaned up, not in an area where a spill could run into a stormwater drain or waterbody.
- ▶ Mix in a well-ventilated and well-lit area.
- ▶ Use clean water for mixing—poor quality water can reduce pesticide performance.
- ▶ Do not work alone if the pesticide is highly toxic.
- ▶ Do not combine products unless label instructions state it is appropriate to do so.
- ▶ Only prepare the volume of mix needed to complete the task. This avoids having to store or dispose of unused portions.





Operators
should
always know
in advance
what to do
in emergency
situations

When handling concentrated pesticides, as opposed to diluted mixes, both operators and the environment may be more at risk.

Calibration

Before calibrating, ensure all spray equipment is clean and in good working order. All seals and nozzles should be clean and working effectively so that the spray mix is delivered to the target pest or weed at the appropriate rate.

The purpose of calibration is to apply pesticides evenly onto the target at the correct rate. Equipment for measuring pesticide concentrate (e.g. scales), as well as application equipment (e.g. boom sprayers, hand sprayers, orchard/vineyard sprayers), should be calibrated according to the manufacturer's recommendation and according to a schedule that ensures optimal equipment performance at all times.

Detailed knowledge on calibration for a range of pesticide application equipment can be obtained through appropriate training.

Accidents and emergency situations

Preparation is the best defence against emergencies. Operators should always know in advance what to do in emergency situations. Written emergency procedures should be available to all operators at all times.

Poisoning

Consult the pesticide label and the MSDS for specific information on first aid. Never put yourself at an unreasonable risk to rescue others, as you may become the next victim. If there is any doubt about whether a person has been poisoned or not, seek medical attention.



Follow first aid steps for anyone who is poisoned or exposed to a pesticide. These could include:

- ▶ removal of affected clothing immediately
- ▶ washing of contaminated skin with soap and water.

If chemical is splashed in the eye, wash it immediately in running water for 15 minutes and call a doctor immediately. The Poisons Information Centre can be contacted on 13 11 26 at any time.

Leaks and spills

Consult the relevant MSDS or manufacturer of the pesticide for specific information on handling leaks and spills.

In the event of a chemical spill:

- ▶ ensure it is safe for you to approach the incident area
- ▶ move people to a safe distance from the incident area
- ▶ keep bystanders away from the spill
- ▶ contain the spilled material if possible, using absorbent material
- ▶ use absorbent material to soak up spilled liquid
- ▶ clean up the spill.



MSDS have information on clean-up and decontamination procedures. If in doubt, contact the emergency phone number on the pesticide label for specialist advice.

A person licensed as a Pest Controller or Pest Management Technician must report any spillage of pesticide that, due to its magnitude, location or toxicity may require assistance to manage, or may have an immediate impact on the environment or public health and safety. The spillage must be reported, either to SA Police (phone 131 444 all hours) or Department of Human Services (phone 08 8226 7107 all hours).

In any fire involving pesticides, the first response is to ensure your own safety, then to raise the alarm

Fire and pesticides

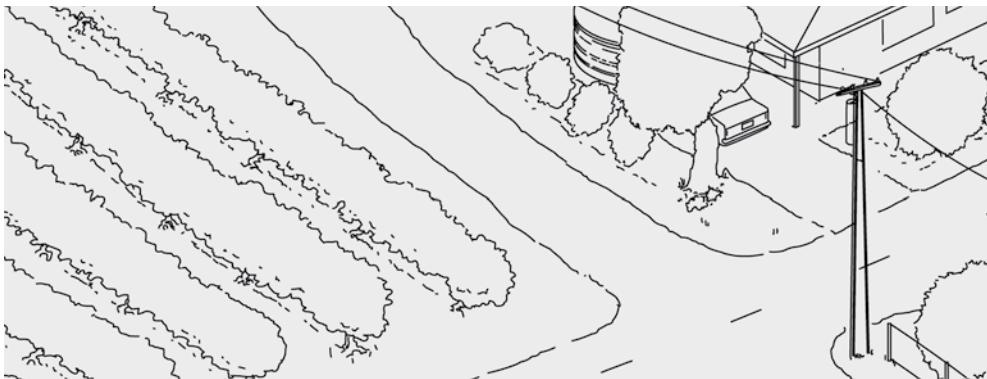
In any fire involving pesticides, the first response is to ensure your own safety, then to raise the alarm, both to people in the vicinity and to the relevant fire authority. Next, evacuate people from downwind of the fire. Do not fight the fire yourself unless you are certain of your own safety. When the fire is extinguished, clean up as for leaks and spills.

If there is a risk of contaminating waterways, the water and foam used in fire fighting should be contained.



