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CENTRE FOR URBAN GREENERY AND ECOLOGY

LEARNER GUIDE

Horticultural Chemical Usage (Level 2)

LNS-GNM-2011-1.1

Version	Effective Date	Changes	Author
1	2010	Curriculum Development	AIMS Pty Ltd
2	2014	Curriculum Review	
3	7 Aug 2017	Curriculum Review	Thoughtplanters Ltd
4	18 Feb 2021	Rename course as per SFw	Amutha

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Course Overview

Code:	LNS-GNM-2011-1.1
Name:	Horticultural Chemical Usage (Level 2)
Duration:	18 hours, inclusive of 2 hours of assessment

WSQ Framework

Landscape

Technical Skills and Competencies (TSC)

Horticultural Chemical Usage

TSC Proficiency Description

Level 2
LNS-GNM-2011-1.1
Manage the safe use of chemicals and biological agents for horticultural works

Learning Outcomes

On successful completion of this unit, the participant will be able to:

1. Recognise the dangers to environment, human and animal health of exposure to chemicals
2. Safely handle and store non-hazardous chemicals
3. Prepare equipment and tools to apply non-hazardous chemicals safely under supervision
4. Apply non-hazardous chemicals safely under supervision
5. Clean and store tools and equipment

Teaching Methodologies

- Lecture
- Discussion
- Demonstration
- Practical
- Feedback

Assessment Methodologies

- Practical Exam (90 minutes)
- Oral Questioning (30 minutes)

Learning Outcome 1: Recognise the dangers to environment, human and animal health of exposure to chemicals

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Underpinning Knowledge

A competent individual will acquire the following knowledge:

- Regulations which impact upon all workplace practices including safety and health
- Observation skills
- Absorption methods of pesticides
- Environmental effects of selected chemicals and how to minimise damaging effects of chemicals.
- Identification and removal or minimisation of hazards and risks.

Performance Criteria

A competent individual must be able to successfully perform the following:

1.1 Recognise symptoms caused by chemical exposure
1.2 Identify routes of absorption
1.3 Identify common causes of exposure
1.4 Select and put on appropriate personal protective equipment (PPE)
1.5 Handle and assist contamination or spill
1.6 Notify appropriate personal and supervisors of contamination or spills.

Introduction

Chemicals are used in the landscape industry to help desired trees, plants and grasses to grow healthily, and to maintain them free of pest, disease and fungus attacks. These chemicals include:

- Herbicides
- Pesticides
- Fungicides

Any users of agrichemicals in Singapore have a legal obligation to:

- Use them **safely**, without harming people or the environment
- Use them **responsibly**, which means you are accountable for your actions
- Use them **effectively**, which means getting the best result with minimum risk.

Three important acts (legislation) deal directly with agrichemical use issues. They are:

- Environmental Protection and Management Act
- Biological agents and toxins act 20015
- Control of plants act chapter 53A 2000 (revised).

Relevant codes of practice and guides are:

- Workplace Safety and Health Guidelines-Landscape and Horticulture Management
- Singapore standard cp 32: 1985 (ics 55.220; 65.100) code of practice for the transportation and storage of pesticides.

Other important legislation that affects users of agrichemicals includes:

- Workplace Safety and Health Act 2006

If you use chemicals in your workplace it is your responsibility to understand:

- Their ingredients and formulation
- Their mode of action
- What happens to them in the environment
- The associated terminology.

Knowing this information goes a long way towards making everyone safer users of agrichemicals and ensures fulfilment of relevant legal obligations.

Herbicides

Herbicides kill plants. Herbicides are grouped by their mode of action.

Contact and desiccant mode

These herbicides only kill the parts of the plant the spray touches. The plant's green leaves and young stem tissues are the most vulnerable.

This type of herbicide is mainly used on annual plants and seedling weeds as the roots of established or perennial weeds (that have the capacity to regenerate shoots) will not be killed and may regrow.

Desiccants kill green plant tissues by rapidly drying them out.

Translocated or systemic mode

These herbicides are absorbed by the plant's leaves and green stems. The herbicide is carried into the sap stream and then onwards into the actively growing roots and shoots of the plant.

Unlike contact herbicides, a translocated or systemic herbicide will kill the target plant's shoot and root parts even though the spray has not made direct contact with them.

Insecticides

Insecticides kill insects. Insecticides are amongst the more toxic group of agrichemicals commonly used in horticulture and include products that contain organo-phosphates and carbamates.

Extreme care must always be taken when using insecticides, in terms of targeted placement, as they are toxic to a range of organisms such as beneficial insects, fish and birds.

Insecticides are grouped according to:

- Their mode of action
- Their ability to be absorbed into plant tissue
- How long they remain on the leaf surface or vaporise into the atmosphere.

Contact mode

These insecticides pass through the skin (cuticle) of the insect, poisoning them as it passes into their body. Insecticide may kill by:

- Direct contact onto the body
- Being picked up and absorbed into the body as the insect walks over or rubs up against the treated area
- Eating treated plant tissue.

Ingested (stomach poison) mode

These insecticides are particularly effective on chewing insects such as caterpillars.

Treated plant surfaces have to be eaten by the insect for the poison to enter the body.

Systemic mode

These insecticides are absorbed by plants and carried in the sap stream throughout the plant. They are particularly effective for controlling sap-sucking insects such as scale and aphid.

They may be applied directly onto the plant's foliage or to the soil, for absorption through the roots.

Systemic insecticides take longer to break down than contact insecticides. This means longer withholding periods will apply, especially for food crops.

Translaminar mode

These insecticides are absorbed by leaf tissues but are not transported throughout the sap stream.

The advantage of this mode is that any insecticide applied to the upper leaf surface will kill insects feeding on the lower leaf surface. The product will also remain active for longer, being protected by the foliage from breakdown from the sun and rain.

Fumigant mode

These insecticides are applied as a spray, which vaporises into the atmosphere and the poisonous vapour is breathed in by the insect.

Fumigant insecticides are of particular use in confined, sheltered or protected growing areas as their action is relatively short-lived.

Ovicidal mode

These insecticides kill insect eggs.

Fungicides

Fungicides kill disease-causing fungi. They are grouped according to their mode of action.

Protectant mode

These fungicides are applied before a fungal infection occurs and must continue to be applied at regular intervals while conditions favour the possibility of infection. Fungal spores landing on treated plant surfaces are killed on contact. Good spray coverage is essential for effective control.

Eradicant mode

These fungicides are applied to kill the fungus after infection has taken place. Timing of application is critical with eradicants as, once an infection has taken place and becomes established, it is more difficult to control.

Systemic mode

These fungicides may be used as either protectant or eradicant fungicides. Systemic fungicides (like systemic insecticides) are absorbed and transported throughout the plant. Once inside the plant they will either kill fungal spores as they germinate and start to feed on the plant or kill newly established infections.

Selective herbicide mode

These herbicides are designed to kill a specific plant group. In most cases they either only kill grass species or only kill broadleaf plants. Selectivity is based on targeting the physical / physiological differences between monocotyledons and dicotyledons.

Non-selective herbicide mode

These herbicides are designed to kill a wide range of plant species. They may also be contact or systemic.

Residual herbicide mode

These herbicides are designed to be absorbed by the plant's roots.

Residual herbicides are applied directly onto the soil.

They are also formulated to remain active in the soil profile for a period of time following application (hence the term 'residual').

They kill weeds as they germinate over a period of time, from several weeks to several months, depending on the herbicide used and soil conditions.

Hormone herbicide mode

These herbicides are designed to mimic the natural plant hormones that control plant growth (growth regulators). They usually kill the plant by either excessively speeding up growth, or by slowing it down. These herbicides only kill broadleaves so they are also selective as well as systemic in action.

Pre-emergent herbicide mode

These herbicides are residual or soil-active, often selective and mainly used in cropping. They are applied to bare soil before the weeds emerge.

Post-emergent herbicide mode

These herbicides are mainly used in cropping, often selective and applied after seedlings have emerged. There is not usually any residual activity with these herbicides.

Non-selective agrichemicals (insecticides, fungicides, herbicides) are also known as **broad-spectrum** agrichemicals – meaning they will kill a wide range of species of the target organism.

Broad-spectrum agrichemicals can be used selectively by targeting individual plants for treatment (e.g. spot spraying application).

Learning activity 1

Please complete the following activity.

Match the following agrichemical terms with the correct meaning.

Place the appropriate number of each term in the right-hand column next to the correct meaning.

	Term	Meaning	Answer
1.	Contact	The way an agrichemical works	
2.	Fumigant	Used before an attack occurs	
3.	Selective	Absorbed into the plant's sap stream	
4.	Mode of action	Only targets one group	
5.	Preventative	Kills when it touches the organism	
6.	Systemic	Uses vapour to kill an organism	
7.	Residual	Used after an attack has occurred	
8.	Eradicant	Remains active for a while	

PC 1.1

Recognise symptoms caused by chemical exposure

Types of poisoning

Apart from the different routes of entry into the body, there are two main types of poisoning:

- Acute poisoning
- Chronic poisoning.

