

Workplace Safety and Health Guidelines

Landscape and Horticulture Management



WSHCOUNCIL

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1. Introduction

The Workplace Safety and Health (WSH) Act came into effect in March 2006. Under the Act, stakeholders are responsible for managing the risks they create at the workplaces, and taking reasonable practical steps to ensure workers' safety and health. From September 2011, the WSH Act was extended to cover all workplaces including maintenance works under the landscaping sector for their works involving general cleansing of parks, horticultural work, turf work and tree work.

Workers in the landscaping sector are exposed to hazards such as working alongside moving traffic, working at heights, excessive noise, use of machinery and equipment, contact with insects, use of chemicals and heat stress. The risk of accidents and ill health due to these hazards can result in suffering, sickness, absenteeism, productivity loss, disability or even death. All these can be prevented.

The purpose of this guide is to provide information and guidance on common workplace hazards which workers involved in landscaping maintenance activities may face, and their preventive measures. For ease of reading, the set of guidelines is divided into two parts:

Part A – Work Activities

Part B – Legislative Requirements

All landscape contractors and their supervisors should familiarise themselves with this set of guidelines. It is the responsibility of everyone to ensure that workers are healthy and are working in a safe environment. Through better safety and health management, companies can strive towards a goal of zero harm.

Note

This set of guidelines replaces the Workplace Safety and Health Guidelines – Landscape and Horticulture Management first issued by WSH Council in 2008 and first revision in 2012.

* Anyone involved in planning or implementing work at heights activities must also make reference to existing regulations, approved codes of practices and guidelines that cover WSH measures related to working at heights.

Part A – Work Activities

1. General Cleansing and Housekeeping

General cleansing involves the cleaning of park premises, facilities and amenities. These include open space, garden sheds, toilets, water bodies such as ponds and playground amenities. To facilitate the cleaning operation, equipment, tools and chemicals are used. Equipment and tools include ladders to access lamp posts or gutters of roof structures, jet washing machines and all terrain litter vehicle (ATLV). The chemicals used are primarily the cleaning agents used for toilet cleaning.

Hazards involved in cleaning operations include slips, trips and falls, contact with hazardous substances, electrical hazard, noise and high pressure of water jet when operating jet washing machine. The rationale on the recommended control measures are addressed in greater details in subsequent sections where applicable. For example, safe use of chemicals is addressed in detail under Part B Section 5.

Safe work practices include:

- Assess the work area before starting work. Look out for infectious material such as vomit substances. If present, please remove it first;
- Equip workers with suitable gloves to guard against cleaning agents and infectious materials;
- Wear safety boots to guard against slips and falls;
- Keep work area dry after cleaning;
- Practise good hygiene habits such as proper hand washing after work completion;
- Place warning signs to alert other users; and
- Wear ear protection to protect the hearing of workers handling the jet washing machine.

1.1 Cleansing of Open Space

1.1.1 Jet Washing

A jet washing machine is used to remove or dislodge stubborn accumulation of algae or stains which remain on concrete surfaces such as concrete tables, toilet walls and flooring. The machine is basically a jet gun connected to a water source and a motor generator, in which high pressure water jets are generated.

Safe work practices include:

- Only trained workers should be allowed to operate the jet washing machine;
- Check the vicinity of work area and the condition of the jet washing machine before starting work;
- Wear safety boots to guard against slips and falls; and
- Handle the jet washing hose with both hands. Do not direct the hose at anyone.



Figure 1: Only trained workers should operate the jet washing machine.

1.1.2 All-terrain Litter Vehicle

For removal of dead leaves, branches and other debris, an all-terrain litter vehicle (ATLV) is sometimes used. The vehicle works like a vacuum cleaner. It simply picks up the debris as it drives over it.

Safe work practices include:

- Only trained workers should be allowed to operate the ATLV;
- Keep all movements slow and gradual on slopes. Do not make sudden changes in speed and direction which could cause the ATLV to roll over;
- Conduct operational checks on ATLV and its components before use; and
- Look out for other users in the work vicinity



Figure 2: Only trained workers should operate the ATLV.

1.2 Cleansing of Garden Sheds

Workers may need to work at height when carrying out cleansing work on garden sheds and rooftops. To minimise fall accidents due to working at height, equipment such as long broom or pole can be used to reach the height required. A ladder is also commonly used for cleaning of garden sheds and rooftops.

Safe work practices include:

- Ensure that all equipment is in good working condition;
- Do not climb to reach the rooftops; and
- Look out for other users in the work vicinity.



Figure 3: Use long broom to clean elevated areas.



Figure 4: Place ladder on level and firm ground, and get another worker to hold it firmly. Refer to Section 2.3.1 under Part A on safe use of ladder.

1.3 Cleansing of Toilets

A clean, well-maintained toilet is not only essential for promoting health and hygiene, it also reduces the spread of infection and diseases. Workers should follow consistent toilet cleaning procedures in order to prevent cross-contamination and improve work efficiency.

Safe work practices include:

- Equip workers with rubber gloves and safety boots to prevent slips and falls;
- Place warning signs at the entrance while cleaning operations are underway and when the floor is wet;
- Practise good hygiene habits such as proper hand washing after work completion; and
- Beware not to mix any cleaning chemical on any surface for which they are not intended to. (Refer to Part B Section 5 for chemical safety)



Figure 5: Equip workers with suitable safety boots to guard against slips and falls.



Figure 6: Place warning signs to alert other users.

1.4 Cleansing of Water Bodies

Certain parks may have large water bodies such as ponds. Workers usually sit on small boats and use nets to scoop out fallen leaves and litter to clean these water bodies. At times, they may also get into the water to carry out minor cleaning works. Rough surfaces, pits and algae-covered rocks may be hidden in both shallow and deep-water bodies. Arising from these hazards, workers may slip, trip and/or fall and can possibly lead to head injuries and even drowning.

Water Safety Checks

For the worker cleaning water bodies to ask:

- Will I drown in this water?
- What safety precautions shall I take?
- Who can really save me?

For other co-workers to ask:

- Will someone drown here?
- What additional safety measures can I put in?
- Do I need to have a rescue plan in place?

Water Safety Code:

- Learn swimming and water survival skills;
- Understand the dangers of working in large bodies of water;
- Follow safety rules and signs;
- Work in safe areas; and
- Never work alone.

Safe work practices include:

- Trained supervisors should identify all potential safety and health hazards (such as condition of the pond, pump location and drainage point) before work commences;
- Check all equipment and tools, and brief all workers involved on safety precautions before work commences;
- Equip workers with luminous vest, life jacket, rubber gloves and rubber boots;
- Only trained workers should be allowed to operate or paddle the boat; and
- Provide workers with fishing bibs especially working in swampy areas.



Figure 7: Equip workers with luminous vests, life jackets, rubber gloves.



Figure 8: Fishing bibs will keep worker dry in the water and protect worker from being bitten by fish and other animals in the water. Having a proper protection rope and supervision are important for working at the pond or waterway to keep the worker safe from drowning accidents.



Figure 9: Use bibs at man-made pond to keep worker dry in the water.

1.5 Cleansing of Playgrounds

The equipment and amenities in a playground should be properly cleaned and disinfected so as to provide a safe and clean environment for the public to enjoy at leisure. While cleaning, workers should also inspect the working conditions of the playground amenities.

Safe work practices include:

- Equip workers with rubber gloves and suitable safety boots;
- Do not mix any disinfecting chemical on any surface for which they are not intended for; and
- Practise good hygiene habits such as proper hand washing after work completion.



Figure 10: Equip workers with rubber gloves and suitable safety boots.

1.6 Housekeeping

Proper housekeeping can help to eliminate some hazards as poor housekeeping can often contribute to injuries, accidents and fires. Housekeeping is not only about cleanliness, but also keeping facilities, equipment, work areas and access routes in good condition.

Safe work practices include:

- All rubbish and debris should be cleared from time to time;
- Keep aisles and exits clear of obstructions;
- Keep evacuation routes clear;
- Check that fire extinguishers are accessible;
- Clean up spills immediately and repair any leaks as soon as possible;
- Inspect machines and ensure that all guards are in place before use; and
- Store flammable materials in designated locations that are away from ignition sources.

For more information on housekeeping matters, refer to WSH Guidelines on Workplace Housekeeping.

2. Horticulture Management

Horticulture management is performed on greenery such as shrubs, palms, ground cover and hedges located within parklands and along roadsides. It generally consists of planting, pruning of shrubs, plant removal, watering operations using water tankers and fertilising. Some hazards involved include working along roadsides, working from elevated work platforms. Various hazards associated with watering operations and the use of horticulture equipment and tools.

Plant pruning is carried out for various reasons which include regulating plant growth, removal of dead or diseased branches, clearing of traffic obstructions as well as for aesthetics purpose. The equipment and tools used to facilitate such plant pruning work range from relatively large machinery such as cranes and chain saws to small hand tools such as secateurs and shears.

2.1 Working with Hand Tools

With a wide range of hand tools available, landscape workers have to be familiar with the right selection and handling of these tools. Hence, proper training of the workers to equip them with a good understanding of the operation and function of the tools is necessary. This will help to reduce the impact and cutting hazards associated with the use of such hand tools.

Safe work practices include:

- Know the purpose and function of the tool well;
- Use the correct tool for the job;
- Use the tool properly and safely (including positioning of tool);
- Maintain the tool in good condition. Do not use a damaged tool;
- Cover the tool (if provided) after use. Avoid carrying a sharp tool in the pocket; and
- Return the tool to its proper place after use. Do not leave them lying around when they can become a tripping hazard.



Pole pruner

To prune small trees without a ladder.



Secateurs

For most pruning needs.



Shear

For pruning a simple hedge.

Figure 11: Various hand-held tools for plant pruning works.

2.2 Working with Machinery and Motorised Tools



Figure 12: Various hand-held tools for plant pruning works.

2.3 Working at Height - For Greenery Planted on Building Structures

To access the greenery planted on building structures located at heights, workers are often required to work from various types of work platforms. Building structures include overhead bridges, rooftops, walkways and railings.



Figure 13: Various hand-held tools for plant pruning works.

The maintenance of the greenery planted on such building structures requires proper safety procedures. For a start, proper and safe means of access to and egress from these work areas have to be provided. If there is a falling hazard, PPE such as safety harness needs to be used. A suitable anchorage point should be identified and provided. At times, barricading of work areas to prevent unauthorised entry by the public is necessary.

Basically, the work platform can be categorically grouped into mechanical and non-mechanical types. An example of a mechanical work platform is the Mobile Elevating Work Platform (MEWP). Ladders and scaffolds are examples of non-mechanical work platform, which are relatively simple and easy to set up.

For more information see:

- Additional control measures on working on roadsides under Part B Section 7; and
- Associated hazards and control measures for MEWP operations under Part A section 4.3.1.1.

2.3.1 Use of Ladders

Dos

- Use a ladder of sound construction and material, and maintain in good condition;
- Remove any oil or grease (if any) on the ladder;
- Place ladder on level and firm ground. If necessary, get another worker to hold it firmly;
- Position the ladder where it will not be easily knocked over by other persons;
- Stand on lower rungs of the ladder where possible for stability;
- Keep both feet on the same rung or step throughout the task;
- Maintain three points of contact while using the ladder; and
- Make sure you have a safe handhold available on the steps.

Don'ts

- Do not overreach - make sure your belt buckle (navel) stays within the stiles.

For more information on safe use of ladders, see Ladder Safety Guide.

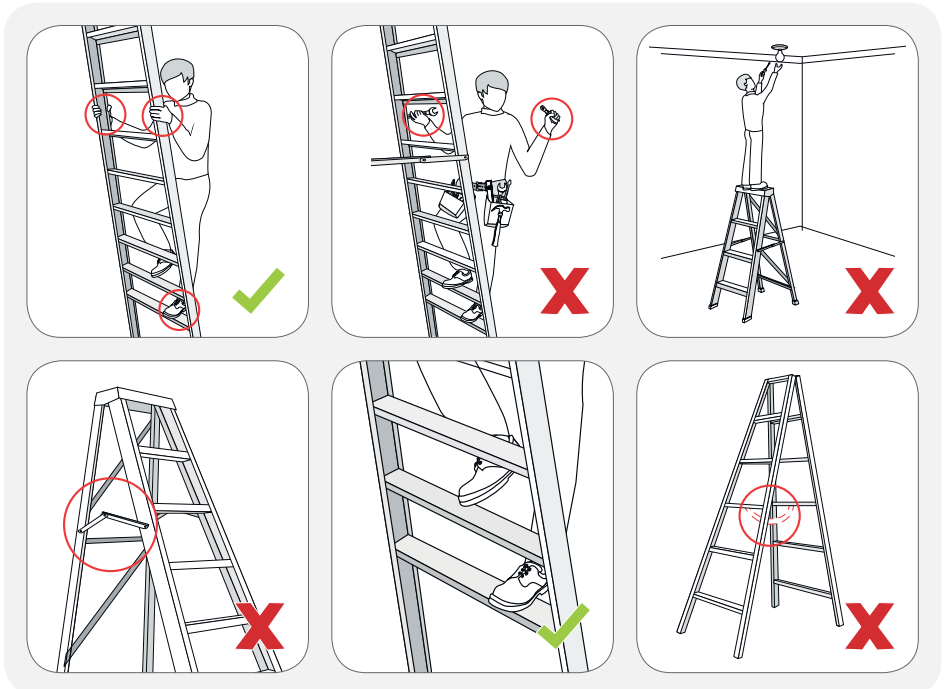


Figure 14: Recommendations on the safe use of ladders.

2.3.2 Use of Scaffolds

All scaffolds shall be erected by trained scaffold erectors under the immediate supervision of a trained scaffold supervisor.

Before using scaffolds, ensure that:

- All scaffolds have been inspected by a competent and authorised scaffold supervisor (except for trestle scaffolds or scaffolds which do not permit a person to fall more than two meters);
- All scaffolds have been inspected by a competent and authorised scaffold supervisor:
 - before its first use;
 - after substantial alteration;
 - after any event likely to have affected its stability; or
 - when it has been in place for seven days.
- All scaffolds are used on stable ground;
- Proper access and egress are provided for;
- Basic personal protective equipment such as safety harness, helmet and safety shoes are worn;
- Scaffolds are not overloaded; and
- All scaffolds and their components must meet the requirements of the regulations stipulated in the Workplace Safety and Health (Scaffolds) Regulations.



Figure 15: Install guard rails and toe-boards on scaffolds.

2.4 Watering Operations

For watering small quantities of plants, watering cans are used. Water tankers are utilised for large scale watering operations, which are often deployed in parks and along the roads.

During watering operation, the water tanker travels at a slow speed with a worker standing on a platform at the rear of the water tanker. The worker will direct the water via a hose onto the flower beds. Though the platform is barricaded, the worker is still susceptible to fall from the water tanker. He is thus required to secure his restraint belt and wear safety boots.



Figure 16: As water tankers travel within parks and along public roads (including expressways), the workers must comply strictly with safety requirements in order to ensure traffic safety.

Safety requirements:

1. Luminous vest
2. Safety belt
3. Safety boots

Safe work practices include:

- Drive safely and slowly along the designated paths;
- Observe the speed limit of 15km/h at all times;
- Mount rotating flashing lights and hazard lights on top and rear platform of the vehicle;
- Cordon off the work areas to warn other park users when carrying out stationary watering;
- Conduct operations in parks during stipulated timing;
- Cordon off work areas to re-direct other road users;
- Place warnings and directional signages at prominent locations to caution and divert traffic according to LTA's Code of Practice Traffic Control at Work Zone;
- Signages include cones, rotating hazard lights and directional arrow lights, and
- Use Truck Mounted Attenuator (TMA) when working on expressways and roads with speed limit above 70km/h.



Figure 17: Place warning signs at prominent locations and directional arrows to alert and divert traffic.



Figure 18: Cordon off work when carrying out stationary watering.

3. Turf Management

Turf maintenance activities primarily involve the use of equipment (including bush cutter, push-behind mower, ride-on mower and remote-controlled mower). The main hazards involved in grass cutting operation are its cutting mechanism, the flying particles resulting from the cutting operation and the excessive noise generated.

For more information see:

- Hazards and control measures associated to noise under Part B Section 6.6.



Figure 19: Turf maintenance work taking place.

3.1 Grass Cutting

3.1.1 Bush Cutter

A bush cutter (nylon trimmers) is a powered hand-held device that uses a flexible monofilament nylon line for cutting grass. It is used on areas where mowers are unable to reach (such as the edge of footpaths, drains, road kerbs or bases of trees). The bush cutter, if used in an unsafe manner, can cause serious injuries to workers and other person in the vicinity.

