Workplace Safety and Health Guidelines
Landscape and Horticulture Management
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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 has extended its coverage to all workplaces including landscaping and garden maintenance.

Workers in the landscaping and garden maintenance industry 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 and garden maintenance activities may face, and their prevention measures. To make them easy to follow, they are illustrated with photographs and graphics, and the hazards are grouped in accordance with various operations such as tree management and horticulture management. All supervisors and workers should familiarise themselves with these guidelines. It is everyone’s responsibility to ensure a safe and healthy working environment.

*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.

Note
This set of guidelines replaces the Workplace Safety and Health Guidelines – Landscape and Horticultures Works published by WSH Council in August 2008.
2. Risk Assessment

Under the WSH (Risk Management) Regulations 2006, risk assessments are to be conducted to address the safety and health risks posed to any person who may be affected by the activities in the workplace. Risk assessment is the process of:

- Identifying and analysing safety and health hazards associated with work;
- Assessing the risks involved; and
- Prioritising measures to control the hazards and reduce the risks.

Risk assessment allows us to identify the hazards at workplaces and implement effective risk control measures before they escalate into accidents and injuries.

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<td>Replace retrofitted lorry crane with proper Mobile Elevating Work Platform (MEWP)</td>
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<th>Administrative Controls</th>
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<th>Personal Protective Equipment (PPE)</th>
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Figure 1: Hierarchy of control.

The control of hazards and reduction of risks can be accomplished by following the WSH Hierarchy of Control (see Figure 1). These control measures are not usually mutually exclusive. Generally, it may be more effective to use multiple control measures, for example, engineering controls work better with administrative controls like training and SWPs. For a more detailed description of each type of risk control method, please refer to Code of Practice on WSH Risk Management.

Under the WSH (Risk Management) Regulations 2006, every workplace including factories, should conduct risks assessments for all routine and non-routine work.

A sample Risk Assessment can be found in Annex 2.

Useful Guides on Risk Management:
- WSH (Risk Management) Regulations
- Code of Practice on WSH Risk Management

3. Tree Management

Tree management comprises of the maintenance and caring of trees in the urban environment. Managing and taking care of trees involves many operations 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, working at heights and being struck by falling objects. Tree management activities also may require the operation of mechanical-powered tools (e.g., chainsaw, aerial lift, crane etc.) which can pose additional risks.

3.1 Common Hazards

3.1.1 Moving Traffic

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 may 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 Land Transport Authority (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:
- 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.
Safe Work Practices When Securing A Work Zone

1. All work vehicles and shadow vehicle shall meet at a pre-arranged location close to the work zone.

2. The driver of the shadow vehicle shall inspect his vehicle and lower the TMA to the horizontal DOWN position in accordance to manufacturer’s instructions.

3. The driver shall then engage the caution mode of the arrow panel.

4. Once ready, all vehicles will move to the work zone with the work vehicles leading the way. The vehicles shall maintain a safe distance.

5. Vehicles shall begin to reduce speed gradually and come to a complete stop well before the work zone. This is to allow other motorists to overtake the vehicles and leave an open gap behind.

6. The driver of the shadow vehicle shall activate the appropriate arrow panel and rotating/ flashing lights as the vehicle slows down and prepares to stop.

7. When the shadow vehicle has been deployed upstream at a safe distance from the advance warning zone, safety and warning devices shall be deployed.

8. Move the work vehicle forward, unload and post temporary warning signs—beginning with the warning signs upstream.

9. Move the shadow vehicle and keep it at a safe distance behind the work vehicle.

10. Deploy a lookout at a safe distance upstream of the transition zone. The lookout shall wave the red warning flag to draw the attention of the motorists to the workers’ presence. He shall alert the workers with the warning whistle (or loudhailer) when he sees vehicle approaching in a dangerous manner. The lookout shall stay on the verge/ shoulder as far as possible.

11. Once it is safe to work, unload and line traffic cones in a tapered fashion. Keep an opening for the shadow vehicle to drive through safely.

12. Drive the shadow vehicle past the traffic cone and “close” the taper quickly.

13. Continue to place remaining safety devices at the activities zone and termination zone.

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.

While working along the roadsides, contractors must follow the LTA’s Code of Practice: Traffic Control at Work Zone. Control measures stipulated in the Code of Practice include cordoning the work area, re-directing of traffic flow, installation of TMA, placement of warning lights and signages.