Acute poisoning

This type of poisoning occurs as a result of exposure to a single dose of a poisonous substance, e.g. accidental swallowing of a splashed concentrate or being drenched by a burst spray hose.

Symptoms may occur relatively rapidly or over the next day or so depending on the type of agrichemical and how it entered the body.

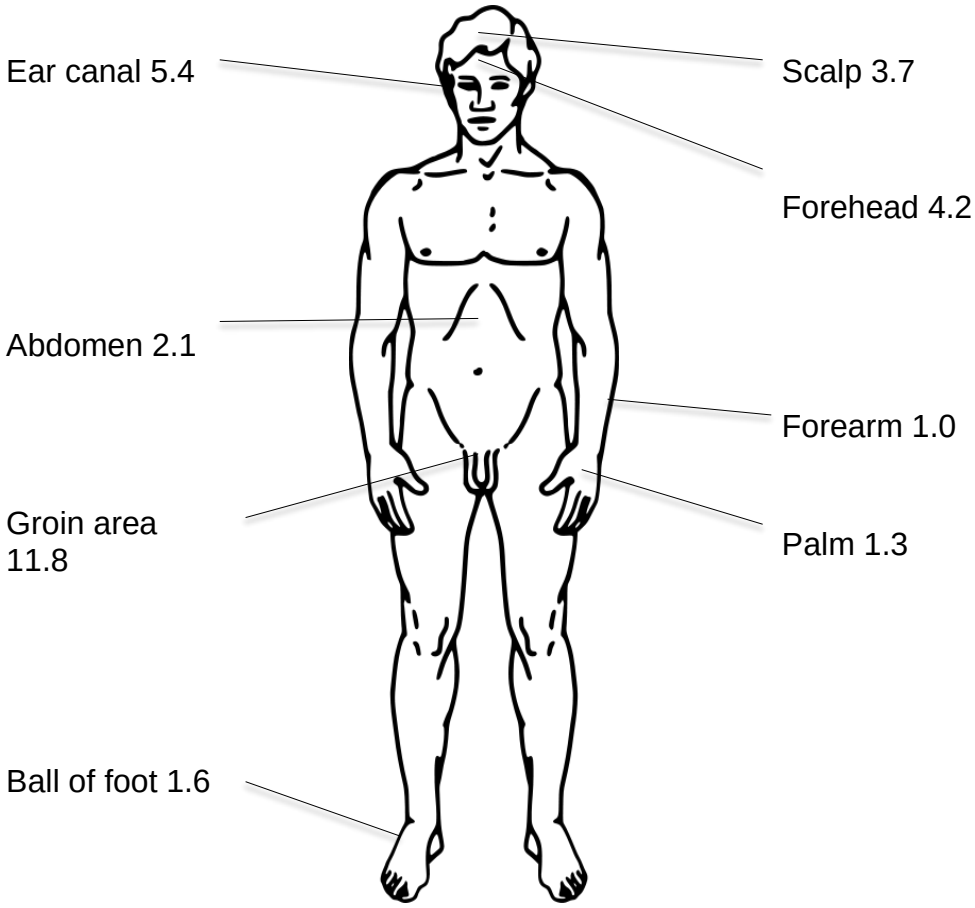
With this type of poisoning, you at least have a good idea of which agrichemical is involved and can report this to emergency medical personnel or the poisons centre helpline.

Chronic poisoning

This type of poisoning occurs as a result of exposure to a number of small doses over a period of time. These small doses may initially have very little effect on but they build up in the body until they reach a level where the body can no longer cope and you get sick.

This type of poisoning is very dangerous from the point of view that you may have been poisoned by several different agrichemicals, making it more difficult for medical personnel to diagnose what is actually poisoning you. This is a very good reason for keeping records of exactly what agrichemical is used.

Agrichemical absorption rates of different parts of the body



This diagram demonstrates which parts of the body are more sensitive to agrichemical absorption, e.g. the forehead will absorb chemicals 4.2 times faster than the forearm, while the groin absorbs chemicals 11.8 times faster than the forearm, etc.

Symptoms caused by exposure to chemical may include:

- Headaches
- Nausea
- Fever
- Asthma
- Cramps
- Allergies
- Diarrhoea
- Dizziness
- Vomiting
- Convulsions
- Memory loss
- Blurred vision
- Rapid heartbeat
- Tightness in chest
- Flu like symptoms
- Respiratory paralysis

- Irritations to skin, eyes, nose and throat
- Muscle twitches
- Loss of coordination.

One of the most serious symptoms of exposure to chemicals like insecticides or pesticides is the loss of co-ordination. Seek immediate help if you experience this.

Regulations which impact upon all workplace practices including safety and health

- Workplace Safety and Health Act
- Environmental Protection and Management Act
- Singapore standard cp 32: 1985 (ics 55.220; 65.100 code of practice for the transportation and storage of pesticides
- Biological Agents and Toxins Act 2005
- Control of Plants Act, Chapter 53A 2000 Revised.

PC 1.2

Identify routes of absorption

UK 1.3 Absorption methods of pesticides

There are several ways in which agrichemicals can get inside your body to cause harm.

By mouth (ingestion)

Also known as oral or ingestion poisoning, this is caused by swallowing agrichemical product. Once it gets into your stomach it is quickly absorbed into the body where it can damage organs.

Common situations when this may occur include:

- When you are measuring and mixing the concentrate and it splashes back at you
- A hose bursts on the spraying equipment, drenching you
- If you eat and smoke, after handling the agrichemical, without washing your hands first.

Through the skin (dermal)

Also known as dermal poisoning, this is caused by agrichemical contact and being absorbed through any exposed skin, to enter the body.

The most ‘at risk’ parts on the body are the head, including the ear canal, and the groin area.

Common situations when this may occur include:

- Measuring and mixing concentrate
- Handling concentrate or diluted product without adequate protection
- A burst hose on spraying equipment
- Working in spray drift or spraying above your head
- Entering a sprayed area that is still wet, without protection.

Into the lungs (inhalation)

Also known as inhalation poisoning, this is caused by breathing in very fine spray droplets (aerosols) or vapours (gasses) given off by the agrichemical.

Once breathed into the lungs the poison is absorbed into the blood stream.

Common situations when this may occur include:

- Measuring and mixing concentrate in enclosed areas (without adequate ventilation)
- Handling concentrate or diluted product without adequate protection
- Returning to a sprayed, enclosed area such as a greenhouse before vapour has cleared, without adequate protection.

Other routes of entry

Another route of agrichemical entry into the body is through the eyes (ocular) via splashes of concentrate and working in spray drift.

Always keep in mind that any agrichemical is many times more toxic in its concentrated form, so from the time you open the container, until it is sealed again, you are at greatest risk.

This is the time, while handling concentrate, to take extra care and ensure you are protected according to the label.

However, this does not mean you don’t need to be protected once the agrichemical is diluted as many agrichemicals are still dangerous to your health even when diluted.

Learning activity 2

Please answer these questions.

1. In what form is an agrichemical likely to be most poisonous to you?

2. Are you ever likely to be totally safe from poisoning when using a chemical?

PC 1.3

Identify common causes of exposure

UK 1.2 Observation skills

There are many common causes of exposure.

Wind

Wind is a common cause for exposure. If you are not careful while applying chemical to plants, the chemical may be blown back onto you.

With wind, you may have these drifts:

- Vapour drift
- Spray drift
- Odour drift

Spills

Spillage and leakages are another common cause of exposure. They usually occur due to improper storage.

Always check storage requirements and follow them accordingly.

Some of these requirements may include temperature, humidity level, etc.

Incorrect application rate / applicator

Incorrect application rate may result in the chemical being expressed too fast, which may cause exposure if you lose control.

Another common cause is the use of the wrong applicator or faulty applicator.

Always check your equipment thoroughly before handling the chemicals.

Not wearing PPE, or wearing PPE incorrectly

PPE will protect you from exposure to chemicals, however many people choose not to wear their PPE due to comfort or laziness and this could be a dangerous mistake. In the event of an accident, the PPE will be the layer that protects you from the chemical.

When coming into contact with chemicals, always wear all PPE that is recommended by the manufacturer.

PC 1.4

Select and put on appropriate personal protective equipment (PPE)

UK 1.1 Regulations which impact upon all workplace practices including safety and health

UK 1.5 Identification and removal or minimisation of hazards and risks

There are many risks involved with the use of agrichemicals and they will be discussed under the headings of PPE, measuring and mixing, application, and after application.

Personal protection equipment (PPE)

Using any agrichemical will require a measure of personal protection. Always check the label for what you should be wearing and wear it.

If a label is unclear about what should be worn, or you feel unsure about what the instructions mean, check the MSDS (Personal Protection)

Before and after using PPE:

- Check for damage, holes and rips
- Check zippers, straps and Velcro fasteners for wear and tear
- Make sure it is clean.