Prior to work commencement, workers need to inspect the turf area for foreign items such as small rocks, broken glass, nails and metal objects. Such items are potential projectiles that can be “kicked up” during grass cutting.



Figure 20: Inspect the turf area for foreign items such as rocks and nails prior to starting work.

Safe work practices include:

- Train workers on the safe handling and operation of a grass cutter;
- Equip workers with the necessary PPE (eye protection, hearing protection, protective overalls with luminous strips, gloves and safety boots);
- Check the bush cutter for any defects before use. Ensure that the safety guards are in place before operation;
- While in operation, always keep both hands on the control handle;
- Maintain good control of the bush cutter. Do not strike its cutting head against any solid objects (e.g., concrete, rocks, woods);
- Keep the cutting head below the waist and do not operate it above head level;
- Keep hand, feet and other body parts away from the nylon line;
- Switch off the engine and let the nylon line come to a stop before lifting the bush cutter to a new position; and
- Ensure grass cutting machine is well maintained and without modification, to minimise the level of noise generated.



Figure 21: Personal protective equipment:

1. Eye protection
2. Ear protection
3. Gloves
4. Protective overall with luminous strip
5. Safety footwear

3.1.2 Push-Behind Mowers

Push-behind mowers are another type of cutting grass device, which only require workers to walk behind and guide the movement instead. It is usually used on lawns with small area as their compact design makes it easy to manoeuvre in tight spaces.

Safe work practices include:

- Train workers on the safe handling and operation of a push-behind mower;
- Ensure that the safety guards are in place before operation;
- Maintain a proper balance and secure footing;
- Mow in a forward direction;
- Keep clear from moving machine parts;
- Keep a distance away from the mower in case of slip accidents; and
- Allow the mower to cool down before refuelling.



Figure 22: Push-behind mower.

3.1.3 Ride-on Mowers

A ride-on mower provides a convenient and easy way for landscaping workers to mow lawns in parks. However, if the operator does not give complete and undivided attention to the safe usage of the vehicle, collision with other vehicles or structures may occur.

Safe work practices include:

- Prior to work commencement, clear foreign objects such as stones and wires from the area;
- Place warning signs on the mower to caution other vehicles and persons;
- Mount a blinking light on top of the mower;
- Ensure that the safety guard is in place before operating the ride-on mower;
- Watch for holes, bumps, rocks or other hidden objects. An uneven terrain could cause the mower to overturn;
- Turn off the blades, stop the engine and remove the key before dismounting;
- Mow in a forward direction. Do not mow in reverse unless necessary. Keep a lookout while reversing;
- Disengage the mower blade when moving on pavement and across walkways;
- When refuelling, check surroundings for ignition sources (e.g., lighter, flames, sparks); and
- Refuel the mower only when the engine is not running and is not hot.



Figure 23: Place warning sign and mount blinking lights on the mower.



Figure 24: Safety guard should be in place before operating the ride-on mower.

3.1.4 Remote-controlled Mowers

A remote-controlled mower allows workers to mow lawns with a remote, hence no manual labour is required.

Safe work practices include:

- Look out for other users in the work vicinity;
- Train workers on the safe handling and operation of a remote-controlled mower; and
- Allow the motor to cool down before refuelling.



Figure 25: Remote-controlled mowers.

3.2 Safety Zones

3.2.1 Grass Cutting in Open Spaces

Safe work practices include:

- Carry out grass cutting operations in parks during stipulated times;
- Barricade work areas especially in areas with high human traffic; and
- Place the warning signs on the mower to caution other vehicles and persons.



Figure 26: Barricades and warning signs should be in place to warn the public.

3.2.2 Grass Cutting in Restricted Spaces

- Carry out grass cutting operations in parks during stipulated timing;
- Co-ordinate tree and/or horticulture management activities together with grass cutting operations (when working along expressways); and
- Place warning signs on the mower to caution other vehicles and persons;



Figure 27: Place warning signs to re-direct the pedestrian.

3.2.3 Grass Cutting on Steep Slopes

Grass cutting on steep slopes is usually carried out by using hand-held bush cutter instead of ride-on mower, so as to reduce the risk of the latter toppling over on steep slope.

Safe work practices include:

- Carry out a risk assessment before work commences to establish whether rope access is appropriate method for the work. Additional factors like difficulty in reaching the point of descent, lack of convenience anchorages, presence of sharp objects and obstructions on the ground and uneven ground must be considered;
- Establish the best access method based on the risk assessment done;
- Only trained and competent persons are allowed to cut grass on steep slopes. These workers have to be closely supervised by a designated, suitably trained or qualified supervisor;
- If there are railings on the slope, wear safety harnesses and hook the lanyard to the railings. However, check with the owner that the railings are able to serve as a strong anchorage point first, or obtain an endorsement from a Professional Engineer that they can take the weight of the worker(s);
- The descender devices attached to the harness should be of a type that will stop if the user loses control or allow only a slow, automatically controlled descent in the hands-off position;
- If there are no railings on the slope, consider other fall protection options, such as using a ladder, erecting a scaffold, installing a catch net, and a static line (in a travel restraint system);
- Wear anti-slip safety footwear to increase the grip on the slope. If necessary, attach crampons to the footwear to increase traction;
- Balance the body and maintain good footing;
- Avoid cutting grass when the ground is wet;

- Avoid working alone;
- Establish clear communication with co-workers using mobile phone, radio and walkie-talkie, whistle; and
- Establish a proper rescue plan.



Figure 28: Install proper anchorage to railings using Self-Retracting Lifeline (SRL) or other protection method is to prevent fall.

4. Tree Management

Tree management comprises the maintenance and caring of trees in both urban and natural environment, which include tree planting and transplanting, tree pruning, removal and tree healthcare. In carrying out these operations, workers are faced with a wide range of hazards, such as moving traffic, workings at height and being struck by falling objects.

4.1 Pre-work Checks

The following steps should be used to decide what is reasonably practicable to ensure workers and other people are not injured when carrying out tree trimming and removal work.

4.1.1 Find Out What Could Cause Harm

The following can help identify potential hazards:

- Observe the workplace to identify how work will be carried out. Consider the physical work environment, equipment, materials and substances used, work tasks and how they are performed, and work design and management. Hazards associated with tree trimming and removal work can include:
 - Tree hazards – See Visual Tree Assessment*;
 - Slips, trips and falls;
 - Manual tasks i.e. lifting, pushing, pulling, repetitive movements, holding machinery;
 - Contact with energised overhead electric lines or underground services;
 - Crush injuries, entanglement, cuts and abrasions from the incorrect use or lack of maintenance of machinery e.g. chainsaws, wood chippers and stump grinders;
 - Being struck by vehicles or mobile plant moving on or working near the work site;
 - Falling objects;
 - Punctures and cuts from tree branches;
 - Allergic reactions to trees and poisonous plants; and
 - Biting or stinging hazards including ants, bees, wasps and snakes.
- Ask workers about the problems they have found at the workplace;
- Discuss the risks in carrying out tree trimming and removal work with the operators of cranes or other machinery used at the site; and
- Talk to manufacturers, industry associations, suppliers and health and safety specialists and review incident and injury records including near misses.

*Visual Tree Assessment

The integrity of a tree is critical to the safety of those working in, under and around it. Before working on or accessing a tree by any method, a thorough visual assessment of the tree should be carried out by a competent person. The assessment should consider hazards, condition, wind loading, structural integrity and location. This assessment should form the basis of a site-specific risk assessment and decision-making on whether the tree is safe to access, the method chosen to access the tree and the safe systems of work to be used on the site.

Figure 29 and Table 1 show the various conditions which could result in serious risk if they are not identified prior to starting work.

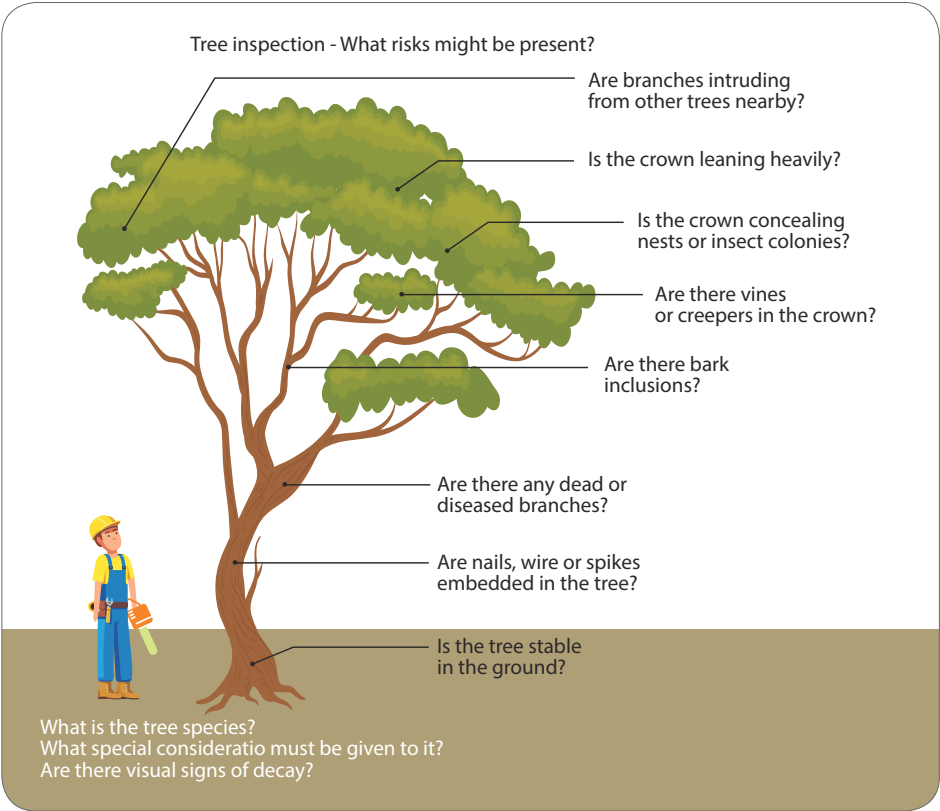


Figure 29 : Tree hazards.

Inspect	What to watch for
Tree species and age	Different species have different characteristics. Some species are more likely to sustain branch failure when under load (e.g. willows, poplars).
Health of the tree	• Is the tree alive or dead? • Is the tree stable in the ground? • Diseased branches may give way under load and dead branches may break and fall during climbing or while other branches are being trimmed.
Condition of the crown	• Is the crown leaning heavily in one direction? This may create a risk when felling or trimming. • Are there loose or hung-up branches, vines or creepers, fungal or fruiting growths, nests or insect colonies present in the crown? Trimming may dislodge hung-up branches or foreign bodies, or disturb possums' nests or insect colonies, placing the climber and the crew below at risk. Vines or creepers can also mask structural defects, rot or nests in the crown. These factors may also create problems in locating suitable tie-in points if climbing is required.
Decay at the base of the tree, in the trunk or in branch forks	The tree may split or collapse when climbed or when weight is placed on its limbs.
Objects embedded in the tree	Wire, nails or spikes may be embedded in the trunk or branches. These are hazardous if a chainsaw makes contact during trimming or section felling operations and could result in 'kickback'.
Proximity of other trees	Branches from adjacent trees which intrude into the crown or body of the tree may cause trimmed branches to become lodged or 'hung up'. Trying to fell such branches may create risk.

Table 1: [Inspection checklist on tree before starting work.](#)

4.1.2 Assess the Risk

In many cases the risks and related control measures will be well known. In other cases you may need to carry out a risk assessment to identify the likelihood of somebody being harmed by the hazard and how serious the harm could be. A risk assessment can help you determine what action you should take to control the risk and how urgently the action needs to be taken.

When carrying out a risk assessment, think about:

- The stability and integrity of the tree:
 - Is the tree decayed or dead and unsafe to climb?
 - Is the species or the particular tree susceptible to branch failure when under load?
 - Is the tree stable in the ground?
 - Is the crown of the tree leaning heavily in one direction?
 - Is the tree suitable to be climbed?
- Ground surface condition include type of soil, underground services, underground tanks, leach drains and gradients of ground surface;
- Animal and insect management e.g. are there insects or other animals in the tree that may be a risk to a worker?
- Workers are trained including in emergency procedures, working near overhead or underground services, use of equipment, work tasks and on-site communication
- Action plans about hazards and the nature of the work including number of workers, each worker's role and job process after discussion with workers;
- Weather condition including heat, humidity and wind speed can affect the job when it can be started and continue to monitor the weather to ensure that conditions are suitable for work;
- Common hazards like vines, creepers in crown, nails and wire are identified and removed or controlled;
- PPE is fit for the purpose and, where appropriate, in accordance with the relevant standards; and
- Establishment of exclusion zones.

4.1.3 Inclement Weather

This includes poor weather conditions, such as strong wind, thunderstorm and heavy rainstorm, which adversely affect the safe operation of tree work. With the exception of emergency work performed by well-trained Tree Workers having adopted necessary safety precautions, no tree work should be carried out during inclement weather.

See further guidance in Section 6.9 Work Hazards in times of Inclement Weather under Part 2

4.2 Pruning Works

Tree management activities may require the operation of hand tools and mechanical-powered tools (e.g. chainsaw), which can pose additional risks.

4.2.1 Working with Hand Tools

Proper training of the workers to equip them with a good understanding of the operation and function of the relevant pruning tools is necessary. This will help to reduce the impact and cutting hazards associated with the use of such hand tools.

Safe work practices include:

- Know the purpose and function of the tool well;
- Use the correct tool for the job;
- Use the tool properly and safely (including positioning of tool);
- Maintain the tool in good condition. Do not use a damaged tool;
- Cover the tool (if provided) after use. Avoid carrying a sharp tool in the pocket; and
- Return the tool to its proper place after use. Do not leave them lying around where they can become a tripping hazard.

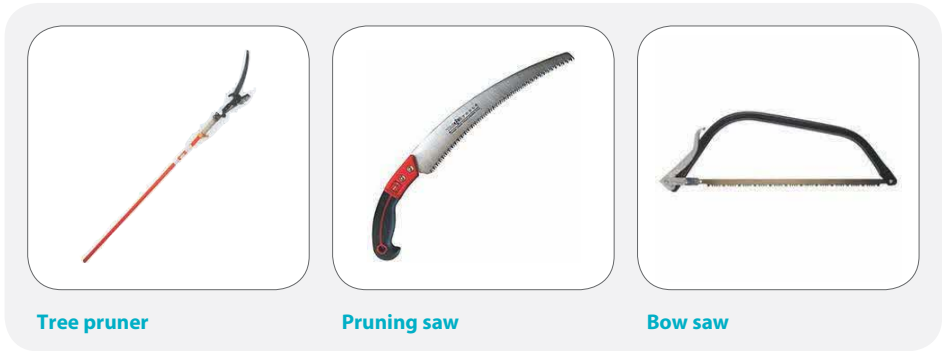


Figure 30: Various hand-held tools for tree pruning works.

4.2.2 Working with Chainsaw

Chainsaws are commonly used for tree pruning and cutting activities because they are a time saving and efficient power tool. The chainsaw is basically a portable motorised saw which is powered by petrol. The mechanical saw can cause severe injuries if it is not handled properly. Hence, workers must be properly trained and equipped with the necessary PPE.



Figure 31: Personal Protective Equipment.

To ensure speed and efficiency in the cutting process, the cutting teeth of the chainsaw must be kept sharp. Its sharpness can however cause severe cuts or amputation injuries to workers during the cutting operation. Even when the chainsaw is not in use, it still poses a cutting hazard. Hence, the sharp cutters of the saw chain should be covered with a scabbard.

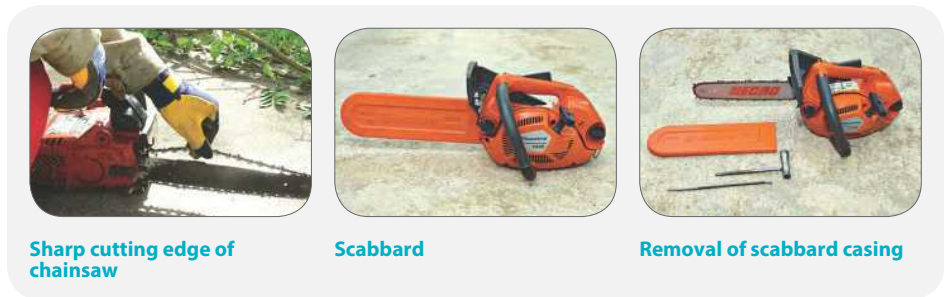


Figure 32: **Parts of a chainsaw.**

4.2.2.1 Kickback

When operating a chainsaw, be aware that kickback of the chainsaw can sometimes occur. Kickback happens when the moving chain in the upper portion of the tip of the guide bar contacts a log, other objects or becomes pinched. The reactive force is strong enough to cause the chainsaw to kick violently upwards and backward in the direction of the operator and result in severe injury.

