

AHC - Agriculture, Horticulture and Conservation
and Land Management

AHC20416 - Certificate II in Horticulture

Unit

AHCCHM201

Apply chemicals under supervision

*This is not to be used for training purposes.
SAMPLE ONLY*

Student/Trainee Manual



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STUDENT/TRAINEE DETAILS

Student/Trainee Name

Student/Trainee Email

Teacher / Trainer Name

School / Institution / Training Organisation / Employer

SAMPLE SAMPLE

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INTRODUCTION

This manual was developed to provide training content that addresses the specific 'Unit of Competency' as outlined in the following pages.

We encourage you the student / trainee to take your time when reviewing this content and seek any assistance from your teacher/trainer should you have difficulty in understanding the information.

LEARNING ACTIVITIES

Also included in this Student / Trainee manual are a series of Learning Activities.

The learning activities in the student and/or trainee manuals are 'Form Enabled' so that if the resources are delivered online, the activities can be entered in using the computer keyboard.

Each learning activity is identified with the following icon.

A blue rounded rectangular button with the text "Learning Activity" in white, bold, sans-serif font.

Learning activities come in the following forms.

- ☆ Questions
- ☆ Research
- ☆ Tasks
- ☆ Interviews

INTRODUCTION—CONT'D

Questions

Questions generally relate to the information presented on previous pages. Questions will also include multiple choice questions, 'Yes' and 'No' questions and/or 'True' and 'False' questions.

Research

This type of learning activity requires you to locate information by using research methods. The research methods could include:

- ☆ Internet searches
- ☆ Reading textbooks and other reference sources
- ☆ Location visits

Tasks

This learning activity type requires you to actually do something and some examples of tasks may include:

- ☆ Creating reports
- ☆ Visiting locations such as workplaces
- ☆ Performing an activity in a workplace

Interviews

This learning activity type would require you to interview person(s) in an actual workplace environment or a person(s) who are experienced in the industry sector which you currently are undergoing training.

You will be made aware of the type of learning activity by noting the learning activity type displayed under the learning activity icon.

INTRODUCTION—CONT'D

USING THE FORM ENABLED FEATURE

If you are using this manual online, you can fill in some of the answers using your computer keyboard.

Your teacher or trainer will provide you with the information and instructions on how to use the 'Form Enabled' feature in this manual.

SELF ASSESSMENT

At the end of each manual is a series of questions that you should review and answer either Yes or No.

The term 'Self Assessment' means you will ask yourself these questions and therefore is no need to provide the answers to the self assessment questions to your teacher or trainer, unless they require you to do so.

This self assessment is to ensure you have reviewed and understood the information that was presented in this manual.

If you answered 'No' to any of these questions or are unsure of your understanding in any of the topics reviewed, you are encouraged to go back and review the information again and/or seek the assistance of your teacher or trainer.

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UNIT OF COMPETENCY OVERVIEW

The following pages are extracts from Training.gov.au website and outlines this specific 'Unit of Competency' including the 'Elements' and the 'Performance Criteria'. The content within this manual has been developed to address this unit.

AHCCHM201- APPLY CHEMICALS UNDER SUPERVISION

ELEMENT	PERFORMANCE CRITERIA
1. Prepare to work	1.1 Confirm the activity to be undertaken with supervisor, including identifying potential hazards and risks 1.2 Take steps to control risks as directed 1.3 Confirm tools and equipment to be used with supervisor 1.4 Wear appropriate personal protective equipment as per label instructions and ensure correct fit
2. Check application equipment	2.1 Carry out pre-operational checks of application equipment and identify and replace any damaged or worn components or report to supervisor 2.2 Prepare application equipment for use
3. Prepare application equipment	3.1 Follow all label instructions for the chemical or substance being used 3.2 Use appropriate mixing equipment 3.3 Check that output of application equipment is correct 3.4 Measure, mix and load chemical mix or substances 3.5 Confirm instructions from chemical label and supervisor in the event of a spill 3.6 Check that output of application equipment is correct and in accordance with application/spray plan.
4. Apply chemicals	4.1 Assess and record meteorological conditions and forecasts prior to and during application where relevant 4.2 Cease application if conditions become unsuitable 4.3 Apply chemical ensuring minimal risk to others and the environment 4.4 Minimise risks to others, product integrity and the environment prior to and during application

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ELEMENT	PERFORMANCE CRITERIA
5. Transport and handle chemicals	5.1 Confirm precautions for the transport and handling of chemicals with supervisor 5.2 Transport and handle chemicals in accordance with relevant commonwealth, state and territory chemical legislation
6. Finalise work	6.1 Clean and store personal protective equipment and application equipment in accordance with manufacturers and work health and safety requirements 6.2 Dispose of excess chemicals and clean containers in accordance with label instructions and regulatory requirements 6.3 Complete incident reports as required 6.4 Complete application records 6.5 Store unused chemical and products in appropriate location 6.6 Adhere to all re-entry requirements

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Section One

Prepare to Work

APPLY CHEMICALS UNDER SUPERVISION

SECTION ONE – PREPARE TO WORK

INTRODUCTION

This unit of competency describes the skills and knowledge required to apply chemicals using workplace specific application equipment under supervision by using handheld or small powered equipment. In addition, workers engaged in this activity need to understand personal protective equipment required when using chemicals, how to measure, mix, transport, handle, store and dispose of chemicals, as well as comply with workplace health and safety (WHS), chemical labels and Material Safety Data Sheets (MSDSs) requirements.

Chemicals are part of everyday life and are used widely to control insect, bacteria, fungal pests and weeds. Examples include the use of chemicals and herbicides to control weeds in the horticultural context, as well as pesticides to control plant pest and diseases.

Chemicals are hazardous substances and it is important to take care when using any chemical product. The most important aspect of chemical use is to read the label, to not only ensure that it is the correct chemical for the required use but to know what Personal Protective Equipment is required, as well as to know and understand the safety precautions to follow.

Horticultural enterprises are regulated by different quality assurance (QA) systems for their businesses. Some of these QA systems include Codex HACCP, the SQF Code, Freshcare, GlobalG.A.P. and Woolworths Quality Assurance Standard (WQA). A critical aspect of QA is the on-farm management of horticultural chemicals. Prescriptive QA systems require evidence of training of operators, calibration of application equipment, correct procedures for chemical storage, handling and appropriate disposal of empty containers, and accurate records of chemical applications. Horticultural businesses have samples of products tested for chemical residues every year. These test results are observed when the business receives its annual independent food safety audit. Testing for microbial contaminants is also conducted, particularly for higher risk products. Further residue testing is undertaken by the National Residue Survey. Five horticulture industries participate in the NRS residue monitoring program; 1) pome fruit (apple/pears) 2) macadamias 3) almonds 4) onions 5) citrus. All samples receive a multi-residue screen tailored to the specific product. Each screen has been developed in consultation with the relevant industry body to ensure the chemicals in the screen represent the chemicals being used on the crop, and to meet international market requirements.

Clearly then, it is evident that this competency regarding application of chemicals is a highly important component of maintaining high quality Horticultural products.

SECTION LEARNING OBJECTIVES

At the completion of this section you will learn information relating to:

- ☆ Confirming the activity to be undertaken with supervisor, including identifying potential hazards and risks
- ☆ Taking steps to control risks as directed
- ☆ Confirming tools and equipment to be used with supervisor
- ☆ Wearing appropriate personal protective equipment as per label instructions and ensuring correct fit



CONFIRM THE ACTIVITY TO BE UNDERTAKEN WITH SUPERVISOR, INCLUDING IDENTIFYING POTENTIAL HAZARDS AND RISKS

The use of herbicides and pesticides in the Horticultural industry provide crop protection and their use is designed to improve overall production quality for man and plants. With pests such as plant diseases, insects, and weeds decreasing the already inadequate food supply in the world, a need for some means of controlling these pests in order to improve the quality and quantity of horticultural crops produced today is required.

Chemicals are often used as the front line of defence against destructive plant diseases, insects, and weeds. When properly used, they can minimise crop losses and pest competition. Knowledge of the pest to control, availability, chemical characteristics and capabilities, application techniques as well as safety concerns are all an integral part of the planning process of a conscientious farmer.



TYPES OF PESTICIDES

Insecticides—Chemical nature and mode of action are two methods of categorising insect control products. A combination of the two methods can be most accurately used to describe an insecticide.

Chemical nature:

- ☆ Plant derived organic insecticides come from plant parts such as leaves or roots. These insecticides can be used against several pests
- ☆ Living microorganisms such as viruses, bacteria, and fungi are effective as insecticides and are selective in the organisms which they kill
- ☆ Inorganic insecticides are those made from minerals. They include sulfur, boron, and diatomaceous earth
- ☆ Synthetic organic insecticides are manmade compounds. They contain carbon, hydrogen, and other elements such as nitrogen, phosphorus, or chlorine

Chemical activity:

- ☆ Contact poisons kill insects on contact
- ☆ Stomach poisons kill the insect after they are ingested by the pest
- ☆ Systemics are taken in by the plant and the plant juices contain the poison which kills the insect as it feeds
- ☆ Application Time: Insecticides are applied preplant, at planting and during the season when the insect populations are high enough to require treatment. Treatments should be made only after scouting the field and determining that an insect population is sufficiently high enough to cause economic crop damage.



Herbicides—Herbicides are products which control weeds. They are categorised by selectivity and mode of action.

Selectivity:

- ☆ Nonselective herbicides are sometimes called soil sterilants. They are often used around buildings or fences to control undesirable weeds or brush. Some nonselective herbicides are extremely toxic to trees and other non-target plants which might be growing in the vicinity of the treatment. Many of these products are persistent and will remain in the soil for several years
- ☆ Selective herbicides are used in and around vegetables. They are divided into pre-plant, pre-emergent and post-emergent herbicides. Pre-plant herbicides may be applied before seeding the crop, some of which require incorporation. Pre-emergent herbicides may be applied before seeding the crop, pre-emergent of the crop or pre-emergent of the weeds and the crop. Post-emergent herbicides are applied following emergence of the crop or weeds or both. Selectivity of some herbicides is accomplished by placement, rather than chemical selectivity

Mode of Action:

- ☆ Contact herbicides kill the plant tissue that it contacts.
- ☆ Systemic or translocated herbicides are moved within the plant away from the site of application and may affect the plant by interfering with normal growth.
- ☆ Growth regulators or harvest aid materials control or modify plant growth, stimulate formation of female flowers, or induce uniform ripening.



PESTICIDE APPLICATION

The success of a pesticide application depends on the pesticide and proper application. Improperly applied pesticides can result in ineffective control, plant injury or excessive pesticide residues. Maximum coverage of the target area is essential to the control of plant pests. Every effort should be made to insure that applications are correct and safe.

There are several types of chemical sprayers which include:

- ☆ Hand held
- ☆ Motorised backpack types
- ☆ Boom types
- ☆ Row crop sprayers
- ☆ Aerial applications



Hand held portable sprayers come in a variety of sizes. However, calibrating these types of sprayers can be difficult because pressure and rate of application are difficult to control. Most of the handheld sprayers are constructed of plastic or stainless steel

Backpack mist blower sprayers use a small motor to generate wind which acts as a carrier for the pesticide solution. This type of sprayer is excellent for applying fungicides and insecticides to small acreage. The calibration is difficult due to variations in speed and flow rate. Some of the newer sprayers also have a small motor to maintain pressure and agitation

Boom type sprayers use pumps to develop a constant pressure as well as a static boom equipped with atomisers that break up and direct the spray solution. Sprayers may be mounted on a tractor chassis or are self propelled. Tractor PTO, hydraulics, or independent power sources operate the pump. Basic sprayer components consist of tank, pump, pressure gauge, regulator, agitator, hoses, valves, fittings and nozzles. Nozzles are mounted on the boom which is suspended over the row

Row crop air sprayers use a blower which generates air that acts as part of the carrier for the pesticide. The spray solution is blown across several rows. Initially sprayers used a two way discharge. Cost of equipment and inability to spray during periods of moderate to high winds are two limiting aspects to the use of this sprayer type. Swath width must not exceed the capabilities of the sprayer and existing weather conditions

Aerial application involves the use of fixed wing and helicopters for the application of pesticides. Size of fields and their location often restrict the efficient use of aerial application.



HAZARDS AND RISKS IN USING CHEMICALS

A hazard is anything in the workplace that has the potential to harm people. Hazards can include objects in the workplace, such as machinery or dangerous chemicals.

Other hazards relate to the way work is done. For instance, hazards on a production line could include manual handling, excessive noise and fatigue caused by the pace of work.

A risk is the impact that the hazard may have in terms of workplace health and safety in the workplace activity.

There are three steps used to manage health and safety at work:

- ☆ **Spot the Hazard (Hazard Identification)** - A hazard is anything that could hurt you or someone else
- ☆ **Assess the Risk (Risk Assessment)** - Assessing the risk means working out how likely it is that a hazard will harm someone and how serious the harm could be
- ☆ **Make the Changes (Risk Control)** - Your workplace supervisor will most probably put in place one of the following as a risk control measure:
 - * **Elimination** - Sometimes hazards - equipment, substances or work practices - can be avoided entirely
 - * **Substitution** - Sometimes a less hazardous thing, substance or work practice can be used
 - * **Isolation** - Separate the hazard from people, by marking the hazardous area, fitting screens or putting up safety barriers
 - * **Safeguards** - Safeguards can be added by modifying tools or equipment, or fitting guards to machinery. These must never be removed or disabled by workers using the equipment
 - * **Instructing workers in the safest way to do something** - This means developing and enforcing safe work procedures
 - * **Using personal protective equipment and clothing (PPE)** - If risks remain after the options have been tried, it may be necessary to use PPE. PPE can protect you from hazards associated with jobs, such as handling chemicals or working in a noisy environment



CHEMICAL HAZARDS AND RISKS

Chemical hazards include:

- ☆ **Health hazards** – These are properties of a chemical that have the potential to cause adverse health effects. Exposure usually occurs through inhalation, skin contact or ingestion. Adverse health effects can be acute (short term) or chronic (long term). Typical acute health effects include headaches, nausea or vomiting and skin corrosion, while chronic health effects include asthma, dermatitis, nerve damage or cancer.
- ☆ **Physicochemical hazards** – These are physical or chemical properties of the substance that pose risks to workers other than health risks, as they do not occur as a consequence of the biological interaction of the chemical with people. They arise through inappropriate handling or use and can often result in injury to people and/or damage to property as a result of the intrinsic physical hazard. Examples of physicochemical hazards include flammable, corrosive, explosive, chemically reactive and oxidising chemicals. Many chemicals have both health and physicochemical hazards.

HAZARD IDENTIFICATION CHECKLIST

A hazard identification checklist is an essential component of pre use chemical planning- the use of a checklist allows workers and Supervisors to systematically check every step in chemical usage and determine if any action needs to be taken prior to commencement of work. The checklist should also include an action required column as shown over the next few pages:

Checklist Questions	Yes/ No	Action Required
Is there an inventory for all types of chemical and pesticides stored on the farm?		
Are Material Safety Data Sheets (MSDSs) and labels available for all agricultural and veterinary chemicals used and stored on the farm?		
Are all chemicals stored in their original containers and with clear and legible labels?		
Are all chemicals stored in a properly constructed and lockable area, which is resistant to fire and prevents access by children and other unauthorised persons?		
Are there clear warning signs posted on outside of storage area?		
Is the chemical store properly ventilated?		
Is there sufficient light in the chemical store so chemicals can be identified and their labels easily read?		
Are incompatible materials stored away from each other?		
Do chemical storage locations have an area to retain accidental spill?		
Is the storage adequate for volumes of chemicals held in the store?		
Are materials available to control spills in the storage area, e.g. sand?		
Do amounts of certain chemicals held on the farm require a Dangerous Goods License?		

Checklist Questions	Yes/ No	Action Required
Are chemicals protected from moisture?		
Are chemicals stored according to label instructions and MSDS?		
Are fire extinguishers located adjacent to fuel & chemical storage areas?		
Is the recommended PPE for chemicals available?		
Is there an emergency shower and eye wash located adjacent to the chemical mixing/storage?		
Transport		
Are chemical containers checked for leaks or damage before transport?		
Are chemicals transported in a compartment separated from people and foodstuffs?		
Are chemical containers well secured during transport?		
Are vehicles with chemicals locked when parked to prevent access by unauthorised persons?		
Are chemicals protected from weather during transport?		
Is there documented emergency response procedures in the event of chemical spills and during transport?		

<i>Checklist Questions</i>	<i>Yes/ No</i>	<i>Action Required</i>
<i>Mixing/ Loading/Cleaning Down</i>		
Is there good ventilation at the mixing site?		
Is appropriate PPE available at the mixing site?		
Is the PPE in good condition?		
Do all operators use PPE during mixing/ loading according to label requirements?		
Are there good washing facilities and an emergency shower located adjacent to the mixing/ loading area?		
Are mixing tanks free from leaks or risk of splashes during mixing/ loading?		
<i>Crop Spray Application and Re-entry Systems</i>		
Is appropriate PPE used by spray operators?		
Is the PPE in good condition?		
Are spray lines, taps and nozzles checked and maintained before spraying?		
Is clean water carried for washing?		
Are clean gloves carried for emergency use?		
Do operators wash hands after spraying and before eating, drinking and smoking?		

<i>Checklist Questions</i>	<i>Yes/ No</i>	<i>Action Required</i>
<i>Post Chemical Application</i>		
Have there been any leaks, spills or splashes causing exposure during spraying?		
If yes, what action is needed to reduce this risk?		
Are there rules preventing all people from entering a sprayed crop area before the expiry of the re-entry period?		
Are containers triple rinsed and disposed of in accordance with relevant authorities procedures?		
Are AVCARE or other relevant procedures followed in disposing of chemical containers and excess chemicals?		



