

StewardshipFirst™ SprayBest



The best practice guide for **ground spray application of pesticides** | First edition



Acknowledgements

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Disclaimer: This document exists to raise awareness of best practice for anyone involved in the ground spray application of crop protection products. CropLife Australia accepts no liability for any negative consequences to readers of SprayBest, or any third party or entity affected by the actions of someone following the guidance of SprayBest. Following the guidelines presented in SprayBest does not eliminate all risk that off-target pesticide movement may occur. For more information visit www.croplife.org.au

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Foreword

CropLife Australia and the Australian Groundsprayers Association present SprayBest, a best practice management guide for agricultural chemical application.

Crop protection products are crucial to modern integrated pest management techniques and systems. In Australia, the economic impact of weeds is estimated to be over \$4.8 billion each year.¹ It is critical that spray applicators, farmers and environmental land managers are properly equipped to use all registered crop protection products safely and responsibly.

The application of crop protection products, whether from a ground boom sprayer, knapsack or aerial platform, needs to be properly planned and carefully executed to minimise the risk of off-target chemical movement. The most common cause of off-target movement is spray drift.

CropLife and the Australian Groundsprayers Association are actively engaged in national and regional spray drift initiatives. Meaningful change in agricultural practice has been shown to result in improvements in on-target application efficiency and reduce the risk of pesticide drift occurring. Management and minimisation of off-target spray drift is, however, complex.

It is imperative that spray applicators and farmers have access to the support and resources required for efficient spray application and effective spray drift management. To this end, CropLife and the Australian Groundsprayers Association have worked together to develop SprayBest.

SprayBest supplements CropLife's best practice reference guide, MyAgCHEMUSE, and is an integral part of SprayPASS, the Australian Groundsprayers Association's stewardship program.

SprayBest is part of CropLife's **StewardshipFirst** program which is a suite of whole-of-lifecycle initiatives and programs for the plant science industry's products.

We encourage all crop protection product users to adopt these best practice measures.

Matthew Cossey

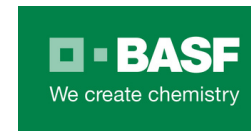
Chief Executive Officer
CropLife Australia

Doug Clark

Chairman
Australian Groundsprayers
Association

¹ <https://invasives.com.au/wp-content/uploads/2019/01/Cost-of-weeds-report.pdf>

CropLife Australia  member companies



SUMITOMO CHEMICAL



Representing the best of the plant science industry



About us

CropLife Australia is the national peak industry organisation representing the plant science sector in Australia. CropLife's members are the world-leading innovators, developers, manufacturers and formulators of crop protection and crop biotechnology products. The plant science industry, worth more than \$20 billion a year to Australian agricultural production, provides products to protect crops against pests, weeds and diseases, as well as developing crop biotechnologies key to the nation's agricultural productivity, profitability and sustainability. CropLife is part of the plant science industry's 91 country international federation.

CropLife member companies are committed to the stewardship of their products, contributing millions of dollars every year to ensure their products are sustainably managed for the benefit of users, consumers and the environment.

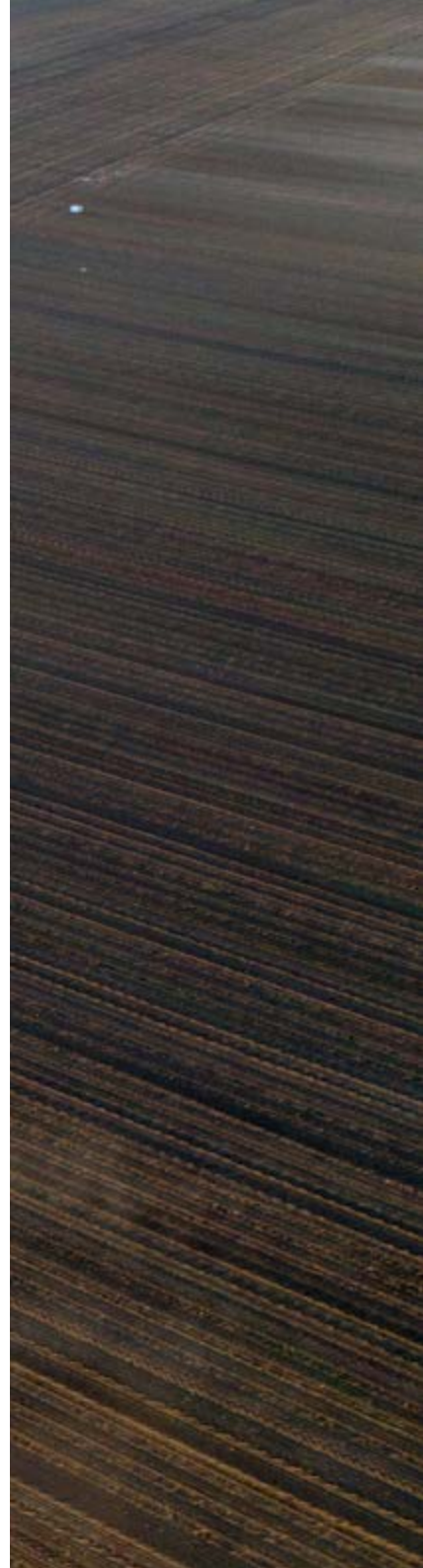
The StewardshipFirst program includes CropLife's mandatory Code of Conduct for members, its comprehensive Resistance Management Strategies, MyAgCHEMUSE, the Pollinator Protection Initiative which includes BeeConnected and the Seed Treatment Stewardship Strategy. Programs run by CropLife's wholly-owned stewardship and safety organisation, Agsafe, including **drumMUSTER**, ChemClear® and Agsafe Accreditation and Training complement the suite of stewardship initiatives and programs.

The Australian Groundsprayers Association

represents state-based ground spraying organisations in matters that are of national concern.

The association assists in the standardisation of the ground spraying industry across Australia, promotes uniform standards of training across Australia and ensures that members adhere to a uniform code of practice to assist in the standardisation of the industry across Australia.

In 2016, the association developed SprayPASS, a national, industry-led stewardship program promoting and supporting the safe and sustainable application of pesticides in Australia, by delivering professional development and certification for groundsprayers.



Who is this guide for?

This best practice guide is for operators and businesses who use ground rig spray equipment to apply pesticides (herbicides, insecticides, fungicides and other agricultural chemical products) in agriculture, horticulture, and urban, industrial or environmental land management.

This encompasses:

- **fee-for-service contractors**—both full-time professional and part-time/side-line—and their employees
- **non-contractor applicators** including corporate and family farmers and graziers (and staff) controlling weeds, pest insects and plant diseases in production agriculture and horticulture
- **spray operators, managers and supervisors** in:
 - amenity situations like golf courses, bowling greens, parks and gardens
 - non-agricultural and industrial land management situations e.g. local councils, national parks, forestry, electricity, railways, water resources etc
- **researchers and technical staff** conducting trials involving pesticide use.

The guide is also a useful resource for **educators** and **trainers**.

It outlines **What** is required (and **Why**) to implement best practice and provides some resources to assist. As technology is continually evolving, operators and businesses need to undertake professional development through training, workshops and research to determine up-to-date technical information on **How** pesticide products are to be managed and applied.

What is best practice?

Best practice is the implementation of the best available knowledge and technology at every point in the pesticide management chain — from initial product selection through to handling and application and the final disposal of any waste, including sound monitoring and recording practices.

Best practice is no accident, it takes planning, time, effort and knowledge. There is no need to tackle the whole lot at once. A process of continual improvement will be more achievable and effective, so work out your priorities. The things to do first are the ones which will provide the greatest benefit.

Benefits of best practice

1 Maximising cost-effective pest control.

Good product selection, management and application ensures effective pest control. The resulting decrease in chemical product waste, the need for fewer repeat applications and reduction in the amount of product used, may also lower costs.

The most expensive product is the one which does not work effectively, reasons for this can include:

- incorrect pest identification
- incorrect pesticide selection
- resistant pests, weeds and/or diseases
- pesticide batch not up to specifications
- use of poor quality water to mix products or incompatible mix
- inappropriate application
- under dosing
- incorrect calibration



- failure to follow label directions
- incorrect timing
- poor equipment.

2 Compliance with legislative requirements.

There are many national and state and territory Acts of Parliament and associated regulations that spray operators are required to comply with. Ignorance is no defence if something goes wrong.

3 Demonstrating due diligence and Duty of Care.

In the event of an incident involving the use of pesticides, being able to demonstrate that all steps have been taken to implement best practice will greatly assist as a defence. Insurance will not cover negligence.

4 Managing risks.

There are a range of risks associated with the use of pesticides, especially when used incorrectly, including to:

- your business—financial, litigation, reputation
- workers—health and safety of spray operators and other workers
- the environment—pollution from spray drift, waste disposal, fire, accident etc
- the community—health and safety from spray drift, pollution
- clients—off-target spray drift damage, residues and market rejection of produce.

5 Possible reduction of insurance or workers' compensation premiums. Implementation of best practice may enable a business to negotiate reduced insurance or workers' compensation premiums.

6 Ability to qualify for contracts.

A documented Pesticide Management Plan may qualify a spray contractor for a contract, or give a competitive advantage when tendering.

7 Enhanced positive public relations and perceptions.

Being able to demonstrate a commitment to best practice will help promote a positive image of pesticide use with neighbours, the community, regulators and consumers.

In addition to these benefits, businesses and operators have an ethical and moral responsibility to employ the highest possible standards of pesticide use.



What managers and operators need to do

- **Managers must take responsibility for workplace chemical management practices.**
- **All personnel must take responsibility for their own actions.**
- Ensure everyone involved has the necessary knowledge and skills. This can be gained by undertaking spray application workshops plus on-going professional development.
- Assess all aspects of pesticide management practices from initial purchase to completion of the job and final disposal of any waste.
- Conduct a self-audit of pesticide management practices using these guidelines and the associated checklists.
- Develop a plan to prioritise and improve practices not currently up to expected standards.
- Start to fix up any aspects that do not meet expected standards.
- Document all steps taken.