To minimise the risk of kickback:

Dos

- Hold the chainsaw securely and firmly with both hands;
- Maintain good footing and posture;
- Position the operator such that the saw could not hit the operator if it were to kick back;
- Use a chainsaw which has a chain-brake or kickback guard;
- Keep the cutter (chain) sharp - a dull cutter is more likely to cause a kickback;
- Maintain correct chain tension;
- Use a high chain speed when reinserting the blade into a cut or removing it from a cut;
- Be conscious of where the nose (or tip) of the guide bar is at all times;
- Activate the chain-brake to reduce the risk of kickback occurrence;
- Cut using the lower part of the guide bar;
- Provide adequate trainings for workers on safe use of chainsaw; and
- Establish and implement maintenance regime for the chainsaw.

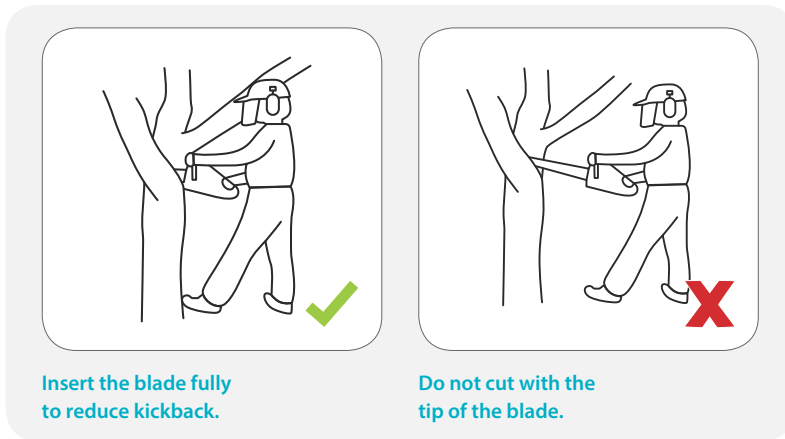


Figure 33: Techniques to reduce the risk of kickback.

Don'ts

- Avoid sawing with the tip of the guide bar;
- Under no circumstances should the chain-brake be removed from the chainsaw; and
- Do not use the upper quadrant of the chainsaw to cut objects.



Figure 34: Minimising risks of kickback.

Safe work practices include:

- Ensure operators have been properly trained and are competent in the use and maintenance of the equipment;
- Perform pre-start and regular checks and remove chainsaw from service if it is found to be damaged or worn;
- Ensure the saw-chain is sharp and tensioned correctly;
- Use chainsaws that are provided with a muffler; spark arresstor, hand-guard and chain-brake, chain-catcher and bumper spikes; and
- Ensure the safety features as installed by the manufacturer are in good working condition at all times.



Figure 35: Chainsaw muffler concealed muffler.

4.2.2.2 Other Safety Tips – Chainsaw

Dos

- Plan the cutting before starting work;
- Know how to start, use, maintain and sharpen a chainsaw properly;
- Check the chainsaw for defects before use. Make sure the chain brake and other safety features are functioning properly;
- Start the chainsaw at least three metres away from flammable substances;
- During ground operations, keep both feet on the ground and balance well when cutting;
- Keep clear from other persons;
- Be sure the immediate area is clear of debris;
- Always engage the chain brake before starting a chain saw;
- Larger saws should be started on the ground or otherwise firmly supported;
- Both handles should be gripped firmly with the thumb wrapped around the handles;



Start a chain saw
on the ground



Never start a chain saw
against your body

Figure 36: Techniques to use the chain saw.

- Always operate a chainsaw with the right hand on the trigger handle and the left hand on the upper handle, even if the operator is left-handed. Chainsaws are designed to be operated on the right side of the body with the right hand activating the throttle trigger and the left hand on the forward handle;
- Keep the chainsaw engine close to the body to increase control and reduce fatigue;
- Engage chain brake if the operator takes one hand off the running saw or takes more than two steps;
- Engage chain brake and hand off the throttle lever if the operator moves between cuts;
- Operator must be aware of the presence and activity of other workers in the vicinity;
- If two workers are operating chain saws simultaneously, they should be at least three metres apart;
- Stop the engine for all cleaning, refuelling and adjustments except where the manufacturers' procedures require otherwise; and
- Make sure the chain does not move and cover the saw chain with a scabbard when the chain saw is being carried any distance. It is best to turn off the engine if the operator is going to carry a saw a long way, but the chain brake can also be engaged to lock the chain. Always carry the chain saw with the saw chain (covered in scabbard) pointing backwards.



Figure 37: Carrying the saw.

Don'ts

- Do not use a chainsaw when other types of saws are more suitable;
- Do not cut with the chainsaw above shoulder level;
- Do not work alone;
- Do not cut near a power line;
- Do not operate a chainsaw when fatigued;
- Do not handle or operate chainsaw with one hand; and
- Other workers should never approach a chain saw operator from the rear as he would not be noticed by the operator.



Figure 38: To avoid kickback, use the base of the blade when cutting logs.



Figure 39: Do operate a chainsaw with both hands.

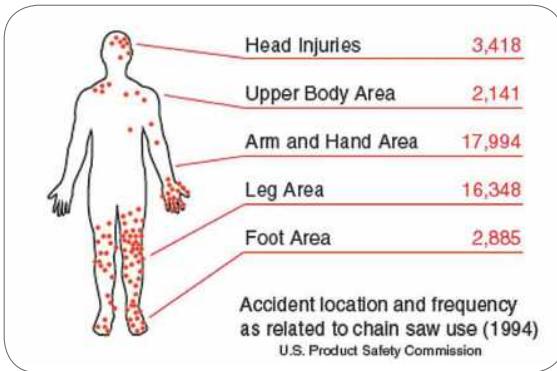


Figure 40: Illustration of injuries related to Right-Handed Chainsaw Operators.

4.2.2.3 Hand-Arm Vibration Syndrome

Hand-Arm Vibration Syndrome (HAVS) is due to the transfer of vibration from a tool or work piece to a worker's hands and arms. The continuous use of vibrating hand-held equipment, including chainsaw, often results in HAVS. The most commonly observed HAVS is Vibration White Finger (VWF), which is due to intermittent lack of blood supply to the fingers.



Figure 41: Continuous use of hand-held chainsaw can cause Hand-Arm Vibration Syndrome.

Symptoms of Vibration White Finger

- Tingling and numbness in the fingers;
- Sense of touch and pain perception reduced;
- Fingers turn white; and/or
- Decreased grip strength, and inability to sustain muscle power.

Prevention of Hand-Arm Vibration Syndrome

- Train workers on safe handling of chainsaws;
- Use chainsaw which is ergonomically designed or provided with damping device to minimise vibrations; and
- Pad the handle of the chainsaw to reduce the impact of vibration;
- Measure the vibration of the chainsaw to ensure that it is not at a hazardous level;
- Reduce the exposure of the workers;
- Decrease the number of days they work with chainsaws through job rotation; and
- Provide frequent, short rest periods for workers using the chainsaw.

4.2.2.4 Refuelling Chainsaw

The following rules shall be observed when refuelling:

- Stop the motor;
- Place the saw on clear ground;
- Fill the oil tank first to allow the saw to cool down;
- Avoid spilling fuel on hot engine components, as excessive heat can cause ignition;
- Do not smoke or have any sparking or open flame near the fuelling point;
- When completed, wipe excess fuel from the saw; and
- Move at least three meters away from the refuelling site before restarting.



Figure 42: Do not start the saw at the place of refuelling.

4.2.2.5 Maintaining a Chainsaw

Proper maintenance is essential for safe use and protection against ill health from excessive noise and vibration. The saw must be maintained in its manufactured condition with all the safety devices in efficient working order and all guards in place. It should be regularly serviced by someone who is competent to do the job.

Operators need to be trained in the correct chain-sharpening techniques and chain and guide bar maintenance to keep the saw in safe working condition. Operators should report any damage or excessive wear from daily checks on the following:

- On/off switch;
- Chain brake;
- Chain catcher;
- Silencer;
- Guide bar, drive sprocket and chain links;
- Side plate, front and rear hand guards;
- Anti-vibration mounts;
- Starting cord for correct tension.

4.2.3 Pruning Techniques

4.2.3.1 Crown Reduction

As trees grow taller, their potential for failure may increase. To mitigate this, the trees may need to be pruned to lower their height for safety reasons. This pruning technique is called crown reduction.

In crown reduction, the drop crotch method is employed to prune off the main terminals, which are often big and long. The pruned branches may not drop directly onto the landing zone. They may snag on the lower branches or worst, bounce off another branch and land in an unprotected area.

As with any tree care operation, the safety of the crew and determining whether the tree can withstand the potential forces are top priorities.

Safe work practices include:

- Do not employ a one cut method to remove the whole branch;
- Always cut the branches into small manageable portions;
- If the landing zone is clear, drop the branch directly; after sending and receiving the audible 'all clear' call communicated between aerial and ground operators;
- Never drop the pruned portions on hard surfaced landing zones, e.g., tarmac and concrete footpaths, as the portions may bounce away;
- Where there are no suitable landing zones, speedlines may be employed to lower the tree or branch sections down;
- Ensure that all components for the speedline are intact, safe for use and in good operational order. Such components may include wire and or synthetic rope, rigging slings, blocks, pulleys and associated attachment hardware;
- The speedline should be slacked and the tree piece should be attached after cutting and arresting the fall upon a separate rigged system;
- Do not dump the cut portion into tensioned speedlines as "shock-loading" the system substantially increases the risk of component failure;
- Never attach the speedlines to the bucket of an MEWP;
- Do not use the MEWP to lower the cut portions;
- An alternative method to lower the cut portions is to utilise another crane;
- Ensure that all riggings and hitches are secured;
- Ensure that no one is in the landing zones; and
- All components for the speedline system are properly installed as well as being adequately and regularly examined, tested and inspected by a designated competent person.



Figure 43: Speedline to lower the cut portion.



Figure 44: A crane is used to lower the cut portion.

4.2.3.2 Falling branches

Branches, when cut, may land on the workers below or any passers-by. Hence, proper work procedures and co-ordination among the workers stationed on top of the MEWP and those working on the ground are essential.

Safe work practices include:

- Brief the workers on safety and co-ordination issues before work commences;
- Establish work co-ordination methods and clear communication means between the workers;
- Ensure that no one stands directly below the area where the branches are being cut;
- Cut the branches in small, manageable pieces;
- Where necessary, use a rope to control the movement of falling branches
- Ensure that no one enters a work zone except for tree workers who are doing the work
- Cordon off the work zone with warning notices and signs prominently displayed; and
- Appoint a watchman to give warnings to any persons nearby.

4.3 Working at Height – For Tree Works

When carrying out tree management activities, workers are required to work at heights (such as working from Mobile Elevating Work Platforms (MEWPs), cranes or even manually access the tree) to cut or trim the branches. As such, they are susceptible to falling from heights. For safe conduct of work, a proper barricaded work platform is provided at the first instance. In the absence of the latter a work-restraint system is considered the second step to prevent the worker from reaching zones where the risk of a falling exists. Only in the situation where the first two options are not available, using a full-body harness with an energy absorber may be considered next (provided the clearance height is ascertained).

It is mandatory for the operator to wear and correctly adjust the work-restraint system. Where work-restraint lanyards are used, the correct length needs to be adjusted to prevent the worker from reaching zones where risk of a fall from height exists. The anchor point being used for securing of this work-restraint system is in accordance with SS570:2011 – Personal protective equipment for protection against falls from a height – Single point anchor devices and flexible horizontal lifeline systems.

Workers involved in activities such as sky garden roofs, are to perform the work in accordance to WSH regulation pertaining to Work at Heights (i.e. Workplace Safety and Health (Work at Heights) (Amendment) Regulations), Approved Code of Practice (WAH), WSH Guideline on Working Safely on Roofs and CUGE Standards CS E02:2010 Guidelines on Design for Safety on Rooftop Greenery.

4.3.1 Equipment Used for Tree Works

Mobile Elevated Work Platforms (MEWPs) and crane lorries are commonly used to access height required for tree works.

Safe work practices include:

- Secure the full-body harness with the fall-arrest systems (such as energy-absorber or self-retracting lifelines, SRL) dependent on the fall clearance height to a designated anchorage point;
- Stay within the work platform at all times and do not overstretch to cut the branches;
- Access door, if provided on the work platform, should open towards the interior and be equipped with a device to prevent inadvertent opening; and
- Maintain a safe distance between the overhead cables and the components of the machinery (aerial lift or crane) at all times especially when the machinery is fully extended.

4.3.1.1 Mobile Elevated Work Platforms

The diagram below shows the types of Mobile elevated work platforms (MEWPs) commonly used to access trees for trimming works.

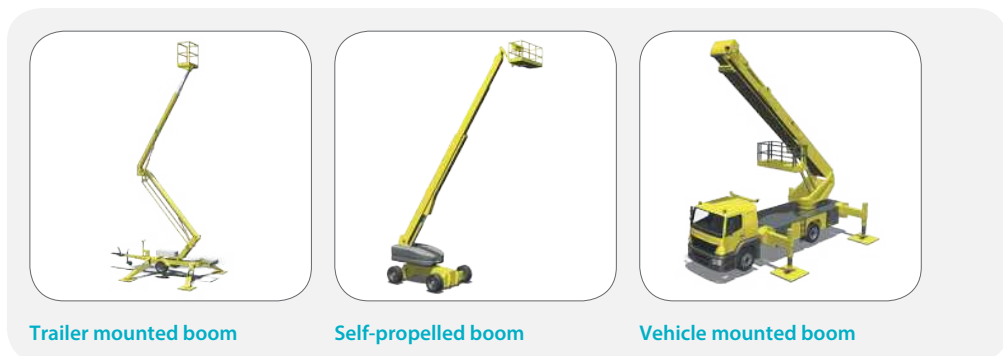


Figure 45: Types of MEWPs.

Safe work practices for MEWP operations include:

Dos

- Park the MEWP on firm and stable ground. Beware of soft or poor ground conditions. If necessary, deploy the MEWP on prepared surfaces, e.g. a thick spreader plate;
- Extend outriggers fully to ensure stability of the MEWP. The outriggers should be fully retracted when not in use;
- The boom is lowered and fully stowed when travelling; and
- It is recommended that the MEWP should be operated using a two-man system where while one worker is inside the work platform, the other is standing on the ground to observe the surrounding obstacles and communicate any potential hazards to the worker in the work platform. If necessary, a watchman may also be appointed to provide warnings to any persons nearby.

Don'ts

- Do not load the MEWP beyond its safe working load;
- For truck-mounted MEWP, do not drive the truck when there is a person in the work platform ; and
- MEWP and its work platform / arm should not be extended beyond the safe working zone such as extended into the area of live traffic lane.



Figure 46: Stay within the work platform at all times and do not overstretch to cut the branches. Hook the safety harness to a designated anchorage point.



Figure 47: MEWP must be stably positioned to avoid hazards such as toppling.



Figure 48: Do not drive an MEWP with the worker in the bucket.

More information on the legislative requirements for MEWP, refer to Part B Section 3.1.

4.3.1.2 Cranes

Safe work practices for crane operations include:

Dos

- Park on a firm and stable ground. Beware of soft or poor ground conditions or surfaces with hollow spots underneath. If necessary, deploy the crane on steel plates or equivalent for stability;
- Extend outriggers fully to ensure the stability of the crane. Retract the outrigger and the arm of the crane fully before moving to another location;
- Ensure outriggers are sitting on firm, stable and level ground with suitable spreader plate; and
- Cordon off the work zone with warning tapes and install warning signs.

Don'ts

- Do not suspend load over persons at any time;
- Do not swing the load excessively. Use a tag rope to control the load movement;
- Do not load a crane beyond its safe working load; and
- The arm should not be extended beyond the safe working zone such as into the area of live traffic lane.



Figure 49: **Workers face the risk of being hit by falling or swinging loads during crane operations.**



Figure 50: **Do not stand below suspended load or on top of unsecured load at all times.**



Figure 51: **Place warning signs to re-direct other road users.**

More information on the statutory regulation of crane, refer to Part B Section 3.2.