Body arms and legs protection

Items of protective clothing required include:

- Cotton overalls
- Disposable waterproof spray suit
- PVC jacket and leggings (wet weather gear)
- Chemical resistant spray suit.

It is unacceptable to wear every day work clothes when handling agrichemicals. The protective clothing is designed to go over the top of them.

A PVC apron is often a requirement only while you are mixing and measuring out the concentrates, and it is removed for actual spraying.

Aprons are added protection for you and the protective clothing you are already wearing, so if you do happen to have a minor spill or splash it saves you from having to remove your overalls or spray suit for cleaning before you can carry on with the task.

Head protection

Items of protective clothing include:

- Waterproof or PVC hoods that are often built into spray suits
- Waterproof hats
- Washable cotton hats.

Check the label for what you should wear.

Hands and feet

Items of protective clothing include:

- Rubber gumboots
- Chemical resistant gumboots
- PVC or nitrile gauntlets (gloves which also protect your forearms)

Check the label for what you should wear.

Waterproof overalls or leggings should always be positioned on the outside of your gumboots to prevent agrichemical spray running down inside.

In most situations the same applies to gauntlet gloves.

Face, eyes and lungs protection

Items of protective equipment include:

- Half face respirator
- Full face respirator
- Spray hoods
- Goggles
- Face shield.

Check the label for what you should wear.

The face shield is often a requirement when you are mixing agrichemical, in a similar way to the apron. Even if it is not a specified requirement, it is a good idea to get into the habit of using one whenever you are handling concentrate.

Disposable dust masks are not a suitable substitute for respirators and have no application when using agrichemicals as they will not prevent gases and fumes from entering your lungs.

If you can smell or taste agrichemical, it has already entered your body.

Learning activity 3

Please complete the following activity.

Write the name of each item of agrichemical PPE underneath its picture. (Continued on next page)

		
1.	2.	3.
		
4.	5.	6.

		
7.	8.	9.
		
10.		11.

Cleaning PPE clothing

After any agrichemical application, it is important to clean or decontaminate spray equipment, including clothing.

1. Clean spray equipment before removing PPE. Equipment is usually cleaned with detergent and water but check with NZS 8409 table (Decontamination agents and use rates for application equipment) for instructions on how to decontaminate certain agrichemical products.
2. Scrub down waterproof PPE while you are still wearing them, with detergent and water and then hose off with clean water. This is also a great check for leaks in your PPE as leaking PPE must be replaced.
3. Hang your PPE out to dry in the sun if possible as sunlight helps to degrade agrichemical.
4. Machine-wash non-waterproof clothing, such as overalls, on their own, i.e. not with regular clothing.
5. After cleaning and drying, store your PPE in a secure, dry place well away from the agrichemicals, i.e. outside of agrichemical storage rooms.
6. After cleaning spray equipment and PPE, wash yourself. Use soap and cold water and pay particular attention to the face, neck, hands and forearms.

Avoid using hot water to wash or rinse agrichemical from skin as this will open up pores and allow for easier absorption of chemical through the skin.

PC 1.5

Handle and assist contamination or spill

UK 1.4 Environmental effects of selected chemicals and how to minimise damaging effects of chemicals.

For major spills, evacuate and follow your workplace emergency procedures, and call emergency services.

For minor spills, follow the clean-up procedures according to the label, MSDS (Material Data Sheet) or product safety card.

For minor spills of liquid agrichemical the following procedure is usually recommended:

- Make sure you are adequately protected.
- Contain the spill using sand or a suitable absorbent material, such as cat litter (diatomaceous earth). 'Contain' means quickly placing a ring of sand around the spill to stop it spreading.
- Absorb the spill by gently placing sand inside the containment ring.
- Sweep up the contaminated sand and place in labelled plastic bags that can be sealed, and place in a dedicated toxic waste container for correct disposal.
- Use water and detergent to wash down the contaminated area and any equipment and PPE that has come into contact with the spill. Dispose of the washings away from plants, drains, waterways, and areas such as waste ground, grassy headlands that are not being grazed, and metal driveways, but not cattle races.

Be prepared by always having a spill kit with you on a site where chemicals or oils are being used and could be spilled.

PC 1.6

Notify appropriate personal and supervisors of contamination or spills

Whenever there is a chemical spill at a work site, it is very important to immediately report this to your supervisor.

The cause of the spill may be investigated and steps taken to prevent future spills for the same reason.

You will need to report what substance was spilled and the approximate quantity.

Any property or waterways contaminated and efforts made to clean up, or minimise contamination

Any other personnel that may be affected by the spill must also be warned to keep clear of the spill zone.

This zone should be marked out if possible using cones, barriers, danger tape or similar warning equipment.

Learning Outcome 2: Safely handle and store non-hazardous chemicals

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Underpinning Knowledge

A competent individual will acquire the following knowledge:

- Preparation of chemicals
- Recognising suitable weather conditions for application of chemicals
- Selection of safety signs and notices.

Performance Criteria

A competent individual must be able to successfully perform the following:

2.1 Read and understand basic hazard information found on MSDS and labels
2.2 Handle chemicals to store appropriately and as required by regulations
2.3 Select appropriate equipment for mixing and handling chemicals
2.4 Mix non-hazardous chemicals according to manufacturer's specifications for a given application
2.5 Recognise suitable weather conditions in which to apply chemicals
2.6 State where and when safety notices should be used

PC 2.1

Read and understand basic hazard information found on MSDS and labels

The main source of specific information for each chemical product can be found in the form of a safety data sheet (MSDS), which the manufacturer must provide with every product sold. There is also:

- The product label
- Product Safety Card such as a Haznote.

Product label

The product label, attached to the product container, is usually the first place we go to find specific information about a product.

There are specific requirements for information that **must** appear on the product label. This information includes:

- Hazard warnings and precautions e.g. Personal protection equipment (PPE)
- Poisoning symptoms and first aid
- Transport and storage warnings
- Directions for use (measuring, mixing, application)
- Withholding periods
- Re-entry periods
- Disposal instructions.

Refer to Learning Activity 4 on page 28 for an example of a label.

Material Safety Data Sheet (MSDS)

The MSDS is specific to each individual agrichemical and there should be a copy of the MSDS for each agrichemical used in your workplace, and this must be readily available to you. Copies can be obtained from the agrichemical supplier, or they can be downloaded from suppliers' web pages.

The MSDS contains 'in depth' technical information about the agrichemical that is not only useful to us as 'end' users but also professional emergency response personnel such as fire fighters and medical staff - another good reason for having them available in the workplace.

A MSDS for a specific agrichemical or hazardous substance should follow a set format and provide information in the following sections:

1. Identification
2. Hazards Identification
3. Composition and ingredient information
4. First aid measures
5. Firefighting measures
6. Spillage, accidental release measures
7. Handling and storage
8. Exposure controls and personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

Refer to *Annex 2 – Sample MSDS* on page 63 for a sample of an MSDS.

More information on MSDSs can be obtained from the Workplace Safety and Health Guidelines – Management of Hazardous Chemicals Programme.

PC 2.2

Handle chemicals to store appropriately and as required by regulations

Chemical storage

There are several things that can go wrong when storing agrichemicals, such as accidental exposure to concentrate agrichemical, spillage, flooding, fire, chemicals mixing and reacting, contamination of foodstuffs, seeds and fertiliser, and unauthorised access by children.

You need to check if there are any specific requirements for storage, depending on the amount and hazardous nature of the agrichemicals you wish to store.

For example, if you wish to store more than 100 litres of glyphosate herbicide you need emergency action signage, an emergency action plan and secondary containment (a method for preventing a spill from leaving the store).

Minimising storage risks

- Store all chemicals in their original containers only, and ensure they are tightly closed.
- Store similar agrichemicals together, i.e. insecticides with insecticides, etc.
- Ensure incompatible chemicals are segregated
- Always keep herbicides separated or on lower shelves.
- Do not store agrichemicals with fuels, oil, pool chemicals, fertilisers, seeds, animal feeds, animal medicines or explosives.

General requirements for the store

The chemical storage area:

- Must not be close to waterways, drains or domestic buildings.
- Must be well ventilated and have good lighting.
- Must be lockable and marked with a warning sign.
- Must be able to contain a spill.
- Must have a suitable spill kit available.
- May need fire extinguishers to be close by.
- Must be inspected regularly to check for deterioration, leakage and spillage
- Should have self-containing drainage trays around the base of the racks / cupboards.
- Must be able to be accessed only by authorised personnel

Keep the storage quantity of any single chemical to a minimum to reduce risk

Check the Code of Practice for specific storage requirements.

Learning activity 4

Please complete the checklist below in groups of 2 or 3, to get familiar with WSH requirements for safe storage of chemicals. Sample label on following page.