CHEMICAL USE SAFETY

When it is necessary to use chemicals, use them wisely and safely. The following tips will help to ensure the safe use of chemicals:

- ☆ Inspect plants and monitor disease, insect numbers and activity on a regular basis. Pay particular attention to underside of leaves where insects and their eggs frequently occur. The older plant foliage will often be the first to show disease symptoms. If treatments are applied when an infestation first starts, plant pests can be maintained at lower levels much more easily and with smaller amounts of chemicals
- ☆ When applying pesticides to plants, treat all plant surfaces unless otherwise stated on the product's label. Do not apply pesticides to wilted plants or during the hottest part of the day. Apply dusts only when the wind is calm and plants are dry. Sprays should be applied when the wind is no more than 5 to 10 mph. Retreatment may be necessary after a rain if the spray did not dry thoroughly
- ☆ Apply pesticides only at recommended dosages; increased amounts can be dangerous, cause plant damage and leave harmful residues without improving control
- ☆ The length of effective control of pesticides varies widely. The toxic properties longevity of a chemical varies with product formulation, water pH, soil pH, and environmental conditions. Temperature, humidity, wind and sunlight affect insecticides. The greater the extremes, the sooner the pesticides are detoxified
- ☆ Always read and follow mixing and application instructions on the label for safe and effective control
- ☆ Select the product that will effectively, economically, and safely control the target pests safely. Labels are a source of information about the product and its handling. Read and carefully follow the label

All chemicals are classified according to their hazard potential to humans, animals as well as the environment. Classification is not based on activity against plant pests. The three signal words include:

- ☆ **DANGER** tells you the product has the highest hazard potential. This is accompanied by the word **POISON** in red and the skull and crossbones prominently displayed on the label
- ☆ **WARNING** is the term used to identify materials that have a moderate hazard potential
- ☆ **CAUTION** is the term used to identify those products that have the least level of potential hazard



CLARIFICATION OF WORK ACTIVITY WITH SUPERVISOR

With regard to using chemicals in the horticultural workplace it is therefore essential that you are able to receive instructions and clarify if necessary in regards to which activity your supervisor wants to undertake. If for example, today your supervisor is carrying out work activities relating to the varying plants within the enterprise, you will need to know precisely what is required to be done and more importantly what is required of you as the worker.

Clarification is important in many workplace situations, especially when what is being communicated is difficult in some way. Clarifying can involve asking questions or occasionally summarising what the speaker has said.

A listener can ask for clarification when they cannot make sense of the speaker's message. Sometimes, the messages that a speaker is attempting to send can be highly complex, involving many different people, issues, places and/or times. Clarifying helps you to sort these out and also to check the speaker's priorities.

Through clarification, it is possible for the speaker and the listener to make sense of these often confused and complex issues. Clarifying involves genuineness on the listener's part and it shows speakers that the listener is interested in them and in what they have to say, which is always a good action for any worker in any situation.

Some examples of clarification-seeking questions are:

"I'm not quite sure I understand what you are saying."

"I don't feel clear about the main issue here."

"When you said what did you mean?"

"Could you repeat ...?"

Clarification is the skill you use in order to ensure that you have understood the message of the speaker. When using clarification, follow these guidelines to help aid communication and understanding:

- ☆ Admit if you are unsure about what the speaker means
- ☆ Ask for repetition
- ☆ State what the speaker has said as you understand it, and check whether this is what they actually said
- ☆ Ask for specific examples
- ☆ Use open, non-directive questions - if appropriate
- ☆ Ask if you understand it correctly and be prepared to be corrected

**Learning
Activity**

Question

LEARNING ACTIVITY ONE

In your own words describe how you would clarify work instructions given by your supervisor in order to ensure you clearly understood?

SAMPLE SAMPLE

**Learning
Activity**

Task

LEARNING ACTIVITY TWO

Describe any work, health and safety hazards that may arise during chemical use in the workplace.

SAMPLE SAMPLE



TAKE STEPS TO CONTROL RISKS AS DIRECTED

All WHS hazards and risks should be risk assessed and then based on the level of risk posed from the chemical use activity, the risks can be managed through a number of potential strategies. The hierarchy of control measures, shown below (and on the next pages), are in order from the best possible solution on in numerical order. If the first control measure cannot be implemented, then the second may be possible and so forth down the list.

Elimination - As the title suggests, this control measure involves eliminating or removing the risk in its entirety.

Risk: High levels of risk in the use of chemicals in Horticulture

Control: Use biological means to control plant pests (if possible) thereby reducing the need to use chemicals at all

Substitution—This form of control involves substituting a safer process or material for the hazardous process/material identified.

Risk: Chemicals causing allergic reactions and nausea

Control: Substituting a less toxic or non-allergenic chemical for the task.

Isolation - This control involves separating the hazard or hazardous work practice from employees other work areas. This may involve sectioning off the area by erecting barriers, or by relocating either the hazardous work practice or the other employees and their work practices.

Risk: Risk of other people being affected by chemical spray drift

Control: Erect warning signs or create a barrier around the area where chemicals are being applied, hence creating an isolating barrier between the hazard and other persons



Engineering Controls - This method of control involves designing and/or adding physical safety features to plant or equipment.

As part of engineering controls are equipment and workplace design which is the provision of new and/or additional equipment or redesign of a workplace can be used to control identified hazards.

Risk: Chemical spills while transporting chemical to work site

Control: Build a secure crate on back of vehicle that ensures chemical containers remain secure

Automation (Engineering Controls) - Fully or partially automating a process removes the need for, or reduces the risk of, performing a hazardous task.

Risk: Chemical fumes given off during enclosed application like a nursery propagation shed

Control: Construction of an air extraction system to remove the fumes at the source.

Administrative Control - This type of control is most effective when used in conjunction with measures mentioned above or as an interim control whilst more effective control measures are developed and implemented. It requires systems to be established or amended in order to control the risk presented. Most often it requires the assessment and modification of the tasks performed.

It may include measures such as amendment or establishment of new Policy and Procedures or Safe Work Procedures.

For example:

- ☆ Developing documented safe work practices for a hazardous task, or implementing restrictive policy to prevent staff from coming in contact with identified hazards
- ☆ The introduction or review of existing maintenance schedules for plant and equipment, or safe work practices. This measure is used to ensure that existing plant, equipment and procedures do not deteriorate to the point where they become hazardous.
- ☆ Limiting the exposure of personnel to elements that are only hazardous when they exceed a certain threshold. These types of hazards can include: noise, radiation, heat, chemicals, etc., and can be controlled by introducing elements as simple as job rotation
- ☆ Providing training and information in safe work practices and other workplace health issues so that personnel can work safely.



Personal Protective Equipment (PPE) - PPE is not a particularly effective control method and should only be used:

- ☆ When all other control measures are impractical
- ☆ In conjunction with other more effective, control measures. It is important to select the correct PPE for the hazard identified, and advice should be sought in this regard if you are not sure

The “Hierarchy of Control” provides a basic guide for controlling hazards in the workplace. Consult your Workplace Supervisor and attempt to find solutions by working your way down the hierarchy. Once appropriate controls are identified, it is necessary to consult senior management and the staff that will be affected by the changes. This will reduce the possibility of oversights and help to gain the support of the staff in the implementation phase.

Let's look at the hazards identified previously in the use of chemicals and determine appropriate risk controls from those we discussed previously:

<i>Hazard</i>	<i>Risk Control</i>
<p>Health Hazards</p> <p><i>Inhalation</i> (breathing chemical spray drift or fumes)</p> <p><i>Absorption Risk</i> (absorption of chemicals through skin either through spilling while mixing, or spray drift)</p> <p><i>Ingestion</i> (accidental swallowing of chemicals)</p>	<p><i>Elimination</i> - can biological means be used to control pest?</p> <p><i>Substitution</i> - could a less toxic chemical be used?</p> <p><i>Isolation</i> - can the chemical application area be isolated to only chemical users?</p> <p><i>Engineering controls</i> - can the spray equipment be engineered to direct spray drift away from operators?</p> <p><i>Automation</i> - could the chemicals be applied for example by application through the irrigation system?</p> <p><i>Administrative controls</i> - are appropriate policies, procedures and work instructions available to spray users? Are all staff properly trained in the use of chemicals?</p> <p><i>PPE</i> - is the correct PPE available and are chemical users shown how to use it correctly?</p>

**Learning
Activity**

Task

LEARNING ACTIVITY THREE

You have been asked to apply chemicals to a Horticultural crop using a hand sprayer. Describe possible risk control measures using the hierarchy of controls described in this Section. Then list how this process has determined which of these control measures can be used in this situation. Use a table format in Word.

Once completed, present this activity to your teacher or trainer for review and discussion.

CONFIRM TOOLS AND EQUIPMENT TO BE USED WITH SUPERVISOR

Tools and equipment used in chemical application vary widely- it is essential that workers understand the type of equipment to be used and how it works to control particular plant pests:

SPRAY EQUIPMENT—TANKS

Sprayer tanks should be rust resistant, preferably fiberglass, polypropylene, or stainless steel. Filler openings should be wide enough for ease in filling. A splash proof filler should be in the tank to prevent pesticides from splashing onto people during filling or while spraying. Each tank should be equipped with a drain. Intake on the suction line should be at the bottom of the tank. Mechanical or return agitation should be used to keep pesticides in solution or suspension.

Image below of a chemical spray tank suitable to be mounted on an ATV- spray is pump driven.



Chemical spray tank mounted on a vehicle- spray is driven by a pump.



Tractor mounted chemical boom sprayer with tank- spray is driven by a pump.



There are several types of pumps capable of spraying pesticides. Roller, gear, centrifugal and piston pumps are most often used. Sprayer operation and pesticide formulations influence pump selection. Piston, roller and diaphragm pumps are positive displacement; therefore, the flow rate is determined by pump speed, not pressure. Centrifugal pumps are a non-positive displacement type and flow rate is influenced by pressure.

There are accessories required by the pump to ensure its efficient operation. These include:

- ☆ **Pressure Regulators**—Pressure regulators adjust the solution flow. When the regulator is open, a constant flow is directed to the nozzles and the overflow returns to the tank. When closed, all flow is diverted to the tank.
- ☆ **Pressure Gauges**—These show the line pressure at the location where the gauge is positioned. A pressure gauge is necessary to accurately calibrate a sprayer. The gauge should be located between the pressure regulator and nozzles. The best location for the gauge is on the boom. This gives the most accurate pressure reading at the nozzle. However, most persons find it more convenient to place the gauge near the regulator and operator. This makes it easier to adjust pressure. However, there will be some drop in pressure because of flow restriction from the hoses. So it is important that this drop in pressure is accounted for when calibrating the sprayer. (we learn more about 'calibration' later)
- ☆ **Strainers**—Screens positioned to protect pump and nozzle tips are called strainers. Different size strainers can be purchased. A screen with large openings may not adequately screen out particles which can damage a pump or clog nozzles. If the openings are too small they become clogged and restrict flow. Strainers located in the nozzle should have a diameter slightly smaller than the nozzle orifice. A slotted strainer is suggested when applying wettable powders.

- ☆ **Nozzles**—Nozzles have three functions in the spray operation. They control the flow rate, droplet atomisation and droplet distribution. They come in several different types and each has a specific purpose in pesticide application.



Hollow cone nozzles: concentrates most of the spray solution at the outer edge of a conical pattern. They operate at high pressure and produce small droplets which effectively penetrate plant canopies. Hollow cone nozzles are often used with foliar nutrients, fungicides and insecticides. They operate in a pressure range between 60 to 100 psi.



Flat fan spray nozzles: produce narrow elliptical spray patterns. There is an uneven spray deposit in the pattern. A greater proportion of the spray solution is deposited near the centre of the pattern and a lesser amount is deposited at the outer margin. To get a uniform spray application, patterns must overlap. Broadcast herbicides, soil fungicides and soil insecticides are applied using flat fan nozzles. A pressure of 20 to 40 psi is required for optimum utilisation.

- ☆ **Hoses**—Hoses used on sprayers should be oil resistant and have a test pressure twice the operating pressure of the pump. A two ply hose should be used on the suction side of the pump. This will prevent collapsing. Hoses should be of sufficient size to prevent excessive pressure drop or loss.



Two ply hose

SPRAYER CALIBRATION

No matter how effective or safe a pesticide is, its performance is dependent on applying the proper rate. Accurate calibration of spray equipment is an important part of pest control. Poor calibration accounts for about 90% of weed control failures.

Applications made using sprayers that are not properly calibrated can result in plant injury, ineffective control, excessive pesticide costs and possible pesticide residue problems.

To calibrate a sprayer using pumps involves following the application information of the pesticide manufacturer and adjusting the pump pressure to ensure the application rate is inline with what is recommended.

SPRAY EQUIPMENT—BACKPACK AND HAND SPRAYER

Most backpack and hand sprayers can be used to apply pesticides. The person carrying the backpack must walk at a uniform speed. Walking speed will vary depending on the soil surface, and how level the crop being sprayed is.

The spray wand must be held in a reasonably fixed position above the soil or plant as the applicator walks.

Backpack chemical unit below- operator uses hand lever to pump air into tank to create pressure to distribute chemicals.



With a hand chemical sprayer, the user pumps air into the unit at top to create pressure to distribute chemicals.



CHEMIGATION

Chemigation is the application of pesticides through an irrigation system. Fungicides, nematicides, insecticides, herbicides, and fertilisers can be applied with this type of system.

Advantages to chemigation:

- ☆ Uniformity of application
- ☆ Ease of chemical incorporation
- ☆ Reduction of soil compaction
- ☆ Less mechanical damage to crop
- ☆ Reduced hazard to operator
- ☆ Economical application

Disadvantages to chemigation:

- ☆ Additional equipment requirement
- ☆ Safety considerations to groundwater, humans and environment
- ☆ Maintenance of equipment



SOIL APPLIED PESTICIDES

There are three main types of soil applied methods for pesticides.

Broadcast applications—are applied to the soil surface and then incorporated. Use a disk or tiller to lightly incorporate materials into the soil. A boom type sprayer can be used to apply materials in front of the incorporator. Low pressure and flat fan nozzles reduce drift.



Banded applications—are made over the row or bed before planting or after seeding. Treated bands vary in width depending on the material applied. Any type of equipment can be used that will mix the top one to two inches of soil and not destroy the bed. The crop should be planted or transplanted without further removal of surface soil. Some pesticides can be applied after planting and then incorporated. A basket or roller incorporator can be used. These do not distribute the seed. Sprinkle irrigation is sufficient to incorporate some pesticides. A back pack sprayer can be used to apply this type of treatment on small fields. When using a back pack sprayer, the operator should always be the same and should take frequent rest stops. This is to insure that the application rate remains constant.



In-furrow applications—are the applications of pesticides directly in the seed furrow. Materials are applied with an even flat fan nozzle, low rate of water and low pressure.



There are two common application methods for soil applied pesticides.

Granular applications—Granules can be applied as broadcast, banded or in-furrow treatments. The application of these products, like sprays, must be accurately calibrated.

Nematicide injections—Some nematicides are injected into the soil. There are pump applicators which release the material into the soil under constant pressure. Other units use gravity flow. Orifices control the flow rates for both gravity and positive pressure applicators. Depth of incorporation varies with pests and pesticide.

Once the chemical application equipment has been selected, the correct chemicals and any mixing components must also be selected. Again this will be specific to the crop being treated as well as the pest or plant disease being targeted.

**Learning
Activity**

Task

LEARNING ACTIVITY FOUR

Your workplace supervisor has asked you to prepare equipment and tools to apply chemicals along a crop paddock fence to kill weeds along the fence that are encroaching on the crop. You will be using a 100 litre spray tank mounted on a quad bike and spraying Roundup chemical which is mixed with water. List the steps you would take in order to prepare for this work activity.

(In this activity you are only required to prepare for this task by listing the steps. If you are at work the supervisor will accompany you to do the actual spraying)

**Learning
Activity**

Task

LEARNING ACTIVITY FIVE

What does 'calibration' mean when referring to chemical spraying?



WEAR APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT AS PER LABEL INSTRUCTIONS AND ENSURE CORRECT FIT

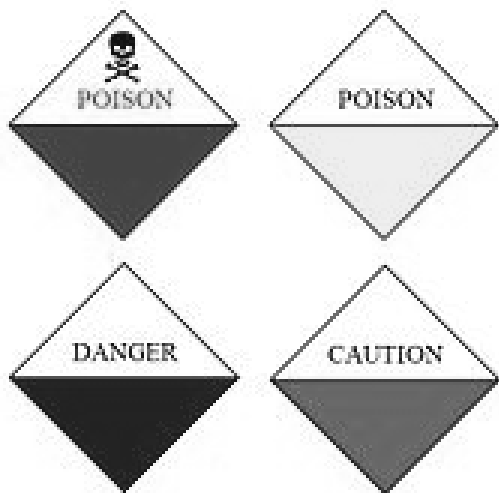
Chemicals can enter the body four ways during chemical application in the workplace tasks:

- 1) Skin
- 2) Eyes
- 3) Mouth
- 4) Lungs

Skin contact is the most common cause of pesticide poisoning for applicators and some pesticides enter the body through the skin quite readily. At the time of mixing, pesticides are more concentrated and the likelihood of injury is increased during this time.

Some parts of the body absorb pesticides extremely fast (within a few minutes) and need extra protection.

Two such areas are the head and body area between the navel and about mid-thigh. If any pesticide is spilled in this area, wash it off immediately and change clothing.