The following is a summary of each aspect of pesticide management that needs to be evaluated. The steps to take to implement best practice in each of these are explained in more detail in following sections.

Summary of what you should do

1 Understand your legal responsibilities

- 1.1 Document the legislation that directly impacts your business or organisations's pesticide management.
- 1.2 Decide what you need to do to ensure you meet your obligations and develop an action plan.

2 Manage personnel

- 2.1 Define the work roles and responsibilities of all personnel in the workplace.
- 2.2 Determine the training and skills requirements of each person and identify any gaps.
- 2.3 Develop an action plan to achieve adequate skills development.
- 2.4 Record training and skills development activities that each person undertakes.

3 Ensure the safety of all personnel

- 3.1 Undertake an audit and risk assessment of all work practices, including:
 - a. identification of hazard
 - b. assessment of the level of risk.
- 3.2 Prioritise the things that need to be fixed.
- 3.3 Develop an action plan to manage the risks identified.
- 3.4 Keep records.





4 Use chemical products as part of Integrated Pest Management (IPM)

- 4.1 Seek advice from consultants, qualified agronomists and researchers.
- 4.2 Evaluate pest management practices.
- 4.3 Select and apply pesticides in accordance with IPM principles.
- 4.4 Manage resistance in pest populations.

5 Select pesticides carefully – know what you are using

- 5.1 Use the best quality products available.
- 5.2 Make sure that the products purchased are registered by the Australian Pesticides and Veterinary Medicines Authority (APVMA) for the intended use by locating the APVMA approval number on the container and reading the label.
- 5.3 Check for resistance management strategies (RMS) relevant to the target pests and chemical products to use.
- 5.4 Evaluate pesticide products and the way they are to be used for any hazards and risks by consulting product labels, Safety Data Sheets (SDS), manufacturer technical bulletins and websites.
- 5.5 Document any hazards and risks identified.
- 5.6 Develop an action plan to minimise any risks.

6 Ensure responsible product purchase

- 6.1 Review your product purchasing practices.
- 6.2 Develop an action plan to improve practices, if required.

7 Follow label directions

- 7.1 Ensure up-to-date SDS for each product used and stored are available to all relevant people in the workplace.
- 7.2 Ensure all users know how to interpret product labels and SDS.
- 7.3 Ensure all users follow label directions.

8 Ensure correct transport

- 8.1 Do an audit of pesticide transport practices.
- 8.2 Develop an action plan to ensure safe and legal transportation.

9 Ensure correct product storage

- 9.1 Check your state or territory legislation for pesticide storage requirements.
- 9.2 Do an audit of pesticide storage practices.
- 9.3 Decide what you need to do to ensure you meet your obligations and develop an action plan.



10 Ensure safe and efficient pesticide application

- 10.1 Undertake training and skills development through certified providers.
- 10.2 Consult with or advise those affected by spray operations.
- 10.3 Use job orders to communicate with spray operators and contractors.
- 10.4 Understand the principles of spray application and the decision-making process.
- 10.5 Implement practical steps to improve application:
 - follow label instructions
 - use the best quality water available
 - use quality, well maintained equipment
 - develop a spray plan for each job
 - adjust spray equipment for the job as per the spray plan
 - maintain accurate equipment calibration
 - ensure correct timing of application
 - minimise spray and vapour drift, and run-off
 - minimise waste
 - wash and/or rinse equipment after use to remove residue
 - ensure operators wash and/or shower after spraying and handling pesticides
 - monitor results.
- 10.6 Do an audit of your application equipment and work practices.
- 10.7 Identify and prioritise gaps to fix.
- 10.8 Develop an action plan to fix those things which need to be improved.
- 10.9 Undertake a risk assessment for each spray application job. Document risks and actions taken.
- 10.10 Complete and keep spray application records.

11 Safely dispose of waste

- 11.1 Do an audit of your waste management and disposal practices.
- 11.2 Check what you can and can't do regarding waste disposal in your local area.
- 11.3 Develop an action plan to meet best practice and legal responsibilities.

12 Keep records

- 12.1 Review your recordkeeping system to ensure it:
 - complies with legal requirements
 - assists with pesticide management and business operations.
- 12.2 Develop an action plan to fix gaps and improve recordkeeping.

13 Monitor results

- 13.1 Keep notes of spray outcomes to assist with future decision-making.

14 Have a Pesticide Management Plan for your business

- 14.1 Compile all checklists and records as the basis of a Pesticide Management Plan (PMP) for your workplace.
- 14.2 Base the PMP on these best practice guidelines and involve key personnel.
- 14.3 Keep the PMP up-to-date and review it annually.



15 Obtain good advice and information

- 15.1 Consult recognised industry experts.
- 15.2 Undertake appropriate quality training and on-going professional development of knowledge and skills.
- 15.3 Access online information and resources.

16 Seek independent certification

- 16.1 Identify appropriate industry/market quality assurance (QA) or best management practice (BMP) programs for your industry sector. Check their pesticide management requirements.
- 16.2 Undertake a self-audit of your workplace and work practices.
- 16.3 Seek an independent peer review of your work practices and pesticide management plan.
- 16.4 Join the Australian Groundsprayers Association and support its endeavours to implement SprayPASS as an independent industry certification program.
- 16.5 Comply with the *SprayPASS Code of Conduct* provisions.

Steps to implement best practice

1 Understand your legal responsibilities

Everyone involved in pesticide use has a legal obligation to comply with **Common Law** (not based on an Act of Parliament) as well as **federal and state and territory legislation** (Acts of Parliament and Regulations).

There are legal responsibilities covering every aspect of pesticide use. Legislation changes from time-to-time, and it is your responsibility to find out your obligations.

Ignorance is no defence, and penalties can be very severe for both individuals and businesses. As well as very large fines, those causing damage may be liable for the cost of that damage. You may need to prove that you have taken all reasonable steps to comply with legislation and to do what is expected. Insurance will not cover negligence.

Duty of Care

Duty of Care is a Common Law responsibility to take all steps to protect people, animals, the environment etc. Basically, it is doing the right thing. Failure in Duty of Care is negligence.

Product selection (Registered use)

Before a pesticide can be sold or used, AgVet Chemical companies must apply to the Australian Pesticides and Veterinary Medicines Authority (APVMA) to have the product evaluated and registered. The product label, which is approved as part of the registration process, will detail the registered use (situation, target pests, dose rates etc). While there is some variation between states and territories, legislation dictates that users can possess and use registered products only.

Transport and storage

Users have a responsibility to transport and store products safely and securely. For products designated **Dangerous Goods**, there are specific legal obligations (depending on quantities transported or stored) set out in the Australian Code for the Transport and Storage of Dangerous Goods (the ADG Code). This code is picked up under relevant state or territory legislation. Labels for products classed as Dangerous Goods will display the relevant Dangerous Goods Class symbol. For example, many pesticides are classed as a Poison (Class 6) or Flammable (Class 3), among others.

A product's Safety Data Sheet (SDS) will provide more information on storage and transport. SDSs for all products must be available to everyone in the workplace.

Control of use

In each state and territory there will be an Act of Parliament governing the legal use of pesticides. While there is harmonisation across all states and territories regarding minimum provisions, there are still some differences. Control of use provisions include:

- only registered products to be sold, possessed or used
- products must be used according to the registered label, approved permit or provisions specific to your state or territory
- requirements for training and licensing of users
- requirements for recordkeeping
- very severe penalties resulting from both **wilful** and **negligent** damage.

In some states the use of certain products and/or application methods may be prohibited in designated sensitive areas, e.g. in Agricultural Chemical Control Areas (ACCAs) in Victoria.

Licensing/Certification of operators

All states and territories have a requirement that commercial pesticide users (everyone other than home gardeners) must be trained to minimum standards.

Users of Restricted Products—those with particular risks regarding human, environmental or food safety or market acceptance—may require higher levels of training and/or licensing.

Some states and territories also require contractors (fee for service applicators) to be licensed.

Health and safety

Pesticide products vary in their level of toxicity and associated risks to human health and safety. The Signal Heading, Health and Safety and First Aid sections on the product label will detail the Poison Schedule, safety precautions and personal protection equipment (PPE) required when using the product. This is determined by federal regulatory authorities under national codes.

Many pesticide products are designated **Hazardous Chemicals** which means they pose significant hazards to health, safety or the environment. Further details are provided in the SDS for each product. If using a Hazardous Chemical product, the SDS for that product must be available to all users. It is important to note that a product's label will not indicate whether or not it is a Hazardous Chemical—you must check the SDS.

Health and safety obligations are detailed in the Occupational Health and Safety (OHS) or Work Health and Safety (WHS) legislation in each state or territory.

Environment protection

Product labels and SDSs will detail the environmental risks of the pesticide and the precautions required to protect the environment.

Food and fibre safety (residues)

When pesticides are used in food or natural fibre production, chemical residues may remain in the product when it is sent to market. If there is the likelihood of a residue then a Maximum Residue Limit (MRL) is determined during the product registration process. This is the maximum amount of residue legally allowed when the food or fibre is marketed in Australia and is used to determine whether the pesticide has been used correctly. For export produce, the legal amount of residue allowed is determined by the importing country. Food and fibre is tested to determine actual residue levels.

To ensure the MRL is not exceeded, pesticide users must:

- follow the label directions regarding application, dose rates and Withholding Periods (the time period which must be allowed between pesticide application and harvest of the produce)
- ensure no off-target contamination of crops or animals through run-off, spray drift, waste disposal etc.

What you should do

- 1.1 Document the legislation that directly impacts your business or organisation's pesticide management.
- 1.2 Decide what you need to do to ensure you meet your obligations and develop an action plan.