Activity Based Checklist

Safe Storage of Chemicals

Improper and unsafe storage of chemicals can be hazardous to you and your workers. Use this basic checklist+ as a guide to keep you and your workers safe. For more information on how you can keep your workplace safe, go to www.wshc.sg

Name of Company _____ Process/ Location _____

Checked by (Name/ Designation) _____ Date _____

Safety Checks		Please tick (✓) Yes	No	NA*	If no, action required by:
Chemicals are kept in closed containers when not in use.					Name: _____ Date : _____
Chemicals and their containers are correctly labelled.					Name: _____ Date : _____
Chemicals and their containers are stored properly (e.g., racks and cabinets) in well-ventilated areas.					Name: _____ Date : _____
Safety data sheets (SDS) are available for all the chemicals stored.					Name: _____ Date : _____
Workers are prohibited from smoking in areas where flammable chemicals are stored.					Name: _____ Date : _____
Containment materials such as absorbents are available.					Name: _____ Date : _____
Fire extinguishers on site are not expired.					Name: _____ Date : _____
Combustibles (e.g., papers and cloths) are removed or stored away from the chemical storage area.					Name: _____ Date : _____

+ This checklist may not cover all aspects of work activities in your workplace. You should review the checklist when there are changes in any work activity.
* NA – Not applicable

WSHCOUNCIL

Sample Label

Pesticide Label

Trade Name

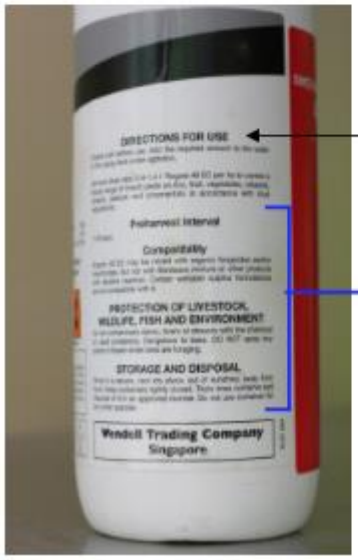
% Active ingredient

Specified use of the pesticide

Treatment in case of poisoning

Name of Manufacturer

Safety directions



Directions for use

Additional information e.g. Postharvest interval , Compatibility, Storage & disposal etc.

PC 2.3

Select appropriate equipment for mixing and handling chemicals

It is important to select correct mixing equipment, such as:

- Measuring jug
- Funnel
- Spill kit
- Face mask
- Respirator
- Rubber gloves
- Other appropriate PPE.

Only use equipment that is dedicated to chemical mixing and nothing else.

After mixing is finished, wash all the mixing equipment thoroughly and put away in designated storage area.

PC 2.4

Mix non-hazardous chemicals according to manufacturer's specifications for a given application

UK 2.1 Preparation of chemicals

When you are mixing chemicals you are probably at greatest risk of suffering acute poisoning because you are deliberately exposing yourself to agrichemical concentrate simply by opening the product container.

There are several things you can do to reduce risk:

- Make sure you have the right agrichemical for the task
- Read the label thoroughly
- Check weather conditions are suitable
- Make sure you are wearing the correct protective clothing
- Check spray equipment is clean and doesn't have leaks
- Make sure the mixing site:
    - Is away from people, plants and animals and at least 20 metres away from drains and waterways
    - Is a well cordoned off zone
    - Is uncluttered, well-lit and ventilated with a secure, level work surface that can be washed down
    - Has a good, clean water supply
    - Has an emergency spill kit available.
- Measure concentrate accurately using accurate equipment (graduated jugs, scales, etc.)
- Replace caps and lids on containers as soon as possible and return concentrates to the secure store
- Dilute measured concentrate with water as soon as possible before adding to a spray tank that has already been partly filled with water
- If mixing several compatible agrichemicals, follow this order:
    1. Wettable powders
    2. Aqueous (soluble) concentrates
    3. Liquids
    4. Emulsifiable concentrates
- Triple rinse empty containers and add rinse to spray tank.
- Secure any containers, including empty ones back in the locked store room when you have finished mixing.
- Only mix up the amount you need to complete the spray job, adjust the water and concentrate amounts if necessary.

Learning activity 5

Please answer the following question.

If a manufacturer recommends a chemical be mixed at a ratio of 20:1, how much chemical would you add to a 4-litre hand spraying bottle?

PC 2.5

Recognise suitable weather conditions in which to apply chemicals

UK 2.2 Recognising suitable weather conditions for application of chemicals

The weather conditions must be considered when applying any chemicals to the landscape.

Safe application is all about getting the agrichemical onto the target with minimal risk to you, others and the environment, and weather can have a direct effect on the success of this goal:

- **Rain** - may dilute or wash away the chemical, causing incorrect or ineffective dosage.
- **Wind** - strong wind may result in the chemical spray being blown in the wrong direction which could cause contamination and exposure. Always check wind direction before spraying chemical.
- **Temperature** - in Singapore we do not really experience extreme weather conditions; however it may not be advisable to apply chemicals if the weather is too hot. Wearing full PPE and standing in the hot sun for too long is not advisable. If you must spray in hot weather minimise the time spraying to 1 hour, then stop and do something else.

PC 2.6

State where and when safety notices should be used

UK 2.3 Selection of safety signs and notices

Before you apply agrichemicals a few checks should be made first. These include:

- Any legal requirements and regulations are being complied with
- Neighbours and other staff members are notified as necessary
- Application equipment is suitable and has been checked for leaks, worn parts, safety, etc.
- Protective clothing and equipment is adequate
- Weather conditions are suitable for application
- You are aware of the sensitive areas and buffer zones
- You have an emergency plan in case of an accident
- Signage has been placed or areas of application have been secured as necessary:
    - Safety notices should be used at the location where chemical application is being carried out
    - Notices should be facing the direction where the majority of the people can read the sign / information.
- Put away all signs and barriers at the end of the operation and when it is safe for public to re-enter the area.

The signs normally used by the landscape industry in Singapore when applying low risk chemicals are:

- **Keep away** / **Caution** signs
- **Spraying in Progress** signs.

Learning Outcome 3: Prepare equipment and tools to apply non-hazardous chemicals safely under supervision

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Underpinning Knowledge

A competent individual will acquire the following knowledge:

- Types of application equipment and tools
- Functionality of application equipment and tools
- Checking of working condition of application equipment and tools.

Performance Criteria

A competent individual must be able to successfully perform the following:

3.1 Select and check appropriate application equipment and tools as directed
3.2 Check working condition of a selection of application equipment prior to filling with chemical
3.3 Check and start motorised sprayer following correct procedure
3.4 Carry out simple troubleshooting of the motorised sprayer following correct procedure
3.5 Report any damage, wear or malfunctions identified to appropriate person

PC 3.1

Select and check appropriate application equipment and tools as directed

UK 3.1 Types of application equipment and tools

Sprayers are used to apply agrichemicals, particularly herbicides. They come in a variety of shapes and sizes depending on the use, formulation and toxicity of the chemicals involved.

- **Simple pump bottles** that typically hold small volumes of herbicides and suit small-scale projects.

- **Knapsacks or backpacks** holding 10 - 15 litres of agrichemicals, are pumped by hand and suited to herbicides that do not need shaking or mixing.

- **Motor-powered knapsacks** holding 10 - 15 litres of herbicides dispersed as a fine mist and suited to situations where you need to reach tall vegetation.

- **Powered mobile tanks or small tanks on wheels** that hold up to 50 litres of herbicides and use a long hose to cover large and difficult-to-reach areas without carrying a knapsack.
- **Tractor-driven spray units** that allow you to carry large amounts of spray and cover large areas easily.

PC 3.2

Check working condition of a selection of application equipment prior to filling with chemical

UK 3.2 Functionality of application equipment and tools

UK 3.3 Checking of working condition of application equipment and tools

At the start of each day or new job, always check all equipment before filling it with chemicals. These checks may include:

- Filling the sprayer with clean water to test it is all in safe working order
- Checking the solution tank to ensure there is no leakage prior to filling with chemicals
- Checking the spray gun for leaks
- Checking the nozzle is working
- Ensuring the nozzle is calibrated correctly by testing with clean water
- Checking all of the mixing equipment is clean and only meant for the purpose of mixing chemicals.

Learning activity 6

Please complete the following activity.

Using clean hand spraying bottles that have never had chemicals in them before, fill each bottle with clean water and go through a pre-use test looking for the things listed above.

If the bottle has no leaks and is working fine, calibrate the nozzle so you obtain a nice even spray that would be suitable for applying herbicide to plants or turf.

PC 3.3

Check and start motorised sprayer following correct procedure

- Check for sufficient fuel
- Petrol must be mixed to the prescribed proportion according to manufacturer's specifications if fuel is insufficient
- Throttle switch to be at correct position prior to starting
- Put to correct throttle speed after machine is started
- Calibrate the sprayer nozzles to achieve an appropriate even spray pattern.

PC 3.4

Carry out simple troubleshooting of the motorised sprayer following correct procedure

If you are having any difficulty with a motorised sprayer, stop work immediately and inspect the unit.

Checks may include:

- Referring to the manufacturer's operating manual (these normally have a trouble-shooting list / matrix you can refer to)
- Checking fuel levels
- Checking and tightening a loose nozzle
- Clearing any blockages that are found and can be safely removed
- Adjusting nozzle opening to control spray droplet size
- Replacing worn out strap if damaged
- Replacing worn out nozzle with new one
- Testing using water prior to mixing chemicals.