CHEMICAL LABELLING SIGNAL WORDS

The four words required on a pesticide label to indicate the relative toxicity of the pesticide are:

Danger- Poison or Danger - Toxicity Category I - Highly toxic (fatal if ingested)

Danger - Toxicity Category I - Highly corrosive to eyes and skin

Warning - Toxicity Category II - Moderately toxic

Caution - Toxicity Category III and IV - Least toxic

These are known as signal words and are assigned on the basis of the highest measured toxicity, be it oral, dermal, or inhalation; effects on the eyes and external injury to the skin.

You should always read the pesticide label to determine what Personal Protective Equipment (PPE) you are required to wear for that product.

Workers must avoid direct contact with pesticides by wearing the proper Personal Protective Equipment (PPE) as specified on the label of the pesticide you intend to use.



PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal Protective Equipment (PPE) should include:

Body covering attire—Regular work attire of long pants and a long-sleeved shirt, shoes, and socks are acceptable for slightly toxic (category III- Caution) and relatively non-toxic (category IV - Caution) pesticides. Many applicators prefer work uniforms and cotton coveralls that fit the regular-work-attire description and provide equal protection. Applicators should reserve one set of clothing for pesticide use only. Launder and store separately from all other clothing.

To apply moderately toxic (category II - Warning) or highly toxic (category I - Danger or Danger-Poison) chemicals, wear a clean, dry protective suit that covers your entire body from wrists to ankles. The sleeves must be long enough to wear over gloves. Openings, such as pockets, should be kept to a minimum.

Protective suits are one- or two-piece garments, such as coveralls and should be worn over regular work clothes and underwear. Protective suits may be disposable or reusable and are available in woven, nonwoven, coated and laminated fabrics. Since pesticides can work their way through clothing fibres, the degree of protection increases as one moves from woven to nonwoven and from coated and laminated fabrics.

Read the manufacturer's label for specific information related to care and intended use. Good quality construction, proper fit, and careful maintenance or disposal are also important.

Chemical -resistant protective suits (image shown below including an air respirator) are a must if you will be in a mist or spray that would wet your clothing. Chemical-resistant suits are recommended when handling highly toxic (category I) pesticides.



SAMPLE

Gloves—Chemical-resistant gloves- Always wear unlined, elbow-length chemical-resistant gloves when handling all pesticides. The elbow-length protects your wrists and prevents pesticides from running down your sleeves into your gloves.

Apron—Wear a chemical-resistant apron when repairing or cleaning spray equipment and when mixing or loading. This is a good practice for all pesticides and is essential for pesticides of category I and II toxicity. Aprons offer excellent protection against spills and splashes of liquid formulations, but they are also useful when handling dry formulations, such as wettable powders.

Aprons can be easily worn over other protective clothing and are comfortable enough for use in warm climates. Choose an apron that extends from the neck to at least the knees. Some aprons have attached sleeves. Nitrile, butyl, and neoprene offer the best protection. PVC and natural rubber are also available.



Boots—Wear unlined chemical-resistant boots which cover your ankles when handling or applying moderately or highly toxic pesticides. Purchase boots with thick soles. Nitrile and butyl boots appear to give the best protection.

Wash boots after each use and dry thoroughly inside and out to remove all pesticide residue. Use them only for pesticide applications. It is wise to keep two pair of boots on hand in case of accidental contamination. Wash socks and canvas sneakers worn under chemical-resistant boots just like you would pesticide contaminated clothing.



Protective eyewear (goggles, face shield or safety glasses)—Wear shielded safety glasses; a full-face respirator; snug-fitting, non-fogging goggles; or a full-face shield whenever the chemical could possibly contact your eyes. Safety glasses with brow and side shields are acceptable for low exposure situations. Always wear goggles or full-face respirator when you are pouring or mixing concentrates or working in a highly toxic spray or dust. In high exposure situations when both face and eye protection are needed, a face shield can be worn over goggles.

Clean them after each use. Be careful of the headband; it is often made of a material which readily absorbs and holds chemicals. Have several spares and change them often, or use a chemical-resistant strap. If possible, wear the strap under your head covering.



Head and neck coverings—The hair and skin on your neck and head must be protected too. This is most important in situations where exposure from overhead dusts or sprays is possible, such as hand-spraying uphill or when flagging for aerial applications. Chemical-resistant rain hats, wide brimmed hats, and washable hard hats (with no absorbing liner) are good. Disposable gloves or shoe covers should be used only once for a very short-term task, and then discarded. First wash the PPE, and then remove them by turning them inside out. Then dispose of them properly.



Respirators—Respirators protect you from inhaling toxic chemicals. The label will tell you if a respirator is required. Consider wearing one during any lengthy exposure with a high risk of pesticide inhalation. Always wear a respirator while mixing or filling highly toxic pesticides. Applicators who will be constantly exposed to small amounts of moderately toxic pesticides for a day or several days, should also wear a respirator. Image below shows a respirator and goggles combination- these types have replaceable cartridges that should be replaced regularly.



Powered air-purifying respirators—(PAPRs) force air through air-purifying material (cartridge or canister) to assist the wearer in obtaining clean filtered air. These are positive pressure respirators and are good for users with respiratory problems or with facial hair that may prevent a tight seal with full or half-face respirators. Powered air-purifying respirators purify contaminated air and do not provide oxygen or supply air from an outside source. The filters may need to be replaced two or more times each day.





USING THE RESPIRATORS CORRECTLY

The respirator should fit properly on your face. It should be worn tightly enough to form a seal all around your face. Respirators come in different sizes. Each person who will wear a respirator must be fit tested prior to using it. Facial hair must be groomed such that a proper seal between the face and the respirator is made. This usually means that beards or long sideburns must be removed. Do not wear the headband too tightly or headaches and/or dizziness may result.

Respirator manufacturers make a variety of cartridges to fit their face pieces and each cartridge has its own intended use. It is essential that a cartridge designed to filter out pesticides from the air be selected and used. Having the wrong cartridge may expose the applicator to toxic levels of pesticides.

Check the filter (the cloth-like outer layer) of your respirator often. Replace it when it looks dirty or if breathing becomes difficult. Cartridges should be changed after every eight hours of use. If you notice a pesticide odour, first check to be sure the respirator is sealed on your face. If the odour persists, change the cartridge immediately.

After each use, wash the face piece with detergent and warm water. Rinse thoroughly and wipe dry with a clean cloth. Store the respirator, filters, and cartridges in a clean, dry place away from pesticides. A tightly closed plastic bag works well for storage.

**Learning
Activity**

Task

LEARNING ACTIVITY SIX

You have been told that your work task will be to apply chemicals that are applying are Category 1 (Danger) chemicals and that the application will be by powered spray with the potential to receive spray drift due to the situation of the application task.

Describe which PPE you think would be required.

SAMPLE SAMPLE

**Learning
Activity**

Task

LEARNING ACTIVITY SEVEN

What is the difference between these two respirators?



**Learning
Activity**

Task

LEARNING ACTIVITY EIGHT

In your own words tell us how you clean and store a respirator.

SAMPLE SAMPLE

Section Two

Check Application Equipment

APPLY CHEMICALS UNDER SUPERVISION

SECTION TWO - CHECK APPLICATION EQUIPMENT

INTRODUCTION

In the previous section we went into some detail about preparing to apply chemicals. One of the topics was the type of equipment used to apply chemicals.

In this section we look closer at readying application equipment prior applications.

SECTION LEARNING OBJECTIVES

At the completion of this section you will learn information relating to:

- ☆ Carrying out pre-operational checks of application equipment and identifying and replacing any damaged or worn components or reporting to supervisor
- ☆ Preparing application equipment for use

CARRY OUT PRE-OPERATIONAL CHECKS OF APPLICATION EQUIPMENT AND IDENTIFY AND REPLACE ANY DAMAGED OR WORN COMPONENTS OR REPORT TO SUPERVISOR

Let's revisit the chemical application equipment identified at in the previous section and consider what pre- operational checks are necessary as well as how to identify and replace any damaged or worn components.

Where the repair requires input beyond your capacity, it is essential that you notify your workplace supervisor prior to commencing work activity.

Equipment	Pre operational checks	How to replace any damaged or worn components
<i>Powered Spray Equipment-tank mounted on quad bike or vehicle.</i>	Check tank for leaks.	If tank is leaking notify Supervisor.
	Check tank strainers and filters.	Clean and replace.
	Check power source is working.	Usually battery operated by vehicle battery- if not working notify Supervisor.
	Check all hoses for leaks. or wear.	Replace any worn or cracked hoses.
	Check 'O' rings and seals.	Remove worn 'O' Rings and replace.
	Check spray applicator trigger.	Test trigger mechanism, should close off completely when released- if worn replace or notify Supervisor.
	Check spray nozzles.	Nozzles should deliver full spray in required pattern- if worn replace.

Equipment	Pre operational checks	How to replace any damaged or worn components
<i>Knapsack or hand sprayer.</i>	Check chemical tank for leaks.	If tank is leaking notify Supervisor.
	Check tank strainers and filters.	Clean and replace.
	Check air operated hand pump is working.	Pump hand pump to build pressure in tank- if sufficient pressure does not deliver spray notify Supervisor.
	Check all hoses for leaks or wear.	Replace any worn or cracked hoses.
	Check 'O' rings and seals.	Remove worn 'O' Rings and replace.
	Check spray applicator trigger.	Test trigger mechanism should close off completely when released- if worn replace or notify Supervisor.
	Check spray nozzles.	Nozzles should deliver full spray in required pattern- if worn replace.
<i>Tractor mounted powered boom spray.</i>	Check tank for leaks.	If tank is leaking notify Supervisor.
	Check tank strainers and filters.	Clean and replace.
	Check power source is working (usually PTO driven on Boom Sprays).	PTO or separate pump engine may power boom spray- test with a small amount of water in tank- if not working notify Supervisor.
	Check all hoses for leaks or wear.	Replace any worn or cracked hoses.
	Check 'O' rings and seals.	Remove worn 'O' Rings and replace.
	Check spray applicator.	Boom spray is engaged by tractor operator.
	Check spray nozzles for correct nozzle and required calibration.	Boom Spray Nozzles should deliver full spray in required pattern- both nozzle size and pressure are determined by amount of chemical required to be applied and consideration for pump delivery capacity multiplied by tractor ground speed. Because of the complexities involved, this activity should be undertaken by Supervisor.

**Learning
Activity**

Task

LEARNING ACTIVITY ONE

Describe the pre-operational checks you would undertake for chemical application using a spray tank mounted on the back of a vehicle. Provide this in bullet point form .

**Learning
Activity**

Question

LEARNING ACTIVITY TWO

What do the letters PTO mean and how does this relate to applying chemicals?

SAMPLE SAMPLE

SAMPLE SAMPLE



PREPARE APPLICATION EQUIPMENT FOR USE

Chemicals play an important role in horticultural production and are regularly used to control insect pests, diseases and weeds.

When applying chemicals, the aim should be to prepare the application equipment to a fine tuned application in order to maximise the amount reaching the target and minimise the amount reaching off-target areas.

PRINCIPLES OF CHEMICAL SPRAY APPLICATION

The majority of chemicals used in horticultural production are delivered in the form of droplets produced from different types of nozzles and spray booms. To maximise spray efficiency, spray droplets must be uniformly distributed on a target surface with minimum losses due to drift, evaporation or run-off.

When targeting the plant, spray droplets should be distributed uniformly over the entire plant, including the underside of the leaves as well as on top of the plant. To achieve this, droplets need to be small enough that they will swirl around as they are deposited onto the plant surface.

Large droplets, being heavier, tend to fall straight down and are not usually deflected by air movement so their redistribution within the crop foliage is limited. Large droplets are also more difficult to retain on the leaf surface tending to bounce or roll off, cascading down the foliage and onto the ground. When larger droplets are produced, there are much less of them, meaning there is less likelihood of them reaching the target.

Select a suitable droplet size and water volume for each spraying job and regularly calibrate and maintain spraying equipment using only clean water.

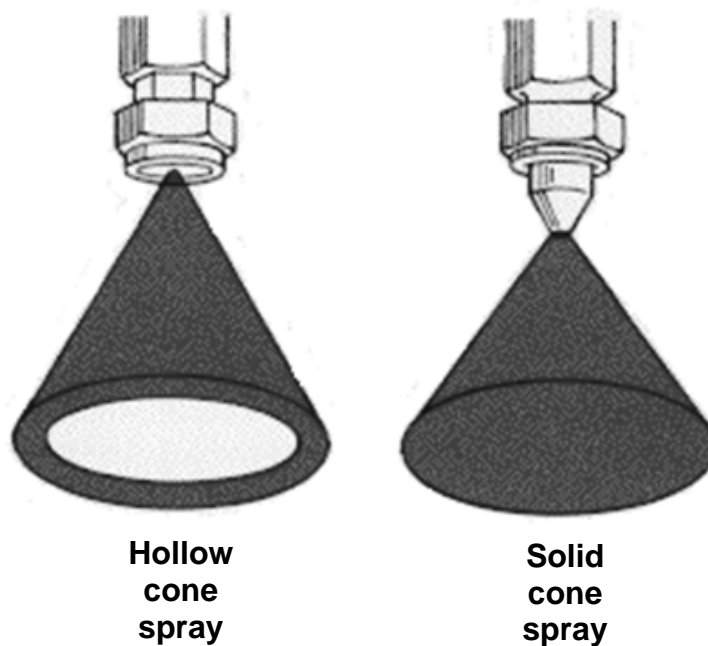
The principles of efficient spray application not only aims for good target coverage, but also in reducing spray drift and any negative impacts it might have on the environment, public health as well as surrounding property.

NOZZLE SELECTION

Nozzle selection is often based on achieving the required water rate at the desired droplet size. The following is a description of the most popular nozzles used for agricultural spraying.

Hollow cone nozzles—Hollow cone nozzles are a popular nozzle for applying insecticides and fungicides. They generally produce a smaller droplet size than most other nozzle types. The characteristic hollow cone shaped spray output is produced when the liquid is forced through slots in the swirl plate (within the nozzle body) then emitted through a narrow orifice.

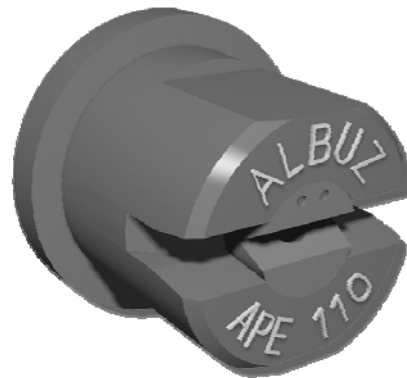
Solid cone nozzles—Solid cone nozzles have an extra hole in the centre of the swirl plate and produce higher flow rates than a similar size hollow cone nozzle. They are not usually recommended for applying insecticides and fungicides as the increase in flow rate comes with an increase in droplet size. Solid cone nozzles are more suitable for residual herbicides and foliar fertilisers.



Flat fan and double flat fan nozzles—Flat fan nozzles are the most common type of nozzle and can be suitable for many different purposes. These nozzles have a rectangular or lens shaped orifice which produce a tapered distribution of droplets across the nozzle swath.

Uniform coverage is achieved by overlapping each nozzle 30% with the nozzle each side of it. There are many sizes of flat fan nozzles that can operate under various pressures with a wide range of droplet sizes.

Double flat fan nozzles (also know as twin flat) produce two spray swaths from the one nozzle body. These nozzles offer the advantage of the spray being directed from two different angles to improve coverage. These nozzles are suitable for applying insecticides and fungicides if the correct size and pressures are used.



**Flat
fan**



**Double
Flat
fan**

Turbo and double turbo fan nozzles—Turbo types are also a common type of nozzle and suitable for broadcast spraying. These nozzles have a tapered edge to give a wide angle flat spray pattern. Uniform coverage is also achieved by overlapping each nozzle 30% with the nozzle each side of it.

There are also many sizes of these nozzles that can be operated under various pressures to produce a wide range of droplet sizes. The double fan nozzles also produce two spray swaths from the one nozzle so the spray can be directed into the target from two different angles.

These nozzles produce a larger droplet size than most other nozzle types when operated at the same pressure.



**Turbo
flat
fan**



**Turbo
double
Flat
fan**

Air induction nozzles—Air induction nozzles produce large air filled droplets. The air inclusion is usually by venturi action and produce large bubbly droplets. These droplets tend to shatter on impact, further distributing the smaller droplets into the canopy. The main advantage of these nozzles is to reduce drift and allow the operator to spray in windier conditions.

Hydraulic spray booms or conventional spray booms with hydraulic nozzles are the most common method of applying chemicals. The best results are achieved when spraying in a light breeze at about 7 km/h.

The wind will be beneficial by creating turbulence to assist in carrying the droplets into the crop canopy. The performance of this boom sprayer can be improved in some cropping situations by the addition of droppers.

These are short lengths of semi-rigid plastic tubes attached to the boom with nozzles at the lower end and positioned between plants to direct spray from a lower angle, increasing spray penetration and coverage.



AIR ASSIST BOOMS

There are a few main types of air assisted booms. The most common form is a conventional hydraulic spray boom with the addition of a high volume output fan mounted centrally above the boom with an air duct extending full length along both arms of the boom. The slotted outlet of the air duct produces a curtain of air adjacent to the spray nozzles.

Air assisted booms also have the potential to reduce spray drift and allow the operator to spray in conditions unsuitable for conventional booms. Controlled Droplet Application (CDA) is a method of spray application where 80% of all droplets produced are within a very narrow size range.

A rotating cage, inverted cone or a flat serrated disc produces droplets by means of centrifugal force when liquid is introduced at the centre of the rotating element. The air stream directs spray down into the plant canopy causing turbulence that assists in achieving better overall coverage.