Resources to help

MRLs

- 🔗 **Australian and overseas information and databases:** www.agriculture.gov.au/ag-farm-food/food/nrs/databases

Labels of registered products

- 🔗 **APVMA Public Chemical Registration Information System search (PubCRIS):** <https://portal.apvma.gov.au/pubcris>
- 🔗 **AgVet Chemical company websites**

Permits for off-label use

- 🔗 **APVMA PubCRIS:** <https://portal.apvma.gov.au/permits>

SDSs

- **Agricultural chemical company websites**
- **Agricultural chemical resellers**

Other important resources

- 🔗 **Australian Dangerous Goods Code:** <https://ablis.business.gov.au/service/wa/australian-dangerous-goods-code-adg-code-7th-edition-17312>
- 🔗 **Hazardous chemicals – SafeWork Australia:** www.safeworkaustralia.gov.au/chemicals
- 🔗 **National Code of Practice for the Storage and Handling of Workplace Dangerous Goods [NOHSC:2017(2001)]:** www.legislation.act.gov.au/di/2006-258/notification.asp

Relevant state and territory legislation

Australian Capital Territory

- 🔗 **Work Health and Safety Act 2011:** www.legislation.act.gov.au/a/2011-35/default.asp
- 🔗 **Work Health and Safety Regulation 2011:** www.legislation.act.gov.au/sl/2011-36/default.asp
- 🔗 **Work Health and Safety (How to Manage Work Health and Safety Risks) Code of Practice 2011:** www.legislation.act.gov.au/ni/2011-749/default.asp
- 🔗 **Dangerous Substances (Storage and Handling Code of Practice) Approval 2006:** www.legislation.act.gov.au/di/2006-258/notification.asp

New South Wales



- 🔗 **Work Health and Safety Act 2011 (No. 10):** www.legislation.nsw.gov.au/#/view/act/2011/10
- 🔗 **Pesticides Act 1999 (No. 80):** www.epa.nsw.gov.au/your-environment/pesticides/pesticides-nsw-overview/regulating-pesticides-nsw/pesticides-act-regulation
- 🔗 **Dangerous Goods (Road and Rail Transport) Act 2008 (No. 95):** www.legislation.nsw.gov.au/#/view/act/2008/95

Northern Territory

- 🔗 **Agricultural And Veterinary Chemicals (Control Of Use) Act 2004:** <https://legislation.nt.gov.au/Legislation/AGRICULTURAL-AND-VETERINARY-CHEMICALS-CONTROL-OF-USE-ACT-2004>



Resources to help


-  **Work Health and Safety (National Uniform Legislation) Act 2011:** <https://legislation.nt.gov.au/Legislation/WORK-HEALTH-AND-SAFETY-NATIONAL-UNIFORM-LEGISLATION-ACT-2011>
-  **Dangerous Goods Act 1998:** <https://legislation.nt.gov.au/en/Legislation/DANGEROUS-GOODS-ACT-1998>


Queensland

-  **Agricultural Chemicals Distribution Control Act 1966 & Regulations of 1998 and 2017:** www.legislation.qld.gov.au/view/html/inforce/current/act-1966-027
-  **Work Health and Safety Act 2011:** www.legislation.qld.gov.au/view/html/inforce/2018-07-01/act-2011-018
-  **Storing and transporting hazardous chemicals:** www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting

South Australia

-  **Agricultural and Veterinary Products (Control of Use) Act 2002:** [www.legislation.sa.gov.au/lz/c/a/agricultural%20and%20veterinary%20products%20\(control%20of%20use\)%20act%202002/current/2002.9.auth.pdf](http://www.legislation.sa.gov.au/lz/c/a/agricultural%20and%20veterinary%20products%20(control%20of%20use)%20act%202002/current/2002.9.auth.pdf)
-  **Work Health and Safety Regulations 2012:** www.legislation.sa.gov.au/lz/c/r/work%20health%20and%20safety%20regulations%202012/current/2012.268.auth.pdf

-  **Dangerous Substances (Dangerous Goods Transport) Regulations 2008:** [www.legislation.sa.gov.au/lz/c/r/dangerous%20substances%20\(dangerous%20goods%20transport\)%20regulations%202008/current/2008.300.auth.pdf](http://www.legislation.sa.gov.au/lz/c/r/dangerous%20substances%20(dangerous%20goods%20transport)%20regulations%202008/current/2008.300.auth.pdf)

-  **Dangerous Substances (General) Regulations 2017:** [www.legislation.sa.gov.au/lz/c/r/dangerous%20substances%20\(general\)%20regulations%202017/current/2017.258.auth.pdf](http://www.legislation.sa.gov.au/lz/c/r/dangerous%20substances%20(general)%20regulations%202017/current/2017.258.auth.pdf)

Tasmania

-  **Agricultural and Veterinary Chemicals (Tasmania) Act 1995:** www.legislation.tas.gov.au/view/html/inforce/current/act-1995-106
-  **Agricultural and Veterinary Chemicals (Control of Use) (Agricultural Spraying) Order 1996:** www.legislation.tas.gov.au/view/html/inforce/current/sr-1996-205
-  **Work Health and Safety Act 2012:** www.legislation.tas.gov.au/view/html/inforce/current/act-2012-001
-  **Dangerous Goods (Road and Rail Transport) Act 2010:** www.legislation.tas.gov.au/view/html/inforce/current/act-2010-016

Resources to help

Western Australia

- 🔗 **Health (Pesticides) Regulations 2011:** www.legislation.wa.gov.au/legislation/statutes.nsf/law_s40586.html
- 🔗 **Occupational Safety and Health Regulations 1996:** www.legislation.wa.gov.au/legislation/statutes.nsf/law_s4665.html
- 🔗 **Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007:** www.legislation.wa.gov.au/legislation/statutes.nsf/law_s38035.html
- 🔗 **Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007:** www.legislation.wa.gov.au/legislation/statutes.nsf/law_s37950.html

Victoria

- 🔗 **Agricultural and Veterinary Chemicals (Control of Use) Act 1992 and Regulations:** <http://agriculture.vic.gov.au/agriculture/farm-management/chemicals/legislation>
- 🔗 **The Occupational Health and Safety Act, 2004 and Regulations:** www.worksafe.vic.gov.au/occupational-health-and-safety-act-and-regulations
- 🔗 **Dangerous Goods Act 1985:** [www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst10.nsf/DDE300B846EED9C7CA257616000A3571/DE306156E2FC98DECA2583B60008A923/\\$FILE/85-10189aa101%20authorised.pdf](http://www.legislation.vic.gov.au/domino/Web_Notes/LDMS/LTObject_Store/ltobjst10.nsf/DDE300B846EED9C7CA257616000A3571/DE306156E2FC98DECA2583B60008A923/$FILE/85-10189aa101%20authorised.pdf)

2 Manage personnel

a Training and professional/skills development.

It is essential that everyone involved in pesticide management in the workplace is trained to appropriate levels—this includes managers, spray operators, office staff etc. There are legal requirements for this, and in the event of an accident or incident involving pesticides, it is likely investigators will ask questions about the level of training of those involved. Important considerations include:

- **Induction.** This is legally required for new employees or if a new piece of equipment or pesticide product is used for the first time. It also demonstrates Duty of Care.
- **Training, accreditation and licensing.** All states and territories require spray operators to be trained to minimum standards and spray contractors to be licensed. Check the requirements for your state or territory. In general, operators should be trained to Australian Qualification Framework (AQF) Level 3, while managers and supervisors should be trained to AQF Level 4. Refresher training and reaccreditation may be required.
- **On-going professional/skills development.** This is required to keep up-to-date with rapidly changing technologies and legislation. Formal refresher training may also be required under state and territory legislation. Professional/skills development may also be informal through attendance at field days, industry seminars and conferences, reading technical articles and bulletins, researching technical issues, peer group discussions or workplace discussions with employees.





- **Record training and professional development.**

All training and professional development should be recorded, preferably on individual personnel records.

b Communication. A critical part of personnel management is good communication in the workplace to avoid misunderstandings. As an example, spray operators and clients should be given a copy of a job sheet/job order which details what, where and how a pesticide is to be applied.

c Monitor health. Pesticide use potentially entails a high level of risk of injury because of the hazards associated with pesticide products (e.g. toxicity), equipment, handling practices and the situations in which products are applied. The health of all personnel must be monitored and any injuries documented. Follow the first aid/safety directions on the product label and consult your doctor, if required.

What you should do

- 2.1 Define the work roles and responsibilities of all personnel in the workplace.
- 2.2 Determine the training and skills requirements of each person and identify any gaps.
- 2.3 Develop an action plan to achieve adequate skills development.
- 2.3 Record training and skills development activities that each person undertakes.

Resources to help

- **SprayPASS template:**
Staff induction and training record

3 ensure the safety of all personnel

There are many hazards and associated risks when using pesticides.

Obligations

So far as is reasonably practicable, everyone in a workplace and each business has a **legal responsibility** to eliminate or minimise risks to health and safety at each step in the pesticide management chain from product purchase to final disposal of any waste.

Achieving this requires each workplace to:

- a undertake risk assessments**—this must be done annually or when circumstances change (e.g. new equipment, chemical product or way of doing things, and each time a pesticide product is applied)
- b manage the risks identified**—take all steps to protect the safety of everyone who may be exposed to the pesticide before, during and after application.

Assessing and managing risks

The process involves *identifying hazards, assessing risks* and then taking steps to *control the risks*.

The **SAFER** approach is good.

S	See it —identify the hazards
A	Assess the nature and level of risk
F	Fix it if it needs fixing
E	Evaluate what you have done to fix it
R	Record any actions you have taken or plan to take



Identify hazards

Hazards are things which have the potential to cause injury or harm to life, health or property. The level of hazard may vary—some things may be highly hazardous and others of very low hazard.

Chemical hazards are detailed on product labels and SDSs, e.g. a chemical may be toxic, flammable, corrosive, an irritant etc.

Other hazards include residues and environmental effects. Warnings on the label and the SDS will indicate any hazards—signal headings, dangerous goods diamonds, health hazard information, safety directions, withholding periods and environmental warnings.

Workplace hazards may be identified through workplace audits using checklists and observation, investigation of incidents and accidents, talking to workers, injury records, and monitoring of worker health and the environment.