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.

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

• 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 6: Safe work practices in high traffic work areas.

Safe Work Practices While Taking Down A Work Zone

- Appoint and equip a lookout with a red warning flag or traffic baton, handphone or radio set.

- Deploy the lookout at a safe distance upstream of the advance warning zone.

- Do not reverse the protective vehicle into unsecured traffic lane on the expressway.

- The works vehicles and the protective vehicle shall move forward only with the lookout following behind.

- The lookout shall use a red warning flag to alert motorists to slow down.

- Remove the traffic cones and warning signs starting with the upstream end while the vehicle moves gradually forward until completion.

- Always keep a safe distance while workers are removing the devices.

- Be sure that the lookout uses the warning flag to signal and warn oncoming traffic of the works vehicle at all times.

- Once all the equipment and workers are on the works vehicle, allow it to accelerate and merge with the traffic.

- Once it is safely on its way, the protective vehicle should join the flow of traffic with the TMA down and the flashing arrow and rotating lights on.

- The protective vehicle shall exit the expressway and high-speed road at the first instance.

- Drive to the nearest safe place to stop and raise the TMA until it is in a vertical upright position.

- Switch off the flashing lights before returning to the office.
3.1.2 Working at Heights

When carrying out tree management activities, workers are required to work at heights (such as working from Mobile Elevating Work Platforms, or MEWPs) 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 shall be provided at first instance; in the absence of the latter a work-restraint system shall be considered second 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 of 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 shall be 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 existing WSH regulations pertaining to Work at Heights, Approved Code of Practice (WAH), WSH Guidelines on Working Safely on Roofs and CUGE Standards CS E02:2010 Guidelines on Design for Safety on Rooftop Greenery.

Safe Work Practices for Working at Heights

- Secure the full-body harness with 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).

3.1.3 Falling Branches

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

Safe Work Practices for Cutting Branches

- 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 work;
- To cordon off the work zone with warning notices and signs prominently displayed; and
- To appoint a watchman to give warnings to any persons nearby.

3.1.4 Overhead Cables

In the operation of machineries such as MEWPs and cranes, part of the machinery may come into contact with overhead cables. Workers carrying out work activities using these machineries can be exposed to the hazards (e.g., electrical) involving overhead cables. Hence, adequate clearance between the machinery and the overhead cables must be provided and maintained.

Safe Practices for Working in Areas with Overhead Cables

- Check the vicinity of the work area for sufficient overhead clearance and safe maneuvering of machinery;
- Maintain a safe distance between the overhead cables and the components of the machinery (MEWP or crane) at all times (especially when the machinery is fully extended);
3.1.5 Manual Tree Access (MTA)

MTA requires operator skills, fitness, persistent concentration and alertness. The operator is required to have sufficient training and knowledge of the personal and ancillary equipments used as well as the ability to identify potential hazards 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, do this:

• 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.

• Revise the SOP regularly.

• Designate a safety officer/ employee to assess and discuss workplace risks with work teams.

Personal Protective Equipment (PPE) and Common MTA/ Climber Equipment

Upper Body PPE and required Climbing Equipment:
1. Approved helmet with chinstrap
2. “Class 5” ear protection
3. Safety glasses or visors
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)

An overview of PPE required by a climber while performing MTA

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 component 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.

3.2 Operation of Aerial Lift/ Mobile Elevated Work Platforms (MEWP)

A 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. The potential hazards include toppling of MEWP, structural failure of work platforms and working at heights. A MEWP should be inspected by an Authorised Examiner (AE) at least once every 6 months to ensure that it can be operated safely. A valid inspection certificate for the aerial lift must be made available prior to work commencement.

Figure 11: Personal Protective Equipment (PPE) and common MTA/ Climber Equipment.

Figure 12: MEWP must be stably positioned to avoid hazards such as toppling.

Figure 13: Use only MEWP with valid inspection certificates.
3.3 Operation of Cranes

Cranes (also known as lorry cranes or lorry loaders) are generally used for the lifting of 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.

In the course of the crane operation, besides the moving traffic hazard, workers also face other hazards such as being crushed by collapsed crane, or being hit by falling or swinging loads.

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

Other requirements include the presence of a lifting supervisor (or safe lifting procedure), rigger and signalman for the lifting operation.