If it is a problem with the sprayer that you cannot fix, red tag the unit and report it to the appropriate person to ensure it is repaired or replaced before being filled with chemicals again.

PC 3.5

Report any damage, wear or malfunctions identified to appropriate person

UK 3.2 Functionality of application equipment and tools

It is important that as soon as you notice damage, wear and tear or the spraying equipment has any malfunctions, the unit is taken out of service (red tagged) and your immediate supervisor is informed of the issue.

Learning Outcome 4: Apply non-hazardous chemicals safely under supervision

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Underpinning Knowledge

A competent individual will acquire the following knowledge:

- Hazards identification, assessment and control
- Assessing of weather conditions
- Methods of chemical application
- Safe and environmentally responsible work practices.

Performance Criteria

A competent individual must be able to successfully perform the following:

4.1 Check surrounding area for hazards and difficult areas to spray
4.2 Assess weather conditions prior and during application of chemicals
4.3 Put on appropriate Personal Protective Equipment (PPE)
4.4 Handle applicator equipment according to correct procedure
4.5 Apply chemicals safely and effectively in accordance with workplace safety and health procedures and manufacturer's specifications
4.6 Take immediate action in case of chemical spillage as required by workplace safety and health and environmental pollution, control procedures and manufacturer's specifications
4.7 Apply basic first aid when chemical/s come in contact with skin or eyes

PC 4.1

Check surrounding area for hazards and difficult areas to spray

UK 4.1 Hazards identification, assessment and control

In the landscape industry you are most likely to be spraying around plants or turf in a park or a streetscape. These are public places that often neighbour private property so it is important to be fully aware of what surrounds the spray zone.

Spraying haphazardly without taking note of what surrounding off target damage can be done is unacceptable and dangerous.

Knowledge of the spray site and surrounding hazards should be known and have been risk assessed before any spraying occurs. This may include looking for:

- Spray sites close to waterways

- Steep and uneven terrain
- Proximity to humans, fauna and protected flora
- Neighbouring properties that have the potential for spray drift

Also consider alternatives to spraying:

- Can the area be hand weeded?
- Is there an organic alternative?

PC 4.2

Assess weather conditions prior and during application of chemicals

UK 4.2 Assessing of weather conditions

It is very important to use herbicides when the weather conditions are suitable. Always take special care to check for rain or wind that may be strong enough to cause spray to drift beyond the target you are spraying.

Rain – check it is not raining and rain is not forecast.

Wind – avoid spraying herbicides in strong winds but note that a small breeze is ideal and better than no wind at all. Agrichemical spray droplets can hang in the air when there is no wind, affecting you and any desired plants nearby.

Wet ground – avoid using herbicides if it has recently finished raining as water on the weeds will dilute the agrichemical spray.

PC 4.3

Put on appropriate Personal Protective Equipment (PPE)

UK 4.4 Safe and environmentally responsible work practices

Wear appropriate PPE at all times when handling, mixing and applying chemicals, and cleaning and storing equipment after use

PC 4.4

Handle applicator equipment according to correct procedure

UK 4.3 Methods of chemical application

Applicator: Handheld sprayer

- Nozzle of sprayer is adjusted to give suitable reach and coverage.
- If the bottle over-flows when you place the pump and lid on the unit, hose it off with clean water before starting spraying.
- Check wind direction and spray in the direction of wind.
- Make sure you keep an even pressure and use the hand pump regularly as you apply the spray.

Applicator: Knapsack sprayer

- Before you add chemicals and/or water, check the filter is below the lid opening so you do not get unwanted debris inside the unit that may cause blockages during application.
- Check the knapsack lid is on and air tight.
- Check the nozzle is calibrated to give suitable reach and coverage.
- Check wind direction, spray in direction of wind
- Keep pumping regularly to maintain an even pressure of spray.

PC 4.5

Apply chemicals safely and effectively in accordance with workplace safety and health procedures and manufacturer's specifications

UK 4.3 Methods of chemical application

Safety steps before application

Always take these four essential safety steps before using an agrichemical (herbicide or other):

1. Read the back label or MSDS that came with the agrichemical before using it.
2. Make sure the agrichemical is suitable for the task at hand.
3. Know what PPE (personal protection equipment) you need to wear.
4. Check if you need to be qualified or supervised to use the agrichemical. Check with your supervisor if you don't know or if you have any questions.

Safety during application

There are many ways in which different chemicals are designed to be applied. Most plant protection products include wet sprays, dry powder or granule application.

Safe application is all about getting an appropriate chemical onto a target with minimal risk to you, others and the environment. Always check:

- All legal requirements and regulations are being complied with
- Neighbours and other staff members are notified as necessary
- Application equipment is suitable and has been checked for leaks, worn parts, safety, etc.
- Protective clothing and equipment is adequate
- Weather conditions are suitable for application
- You are aware of the sensitive areas and buffer zones
- You have an emergency plan in case of an accident
- Signage has been placed or areas of application secured as necessary.

During application consider:

- Any changes in weather conditions that may affect safe application. Stop spraying if conditions deteriorate.
- Work in a direction that minimises your exposure to agrichemical.
- Work methodically to avoid misses and excessive over application.
- Be aware of your surroundings, hazards, and the possibility of people straying into the application area. Be prepared to stop.

Understanding ‘re-entry periods’

A re-entry period is the minimum time you must wait after you have applied an agrichemical to a site, before going back into the treated area without PPE.

In many cases this time period is relatively short and it may say on the product label ‘when fully dry’, but always check the label for any specific time periods.

The purpose of having a re-entry period for some agrichemical products is to prevent contamination of skin and normal work clothing from treated plants, etc. that are still wet with the spray.

Some agrichemicals may also specify a difference depending on whether you are going to handle the plants or not, e.g. if you are going to train or prune plants that have just been sprayed. This will show on the label as a ‘Contact re-entry period’ and a ‘non- contact re-entry period’.

Understanding ‘withholding periods’

A withholding period applies to both plant crops and animals. It is the minimum amount of time you must wait, after applying an agrichemical, before you can harvest a crop or allow animals to graze a paddock that has been sprayed with herbicide.

Withholding periods are designed to allow time for chemical residues in or on plants and animals to degrade to acceptable levels.

Other safety considerations

- Wear appropriate PPE at all times.
- The work area must be properly cordoned off and notices must be clearly displayed.
- Use correct application tools and equipment.
- Use correct type of chemical and appropriate dosage by always following the manufacturer’s recommendations implicitly.
- Chemical is sprayed evenly onto, above and below surfaces of leaves and other targeted plant parts.

PC 4.6

Take immediate action in case of chemical spillage as required by workplace safety and health and environmental pollution, control procedures and manufacturer's specifications

For major spillages, evacuate and follow your workplace emergency procedures, call emergency services.

For minor spills, follow the clean-up procedures according to the label, MSDS or product safety card. For minor spills of liquid agrichemical the following procedure is usually recommended.

- Make sure you are adequately protected.
- Contain the spill using sand or a suitable absorbent material. 'Contain' means quickly placing a ring of sand around the spill to stop it spreading.
- Absorb the spill by gently placing sand inside the containment ring.
- Sweep up the contaminated sand and place in labelled plastic bags that can be sealed and placed in a dedicated toxic waste container for correct disposal.
- Wash down contaminated area and any equipment and PPE that has come into contact with spill, with water and detergent. Dispose of the washings away from plants, drains, waterways, etc.
- Report the spill / incident to appropriate person as soon as possible,

The main objectives of containing a chemical spillage include:

- Containing the flow of chemical into any waterway or body of water
- Soaking up all residue on hard ground
- Diluting all spilled chemical with water as quickly as possible.

PC 4.7

Apply basic first aid when chemical/s come in contact with skin or eyes

The following first aid steps are recommended by AVA (Agrifood and Veterinary Authority of Singapore and can be found on www.ava.gov.sg.

First aid for contact with chemicals

Chemical on the skin

1. Remove all contaminated clothing immediately.
2. Wash the affected area, including hair, with water and soap, then rinse well. Using a shower is best, if available.

   Avoid harsh scrubbing which will enhance pesticide absorption.

3. Gently dry the affected area and wrap it in loose cloth or a blanket, if necessary.
4. If the skin has chemical burns, cover the area loosely with a clean, soft cloth.

   Avoid using ointments, greases, powders and other medications unless instructed to do so by a medical worker.

Chemical in the eyes

1. Immediately hold the eyelid open and gently wash the affected eyes with drips of clean water.

   Do not use chemicals or drugs in the wash water unless instructed to do so by a physician or a poison control centre.

   Drip the water across the eye, not directly into the eye or use an eye- wash dispenser.
2. Continuously rinse the eyes for 15 minutes.
3. If only one eye is involved, be careful not to contaminate the other eye.
4. Flush water under the eyelids to remove debris.
5. Cover the eye with a clean piece of cloth and seek medical attention immediately.