BEFORE SPRAYING

BEFORE SPRAYING



Before applying pesticides, it is recommended that the spray operator conduct a thorough assessment of the job at hand. The completion of a risk assessment is not only a requirement under the OH&S Regulations 1995, but also good practice.

Risk assessment principles

A risk assessment needs to consider all aspects relating to:

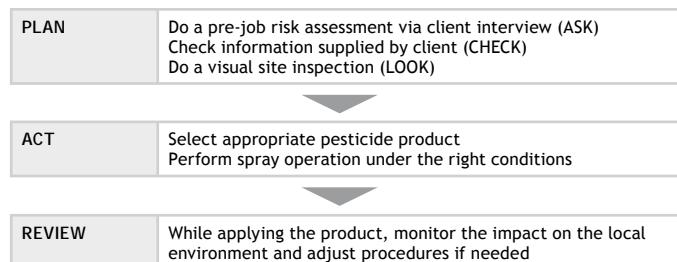
- ▶ client's expectations and the feasibility and practicability of the required job
- ▶ physical characteristics of the job site
- ▶ optimal pest control method, including alternatives to use of pesticide, with a consideration of the risks/advantages of each alternative
- ▶ pesticide characteristics (physical, chemical and environmental)
- ▶ potential environmental effects resulting from spraying
- ▶ related human health issues.

Before applying pesticides, it is recommended that the spray operator conduct a thorough assessment of the job at hand



BEFORE SPRAYING

The risk assessment process is illustrated in this flowchart:



Planning

ASK

The following questions could be asked of the client as part of any initial contact, and the answers collected prior to visual site inspection. Alternatively, they could be completed as part of the pre-job interview, by client and operator together. Not all questions will be applicable to all situations.

- ▶ What is the target pest?
- ▶ What is the approximate area of infestation ('target area')?
- ▶ Is control of the pest really necessary?
- ▶ Have you tried or considered methods of control other than pesticides?
- ▶ Are there considerations about the timing of pest control (e.g. around issues of dormancy and life cycle of the target pest)?
- ▶ Are there issues with regard to:
 - quarantine (e.g. annual ryegrass toxicity, broomrape, other declared plants); bio-security (e.g. genetically modified crops, patented crops); protected or endangered species; bee hives; or livestock in the treatment area?)
- ▶ What is the nature of the target area to be treated?
- ▶ Is there suitable access to the site?
- ▶ What is the terrain like (slope of land, roughness of ground, obstacles such as stumps, rocks and holes, cliffs and trees)?



BEFORE SPRAYING

- ▶ Is there a water supply at or near the target site?
- ▶ What directions to the site will you provide to the spray operator (e.g. map, markers, personal guide)?
- ▶ What are the land uses of adjoining properties (e.g. school, park, farm, etc.)?
- ▶ Have you consulted with neighbours about your proposed spray operation?
- ▶ Is there a preferred time of day for the operation (e.g. when neighbours are absent)?
- ▶ Have you any preference about the pesticide to be applied?
- ▶ If so, will you supply this product yourself, or delegate supply to the spray operator?

CHECK

The following points can be used as a checklist for risk assessment.

- ▶ How can the site be accessed?
- ▶ What is the nature of the terrain, and potential hazards for equipment (e.g. slope of land, roughness of ground, obstacles such as stumps, rocks and holes, cliffs and trees)?
- ▶ Is there potential for off-target migration (e.g. spray drift, subsurface seepage, overland flow) onto sensitive:
 - adjoining property
 - crops
 - native scrub and associated animal/plant life waterways
 - public lands (e.g. parks, gardens, roads)
 - other sensitive areas?
- ▶ If so, how might this be minimised?
- ▶ Is noise pollution a potential problem? If so, how can it be minimised?
- ▶ What is the stage of the development of the pest?
- ▶ Is this the best timing for the application in relation to the life cycle of the pest (e.g. have most weeds germinated, or have most insects hatched or emerged)?



BEFORE SPRAYING

A further risk assessment should be conducted immediately prior to applying the pesticide to the target

- ▶ What is the best time of day to apply the pesticide, in relation to:
 - minimising off-target damage (i.e. which time of day is calmest)
 - effect on neighbours?
- ▶ If the client has chosen a pesticide, is it suitable for the job?
- ▶ Will the client purchase the product?
- ▶ If yes, does he/she have appropriate accreditation to do so?
- ▶ How will the client make the product available to the operator, considering security of the product if left unattended?
- ▶ Does the client have a source of clean, accessible water for applying the pesticide and cleaning equipment after application?
- ▶ Where can assistance be obtained in any emergency situation, such as accident or illness?