Operating Aerial Lifts/ Mobile Elevated WorkPlatforms (MEWP)

Dos

- Only trained and competent personnel should be allowed to operate an MEWP;
- Conduct operational checks on an MEWP before use;
- Check limits for safe operations (loading, wind speed, etc);
- Park the MEWP on firm and stable ground. Beware of soft or poor ground conditions;
- Place a hard surface, e.g., a thick metal sheet for the footing;
- Extend outriggers fully to ensure stability of the MEWP;
- Retract the outrigger fully when not in use;
- Retract and lower the arm of the MEWP fully before moving to another location;
- It is recommended that the MEWP be operated under a 2-man system where one man is on top inside the work platform while the other is standing on the ground to observe the surrounding obstacles that the man in the work platform may not be able to see from his angle;
- To cordon off the work zone with warning notices and signs prominently displayed; and
- To appoint a watchman to give warnings to any persons nearby.

Don’ts

- Do not load the MEWP beyond its safe working load;
- Do not drive the MEWP with the worker in the bucket; and
- The arm of should not be extended beyond the secured working area especially above live traffic lane.

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

Use only cranes and lifting gears with valid inspection certificates.

Do not stand below suspended load or on top of unsecured load at all times.

Figure 14: Dos and Don’ts when operating aerial lifts/ MEWPs.

Figure 15: Safe operation of cranes.
Safe Work Practices For Crane Operations

Dos
- Only trained and competent personnel should be allowed to operate the crane;
- Provide lifting procedures for the 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 operations (loading, wind speed, etc);
- Park on a firm and stable ground. Beware of soft or poor ground conditions;
- Remove soft, uneven ground by compacting;
- 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 ground or packing plates;
- Use cranes and lifting gears with valid inspection certificates;
- To establish and implement a lifting plan; and
- To cordon off the work zone with warning notices and signs prominently displayed.

Don’ts
- Do not stand below a suspended load at all times;
- Do not swing the load excessively. Use a tag rope to control the load movement;
- Do not load a crane beyond its safe working loads; and
- The arm should not be extended beyond the secured working area especially above live traffic lane

Loading 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 or canvas sheets (as shown), to prevent loose debris from falling down during the course of transportation. It is not enough to secure the branches by just pressing them down with the boom.

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

Key hazards involving excavation works include workers being hit by the excavator or its bucket, and excavator bucket coming into contact with live cables.

Safe Work Practices When Operating Excavators
- Only trained personnel are allowed to operate the excavator;
- Barricade affected area with warning tapes and install warning signs;
- No one should be allowed to go into the barricaded area or within close proximity of the excavator;
- For operation of excavator along roadside or expressway, refer to “Moving Traffic” from pages 5 to 9 on associated hazards and control measures; and
- Operator must switch off the engine and remove key before leaving the cabin.
- Check with Energy Market Authority (EMA) if there are possibilities 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. Do not use bare hands;
- Use the banksman to guide movement of excavators especially during reversing; and
- The arm/ bucket should not be allowed to swing beyond the secured working area.
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. To prevent workers from coming into accidental contact with the cutter when it is not in use, the sharp cutters of the sawchain should be covered with a scabbard.

3.5 Operation of 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 operating the chainsaw must be properly trained and equipped with the necessary PPE to ensure their safety.

3.5.1 Kickback
When operating a chainsaw, 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 upward 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;
• 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 in 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 training for workers on the safe use of chain-saw; and
• Establish and implement maintenance regime for the chain-saw.

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.
3.5.2 Other Safety Tips–Chainsaw

Safe Work Practices when Using Chainsaws

**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 3 metres away from flammable substances;
- During ground operations; keep both feet on the ground and balance well when cutting; and
- Keep clear from other persons.

**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; and
- Do not handle or operate a chainsaw with one hand.

Figure 21: Chainsaw with concealed muffler.

Figure 22: To avoid kickback, use the base of the blade when cutting logs.

Figure 23: Do operate a chainsaw with both hands.

3.5.3 Hand-Arm Vibration Syndrome

Hand-Arm Vibration Syndrome (HAVS) is due to the transfer of vibration from a tool or workpiece to a worker's hands and arms.

The continuous use of vibrating hand-held chainsaw often results in HAVS, where the vibration effect is localised to a particular part of the body. The most commonly observed HAVS is Vibration White Finger (VWF), which is due to intermittent lack of blood supply to the fingers.