KNAPSACK SPRAYERS

Knapsacks (or hand operated sprayers) are designed to be carried and operated manually by one person. These sprayers have a tank of up to 20 L capacity and are usually carried on the operators back. The nozzles used in knapsacks are the same as those used in conventional boom sprays.

Often there is only one nozzle at the end of a wand, but there may be more to increase water rate or spray width. Knapsacks can be pressurised by a lever operated pump which operate at moderate to low pressure (200 to 400 kPa). Droplet size and flow rates can be regulated by adjusting the pressure.



**WATER QUALITY**

The quality of water used when spraying agricultural chemicals can have significant effects on chemical efficacy. It is always advisable to use clean rainwater where possible.

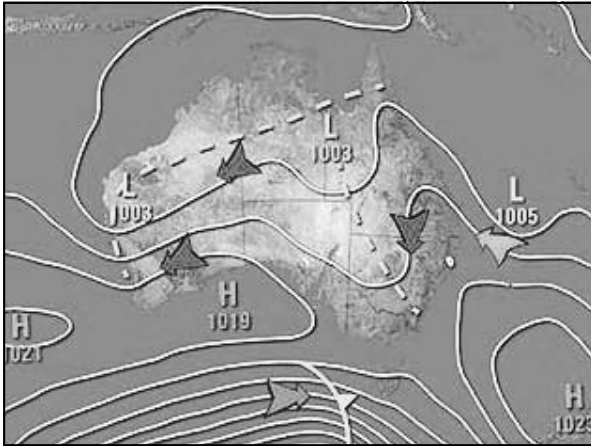
This is not always possible and usually water has to be sourced from other places including bores, dams, channels and rivers.

The quality of water available from these other sources can be variable and may cause significant application problems.

It is preferred that the water is clear, colorless, odorless and neutral (pH 7.0). That is, not acid, alkaline or brackish.

CALIBRATION

There is also a need to calibrate the spray equipment. We will learn more about this step in the next section.



PREVAILING WEATHER CONDITIONS

Prevailing weather conditions have an important influence on the behavior of these droplets and consequently their final resting place and efficacy in the crop. Temperature will affect the rate of evaporation (volatilisation).

High temperatures will increase the rate of volatilisation of the chemical and increase the rate of evaporation of the liquid that forms the spray droplets.

Low humidity will also increase the rate of evaporation of droplets. It is best to spray when the temperature is low and the humidity is high. Wind speed and wind direction also have a significant effect on spray droplets. The ideal wind speed is a light breeze of about 7 to 10 km/h (leaves and twigs are in constant motion).

**Learning
Activity**

Question

LEARNING ACTIVITY THREE

What were the seven types of spray nozzles described in this section?

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY FOUR

What type of sprayer is the picture below depicting?



**Learning
Activity**

Question

LEARNING ACTIVITY FIVE

What does it mean to have water pH neutral and why is this important?

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY SIX

What six steps are required to prepare chemical application equipment for use?

SAMPLE SAMPLE

Section Three

Prepare Application Equipment

APPLY CHEMICALS UNDER SUPERVISION

SECTION THREE – PREPARE APPLICATION EQUIPMENT

INTRODUCTION

In the previous section we learned about checking the application equipment chosen and the steps in preparing the equipment basically from a mechanical point of view.

In this section we will learn how to prepare the application equipment, focussing more on preparing the chemicals.

SECTION LEARNING OBJECTIVES

At the completion of this section you will learn information relating to:

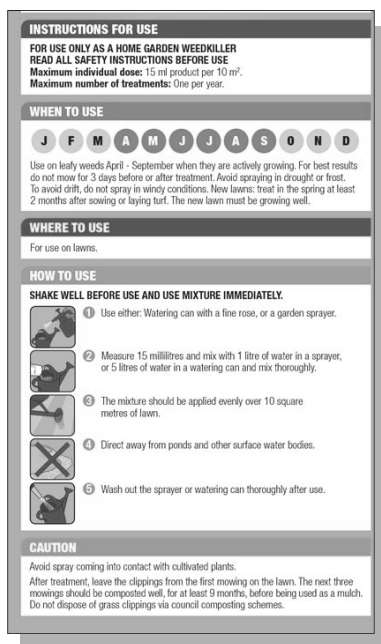
- ☆ Following all label instructions for the chemical or substance being used
- ☆ Using appropriate mixing equipment
- ☆ Checking that output of application equipment is correct
- ☆ Measuring, mixing and loading chemical mix or substances
- ☆ Confirming instructions from chemical label and supervisor in the event of a spill
- ☆ Checking that output of application equipment is correct and in accordance with application/spray plan

FOLLOW ALL LABEL INSTRUCTIONS FOR THE CHEMICAL OR SUBSTANCE BEING USED

The chemical label is one of the most crucial parts of the entire chemical application process. Do not use chemicals without carefully reading and following all the information on the chemical label and the Safety Data Sheet (SDS).



SAMPLE SAMPLE



The most important part of any chemical container is its label. For this reason chemicals should never be put into another container. Many people have been poisoned for consuming the contents of a container which was not specifically labelled with the contents.

Coke as well as other soft drink and cordial bottles are not intended to contain poison. The chemical may react with the plastic and also the contents may look the same as coke as well as other soft drinks or cordials, but is highly toxic.

Labels are used to identify:

- ☆ The name of the product – the name includes all words used
- ☆ The hazardous nature of the product
- ☆ The active constituent that is the main ingredient
- ☆ What it is used for
- ☆ How and where to apply the chemical
- ☆ Precautions
- ☆ Storage and disposal
- ☆ Safety directions
- ☆ First aid directions
- ☆ Directions for use that is dilution rates
- ☆ The manufacturer
- ☆ An emergency phone number

Labels are therefore quite complex. If a booklet is included with the chemical when it is purchased, then this booklet forms part of the label. A chemical label example is shown next page with all parts of the label illustrated to show what they refer to.

The Signal Heading indicates how poisonous the farm chemical is

Learn to recognise the Mode of Action letter and you will be less likely to use the farm chemical in a way that will promote pest resistance

Observe the Withholding Period so you will not have unacceptable levels of residues in your produce

Precaution Statements identify risks to human safety

Material Safety Data Sheet (MSDS) contains extra hazard information and is available from the supplier

The Batch Number allows tracking in case of defective batches. The Date of Manufacture or Expiry Date helps safeguard against the farm chemical being used when out of date and ineffective



Active Constituents, Solvents and Scheduled Ingredients are important for first aid instructions

The Directions for Use and General Instructions give advice on preparing and applying the farm chemical

Storage and Disposal will help with correct storage and cleaning up after use

Safety Directions describe how to protect yourself when preparing and using the farm chemical

Protection Statements describe what to do to avoid unintended off-target damage to crops, environment or livestock


First Aid instructions

NRA Approval Number tells you the farm chemical has been assessed and registered by the NRA (the last four digits show the date of the last assessment)

NOTE: This is not a real label. It has been created by the NRA to show the different items that can appear on farm chemical labels. Not every item shown in this example will be on every label. Labels vary in size and some can be very long.

POISON SCHEDULE

Before you can read a label you need to understand the system used to identify how hazardous a chemical is. Chemicals, and other substances, are classified according to a poisons schedule.



Schedule 1	Not currently in use
Schedule 2	Pharmacy Medicine
Schedule 3	Pharmacist Only Medicine
Schedule 4	Prescription Only Medicine OR Prescription Animal Remedy
Schedule 5	Caution
Schedule 6	Poison
Schedule 7	Dangerous Poison

Schedule 2 medicines are labelled “PHARMACY MEDICINE”

Schedule 3 medicines are labelled “PHARMACIST ONLY MEDICINE”

Schedule 4 medicines are labelled “PRESCRIPTION ONLY MEDICINE”

Schedule 5 the label on these products is headed “CAUTION”

Schedule 6 the label on these products is headed “POISON”

Schedule 7 the label on these products is headed “DANGEROUS POISON”

SAFETY DATA SHEETS (SDS)

While the label contains most of the information needed to use a chemical, more information is available on the Safety Data Sheet (SDS) for that chemical.

A SDS (also known as a Material Safety Data Sheet or MSDS) contains information about a product under the following headings:

- ☆ Identification of the substance and supplier
- ☆ Hazards identification
- ☆ Composition/Information on ingredients
- ☆ First Aid Measures
- ☆ Fire Fighting Measure
- ☆ Accidental Release Measures
- ☆ Handling and Storage
- ☆ Exposure controls/Personal Protection
- ☆ Physical and Chemical properties
- ☆ Stability and reactivity
- ☆ Toxicological information
- ☆ Ecological information
- ☆ Disposal considerations
- ☆ Transport information
- ☆ Regulatory information

On the next few pages we look at an example of a SDS (MSDS) in more detail.

Safety Data Sheet



1. IDENTIFICATION OF THE MATERIAL AND SUPPLIER

Product Name: YATES BUG GUN PYRETHRUM INSECTICIDE RTU

Recommended Use: Ready to use insecticide for the control of aphids, thrips, caterpillars, ants, flies, earwigs and cabbage moths indoors and outdoors.

Supplier: Yates Australia, a division of DuluxGroup (Australia) Pty Ltd
ABN: 67 000 049 427
Street Address: 1 Gore Street,
 Parramatta, NSW 2211
 Australia
Telephone Number: +61 2 97 81 8777
Facsimile: +61 2 97 81 8325
Emergency Telephone: 1 800 033 111 (ALL HOURS)

2. HAZARDS IDENTIFICATION

Based on available information, not classified as hazardous according to criteria of Safe Work Australia. NON-HAZARDOUS SUBSTANCE.

Not classified as Dangerous Goods by the criteria of the Australian Dangerous Goods Code (ADG Code) for transport by Road and Rail. NON-DAINGEROUS GOODS.

Parsons Schedule: None allocated.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Proportion	Risk Phrases
Preservatives		< 1%	-
Water	7732-18-5	to 100%	-
Pyrethrin (pyrethrum)	8003-34-7	0.01%	R20/21/22 R50/53
Emulsifier		< 1%	-
Potassium borate	51-03-6	0.12%	-
Ethyl alcohol	64-17-5	1%	R11

4. FIRST AID MEASURES

For advice, contact a Poisons Information Centre (e.g. phone Australia 131 126, New Zealand 0800 764 788) or a doctor.

Inhalation:
 Remove victim from area of exposure - avoid becoming a casualty. Seek medical advice if effects persist.

Skin Contact:
 If skin contact occurs, remove contaminated clothing and wash skin with soap and water. If irritation occurs, seek medical advice.

Eye Contact:
 If in eyes, wash out immediately with water. In all cases of eye contamination it is a sensible precaution to seek medical advice.

Product Name: YATES BUG GUN PYRETHRUM INSECTICIDE RTU
 Substance No: 00000000034

Revised: 19/05/2009
 Version: 2

Page 1 of 5

Pyrethrum Insect Dust - Material Safety Data Sheet

Material Safety Data Sheet

Hazardous according to criteria of Worksafe Australia
Pyrethrum Insect Dust

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

COMPANY DETAILS:

Kendon Chemical & MNFG. Co. Pty Ltd
71 McClure Street
Thornbury, Vic, 3071
Phone: 03 9497 2822
Fax: 03 9499 7225

PRODUCT DETAILS

Product Name: Pyrethrum Insect Dust
Synonyms: Pyrethrin based insecticide.
Manufacturer's Product Code(s): A130

Use: A powder insecticide especially suited for use on vegetables, ornamentals, in domestic use, in stored potatoes, dust bins and compost heaps for the control of insect pests. The piperonyl butoxide ingredient enhances the activity of the permethrin (synergist).

UN Number: Not applicable
Proper Shipping Name: Not applicable
Dangerous Goods Class: Not applicable
Subsidiary risk: Not applicable
Packing Group: Not applicable
Hazchem Code: Not applicable

2. COMPOSITION / INFORMATION ON INGREDIENTS

SUBSTANCE NAME	Proportion	CAS Number
PYRETHRUM	2.2%	8003-34-7
PIPERONYL BUTOXIDE	12.5%	51-03-6
TALC (magnesium silicate hydrate mineral)	>60%	14807-96-6

3. HAZARD IDENTIFICATION

Hazardous according to the criteria of Worksafe Australia

Pyrethrum Insect Dust - Material Safety Data Sheet

Hazard Category: Irritant

ACUTE HEALTH EFFECTS

Swallowed:

May be harmful if swallowed. May cause irritation to mouth, throat and stomach with effects including mucous build up, irritation to the tongue and lips and pains in the stomach.

Eye:

Will cause irritation to the eyes, with effects including: tearing, pain, stinging and blurred vision. Depending upon duration of exposure, eye damage may occur.

Skin:

Will cause irritation to the skin, with effects including: Redness, itchiness, and possible dermatitis.

Inhaled:

May cause irritation to the nose, throat and respiratory system with effects including: Dizziness, headache and possible confusion.

Chronic:

Prolonged or repeated skin contact may lead to dermatitis.

4. FIRST AID MEASURES

Swallowed:

If swallowed, DO NOT induce vomiting. Give a glass of milk. Seek medical assistance immediately

Eye:

If dust enters the eyes, immediately, flush with plenty of water for 15 minutes, ensuring eye lids are held open. If irritation persists transport to hospital or doctor.

Skin:

If material contacts the skin, remove any contaminated clothing and wash skin thoroughly with water and soap if available. If irritation persists transport to hospital or doctor.

Inhaled:

Move victim to fresh air. Apply resuscitation if victim is not breathing. Open all doors, windows and/or vents.

First Aid Facilities:

Eye wash fountain, safety shower and normal wash room facilities nearby.

Advice to Doctor:

Treat symptomatically. Contact Poisons Information Centre 13 1126.

5. FIRE-FIGHTING MEASURES

Extinguishing Media: Use extinguishing media suitable for surrounding fire situation.

If safe to do so, move undamaged containers from fire area.

Fire/Explosion Hazard: Not an explosion hazard.

Pyrethrum Insect Dust - Material Safety Data Sheet

Hazardous Decomposition Products: Decomposes on heating emitting soot, smoke, decomposition products and carbon monoxide. Fire Fighting Procedures Fire fighters to wear self-contained breathing apparatus (SCBA) if exposed to products of decomposition. Full protective clothing is also recommended.

6. ACCIDENTAL RELEASE MEASURES

Spillage: Ventilate the area. Remove all unnecessary personnel from spill area. Wear protective equipment. Sweep or shovel up, avoid spreading the dust. Prevent the powder from entering into drains and waterways. Collect and seal in properly labelled containers for disposal.

7. HANDLING AND STORAGE

Store in a cool place and out of direct sunlight. Store away from sources of heat, from oxidizing agents and from food. Keep containers closed, when not using the product. Store in original packages as approved by manufacturer.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Standards

PYRETHRUM

(Worksafe Australia) 5 mg/m³ [TWA]

(American Conference of Govt. Industrial Hygienists) 5 mg/m³ [TWA]
A4 - Not classifiable as a human carcinogen.

PIPERONYL BUTOXIDE No Exposure Standard available

POLYETHANOXY-9-NONYL PHENOL: No Exposure Standard available

Engineering Controls

Maintain adequate ventilation at all times. In most circumstances natural ventilation systems are adequate unless the material is heated, reacted or otherwise changed in some type of chemical reaction, then the use of a local exhaust ventilation system is recommended.

Personal Protection Equipment

Avoid skin, eye and inhalation contact.

CLOTHING: PVC or natural rubber apron.

GLOVES: PVC or natural rubber.

EYES: Chemical goggles, faceshield or safety glasses with side shields to protect eyes.

RESPIRATORY PROTECTION: Avoid breathing dusts. If natural or local exhaust ventilation is not adequate, select and use

Pyrethrum Insect Dust - Material Safety Data Sheet

a dust respirator in accordance with AS/NZS 1715/1716.

If entering spaces where the airborne concentration of a contaminant is unknown then the use of a Self-contained breathing apparatus (SCBA) with positive pressure air supply.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Fine beige powder
Boiling Point	Not applicable
Melting Point:	Not applicable
Vapour Pressure:	Not available
Specific Gravity:	2.7 approx
Flash Point:	Not Applicable
Flammability Limits:	Not Applicable
Solubility in Water:	The active ingredient is soluble in water. The carrier (talc) is insoluble in water.

10. STABILITY AND REACTIVITY

The active ingredients are stable under normal conditions of use.

CONDITIONS TO AVOID: Heat, flames, and incompatibles.

INCOMPATIBLE MATERIALS: Strong alkalis, acids, oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: The active ingredient will emit smoke and fumes when heated to decomposition. May form carbon monoxide

HAZARDOUS POLYMERIZATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Pyrethrum (as 100%):

Acute Oral Toxicity LD₅₀ (rat) = 3500 mg/kg

Acute Skin Toxicity LD₅₀ (rabbit) = >19000 mg/kg

Piperonyl Butoxide (as 100%):

Acute Oral Toxicity LD₅₀ (rat) = 6150 mg/kg

Acute Skin Toxicity LD₅₀ (rabbit) = 1880 mg/kg

Pyrethrum Insect Dust - Material Safety Data Sheet

12. ECOLOGICAL INFORMATION

This substance may be harmful to aquatic organisms. Avoid contaminating waterways.

Pyrethrins degrade quickly on exposure to sunlight and are not persistent in soil or water.

Piperonyl Butoxide is also degradable in soils and water and is basically immobile in most soils.

- Aquatic Toxicity: Fish LC50 (Carassius Auratus) : 4.2 mg/L

LC50 (Rainbow Trout) : 6.1 mg/L

- Aquatic Toxicity: LC50 (Daphnia Magna) : 2.95 mg/L after 24 hrs

13. DISPOSAL CONSIDERATIONS

Disposal: In accordance with the Local, State & Federal EPA waste regulations.