Only spray operators with a Full Pest Management Technician's Licence are permitted to give advice on pesticides.

LOOK

A further risk assessment should be conducted immediately prior to applying the pesticide to the target. This is because circumstances may have changed since completion of questionnaire and checklist above. Carry out a final visual inspection of the target area, using the following check list:

- ▶ Is access to the site adequate?
- ▶ Is the terrain suitable for the spray vehicle?
- ▶ Has the target pest altered (e.g. different growth stage, different pest, pest no longer present) since the client interview?
- ▶ Is the method of pest control still appropriate?
- ▶ Is the target area the same as when discussed with the client?
- ▶ Is the weather suitable to apply the product?
- ▶ Do you need to review any plan to minimise off-target migration of product?
- ▶ Have neighbours been made aware of the impending spray?



BEFORE SPRAYING

Choose the right pesticide

Always check the level of toxicity on the product label. Spray operators should be aware that the use of certain chemicals could present a significant hazard to nearby people, crops, waterways and desirable vegetation. If spraying is to be done near sensitive areas, avoid causing off-target damage by using less hazardous chemicals or alternative treatments.

Highly volatile herbicides, such as ester formulations of 2,4-D and MCPA, should not be used near susceptible crops such as vineyards and tomatoes. For further information see the PIRSA *Avoid Spray Drift* fact sheet.

In addition, insecticides that are highly toxic to fish, yabbies and marron (e.g. synthetic pyrethroids) should not be used near waterways or aquaculture farms. Soil-active herbicides can present a significant hazard to non-target vegetation.

Consider the following factors when making your choice:

Registration

Is the product registered (or permitted) by the Australian Pesticides & Veterinary Medicines Authority (APVMA) for use in the situation? If not, the product must not be used.

Occupational health and safety

How toxic is the product to the operator? In general, select the least toxic product (i.e. a product with the lowest poison schedule, or an unscheduled product) that will do the job effectively.



BEFORE SPRAYING



Can the product control the pest, but leave other organisms unharmed?

Chemical characteristics

Assess the following characteristics of chemicals when selecting a pesticide:

- ▶ *General environmental risk.* Select a product that has few or no environmental risks (e.g. to birds, fish, invertebrates, native vegetation, waterways).
- ▶ *Selectivity.* Can the product control the pest, but leave other organisms unharmed? In general, a selective product is more desirable than a non-selective product.
- ▶ *Persistence or half-life.* Does the product remain active in the environment for a long period of time. In general, a non-persistent product (short half-life) is more desirable than one that is persistent or ‘residual’.
- ▶ *Volatility.* Does the product readily evaporate into the atmosphere. Select a product with low volatility to minimise the risk of volatile drift onto non-target areas.
- ▶ *Adsorption.* Select a product with a high adsorption coefficient as it adheres to organic matter in the plant and soil, and is less mobile in the environment.
- ▶ *Solubility.* Select a product with low solubility, as it is less likely to migrate from the application site in surface or soil water.

Product labels and Material Safety Data Sheets (MSDS) also provide information to help with choice of pesticide. The OHS&W Regulations 1995 require a workplace to have a current copy of MSDS for all relevant hazardous substances stored and used in the workplace. The MSDS must be accessible to all users.

Consider the landholder's property management plan

When purchasing a new property or changing the land use of an existing property to include intensive farming operations, landholders must seek development approval from local council. They should then complete a property management plan. This



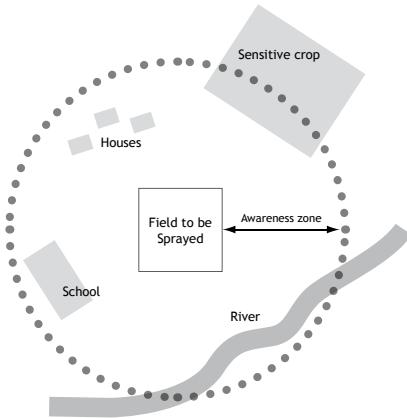
BEFORE SPRAYING

involves assessing the likelihood of harm from any intended chemical use on nearby crops, rural living blocks, passers-by and waterways.

Similarly, when planning the location of crops, landholders must consider the sensitivity of neighbouring land uses to pesticide application. Conflicts over spray drift can be avoided by ensuring that adequate buffer zones are located between areas where chemicals will be used, and downwind areas that may be sensitive to such use.

Awareness zones

Draw a sketch map that highlights any sensitive areas around the field to be sprayed and shows the prevailing wind direction. This will help to provide you with a risk assessment for the area.



In addition to the immediate awareness zone, nearby power lines, roads, and the distance to the nearest town need to be taken into consideration.