Assess the level of risk

Risk is the likelihood of damage or injury occurring when a product or piece of equipment is used.

The degree of risk depends on the level and nature of the hazard and the likelihood of exposure to that hazard.

Exposure will depend on chemical handling practices, frequency of use, quantity of chemical being used, length of time it is being used, skill of the operator and precautions taken.

You must do a risk assessment of every step in the pesticide management chain including:

- **The pesticide product:**

- What are the hazards and how serious are those hazards e.g. how toxic is it?
- Is it flammable or corrosive?
- What is the likelihood of exposure to that chemical?

- **Transport, storage, handling, mixing:**

- Potential for spills, contamination, injury to people or the environment.

- **The equipment used to handle and apply chemicals:**

- Is it suitable and well designed?
- Is it maintained and serviced?
- How is it operated?
- How is it washed down/cleaned after use?
- What is the potential for injury to people from cuts, falls, crushing or chemical exposure?

- **The situation.** Before each pesticide application job, assess the:

- Potential risks to the surroundings (sensitive areas like public places, crops, pastures, waterways etc).
- Risks posed by the weather conditions—wind speed and direction (plus what is down wind), surface temperature inversions, humidity, forecast changes.

- **Waste disposal** risks posed by rinsate, left over dilute chemical mix, unwanted concentrate and chemical containers.



The following matrix may be useful to determine the level of risk.

Risk assessment matrix

CONSEQUENCES How severely could it hurt, or make someone ill?	HOW LIKELY IS INJURY TO OCCUR?			
	Almost certain (likely to happen at any time or daily exposure)	Likely (could happen sometime or weekly exposure)	Possible (could happen but is not likely or monthly exposure)	Remotely possible (could happen, but probably never will or rare exposure)
Disaster (could kill or cause permanent ill health or disability)	1 – Extreme	2 – Very high	2 – Very high	3 – High
Very serious (could cause long term ill health or disability)	2 – Very high	2 – Very high	3 – High	4 – Medium
Serious (medical attention and days off work probably required)	2 – Very high	3 – High	4 – Medium	5 – Low
Minor (first aid would be needed)	3 – High	4 – Medium	5 – Low	6 – Very low

Adapted from Kent J. *Pesticide Management*. Charles Sturt University

Manage risks identified

Hierarchy of risk controls

Once risks are identified, take steps to minimise the risks. Prioritise them and fix the most serious things first. Where there is an extreme or very high risk it must be fixed immediately. When managing the risks there is a **hierarchy of controls** in order of effectiveness:

Most effective	Elimination	<ul style="list-style-type: none">● Avoid using chemicals or hazardous equipment.
	Substitution	<ul style="list-style-type: none">● Use a less hazardous chemical.● Use a less hazardous way of applying the chemical.● Use less hazardous equipment.
	Separation	<ul style="list-style-type: none">● Prevent exposure by limiting access by people to hazardous areas.● Move chemicals to safer areas.● Use physical barriers.
	Engineering controls	<ul style="list-style-type: none">● Design storage, mixing and handling areas to minimise risks.● Modify equipment with guards, shields etc to prevent exposure.● Adjust sprayers to minimise fine droplets which drift.● Use closed systems for chemical mixing and transfer, and sprayer cabs with chemical filters.● Fit access ladders to sprayers.● Use chemical concentrate containers which are easier to handle.● Use exhaust fans in enclosed areas.● Modifications to equipment should only be carried out by appropriately trained and experienced engineers to ensure any legal obligations are met.
	Work practices	<ul style="list-style-type: none">● Implement work practices and standard operating procedures to make the workplace safer.● Ensure appropriate training, instruction and supervision for those doing the work.● Minimise the amount of chemical mixed up or stored in the workplace.● Keep unauthorised people out.
Least effective	Personal Protection Equipment (PPE)	<ul style="list-style-type: none">● Adhere to label and SDS requirements for the use of PPE.● Ensure PPE is of good quality (meets Australian Design Standards) and is correctly maintained.● Ensure everyone handling chemicals are instructed in the use of the PPE.

Adapted from: Kent J. *Pesticide Management*, Charles Sturt University



How to minimise risks

1 Ensure knowledgeable and skilled personnel

All users must:

- have the correct training and skills for the tasks undertaken
- know how to interpret product labels and SDSs to determine toxicities (signal headings), other possible health effects, symptoms of poisoning and first aid in the event of poisoning
- be aware of legal obligations.

2 Implement safe work practices

Make sure all work practices and procedures are safe.

This includes how:

- chemical products are loaded and unloaded from transport vehicles
- chemicals are measured out and transferred to spray tanks
- contaminated PPE is handled and cleaned
- contaminated pesticide handling equipment and spray rigs are washed down after use
- contaminated rinsate is disposed of.

Good practices include:

- letting someone know that chemicals are being used, where they are using them, what the chemicals are and the expected finish time
- keeping chemicals in original containers in a secure place—do not decant
- providing shower and emergency wash facilities (e.g. eye wash) where the chemicals are used
- providing PPE and training in its correct use
- following **drumMUSTER** pesticide container disposal guidelines

- avoiding exposure through safe handling and personal protection, for example:
 - using PPE as specified on the product label
 - taking extra care opening drums and cans of concentrate
 - taking care when measuring concentrate—use transfer pumps if available
 - avoiding dust when using powder formulations
 - avoiding contact with concentrated formulations
 - using gloves when cleaning blocked nozzles and handling contaminated application equipment and clothing
 - not storing protective clothing in the pesticide store
 - never eating, drinking or smoking while handling farm chemicals
 - washing before going to the toilet
 - washing skin and clothing immediately if any chemical is spilt onto it
 - keeping chemicals away from children
 - observing re-entry times
 - safely disposing of unwanted chemicals
 - showering and laundering clothes at the end of the job.

In the event of suspected poisoning:

- check label and SDS first aid directions
- seek medical attention immediately
- do not drive unless there is **no** alternative
- take a label or SDS.

3 Erect safety signage and provide access to safety documentation and equipment

All people entering or working where chemicals are used must be made aware of the dangers and the safety procedures to be observed. Part of this includes having adequate, clearly displayed signage. This should include:

- **warning signs** on the pesticide store including appropriate Dangerous Goods diamonds (depending on quantities stored)
- **Standard Operating Procedures**
- **emergency procedures**—what to do and who to contact in an emergency
- **location** of PPE, first aid kits, fire extinguishers, SDSs etc.

4 Have an effective reporting procedure

Everyone in the workplace has a responsibility to report any safety concerns or issues. There must be an effective and well understood procedure for this.

Regular workplace inspections and audits of workplace safety are required by WHS legislation.

Any unintended or unexpected effect on animals, humans or the environment, or a lack of efficacy associated with the correct use of a registered product should be reported to the APVMA Adverse Experience Reporting Program website: www.apvma.gov.au/node/69. Accidents may need to be reported to state or territory regulatory authorities, e.g. Workcover.

5 Keep records

As part of managing risks, keep records of:

- risk assessments and audits
- actions taken
- any incidents, accidents and injuries

- health monitoring outcomes and adverse effects of pesticide use
- training and instruction given.

What you should do

- 3.1 Undertake an audit and risk assessment of all work practices, including:
 - a. hazard identification
 - b. assess the level of risk.
- 3.2 Prioritise the things that need to be fixed.
- 3.3 Develop an action plan to manage the risks identified.
- 3.4 Keep records.

Resources to help

To assist you to determine the level of risk and what needs to be done, use the following resources:

- **SprayPASS** templates:
 - Hazard, accident and incident record
 - Pesticide purchase log and risk assessment
 - Spray application job order and risk assessment
- Self-audit checklists for pesticide management practices:
 - Pesticide transport
 - Pesticide storage
 - Pesticide mixing and handling
 - Spray application
 - Clean-up and waste disposal



4 Use chemical products as part of IPM, IWM and IRM

Integrated pest management (IPM), integrated weed management (IWM) and integrated resistance management (IRM) are all terms describing the multipronged approach to managing pests (weeds, insect pests, disease-causing pathogens, and vertebrate pests etc).

This approach integrates biological controls, physical controls, genetics (e.g. resistant varieties) and preventative measures including exclusion and quarantine with the use of pesticides. The aim is to manage pests, so they are no longer causing damage, and to protect the environment and community while maximising the benefits of pesticides and prolonging their useful life by slowing down the development of target pest resistance to the chemical products.

Implementing this approach will greatly assist in managing target pest resistance. In pest populations the development of genetic resistance to pesticides is a major problem.

What you should do

- 4.1 Seek advice from consultants, qualified agronomists and researchers.
- 4.2 Evaluate pest management practices.
- 4.3 Select and apply pesticides in accordance with IPM principles.
- 4.4 Manage resistance in pest populations.

5 Select pesticides carefully — know what you are using

Pesticides are your tools of trade. It is essential that you carefully select the products to use and have a good knowledge of their characteristics because it:


- is necessary for a thorough risk assessment of the product being used
- will help achieve better pest control results
- will assist in the selection and adjustment of application equipment
- will determine the timing of application
- will govern correct mixing and use of adjuvants
- may give a competitive advantage in business.

Make sure those using pesticides understand the information provided on the label and follow the directions to ensure safe and effective use.

Things to consider include:

- a Effectiveness**—does it control the target pest/s? Make sure the product selected will do the job. Do your homework and consult respected agronomists as well as research results and peer experience.
- b Registration status**—use products which have been approved and registered by the APVMA. The registered use information is detailed on the label, for example, the target pests against which it can be used, the situation in which it can be used, and the approved dose rates etc. The label will also detail any restrictions and precautions including if a licence or





training is required before using the product. Products which have been approved and registered by the APVMA will have an Approval Number on the label. Check for Permits which allow specific off-label use.