Advise irritant nature. Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to an approved waste facility. Processing, use or contamination of this product may change the waste management options.

The unclean container must also be handled as hazardous waste until cleaned.

14. TRANSPORT INFORMATION

Not classified as a Dangerous Good according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) 6th Edition; or according to the UN, IACO(IATA) [by air] or IMO(IMDG) [by sea].

15. REGULATORY INFORMATION

Workplace Hazardous Substance

HAZARD CATEGORY: IRRITANT

RISK PHRASES

R36/38 Irritating to eyes and skin.

SAFETY PHRASES

S2 Keep out of reach of children.

S13 Keep away from food, drink and animal feeding stuffs.

S24/25 Avoid contact with skin and eyes.

S37/39 Wear gloves and eye/face protection.

S26 After contact with eyes, rinse immediately with water and seek medical advice.

S28 After contact with skin, wash immediately with soap and water.

Not a Dangerous Good.

Not a Scheduled Poison.

NICNAS - Aust. Inventory of Chemical Substances: All ingredients are on the AICS.

Learning Activity

Task

LEARNING ACTIVITY ONE

Refer to the Material Safety Sheet (MSDS) on the previous pages and the chemical label to the right for Pyrethrum Insecticide and describe what this chemical is used for, as well as the correct chemical mixing rate.

Directions for Use:

Pyrethrum 5 EC is an emulsifiable concentrate for dilution with water prior to use.

Mixing: Shake well and dilute with water before use. Mix thoroughly and use immediately.

Water Volume: It is essential to achieve good spray coverage of the target crop foliage for optimum pest control. Apply in a high volume spray to ensure thorough coverage of the foliage to the point of run-off. Ensure that both upper and lower surfaces of the leaves are treated.

Timing of application:

Apply Pyrethrum 5 EC as soon as pest or pest damage is seen and when motile stages of pests are most active. Do not apply in direct sunshine or in very hot weather when it is advisable to apply in early morning or in the evening.

Rates of Use:

Apply Pyrethrum 5 EC at a dilution rate of 20 ml in 5 litres water.

For outdoor crops, apply at a maximum individual dose of 1.1 litres product per hectare.

For crops grown under protection, apply at a maximum individual dose of 2.4 litres product per hectare.

DO NOT EXCEED MAXIMUM INDIVIDUAL DOSE

Spray Programme and Harvest

Crops may be sprayed at 7 day intervals and harvested 24 hours after the last application.

Crop Safety

Some species of plant may be sensitive to Pyrethrum 5 EC and show signs of yellowing, particularly after a second application. Do not apply to open blooms and test spray on a small number of representative plants before spraying larger batches. Certain types of bedding plants may suffer some damage to any flowers present at the time of spraying. Subsequent new growth is unaffected.

APPLICATION

Wash Equipment thoroughly immediately after use. Fill the tank with clean water plus some wetter or detergent and flush out. Refill with water and spray out before storage or using other products. Traces of Pyrethrum 5 EC may cause damage to susceptible crops sprayed later.

Drift: Avoid drift off the target area. Avoid spraying within 6m of the field boundary to reduce effects on non-target insects and other arthropods.

Pyrethrum 5 EC must be stored in a suitable pesticide store in a dark place.

Resistance

Pesticide resistance in glasshouse whitefly and some aphids is widespread. Where strains resistant to products containing pyrethrins occur, this product is unlikely to give satisfactory control. Note: Resistant strains of the tobacco whitefly are also known to occur.

PROTECT FROM FROST

The (COSHH) Control of Substances Hazardous to Health Regulations may apply to the use of this product at work

IMPORTANT INFORMATION

FOR USE ONLY AS AN

AGRICULTURAL/HORTICULTURAL/FORESTRY/INDUSTRIAL INSECTICIDE.

Crops/situations: All edible and non-edible crops. Maximum individual dose: 20 ml product in 5 litres water.

Other specific restrictions:

- (1) Do not exceed 1.1 litre product/ha for crops grown outdoors
 - (2) Do not exceed 2.4 litres product/ha for crops grown under protection
- READ THE LABEL BEFORE USE. USING THIS PRODUCT IN A MANNER THAT IS INCONSISTENT WITH THE LABEL MAY BE AN OFFENCE. FOLLOW THE CODE OF PRACTICE FOR USING PLANT PROTECTION PRODUCTS.

SAFETY PRECAUTIONS

Operator protection

Engineering control of operator exposure must be used where reasonably practicable in addition to the following personal protective equipment:

WEAR SUITABLE PROTECTIVE CLOTHING (COVERALLS) AND SUITABLE PROTECTIVE GLOVES when handling the concentrate.

WEAR SUITABLE PROTECTIVE GLOVES when applying by hand-held equipment.

However, engineering controls may replace personal protective equipment if a COSHH assessment shows they provide an equal or higher standard of protection.

WHEN USING DO NOT EAT, DRINK OR SMOKE. WASH HANDS AFTER USE. DO NOT BREATHE SPRAY.

Environmental protection

RISK TO NON-TARGET INSECTS OR ARTHROPODS.

See Directions for use.

HIGH RISK TO BEES. DO NOT apply to crops in flower or to those in which bees are actively foraging. Do not apply when flowering weeds are present.

DO NOT CONTAMINATE SURFACE WATER OR DITCHES with chemical or used container.

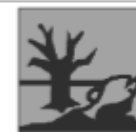
DO NOT ALLOW DIRECT SPRAY from horizontal boom sprayers to fall within 5m of the top of the bank of a static or flowing water body, or within 1m of the top of a ditch which is dry at the time of application.

DO NOT ALLOW DIRECT SPRAY from hand-held sprayers to fall within 1m of the top of the bank of a static or flowing water body. Aim spray away from water. THIS PRODUCT IS NOT ELIGIBLE FOR BUFFER ZONE REDUCTION UNDER THE LERAP HORIZONTAL BOOM SPRAYERS SCHEME.

Storage and disposal
KEEP OUT OF REACH OF CHILDREN.
KEEP AWAY FROM FOOD, DRINK AND ANIMAL FEEDING STUFFS.
KEEP IN ORIGINAL CONTAINER, tightly closed, in a safe place.
EMPTY CONTAINER COMPLETELY and dispose of safely.



IRRITANT



DANGEROUS FOR THE ENVIRONMENT

- R41 RISK OF SERIOUS DAMAGE TO EYES
R50 VERY TOXIC TO AQUATIC ORGANISMS
R53 MAY CAUSE LONG-TERM ADVERSE EFFECTS IN THE AQUATIC ENVIRONMENT.
S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice
S39 Wear eye/face protection
S35 This material and its container must be disposed of in a safe way
S57 Use appropriate containment to avoid environmental contamination
S75 TO AVOID RISKS TO MAN AND THE ENVIRONMENT COMPLY WITH THE DIRECTIONS FOR USE

Net Contents 5 litres

Manufactured and marketed by:

Agropharm Ltd

Penn Bucks UK HP10 8LN

Tel: 01494 816575

Fax: 01494 816578

www.agropharm.co.uk



Batch No:

Man. Date:

Pyrethrum 5 EC is manufactured in the UK by Agropharm Ltd. to the highest quality standards.

**Learning
Activity**

Task

LEARNING ACTIVITY TWO

Again refer to the SDS or the manufacturers label for the same Pyrethrum Insecticide and list the health hazards and the recommended PPE.

Health Hazards**PPE**

SAMPLE SAMPLE

USE APPROPRIATE MIXING EQUIPMENT

Correct mixing order using only equipment designed for that purpose is critical in order to reduce the risk of products interacting in a way that may reduce their efficacy or affect the stability of the tank mix. The addition of multiple products to the spray tank must take place in a specific order to ensure they can be adequately mixed through the solution, according to their solubility and formulation type.

Bringing most products into contact with each other in a concentrated form will usually result in undesirable interactions between products. Applicators must understand what the formulation and adjuvant type is for each of the products they intend mixing. Information about the correct mixing order can often be found on the product label. However, for some tank mix combinations, further information may be required from the manufacturer through tech notes or product guides.



Boom sprayer standard order of mixing—When loading the sprayer, it is critical to follow standard mixing order. Only deviate from this mixing order if there is a specific directive on the label of a key component of the mix.

- ☆ Fill your tank at least 2/3 with water which is suitable for all of the components of the proposed mix, such as no pH, hardness, clay or other limitations
- ☆ Add water conditioners e.g. pH adjusters, ammonium sulphate
- ☆ Add chemical granules / flowables / powders and mix well. It is best to apply these to the top of tank so that they disperse with plenty of water
- ☆ If loading with a pre-mix pot, ensure good water movement so that the chemical is rapidly dispersed
- ☆ If you are using liquid fertilisers as carriers, very good agitation is essential
- ☆ Add wetters
- ☆ Top up with water, mix well and apply the mixture as soon as possible



Mixing a knapsack or hand held sprayer—The same mixing process applies as with the boom sprayer; fill the spray unit half with water, add chemical and replace spray tank lid- shake vigorously to mix chemical and then fill the spray tank with remaining water to the required level.

Only use measuring containers explicitly for chemical use only and rinse well after use.

**Learning
Activity**

Question

LEARNING ACTIVITY THREE

In this activity you will need again to refer to the Material Safety Sheet (MSDS) and the chemical label for Pyrethrum Insecticide in on the previous pages.

In this activity you will need to tell us how this chemical must be mixed for a 10 litre knapsack spray unit.

SAMPLE SAMPLE



CHECK THAT OUTPUT OF APPLICATION EQUIPMENT IS CORRECT

Once chemicals have been mixed accurately it is then essential that they are applied at the correct rate for maximum kill of target pest with minimum waste or collateral damage to the environment. This requires the operator of the equipment to have it properly calibrated.

To apply a specified rate of chemical to the target surface (e.g. plant, soil, pest), you need to measure the total spray output of the machine, the travel speed and the swath width. Then calculate the application rate. By calibrating your chemical sprayer you can find out your spray application rate. This information is necessary whenever you use chemicals that are specified in amounts per hectare. It also lets you work out how many spray tanks are needed for a particular job. The spray application rate varies for different crops, different row spacing's and the age, height and density of crops. This means you need to calibrate for each crop or block.

On the next page we learn more about a calibration method.



CALIBRATION METHOD

Total sprayer output (L/min) - The aim here is to measure the total liquid sprayed from your machine in one minute.

- 1) Fill the spray tank with clean water
- 2) Place a measuring jug under one nozzle. If you do not want to get wet, attach a piece of plastic hose to the nozzle and place the other end into the jug
- 3) Run the sprayer for one minute at the correct pressure with all nozzles operating
- 4) Measure how much water is in the jug. Compare this to the output specified by the manufacturer using the correct pressure. Nozzle output should not vary by more than 10%. If it does, the nozzle could be worn or damaged and should be replaced. All nozzles on the boom should have a similar output
- 5) Repeat steps 2–4 for all nozzles
- 6) Add all the jug measurements to find the total sprayer output in litres per minute

Tractor travel speed (km/h) - The normal speed for spraying with small boom sprayers in horticulture situations is 4–10 km/h. The slower you travel, the higher the application rate. A change in ground speed of 10% results in a 10% change in application rate. Adjust your travel speed to suit ground conditions.

- ☆ Measure out a distance of 100 metres on the ground to be sprayed and mark the start and finish positions with pegs
- ☆ Select the right gear and engine revs for spraying
- ☆ Measure how many seconds it takes to travel 100 metres with the sprayer attached and half full
- ☆ Calculate your travel speed by inserting the time in seconds into the following formula:

$$\text{Travel speed (km/h)} = 100 (m) \times 3.6 \text{ Time (seconds)}$$

Swath width - measure your swath width (in metres). For general broadcast spraying, the swath width is equal to the number of nozzles multiplied by the nozzle spacing. For band spraying the swath width is equal to the total of all the band widths.

**CALCULATING SPRAY APPLICATION OUTPUT RATE**

Calculate the application rate using the following formula:

$$\text{Application rate (L/ha)} = 600 \times \text{total sprayer output (L/min)} \times \text{swath width (m)} \times \text{travel speed (km/h)}$$

For example if your total sprayer output is 5 L/min, your speed is 10 km/h and the swath width is 5m, your application rate is:

$$\frac{600 \times 5}{3000} \text{ divided by } \frac{5 \times 10}{50} = 60 \text{ L/ha}$$

**Learning
Activity**

Question

LEARNING ACTIVITY FOUR

Why is calibration of spray equipment critical in chemical applications?

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY FIVE

Do some research and tell us what 'emulsifiable concentrate' means?

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY SIX

What were the three elements required to calculate application output?

--	--	--

SAMPLE SAMPLE



MEASURE, MIX AND LOAD CHEMICAL MIX OR SUBSTANCES

On the previous pages we looked at calibrating the sprayer. This was done using clean water. Next is to prepare the chemicals.

During mixing and loading chemical users are required to handle concentrated products, meaning that the hazards, including the potential for skin and eye exposure, are greater than at any other stage during the spraying process. Similarly, spills involving concentrated products have a greater potential to impact on the farm and natural environment. Careful mixing and loading is also important in ensuring the performance, ease of use and crop safety of crop protection products. In order to ensure performance, applicators should carefully read product labels to determine the compatibility of different products or additives prior to mixing. It is also important that products are added to the spray tank in an appropriate order.

Mixing procedure—Partly fill the spray tank with water, as per label directions. Start the agitation system and maintain agitation throughout the mixing and spraying process. Add the correct amount of product to the spray tank in line with recommended mixing order ensuring it is fully dispersed or dissolved before adding the next product.

Fill the remainder of the spray tank with water. Use the spray mix within 24 hours of preparation (unless otherwise stated on label).

Mixing order—Some products may react with other products if they are not mixed in the correct order. The general mixing order of products should be:

- ☆ Water dispersible granules
- ☆ Wettable powders—finely ground powders that are easily suspended in water
- ☆ Flowable or suspension concentrates
- ☆ Emulsifiable concentrates
- ☆ Water based or soluble concentrates
- ☆ Adjuvants—chemicals or additives that enhances or modifies the action of the principal ingredient



MINIMISING THE RISKS INVOLVED IN MIXING AND LOADING

The hierarchy of controls framework for risk management we looked at previously represents a useful step by step guide when considering how to minimise the risks involved in mixing and loading chemicals.

Workplace safety legislation in many States and Territories is based on the hierarchy of controls framework, with laws requiring employers/ management to identify all possible hazards, undertake a workplace risk assessment and in cases where hazards cannot be eliminated, to manage risks through following the hierarchy of controls.

- ☆ **Elimination** - Can the hazard be eliminated?
- ☆ **Substitution** - Is it possible to find an effective substitute for the hazardous product/process?
- ☆ **Separation** - Is it possible to separate the hazard by distance or a physical barrier?
- ☆ **Engineering** - Can the process or piece of equipment be re-engineered to isolate the hazard?
- ☆ **Administrative controls** - Can new procedures/processes be introduced to minimise exposure to a hazard?
- ☆ **Personal protective equipment** - What PPE can be worn to minimise exposure?

**Learning
Activity**

Task

LEARNING ACTIVITY SEVEN

In this activity we want you to create an A3 poster. This poster will be describing the correct mixing procedure of chemicals in a 'step-by-step' layout. Be as creative as possible. Once completed, present your poster to your teacher or trainer for review and discussion.

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY EIGHT

What does it mean to keep the mix 'agitated'.?

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY NINE

Why is it critical to use the correct order for mixing and loading chemicals?

SAMPLE SAMPLE

SAMPLE SAMPLE



CONFIRM INSTRUCTIONS FROM CHEMICAL LABEL AND SUPERVISOR IN THE EVENT OF A SPILL

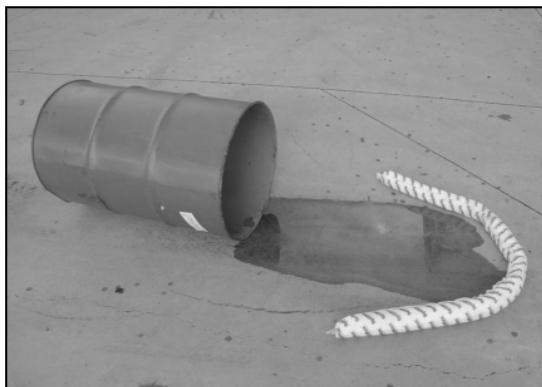
An accidental chemical spill can happen at any time. However, before attempting to control any spill, put on personal protective equipment. By acting quickly to control the flow of the spilled material, the less damage it can cause.

- ☆ **Control the spill**—You need to act quickly—the sooner the spill is controlled the less damage it can cause. Immediate steps should be taken to control the flow of the material being spilled, regardless of the source. If a can on a storage shelf has rusted through and is leaking, a sprayer has tipped over, or a hazardous chemical is leaking from a damaged tank truck, do everything possible to stop the leak or spill at once. For instance, smaller containers can be put into larger containers to prevent further release of the chemical.
- ☆ **Get help**—If the spill is large or dangerous, have someone get help. Do not leave the site unattended. Be sure to have the product label and safety data sheet (SDS) available as it has information regarding actions required in the event of a spill.

Another very important number to remember is the emergency telephone number found on product labels and on transportation shipping papers. Calls to manufacturers are answered 24 hours per day by people who are prepared to handle pesticide emergencies involving their products.

- ☆ **Isolate the area**—Rope off the contaminated area; keep people at least 30 feet away from the spill. Avoid contact with any drift or fumes that may be released. Do not use road flares if you suspect the leaking material is flammable. At times, evacuating people that are downwind from the spill may be necessary.

Do not leave the spill site until someone relieves you. Someone should be present at the spill site continuously until the danger is removed, the chemical is cleaned up, and the area is decontaminated.