BEFORE SPRAYING



The establishment of effective buffer zones will often help avoid community conflict or litigation

A spray plan should be prepared for areas that are routinely sprayed. The plan should consist of a map of the awareness zone, and include information on methods of drift reduction. It should also indicate any protective buffer zones. The landowner should ensure the commercial spray operator has a copy of an up-to-date spray plan and awareness zone assessments.

Buffer zones

Buffer zones, or ‘separation distances’, can be used on the downwind edge of a field to ensure spray drift does not impact on adjoining sensitive areas. The establishment of effective buffer zones will often help avoid community conflict or litigation.

Different types of buffer zones include:

Field splitting

This involves treating the upwind section of a field, leaving the required buffer distance to neighbouring sensitive areas unsprayed (a ‘no-spray zone’), until there is a favourable change in wind direction. For example, when a southerly wind is blowing, a spray operator could spray the southern end of the field, and vice versa when a northerly wind is blowing. Downwind ‘no-spray zones’ may be prescribed on product labels.

Vegetative buffers

Rows of trees, shrubs or tall grasses can be planted on the downwind edge of a property to reduce the impact of spray drift on neighbouring sensitive areas. Vegetative buffers work by filtering spray droplets out of the air as it passes through foliage. Vegetative buffers should only be considered in addition to other methods of drift control, not as a substitute.

Many factors influence the type and distance required for the buffer. Specialist advice may be useful at the design stage.



BEFORE SPRAYING

Principles of vegetative buffer design include:

- ▶ *Buffer width.* The wider the buffer, the greater its effectiveness in reducing spray drift.
- ▶ *Buffer height.* The buffer should be about twice the height of the spray release. The greater the density of the buffer, the higher a barrier needs to be in relation to the spray release height.
- ▶ *Buffer distance.* The closer the buffer to the release point, the greater its effectiveness.
- ▶ *Type of buffer vegetation.* Trees or bushes with small or hairy leaves tend to maximise droplet capture. Thin, rough foliage should extend from the base to the crown of the buffer trees.

Consider waterbodies

Before applying pesticides near a waterbody (e.g. drainage line, creek, stream, farm dam, lake or reservoir) it is important to consider environmental and seasonal conditions which increase the risk of harm to aquatic environments. Although herbicides are the most frequently used pesticides near a waterbody (to control weeds), there might be handling or application of other pesticides such as insecticides, fungicides, post-harvest fruit dips, or animal dips and sprays.

Pesticides can enter water either directly through in-stream spraying or spray drift, or they can reach the surface water via surface run-off or leaching and sub-surface drainage. It is therefore important to understand that herbicides can move into waterways even as a result of off-stream activities.

When spraying weeds near waterbodies, the choice of herbicide is critical. This is because many herbicides are toxic in aquatic ecosystems and may harm animal and plant life. They may also pollute water supplies intended for human consumption.



BEFORE SPRAYING

Landholders and spray operators should both consider whether a spray operation near water is really necessary.

Only some herbicides are suitable for use near waterbodies. Such herbicides need the following characteristics:

- low eco-toxicity
- nil or low volatility at all temperatures (e.g. $<10^6$ mm Hg) (to reduce spray drift potential)
- low water solubility (e.g. <3 mg/L) (to reduce potential for leaching to groundwater)
- high soil absorption coefficient (e.g. $K_{oc}>1900\text{ cm}^3/\text{g}$) (to reduce potential for leaching to groundwater)
- short half-life (in water <15 days; aerobic soil metabolism <610 days; anaerobic soil metabolism <9 days).

Herbicides applied to the edge of a waterbody or in wetted areas around its edge must be registered for use in aquatic environments by the Australian Pesticides & Veterinary Medicines Authority (APVMA).

Landholders and spray operators should both consider whether a spray operation near water is really necessary, or whether integrated pest management (IPM) practices could be used. Landholders need to develop a long-term weed control program as part of sustainable management for areas close to water.

For more information on this topic, see our companion publication, *Safe and effective herbicide use: a handbook for near-water applications*.

Consider off-target migration

Spray drift is the airborne movement of agricultural chemicals away from the target area during, or shortly after, its application. It can be in the form of droplets, particles (fine dust) or vapour and can occur to some degree even when the chemical is being applied according to label instructions. It becomes an issue when it has the potential to damage health, trade or the environment.



BEFORE SPRAYING

Spray drift is not the only process by which chemicals can potentially leave the target area. Chemical trespass is the broader term used to describe the off-target impact of a chemical on air, soil, groundwater and surface waters.

To ensure the impact of spray drift on sensitive areas is minimised, spraying should be carefully planned, especially for areas that are routinely sprayed. Planning should include a map of the awareness zone (see p. 23) and information on methods of drift reduction and buffer zones (see p. 24).