4.3.2 Manual Tree Access

Manual Tree Access (MTA) requires operator skills, fitness, persistent concentration and alertness. The operator is required to have sufficient training and knowledge of the personal and ancillary equipment used as well as the ability to identify potential hazard of the tree or trees that are to be climbed.

The operational task of MTA requires constant commitment from managers, supervisors, operators and all other team members to ensure that personnel safety and operational objectives are being met.

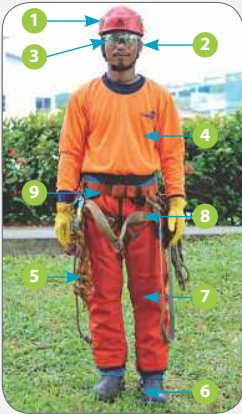
For MTA, the steps are as follows:

- Send managers, supervisors and operations personnel to undertake proper training/to ensure competency;
- Through a collective and communicative approach, develop and implement safe operating procedures (SOP) under which operations are performed;
- Develop and implement SOP under which operations are performed through a collective and communicative approach;
- Revise the SOP regularly; and
- Designate a safety officer/ employee to access and discuss workplace risks with work teams.

Figure 52: Personal Protective Equipment (PPE) and Common MTA/Climber Equipment.



An overview of PPE required by a climber while performing MTA.



Upper Body PPE and required Climbing Equipment:

- 1) Approved helmet with chinstrap
- 2) 'Class 5' ear protection
- 3) Safety glasses or visor
- 4) High visibility clothing
- 5) Climbing rope (minimum 22kN tensile strength)

Lower body PPE and required Climbing Equipment:

- 6) Steel toe safety boots
- 7) Cut resistant chainsaw trousers
- 8) Work positioning harness
- 9) Lanyard (secondary point of attachment)

Additional information:

1. Helmets used in tree-care or tree-felling operations should meet or exceed international standards; EN397, ANSI Z89.1 – 2003 Type 1 Class C, AS/NZS 1801:1997 or equivalent.
2. Earmuffs or earplugs should meet or exceed “Class 5” protection which protects wearers from noise up to 110 decibels.
3. Safety glasses or visors should be rated for impact protection and meet or exceed CSA Z94.3:2007 and ANSI Z87.1:2003 standards or similar.
4. All ropes, connectors (carabiners), harnesses or any other components of the climbing system used for fall arrest should meet or exceed 22kN tensile/breaking strength.
5. Protective boots should be steel-toed and provide ankle support.
6. Chainsaw protection trousers should meet or exceed AS/NZS 4453.3:1997, EN 381 – 5 standards or equivalent.

Note

All PPE equipment and climbing equipment should be free from defects and in good working order. They should be regularly inspected, properly maintained and stored.

4.4 Planting and Transplanting Works

Transplanting is performed to relocate trees to meet specific objectives. Transplanting operation involves a set of processes that can be hazardous to workers and others. The components in tree transplanting are:

- Preparation of receiving hole;
- Selection of trees;
- Pruning of excessive branches;
- Trenching and digging;
- Balling and burlapping;
- Lifting;
- Transporting;
- Planting;
- Post Transplanting Maintenance; and/or
- Watering, Mulching, Pruning, Staking

4.4.1 Excavation Works

The preparation of planting holes and trenching of the root ball require the use of excavators. Key hazards involving excavation works include being hit by the excavator or its bucket, and coming into contact with live cables.



Figure 53: Excavation work with an excavator.

Safe work practices include:

- Only trained personnel are allowed to operate the excavator;
- Unless necessary, no one should be allowed to go into the barricaded area or within close proximity of the excavator;
- Check with EMA if there is a possibility of buried live wires/ cables near the area where excavation work is to be carried out;
- Engage a licensed electrical worker (LEW) to assist in electrical works as required by EMA;
- Beware of buried live wires/ overhead cables;
- Use an insulator when in contact with live wires/ cables;
- Prior to any excavation work, the site must be completely barricaded with sufficient space to allow for the swing radius of the excavator boom and stick and the movement of the excavator;
- The bucket or any components of the excavators must not stray outside the barricaded area;
- Always check height, width and weight restrictions;
- When the excavator is in operation, no one should enter the full swing area of the machine;
- Never allow anyone to work under a raised bucket;
- When working around an excavator, the worker should always work facing the machine; and
- Workers are not to be in the trench while it is being excavated.



Figure 54: When the excavator is in operation, no one shall enter the full swing area of the machine.



Figure 55: Barricade work area with warning tapes and signs.

4.4.2 Severing of Root Ball

Trees may have deep roots that can grow more than 1.0m into the soil. Under most soil conditions, direct lifting of the tree either by the truck or by the soil ball may fracture the bottom of the soil ball if the bottom roots are not severed or cut.

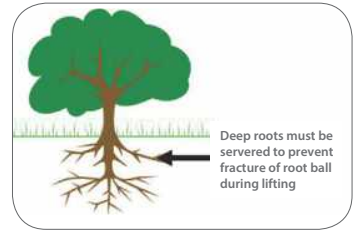


Figure 56: Deep roots.

Safe work practices include:

- The trench should be wide enough for the worker(s) to carry out the task comfortably;
- Soil balls up to 1m in diameter can be broken free by tipping the ball over to one side and undercutting the opposite one side with a sharp spade. A rope can be placed around the top of the root ball and a pry-pole used to pull it over;
- Bottom roots can also be undercut by running a small steel cable around the bottom of the ball below the burlap. Secure both ends to a hook, which is attached at the end of another cable running to a power winch. When power is applied, the cable cuts cleanly underneath the root ball, severing all roots; and
- If it is necessary, use a crane to keep the tree firm and secure.

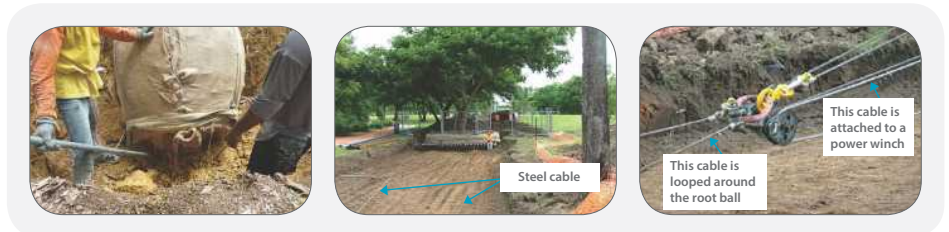


Figure 57: Severing deep seated roots.

4.4.3 Lifting Process

A crane (either truck mounted or mobile) is used to lift the trees. Lifting a load is a very risky and dangerous operation. If improperly carried out, a lifting operation can cause injuries and even death. It may also lead to damage to the tree. In transplanting, trees are lifted out of the existing ground or into a new planting hole. A lifting plan should be established and implemented.



Figure 58: Lifting process.

Safe work practices include:

- Only trained and competent personnel is allowed to operate the crane;
- Provide lifting procedures, lifting supervisor, rigger and signalman for the lifting operation;
- Conduct an operation check on the crane and its lifting gears before use;
- Check limits for safe operation, e.g., loading, wind speed (especially when the tree is full crowned);
- Park on a firm and stable ground;
- Extend outriggers fully to ensure the stability of the crane;
- Retract the outriggers and the arm of the crane fully before moving to another location;
- Use cranes and lifting gears with valid inspection certificate;
- Do not stand below a suspended tree at all times;
- Do not lift tree over people. No one shall be under the hoisting tree;
- Do not swing the tree excessively;
- Do not load a crane beyond its safe working loads;
- No workers should remain in the planting hole when the tree is being lifted out or into the hole;
- Inspect all straps, slings, chains before use;
- Rig the root ball securely with slings/ straps/ chains that are adequate to the task;
- Make sure the sling is well balanced;
- The hoist line, which takes most of the loading must be vertical prior to the lift (remove slack in the hoist slowly);

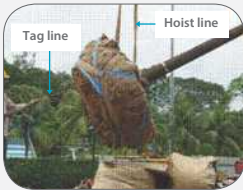
- Always lift the tree a few centimetres and verify rigging. This will also prevent damages to the tree and root ball;
- Always use tag lines to guide and control the movement of the trees; and
- Never stand in the hole and never use bare hands to guide or control the movements of the trees.

When properly carried out, a transplanting operation will be safe for all. It will also prevent damage to the trees.

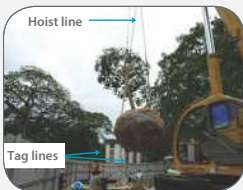
Figure 59: Guidelines to Transplanting Operation



Inspect all riggings, straps, chains and slings used for lifting. Ensure that all riggings are secured before attaching to the hoist line.



No workers shall remain in the planting hole when the tree is being lifted out or into the hole. Use tag lines instead to guide and control the movements of the tree.



Use the tag lines to guide and control the movements of the trees.



No worker should remain in the planting hole when the tree is being lifted out or into the hole.

4.4.4 Estimating Total Tree Load

During tree transplanting, one of the items for consideration during the planning stage is the capability of the machines to do the lifting, which is governed by the weight of the tree and the distance from the machine during pick up and planting.

Estimating size of root ball: ratio of trunk diameter at breast height (DBH) to root ball diameter size varies from 1:8 to 1:12 depending on the site condition and species of trees to be transplanted.

Estimating Weight of Tree

Weight of rootball:

Area of root ball (m²) X depth of root ball (m) X 1.8 (m³ tonne / mass of soil) = estimate weight of rootball (tonne)

Total Weight of tree:

Weight of rootball + weight of tree (Appox 10% of Rootball mass) = *total weight of tree

The tree sizes reflected by estimates of height and root ball diameter in estimates above are limited by the probable capability to transport the size range of trees on public roads. (eg: <0.4m DBH).

In the cases of the larger sized trees listed in estimates above (eg: 0.3m-0.4m DBH), oversized loads may result which may require low-bed trailer and, oversized load permits and escorts as required by the Land Transport Authority (LTA).

Note 1:

The total weight of tree would then be used in the preparation of a lifting plan by the Responsible Person. A sample of basic lifting plan can be found in Appendix 1 of the Code of Practice (CP) on Safe Lifting Operations in the Workplaces which serves as an overarching document regarding lifting operations and the use of lifting equipment.

Note 2:

Under the WSH (Operations of Cranes) Regulations, a Responsible Person refers to the employer of the person operating the crane or the principal under whose direction the operator operates the crane. It is this responsible person's duty under the same regulations to establish and implement a lifting plan which shall be in accordance with the generally accepted principles of safe and sound practice for all lifting operations involving the use of any crane at a workplace.

Note 3:

Factor of Safety (FoS) should be allowed for uncertainties such as environmental factors and site conditions.

4.4.5 Rigging Method

The primary lift rig bearing the total tree load should be attached to the root ball instead of the main trunk or branches as this pressure damages the tree tissue, irrespective of the trunk protection measures that might be used (see Figure 60 and 61 below). Secondary rig slings may be attached to manage tree tilt (see Figure 62 and 63 below) and aid in preventing tree swing or roll during lifting, loading and planting operations.



Figure 60: Suitable capacity slings coupled together with rated load; suitably rated webbing straps should be added by attaching to lower slings at base of root ball, lacing and tightening over top of root ball to prevent lower slings at base, from slipping beneath the load. Refer to Figure 63.



Figure 61: Vertical lift slings arranged evenly around the root ball to form the cradle or basket to be lifted.

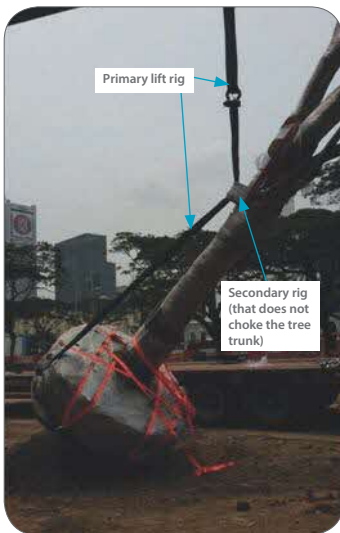


Figure 62: Primary and secondary lift rigs configured to allow controlled tilt and loading horizontally onto trailer.



Figure 63: Illustrates lacing from over top of root ball (orange webbing) to prevent lower slings at base, from slipping beneath the load.

4.4.6 Securing on Trailer / Lorry Crane

The tree must be protected from damage, secured down to trailer using suitable capacity tie-down devices and, entirely covered with shade netting or similar material to keep the branches held in tight and, prevent unnecessary wind damage to tree foliage.



Figure 64



Figure 65

- (i) Specially manufactured 'adjustable tree propping devices' should be installed over the horizontal length of the tree main trunk and stems and contact points well protected using heavy thickness rubber material.
- (ii) Using suitably rated tie-down devices (soft slings/ chains, ratchet straps), bring the system under tension to prevent roll or movement on the trailer during transport.



Figure 66



Figure 67

Example of loaded tree on trailer and, tree load entirely covered with netting for on road transport.

4.5 Communication

The voice command and response system ensure that warning signals are heard, acknowledged, and acted upon. The climber warns “Stand clear” but does not proceed until hearing the acknowledgement “All clear”. When there are multiple workers on the job, reduce confusion by assigning one person to respond to the climber after ensuring that the area is clear and safe.

There are times when it may be difficult for workers to hear each other. In these cases, hand signals can be used as well.

Figure 68: Process of Good Communication



Good communication among workers is an integral part of working safely. Workers must coordinate operations on the ground and aloft in the trees, and there is little margin for error. Each worker on the crew must always be aware of what the others are doing, and each must take measures to prevent accidents.

Each job should begin with a job briefing, which coordinates the activities of every worker. The job briefing summarises what has to be done and who will be doing each task, the potential hazards and how to prevent or minimise them, and what special PPE may be required. All workers must have a clear understanding of the communication system that will be used. The on-site supervisor should formulate and communicate the work plan. There should be no question about assignments so that the work is well coordinated. Teamwork is essential on a tree crew.

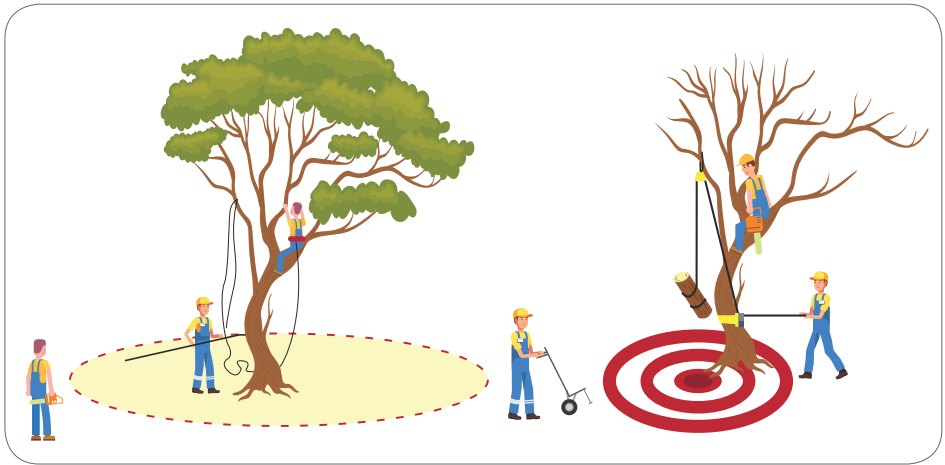


Figure 69: There must be a clear and efficient means of communication between climbers and ground workers so that each knows when it is safe for a ground worker to enter the work zone including the landing zone or drop zone, where branches are being dropped or lowered to the ground.

Part B – Legislative Requirements

Part B aims to highlight few legislative requirements (non-exhaustive) applicable to landscaping works. This part does not intend to provide an interpretation of the law; rather it is in the form of guidance notes on how can stakeholders comply with the legislative requirements. Users are advised to refer to the Singapore Statutes Online at <https://sso.agc.gov.sg> for the complete Workplace Safety and Health Act and its Subsidiary Legislation.

1. Risk Management and Risk Assessment

Safety, health and wellbeing should be managed holistically, both at the workplace and of the employees. Under the WSH (Risk Management) Regulations, organisations are required to conduct Risk Assessment (RA) to identify, evaluate and control safety and health risks posed to any person who may be affected by the activities in the workplace, prior to the commencement of the work. RA aims to reduce workplace incidents and improve the overall safety, health and wellbeing of everyone in the workplace.