Inhaled Chemicals

1. Immediately carry the victim to fresh air—do not allow them to walk.

   Do not attempt to rescue someone who is in an enclosed, contaminated area unless you are wearing appropriate PPE.

2. If other people are in the vicinity, warn them of the danger.
3. Get the victim to lie down and loosen clothing.
4. Keep the victim warm and quiet. Do not allow them to become chilled or overheated.
5. If the victim is convulsing, protect their head and watch that breathing continues. Keep their chin up to ensure air passages are open for breathing.
6. If breathing stops or is irregular, give artificial respiration.

Chemicals in the mouth, or swallowed

- **If the pesticide has got into the mouth but has not been swallowed**, rinse the mouth with plenty of water. After this, give the victim large amount (up to 1 litre) of milk or water to drink.
- **If the pesticide is swallowed**, one of the most critical first aid decisions is whether to induce vomiting. Induce vomiting **only** if the label instructs to do so. Several pesticides cause more harm when vomited than if they remain in the stomach.

Learning Outcome 5: Clean and store tools and equipment

Underpinning Knowledge

A competent individual will acquire the following knowledge:

- Correct disposal of chemicals
- Tools and equipment required to clean up chemicals and spillage
- Cleaning process and techniques
- Checking working condition of tools and equipment
- Correct storage of tools, equipment and materials.

Performance Criteria

A competent individual must be able to successfully perform the following:

5.1 Dispose of left-over chemicals in appropriate containers in accordance with regulations and procedures
5.2 Wash down hands and body before proceeding with further work
5.3 Clean tools and equipment in appropriate manner
5.4 Check working condition and report defective tools and equipment, if any, to appropriate person
5.5 Clean and store personal protective equipment appropriately after use
5.6 Observe personal hygiene by ensuring all residue to cleaned from body

PC 5.1

Dispose of left-over chemicals in appropriate containers in accordance with regulations and procedures

UK 5.1 Correct disposal of chemicals

Disposal of left-over agrichemical spray mix (diluted)

The easiest way to disposal of left-over agrichemical spray mix is to not let it happen in the first place, i.e. mix up the right amount. With experience you will learn how to make up spray mixes so you don't have too much mix left over at the end of the spray task.

To achieve this successfully you will need to know how to calibrate and test your spray equipment for spray output and coverage, as well as how to adjust the agrichemical concentrate and water rates for a given area to be sprayed.

However, it is not uncommon to have spray mix left over and the best way to dispose of it is:

- To re-spray your target, or
- To find an alternative target to spray.

This is not usually a problem for herbicides but care needs to be taken when re-spraying the same target with insecticides and fungicides due to the maximum residue levels permitted, especially on food crops. Check with your supervisor first before you do this.

If suitable options for re-spraying or alternative targets have run out, it is acceptable to spray out agrichemical onto waste land with consideration to sensitive areas such as waterways. One thing you never do is dump or drain your spray tank in one spot.

Disposal of unwanted agrichemical concentrate

Occasionally it becomes necessary to dispose of concentrated agrichemical because it has been superseded by another agrichemical, or the crops it was used on are no longer grown, etc.

The disposal options should include:

- Finding an alternative use for them, can they be legally used for an alternative purpose than what they were originally purchased for? Can they be legally given away to someone who can use them?
- Return to the manufacturer (note: this is usually only an option for chemicals such as animal medicines.
- Local body collections - check with your local authority.
- Landfill disposal for low toxicity and low hazard agrichemicals, again, check if this is possible with your local authorities.
- Commercial waste disposal company who are licenced to handle hazardous waste.

Disposal of empty agrichemical containers

All plastic and glass containers must go through a rigorous cleaning process before disposal. This involves triple rinsing by;

1. Draining the empty container into the spray tank for 30 seconds.
2. Filling the container to 20% of capacity, replacing the lid and shaking vigorously.
3. Pour rinsing into the spray tank and drain for a further 30 seconds.
4. Repeat steps (2) and (3) two more times.

Following this process renders the container as non- hazardous waste. This means it may be disposed of by:

- Returning to the supplier
- Recycling through the appropriate local expert recycling authority

Cardboard containers may be cleaned and then either crushed for landfill disposal or burned according to local authority conditions.

The disposal of old unused agrichemical application equipment and PPE is subject to the same requirements for rigorous cleaning prior to disposal as the empty containers.

All empty agrichemical containers and unwanted concentrate must be kept securely in the storage facility until ready for disposal.

Learning activity 7

Please complete the following activity.

For each of the following statements, tick ✓ to indicate if it is true or false.

		True	False
1.	Washings of agrichemical equipment can be tipped down the drain		
2.	The best thing to do with empty containers is to recycle them		
3.	I can get rid of a very toxic agrichemical concentrate at the local rubbish tip.		
4.	The best way to get rid of unwanted dilute spray mix is to find something else I can use it on.		
5.	I must clean plastic containers by triple rinsing before disposing of them.		

PC 5.2

Wash down hands and body before proceeding with further work

UK 5.3 Cleaning process and techniques

To avoid contamination to other people and the work area, wash down your hands and body before you proceed with further work.

Always wash thoroughly with soap and water

The most efficient way of washing down after spraying chemicals is to take a shower.

Following a shower, put clean clothes on. Do not put on the clothes you wore when spraying. These clothes should now be in the appropriate organisational cleaning / laundry process.

PC 5.3

Clean tools and equipment in appropriate manner

UK 5.2 Tools and equipment required to clean up chemicals and spillage

- The sprayer must be drained of all excess / unused horticultural chemicals into a container provided. As far as possible, all prepared chemicals should be used for spraying.
- All tools and equipment are cleaned, dried and stored in assigned location.
- Cleaning tools and materials used for housekeeping are cleaned and stored in assigned location.
- Worksite is cleaned, tidied and reinstated.

PC 5.4

Check working condition and report defective tools and equipment, if any, to appropriate person

UK 5.4 Checking working condition of tools and equipment

- Check working conditions and report defective tools and equipment, if any, to your supervisor
- Defective tools and equipment are to be put aside and shown to your supervisor.

PC 5.5

Clean and store personal protective equipment appropriately after use

UK 5.5 Correct storage of tools, equipment and materials

Once all of the chemicals used have been stored and the spraying equipment has been cleaned and put away, you can carry out your PPE cleaning procedures

Ensure all PPE is cleaned, dried and stored in its appropriate storage position before you clean yourself.

PC 5.6

Observe personal hygiene by ensuring all residue to cleaned from body

UK 5.3 Cleaning process and techniques

Remove all clothes worn while mixing or applying chemicals and place them in the laundry before washing yourself

Ensure all traces and residue of any chemicals you have been working with or near are washed from your body by having a shower. This includes washing thoroughly with soap or similar personal cleaning agent.

Assessment Information

The assessment methodology for this course is Practical Exam and Oral Questioning.

Practical Exam

For the Practical Exam, you will be given **90 minutes** to perform the following tasks to demonstrate your competence for the learning outcomes:

a. Recognise the dangers to environment, human and animal health of exposure to chemicals Identify one invasive species, assess the extent of spread and recommend an appropriate remediation method.
b. Safely handle and store non-hazardous chemicals Put on the appropriate PPE, set up a safe worksite and select the appropriate tools, equipment for plant pruning and chemical application.
c. Prepare equipment and tools to apply non-hazardous chemicals safely under supervision Reinstate the worksite and dispose of horticultural waste and leftover chemical.
d. Apply non-hazardous chemicals safely under supervision.
e. Clean and store tools and equipment

Oral Questioning

For Oral Questioning, you will be given **30 minutes** to answer 10 questions that check your knowledge in accordance to the learning outcomes.

Reference material

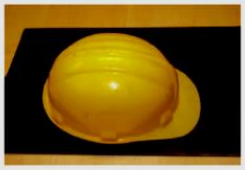
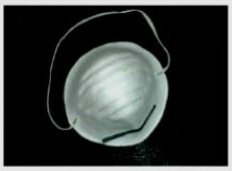
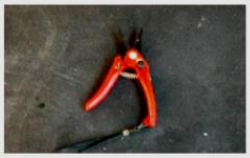
- *Agrifood and Veterinary Authority of Singapore (AVA) – guidelines for the use of pesticides*

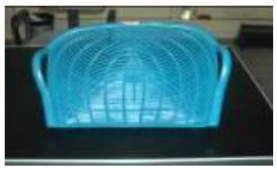
- *WSH Guidelines for Safety and Health – Landscape and Horticultural Maintenance*

- *ThoughtPlanters teaching resources for NZQA Unit Standards 21554 Demonstrate knowledge of safety with agrichemicals, 21556 Control weeds under supervision, 21560 Demonstrate knowledge of agrichemicals*