- c Safety**—what safety precautions are required for its use? Pesticide products will differ in their levels of toxicity, effects on human health and the environment. The product label and SDS will identify any hazards, e.g. toxicity, Dangerous Goods class, Hazardous Substance designation, environmental effects, residues resulting in food safety or market issues, resistance status of target pests, how to deal with fires and spills, and how the product should be stored. The label will also specify safety precautions and the PPE required.
- d Use pattern**—check the label for information on how and when the product is to be used, e.g. post-emergence versus pre-emergence herbicides; translocated versus contact insecticides; preventative versus curative fungicides.
- e Mode of Action (MoA)**—check the label for information on the pesticide's MoA, i.e. how the active constituent affects the target pest physically or biochemically (is the insecticide a nerve poison? Does the herbicide disrupt photosynthesis, and if so, how?). This knowledge will assist in selection of the most appropriate product to use and rotation of products to reduce target pest resistance.
- f Formulation and compatibility**—the formulation is the physical state of the pesticide concentrate as purchased. Is it a powder to be applied as a dust? Is it a powder to be mixed with water to form a suspension to be sprayed on? Is it an oil-

based emulsifiable concentrate to be sprayed on, or is it a water-based solution? What is the concentration of active constituent in the concentrate? What additives are in the concentrate? The formulation will determine:

- application equipment required
 - adjustments and calibration of spray equipment
 - mixing of sprays and compatibility if mixing products together
 - adjuvants required for the target, situation and product
 - the quality of water required
 - equipment cleaning procedures required
 - safety to operators (toxicity, flammability etc)
 - storage requirements
 - waste disposal.
- g Environmental fate**—check the label for warning statements. What happens to the pesticide after it is applied? Will it break down quickly or will it have a long residual life? What effect will it have on non-target organisms, e.g. aquatic life, beneficial insects, honey bees etc?
- h Cost effectiveness**—the APVMA evaluation process ensures that registered products have been thoroughly researched and tested, and will work effectively if used according to the label. Manufacturers and resellers who are members of CropLife Australia and who have Agsafe Accreditation provide end users with a level of assurance and confidence that their products are backed up by good technical support.

- i Market acceptance**—some pesticide products may not be acceptable to markets because of potential residues in produce. Allowable residue levels (MRLs) may differ between markets.
- j Ease of use and application**—what equipment is required for handling and mixing? Does it require specialist application technology, equipment, or set up parameters for that equipment? Is this equipment available?
- k Target pest resistance** —the target pest population may need to be tested for their resistance status and susceptibility to different chemical MoAs. Select pesticide products with a MoA which will be effective on the target pest population. If possible, do not use products with the same MoA repeatedly because this selects for resistance. Rotate between different MoAs and incorporate different non-chemical pest control techniques as part of IPM. A number of RMS have been developed and should be followed.

What you should do

- 5.1 Use the best quality products available.
- 5.2 Make sure that the products purchased are registered by the APVMA for the intended use by locating the APVMA approval number on the container and reading the label.
- 5.3 Check for RMS relevant to the target pests and chemical products to use.
- 5.4 Evaluate pesticide products and the way they are to be used for any hazards and risks by consulting product labels, SDSs, manufacturer technical bulletins and websites.
- 5.5 Document any hazards and risks identified.
- 5.6 Develop an action plan to minimise any risks.

Resources to help

- **SprayPASS template:**
Pesticide purchase log and risk assessment
- 🔗 **CropLife RMS:**
www.croplife.org.au/resources/programs/resistance-management/
- 🔗 **MRLs (Australian and overseas databases):**
www.agriculture.gov.au/ag-farm-food/food/nrs/databases

6 Ensure responsible product purchase


Best practice pesticide product purchase includes:

- a Purchase made by a responsible person**—the person collecting the pesticide needs to know how to transport the containers correctly to safeguard the health and safety of themselves, the community, environment and products themselves. Things to consider include: Dangerous Goods classification (quantities, vehicle placarding, documentation, compatibilities) and container restraint.
- b Purchase from reputable Agsafe Accredited outlets or resellers**—this gives an assurance of responsibility and good advice.
- c Not buying or storing too much**—it is false economy to purchase more than is required. Apart from the added expense, pesticide products will deteriorate over time in storage and may lose their effectiveness.

What you should do

- 6.1 Review your product purchasing practices.
- 6.2 Develop an action plan to improve practices, if required.

Resources to help

-  **Agsafe Accredited outlets:**
www.agsafe.org.au/search-directory

7 Follow label directions

The label is a very important document because it summarises the information applicators need to know about using the product. State and territory legislation may include a legal requirement for users to read the label (or have it read to them) and to follow the directions on the label.

SDSs will have additional information to assist with risk assessments and how to manage emergencies such as spills, fire and poisoning.

What you should do

- 7.1 Ensure up-to-date SDS for each product used and stored are available to all relevant people in the workplace.
- 7.2 Ensure all users know how to interpret product labels and SDSs.
- 7.3 Ensure all users follow label directions.

Resources to help

- Check **AgVet chemical company websites** for registered products, labels and SDSs
-  **APVMA PubCRIS:**
<https://portal.apvma.gov.au/pubcris>
-  **Infopest database of all registered AgVet Chemicals in Australia:**
www.infopest.com.au/



8 Ensure correct transport

Regardless of the quantities of pesticide product transported, there is a legal requirement for safe transport and handling practices to protect people, the environment and the products themselves.

This includes:

- securing containers well to prevent theft or loss in transit
- keeping pesticides separate from the passenger cab: **“Ute it, don’t boot it!”**
- preventing damage to the containers in transit
- avoiding public and sensitive areas
- not transporting foodstuffs and pesticides on the same vehicle
- not decanting product into alternate containers
- carrying a spill kit and PPE in case of a spill or leak
- ensuring the driver knows what to do in the event of an accident, spill or leak.

If transporting products that are classified as Dangerous Goods, check regulatory requirements in your state or territory legislation e.g. Dangerous Goods Act which incorporates the national ADG Code and consult your reseller. Depending on quantities transported, legislated requirements include:

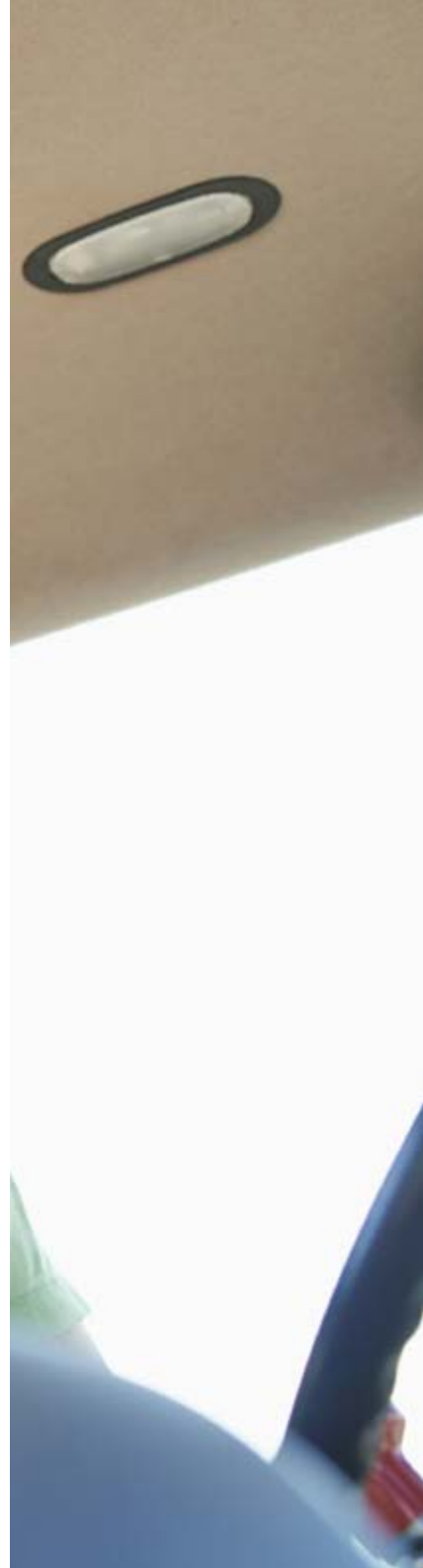
- product segregation of incompatible Dangerous Goods
- vehicle design and maintenance
- placarding of vehicles
- driver licensing
- documentation (shipping documents) to be carried
- hazchem codes for emergencies.

What you should do

- 8.1 Do an audit of pesticide transport practices.
- 8.2 Develop an action plan to ensure safe and legal transportation.

Resources to help

- **Australian Dangerous Goods Code:**
<https://ablis.business.gov.au/service/wa/australian-dangerous-goods-code-adg-code-7th-edition-/17312>
- **State or territory legislation**
- **SprayPASS checklist:** Pesticide transport



9 Ensure correct product storage

When storing pesticides in the workplace ensure protection of people, the environment and the products themselves. The self-audit checklist details design and management practices.

A good, basic pesticide store should:

- be secure and weatherproof
- be well sited away from public and sensitive areas, water courses, animals etc.
- ensure product containers are out of direct sunlight to avoid unnecessary heating and label fading
- have good shelving which does not damage packaging or absorb chemicals
- be well ventilated and well lit
- be fire resistant
- have bunded floor to contain spills
- have the capacity to segregate incompatible products e.g. herbicides separate from insecticides, fungicides, and fertilisers; flammables kept separate in a bunded area
- display hazard warning signs
- have water and emergency washing/shower facilities
- be close to a level mixing site
- be separate from, but near to spill response kit, safety equipment, manifest, SDSs, first aid kit and a phone.

If products stored are classified as Dangerous Goods then—depending on the maximum quantities to be stored—there are legal requirements for:

- chemical store design (e.g. ventilation, bunding, security)
- how products are stored (segregation of incompatible products, e.g. keep flammable liquids separate)
- storage manifests
- emergency plans
- safety signage
- licensing of chemical store if Dangerous Goods quantities exceed exemption limits.

What you should do

- 9.1 Check your state or territory legislation for pesticide storage requirements.
- 9.2 Do an audit of pesticide storage practices.
- 9.3 Decide what you need to do to ensure you meet your obligations and develop an action plan.