CONTAIN THE SPILL OR LEAK

At the same time the leak is being controlled, contain the spilled material in as small an area as possible and keep it from spreading. In some situations, a shovel or power equipment may be needed to construct a dam.

Liquid spills can be further contained by spreading absorbent materials such as fine sand, vermiculite, clay, or pet litter over the entire spill. However, a word of caution is needed here. Avoid using sawdust or sweeping compounds if the material is a strong oxidiser (check the label or SDS) because such a combination presents a possible fire hazard.



In addition, spill kits contain non selective, universal sorbents packed in porous fabric pillows. These pillows and “tubes” can be placed directly on the spill or used to dike around the spill area. Waste disposal also is simplified since the contaminated pillows can be placed into heavy-duty disposal bags without loss of waste material.

The spread of spilled products formulated as dusts, wettable powders, or granular materials can be reduced by lightly misting the material with water or covering the spill with some type of plastic cover. However, if a plastic cover is used, it will be contaminated and should be discarded according to the disposal instructions on the product label.

The most important point to remember is, 'do not' get any spilled chemicals into any body of water, including storm sewers or drains, no matter how small the spill.



**Learning
Activity**

Question

LEARNING ACTIVITY TEN

In this activity you will need again to refer to the Material Safety Sheet (MSDS) and the chemical label for Pyrethrum Insecticide in on the previous pages.

In this activity you will need to tell us the required action in the event of a spill of Pyrethrum .

SAMPLE SAMPLE



CHECK THAT OUTPUT OF APPLICATION EQUIPMENT IS CORRECT AND IN ACCORDANCE WITH APPLICATION/SPRAY PLAN

As we now know, chemicals need to be applied at the correct rate in the appropriate amount of water. To achieve this, all spraying equipment needs to be calibrated. There are many methods of calibrating with an accurate and simple method to calibrate a tractor driven boom spray was explained earlier in this section.

It is acknowledged that calibration of a boom spray is beyond the capabilities and intent of this competency, however it is good knowledge to have initially while being shown by the supervisor on how to calibrate a sprayer and calculate the application flow rate.

Generally, horticultural farmers will have an application plan.

The plan would show what area was to be sprayed within a certain period and what chemicals would be used.

The area to be sprayed may differ from day to day on the plan, so this means the application flow rates would need to be adjusted.

**Learning
Activity**

Research

LEARNING ACTIVITY ELEVEN

There are now 'apps' for almost anything you can think of.

There are numerous 'apps' for horticultural farmers that are for developing application or spray plans.

In this activity we want you to do some research and locate three 'apps' available in Australia for farmers to use for creating an application or spray plan.

Tell us the name of the 'app' and the supplier here in Australia.

App 1 name _____

Supplier name _____

App 2 name _____

Supplier name _____

App 3 name _____

Supplier name _____

Section Four

Apply Chemicals

APPLY CHEMICALS UNDER SUPERVISION

SECTION FOUR – APPLY CHEMICALS

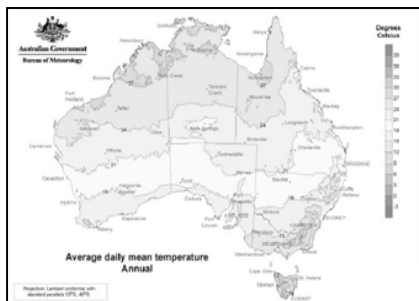
INTRODUCTION

In this section we will focus on the safe application of chemicals, specifically weather factors, environmental factors and the public.

SECTION LEARNING OBJECTIVES

At the completion of this section you will learn information relating to:

- ☆ Assessing and recording meteorological conditions and forecasts prior to and during application where relevant
- ☆ Ceasing application if conditions become unsuitable
- ☆ Applying chemical ensuring minimal risk to others and the environment
- ☆ Minimising risks to others, product integrity and the environment prior to and during application



ASSESS AND RECORD METEOROLOGICAL CONDITIONS AND FORECASTS PRIOR TO AND DURING APPLICATION WHERE RELEVANT AND CEASE APPLICATION IF CONDITIONS BECOME UNSUITABLE

(Over the next few pages we cover two 'Performance Criteria' points at the same time to avoid repetition)

When planning to spray, consider local forecasts and consult the label for product specifications such as optimal application conditions, drying time, absorption rate and retention time. Use a handheld weather station to adapt your application method to changing weather conditions. If conditions become too adverse it is sometimes necessary to stop spraying until they improve. You can't change the weather, but with accurate information you can work with it to achieve the best results.

Weather conditions such as wind, temperature, relative humidity and precipitation influence the effectiveness of chemical spray applications and the potential for wastage by run-off and drift. We will look at the impact of weather conditions on spray applications and how to change application methods to match weather conditions, improve accuracy and reduce wastage. We will also consider how to use simple tools to measure and monitor weather conditions and provide information on where to purchase these tools.

- ☆ **Wind**—Wind direction determines whether droplets travel toward the target or toward unintended downwind areas such as open water, sensitive crops or areas of human activity. Wind speed affects the distance a droplet will travel before it is deposited on the target.

Spray only when wind direction is consistent and between 2–15 km/h, or as indicated on the product label. The impact of wind is particularly significant when performing directed (e.g. air blast) spraying, so spray with a crosswind and always orient nozzles and deflectors to direct the spray into canopies, not over them.

- ☆ **Temperature and relative humidity**—Spray when temperatures are low and relative humidity is high. In general, do not spray when relative humidity is less than 40 per cent and air temperature is above 25°C. This reduces the chance of drift due to temperature inversions or evaporation. It also increases target deposition and coverage.

Hot and dry conditions increase drift because droplets rapidly evaporate and become fine droplets, vapour or particles of concentrated pesticide. Optimum spraying conditions are early mornings following overcast nights.



- ☆ **Precipitation**—Rain can have both a positive or negative effect on spraying. Some products work best when rain water carries them into the soil after application, but not far enough to enter the water table before they do their work and break down. Depending on the rain-fastness of the product, rain soon after application may also wash the product from leaves and reduce the level of protection. While rain can also redistribute certain products over the target, do not rely on this for distribution.

Monitor weather forecasts and understand the impact on the product being applied. Avoid spraying when foliage is still wet from rain or dew unless indicated by the label. A leaf can retain only a limited volume of spray, and therefore a limited amount of product. Once wetted, deposition will not increase beyond the tank concentration and the surplus will run off to the lower leaves and onto the soil.

MEASURING WEATHER CONDITIONS

Measure weather conditions when planning to spray, or during spraying if a change in conditions is suspected. Limitations on application temperature and wind speed may be on the pesticide label. It is the responsibility of all applicators to monitor and record local conditions using a combination of weather forecasts, a standard compass or windsock and a fixed or handheld weather station.

A handheld weather station is an option for measuring temperature, relative humidity and wind speed. To measure temperature or relative humidity, take readings in the shade and wait a minimum of 15 seconds for accurate readings.

To measure wind speed, hold the meter 1.5 m above the ground or the height of the spray boom, whichever is greater. Depending on the fullness of the canopy, wind speed is higher at the outer rows and the top of an orchard or vineyard canopy, so use a pole to lift the meter to canopy height and then check the recorded average. Monitor wind speeds over 2–3 minutes to determine the maximum and average wind speed and direction. Use a basic orienteering compass to determine prevalent wind direction.

Step away from the sprayer, face square into the wind, and hold the compass level at waist height. Turn the whole compass so that the arrow in the centre of the base is facing away from you (into the wind). Turn the bezel, the rotating ring surrounding the compass face, until the “N” is centred over the north (red) end of the compass needle. Read the bearing of the wind, which is in degrees, from the circular scale directly over the centreline of the compass. The bearing is a value between 0 and 360 degrees.

**Learning
Activity**

Question

LEARNING ACTIVITY ONE

1) Why are weather conditions important in application of chemicals?

2) Where would you find information that informs you of the desired weather condition for certain chemicals?

3) What weather conditions would indicate that chemical spray application should cease?

4) How can you determine with accuracy that weather conditions have changed?

SAMPLE SAMPLE

APPLY CHEMICAL ENSURING MINIMAL RISK TO OTHERS AND THE ENVIRONMENT

In Australia the Commonwealth Government controls the use of agricultural and veterinary chemicals through the Agricultural and Veterinary Chemicals Code Act 1994 and associated regulations.

The Australian Pesticides and Veterinary Medicines Authority (APVMA) administers this Act and is responsible for controlling agricultural and veterinary chemicals, from importation and manufacture to the point of retail sale.

The purpose of the Act is to impose controls in relation to:

- ☆ the use, application and sale of agricultural and veterinary chemical products, fertilisers and stock foods and the manufacture of fertilisers and stock foods
- ☆ providing protection against financial loss caused by damage and contamination to land, plants and stock from agricultural spraying
- ☆ the production of agricultural produce to avoid the contamination of food for human consumption



Other relevant State legislation to be aware of includes:

- ☆ Environment Protection Act 1970
- ☆ Drugs, Poisons and Controlled Substances Act 1981
- ☆ Dangerous Goods Act 1985
- ☆ Health Act 1958
- ☆ Occupational Health and Safety Act 2004.

As you can see the personal safety of workers and the general public as well as mitigating damage to the environment, are heavily mandated by various Government Legislation and Regulations. This makes it crucial to make every effort to reduce these risks associated with chemical application.



SAFE APPLICATION

The following information needs to be considered when applying chemicals.

- ☆ ***Spray equipment and practice***—The aim of a successful spray application is to ensure the correct amount of agricultural chemical is applied to the intended target, with no contamination to off-target areas. Before applying the chemical, consider what type of equipment is best suited to reducing risk to others and the environment.
- ☆ ***Spray drift***—Spray drift is the most common cause of off-target chemical movement. As an agricultural chemical user, you must take care to prevent spray drift. It is an offence to undertake agricultural spraying which:
 - ☆ Injures any plants or stock outside of the target area
 - ☆ Injures any land outside the target area so that growing plants, or keeping stock on that land would result in contamination, or
 - ☆ Is likely to contaminate any agricultural produce derived from plants or stock outside the target area



- ☆ **Equipment to reduce spray drift**—Automatic rate controllers when set up correctly, allow pressure to change relative to the ground speed while maintaining the water rate, increasing the droplet size when travelling near sensitive areas.

Air-assisted sprayers provide directed air, which blows spray onto the target area and into a crop canopy. The air assists the spray moving against the wind.

Air induction/inclusion nozzles have a venturi which draws air into the body of the nozzle, where it is mixed with the spray solution under pressure. The spray pattern is made up of large air filled coarse droplets with very few fine droplets which may be prone to drift. The air bubbles in the droplets shatter on impact with the target providing good coverage.

Direct soil injection systems have sprays attached to tynes, which spray into the soil as the tynes break and lift the soil. No spray drift is possible because spray is confined beneath the soil. Vapour drift is still possible.

Low drift nozzles are very similar to a normal flat fan nozzle. The nozzle contains a plate with a small hole that reduces the energy of spray before it exits the nozzle, making droplets coarser and slower. This reduces the number of fine droplets that are likely to drift.

Standard equipment can be modified to reduce spray drift by using a coarser nozzle, reducing spray pressure or angling the nozzles forward, so that the boom can be lowered.

Shielded boom sprayers control drift using a physical barrier that contains the spray cloud, or act as an aerodynamic guide, controlling air flow around the nozzle. The controlled air flow is less turbulent, minimising the volume of droplets being carried away from the target. The air flow can also force droplets down onto the target.

Twin fluid systems inject compressed air into the spray at the nozzle, providing independent control of pressure and flow rate. Droplet size can be maintained at a lower volume rate because air pressure (not liquid pressure) is used to atomise the liquid.



- ☆ **Chemical run-off into pasture paddock**— Off-target movement of chemicals can also be caused by run-off.

To avoid run-off:

- ☆ Decant chemicals carefully to prevent spillage
- ☆ Locate chemical mixing and wash-down sites away from streams, drains and bores
- ☆ Store chemicals carefully to prevent leakage
- ☆ Avoid back-siphoning chemicals when filling tanks
- ☆ Provide spray employee/contractors with a farm plan that outlines waterways
- ☆ Observe any 'DO NOT...' statements on the label relating to spraying in wet or water-logged soils
- ☆ Spray away from water when treating weeds on a bank
- ☆ Establish vegetative buffers between crops and waterways
- ☆ Use the right water rate for the soil type
- ☆ Do not spray when rain is expected
- ☆ Avoid over-irrigating after applying chemicals
- ☆ Constantly monitor weather conditions while spraying is taking place
- ☆ Ensure that application equipment is correctly calibrated

- ☆ **Precautions to ensure general safety**—Common precautions to take when using chemicals include:

- ☆ Do not allow others, including children, to be where chemicals are being mixed or applied
- ☆ Never eat, drink or smoke when using agricultural chemicals
- ☆ Avoid chemicals touching your skin, eyes or mouth
- ☆ Immediately wash your hands or any skin exposed to chemicals
- ☆ Do not use your mouth to clear blocked nozzles or suck the end of a hose to begin siphoning
- ☆ Never store agricultural chemicals in unlabelled containers or in drink bottles whether they are labelled, or not
- ☆ Use equipment that minimises contact with chemicals (e.g. metering pumps, self-cleaning filters and electronic spray controllers)
- ☆ Stop work and seek medical attention if you feel ill or show symptoms of poisoning
- ☆ Keep spray downwind of the operator. If this is not possible, wear a respirator and hood in addition to PPE

**Learning
Activity**

Question

LEARNING ACTIVITY TWO

- 1) What is the name of the Australian Commonwealth Legislation that imposes conditions upon any users of agricultural chemicals in order that risk to others and the environment is mitigated during any chemical use?

- 2) What are some ways of ensuring minimal risk to others and the environment during chemical application?

SAMPLE SAMPLE

MINIMISE RISKS TO OTHERS, PRODUCT INTEGRITY AND THE ENVIRONMENT PRIOR TO AND DURING APPLICATION

Horticultural pesticides are chemicals that protect crops and livestock from rodents, insects, disease, or weeds. Because pesticides are poisonous, they can be extremely dangerous to humans. Before applying chemicals always ensure your safety, the safety of others and the safety of the environment.

The following information provides guidelines for handling pesticides in order to minimise risks to others, product integrity and the environment prior to, as well as during application:

- ☆ Do not transport, mix, or use agricultural chemicals unless you can summon help, if needed
- ☆ Keep an ample supply of water nearby to flush exposed areas, if a spill occurs
- ☆ Check all pesticide equipment before you use it to ensure proper working condition
- ☆ Read pesticide labels carefully. Follow the label directions when mixing, applying, storing, or disposing of pesticides
- ☆ Wear personal protective equipment to prevent dermal, inhalation and mucous membrane exposure
- ☆ Do not eat, drink, or smoke when handling pesticides
- ☆ Launder clothing and bathe after working with pesticides to ensure that all chemicals are removed from clothing and skin.
- ☆ Observe assigned re-entry intervals. Always wear the appropriate protective clothing when entering fields before the re-entry date.
- ☆ Always handle pesticides downhill from wells, cisterns, sink holes, ditches, or standing water. Do not allow pesticide rinse water to contaminate water supplies
- ☆ Do not apply pesticides when rain is imminent, or if wind could affect the spraying area.
- ☆ Triple-rinse spray equipment and empty containers. Apply the rinse water to the treated field.
- ☆ Avoid pesticide drift, runoff, and spills
- ☆ Avoid equipment accidents. Keep suitable absorbent (e.g., vermiculite) on hand in case of spills
- ☆ Always try to use all the pesticide in your application tank. If pesticides remain, use them on other target locations. After emptying the tank, clean and store the equipment
- ☆ Store pesticide containers in rows with the labels plainly visible and place contents from damaged containers in sound containers. If relevant, segregate pesticides by formulation
- ☆ Store rigid containers in an upright position, with tight lids/bungs, off the ground, in a manner to permit access and inspection and properly dispose of empty containers.
- ☆ Maintain a complete inventory indicating the number and identity of containers and check containers regularly for corrosion and leaks.
- ☆ Always thoroughly clean all pesticide equipment as soon as you are through with it
- ☆ Clean the inside and outside of pesticide equipment, including nozzles
- ☆ Dispose of contaminated rinse water as directed on the chemical label

**Learning
Activity**

Question

LEARNING ACTIVITY THREE

Why is it important to minimise risks to others, product integrity and the environment prior to and during chemical application?

SAMPLE SAMPLE

Section Five

Transport and Handle Chemicals

APPLY CHEMICALS UNDER SUPERVISION

SECTION FIVE – TRANSPORT AND HANDLE CHEMICALS

INTRODUCTION

In all cases a farm will be transporting chemicals from suppliers to the farm and then have them placed in storage.

As farm chemicals are considered dangerous goods, there are certain precautions that need to be taken when transporting chemicals.

In this section we review the safe transport of chemicals.