For further information, see the PIRSA *Avoid Spray Drift* fact sheet, the APVMA's risk assessment procedure on spray drift and the Primary Industries Standing Committee report, *Spray Drift Management: Principles, Strategies and Supporting Information*.

Consider weather conditions

Consider weather conditions before spraying, paying particular attention to:

- ▶ *Wind speed.* Consistently light winds are ideal (3-15 km/hr or as specified on label). Higher wind speeds may be acceptable in low risk areas, or where adequate distances to other areas are maintained.
- ▶ *Wind direction.* The wind should be blowing away from sensitive areas.
- ▶ *Temperature.* Mild temperatures (<27°C) and high humidity (>45%) are ideal.

The morning hours often give the best weather conditions for spraying. Spray operators should monitor and record wind direction, wind speed, temperature and humidity before and



BEFORE SPRAYING

during every spray operation. Inexpensive hand-held devices are available to assist this. Alternatively, take readings using the Beaufort Scale.

Table 1: Beaufort Scale

Beaufort No.	Description	Km/hr	How to recognise
0	Calm	0-2	Smoke rises straight up
1	Light air	3-6	Smoke drifts
2	Light breeze	7-11	Wind felt on face; leaves rustle
3	Gentle breeze	12-19	Flags flap; twigs move all the time
4	Moderate breeze	20-28	Papers blow; small branches move

Do not spray:

- ▶ when the wind speed is either still or very light (0-3km/hr). Under these conditions inversions may be present which can enable spray to drift over large distances. During periods of low wind speed, changes in wind direction are also more likely
- ▶ when wind speeds are above 15 km/hr, as this may result in excessive movement of spray droplets downwind of the target area
- ▶ when the wind is blowing towards a sensitive area, unless an effective buffer zone has been established
- ▶ when temperatures are high and humidity is low, as water-based sprays may evaporate. Plants are often also stressed under such conditions, making the spray less effective.

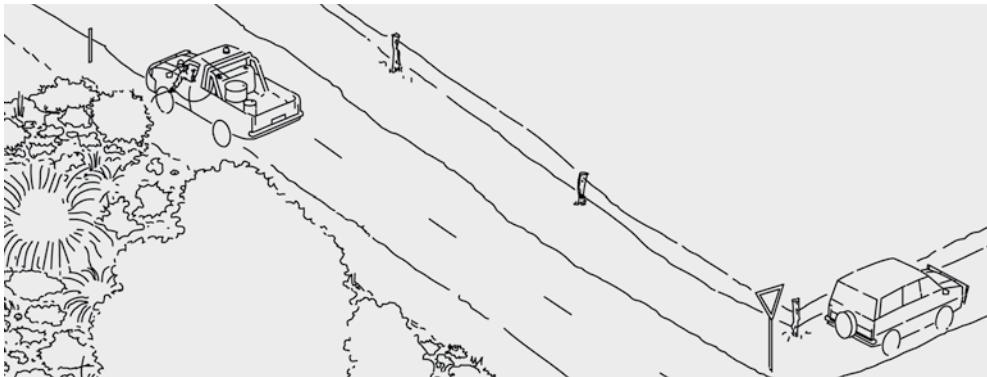
Communicate with neighbours

Keeping neighbours informed about proposed chemical use can help reduce the likelihood of misunderstanding and future conflict. Neighbours should be notified before spraying to give them an opportunity to move stock, disconnect rainwater tanks and close house windows.



DURING SPRAYING

DURING SPRAYING



Risk monitoring

Sometimes conditions change while applying pesticides. For example, wind speed or direction can change quickly, or it may start raining. The pesticide applicator should constantly monitor environmental conditions while working, and may have to adjust their procedures if there are changes, or even stop the application. If conditions alter while applying the pesticide, this should be noted in the pesticide application record (see p. 36).

The pesticide applicator should constantly monitor environmental conditions while working

Avoiding off-target migration (including spray drift)

Off-target migration is a term used to describe the off-target impact of a chemical on air, soil, groundwater and surface waters. It can occur in a variety of ways, including surface water run-off, leaching, sub-surface drainage or spray drift.

Spray drift is the airborne movement of pesticide away from the target area during or shortly after ground or aerial application. Spray drift can be in the form of droplets, fine dust or vapour. It has the potential to impact on human health, trade and the environment, and can happen even when the chemical is being applied according to label instructions.

It is important to minimise the risk of spray drift by carrying out a thorough risk assessment before spraying. See the list on page 27 of this booklet for more resources on the subject of minimising spray drift.