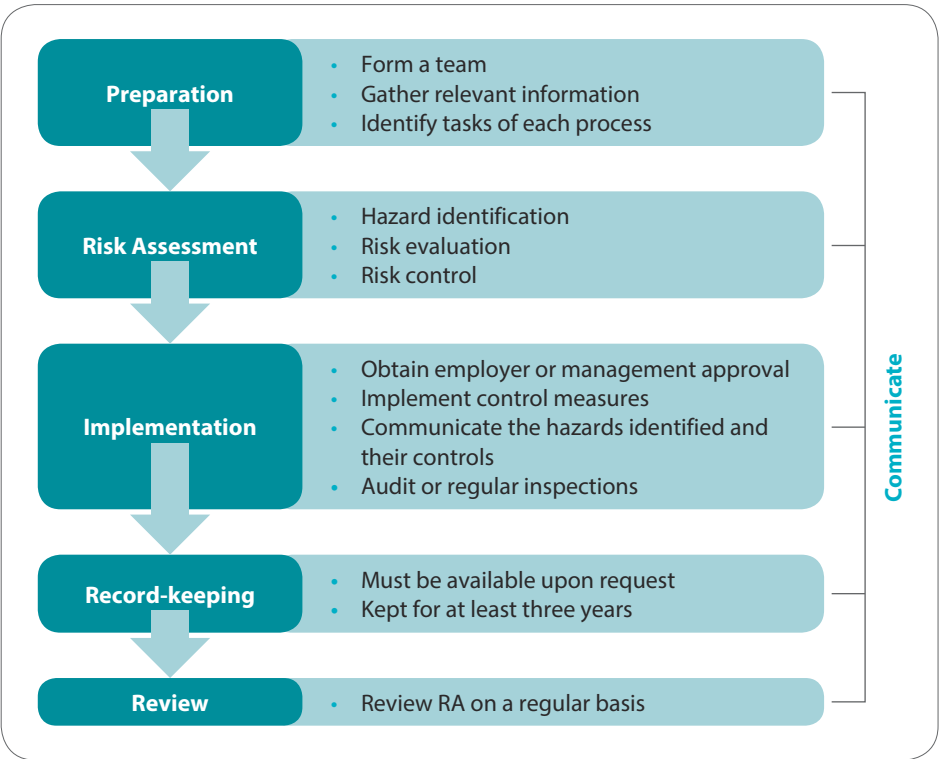


Figure 69: Risk management process.

1.1 Preparation

A multi-disciplinary RA team should be formed, comprising of personnel who have different job responsibilities for the work operations, and personnel who are familiar with the potential hazards and risks of the work activities such as WSH personnel, contractors, and human resource representatives. Relevant information pertaining to the work and operations such as a list of work activities should also be collated beforehand to facilitate better understanding by the team.

After completing the preparatory work, the workplace risks are then assessed in three simple steps: hazard identification, risk evaluation and risk control.

1. Hazard Identification	2. Risk Evaluation	3. Risk Control
Identify hazards.	Estimate the risk levels of the workplace hazards identified.	Formulate the control measures according to the Hierarchy of Controls. See Figure 77.
Identify potential accidents or incidents.	Prioritise the hazards to be controlled.	Analyse and evaluate residual risks.

Figure 70: Three steps to evaluate workplace risks.

1.2 Risk Assessment

All activities within the workplace should be assessed and the information should be kept up-to-date. The activities should include:

- Routine activities (e.g. grass cutting; cleansing works);
- Non-routine activities (e.g. cleansing work in confined space (water tank); manual tree access);
- Emergency conditions (e.g. transportation of hazardous substances); and
- Activities of all personnel having access to the workplace including volunteers, students, subcontractors and visitors.

1.2.1 Hazard Identification

When identifying hazards, three aspects should be considered and evaluated side by side. These aspects are the physical work environment and processes, work organisation and individual health factors. The possibility of exposure to hazards from other work processes in the workplace and the behaviour or work practices of employees at work should also be considered. Figure 71 illustrates the three aspects with some possible examples or areas to consider.

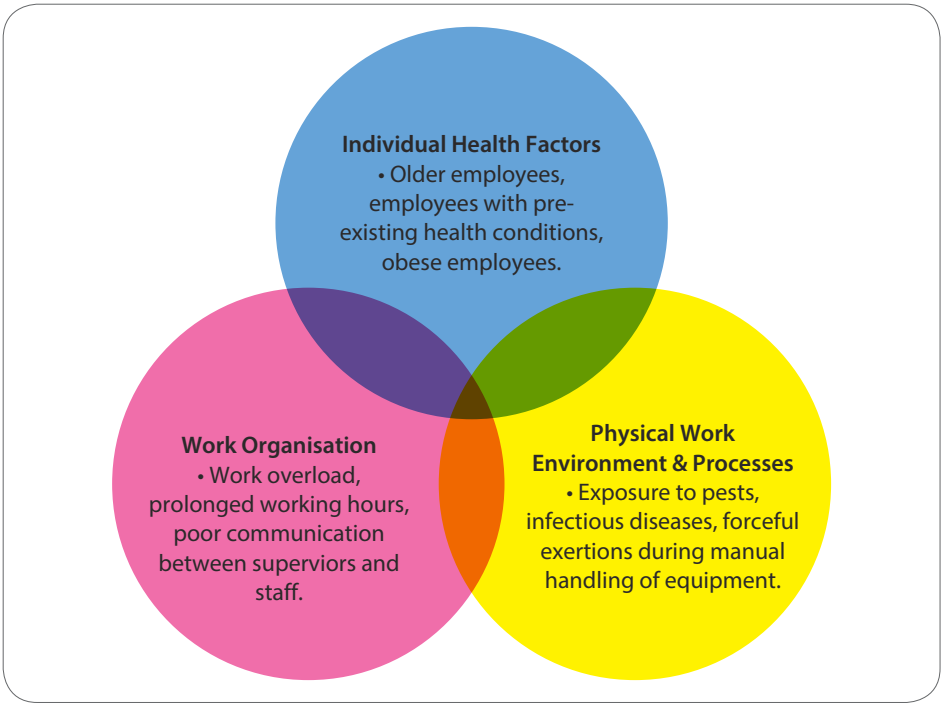


Figure 71: **Three aspects of hazard identification.**

1.2.2 Risk Evaluation

For each hazard identified, estimate the risk levels of the hazards and determine their acceptability. The outcome of a risk evaluation will help in prioritising actions to control the hazards and minimise safety and health risks to the affected employees.

When estimating the risk level associated with each hazard, predict the severity of the hazard and estimate the likelihood of the accident or ill health by taking into consideration existing risk controls. Once the severity and likelihood have been established, the risk level can be obtained by using a risk matrix. Figure 72 gives an example of how severity and likelihood help to determine the risk level via a 5x5 risk matrix with risk prioritisation numbers (RPNs).

Likelihood (L) \ Severity (S)	Rare (1)	Remote (2)	Occasional (3)	Frequent (4)	Almost Certain (5)
Catastrophic (5)	5	10	15	20	25
Major (4)	4	8	12	16	20
Moderate (3)	3	6	9	12	15
Minor (2)	2	4	6	8	10
Negligible (1)	1	2	3	4	5

Figure 72: 5x5 risk matrix with numeric ratings.

Level	Severity	Description
5	Catastrophic	Death, fatal diseases or multiple major injuries.
4	Major	Serious injuries or life-threatening occupational diseases (occupational cancers, acute poisoning, disabilities including amputations, major fractures, multiple injuries, and deafness).
3	Moderate	Injury or ill-health requiring medical treatment (including lacerations, burns, sprains, minor fractures, dermatitis and work-related upper limb disorders).
2	Minor	Injury or ill-health requiring first-aid only (including minor cuts and bruises, irritation, ill-health with temporary discomfort).
1	Negligible	Negligible injury.

Figure 73: A guide to severity rating.

Level	Likelihood	Description
1	Rare	Not expected to occur but still possible.
2	Remote	Not likely to occur under normal circumstances.
3	Occasional	Possible or known to occur.
4	Frequent	Common occurrence.
5	Almost Certain	Continual or repeating experience.

Figure 74: A guide to likelihood rating.

Risk Prioritisation Number (= Severity x Likelihood)	Risk Level
1 – 3	Low Risk
4 - 12	Medium Risk
15 - 25	High Risk

Figure 75: Risk evaluation using a 5x5 matrix with corresponding risk prioritisation numbers (RPNs).

1.2.3 Risk Control

Based on the risk level or RPN determined, risk controls should be selected to reduce the risk to an acceptable level. Figure 73 suggests the acceptability of risk for the different risk levels and the recommended actions. The most effective way to reduce risk is to tackle the risk at the source. This can be achieved through upstream risk controls starting by eliminating the risk, followed by substitution, and implementation of engineering controls, according to the Hierarchy of Controls (see Figure 77). Engineering controls are physical means to reduce exposure to the hazards such as mechanical guards or local exhaust ventilation.

Risk level	Risk Acceptability	Recommended Actions
Low	Acceptable	- No additional risk control measures may be needed. - Frequent review and monitoring of hazards are required to ensure that the risk level assigned is accurate and does not increase over time.
Medium	Tolerable	- A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as reasonably practicable (ALARP) within a defined time period. - Interim risk control measures, such as administrative controls or PPE, may be implemented while longer term measures are being established. - Management attention is required.
High	Not acceptable	- High Risk level must be reduced to at least Medium Risk before work starts. - There should not be any interim risk control measures. Risk control measures should not be overly dependent on PPE. - If practicable, the hazard should be eliminated before work starts. - Management review is required before work starts.

Figure 72: 5x5 Risk Matrix with numeric ratings.

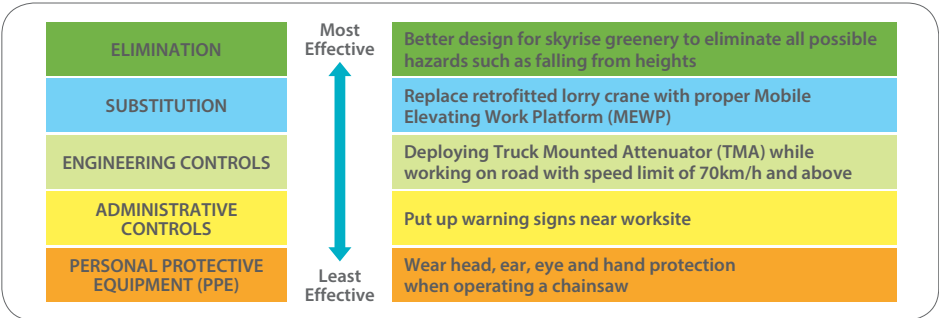


Figure 77: Hierarchy of control.

1.3 Implementation and Review

The risk control measures once approved by the management should be implemented immediately.

For risk management (RM) to be effective, the hazards and their control measures must be communicated to the employees performing the work. The manager who oversees the work area, function or activity where the risks exist should ensure that all persons who will be exposed are informed about the risks and the associated mitigating measures.

Regular inspections or audits can be carried out to verify the effectiveness of the control measures put in place. This will ensure that the measures are current and working to manage the risks at the workplace.

RA must be reviewed or revised at least once every three years. It must also be reviewed after an accident, incident or occurrence of an occupational disease as a result of exposure to a hazard, a significant change in the work processes that could affect the safety and health of employees e.g. the introduction of a new clinical procedure.

1.4 Record-keeping

All WSH RAs and related documents should be kept for at least three years and must be made available upon request by the Commissioner for WSH.

For more information on RM, refer to the WSH Council's Code of Practice on WSH Risk Management at www.wshc.sg.

2. Emergency Response and First Aid

Establishing and having an effective implementation of an emergency response plan are crucial in saving lives and minimising losses in any emergency situations. These may include:

- Workers working on road side being hit by moving vehicles;
- Workers falling down from tree;
- Lorry crane/ mobile elevated work platform toppling over;
- Workers hit by the swinging arm of an excavator;
- Workers cut by a chainsaw;
- Eyes in accidental contact with insecticide in the mixing process;
- Insect/ snake bite; and
- Lightning strikes.

For example, in particular, for tree work. All types of emergency and rescue scenarios should be considered when developing emergency and rescue procedures. Information from the risk assessment will help with this task. Some questions to consider when establishing these procedures are in Table 2.

Table 2: Considerations when developing emergency procedures.

Relevant considerations	
Location of the work area	• Is the work being carried out in a remote or isolated place? How accessible is it in an emergency and how far away is it from medical facilities? • Is a second rescue climber or a trained rescue climber onsite? • Is the worker in a vulnerable position that could be life threatening? • Can a person be recovered immediately after a fall without relying on emergency services?
Communication	• How can workers communicate in an emergency? • A minimum of two people should be present during tree-climbing operations. One person of the ground team should be available, competent and equipped to carry out an aerial tree recovery without delay.
Recue/recovery equipment	• What kinds of emergencies may arise? The equipment depends on the nature of the work and control measures used and should include equipment necessary to carry out the planned emergency procedures. • Equipment should be kept close to the work area for immediate use.

Relevant considerations

Capabilities of rescuers	• Are rescuers properly trained and sufficiently fit to carry out their task and capable of using equipment provided for rescue, for example access equipment? • Have emergency procedures been tested to show they are effective?
First aid	• Is first aid available for injuries associated with falls, crush and cut injuries, for example from chainsaws? • Are trained first aiders available to use the necessary first aid equipment? • Workers may be exposed to insects and animals, like wasps, bees, spiders, possums, birds, snakes, rats and cats whilst working in and around trees. A single wasp or bee sting could be fatal if the worker has an allergic reaction. Contact with some plants can also cause allergic reactions. Identifying workers' sensitivities and allergies should be considered as part of the emergency planning process. • Workers must have access to first aid equipment and facilities to administer first aid. Workers must also be trained to administer first aid or even access to people who are trained in first aid.
Local emergency services	• Should local emergency services be relied on for rescue? Other arrangements should be made if workers cannot respond quickly. • How will the local emergency services, for example ambulance be notified of an incident? • Are there ways to ensure information is given about the location of the site and access problems, personal details about the casualty including names and relevant medical history as well as the approximate time of the incident, treatment given, and any chemical involved?
Rescue operation	• When an injured worker needs rescuing, all possible precautions should be taken to protect other members of the work team and others entering or approaching the worksites.

An emergency response plan should include the following list of items (non-exhaustive):

Procedures for raising of alarm are:

- Procedures for evacuation and rescue of victim;
- Provision of means of rescue and first aid;
- Provision of means of communication with regular government authorities and response agencies; and
- Establishing an emergency response team with the duties and responsibilities of each member clearly defined, with emergency contacts.

Top management should ensure that all employees are familiar with the plan and procedures in the event of an emergency. Regular drills and exercise should be conducted. An evaluation of the drill performance should be carried out and learning points should be used to improve the plan.

This emergency response plan forms part of the overall emergency response plan for the workplace.

2.1 First Aid

First Aid is rendering immediate help to an injured person. The life of an injured person may depend on proper first aid given within the first few minutes of an accident. Besides saving lives, first aid treatment is important in preventing further injury and pain.

Tree workers should receive training in first aid and cardiopulmonary resuscitation (CPR). In addition, an adequately stocked first aid kit must be provided on each truck. All employees must be instructed in the use of first aid kits and in emergency procedures. Emergency phone numbers should be posted in the truck.

For more information, refer to the publication, “A Guide to the Workplace Safety and Health (First Aid) Regulations” which is available on the Ministry of Manpower (MOM) website: www.mom.gov.sg.

2.2 Incident Reporting and Investigation

The WSH (Incident Reporting Regulations) requires employers to report accidents, dangerous occurrences, occupational diseases and all work-related traffic accidents involving their employees at workplaces.

Employers are advised to submit the report within 10 days of the incident to MOM through the electronic reporting system, iReport (<http://www.mom.gov.sg>).

Reportable Incidents, Accidents and Occupational Diseases

- | |
|--|
| (1) An accident in the course of work that results in: <ul style="list-style-type: none">• Fatality; and• Hospitalisation for at least 24 hours; or• The injured person is given more than three days of medical leave (cumulative). |
| (2) Work-related traffic accidents involving employees. |
| (3) A dangerous occurrence such as: <ul style="list-style-type: none">• Explosion or fire;• Collapse of structure or equipment; and• Machinery damage. |
| (4) An occupational disease (regardless of whether any medical leave was given) |

Figure 78: Reportable incidents, accidents and occupational diseases.

Employers must submit notifications of occupational diseases within 10 days of receipt of a written diagnosis. Reports or notifications made under the Regulations must be kept for at least three years from the time of reporting.