SECTION LEARNING OBJECTIVES

At the completion of this section you will learn information relating to:

- ☆ Confirming precautions for the transport and handling of chemicals with supervisor
- ☆ Transporting and handling chemicals in accordance with relevant commonwealth, state and territory chemical legislation

**CONFIRM PRECAUTIONS FOR THE TRANSPORT AND HANDLING OF CHEMICALS WITH SUPERVISOR
AND
TRANSPORT AND HANDLE CHEMICALS IN ACCORDANCE WITH RELEVANT COMMONWEALTH, STATE AND TERRITORY
CHEMICAL LEGISLATION**

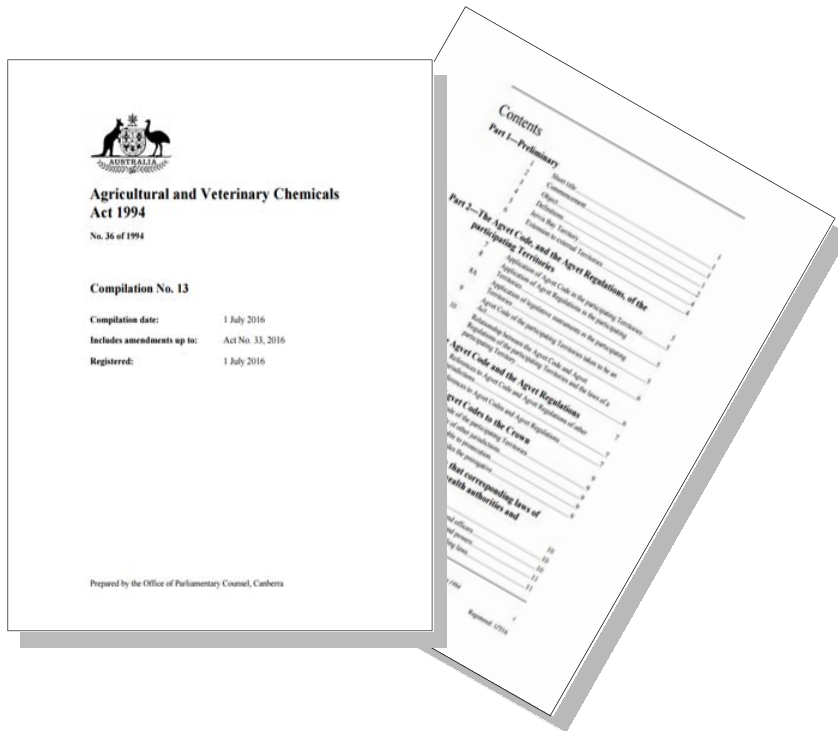
(Over the next few pages we cover two 'Performance Criteria' points at the same time to avoid repetition)

During the application of Horticultural chemicals there are critical protocols that need to be observed, both during transport of chemicals from the retail outlet to the farm, as well as then transporting chemicals around the workplace to the chemical application site.

Many chemicals are scheduled poisons, hazardous substances or 'Dangerous Goods'.

If a farm chemical is considered 'Dangerous Goods', there will be a diamond shaped hazard symbol on the label like those shown below.





Various legislation controlling transport handling and storage of chemicals exist.

At the Commonwealth level, agricultural chemicals are regulated by the Agricultural and Veterinary Chemicals (Administration) Act 1992, Agricultural and Veterinary Chemicals Act 1994, Agricultural and Veterinary Chemicals Code Act 1994 and Agricultural and Veterinary Chemical Products (Collection of Levy) Act 1994.

Most States regulate the storage and transport legislation which comes under the Dangerous Goods Act and Dangerous Goods Regulations.

These include chemicals and chemical substances that are explosive, flammable, toxic, corrosive or exhibit chemical properties that are potentially dangerous to people or property. People handling dangerous goods are required to make sure that the goods are handled, stored and transported safely.



TRANSPORTING HANDLING AND STORING CHEMICALS

The following are steps to take when transporting farm chemicals. Everyone transporting farm chemicals has a duty of care and a responsibility to carry out their tasks in a manner which will not cause harm or injury to themselves, other people, their property, animals or the environment.

- ☆ Check the label of each farm chemical you plan to move
- ☆ Information on the transport requirements is found on the pesticide label or on Material Safety Data Sheets (SDS)
- ☆ When you collect new containers of farm chemicals, check them carefully for damage and tighten the lids firmly to prevent leakage
- ☆ Make sure your vehicle is roadworthy and can safely transport farm chemicals
- ☆ Put pesticide containers and packages inside a tray of some kind, which will contain any spillage
- ☆ Never transport pesticides in the same compartment as food and drinks (either for human or animal consumption)
- ☆ Do not transport animals, plants and seeds, veterinary products, safety equipment (including protective clothing), or other clothing with pesticides
- ☆ Do not transport items classed as Dangerous Goods in large quantities. Pesticides should be carried in the back of your truck or van, never in the same compartment as the driver and passengers

When packing the vehicle, make sure light items are packed on top of heavy ones to avoid the chance of damage in transit. Make sure the lid or cap is always positioned facing up. Pack the load securely so that items will not move around during transit, fall over, fall off the vehicle or be projected from the vehicle. As with storing pesticides, always keep different classes of pesticides apart. Do not pack insecticides, herbicides and/or fertilisers together. Make sure there is nothing in the load area that could damage or puncture containers. Protect easily-damaged packaging such as glass. Put the least dangerous items on the top of the load.

Take the safest route from your agricultural chemical supplier to your farm. Avoid exposing containers to extreme heat and water by covering the load with a tarpaulin during the trip. If you do stop along the way, remember to securely lock your vehicle. If any spillage occurs during transport, clear the vehicle immediately. The main steps in dealing with a spillage are to isolate, contain, decontaminate and dispose.

On reaching the farm, place the containers in your pesticide store as soon as possible. Unload the vehicle carefully. Make sure packaging and containers are not damaged and that lids are tightly closed.

**Learning
Activity**

Question

LEARNING ACTIVITY ONE

In Section Three we reviewed a chemical called Pyrethrum Insecticide. In this activity we want you to refer to the Material Safety Sheet (MSDS) of Pyrethrum Insecticide and list the transport requirements as indicated.

SAMPLE SAMPLE

**Learning
Activity**

Task

LEARNING ACTIVITY TWO

In this activity we want you to list out as a summary in bullet point form and in your own words the safety precautions listed in this section for transporting chemicals.

SAMPLE SAMPLE

Section Six

Finalise Work

APPLY CHEMICALS UNDER SUPERVISION

SECTION SIX – FINALISE WORK

INTRODUCTION

In this section we will focus on the safe application of chemicals, specifically weather factors, environmental factors and the public.

SECTION LEARNING OBJECTIVES

At the completion of this section you will learn information relating to:

- ☆ Cleaning and storing personal protective equipment and application equipment in accordance with manufacturers and work health and safety requirements
- ☆ Disposing of excess chemicals and clean containers in accordance with label instructions and regulatory requirements
- ☆ Completing incident reports as required
- ☆ Completing application records
- ☆ Storing unused chemical and products in appropriate location
- ☆ Adhering to all re-entry requirements



CLEAN AND STORE PERSONAL PROTECTIVE EQUIPMENT AND APPLICATION EQUIPMENT IN ACCORDANCE WITH MANUFACTURERS AND WORK HEALTH AND SAFETY REQUIREMENTS

Cleaning and maintenance instructions from the PPE manufacturer must be followed for **reusable** PPE. **Never reuse** any type of disposable (one-time use) PPE equipment, because you can be exposed to residues remaining on the PPE from the previous use, or to product moving through damaged or deteriorated PPE during reuse.

Note that reusable or limited-use PPE must be discarded if not cleaned and maintained properly, because there is a significant risk of pesticide exposure. For example, pesticide exposure can occur from residues remaining from the previous use, damaged seals in the respirator, small holes or tears in gloves or clothing, or degradation of the chemical-resistant PPE.

Remove PPE as soon as you complete the tasks where you were exposed to the pesticide. Wash disposable OR reusable gloves with soap and water, and then remove other PPE while still wearing the gloves. Then wash the gloves again with soap and water before removing them. Clean reusable PPE according to the PPE instructions, without causing contamination to yourself.

Wash regular work clothes that have been exposed to pesticides as soon as possible to ensure maximum pesticide residue removal. Wash them separately from other laundry using detergent and hot water. Using an outdoor clothesline rather than a dryer may help break down any remaining pesticide residues.

Always obtain replacement parts for half and full-face respirators from the original manufacturer and repair PPE in accordance with manufacturer instructions. Respirator component parts are NOT interchangeable between different manufacturers.

Storage instructions from the PPE manufacturer must be followed for both reusable and disposable PPE. Most PPE must be protected from chemicals, sunlight, extreme temperatures, excessive humidity, and moisture, or the specified shelf-life will be reduced. Disposable, reusable, or limited-use PPE must be discarded if not stored properly.

Keep PPE in its sealed package until use and never store PPE with pesticides or personal clothing.





Keep PPE in its sealed package until use, and never store PPE with pesticides or personal clothing.

Disposal is the critical last step in handling PPE. Ensure that you remove and discard PPE without causing contamination to yourself, garbage collectors, or the environment. PPE may have an expiration date, while other PPE requires careful inspection – read the PPE manufacturer directions and be diligent about disposal of PPE that will no longer provide protection.

Clean disposable, washable items with soap and water prior to disposal, to remove pesticide residues. Properly cleaned PPE can be disposed as regular garbage.

PPE that is contaminated with a pesticide must be disposed of according to directions on the pesticide product label and all Commonwealth, state, and local regulations. In the absence of specific label directions or government regulations, dispose of contaminated PPE as household hazardous waste, which can be taken to an appropriate waste collection event or disposal site.

If all PPE instructions for cleaning, maintenance, storage, and disposal are not followed carefully, PPE can become ineffective or even increase exposure to a pesticide. If in doubt, dispose of the PPE or PPE component.

**Learning
Activity**

Question

LEARNING ACTIVITY ONE

Why should you not clean and re-use disposable PPE?

SAMPLE SAMPLE

**Learning
Activity**

Task

LEARNING ACTIVITY TWO

Describe the steps to clean any other PPE.

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY THREE

Describe the reasons for correctly storing PPE and application equipment.

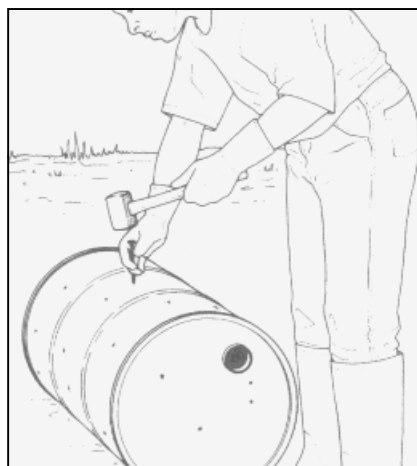
SAMPLE SAMPLE

DISPOSE OF EXCESS CHEMICALS AND CLEAN CONTAINERS IN ACCORDANCE WITH LABEL INSTRUCTIONS AND REGULATORY REQUIREMENTS

Proper pesticide waste disposal is an important part of responsible pesticide use. Improper disposal can lead to contamination of soil, groundwater, and surface water, causing serious liability problems for the pesticide user, as well as a poor public image. Below are the main waste products from chemical use and how to properly dispose of them.

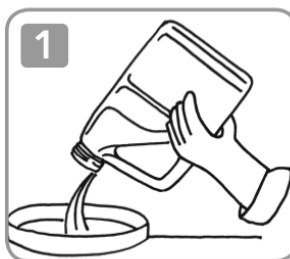
- ☆ **Empty containers**—Empty bags should be shaken clean. They may be buried in a sanitary landfill if the operator allows. Empty drums, bottles, or cans must be triple rinsed or pressure-rinsed. To triple-rinse, empty the pesticide concentrate into your spray tank and drain the container in a vertical position for 30 seconds. Refill the container about 1/4–1/5 full with water and rinse thoroughly. Add this rinse water to your tank, unless the product is to be applied without dilution. Be sure to let the pesticide container drain for a few seconds. Repeat rinsing and draining two more times. Now add water to your tank to bring it up to the needed level.

Containers can also be cleaned using *pressure rinsing*. This is done using a special pressure-rinsing device, which is inserted into the container. Water under pressure is used to rinse the inside of the container. The rinse water is added to the application equipment tank. After triple-rinsing, mark the containers and punch holes in the containers to prevent re-use. (The pressure-rinse procedure punctures the container.) Properly rinsed containers may then be buried in a landfill, if the operator allows and local regulations allow.



Triple rinsing

Standard operating procedure for rinsing pesticide containers.



Empty contents of container into spray tank, turning the container so that any product trapped in the handle is allowed to flow out.



Once flow is down to a drip, allow the container to drain for an additional 30 seconds.



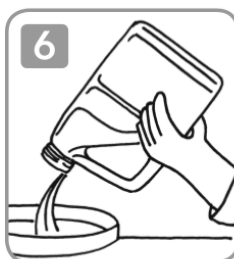
Fill the empty container 1/4 full of clean water.



Put cap back on container.



Shake the container vigorously, ensuring all sides, corners, and handles are rinsed. Rinse for 30 seconds.



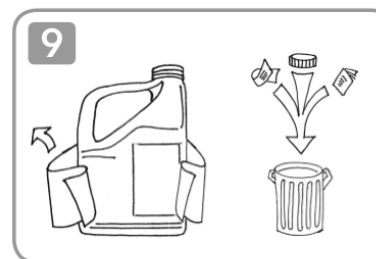
Drain rinse water into spray tank as previously described.



Repeat steps 3-6 twice, with the container upright. Shake the container as described previously.



Rinse any excess product from cap and then dispose appropriately as regular solid waste.



Remove label from container wall and dispose of as regular solid waste.



- ☆ **drumMUSTER**—drumMUSTER is a national collection and recycling scheme that provides a solution to the problem of disposing of used non-returnable chemical containers.

Since 1 February 1999 farmers have paid a 4c/L or 4c/kg levy on non-returnable chemical containers bigger than 1 L or 1 kg, which funds drumMUSTER. Local councils, either individually or in groups, enter into an agreement with drumMUSTER and use these funds to hold a drumMUSTER collection operation.

Farmers are then able to deliver cleaned (i.e. triple or pressure rinsed) used containers to designated collection points, run by the participating councils, where they are inspected and either accepted or rejected.

Only containers with the drumMUSTER sticker, for which the levy has been paid, are accepted. Remember: Always refer to the pesticide label for the recommended method of disposal – this includes metal and plastic containers, as well as cardboard or plastic packaging material.

- ☆ **Excess mixture**—Excess mixture is diluted pesticide that is left over in your spray tank after a pesticide application. Avoid the problem of excess mixture; measure and calibrate carefully. Fill your spray tank with only the amount required to do the job. Don't generate excess mixture. If you do, the way to dispose of excess mixture is to use it on a labelled site, such as a properly designed land excavation.
- ☆ **Excess product**—Excess product is unused pesticide that you no longer need or that is no longer legal. To avoid the problem of excess product, buy only what you can use in one season. The best way to dispose of excess product is to find someone who can use it—if the product is still legal to use. Check with the supplier or manufacturer to determine if they will take it back. You may be able to dispose of small quantities of excess product during hazardous waste collection programs sponsored by local solid-waste management agencies.



☆ **Rinse water**—Improperly disposed rinse water from application equipment has great potential for causing ground and surface water contamination.

- **Don't** discharge rinse water to the ground
- **Don't** discharge rinse water to septic systems—you're increasing the chance that it will get into the groundwater
- **Don't** discharge rinse water to ditches or streams—that's illegal and may cause damage to neighbours' crops or trees or be a serious hazard to fish and other wildlife
- **Don't** bury rinse water—it may contaminate groundwater
- **Do** minimise rinse water—wash out equipment only when necessary.
- **Do** re-apply rinse water to a chemical application site—this is allowed under law and will not result in an applied concentration above the label recommendation
- **Do** re-use rinse water to dilute the next batch of chemical mix, as long as the site to which the rinse water is applied is a designated chemical application site. Up to five percent of the water for dilution may be rinse water

**Learning
Activity**

Question

LEARNING ACTIVITY FOUR

In Section Three we reviewed a chemical called Pyrethrum Insecticide. In this activity we want you to refer to the Material Safety Sheet (MSDS) of Pyrethrum Insecticide and list the disposal requirements as indicated.

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY FIVE

The farmer pictured below is washing down his sprayer over an 'impervious containment pad'. What is an 'impervious containment pad'?



SAMPLE SAMPLE

ADVERSE EXPERIENCE REPORTING (AER) FORM FOR VETERINARY MEDICINES & AGRICULTURAL CHEMICALS

I am at:

☐ Animal owner or farmer
☐ Health Professional
☐ Veterinary
☐ Adverse experience or neighbour
☐ Pest control operator
☐ Product Regulator - Please attach detailed report including action taken or proposed
☐ Other (please specify)

I am reporting:

☐ An adverse human reaction
☐ An adverse animal or plant reaction including side effects, toxicity, allergy, crop death/damage, resistance
☐ Loss of yield / poor efficacy
☐ Environmental damage
☐ Other (please specify)

Product Details

Product name (if known) _____
 Active ingredients (if known) _____
 Registrant/Manufacturer (if known) _____
 Details of Product used (if known) _____
 As listed on label: NPA/VPMA No. _____ Batch No. _____ Expiry date: / /
 Storage details (+ 30°C) (+ 20°C) refrigerated etc. _____
 Was the product used according to the label instructions? ☐ Yes ☐ No ☐ Not sure
 Were other products used at the same time as this product? ☐ Yes ☐ No
 If yes, please provide the details (including quantities etc.) _____

Affected Animal, Human, Crop or Plant

☐ Animal ☐ Human (please select one)

No. treated _____ No. affected _____ (Specify animals only)
 Sex _____ Age _____ Breed _____
 Physiology ☐ Pregnant ☐ Lactating ☐ Weighing _____
 Crop / Plant _____ Exposure type: ☐ Target Crop/Plants ☐ Spray Drift ☐ Other _____
 Area affected _____ Area exposed _____ Growth Stage _____
 Product treatment/exposure: First Occurrence: / / Last Occurrence: / / ☐ Open ☐ Open
 Description (e.g. frequency, rate, duration of use, etc.) _____
 Who applied the product: ☐ Self ☐ Vet ☐ Contractor ☐ Unknown ☐ Other (specify) _____
 Purpose of product use (if known) _____

Adverse Experience - Tell Us What Happened

Incident date: / /
 Location: _____
 Tell us what happened _____
 Tell us what you are planning _____

COMPLETE INCIDENT REPORTS AS REQUIRED

There are legislative requirements in regards to records required for any chemical use in Australia. We will look at other records in the next Elements, however one very important document required is an incident report in the event of any adverse effects sustained from the application of chemicals.