The following factors should be considered as part of continually assessing the risk for off-target migration:

- ▶ product
- ▶ awareness zones
- ▶ buffer zones
- ▶ weather conditions
- ▶ spray equipment.

Spray equipment

Spray equipment should be operated with the aim of reducing drift. Equipment is available to reduce spray drift, but operator expertise is also required to select the right nozzle size and type, spray pressure and spray height. For further information on methods of minimising drift from a specific type of spray equipment, contact a recognised spray equipment manufacturer or distributor.

Ground spraying with hand-held sprayers

Preferably, use ‘low-drift’ nozzles that minimise the number of small droplets produced, consistent with the required coverage. Smaller droplets are more likely to form spray drift as they tend to remain airborne longer, and can be blown further from the target before landing. The release height and spray pressure should be set as low as possible, consistent with nozzle specifications and coverage requirements. Your spray equipment should be calibrated regularly to ensure the chemical is being applied at the correct rate, as per the manufacturer’s instructions.



DURING SPRAYING

Airblast sprayers

Airblast sprayers are used to direct spray at high speed into the crop canopy. When setting up equipment, ensure that the spray is contained within the crop canopy, and not allowed to reach the air above the canopy. Deflectors may be used for this purpose.

When a sensitive area is downwind from the area to be sprayed, the outer row should be used as an untreated buffer for the sensitive area. Alternatively, equipment that directs spray in one direction can be used to avoid chemical being sprayed towards the sensitive area.

Aerial spraying

The aerial contractor pilot will require an awareness zone map of the crop to be sprayed, showing the location of any neighbouring sensitive areas. The pilot will also need information on nearby power lines, roads, and distance to the nearest town.



To ensure the ongoing minimisation of spray drift, the area downwind of the spray site should be constantly monitored by means of, for example, spray detection cards.

Environmental noise issues

Noise pollution is most likely to occur when using fan-assisted sprayers, and when spraying near houses and areas of human activity. The effect of noise on intensive animal production (e.g. intensive poultry production or piggeries) should also be considered.

When using a fan-assisted sprayer within 600 m of residences (or 800 m in some circumstances, such as on a calm night), an operator must take all reasonable and practicable measures to prevent noise impact on any nearby residents. It may be possible

to time applications to minimise such impact. Communication beforehand with those likely to be affected can often prevent annoyance to nearby residents.

The EPA's Environment Protection (Industrial Noise) Policy 1994 suggests 'indicative noise factors' as a useful aid to gauging acceptable levels of industrial noise. The following table divides areas into categories of land use, giving an indicative noise factor for each category, for both daytime and night-time.

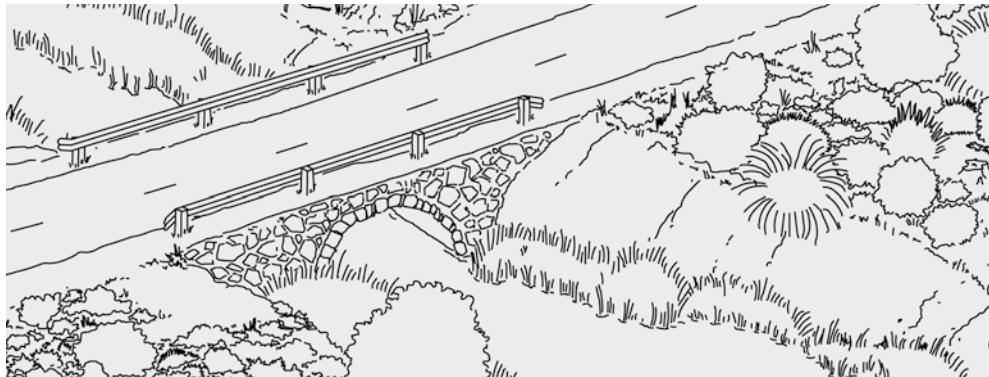
Table 2: Indicative noise factor by land use

Land Use	Indicative Noise Factor (dB(A))	
	Day	Night
Rural/Rural Living	47	40
Residential	52	45
Light Industry/Intensive Primary Production	57	50
Commercial	62	50
General Industry	65	55
Special Industry	70	60



AFTER SPRAYING

AFTER SPRAYING



Clean up

To minimise cost and potential harm to the environment, the goal of every spray operation should be to plan the spray job carefully to avoid excess spray solution. Clean equipment away from sensitive areas such as waterbodies, children's play areas or sensitive vegetation.