Employee injuries and illnesses which are not reportable to MOM could be recorded and kept by the facility for monitoring purposes. These records can provide insight into the WSH performance of the facility as well as the effectiveness of its WSH programme(s).

Other useful information that could be captured in such a monitoring log can include:

- Severity of the injury or illness;
- Date and time of the occurrence;
- Brief description of the occurrence;
- Particulars of the employee(s) involved; and
- Lost time associated with the injury or illness.

After being notified of an accident or incident, the management should review the information collected and decide on the next course of action. The facility should develop and implement effective procedures for investigating accidents, occupational illnesses and incidents.

The purpose of accident/incident investigation is to prevent recurrence of similar situations. These procedures could include, but not restricted to the following:

- Process for capturing information and record keeping;
- Type of events to be investigated e.g. those that have led or could lead to serious harm;
- Process of investigation;
- Identification and implementation of corrective and/or preventive actions; and
- Review of follow-up actions for effectiveness.

Refer to the WSH Guidelines on Investigating Workplace Incidents for SMEs for guidance on incident investigation methods and their related tasks.

3. Legislative Requirements for Equipment

3.1 Operation of Mobile Elevated Work Platforms

A mobile elevated work platforms (MEWP) facilitates tree pruning workers to reach out to targeted branches. However, if the MEWP is not operated in a safe manner, the consequence can be very serious. A MEWP should be inspected by an Authorised Examiner (AE)¹ at least once every six months to ensure that it can be operated safely. A valid certificate of test and examination for the MEWP must be made available prior to work commencement.

- Only authorised persons who are trained and competent can be allowed to operate MEWP;
- Conduct daily pre-use inspection checks on an MEWP before use which include checking the operating limits of the MEWP for safe operations (e.g. loading, wind speed); and
- Cordon off the work zone with warning notices and signs prominently displayed; refer to LTA for more information on putting barricades on public roads.

3.2 Operation of Cranes

Cranes such as mobile cranes and lorry cranes are frequently deployed to lift trees during planting and transplanting, clearing and removal of branches after pruning, as well as for the lifting of other heavy objects or debris from the work area.

Crane operation is considered a high risk activity. Besides hazards from moving traffic, workers working with crane near road side work are also faced with other challenges such as space constrain.

Cranes and their lifting gears should be inspected by an Authorised Examiner at least once every 12 months to ensure that they can be safely to use. Valid certificates of test and examination for the cranes and lifting gears must be made available prior to work commencement.

Other requirements include the development and implementation of a lifting plan and lifting in the presence of a team which includes the lifting supervisor, rigger and signalman for the lifting operation.

All lorry cranes used with attached work basket is to be designed in conformance with BS EN280 and equipped with integrated load stability control system. Such lorry cranes are to be inspected by an Authorised Examiner at least once every six months. Alternatively, use truck-mounted MEWP in lieu of lorry cranes with attached baskets.

¹ Authorised Examiner refers to any person approved by the Commissioner under Section 33 of the Workplace Safety and Health Act for the purpose of carrying out any prescribed examination or test of any machinery required by the Act.

Crane Operations

- Only trained and competent personnel should be allowed to operate cranes. Operators of mobile cranes are required to be registered with the MOM while operator of lorry crane are required to have undergone and passed the relevant training;
- Establish and implement lifting plan and safe work procedures for the lifting operation. The load should be calculated and its centre of gravity taken into consideration when developing the lifting plan;
- Conduct daily pre-use inspection checks on the crane and its lifting gears before use, which include checking the operating limits of the crane for safe operations. (e.g. safety devices, loading, wind speed); and
- All outriggers must be fully extended to ensure stability during lifting operations. If it is not feasible, use a crane that is equipped with rated capacity limiter or with stability control system accepted by Manufacturers or seek Manufacturers' advice.

3.3 Operation of Excavators

In the process of tree management, excavators are often deployed to facilitate the works such as preparing planting holes and removal of the tree stumps.

Excavators are not designed primarily for lifting purposes and should only be used if there are no other practicable means. If it were to be used as a lifting machine, the following conditions must be met:

- The excavator has been originally designed and manufactured to also function as a lifting machine;
- The excavator shall be equipped with original hook(s) with safety catch for hoisting purposes;
- The excavator shall have a load capacity chart furnished by the manufacturer;
- The excavator shall be equipped with an accurate indicator which shows clearly to the operator, the working radius and the corresponding safe working load at all times and gives a warning signal when the radius is unsafe;
- It is inspected by an Authorised Examiner at least once every 12 months; and
- Any other applicable requirements as stipulated in the WSH Act and its subsidiary legislations.

4. Personal Protective Equipment and Tool Box Meeting

Landscaping workers are exposed to various types of hazards while carrying out their work. More often than not, these hazards arise from the machine or tool which is being operated or not, the working conditions and/or lack of vigilance on the part of the workers themselves.

To protect the workers from these hazards, precautionary control measures such as guarding of the dangerous parts of the machine, use of less hazardous chemicals, training of workers, instituting procedures for safe operation of equipment, and whether provision of traffic warning cones can be used.

In addition, PPE should be provided to and worn by the workers to reduce their exposure to hazards. While PPE provide some basic protection for the workers, it is noted that the success of PPE largely depends on the PPE being chosen correctly, fitted properly, maintained in good condition and worn by the workers at all times.

4.1 Standard Work Attire

In carrying out park operations, workers are required to wear some basic PPE for protection. As part of the standard work attire, these PPE are protective clothing and safety footwear.

4.1.1 Protective Clothing

Protective clothing such as a long sleeve shirt protects workers against minor cuts by tree branches and shrubs as well as by sharp tools. The clothing must be comfortable for the workers and should not be too tight as to restrict free movement. It should not also be too loose as to pose a hazard to workers working with and around rotatory machinery. For works involving hazardous machinery such as chainsaw, additional protective clothing (e.g., chainsaw chaps) will be required.

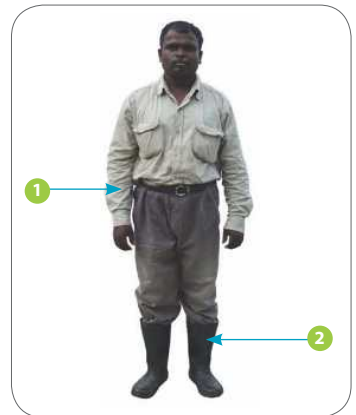


Figure 79: Basic standard work attire.
1. Protective clothing
2. Safety footwear

4.1.2 Safety Footwear

Safety footwear (safety boots or safety shoes) protect the workers against foot injuries such as crushing by object and puncturing by sharp nail or glass. When required to work in a wet environment such as toilet cleaning, safety boots must be provided and worn correctly by workers to guard against slipping and falling.



Figure 80: Safety footwear.

4.2 Other Personal Protective Equipment

In addition to the above standard work attire, workers are also required to don other PPE, depending on their work activities and the hazards to which they are exposed.

4.2.1 High Visibility Vests

If workers are required to work in areas where there is traffic movement such as along expressway or roadside, they are required to wear high visibility vests. This will help to increase the visibility of the workers to the traffic users and reduce the possibility of the workers being knocked down.

The vests should incorporate both day and night time visibility. Vest material that is fluorescent lime-yellow or red-orange increases day time visibility while retro-reflective material enhances night time visibility vests incorporating retro-reflective material should comply with recognised standards such as EN (Europe) or ANSI (US) for optimal visibility performance.



Figure 81: Vest with high visibility.

4.2.2 Head Protection

Workers are required to wear head protection safety helmets at workplaces where a person could suffer head injury arising from being struck by falling objects. This is especially so for workers doing tree pruning activities or horticulture works at heights.



Figure 82: Head protection.

4.2.3 Eye Protection

Workers are exposed to the hazards of impact force, flying particles, dust and chemicals depending on the nature of work.

They should wear the appropriate cover goggles, safety spectacles/ safety prescription spectacles (made of polycarbonate lenses for impact resistance) with side shields or over-the-glass safety spectacle to protect against high speed large particles when carrying out tree pruning or grass cutting. When handling chemicals, they should use cover goggles with indirect air venting to protect their eyes from accidental chemical splashes that can potentially lead to blindness. When exposed to dust or smaller particles, direct ventilated cover goggle or non-vented cover goggles can be used for eye protection.

NB: Ventilation ports prevents fogging of goggles



Figure 83: Eye protection.

4.2.4 Face Protection

Workers should use goggles with a face shield for optimum protection to their eyes and face to protect against flying particles, chemical splashes and dust, e.g., during spray application of pesticides. The face shield can be worn using an elastic headband or attached to a hardhat, depending on the type of work activity.

Face shield are considered as a primary protection to the facial area but secondary protection for the eyes. Face shield should not be used as the sole means of protection against injury to the eyes.

NB: For spray application, using a full face piece respirator gives the best overall protection.



Figure 84: Face protection.

4.2.5 Hearing Protection

Excessive noise can cause hearing loss to workers. Workers should not be exposed to noise levels exceeding 85dBA for eight hours a day or its equivalent. See Permissible Exposure Level (PEL) for Noise in Annex 1

Hearing protection (ear plugs or ear muffs) must be worn when the noise level exceeds the PEL indicated. Typically, excessive noise is generated during the operation of chainsaw, grass cutter or ride-on mowers. See Section 6.6 for further details on managing noise hazards.

4.2.6 Hand Protection / Skin Protection

Hand protection such as gloves must be worn to avoid the risks associated with cuts, dermatitis, sensitisation and chemical absorption through skin. Besides ensuring that the correct type of gloves is chosen, it is also important that the gloves fit properly. Hand protection is required when handling chemicals such as pesticides and fertiliser, and working with hand tools.

Glove material such as nitrile, Viton/Butyl, Polyvinyl alcohol (PVA), can be used when handling petrol/gasoline.



Figure 85: Examples of suitable gloves for handling petrol.

Cotton gloves used for handling of petrol can result in direct skin contact when there is a leakage of petrol onto the cotton gloves.



Figure 86: Incorrect gloves used for handling petrol.

4.2.7 Fall Protection

Workers working at heights must be provided with safety measures such as suitable working platforms with guardrails, and safe means of access and egress. They must also be provided with fall arrest system/ work restraint systems to arrest/ prevent falls from heights. Examples of such work activities include horticulture pruning at overhead bridges and tree pruning. Further guidance can be obtained from the Code of Practice for Working Safely at Height published by WSH Council.

5. Chemical Safety

Chemicals are used in landscape care and maintenance operations to enable the trees, plants and turfs to grow healthily as well as to free them from pest, disease and fungus attacks. These chemicals include fertilisers, herbicides and pesticides (insecticide and fungicides).

In addition to the above, chemicals are used for the cleaning and washing of park facilities and amenities. These chemicals include detergents and cleaning agents.

Chemicals can be hazardous if they are not handled or used properly. Manufactures or suppliers have to provide information on the chemicals in the form of a safety data sheet (SDS).

The SDS should contain information on the chemical such as product specification, physical and chemical properties (i.e., flammability, toxicity or reactivity), hazard identification (i.e., potential safety and health effects), safe handling and storage, exposure controls and personal protection and disposal considerations.

With the information gathered from the SDS of the chemical, proper preventive measures can thus be developed for the storage and handling, application and use, as well as the disposal of the chemicals.

More information on SDS can be obtained from the WSH Guidelines – Management of Hazardous Chemicals Programme.

5.1 Storage and Handling of Chemicals

Chemicals are usually toxic and therefore potentially dangerous to our health. They can be also corrosive or flammable. Hence, they should be stored and handled with care.

The storage of chemicals should take into consideration the properties of the chemicals, any form of incompatibility, quantity to store, operational and environmental conditions. Different chemicals may require different storage containers. Generally, containers made of galvanised or stainless steel are not suitable as some chemicals may react with the steel to produce hydrogen gas, which is flammable and easily ignited.



Figure 87: Store the chemical in its original container.

Chemicals should be stored in dry and well-ventilated areas, away from heat and direct sunlight. Chemical containers should be properly labelled and covered when not in use. Safety equipment such as fire extinguishers and washing facilities and PPE should be provided in the vicinity of the storage area.

The SDS of the chemicals should be referred to for their proper storage and handling.



Figure 88: **Store chemicals in dry and well-ventilated premises.**

Safety tips for storage of chemicals are:

- Ensure that each chemical has a safety data sheet (SDS);
- Refer to the SDS for information on the storage requirements;
- Store the chemical in its original container;
- Label the chemical container properly and clearly with hazard warning signs;
- If required to transfer chemicals, store them in suitable containers;
- Store the chemicals in dry and well-ventilated premises, away from heat and direct sunlight;
- Ensure that incompatible chemicals are segregated and stored separately;
- Access to the chemical store should only be given to authorised personnel;
- Keep the storage quantity of chemicals to a minimum;
- Keep sources of ignition (e.g., open flame, spark, lighted cigarette, welder's torch) away from the storage area;
- Equip the store with necessary safety equipment (such as fire extinguishers, washing facilities and chemical spill kits);
- Provide suitable PPE (such as protective clothing, safety goggles, chemical resistant gloves, suitable masks / respirators and safety boots) within close vicinity of the chemical store;
- Inspect the chemical store regularly to check for deterioration, leakage or spillage; and
- Chemical stores should have self-containing drainage trays around the base of the racks / cupboards.



Figure 89: **Nozzle attachment used for transferring of petrol.**

Petrol can with nozzle attachment to transfer petrol from one container to another – minimises spillage during transfer.



Figure 90: Unlabelled containers storing chemical.



Figure 91: Labelled chemical container.

5.2 Application and Use of Chemical

Depending on the type of chemicals and their physical forms as supplied, the methods of chemical application will vary accordingly. These methods include spraying onto the plants or turfs using power sprayers, drenching the soil around the plants, and direct injection into the tree structures (for tree management, horticulture management and grass maintenance operations).

In addition, chemicals such as washing detergents and bleaching solutions are also used for cleaning, washing and removal of stubborn stains and deposits.

The process of chemical applications poses certain hazards such as inhalation of chemical droplets during spraying, and direct skin contact with the chemicals. It is noted that the chemicals can be toxic to both workers and other persons in the vicinity.

Safe work procedures when applying and using chemicals are:

- Wear proper PPE (such as protective clothing and cap, face shield, chemical resistant gloves, suitable respirators and safety boots);
- Mixing of chemicals must be carried out in well-ventilated areas;
- Do not eat, drink or smoke when handling chemicals;
- Wash immediately after contact with chemicals. Seek medical attention, if pain persists or after ingestion of chemicals;
- Arrange for medical examination every six months and at pre-employment for workers who are exposed to organophosphates (chemical), a type of pesticide. Some examples include parathion and diazinon;
- Allow only trained and competent personnel to handle the power sprayer;
- Check that the equipment (e.g., spraying apparatus) is working properly before use;

- Hold the power sprayer securely and firmly with both hands. Do not direct the sprayer against the wind direction. Beware of spray drift;
- Check the equipment and apparels thoroughly before and after use to avoid chemical contamination; and
- Wash hands immediately after handling chemicals. The workers should take a shower if possible, especially after a spray application.



Figure 92: **Wear proper personal protective equipment when using chemicals.**



Figure 93: **Wash hands immediately after handling chemicals.**



Figure 94: **Hold the power sprayer securely with both hands.**

5.3 Disposal of Chemicals

Due to its hazardous nature, the disposal of chemicals must not be taken lightly. Waste chemicals should be disposed properly to prevent pollution and endangering the safety and health of workers. The SDS should be referred to for the proper disposal method, and disposal should comply with the requirements stipulated by the National Environment Agency (NEA).

In general, workers should also adopt proper housekeeping and good hygiene habits. These include cleaning up of work area and proper handling of chemicals after use.

Safety precautions for chemical disposal are:

- Wear appropriate PPE (such as impervious gloves, face-shield, eye goggles, coveralls and boots) when handling waste chemicals;
- Wash and clean the work area thoroughly after use;
- Expired chemicals should not be used and must be disposed immediately and properly. Do not mix different waste chemicals, unless the constituents in the waste are known; and
- Follow the disposal method as stated in the SDS of the chemical and adhere to any requirements stipulated by NEA.

More information on hazards of handling petrol and their control measures under Part B Section 5.4.

5.4 Chemical Hazard

Petrol/Gasoline

Gasoline is currently classified by International Agency for Research on Cancer (IARC) Group 2B which is ‘Possibly Carcinogenic to Humans’, GHS classification Carcinogen Category 1B. An example of composition in gasoline is shown in Table 3.