**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 vibration; 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.
3.5.4 Excessive Noise

The noise generated by a chainsaw (when in operation) can be deafening and typically exceeds the Permissible Exposure Level (PEL). Workers should not be exposed to noise levels exceeding 85 dBA for 8 hours a day or its equivalent [see Permissible Exposure Level (PEL) for noise in Annex 1].

Excessive Noise

To curb such excessive noise production, chainsaws are provided with mufflers, which help in reducing noise levels.

Examples of sound level for comparison

<table>
<thead>
<tr>
<th>Source</th>
<th>dB</th>
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</thead>
<tbody>
<tr>
<td>Threshold of hearing</td>
<td>0</td>
</tr>
<tr>
<td>Average residential home, library</td>
<td>40</td>
</tr>
<tr>
<td>Whisper</td>
<td>50</td>
</tr>
<tr>
<td>General office, average conversation</td>
<td>60</td>
</tr>
<tr>
<td>Conversational voice</td>
<td>70</td>
</tr>
<tr>
<td>CNC machine</td>
<td>80</td>
</tr>
<tr>
<td>Typical home music listening levels</td>
<td>85</td>
</tr>
<tr>
<td>Shouting</td>
<td>90</td>
</tr>
<tr>
<td>Auto horn, pneumatic hammer</td>
<td>100</td>
</tr>
<tr>
<td>Loud rock band</td>
<td>110</td>
</tr>
<tr>
<td>Chipping hammer, jet take-off, pneumatic drill at 1m</td>
<td>120</td>
</tr>
<tr>
<td>Jet engine at 30m</td>
<td>130</td>
</tr>
<tr>
<td>Jet engine, threshold of pain</td>
<td>140</td>
</tr>
<tr>
<td>Jet engine close up</td>
<td>150</td>
</tr>
<tr>
<td>Rocket</td>
<td>180</td>
</tr>
</tbody>
</table>

Note: If the second sound source produces twice as much power than the first, the difference in dB is 3dB.

3.5.5 Handling of Petrol

Chainsaws run on petrol which can pose fire and explosion hazards. Hence, proper storage and safe handling (including re-fuelling) of petrol is important.

Petrol must be stored in suitable containers with the caps screwed on tightly. While refuelling the chainsaw, workers must wait for the motor to cool down and smoking should not be allowed in the vicinity.

It should be noted that skin exposure to petrol can cause rash or burning sensations.

Safe Work Procedures when Handling Petrol/ Oil

- Store petrol and oil in approved, suitably marked/labelled containers;
- Choose a well-ventilated area when refueling. Use a pouring spout or funnel to avoid spills;
- Check surroundings for sparks or lighting before refuelling;
- Wear suitable protective clothing when refuelling;
- Always shut off engine and allow chainsaw to cool before refuelling; and
- After refuelling, wipe the chainsaw clean and dry.

Figure 27: Do not smoke when refueling the chainsaw.

Figure 26: Store petrol in suitable containers.
3.6  Tree Transplanting

Transplanting is performed to relocate trees to meet specific objectives. Transplanting operation involved 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.

3.6.1  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.

Safe Work Practices When Operating Excavators During Transplanting:

(please also refer to page 17 for reference of the SWP when operating excavators )

- 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 excavator 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;
- Workers are not to be in the trench while it is being excavated; and
- Excavators should not be used as a lifting machine, unless the following conditions are met:
  a) the excavator has been originally designed and manufactured to also function as a lifting machine;
  b) the excavator shall be equipped with the original hook(s) with a safety catch for hoisting purposes;
  c) the excavator shall have a load capacity chart furnished by the manufacturer or builder;
  d) 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; and
  e) Registered as a Lifting Machine with the Ministry of Manpower (MOM).

Figure 29: When the excavator is in operation, no one shall enter the full swing area of the machine.

Figure 30: Stay clear of the dangerous area.
3.6.2  **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 trunk or by the soil ball may fracture the bottom of the soil ball if the bottom roots are not severed or cut.

**Safe Work Practices When Undercutting or Severing Deep Seated Roots**
- 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 necessary use a crane to keep the tree firm and secure.

Figure 31: **Deep roots.**

3.6.3  **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. Improperly carried out, a lifting operation can cause injuries and even death. It may also lead to damages 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.