Resources to help

- 🔗 **Australian Dangerous Goods Code:**
<https://ablis.business.gov.au/service/wa/australian-dangerous-goods-code-adg-code-7th-edition-/17312>
- **State or territory legislation.**
- **SprayPASS checklist:** Pesticide storage



10 Ensure safe and efficient pesticide application

Undertake good training and skills development

Good spray operators have a thorough understanding of the spray application process, how spray droplets behave and the influences of weather conditions. It is also important that they have an understanding of the pest in relation to the crop or field situation and the characteristics of the application equipment. Knowledge and skills are essential for:

- maximising the effectiveness (efficacy) of the pesticide product
- ensuring safety to the operator and others
- minimising off-target damage through spray and vapour drift, or run-off
- minimising costs of application
- risk management
- good business practice.

It is highly recommended that spray operators undertake high quality, face-to-face **advanced spray application** workshops and complete online training modules to gain the underpinning knowledge and practical skills. To keep up with rapid advances in knowledge and technology on-going professional development is essential.

Consult with or warn those affected by spray operations

Consultation is an important part of safe and efficient spray application.

- Discuss spray operations with clients and neighbours, as appropriate.
- Check for, and be aware of, any issues or sensitive areas.
- Search for any nearby beekeeping activities and notify beekeepers of planned crop protection activities via BeeConnected.

Consultation and cooperation by all growers and spray operators on a catchment-wide basis is highly recommended.

Use job orders

To help prevent misunderstandings and errors, use a written job order to inform spray operators and contractors of the details of each spray job including:

- location
- products to use
- conditions under which application is to occur
- hazards
- sensitive areas at the job site.

Understand the principles of spray application

Pesticide application is a complex process with many variables involved. It is more than just spraying out a pesticide.

Every situation is different, and spraying is nearly always a compromise between what is ideal and what must be done. It is inefficient because there are many losses.

However, efficiency can be greatly improved by understanding and controlling the things that impact on the spray process.

Some of the basics include:

The decision-making process

When spraying out products, the following decisions must be made:

- 1** What is the target pest (the biological target)?
- 2** What is the pesticide?
- 3** Where must the pesticide be placed to be effective, i.e. what is the application target?
- 4** What is the most suitable equipment to achieve this? Consider cost, size, effectiveness, maintenance.
- 5** How should the equipment be set up to give best results?
- 6** What is the best time for application with regard to weather, pest and the situation?
- 7** How to minimise waste through spray missing the target, drift and run-off?
- 8** How should risks be managed?

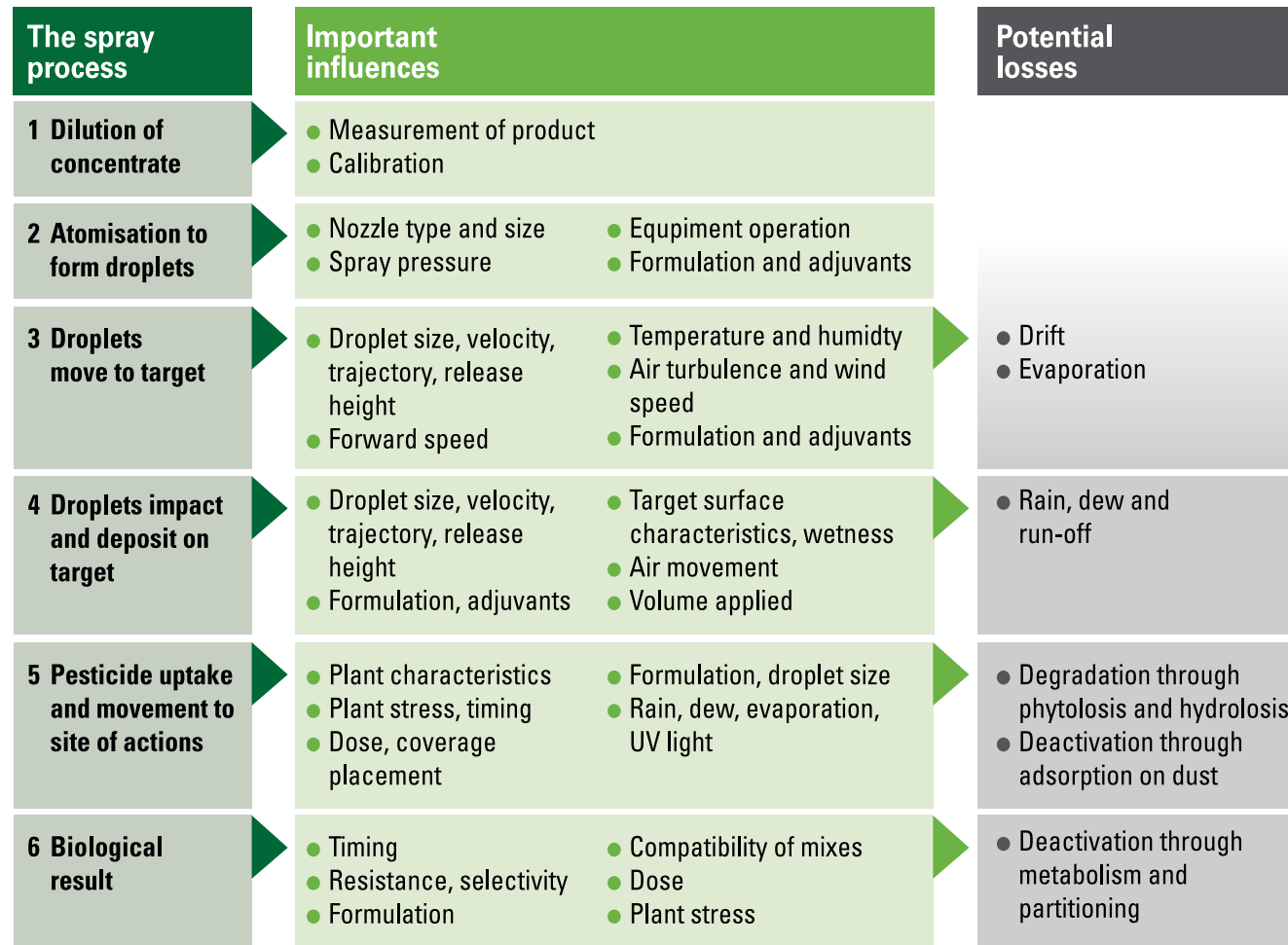
The spray application process and influencing factors

To maximise efficient and effective results, it is important to gain a good practical understanding of:

- the spray application process
- how different sizes and types of spray droplets behave
- how spray droplets are formed and the influence of spray pressures, different spray nozzle types, sizes and nozzle wear
- the interactions between spray volume, droplet type and size to achieve the required target coverage
- the effect of weather (wind speed, temperature, relative humidity, atmospheric stability and surface temperature inversions) on spray droplets and the resulting potential for spray and vapour drift
- how to select different nozzle types and sizes, and spray pressures to produce the droplet sizes (spray quality) and spray volumes best suited to the job, the chemical product, spray target, situation and drift potential.

The spray process and influencing factors

The following figure illustrates the spray process and the many factors involved:



Adapted from: Kent J. *Pesticide Management*, Charles Sturt University



Implement practical steps to improve application

To maximise efficacy and minimise off-target drift it is important to adopt good spray application technology.

Practical steps include:

Using the best quality water available

- Water quality can dramatically influence chemical product efficacy. Dirty water, very hard water (high pH) and water with high levels of dissolved minerals can adversely affect results. Be very careful using bore water, dam water or river water. Rain water is the best. Before use, water may need to be filtered or spray buffers and adjuvants added to the spray mix.
- Test the quality of water if possible.

Using good equipment

- Purchase the best quality application equipment that you can to meet your needs. Good service back up is important.
- Ensure application equipment meets expected standards and can be set up to deliver the results required.

Maintaining equipment in good condition

Maintain all equipment to ensure:

- it is clean
- there are no leaks
- pumps, spray controllers and pressure gauges etc are working correctly and accurately
- nozzle wear is monitored and nozzles are replaced when worn.

Having a spray plan for each job

Before spraying, plan what you are going to do and how you are going to do it. The spray plan should include:

- 1** target pest/s
- 2** product/s to be applied, along with any adjuvants
- 3** label application rates and requirements for these products
- 4** a sketch of the awareness zone (spray zone and surrounding area) identifying everything that may be affected by the spray job
- 5** expected weather conditions—temperature, humidity, wind direction, wind speed, atmospheric stability, plus forecast of any change in conditions, and under what conditions spraying is to cease
- 6** a risk assessment of the job (sensitive areas, hazards, equipment, chemicals, weather etc)
- 7** spray quality required for the pesticide, pest, product efficacy and drift control
- 8** nozzles and spray pressures required to deliver the desired spray quality
- 9** forward speed (maximum and minimum) to deliver the desired spray application volumes.

Adjusting spray equipment for the job as per the spray plan

- Adjust spray equipment to suit the situation (chemical product, spray target, weather conditions, off-target damage risk).
- Balance nozzle type and size, spray pressure and forward speed to give the best droplet size (spray quality) and spray volume (water plus chemical) for the situation, noting that droplet size may be prescribed by law on the product label. Different nozzles and pressures may be needed for different situations.





- For boom sprayers, adjust boom heights to give uniform spray coverage across the boom while minimising droplet drift potential.
- For air assist sprayers, adjust air volume, velocity and air direction to accurately direct droplets into the target canopy without wastage or drift.
- Adjust forward speed of the sprayer to ensure desired spray volumes are achieved without creating a drift hazard or inconsistent coverage effects around the sprayer.

Maintaining accurate equipment calibration

- Monitor sprayer outputs and calibrate regularly. Check for worn nozzles.
- Do a manual calibration to check accuracy of spray controllers.

Ensuring correct timing of application

- Timing of application is critical to maximise efficacy while minimising possible adverse consequences. Things to consider include:
 - target pest susceptibility
 - pesticide use pattern
 - weather conditions (wind speed and direction, relative humidity and atmospheric stability especially temperature inversions)
 - situation e.g. surroundings such as sensitive areas and crops, public places, animals, insects (grazing stock, bees).