An 'incident' means a transportation accident, storage container rupture, portable container rupture, leak, spill, emission, discharge, escape, disposal, or other event that releases or immediately threatens to release an agricultural chemical, accidentally or otherwise into the environment and may cause unreasonable adverse effects on the environment.

Following are some general guidelines on reporting agricultural chemical incidents. Additional reporting requirements may exist under other state or federal laws, local government regulations or permits. Understanding all reporting requirements is the responsibility of anyone who transports, uses, stores, or handles agricultural chemicals.

Adverse Experience Reporting Program for Agricultural Chemicals in Australia is regulated by Australian Pesticides and Veterinary Medicines Authority (APVMA) and protocols required in the event of a chemical spill incident are required to be reported under "Adverse Incidents" Regulations.

APVMA advise that if any person has been adversely affected by a registered agricultural chemical that they follow these instructions:

- ☆ If you have been affected seek immediate medical advice
- ☆ If your animal has been affected seek immediate veterinary advice
- ☆ Call the contact number on the product label and report your adverse experience to the registrant
- ☆ Keep any remaining product in a safe place in case a sample is required
- ☆ Contact the APVMA to report the incident, but please note that the APVMA does not provide medical or veterinary advice

DEFINITION OF AN ADVERSE EXPERIENCE FROM APVMA

An adverse experience is defined as being:

- ☆ An unintended or unexpected effect on plants, plant products, animals, human beings or the environment or lack of efficacy associated with the use of an agricultural chemical product when used according to label instructions.

Definition of a serious adverse experience:

- ☆ A serious or urgent adverse experience is expected to be reported promptly to the APVMA by the product registration holder. A serious adverse experience is one that involves:
 - Widespread and significant crop and plant damage (for example, crop death, severe stunting or significant yield loss)
 - Life-threatening or other significant effects in a human, including death
 - Farm, domestic and native animal deaths
 - Significant environmental damage, including fish kills and water quality issues
 - As a point of comparison, a minor adverse experience is one that involves:
 - Crop and plant damage that is not widespread or significant (for example, minor wilting or yellowing of crops, minor yield loss)
 - Human health effects that require medical attention, but are not life-threatening
 - Injury to domestic and native animals that requires veterinary attention
 - Minor environmental damage

ORIGINAL
SECTION 98(3) OCCUPATIONAL HEALTH AND SAFETY ACT 2004 AND
REGULATION 196 EQUIPMENT PUBLIC SAFETY REGULATIONS 2007

WorkSafe
VICTORIA

WORKSAFE VICTORIA

INCIDENT NOTIFICATION FORM

Sept 2013

Reference Number

Ring 332 360 to obtain a Reference Number.

The Reference Number is your proof of immediate notification. Immediate notification is required under section 38(1) of the *Occupational Health and Safety Act 2004* and regulations 902(1) and 903(1) of the *Equipment (Public Safety) Regulations 2007*.

Person Submitting Details (Please print in BLOCK letters)

Name	Position Title	Telephone Number
Date	Date of Incident	Time of Incident
Name of Employer / Self-Employed Person / Person in Charge of Prescribed Equipment		
Business Address (Not P.O. Box)		Postcode
Name of Employer of Deceased / Injured Person(s), if any, if different from above		
Address or Location where Incident Occurred		
Brief Description of the Incident		

Details of Deceased / Injured Person(s)

Name	<input type="checkbox"/> Male <input type="checkbox"/> Female
Residential Address	Postcode
Date of Birth	Telephone Number
Occupation / Job Title	Employee / Contractor / Member of Public
Work / Activity being undertaken at Time of Incident (Identify any Plant, Substance, Equipment Involved)	
Brief Description of Injuries	
Person(s) who saw Incident or first came to Scene	
Action Taken / Intended, if any, to prevent recurrence of Incident	

The above information is to be provided to the extent that it is known at the time of writing

Declaration

I declare that where I provide personal or health information to WorkSafe Victoria (WorkSafe) about any other individual, I am authorised to provide that information, the information has been collected in accordance with applicable privacy legislation and the individual has been or will be made aware of WorkSafe's identity and how to contact it and of the other matters of which an individual is required to be made aware when personal or health information is collected about them.

Signature	Date
Name	

Optional

WorkSafe ID

Establishment No

WHS REPORTING

WHS regulations also have a requirement for chemical use incidents to be reported. They are called 'notifiable incidents'.

The WHS law requires:

- ☆ a 'notifiable incident' to be reported to the regulator immediately after becoming aware it has happened
- ☆ if the regulator asks—written notification within 48 hours of the request
- ☆ the incident site to be preserved until an inspector arrives or directs otherwise (subject to some exceptions)

A 'notifiable incident' is:

- ☆ the death of a person
- ☆ a 'serious injury or illness'
- ☆ a 'dangerous incident' arising out of the conduct of a business or undertaking at a workplace.

'Notifiable incidents' may relate to any person—whether an employee, contractor or member of the public

**Learning
Activity**

Task

LEARNING ACTIVITY SIX

Provide a definition for a chemical “incident” and name the Australian regulatory authority to which incidents must be reported.

SAMPLE SAMPLE

**Learning
Activity**

Research

LEARNING ACTIVITY SEVEN

In this activity we want you to locate a 'Factsheet' that was published by 'Work Safe Australia'.

The fact sheet is called 'Incident Notification Information Sheet'. Once you have located it, print it out. You will need it for the next activity.

SAMPLE SAMPLE

**Learning
Activity**

Task

LEARNING ACTIVITY EIGHT

In the previous activity we wanted you to locate a 'Factsheet' called 'Incident Notification Information Sheet' and print it out.

In this activity, in your own words summarise what the factsheet says about '***dangerous incidents including 'near misses'***'.

SAMPLE SAMPLE



COMPLETE APPLICATION RECORDS

It is a legislative requirement that all chemical users keep required chemical application records.

The records must be made and kept for agricultural chemicals used are:

- ☆ The product trade name
- ☆ The date the product was used
- ☆ The application rate of the product
- ☆ The crop/commodity that was treated or the situation in which the product was applied
- ☆ The extent of use (the area of land treated, or the volume of water treated, or the volume of stored commodity treated, or the weight of the commodity treated)
- ☆ The location where the product was used
- ☆ The name and address of the applicator/supervisor, and
- ☆ The name and address of the person for whom the application was carried out
- ☆ Where a product is being sprayed outdoors (excludes hand-held devices, such as small portable sprayers that can be carried by a person and which are operated manually), the following record must also be made:
 - ☆ The wind speed and direction at the time of application

There are no prescribed formats these records need to be in. They just need to include the abovementioned information.

The records could be in a spreadsheet format, table format in a Word document or be entered into a 'app' designed for chemical application record keeping.

**Learning
Activity**

Task

LEARNING ACTIVITY NINE

Complete a chemical application record for the following scenario:

On the 10th February 2016 you applied the chemical Pyrethrum (refer back to the label in previous activities) to treat a one hectare crop of Zucchini for Joe Bloggs of Joes Farm - 1 Somewhere Road - Any Town—NSW.

You applied 100 litres via a quad bike mounted spray tank and treated a total crop of one hectare. Wind speed was measured at 10 knots South Easterly.

Use whatever format you wish. Once completed, present it to your teacher or trainer for review and discussion.

SAMPLE SAMPLE



STORE UNUSED CHEMICAL AND PRODUCTS IN APPROPRIATE LOCATION

Horticultural and Agricultural chemicals are legally required to be stored appropriately to prevent unauthorised access and any incidental environmental impact.

Characteristics of a agricultural chemical storage facility:

- ☆ A free-standing, roofed building
- ☆ Located a minimum of 15m from the boundary property, 10m from buildings occupied by people or livestock, 3m from unrelated work areas, offices and amenities
- ☆ 3m from flammable materials and fuel storage, 5m from any watercourse, body of water, drain or sewer

Construction of chemical shed should be as follows:

- ☆ Be fire resistant and structurally sound
- ☆ Be protected against extreme heat and exposure to sunlight
- ☆ Have floors made from concrete or other material which is impervious and resistant to chemical erosion
- ☆ Provide a method for containing spills, such as bunding
- ☆ Be located in an area that is safe from flooding or inundation, and is also not in the immediate catchment of a dam or waterway
- ☆ Be securely lockable
- ☆ Have clear access to avoid hazards whilst carrying chemicals
- ☆ Have sturdy, non absorbent shelving that is adequate to store chemicals without stacking



STORING AND HANDLING CHEMICALS

Some types of pesticide and veterinary chemicals should be segregated from other chemicals and from each other to ensure cross contamination cannot occur if there is a leaking container or spill. Therefore:

- ☆ Liquids should be stored as close to floor level as practicable to reduce the risk of breakage or spillage
- ☆ Liquids should not be stored above solids to avoid any damage or contamination of other products through leakage
- ☆ Flammable products should be segregated from non-flammable products by at least 3m.
- ☆ Veterinary chemicals must be segregated from all other chemicals
- ☆ Scheduled poisons should be segregated according to their schedule



Personal Protective Equipment (PPE) should be located near but not inside the chemical store, as this may lead to contamination of PPE. Any dirty PPE should be kept separate while waiting to be cleaned or disposed of. PPE needs to be appropriate to the chemical being used/stored. Information about appropriate PPE can be found on the chemical label and SDS (MSDS).

Ventilation of the storage facility must prevent a build up of chemical vapours. The areas used for handling, filling and decanting chemicals must have additional ventilation to ensure a safe working environment.

Spills can be contained by constructing a 'bunded' area, or sloping floor that drains to a containment pit or tank.

The method used for containing spills must be capable of containing 25% of the total liquid stored. A spill kit containing the following materials must be kept in the storage area:

- ☆ Absorbent material ie: 'kitty litter'
- ☆ Hydrated lime
- ☆ Shovel and broom
- ☆ Containers for storage of contaminated substances used to treat a spill

A safety shower and eye wash facility should be installed in an area that is quick and easy to access in case of an emergency. Such facilities should not be located inside the storage area. The water supply will need to be adequate for a minimum of 15 minutes of full water flow.



SECURITY AND SAFETY OF STORAGE AREA

All storage areas must be secured to prevent unauthorised access, including children accessing the storage area via windows or vents. Only authorised personnel should have access to storage area, including the keys. Persons other than employees should be accompanied at all times or should be aware of the hazards present.

The chemical storage area requires warning signs.

On the entry point there should be a sign stating:

- ☆ "Chemical Store Keep Out"
- ☆ "Authorised Staff Only"
- ☆ "No smoking"
- ☆ "No naked flames"

On the inside of the chemical store there should be signs stating "No Smoking" as well as one indicating the location of the "Spill Kit". All warning signs shall be clearly visible at all times.

Equipment and machinery such as personal protective equipment (PPE), first aid kit, spill kit, fire fighting equipment, mixing equipment and spray applicators should be checked on a regular basis to ensure everything is fully stocked and operational.

An appropriate extinguisher should be placed directly outside the store and be easily accessible. An appropriate first aid kit should be kept in a clean, easily accessible area.

The area within 3m of any storage area of agricultural and veterinary chemicals should be well maintained ensuring it is free from combustible materials such as vegetation or pallets. Any rubbish or empty containers need to be properly decanted and disposed of.



A copy of the inventory must be kept separately from the storage area for emergency purposes. The inventory should be updated every three months, including quantity and trade names of chemicals.

The SDS (MSDS) contains additional information about the chemical and details of the first aid requirements of a chemical.

Current SDS (MSDS) must be obtained and held for all products found in the chemical store. SDS (MSDS) must be easy to access in case of an emergency.

Completing a hazard assessment is important in order to understand any potential hazards and risks involved. This includes:

- ☆ The volume of chemicals stored
- ☆ The height of stacking chemicals
- ☆ Segregation of materials with different hazards

An emergency plan should be in place in case of a spill, fire, explosion, leak or other emergency. All staff should be fully trained for these scenarios and made aware of the procedures and the equipment to use in case of an emergency. Emergency contact numbers and assembly areas should be clearly signposted and known to all staff.

People with responsibility for storage areas need to be familiar with the hazards associated with chemical storage and use.

A thorough understanding of Safety Data Sheets or Material Safety Data Sheets (SDS or MSDS) relating to the chemicals stored on site and what actions need to be taken in the case of an emergency is essential.

Those in charge should also be trained in cleaning up spills and fire fighting techniques, as well as familiarising themselves with the equipment used.

**Learning
Activity**

Question

LEARNING ACTIVITY TEN

What were the three characteristics of an agricultural chemical storage facility?

SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY ELEVEN

What were the eight construction requirements of an agricultural chemical storage facility?

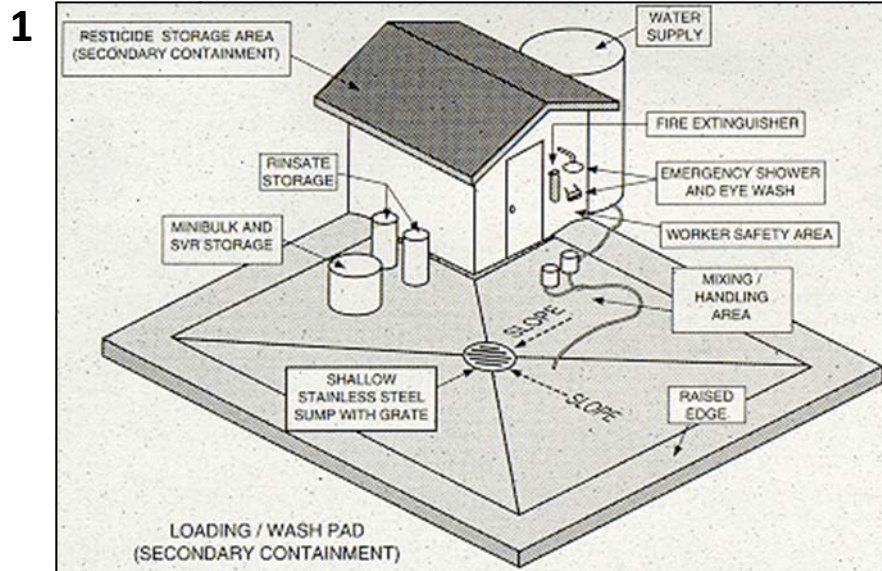
SAMPLE SAMPLE

**Learning
Activity**

Question

LEARNING ACTIVITY TWELVE

From the images below choose the one that best represents the requirements of a chemical storage facility.



Your choice _____

**Learning
Activity**

Question

LEARNING ACTIVITY THIRTEEN

What were the five important considerations when storing chemicals?

SAMPLE SAMPLE



ADHERE TO ALL RE-ENTRY REQUIREMENTS

An essential component of chemical application work activities is to determine re-entry requirements.

The re-entry time is the minimum amount of time that must pass between the time a pesticide was applied to an area or crop and the time that people can go into that area without protective clothing and equipment.

Re-entry times are set to protect people (and animals, for example in a kennel) against poisoning by pesticides if they enter a treated area too soon after application without proper protective equipment.

The manufacturer's label and SDS (MSDS) for the pesticide provides information on the re-entry times. Signs should also be posted that indicate spraying has occurred and what the re-entry time is or direct them to the farm office.

**Learning
Activity**

Question

LEARNING ACTIVITY FOURTEEN

In Section Three we reviewed a chemical called Pyrethrum Insecticide. In this activity we want you to refer to the Material Safety Sheet (MSDS) of Pyrethrum Insecticide or the label and determine the re-entry requirements.

SAMPLE SAMPLE

SELF ASSESSMENT

Self assessment is where you ask yourself certain questions to ensure you have understood what you have learned while reading this manual and completing the learning activities.

This unit requires you the student or trainee at the completion of your training to have a certain level of 'Required Knowledge' in which you would be need to have acquired and in which you will be assessed on.

This self assessment section reviews this required knowledge by way of questions and if you are able to say YES to all of them you can be confident your assessment will be satisfactory.

☆ Do you understand the following topics in relation to this competency:

- relevant commonwealth, state and territory legislation?
- various transport and handling techniques and requirements?
- layout and information contained in chemical labels and SDS?
- features and functions of a range of application equipment relevant to the role?
- risk factors to be taken into account such as human and animal health, spillage and environmental damage?
- different broad chemical types such as insecticides, herbicides and fungicides as well as their mode of action symbols on the label?
- paths of entry of poisons into the body and the methods of limiting exposure?
- how to assess if weather conditions increase risks and when it becomes unsuitable for application to continue?
- relevant applied principles of Integrated Pest and Resistance Management?
- relevant parts of the workplace spray plan?

☆ In your workplace could you confidently perform the following tasks:

- identify hazards and adopt safe work practices?
- follow directions on chemical labels and relevant Safety Data Sheets SDS?
- carry out pre-operational checks of application equipment?
- measure, mix and load chemical mixes?
- safely apply chemical under supervision?
- report spillages, accidents or deficiencies in procedures and practices to supervisor?
- use appropriate personal protective equipment?
- follow emergency procedures during an accident or spillage?
- follow enterprise work health and safety procedures?
- safely dispose of chemicals?
- record relevant information, including amount of chemical applied as per commonwealth, state and territory chemical legislation?

If there were any questions that you were unable to confidently say YES to, we encourage you to review the information again in this manual and if needed seek the assistance of your teacher or trainer.

NOTES

SAMPLE SAMPLE