**Safe Work Practices For Lifting Operations**
(also to refer to page 15 for details Safe Operation Of Cranes)
- Only trained and competent personnel shall be 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 operations, 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 outrigger 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 shall 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;

Figure 32: **Severing deep seated roots.**

Figure 33: **Lifting process.**

Figure 34: **Inspect all riggings, straps, chains and slings used for lifting. Ensure that all riggings are secured before attaching to the hoist line.**

Figure 35: **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.**

Figure 36: **Use the tag lines to guide and control the movements of the tree.**
• 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 centimeters and verify rigging. This will also prevent damages to the tree and root ball;
• Always use the tag lines to guide and control the movements of the trees; and
• Never stand in the hole and use bare hands to guide or control the movements of the trees.

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

### 3.7 Crown Reduction

As our 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. These branches are often big and long. The pruned branches may not be able to 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 priority.

Please refer to page 22 for Safe Work Practices in Operating Aerial Lifts/ Mobile Elevated Work Platforms (MEWP).

**Safe Work Practices in Pruning**

- Do not employ a one cut method to remove the whole branch;
- Always cut the branch 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 ropes, 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 speedline 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 down the cut portions;
- An alternative method to lower down the cut portions is to utilise another crane;
- Ensure that all riggings and hitches are secured;
- Ensure no persons that position themselves within the landing zone and that;
- 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.

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**Figure 38: Speedline to lower the cut portion.**

**Figure 37: Lifting process.**

**Figure 39: A crane is used to lower the cut portion.**

**Figure 40: Sectional cutting of trunk or branch into smaller pieces and lowered using a speedline.**
4. Horticulture Management

Horticulture work is performed on greenery such as shrubs, palms, ground cover and hedges located within parklands and along roadsides. This serves to enhance the existing landscape in our Garden City.

Horticulture management consists of general planting, pruning of shrubs, plant removal, watering operations using water tankers and fertilising.

The key challenges faced by the workers when carrying out such activities include working along roadsides, working from elevated work platforms, various hazards associated with watering operations and the use of horticulture equipment and tools.

4.1 Common Hazards
4.1.1 Working along Roadsides
Workers are often required to carry out horticulture works on the greenery planted along the roadsides. They are subjected to moving traffic hazard. As a matter of principle, workers should always stay behind the guardrails installed along the roadsides when carrying out such works.

At times, workers may be required to step beyond the guardrails and carry out horticulture works along the roads. They will need to adhere to the guidelines provided in the LTA’s Code of Practice: Traffic Control at Work Zone.

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

Basically, the work platform can be categorically grouped into mechanical and non-mechanical types. An example of a mechanical work platform is the MEWP.

At times, workers may be required to carry out horticulture work (such as clearing of plant or shrub wastes) located at certain heights. Ladders or scaffolds can be utilised to reach out to these areas. Such non-mechanical work platforms are commonly used in the landscaping industry as they are relatively simple and easy to set up.

More information on:
- Additional control measures on working on roadsides on page 6
- Associated hazards and control measures for MEWP operations on page 13

Use of Ladders

**Dos**
- Use a ladder which is of sound construction and material, and maintained 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 person;
- Stand on the lower rungs of the ladder where possible for stability;
- Keep both feet on the same rung or step throughout the task;
- Maintain 3 points of contact while using the ladder; and
- Make sure you have a safe handhold available on the steps.

**Don’t**
- Do not overreach – make sure your belt buckle (navel) stays within the stiles
4.1.3 Greenery Planted on Building Structures

The maintenance of the greenery planted on building structures (such as overhead bridges, rooftops), along walkways and railings require proper safety procedures. For a start, proper and safe means of access to and egress from these work areas have to be provided. Whenever there is a falling hazard and PPE such as a safety harness need to be used, a suitable anchorage point should be identified and provided for the persons at work. At times, barricading of work areas to prevent unauthorised entry by members of the public is necessary.

Use of Scaffolds
- Use scaffold which is stable and secured in position;
- Provide proper access and egress (e.g., stairs) to enable workers to go up and come down from the scaffold;
- Install guard rails and toe-boards on scaffold to reduce potential fall of person and object;
- Provide work platform of at least 500mm wide; and

Refer to MOM’s legislation on other requirements involving scaffolds.