Annex 1 – Tools and equipment checklist

Tools and equipment checklist for handling non-hazardous chemicals

Personal Protective Equipment			
 Safety Vest ☑	 Cotton Gloves ☐	 Safety Helmet ☐	 Safety Boots ☑
 Eye Protection ☑	 Dust Mask ☑	 Rain Coat ☑	 Face Shield ☑
 Rubber Gloves ☑	 Ear Plugs ☐		
Work Zone Requirements			
 Red & White Tape ☑	 Safety Cones ☑	 Blinking Light ☑	 Warning Sign ☑
Tools and Equipment			
 Secateurs ☐	 Garden Shears ☐	 Lopping Shears ☐	 Pole Pruner ☐
 Cotton Twine ☐	 Hand Fork & Hoe ☐		

Tools and Equipment			
 Landscape Trolley ☑	 Notepad & Pen ☑	 Plier ☐	 Screwdriver ☐
 Changkul ☐	 Tree Guard, Stake & Tie ☐	 Mallet ☐	 Rod ☐
 Measuring Tape ☐	 Penknife ☐	 Pungkis ☐	 Bunker Rake ☐
 Trowel ☐	 Fertiliser ☐	 Watering Can ☐	 Scoop ☑
 Chemical ☑	 Handheld sprayer ☑	 Pail ☑	 Measuring cup ☑
 Trash bag ☐	 Coconut Broom ☐	 Wheelbarrow ☐	 Scrapper ☐

Tools and Equipment			
 Cloth ☑	 Rake ☐	 Brush ☐	 Dustpan ☐
Machines			
 Hedge Trimmer ☐	 Knapsack Brushcutter ☐	 Lawn Mower ☐	
Planting Materials			
 Top Dress/Soil ☐	 Clump of Turves ☐	 Mulch ☐	 Tree & Shrub ☐

Annex 2 – Sample MSDS

SAFETY DATA SHEET

ROUNDUP(R) HERBICIDE BY MONSANTO

Infosafe No.: LQ1E1
ISSUED Date: 13/10/2015
ISSUED BY SCOTTS AUSTRALIA PTY LTD

1. IDENTIFICATION

GHS Product Identifier
ROUNDUP(R) HERBICIDE BY MONSANTO

Company Name
SCOTTS AUSTRALIA PTY LTD

Address
Level 2,
32 Lexington Drive, Bella Vista
NSW 2153 Australia

Telephone/Fax Number
Tel: (02) 8602 9000
Fax: (02) 8602 9001

Emergency phone number
1800 033 111

Recommended use of the chemical and restrictions on use
Weedkiller

2. HAZARD IDENTIFICATION

GHS classification of the substance/mixture
Classified as Hazardous according to the Globally Harmonised System of Classification and labelling of Chemicals (GHS) including Work, Health and Safety regulations, Australia.
Not classified as Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail. (7th edition)

GHS Classification:
Eye damage/irritation 1
Hazardous to the aquatic environment - acute hazard category 2

Signal Word (s)
DANGER

Hazard Statement (s)
H318 Causes serious eye damage.
H401 Toxic to aquatic life.

Pictogram (s)
Corrosion

Precautionary statement – Prevention

P273 Avoid release to the environment.
P280 Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statement – Response
P310 Immediately call a POISON CENTER or doctor/physician.
P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Precautionary statement – Disposal
P501 Dispose of contents/container to an approved waste disposal plant.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients

Name	CAS	Proportion
Isopropylamine salt of glyphosate	38641-94-0	40-<45 %
Ethoxylated Tallow Amine		10-<15 %
Ingredients determined not to be hazardous.		Balance

4. FIRST-AID MEASURES

Inhalation
If inhaled, remove affected person from contaminated area. Keep at rest until recovered. If symptoms persist seek medical attention.

Ingestion
Do not induce vomiting. Wash out mouth thoroughly with water. Seek immediate medical attention.

Skin
Wash affected area thoroughly with soap and water. Take off contaminated clothing, wristwatch, jewellery. Wash clothes and clean shoes before re-use. If symptoms develop seek medical attention.

Eye contact
If in eyes, hold eyelids apart and flush the eyes continuously with running water. Remove contact lenses. Continue flushing until advised to stop by the Poisons Information Centre or a doctor, or for at least 15 minutes. Seek immediate medical attention.

First Aid Facilities
Eyewash, safety shower and normal washroom facilities.

Advice to Doctor
Treat symptomatically. This product is not an inhibitor of cholinesterase.
Antidote:
Treatment with atropine and oximes is not indicated.

Other Information
For advice in an emergency, contact a Poisons Information Centre (Phone Australia 131 126) or a doctor at once.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use water, foam, dry chemical, carbon dioxide.

Unsuitable Extinguishing Media
Not available

Hazards from Combustion Products
Under fire conditions this product may emit toxic and/or irritating fumes and gases including carbon monoxide (CO), phosphorus oxides (PxOy), nitrogen oxides (NOx).

Specific Hazards Arising From The Chemical
This product is non combustible. However, following evaporation of aqueous component under fire conditions, the non-aqueous component may decompose and/or burn. Minimise use of water to prevent environmental contamination.

Decomposition Temperature
Not available

Precautions in connection with Fire
Fire fighters should wear full protective clothing and self-contained breathing apparatus (SCBA) operated in positive pressure mode. Fight fire from safe location.

6. ACCIDENTAL RELEASE MEASURES

Emergency Procedures
Wear appropriate personal protective equipment and clothing to prevent exposure. Increase ventilation. If possible contain the spill. Place inert absorbent material onto spillage. Collect the material and place into a suitable labelled container. Do not dilute material but contain. As a water based product, if spilt on electrical equipment the product will cause short-circuits. Dispose of waste according to the applicable local and national regulations. If contamination of sewers or waterways occurs inform the local water and waste management authorities in accordance with local regulations.
Small spill: Flush spill area with water.
Large spill: Absorb in earth, sand or absorbent material. Dig up heavily contaminated soil. Collect in containers for disposal.

7. HANDLING AND STORAGE

Precautions for Safe Handling
Use only in a well ventilated area. Keep containers sealed when not in use. Prevent the build up of mists or vapours in the work atmosphere. Avoid inhalation of vapours and mists, and skin or eye contact. Maintain high standards of personal hygiene i.e. Washing hands prior to eating, drinking, smoking or using toilet facilities.

Conditions for safe storage, including any incompatabilities
Store in a cool, dry, well-ventilated area, out of direct sunlight. Store in suitable, labelled containers. Keep containers tightly closed. Store away from incompatible materials. Ensure that storage conditions comply with applicable local and national regulations. Protect from freezing.
Partial crystallization may occur on prolonged storage below the minimum storage temperature. If frozen, place in warm room and shake frequently to put back into solution. This formulation can be stored for 2 to 3 weeks at temperatures colder than -20°C without impact. If the temperature remains below -20°C for longer the water phase of the formulation may freeze. Should this occur allow the product to warm and it will return to its original homogeneous state. We recommend that the container should be agitated (shaken) prior to pouring.
Minimum shelf life: 5 years.

Storage Temperatures
Minimum storage temperature: -15 °C
Maximum storage temperature: 50 °C

Recommended Materials
Stainless steel, aluminium, fibreglass, plastic, glass lining. Keep in original packaging.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Occupational exposure limit values
No exposure standards have been established for the mixture. However, over-exposure to some chemicals may result in enhancement of pre-existing adverse medical conditions and/or allergic reactions and should be kept to the least possible levels.

Biological Limit Values
No biological limits allocated.

Appropriate Engineering Controls
This substance is hazardous and should be used with a local exhaust ventilation system, drawing vapours away from workers' breathing zone. If the engineering controls are not sufficient to maintain concentrations of vapours/mists below the exposure standards, suitable respiratory protection must be worn.

Respiratory Protection
If engineering controls are not effective in controlling airborne exposure then an approved respirator with a replaceable vapor/ mist filter should be used. Refer to relevant regulations for further information concerning respiratory protective requirements. Reference should be made to Australian Standards AS/NZS 1715, Selection, Use and Maintenance of Respiratory Protective Devices; and AS/NZS 1716, Respiratory Protective Devices, in order to make any necessary changes for individual circumstances.

Eye Protection
Safety glasses with full face shield should be used. Eye protection devices should conform to relevant regulations. Eye protection should conform with Australian/New Zealand Standard AS/NZS 1337 - Eye Protectors for Industrial Applications.

Hand Protection
Wear gloves of impervious material such as nitrile, butyl, neoprene, polyvinyl chloride (PVC), natural rubber and/or barrier laminate. Final choice of appropriate gloves will vary according to individual circumstances. i.e. methods of handling or according to risk assessments undertaken. Occupational protective gloves should conform to relevant regulations. Reference should be made to AS/NZS 2161.1: Occupational protective gloves - Selection, use and maintenance.

Body Protection
Suitable protective work wear, e.g. cotton overalls buttoned at neck and wrist is recommended. Chemical resistant apron is recommended where large quantities are handled.