Disposal

In relation to the disposal of unwanted pesticides and wash water, failure to observe the following strictures may represent a breach of the General Environmental Duty under the Environment Protection Act.

the goal of every spray operation should be to plan the spray job carefully to avoid excess spray solution

Unwanted pesticides can be disposed of through the ChemClear program. Call ChemClear on 1800 008 182, or find them on the web at www.chemclear.com.au

Disposal of diluted pesticide

Any diluted pesticide solution that is left over from a job should be either:

- ▶ taken to the next job and used there
- ▶ temporarily stored for pick up by a commercial waste disposal business
- ▶ diluted further with water and applied over a non-sensitive 'sacrifice area'.

Suitable areas include areas of fallow land or pasture, internal tracks or firebreaks. Such areas should be endorsed by the client and recorded on the pesticide application record (see p. 36).

Disposal of wash water

Water that has been used to wash spray equipment will contain pesticide residue and possibly also cleaning agents. It should be directly disposed of at an authorised waste depot or stored in a tank that is dedicated for such storage, and which is emptied periodically by a commercial waste-disposal business.

Alternatively, this water could be disposed of by spreading it over a sacrifice area (as described above).

Disposal of concentrated pesticide

Unwanted pesticides can be disposed of through the ChemClear program. Call ChemClear on 1800 008 182, or find them on the web at <www.chemclear.com.au>. Alternatively, businesses can pay a commercial waste-disposal business to take any unwanted pesticide concentrate.

If the responsibility for chemical disposal lies with the landowner, he or she can take unwanted pesticide concentrate to the EPA Hazardous Waste Depot, at Dry Creek in Adelaide, between



AFTER SPRAYING

9.00 am and 12.00 noon on the first Tuesday of each month. An alternative time can be arranged by calling the EPA on 8204 2004 or 1800 623 445.

Never dump unwanted concentrated pesticide into a waterbody or the soil, as this is a potential breach of the General Environmental Duty.

Disposal of empty pesticide containers

Empty pesticide containers should be triple rinsed (add rinse water to the spray tank) and disposed of through the drumMuster program. Contact your local council for more information on drumMuster collection days, or find them on the web at <www.drummuster.com.au>.

Quarantine and bio-security

Operators should be aware of quarantine areas for pest plants (e.g. Broomrape), insects (e.g. Phylloxera), or diseases (e.g. Annual Ryegrass Toxicity, Phytophthora). Such situations should be identified during the initial interview with the client, who should also advise on any special clean-down procedure required.

In addition, operators should avoid the transfer of weed seeds, insects and diseases between clients, and even between different areas on one property, by inspecting the spray vehicle and cleaning it if necessary before leaving a spray job.

Bio-security may be an issue where the genetic material (e.g. pollen or seeds) of a crop is transferred from the place of origin to other places. Again, the spray vehicle should be thoroughly inspected before leaving a client's property, and cleaned if necessary.

When cleaning of clothing and spray vehicles for quarantine or bio-security reasons is necessary, the cleaning should take place on the property where the contamination happened.

Record of pesticide application

A record of pesticide application for each job must be kept by the spray operator, and a copy of this record should be given to the client. Application records should include:

- ▶ name and address of landholder
- ▶ precise location of application area (may include a map)
- ▶ date of application
- ▶ operator's name
- ▶ situation of application (e.g. crop, pasture, native vegetation, amenity area)
- ▶ growth stage and general condition of crop where appropriate
- ▶ pests to be controlled
- ▶ growth stage and general condition of pests
- ▶ level of infestation of pests
- ▶ description of pesticides used, including product name and active constituents, resistance group, batch number, application rate (dilution ratio and rate per hectare), withholding period, re-entry and plant-back periods where applicable
- ▶ identification of application equipment
- ▶ quality and source of water for diluting pesticide
- ▶ weather conditions at time of application (e.g. rainfall, cloud cover, temperature, humidity, wind speed and direction)
- ▶ personal protective equipment worn by operator
- ▶ measures taken to minimise off-target migration of pesticide, environmental damage or noise pollution.

RESOURCES

Topic	Contact details	Notes
Australian Standards	Standards Australia Ph: (08) 8373 4140 or 1300 654 646	
Chemical use (general)	EPA Ph: (08) 8204 2000	
Commonwealth regulation, review and registration	APVMA www.apvma.gov.au Ph: (02) 6272 5852	See website for details of <i>Agricultural and Veterinary Chemicals Code Act 1994</i>
Disposal of unwanted concentrated pesticide	EPA Ph: (08) 8204 2004 or 1800 623 445 or epainfo@epa.sa.gov.au or www.epa.sa.gov.au/pub.html	<i>Household hazardous waste—management and disposal; EPA guideline</i>
	ChemClear Ph: 1800 008 182 www.chemclear.com.au	
Disposal of unwanted pesticide containers	drumMuster www.drummuster.com.au , or Ph: (08) 8554 7268 or 0409 834 113	Contact local council
Emergency	000	Fire, ambulance, police
Emergency (environmental)	Environment Protection Authority Ph: 1800 100 833	Emergency Response Line (to report an incident that has actually, or may potentially, cause serious or material environmental harm)
Environmental responsibilities	EPA Ph: (08) 8204 2002 or 1800 623 445	Environment Protection Act 1993; EPA <i>Guideline for Environmentally Responsible Pesticide Use</i>
Emergency (poisoning)	Poisons Information Centre Ph: 13 11 26	24 hours a day, 7 days a week