4.1.4 Equipment and Hand-held Cutting Tools

Plant pruning is carried out for various reasons which include regulating plant growth, removal of dead or diseased branches, clearing of traffic obstruction as well as for aesthetics purpose.

The equipment and tools used to facilitate such plant pruning work also vary from relatively large machinery such as cranes and chain saws to small hand tools such as secateurs and shears.

More information on:
- Hazards involving the operation of cranes and their control measures on page 15
- Hazards involving the operation of chainsaws and their control measures on page 18

With a wide range of tools available, landscaping 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 significantly the impact and cutting hazards associated with the use of such hand tools.

Use of Scaffolds
- Use scaffold which is stable and secured in position;
- Provide proper access and egress (e.g., stairs) to enable workers to go up and come down from the scaffold;
- Install guard rails and toe-boards on scaffold to reduce potential fall of person and object;
- Provide work platform of at least 500mm wide; and

Refer to MOM’s legislation on other requirements involving scaffolds.

Safe Work Practices when Working on Platforms
- Barricade work area to prevent unauthorised entry into operational zone; and
- Secure hand tools properly to prevent accidental displacement and dropping onto the traffic below.

Figure 45: Install guard rails and toe-boards on scaffold.

Figure 46: Maintenance of greenery planted on building structures or along walkways and railings can be hazardous.

Figure 47: Put on work restraint systems to prevent fall.

Figure 48: Various hand-held tools for plant pruning works.

Secateur
For most pruning needs

Shear
For pruning a simple hedge

Pruning Saw
They are narrow enough to fit into tight spaces between branches

Electrical Hedge Pruner
To prune large or long hedges

Lopping Shear
Long handles allow for better leverage (when dealing with thicker branches) and further outreach (into the middle of bushes)

Pole Pruner
To prune small trees without a ladder
4.2 Watering Operation

Watering operation is an important activity in horticulture management as water is essential for plant maintenance and growth.

For watering small quantities of plants, watering cans are used. However, for large scale watering, water tankers are utilised instead. These water tankers are often deployed in parks and along the roads to facilitate watering operation.

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 falling from the water tanker. He is thus required to secure his safety belt and to wear safety boots during operation.

Safe Work Practices for Water Tankers Operating in Parks/ Roads

- 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 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 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 arrows lights; and
- Use Truck Mounted Attenuator (TMA) when working on expressways and roads with speed limits of above 70km/h.

Figure 51: Place warning signs at prominent locations to alert and divert traffic.

Figure 52: Cordon off work when carrying out stationary watering.

Safety Tips when Using Tools

- 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 49: Safety tips when using tools.

Figure 49: Safety tips when using tools.

Figure 50: 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.

1. Luminous vest
2. Safety belt
3. Safety boots
5. Grass Maintenance

Grass maintenance activities primarily involve the use of equipment (including grass cutter and ride-on mower) and the transportation of these equipment using lorries.

5.1 Operation of Grass Cutter

A grass 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 operation of a nylon grass cutter is generally safer than the blade cutter. However, the grass cutter, if used in an unsafe manner, can cause serious injuries to workers and other persons in the vicinity. 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.

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.

Safe Work Procedures for Grass Cutting

- 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);
- Carry out grass cutting operations in parks during stipulated timing;
- Barricade work areas especially in areas with high human traffic;
- Co-ordinate tree and/or horticulture management activities together with grass cutting operations (when working along expressways);
- Refer to page 15 for control measures when working along roadsides;
- Check the grass 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 grass cutter. Do not strike its cutting head against any solid objects (e.g., concrete, rocks, wood etc.);
- Keep the cutting head below the waist and do not operate it above head level;
- Keep hands, feet and other body parts away from the nylon line;
- Maintain good footing when working on slopes or slippery areas;
- Switch off the engine and let the nylon line come to a stop before lifting the grass cutter to a new position; and
- Ensure grass cutting machine is well maintained and without modification, to minimise the level of noise generated.

Figure 53: Grass maintenance work taking place.

Figure 54: Inspect the turf area for foreign items such as rocks and nails prior to starting work.

Figure 55: Barricade work areas with high human traffic.

Figure 56: PPE for grass cutting.
5.2 Grass Maintenance on Steep Slope

While most of the grass maintenance activities are carried out on flat grounds or gentle slopes, there are circumstances where workers need to cut grass on steep slopes. Such activities are usually carried out by using hand-held grass cutters instead of ride-on mower, so as to reduce the risk of the latter toppling over on steep slope.