Minimising spray drift (droplets plus vapour) and run-off

Spray applicators can unknowingly cause major off-target damage as a result of spray drift, vapour drift and run-off of herbicides, insecticides and fungicides. The drift of fine droplets or volatile vapour of herbicides is a major problem—it can travel many tens of kilometres! Operators are legally liable for the cost of this damage. This damage can be a result of:

- spraying inappropriate products e.g. highly volatile formulations and products which should not be sprayed near sensitive areas (e.g. bees on flowering crops, waterways, public areas) or susceptible crops
- spraying under inappropriate weather conditions (wind direction and speed, temperature, humidity, atmospheric stability—especially surface temperature inversions)
- inappropriate spray rig set up (nozzle type and size, spray pressures, spray volumes, travel speed, boom height)
- using inappropriate spray adjuvants resulting in more fine droplets which drift
- spray operators not conducting a risk assessment of the spray situation and not developing a spray plan to ensure good product efficacy while minimising off-target damage.

Off-target damage **MUST** be minimised.



For each spray job the following steps should be taken to manage spray drift.

Steps to manage drift

Select low hazard products

- If possible, choose products of low volatility (less chance of vapour drift) that will not harm surrounding sensitive areas.

Read the product label

- Check label directions for drift reduction information.

Identify susceptible areas in the awareness zone

- Identify sensitive crops, public places, waterways etc that may be impacted in the surrounding area (may be a whole catchment area).
- Do a risk assessment.

Communicate with those who may be affected

- Notification may be required by legislation.
- Have a notification plan i.e. who will be notified and when.
- Keep records of consultations.

Spray only when the spray window of conditions is suitable

Check the forecast and current conditions. Monitor conditions before and during spraying.

a Wind direction:

- make sure wind is blowing away from susceptible areas
- work across and into the wind
- be alert to changes during the job.

b Wind speed (for large area spraying):

- ideal is steady breeze of 4–15 km/hr
- not dead calm, light variable winds, or strong winds.

c Temperature: The ideal temperature is 10–30°C with some humidity. If < 10°C spraying is inadvisable due to frost, dew, inactive plants and insects. If > 30°C then there will be stressed plants, a stressed operator, possible phytotoxicity and high evaporation and volatilisation of sprays. Avoid temperatures > 35°C. It is the temperature at the spray target that is critical!

d Humidity: Low humidity results in high evaporation. High humidity can result in reduced evaporation which extends droplet life.

e Delta T: measures the interaction between temperature and humidity measured by a wet and dry bulb thermometer. The Delta T is the temperature difference between the dry bulb (air temperature) and the wet bulb (cooler due to the evaporation effect). Hot dry days result in a large Delta T. The ideal Delta T is 2–8°C. Avoid spraying in low relative humidity when the Delta T exceeds 10°C.

f Atmospheric stability: Avoid unstable conditions when there is a great deal of vertical movement of air which can carry spray drift upwards. **Do NOT** spray if there is a ground level temperature inversion or cold air drainage.



Steps to manage drift

Control droplet size	Unless specifically stated otherwise on the label instructions, use the largest spray droplet size (coarse spray quality) which will balance product efficacy with minimising spray drift. Droplet size is controlled by nozzle type, nozzle size, spray pressure and adjuvants (oils and antievaporants). Some surfactants result in smaller droplet size.
Control droplet trajectory	<ul style="list-style-type: none">● Minimise the distance droplets have to travel while ensuring uniform coverage across the spray swath (e.g. set boom height to achieve double overlap of sprays).● Direct spray (and air) to the target.
Avoid high spraying speeds	<ul style="list-style-type: none">● Keep forward speeds low especially when there is limited vegetative ground cover.
Modify sprayer	<ul style="list-style-type: none">● Use well designed hoods, shields and covers to trap spray droplets.
Leave buffer zones	<ul style="list-style-type: none">● Buffer zones are no-spray areas between a sprayed area and sensitive downwind areas.● Labels may specify a legally binding buffer zone.● Spray drift barriers of vegetation and wind breaks (not solid barriers) may be effective as buffers.
Manage risks	<ul style="list-style-type: none">● Have a spray plan for each job detailing risk management and operational actions to take.● Keep spray plans as a record.

Minimising waste

- Ensure accurate calibration and calculations so that there is no spray mix left over after a job.
- Make sure the spray controller is set up correctly and is accurate.
- Adjust spray volumes so that when spraying foliage there is no excess run-off of spray onto the ground.
- Direct spray (and air if using an air assist sprayer) to minimise spray missing target foliage.

Decontaminating equipment and operators

- Application and handling equipment must be washed down to remove chemical residue after use.

- **Do not** take unwashed equipment and spray rigs along public roads or into other public areas.
- Wash water must be disposed of safely to avoid risks to people and the environment.
- All PPE used must be decontaminated after use.
- Operators must shower and put on clean clothes after spraying.

Monitoring results

- If possible, check the results of spraying to see if it has worked effectively without off-target damage.
- Consider how application practices may be improved to give the best results possible.

What you should do

- 10.1 Undertake training and skills development through certified providers.
- 10.2 Consult with or advise those affected by spray operations.
- 10.3 Use job orders to communicate with spray operators and contractors.
- 10.4 Understand the principles of spray application and the decision-making process.
- 10.5 Implement practical steps to improve application:
 - follow label directions.
 - use the best quality water available
 - use high quality, well maintained equipment
 - maintain equipment in good condition
 - develop a spray plan for each job
 - adjust spray equipment for the job as per the spray plan
 - maintain accurate equipment calibration
 - ensure correct timing of application
 - minimise spray and vapour drift, and run-off
 - minimise waste
 - wash and/or rinse equipment after use to remove residue
 - ensure operators wash and/or shower after spraying and handling pesticides
 - monitor results.
- 10.6 Undertake an audit of your application equipment and work practices.
- 10.7 Identify and prioritise gaps to fix.
- 10.8 Develop an action plan to fix those things which need to be improved.
- 10.9 Undertake a risk assessment for each spray application job. Document risks and actions taken.
- 10.10 Complete and keep spray application records.

Resources to help

GRDC resources

- 🔗 **Spray Application Manual:**
<https://grdc.com.au/resources-and-publications/grownotes/technical-manuals/spray-application-manuals>
- 🔗 **Maintaining efficacy with larger droplets – new 2,4-D application requirements October 2018:**
<https://grdc.com.au/resources-and-publications/all-publications/factsheets/2018/10/maintaining-efficacy-with-larger-droplets>

SprayPASS

- **Spray application job order and risk assessment** template
- **Spray application** checklist

Other resources

- 🔗 **CropLife MyAGCHEMUse:**
www.croplife.org.au/resources/programs/myagchemuse/
- 🔗 **NuFarm SprayWise** technical information: www2.nufarm.com/au/campaign-page/
- Consultants, manufacturer technical bulletins and websites
- Advanced spray application workshops, professional development workshops, spray information sessions (dye nights), seminars etc



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AgSAFE
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MUSTER

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drumMUSTER.org.au
1800 008 707

11 Safely dispose of waste

All waste must be disposed of safely. Waste includes:

- a** unwanted chemical concentrate—may be disposed of through ChemClear
- b** triple-rinsed containers—these may be disposed of through **drumMUSTER**
- c** waste dilute pesticide after washing down equipment and spray rigs—this is best disposed of in the area sprayed or at a designated wash down bay with a biopit or evaporation pond.

Waste can be minimised by:

- purchasing only those quantities required
- using returnable/refillable containers where possible
- accurate calibration of equipment
- accurate mixing of sprays.

What you should do

- 11.1 Do an audit of your waste management and disposal practices.
- 11.2 Check what you can and can't do regarding waste disposal in your local area.
- 11.3 Develop an action plan to meet best practice and legal responsibilities.

Resources to help

- **ChemClear®**: www.chemclear.org.au/
- **drumMUSTER**: www.drummuster.org.au/
- **SprayPASS** checklist:
Clean up and waste disposal

12 Keep records

There are many reasons for keeping records of chemical management practices and use.

- 1** Records are required by WHS legislation, state and territory control-of-use legislation and APVMA label instructions.
- 2** Records are essential for QA programs and produce marketing.
- 3** Good records are the only way to substantiate actions to show 'due diligence' (that you are trying to do the right thing) in the event of an incident or litigation.
- 4** Records are good business practice and help with planning.
- 5** Records assist with the identification of errors that have created failures.

Keeping records

Check for how long you must keep records in your state or territory. Some records **MUST** be kept, other records **SHOULD** be kept.

Records you **MUST** keep:

- chemical application log/spray diary
- chemical store manifests (register of products)
- risk assessments and actions (annual or when things change)
- records of training
- health monitoring if there is an exposure risk from organophosphates
- accidents and incidents.

Records which **SHOULD** also be kept:

- spray plans
- paddock/area treatment records.
- job orders (instructions for application jobs)
- chemical store stock control
- notification and consultation carried out regarding operations.

What you should do

- 12.1 Review your record keeping system to ensure it:
 - a. complies with legal requirements
 - b. assists with pesticide management and business operations.
- 12.2 Develop an action plan to fix gaps and improve record keeping.

Resources to help

- There are a number of commercially available record keeping systems
- **SprayPASS checklist:** Recordkeeping
- **SprayPASS** recordkeeping templates

13 Monitor results

If possible, monitor the effectiveness of spray application jobs. Has the pesticide worked? Have there been any issues resulting from the job? How can practices be improved for next time?

What you should do

- 13.1 Keep notes of spray outcomes to assist with future decision-making.

14 Have a PMP for your business

An overall Pesticide Management Plan (PMP) documents all chemical management policies and procedures. It is developed through a systematic audit of practices and decisions on how these can be improved. A PMP does not need to be complicated, but it should be a living document.

A PMP:

- may be required of contractors
- demonstrates implementation of best practice
- should be available in the workplace to inform all workers
- can be used as part of induction training.