Ingredients	Composition
Isoalkanes	25 – 40%
Total aromatics (eg. Toluene, xylene, etc.)	20 – 50% vol
Benzene	0.5 – 2.5% vol

Table 3: Composition of gasoline²

Skin Absorption

When pouring gasoline/ petrol for refilling/ mixing with 2T oil in another container, there is potential contact with skin if there is a spillage. The spilled gasoline/petrol can come into contact with the skin of the person and may be absorbed into the body.

Inhalation

While pouring gasoline/petrol to refill the equipment, the vapours of the gasoline/petrol will be emitted. The vapours could be inhaled by the person pouring it and also persons working nearby.

Ingestion

After handling gasoline/petrol, it is important to wash your hands thoroughly to prevent accidental ingestion of residual gasoline/petrol on your hands during meal.

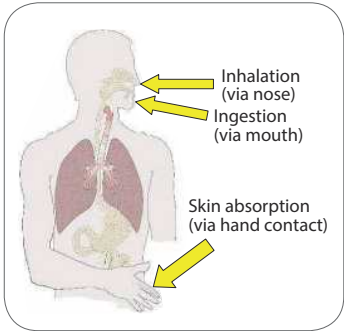


Figure 95: Use of gasoline/ petrol/ 2T oil for mixing and refilling for gasoline-powered equipment- How gasoline/petrol and its components can enter your body³



Figure 96: Wash hands thoroughly.

² Information obtained from IARC Monographs on the Evaluation of Carcinogen Risks to Humans Volume 45, Occupational Exposures in Petroleum Refining; Crude Oil and Major Petroleum Fuels, 1989.

³ Image obtained from <http://www.stewardshipcommunity.com/stewardship-in-practice/human-health/hazard-risk-human-health-and-pesticides/hazard-profile-and-risk-assessment.html>

Health Effects from Exposure

- Discomfort to the upper respiratory tract and may be harmful;
- May cause drying of the skin, which may lead to dermatitis after repeated exposures.

5.5 Training

All persons who work with hazardous chemicals should receive information and training on:

- Legal requirements on the control of hazardous chemicals;
- Company policy on hazardous chemical hazard control;
- Chemical safety and health rules and regulations;
- Simple RA;
- Hazards and necessary precautions to take based on the information that can be found on the SDS of respective hazardous chemicals;
- Safe work procedures;
- PPE including topics on selection, fitting, use and maintenance; and
- Procedures for emergency response.

Training should be conducted at least once a year:

- For each new employee before starting a job;
- For each new hazardous chemical introduced; and
- When new information about any hazardous chemical used becomes available.

All induction and training should be properly recorded and documented.

Refer to WSH Guidelines on Management of Hazardous Chemicals Programme for further guidance

6. Other Hazards and Controls

It is noted that some work hazard (such as the use of chainsaws) are found only in certain landscaping and garden maintenance activities. An example is the use of chainsaw for tree pruning works.

However there are other hazards which are commonly faced by workers whether they are undertaking tree management, horticulture management, grass maintenance, parks cleansing activities.

These common hazards include working in confined space, coming into contact with poisonous/ venomous/ stinging/ biting animals, exposure to soil-borne micro-organisms, heat stress, incorrect work postures and exposure to excessive noise.

6.1 Confined Space Management

Tanks, pits, silos and manholes are common confined spaces that are usually found in landscaping and horticulture works. If entries into such places are required in the course of work, precautions should be taken to ensure the safety and health of workers.



Figure 97: Tank



Figure 98: Manholes



Figure 99: Silo

Confined space is defined as any enclosed space, in which

- Dangerous gases, vapours or fumes are liable to be present to such an extent as to involve a risk of fire or explosion, or persons being overcome thereby;
- The supply of air is inadequate, or is likely to be reduced to be inadequate, for sustaining life; and
- There is a risk of engulfment by hazardous materials.

Table 4: Impact on Various Hazards.

Hazards	How it can happen	Possible injuries
Oxygen deficiency (less than 19.5% vol oxygen)	• Oxidation from rotting of organic materials • Rusting • Bacterial growth • Oxygen depleting work such as welding and cutting • Displacement by other gases • Poor ventilation	Breathing difficulties, headaches, nausea, unconsciousness and eventually death at low oxygen levels
Oxygen enrichment (more than 23.5% vol oxygen]	• Leaking oxygen from gas cutting equipment, e.g. welding torch • Leaking pneumatic tools	Flammable materials catch fire more easily
Fire/Explosion	• Fuel, oxygen, and a source of Ignition	Burns and deaths
Toxic atmospheres	• Accumulates through some manufacturing, biological, or chemical reactions • Released during tasks such as cleaning • Produced by generators and vehicular exhaust	Exposure to these toxic substances can cause irritation, chemical asphyxiation, headache, dizziness, nausea, cancer and chemical poisoning
Heat	• Poor mechanical ventilation • Crowded space • Hot work • Heat generating machinery • Thick/heavy protective clothing/ equipment • Strenuous activities	Heat cramps, heat exhaustion, heatstroke

Hazards	How it can happen	Possible injuries
Noise	• Jack hammering • Cutting • Ventilation fans • Physical activity, e.g. erecting scaffolds	Short term or long term hearing loss (noise-induced-deafness) Poor communication between entrants, leading to accidents
Ergonomic hazards	• Limited space • Awkward working position, e.g. overhead • Manual carrying/lifting of equipment, e.g. PPE, tools	Musculoskeletal effects, e.g. backache, muscle cramps/strain
Poor lighting	• Insufficient artificial lighting	Slips, trips, falls
Mechanical hazards	• Moving or rotating parts, e.g. belts, gears • Improper or lack of lock out and tag out procedures	Injury, death
Electrical hazards	• Improper electrical wiring • Poor housekeeping of electrical cables • No provision of grounding • Improper or lack of lock out and tag out procedures • Wet spaces • Humid environment which leads to decreased electrical resistance	Electrocution which leads to burns, death
Skin contact with chemicals/absorption	• Painting, cleaning using solvents or acid • Inadequate skin protection	Skin irritation, dryness, swelling Skin burns Systemic effects, e.g. liver poisoning, blood disorders if absorbed through skin into the bloodstream

Precautions for Confined Space Management

Some of the precautions are listed below:

- All confined spaces in the workplace shall be clearly identified, documented, labelled and warning signs shall be displayed at every access point to warn persons of the confined space and its hazards;
- Always carry out purging (to rid the atmosphere of hazardous contaminants) and ventilation (to render the atmosphere safe for work) of a confined space before entry;
- A confined space safety assessor is to verify that the atmosphere is safe for entry;
- Ensure that a confined space entry permit has been issued before any person enters or works in a confined space;
- Appoint a confined space attendant before any entry into a confined space;
- Test the atmosphere in the confined space at such intervals as is necessary to ensure the safety and health of the person entering or working in the confined space;
- Select and use appropriate equipment;
- Conduct a thorough risk assessment for all work activities to manage any foreseeable risk that may result from working in confined spaces. In particular, the risk assessment should cover the possibility of fire/explosion hazards;
- Mechanical ventilation (blowers) shall be provided at all times to a confined space during occupancy;
- Provide adequate safety and health training on working in confined spaces to personnel involved in working inside the confined spaces; and
- Prepare a rescue operation plan and provide rescue equipment.

Further information on entry into and work in a confined space can be found in:

- Workplace Safety and Health (Confined Spaces) Regulations
- Approved Code of Practice Singapore Standard SS 568: 2011 Code of Practice for Confined Spaces; and
- Technical Advisory on Working Safely in Confined Spaces

6.2 Contact with Animals and Insects

Workers doing landscaping jobs often come into contact with animals and insects. Although there may be several species of insects present on plants, only a handful of them are harmful. Harmful insects which are commonly encountered include red ants, black ants, bees, wasps and hornets.

Safety precautions to reduce contact with insects are:

- Check for insect nests before starting work;
- Engage pest control company to remove nests of bees, wasps and hornets;
- Equip worker with protective clothing and hand protection;
- If possible and only if necessary, spray insecticide to get rid of insects before working on the plant; and
- Administer medical treatment to reduce swelling or pain. If it persists, seek medical attention.

Dealing with bees attack and other similar insects:

- Run, get to the shelter as quickly as possible;
- Get in a vehicle or building that can be securely shut;
- If shelter is far away, try to run through shrub or brush to distract the bees.
- If there is no shelter nearby, keep running until the bees have left. Some bees may pursue for 800 metres or more before giving up;
- Do not seek escape in water. The bees will wait for the victim to emerge; and
- Once the bees are gone, remove any stingers from the skin as soon as possible. Seek medical attention immediately if one experience hives, swelling around the throat or face, or difficulty in breathing.



Figure 100: Contact with biting/stinging insects.



Figure 101: Red ants are a common work hazard.

6.3 Contact with Soil-Borne Micro-Organisms

Workers come into frequent contact with soil in either excavation work (i.e., during the preparation of planting holes or the installation of park facilities) or plant weeding work. Thus, exposure of these workers to soil-borne micro-organisms is inevitable if they have a cut or graze. Soil-borne micro-organisms may be harmful or even deadly. To prevent infection from these micro-organisms, workers need to wear protective clothing and hand protection. Workers should also adopt good hygiene habits such as washing themselves thoroughly after coming into contact with the soil.

Precaution to take when in contact with soil are:

- Equip workers with protective clothing, hand protection and safety boots;
- Wash thoroughly after coming into contact with soil; and
- If infected with micro-organisms and when swelling or pain persists, seek medical attention.



Figure 102: **Contact with soil-borne micro-organisms.**



Figure 103: **Equip workers with protective clothing.**

6.4 Heat Stress

Landscaping works are primarily outdoors activities. Being in a tropical environment, workers are more prone to heat stress such as heat exhaustion, heat cramps and heat stroke.

When a worker perspires, loss of body fluid occurs. If the body fluid is not replaced fast enough, the worker can become dehydrated and susceptible to heat exhaustion. In more severe circumstances, the worker may suffer painful spasms in one or more muscles (heat cramps) or even heat stroke which can be life threatening.

Further guidance can be obtained from WSH Guidelines on Managing Heat Stress in the Workplace.

Precautions to take to prevent heat stress are:

- Implement appropriate work-rest schedule to enable workers to have sufficient rest breaks;
- Schedule strenuous activities to cooler times of the day if practical;
- Provide a sheltered rest area where the workers can take breaks;
- Equip workers with loose and cool clothing; and
- Provide adequate supply of cool water to enable workers to replenish the loss of body fluid.



Figure 104: Equip workers with loose and cool clothing.

6.5 Work Postures

Our bodies function best in natural postures. Prolonged periods of standing, squatting or maintaining awkward body postures can cause musculoskeletal injuries and disorders such as lower limb aches and pains, back injuries and stress on muscles and ligaments.

In the context of landscaping workers, they may be subjected to long periods of squatting to carry out weeding activity or standing to do horticulture pruning.

Preventive measures to control poor work postures include application of good ergonomic principles in work design and work practices.



Figure 105: When a worker needs to bend down to clear the drains.

6.6 Noise

The work activities for landscaping can be noisy. Prolonged exposure to excessive noise can lead to noise-induced deafness. The following table shows the typical noise levels of work activities measured using a sound level meter. To understand the actual noise levels that workers are exposed to, noise monitoring of the full work process should be conducted by a competent person using suitably calibrated equipment.

Activity	Noise Level (dBA)	Exposure limits per day
Tree pruning	91 – 107	3 mins – 2 hrs
Shrub trimming	~ 92	1 hr 35 mins
Leaf/grass clippings blowing	86 – 90	2 hrs 30 mins – 6 hrs 20 mins
Grass cutting	85 – 90	2 hrs 30 mins – 8 hrs
Lawn mowing	~ 86	6 hrs 20 mins

Table 5: Noise level.

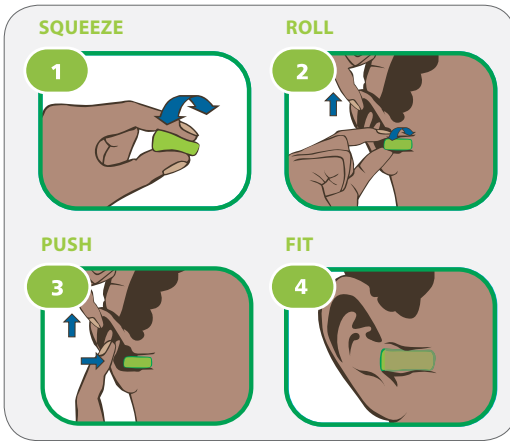


Figure 106: Correct way of wearing disposable ear plugs.

Training for Workers

The workers who are exposed to occupational health hazards should be trained on the hazards of the activity carried out annually. Records of the training and the topics covered have to be kept.

Hearing Conservation Programme

Yearly training on hearing conservation programme for affected workers will have to cover the following elements:

- Relevant provisions of the Act and these Regulations;
- Effects of noise on hearing;
- Purpose of hearing protectors;
- Advantages, disadvantages and attenuation of various types of hearing protectors;
- Selection, fitting, use and care of hearing protectors; and
- Purpose of hearing tests and the appropriate procedures and requirements of such tests.



Figure 107: Training on proper wearing of hearing protectors.

For more information, you can refer to the WSH Guidelines on Hearing Conservation Programme.

When carrying out noisy work, hearing protectors must be worn to reduce the noise level exposed. However, hearing protectors are only short-term solutions while other control measures are undertaken to ensure that workers do not suffer from the ill-effects of exposure to excessive noise.



Figure 108: Hearing protectors used for noisy work processes.

6.7 Exhaust Emissions from Machine/Equipment

When equipment is powered by diesel/gasoline, the components in exhaust emitted from the equipment are:

- Toluene
- Benzene
- Nitrogen oxides
- Carbon monoxide
- Polycyclic aromatic hydrocarbon (PAH) particulates



Figure 109: Keep a distance away from other equipment exhaust.

Fellow workers should keep a distance away from the exhaust when operating equipment to avoid inhaling the exhaust fumes, flying particles and excessive noise generated.

6.8 Statutory Medical Examination

Workers who are exposed to certain hazards would require medical examinations to be conducted by Designated Workplace Doctor. Some examples relevant for the industry would be:

- Benzene
- Organophosphates
- Excessive noise (e.g. grass cutters, blowers)



Figure 110: Audiometric examination.

6.9 Work Hazards in times of Inclement Weather

Inclement weather may create danger to people working outdoors, especially in exposed areas such as during cleansing of open space, horticulture work, tuff work and tree management work.

Serious or even fatal accidents may occur at workplaces under inclement weather conditions. Include such work hazards in the RA.

Dos and Don't of Individuals

Threats of	DOs	DON'Ts
Strong wind 	• Stop work at places with risks of falling objects or fall of tree branches • Remove or secure loose materials • Secure cut branches, plants and wooden logs • Use suitable personal protective equipment e.g. safety helmets • Evacuate to safe shelters to avoid exposure to strong winds • Protect from breakage of window glasses	• Don't perform lifting work to high level • Don't perform work at height that could not be safely perform • Don't use umbrella which can cause loss of body balance due to strong wind • Don't stay near windows
Lightning 	• Stop outdoor work and stay inside safe shelter • Stay away from metal pipes, cable, structure or fences • Remove metal objects from body • Stay away from windows • Use battery-operated radio for listening weather broadcasts • Always remain alert on canges of working environment	• Don't stay in water or at exposed areas • Don't stay at areas higher than the surrounding landscape, such as hilltops • Don't stay under trees, lamp posts, or any conductive objects • Don's use plugged-in electrical equipment • Don't wear highly conductive equipment, e/g/ headset • Don't hold rod-like or sharp pointed long objects • Don't lean against vehicles or walls of structure • Don't rely on rubber boots and raincoats as protection from lightning strike

Threats of	DOs	DON'Ts
Persistent rain 	• Be alert to signs of rising water or in-rush of water • Prepare for evacuation at any moment • Be familiar with the escape route in case of emergency • Follow established safety procedures • Resume work at area only when flooded water has been drained away and the ground conditions improved	• Don't stay near steep slope, inside excavated trench, and don't take shelter inside culverts and drainage pipes to avoid the danger of flooding or collapsed soil • Don't walk through flooded water without knowing the conditions of the ground • Don't take shelter in cars that are out of order

It is essential, in times of inclement weather, that employers / self-employed proprietors and employees should take prompt and necessary action to ensure that reasonable safety measures are in place and be regularly communicated to all concerned.

7. Working at Roadside

Ongoing traffic movement around the work area can pose a danger to the workers working along the roadsides. Other vehicles may knock onto the workers, or collide with the aerial lift or crane parked along the roads.