Safe Work Procedures for Grass Cutting on Steep Slope:

- Carry out a risk assessment before work commencement to ensure that the risk is eliminated or reduced to as low as is reasonably practicable. In the first instance, an assessment should be made to establish whether rope access is an appropriate method for the work. Additional factors like difficulty in reaching the point of descent, lack of convenient anchorages, presence of sharp objects and obstructions on the ground, uneven ground, etc, 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 slope. 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, please 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 a clear communication with co-workers using mobile phone, radio, walkie-talkie, whistle, etc.
- Establish a proper rescue plan.

5.3 Operation of 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. Precautions should be taken when riding the mowers on high terrain such as slopes.

Precautions to Observe when Operating a Mower

- Prior to work commencement, clear foreign objects (e.g., stones, wires etc.) 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;
- On slopes, keep all movements slow and gradual. Mow up and down and not across. Do not make sudden changes in speed and direction which can cause the mower to roll over;
- 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.
5.4  Transportation of Equipment using Lorries
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 Procedures when Transporting Using Lorries
- Use slings or other means to secure the equipment during 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.

6.  Park Cleansing
Park cleansing involves the cleaning of park premises, facilities and amenities. These include park compound, ponds (water bodies), toilets, concrete tables and footpaths, benches and lighting. To facilitate the cleaning operation, equipment, tools and chemicals are used. Equipment and tools include ladders, jet washing machines and all terrain litter vehicle (ATLV). The chemicals used are primarily the cleaning agents (used for toilet cleaning).

6.1  General Park Cleaning Operations
General park cleansing operations involve the use of chemicals (cleaning agents) and also requires workers to work at heights (such as using ladders to access lamp posts or gutters of roof structures).

These hazards and their respective control measures are covered in separate sections. For safe use of ladders, see page 31-32. For safe use of chemicals, see pages 56 to 59. Other hazards involved in cleaning operations include slips and falls, contact with hazardous substances and the operation of jet washing machine.
Safe Work Procedures for Park Cleaning Operations

- Assess the work area before start work. Look out for infectious material such as vomit substances. If present, 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;
- Wear ear protection to protect the hearing of workers handling the jet washing machine.

Safe Work Processes for Operating Jet Washing Machine

- Only trained workers should be allowed to operate the jet washing machine;
- Check the vicinity of the 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.

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, and it simply picks up the debris as it drives over it.

Safe Work Processes for Operating the All Terrain Litter Vehicle

- 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;
- Look out for other users in the work vicinity;
- Conduct operational checks on ATLV and its components before use; and
- Look out for other users in the work vicinity.

More information on:
- Safe use of ladders on page 31
- Safe use of chemicals from pages 48 to 49

6.2 Cleaning Water Bodies

Certain parks may have large water bodies such as ponds. To clean these water bodies, workers usually sit on small boats and use nets to scoop out fallen leaves and litter. 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 which can possibly lead to head injuries and even drowning.

6.2.1 Water Safety Checks

For the worker cleaning water bodies:

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

For other co-workers:

- 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 Procedures when Cleaning Ponds
- 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 area.

7. Construction Management and Facilities Management

Construction Management oversees the construction of parks and park connectors. These construction projects are normally awarded to contractors who will build the facilities and amenities required.

The park facilities and amenities include visitor centres, viewing towers, shelters, bridges, playground and fitness equipment, concrete and tarmac footpaths, park furniture, landscaping and tree planting, toilets, lightings and signages.

Contractors undertaking such construction projects are required to register the worksites with MOM, as well as to comply with the legal requirements stipulated in the WSH Act and its subsidiary legislations.

In addition, managing authorities such as National Parks Board (NParks) may issue Safety Guidelines from time to time to impose other requirements to ensure safe conduct of operation for the construction projects.

Subsequent to the construction, regular maintenance and upgrading of these park facilities and amenities are carried out to enhance their relevance and recreational value.

Facilities Management is responsible for such maintenance and upgrading works, and the works are normally carried out by contractors on a term contract basis. The contracts can be divided into areas such as building and civil works, mechanical works and electrical works.

Similar to Construction Management, the contractors undertaking facilities maintenance contracts are also required to register the worksites with MOM, as well as to comply with the legal requirements stipulated in the WSH Act and its subsidiary legislations.