9. PHYSICAL AND CHEMICAL PROPERTIES

Properties	Description	Properties	Description
Form	Liquid	**Appearance**	Pale amber-pale brown Liquid, free from foreign materials
Colour	Pale amber-pale brown	**Odour**	Slight
Decomposition Temperature	Not available	**Melting Point**	Not available
Boiling Point	Not available	**Solubility in Water**	Soluble
Specific Gravity	1.168	**pH**	4.7 (80g/l)
Vapour Pressure	Not available	**Vapour Density (Air=1)**	Not available
Evaporation Rate	Not available	**Odour Threshold**	Not available
Viscosity	Not available	**Partition Coefficient: n-octanol/water**	Not available
Density	1.168g/cm³ (20°C)	**Flash Point**	Does not flash
Flammability	Non-combustible liquid	**Auto-Ignition Temperature**	Not available
Flammable Limits - Lower	Not available	**Flammable Limits - Upper**	Not available
Explosion Properties	Not available	**Oxidising Properties**	None

Other Information
log Pow: -3.2 at 25°C (glyphosate)

10. STABILITY AND REACTIVITY

Reactivity
Reacts with galvanised steel or unlined mild steel to produce hydrogen, a highly flammable gas that could explode.

Chemical Stability
Stable under normal conditions of storage and handling.

Reactivity and Stability
Reacts with incompatible materials

Conditions to Avoid
Extremes of temperature and direct sunlight.

Incompatible materials
Incompatible materials for storage: galvanised steel, unlined mild steel

Hazardous Decomposition Products
Thermal decomposition may result in the release of toxic and/or irritating fumes and gases including carbon monoxide, carbon dioxide, oxides of nitrogen and oxides of phosphorus.

Possibility of hazardous reactions
Reacts with galvanised steel or unlined mild steel to produce hydrogen, a highly flammable gas that could explode.

11. TOXICOLOGICAL INFORMATION

Toxicology Information
No toxicity data available for this material. Data obtained on more concentrated products and on components are summarized below.

Acute Toxicity - Oral
More concentrated formulation:
LD50 (Rat): 5000 mg/kg body weight

Acute Toxicity - Inhalation
More concentrated formulation:
Rat, LC50 (limit test), 4 hours, aerosol: 3.18 mg/L
Aerosol particle size (< 10 micron) much lower than the droplet size (> 100 micron) normally achieved during spraying operations. This product is not aerosolized during handling or use

Acute Toxicity - Dermal
More concentrated formulation:
LD50 (rabbit, limit test): >5000 mg/kg body weight
No mortality

Ingestion
Not classified according to GHS criteria.

Inhalation
Not classified according to GHS criteria.

Skin
Not classified according to GHS criteria.

More concentrated formulation:
Skin irritation
Rabbit, 6 animals, OECD 404 test:
Redness, mean EU score: 0.64
Swelling, mean EU score: 0.03
Days to heal: 3

Eye
Causes serious eye damage. Eye contact will cause stinging, blurring, tearing, severe pain and possible burns, necrosis, permanent damage and blindness.

More concentrated formulation:
Eye irritation
Rabbit, 6 animals, OECD 405 test:
Conjunctival redness, mean EU score: 1.17
Conjunctival swelling, mean EU score: 1.60
Corneal opacity, mean EU score: 0.57
Iris lesions, mean EU score: 0.50
Days to heal: > 28
Other effects: pannus, ulcer on surface of eye (ulceration of cornea)

Respiratory sensitisation
Not expected to be a respiratory sensitiser.

Skin Sensitisation
Not expected to be a skin sensitiser.

More concentrated formulation:
Guinea pig, 9-induction Buehler test:
Positive incidence: 0 %

Germ cell mutagenicity
Not considered to be a mutagenic hazard.

Carcinogenicity
Not considered to be a carcinogenic hazard.

Reproductive Toxicity
Not considered to be toxic to reproduction.

STOT-single exposure
Not expected to cause toxicity to a specific target organ.

STOT-repeated exposure
Not expected to cause toxicity to a specific target organ.

Aspiration Hazard
Not expected to be an aspiration hazard.

Other Information
N-(phosphonomethyl)glycine; (glyphosate acid)

Genotoxicity
Not genotoxic

Carcinogenicity
Not carcinogenic in rats or mice.

Reproductive/Developmental Toxicity
Developmental effects in rats and rabbits only in the presence of significant maternal toxicity.
Reproductive effects in rats only in the presence of significant maternal toxicity.

Ethoxylated tallowamine

Genotoxicity
Not genotoxic

Reproductive/Developmental Toxicity
Reproductive effects in rats only in the presence of maternal toxicity.
No developmental effects in rats.

12. ECOLOGICAL INFORMATION

Ecotoxicity
Toxic to aquatic life. Data obtained on a similar glyphosate formulation and/or glyphosate are summarized below.

Persistence and degradability
Not available

Mobility
Not available

Bioaccumulative Potential
Not available

Other Adverse Effects
Not available

Environmental Protection
Prevent this material entering waterways, drains and sewers.

Acute Toxicity - Fish
Similar formulation

Bluegill sunfish (Lepomis macrochirus):
Acute toxicity, 96 hours, flowthrough, LC50: 5.8 mg/L
Rainbow trout (Oncorhynchus mykiss):
Acute toxicity, 96 hours, flowthrough, LC50: 8.2 mg/L
Rainbow trout (Oncorhynchus mykiss):
Prolonged exposure toxicity, 21 days, flowthrough, NOEC: 2.4 mg/L

Acute Toxicity - Daphnia
Similar formulation

Water flea (Daphnia magna):
Acute toxicity, 48 hours, static, EC50: 11 mg/L
Water flea (Daphnia magna):
Life cycle/reproduction test, 21 days, semi-static, NOEC: 3.2 mg/L

Acute Toxicity - Algae
Similar formulation

Green algae (Selenastrum capricornutum):
Acute toxicity, 72 hours, static, ErC50 (growth rate): 8.0 mg/L
Green algae (Selenastrum capricornutum):
Acute toxicity, 72 hours, static, NOEC (growth rate): 1.5 mg/L

Acute Toxicity - Other Organisms
Similar formulation

Arthropod toxicity
Honey bee (Apis mellifera):
Oral, 48 hours, LD50: > 395 µg/bee
Honey bee (Apis mellifera):
Contact, 48 hours, LD50: > 338 µg/bee
Soil organism toxicity, invertebrates
Earthworm (Eisenia foetida):
Acute toxicity, 14 days, LC50: > 5000 mg/kg dry soil

Other Information
N-(phosphonomethyl)glycine; { glyphosate acid}

Avian toxicity
Bobwhite quail (Colinus virginianus):
Dietary toxicity, 5 days, LC50: > 4640 mg/kg diet
Mallard duck (Anas platyrhynchos):
Dietary toxicity, 5 days, LC50: > 4640 mg/kg diet
Bobwhite quail (Colinus virginianus):
Acute oral toxicity, single dose, LD50: > 3851 mg/kg body weight

Bioaccumulation
Bluegill sunfish (Lepomis macrochirus):
Whole fish: BCF: < 1
No significant bioaccumulation is expected.
Dissipation
Soil, field:
Half life: 2 - 174 days
Koc: 884 - 60000 L/kg
Adsorbs strongly to soil.
Water, aerobic:
Half life: < 7 days

13. DISPOSAL CONSIDERATIONS

Disposal considerations
Dispose of waste according to applicable local and national regulations. Do not allow into drains or watercourses or dispose of where ground or surface waters may be affected. Wastes including emptied containers are controlled wastes and should be disposed of in accordance with all applicable local and national regulations.

14. TRANSPORT INFORMATION

Transport Information
Road and Rail Transport (ADG Code):
Not classified as Dangerous Goods according to the Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) (7th edition).

Marine Transport (IMO/IMDG):
Not classified as Dangerous Goods by the criteria of the International Maritime Dangerous Goods Code (IMDG Code) for transport by sea.

Air Transport (ICAO/IATA):
Not classified as Dangerous Goods by the criteria of the International Air Transport Association (IATA) Dangerous Goods Regulations for transport by air.

U.N. Number
None Allocated

UN proper shipping name
None Allocated

Transport hazard class(es)
None Allocated

Special Precautions for User
Not available

IMDG Marine pollutant
No

Transport in Bulk
Not available

15. REGULATORY INFORMATION

Regulatory information
Classified as Hazardous according to the Globally Harmonised System of Classification and labelling of Chemicals (GHS) including Work, Health and Safety regulations, Australia
Classified as a Scheduled Poison according to the Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP)

Poisons Schedule
S5

16. OTHER INFORMATION

Date of preparation or last revision of SDS
MSDS Reviewed: October 2015
MSDS Supersedes: October 2012

References
Preparation of Safety Data Sheets for Hazardous Chemicals Code of Practice.
Standard for the Uniform Scheduling of Medicines and Poisons.
Australian Code for the Transport of Dangerous Goods by Road & Rail.
Model Work Health and Safety Regulations, Schedule 10: Prohibited carcinogens, restricted carcinogens and restricted hazardous

chemicals.
Workplace exposure standards for airborne contaminants, Safe work Australia.
American Conference of Industrial Hygienists (ACGIH).
Globally Harmonised System of classification and labelling of chemicals.

END OF SDS