For traffic control measures relating to traffic diversion and traffic management, please refer to the LTA's Code of Practice: Traffic Control at Work Zone for further details.

In addition, workers deployed to work along the roadsides are required, among other things, to wear luminous vests to enhance their visibility to other road users.

Safe work practices in high traffic work areas are:

- Cordon off work area to re-direct other road users;
- Place warning and directional signages to warn oncoming traffic;
- Use Truck Mounted Attenuator (TMA) when working on expressways and roads with speed limit above 70km/h; and
- Mount blinking beacon lights on the top and rear of vehicles.



Figure 111: Warning signs help alert oncoming traffic.



Figure 112: Use Truck Mounted Attenuator (TMA) when working on expressways and roads with speed limit above 70km/h.



Figure 113: Mount blinking beacon lights on top and rear of vehicles.

7.1 Securing Work Zones along Expressways and Fast Lanes

Ongoing traffic movement around the work area can pose a danger to the workers working along the roadsides especially along expressways where vehicles travel at greater speed. Securing the work zone temporarily are critical safety activities. The TMA attached to the protective vehicle plays a very important role in keeping the road environment safe.



Figure 114: TMA – Truck Mounted Attenuator.

While working along the roadsides, contractors must follow the LTA's Code of Practice on:

- Traffic Control at Work Zone;
- Control measures stipulated in the Code of Practice include cordoning the work area;
- Re-directing of traffic flow; and
- installation of TMA, placement of warning lights and signages.

In addition, workers deployed to work along the roadside are required, among other things, to wear luminous vests to enhance their visibility to other road users.

The main challenge while working on live roads is establishing the work zone and its removal, especially near fast lanes, expressways and major roads.

Safe Work Practices When Securing a Work Zone



Notes

- For mobile operations, the driver of the shadow vehicle shall remain in the vehicle at all times. The shadow vehicle shall maintain a longitudinal buffer distance of 25m behind the working vehicles. The distance shall remain constant as the work progresses down the road.
- For stationary operations, the driver of the shadow vehicle shall not be in the vehicle. He shall be in a safe location off the road, preferably behind the vehicle-impact guardrail or other forms of safety device. He must remain on site throughout the whole operations and monitor the safety with respect to the workers and motorists.
- The shadow vehicle shall maintain a longitudinal buffer distance of 10m behind the start of the work area. The distance shall remain constant as the work progresses down the road.
- The shadow vehicle is defined as the LTA-approved truck where the TMA is mounted on.
- Never position the protective vehicle in the breakdown lane.
- The wheels of the TMA should be aligned parallel with traffic at all times.
- The emergency brake shall be set and the transmission put into neutral during stationary operation.
- Provide adequate roll ahead space in front of the protective vehicle.
- Wherever possible, workers movements should be restricted to the area behind the Vehicle Impact Guardrail (VIG) or between the vehicle and the road kerb.
- Workers should always work facing the on-coming traffic.
- Monitor the works if you need to re-position your vehicle at a safe distance as recommended by the manufacturer in order to protect the worker. Direct all workers out of the safety zone, i.e., behind the TMA or within 8m in front of the vehicle. Always keep a safe distance of at least 8m and 24m for stationary and mobile works respectively.



Figure 115: Place warning signs and appropriate directional arrows to re-direct other road users.

7.2 Taking Down Work Zones Along Expressways and Fast Lanes

Safe work practices while taking down a work zone are:



8. Loading and Transportation

8.1 Transport of Workers

Trucks are usually used to transport workers from one work place to another. If precautionary measures are not taken, workers may fall and this may result in injuries.

Safe work practices include:

- Passenger seat(s) in the lorry's cabin must be filled up before workers can be carried at the rear compartment of the lorry;
- The vehicle must not travel faster than the road speed limit or the vehicle speed limit of 60km/h, whichever is lower;
- Lorries that carry workers must display a Maximum Passenger Capacity (MPC) label on the right side of the rear tailboard indicating the maximum number of workers that can be transported; and
- If goods are also transported, they must be properly secured such that they will not endanger the workers carried or other road users.



Figure 116: Ensure that there is sufficient space for each worker and the canopy cover is available.

8.2 Loading and Transport of Equipment

Transportation of equipment (such as ride-on mowers) to the work areas is normally done using lorries. These lorries must be provided with ramps to facilitate the loading and unloading of equipment.

Safe work practices include:

- Use slings or other means to secure the equipment using transportation;
- Use stoppers to stabilise the lorry during loading and unloading processes;
- Mount blinking lights on the lorry to alert other park users;
- Use the ramp provided for loading and unloading of equipment;
- Establish proper work co-ordination and communication between workers; and
- Position the ramp at a safe working height and ensure that it is secured properly.



Figure 117: Mount blinking lights on lorry to alert others.



Figure 118: Use tie-down or other means to secure the equipment during transportation.



Figure 119: Use appropriately designed ramps for unloading and loading equipment.

8.3 Loading and Transporting of Whole Trees, Cut Branches or Wooden Logs

8.3.1 Loading and Transporting of Whole Trees

- When transporting whole trees, the foliage (leaves and branches) and root ball (root system and soil) should be pared down to reduce the dimensions and weight to facilitate securing and transporting;
- Trailer bed should have at least two pairs of stanchions on opposite sides for blocking; and
- Depending on the height of the tree, a minimum of three lashing devices should be used, one of which is used to bind branches that are overhanging to prevent whipping.

Oversized Heavy Vehicles that Require Application Submissions to Land Transport Authority (LTA) as defined below:

- Overall vehicle width (including load) exceeds 3 metres; or exceeds 2.6 metres on controlled roads; and
- Rear overhang of load is more than or equal to 40% of the vehicle length or 1.8 metres, whichever is lesser.

See illustration below:

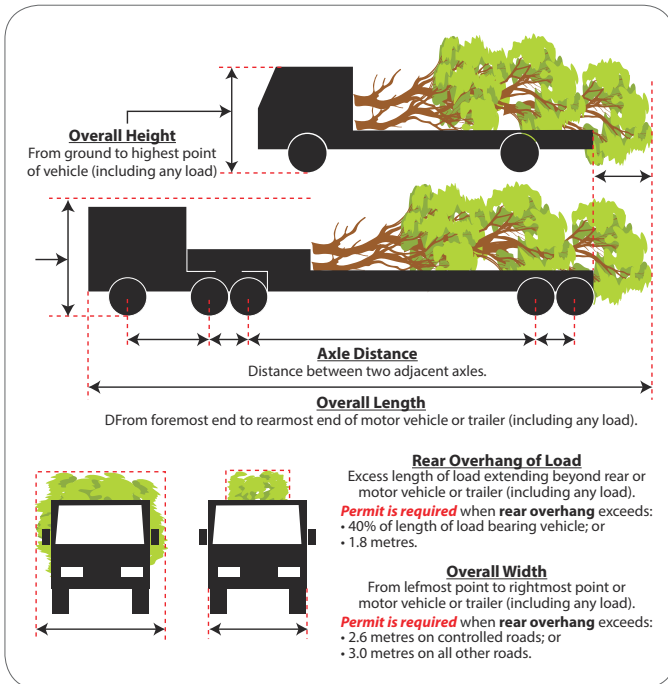


Figure 120: Diagram illustrates the dimension limit when tree (i.e. load) are being transported on road using trailer.

Police Escort

Police (auxiliary) officers are required as escorts when oversized heavy vehicles are used on the road:

- Overall vehicle height exceeding 4.5 metres;
- Vehicle laden weight of 80,000 kg or more; and
- Overall vehicle width (including load) exceeding 3.4 metres.

Note

All the measurements stated in this article apply to both the vehicle and its load, where applicable.

More information can be found in: https://www.onemotoring.com.sg/content/onemotoring/en/on_the_roads/road_facilities/ahvm.html

8.3.2 Loading and Transporting of Cut Branches

- When loading cut branches onto a lorry crane or a lorry, it is important to secure the branches on the lorry bed with ropes and canvas sheets (Figure 116), to prevent loose debris from falling off during the course of transportation;
- It is not enough to secure the branches by just pressing them down with the boom.



Figure 121: Secure tree branches on the lorry bed with canvas sheets.

8.3.3 Loading and Transporting of Wooden Logs

- During loading and transporting of wooden logs, workers are to be vigilant and stay out of hazard zone when the logs are being lifted onto the lorry;
- Side stanchion should be installed when transporting of wooden logs to prevent it from slipping sideways and dropping out of the lorry during loading or when the vehicle is on the move; and
- Stanchion should be deployed at all times.

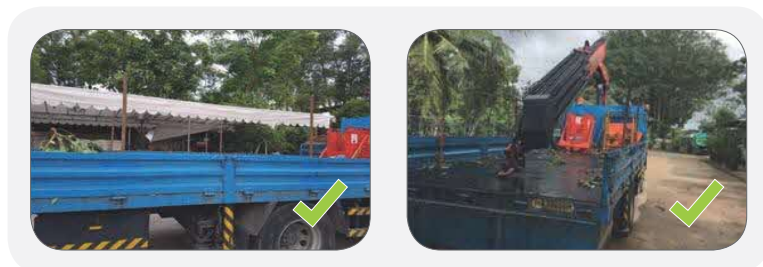


Figure 122: Side stanchion should be installed when transporting wooden logs to prevent it from dropping off.

For more information, see WSH Guidelines on Safe Loading on Vehicles.

8.4 Transport of Waste Materials

- Conduct a pre-use check on the vehicles and skip tanks;
- Equip workers with luminous vests, gloves and non-slip boots;
- Avoid operating the vehicle in reverse. If reverse is required, appoint a co-worker to coordinate the reverse movement with the driver;
- If manual handling of waste bin is required, ensure proper footing before using both hands to lift the heavy waste; and
- Practise good hygiene habits such as proper hand washing after work completion.



Figure 123: Skip tanks are usually used for waste collection and disposal.

9. References

Ministry of Manpower / Workplace Safety and Health Council

- Workplace Safety and Health Act
- WSH (General Provisions) Regulations
- WSH (Risk Management) Regulations
- WSH (Construction) Regulations
- WSH (Scaffold) Regulations
- WSH (Noise) Regulations
- WSH (Medical Examinations) Regulations
- WSH (First Aid) Regulation
- Management of Hazardous Chemical Programme
- Fatigue Management Guidelines
- Workplace Traffic Safety Management Guidelines
- Safe Loading on Vehicle Guidelines
- A Guide to the Workplace Safety and health (First Aid) Regulations
- Management Heat Stress in the Workplace Guidelines
- Safeguarding Against Falling Objects Guidelines
- Code of Practice for Working Safely at Height
- Code of Practice on WSH Risk Management
- Code of Practice on Safe Lifting Operation in the Workplace
- Guideline on Working Safely on Roofs

National Parks Board

- Arboriculture User Instructions and Manuals
- Parks Management Use Instructions and Manuals
- CUGE standards CS E02:2010 Guidelines on Design For Safety on Rooftop Greenery

National Environment Agency

- Environmental Pollution Control Act
- Environmental Pollution Control (Trade Effluent) Regulations

Land Transport Authority

- Code of Practice for Traffic Control at Work Zone

ANSI Z 133.1 (USA)

- Safety Requirement for Arborist Operations

Department for Environment, Food and Rural Affairs (Defra), the Health and Safety Commission (HSC) and the National Assembly for Wales Environment, Planning and Countryside Department

- Code of Practice for using plant protection products

OSHA (Occupational Safety and Health Administration)

- Personal Protective Equipment

Acknowledgements

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Landscape Industry Association (Singapore)	Mr Goh Eng Lam (Chairperson)
Singapore Arboriculture Society	Mr Rick Thomas Mr Boo Ghim Yew
National Parks Board	Mr Chew Thiam Kwee Mr Abdul Hamid Mohd Mr Joseph Chua
Land Transport Authority	Mr Lee Min Kwang
Holland-Bukit Panjang Town Council	Ms Cynthia Lee Kim Kuan
Defence Science and Technology Agency	Mr Tony Khoo Hui Sing
Institutions of Engineers Singapore	Mr John Baptist Tan Kar Him
Ministry of Manpower, Occupational Safety and Health (OSH) Division	Dr Joshua Wong Ms Lee Guek Hoon Mr Lim Koon Teck
Workplace Safety and Health Council	Mr Han Kin Sew

We thank International Powered Access Federation, Landscape Industry Association (Singapore), National Parks Board and Singapore Arboriculture Society for their assistance on the cover photo as well as all photos taken for the purpose of illustration to improve clarity of intent within the context of this guidance document.

Annex 1 – Permissible Exposure Limits for Noise

Source : WSH (Noise) Regulations 2011, Part IV, The Schedule

Sound pressure level, dB(A)		Maximum duration per day
1.	82	16 hours
2.	83	12 hours 42 minutes
3.	84	10 hours 5 minutes
4.	85	8 hours
5.	86	6 hours 21 minutes
6.	87	5 hours 2 minutes
7.	88	4 hours
8.	89	3 hours 11 minutes
9.	90	2 hours 31 minutes
10.	91	2 hours
11.	92	1 hour 35 minutes
12.	93	1 hour 16 minutes
13.	94	1 hours
14.	95	48 minutes
15.	96	38 minutes
16.	97	30 minutes
17.	98	24 minutes
18.	99	19 minutes
19.	100	15 minutes
20.	101	12 minutes
21.	102	9 minutes
22.	103	7.5 minutes
23.	104	6 minutes
24.	105	5 minutes

Sound pressure level, dB(A)		Maximum duration per day
25.	106	4 minutes
26.	107	3 minutes
27.	108	2.5 minutes
28.	109	2 minutes
29.	110	1.5 minutes
30.	111	1 minute
31.	112	56 seconds
32.	113	45 seconds
33.	114	35 seconds
34.	115	28 seconds
35.	116	22 seconds
36.	117	18 seconds
37.	118	14 seconds
38.	119	11 seconds
39.	120	9 seconds
40.	121	7 seconds
41.	122	6 seconds
42.	123	5 seconds
43.	124	4 seconds
44.	125	3 seconds
45.	126 to 127	2 seconds
46.	128 to 129	1 second
47.	130 to 140	<1 second

Annex 2 – Risk Assessment Sample

Department of Trade: ABC Company Process/Activity Assessed: Insecticide spraying Process/Activity Location: Plant nursery Assessment Date: 1-Jul-11 Last Review Date: 5-Oct-09 Next review Date: 2-Jul-14				RA Leader: Tan Ah Lee RA Member 1: Ong Huat Ling RA Member 2: Tan Ai Ling RA Member 3: Abdul Rashid RA Member 4: Kandasamy RA Member 5 Mohd Ali				Approved by: Number: _____ Signature: _____ Name: Salim Bin Samat Designation: Manager Date: 2-Jul-11						
Hazard Identification				Risk Evaluation				Risk Control						
Ref	Work Activity	Hazard	Possible injury /ill-health	Existing Risk Control	S	L	RPN	Additional Controls	S	L	RPN	Implementation Person	Due Date	Remarks
1	Dissolve insecticide in water	Excessive inhalation of toxic powders	Nervous system effects (workers)	(1) Well-ventilated area for mixing (2) Proper equipment for mixing (3) Training of workers on proper handling of chemicals (4) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, suitable respirators, chemical resistant gloves)	2	3	6	To install local exhaust ventilation (LEV) for the mixing process	3	1	3	Tan Ah Lee (Supervisor)	2/8/2011	
2	Applying insecticide mixture with a sprayer	Excessive inhalation of toxic mists	Nervous system effects from over-exposure (workers, members of public)	(1) Check hand-held sprayer before use (2) Cordon off area (3) Prohibit unauthorised entry (4) Safe work procedures for application of insecticide (5) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, suitable respirators, chemical resistant gloves)	2	3	6	-	-	-	-	-	-	
3	Applying insecticide mixture with a sprayer	Drifting of toxic mists into eyes	Eye irritation (Workers, members of public)	(1) Cordon off area (2) Prohibit unauthorised entry (3) Safe work procedures for application of insecticide (4) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, suitable respirators, chemical resistant gloves)	2	3	6	-	-	-	-	-	-	
4	Applying insecticide mixture with a sprayer	Excessive skin absorption of toxic chemicals	Skin irritation (Workers, members of public)	(1) Cordon off area (2) Prohibit unauthorised entry (3) Safe work procedures for application of insecticide (4) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, suitable respirators, chemical resistant gloves)	2	1	2	-	-	-	-	-	-	

Published in August 2008 by the Workplace Safety and Health Council in collaboration with the Ministry of Manpower.

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