Components of a PMP:

- 1 Chemical management policies and scope (what does it cover).
- 2 Delegations of responsibilities and roles of personnel (who is responsible for what?).
- 3 Training requirements—who? Level of training required? Workplace induction?
- 4 Risk assessments of each product and how it is used.
- 5 Risk assessments of practices.

- 6 Standard Operating Procedures (display and ensure all persons are aware of them), e.g.:
 - a purchases of chemical products—who? how?
 - b safety—what is required?
 - c transport—who? how?
 - d handling—how?
 - e storage—how? where?
 - f application and equipment use—who? how?
 - g disposal of waste drums, and dilute and concentrate chemical—how? where?
- 7 All required records—have a systematic record keeping system.
- 8 Emergency plan. What to do in an emergency (poisoning, spill, fire) e.g. who to notify and how to notify them? Where is the evacuation point? Where are first aid kits and fire extinguishers?

What you should do

- 14.1 Compile all checklists and records as the basis of a PMP for your workplace.
- 14.2 Base the PMP on these best practice guidelines. Involve key personnel.
- 14.3 Keep the PMP up-to-date. Review it annually.





15 Obtain good advice and information

All spray management and application practices should be underpinned by high quality expert advice backed by science. On-going professional development of knowledge and skills is essential to keep up-to-date with rapidly advancing technology and issues. Such information can be gained by attending refresher training and advanced spray application workshops, consulting experts, online research, reading technical bulletins and attendance at industry field days etc.

Networking with like-minded peers and skilled industry personnel, and membership of relevant industry associations (e.g. Australian Groundsprayers Association) can be very beneficial.

What you should do

- 15.1 Consult recognised industry experts.
- 15.2 Undertake appropriate quality training and on-going professional development of knowledge and skills.
- 15.3 Access online information and resources.

Resources to help

CropLife stewardship resources

- 🔗 **MyAgCHEMUSE Best Practice Reference Guide for Spray Drift management** a one-stop-resource for farmers, spray contractors and environmental land managers to help them use crop protection products safely and effectively. www.croplife.org.au/resources/programs/myagchemuse/

Resources to help

- 🔗 **BeeConnected** a nation-wide, user-driven smart-phone app that enables collaboration between beekeepers, farmers and spray contractors to facilitate best-practice pollinator protection www.croplife.org.au/resources/programs/beeconnected

GRDC resources and publications

- 🔗 **GROWNOTES: Spray Application Manual** a highly recommended, up-to-date, easy-to-read, scientifically-based set of modules. <https://grdc.com.au/resources-and-publications/grownotes/technical-manuals/spray-application-manual>
- 🔗 **Practical tips for spraying** <https://grdc.com.au/resources-and-publications/all-publications/factsheets/2014/08/practical-tips-for-spraying>
- 🔗 **Ground Cover Issue 122 – Spray application** <https://grdc.com.au/resources-and-publications/groundcover/ground-cover-supplements/ground-cover-issue-122-spray-application>
- 🔗 **Ground Cover Issue 141 – Spray drift management** <https://groundcover.grdc.com.au/story/6366251/highlights-reel-from-the-spray-drift-supplement-gallery>

Training workshops

- 🔗 **AgSkilled** advanced spray application and risk management workshops www.tocal.nsw.edu.au/courses/agskilled
- **Spray Safe and Save.** Craig Day provides training in advanced spray application and chemical management, and advice on setting up spray rigs





Resources to help

Agricultural chemical user training and accreditation

-  **SmartTrain**
www.tocal.nsw.edu.au/courses/smarttrain-chemical-safety-and-training
-  **ChemCert**
www.chemcert.com.au
-  **AusChem**
www.auschemtraining.com.au
-  **Agsafe** online and in-house reseller training and accreditation and premises accreditation
www.agsafe.org.au/training/training

Industry organisations

-  **Australian Groundsprayers Association** and state branches
www.australiangroundsprayers.com.au
e secretary@australiangroundsprayers.com.au
-  **NuFarm Spraywise Decisions**
www.spraywisedecisions.com.au
-  **CottonMap** cotton awareness mapping
www.cottonmap.com.au
-  **Queensland Horticulture Industry's Growcom Hort360** is a best practice management program
www.hort360.com.au
-  **Graincare on-farm QA program**
www.graincare.com.au

16 Seek independent certification

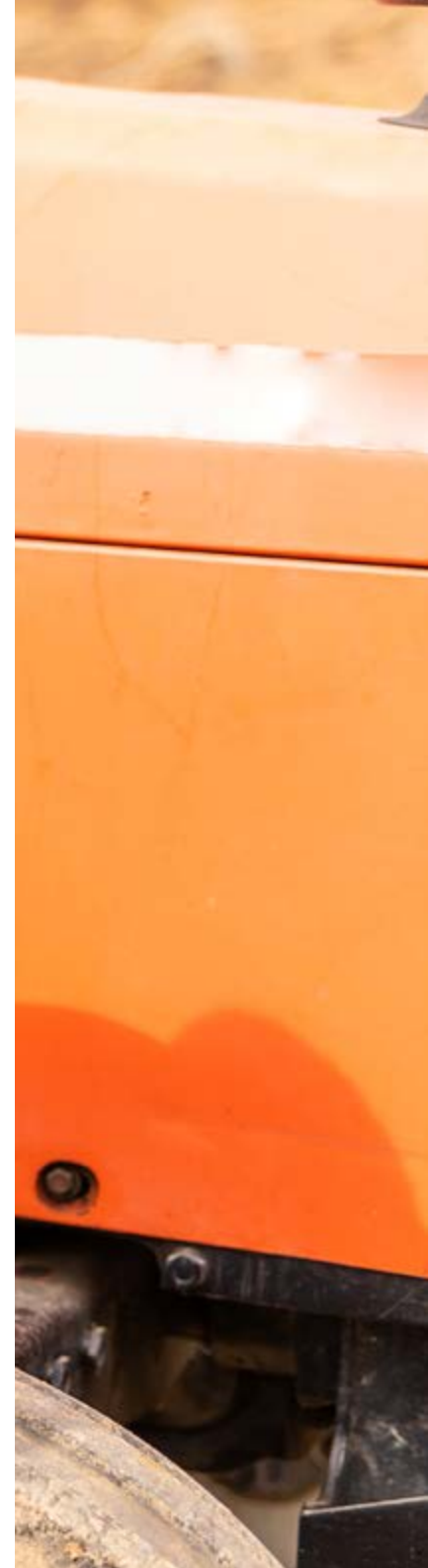
There is industry accreditation for basic agricultural chemical use (e.g. ChemCert, SmartTrain, AusChem etc). Higher level industry certification for groundspray operators and businesses—SprayPASS (www.spraypass.org.au)—is being developed by the Australian Groundsprayers Association.

Independent certification will:

- provide a structured framework for the implementation of best practice
- allow for unbiased review of practices and excellent feedback
- demonstrate and reward the implementation of best practice. It lets everyone know how well you manage chemicals in your workplace and can be used to promote your business
- assist with the marketing of produce or services e.g. preferred supplier status or higher returns.

What you should do











- 16.1 Identify appropriate industry/market QA or BMP programs for your industry sector. Check their pesticide management requirements.
- 16.2 Undertake a self-audit of your workplace and work practices.
- 16.3 Seek independent peer review of your work practices and PMP.
- 16.4 Join the Australian Groundsprayers Association and support its endeavours to implement SprayPASS as an independent industry certification program.
- 16.5 Comply with the SprayPASS *Code of Conduct* provisions.



Appendix: SprayPASS resources

SprayPASS is the Australian Groundsprayers Association's national stewardship program promoting and supporting safe and sustainable application of pesticides in Australia. SprayPASS provides professional development and certification for ground sprayers.

Use the following SprayPASS resources and templates to support your implementation of best practice:

-  **Staff induction and training record**
https://spraypass.org.au/resources/Documents/1.%20SP_Staff%20induction%20and%20training%20record.pdf
-  **Hazard, accident and incident record**
https://spraypass.org.au/resources/Documents/2.%20SP_Hazard,%20accident,%20incident%20record.pdf
-  **Pesticide purchase log and risk assessment**
https://spraypass.org.au/resources/Documents/3.%20SP_Pesticide%20purchase%20log%20and%20risk%20assessment.pdf
-  **Checklist: Pesticide storage**
https://spraypass.org.au/resources/Documents/4.%20SP_Pesticide%20storage.pdf
-  **Checklist: Pesticide transport**
https://spraypass.org.au/resources/Documents/5.%20SP_Pesticide%20transport.pdf
-  **Checklist: Pesticide mixing and handling**
https://spraypass.org.au/resources/Documents/6.%20SP_Pesticide%20mixing%20and%20handling.pdf
-  **Spray application job order + risk assessment record**
https://spraypass.org.au/resources/Documents/7.%20SP_Spray%20app%20job%20order%20and%20risk%20assessment%20record.pdf
-  **Checklist: Spray application**
https://spraypass.org.au/resources/Documents/8.%20SP_Spray%20application%20checklist.pdf
-  **Checklist: Clean-up + waste disposal**
https://spraypass.org.au/resources/Documents/9.%20SP_Clean%20up%20and%20waste%20disposal.pdf
-  **Checklist: Record keeping**
https://spraypass.org.au/resources/Documents/10.%20SP_Recordkeeping.pdf





Abbreviations and acronyms

Acronym	Full title/explanation
ACCAs	Agricultural Chemical Control Areas
APVMA	Australian Pesticides and Veterinary Medicines Authority
AQF	Australian Qualifications Framework
BMP	Best management practice
IPM	Integrated pest management
IRM	Integrated resistance management
IWM	Integrated weed management
MRL	Maximum Residue Limit
OHS	Occupational Health and Safety
PMP	Pesticide Management Plan
PPE	Personal protection equipment
PubCRIS	Public Chemical Registration Information System
QA	Quality Assurance
RMS	Resistance Management Strategies
SDS	Safety Data Sheets
WHS	Worker Health and Safety