Topic	Contact details	Notes
General pesticide information	EPA Ph: (08) 8204 2004 or 1800 623 445 or epainfo@epa.sa.gov.au or www.epa.sa.gov.au/pub.html	<i>EPA Guidelines for Responsible Pesticide Use</i> 2005
	PIRSA Ph: (08) 8226 0405	<i>inFINDER</i> set of CDs, available from PIRSA (pesticide labels, MSDS, and registered uses of pesticides);
	EXTOXNET www.extoxnet.orst.edu	Website of Oregon State University/ USA with chemical & physical characteristics of pesticides relating to environmental safety and transport
	NRM Boards www.nrm.sa.gov.au	
Hazardous chemicals	Department for Administrative and Information Services Workplace Services Ph: (08) 8303 0436 or 1300 365 255	<i>Dangerous Substances Act 1979</i>
Industry Associations	Australian Landscape Industry Association www.landscapingaustralia.com.au info@landscapingaustralia.com.au	Contact the ALIA for information on the standards (QA) related to their industry
	Groundsprayers Association of SA c/ Wrenhaven Pty Ltd Ph: (08) 8391 1999	Contact the GASA for information on the standards related to their industry--QAMS
Integrated pest management (IPM)	National Association for Sustainable Agriculture Australia www.nasaa.com.au/ PO Box 768 Stirling SA 5152 Ph: (08) 8370 8455 Fax: (08) 8370 8381 Email: enquiries@nasaa.com.au	Organic growers

Topic	Contact	Notes
Integrated pest management (IPM)	BFA www.bfa.com.au/	Organic growers
	www.environment.act.gov.au/petsandlocalwildlife/integratedpestmanagement.html	Another useful website
Licensing and regulation of commercial spray operators	Department of Health www.dhs.sa.gov.au Ph: (08) 8226 7137	<i>Controlled Substances Act 1984 and Regulations</i>
Noise	EPA Ph: (08) 8204 2002 or 1800 623 445	(Draft) Environment Protection (Noise) Policy
Permits for off-label use of pesticide	APVMA www.apvma.gov.au Ph: (02) 6272 5158	
Public and environmental health issues	Public Health SA Department of Health www.dhs.sa.gov.au/pehs Ph: (08) 8226 7107	
	WorkCover Corporation Ph: (08) 8233 2222 or 1800 188 000	<i>Occupational Health, Safety and Welfare Act 1995</i>
Pesticide storage, transport and handling	PIRSA, Rural Chemicals Program Ph: 1300 799 684	<i>Agricultural & Veterinary Chemicals (Control of Use) Act 2002</i>
Reporting a significant pesticide spill	Police Ph: 131 444 (24 hrs)	
	Department of Human Services Ph: (08) 8226 7107 (24 hrs)	<i>Controlled Substances Act 1984 and Regulations</i>
Reporting off-target damage from pesticide	PIRSA Rural Chemicals Ph: (08) 8226 0528	

Topic	Contact	Notes
Spray drift management: principles, strategies and supporting information.	PIRSA Chemical Trespass Coordinator Ph: (08) 8226 0528 Fax: (08) 8226 1844	PISC (SCARM) Report 82, Primary Industries Report Series, CSIRO Publishing /PISC (SCARM), October 2002.
Training and courses for licensing	Torrens Valley Institute of TAFE Urrbrae Campus Pest and Weed Unit Ph: (08) 8372 6814	
	National Training Information Service www.ntis.gov.au	
Training in the use of farm chemicals	ChemCert Australia (SA) Inc Ph: (08) 8842 4048	<i>Controlled Substances Act 1984, and Regulations. Agricultural and Veterinary Products (Control of Use) Act 2002 and Regulations.</i>
Weed management	CRC for Weed Management Ph: (08) 8303 6590	
Workplace health and safety	Workplace Services, DAIS Ph: 1300 365 255 www.eric.sa.gov.au wisinfo@eric.sa.gov.au	<i>Occupational, Health, Safety and Welfare Act 1986</i>

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Freecall (country): 1800 623 445

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