Also, managing authorities such as NParks may issue Safety Guidelines from time to time to impose other requirements to ensure safe conduct of facilities maintenance works.
8. 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 fertilizers, herbicides and pesticides (insecticides and fungicides).

In addition to the above, chemicals are also 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. Manufacturers 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 chemical.

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

8.1 Storage and Handling of Chemicals

Chemicals are usually toxic and therefore potentially dangerous to our health. They can also be 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 galvanized or stainless steel are not suitable as some chemicals may react with the steel to produce hydrogen gas, which is flammable and easily ignited.

Chemicals should be stored in dry and well-ventilated areas, away from heat and direct sunlight. Chemical containers should be properly labeled, and covered when not in use. Safety equipment (such as fire extinguishers and washing facilities) and personal protective equipment (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.

Safety Tips for Storage of Chemicals

- 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;
- 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 etc.) 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 and spillage; and
- Chemical stores should have self containing drainage trays around the base of the racks/cupboards.
8.2 Application and Use of Chemicals

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.

8.3 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

- 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.

Safe Work Procedures when Applying and Using Chemicals

- 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 while handling chemicals;
- Wash immediately after contact with chemicals. Seek medical attention, if pain persists or after ingestion of chemicals;
- Arrange for medical examination every 6 months and at pre-employment for workers who are exposed to organophosphates (chemical), a type of pesticide. Some examples include parathion, diazinon, etc;
- 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;
- Clean the equipment and apparels thoroughly before and after use to avoid chemical contamination; and
- Wash hands immediately after handling chemicals. The worker should take a shower if possible, especially after a spray application.

More information on:
Hazards of handling petrol and their control measures on page 23
9. Other Hazards and Controls

It is noted that some work hazards (such as 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, construction management or facilities management activities.

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

9.1 Contact with Poisonous/Venomous/Stinging/Biting Animals

Workers doing landscaping jobs often come into contact with these animals. 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

- 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 if only 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.

9.2 Exposure to 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. Also, workers should adopt good hygiene habits such as washing themselves thoroughly after coming into contact with soil.

Precautions to Take when in Contact with Soil

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

9.3 Heat Stress

Landscaping works are primarily outdoor 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 fluids 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

- Implement appropriate work-rest schedule to enable workers to have sufficient rest breaks;
- Schedule strenuous activities to cooler times of the day of practical;
- Provide a sheltered rest area where 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 fluids.
9.4 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 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 (see examples below).

10. Personal Protective Equipment

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 used, 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 machine, use of less hazardous chemicals, training of workers, instituting procedures for safe operation of equipment, and provision of traffic warning cones can be used.

In addition, personal protective equipment (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 the PPE largely depend on the PPE being chosen correctly, fitted properly, maintained in good condition and worn by the workers at all times.

10.1 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.

10.1.1 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 also not be too loose as to pose a hazard to workers working with and around rotating machinery. For works involving hazardous machinery such as the chainsaw, additional protective clothing (e.g., chainsaw chaps) will be required.

Figure 81: There are times when a worker needs to bend down to clear the drains.

Figure 82: Basic standard work attire.
10.1.2 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 wet environment such as toilet cleaning, safety boots must be provided to and worn correctly by workers to guard against slipping and falling.

10.2 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.

10.2.1 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.

10.2.2 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.

10.2.3 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 dusts or smaller particles, direct ventilated cover goggle or non-vented cover goggle can be used for eye protection.

NB: ventilation ports prevents fogging of goggles
10.2.4 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 shields are considered as a primary protection to the facial area but secondary protection for the eyes. Face shields 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.

10.2.5 Hearing Protection

Excessive noise can cause hearing loss to workers. Workers should not be exposed to noise levels exceeding 85 dBA for 8 hours a day or its equivalent [see Permissible Exposure Level (PEL) on the next page].

Hearing protection (ear plugs or ear mufflers) 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 mower. [see Permissible Exposure Level (PEL) for noise in Annex 1]

10.2.6 Hand Protection

Hand protection (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 pesticide and fertilizer, and working with hand tools.

10.2.7 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 systems/ 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.

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**Examples of sound level for comparison**

<table>
<thead>
<tr>
<th>Source</th>
<th>dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold of hearing</td>
<td>0</td>
</tr>
<tr>
<td>Average residential home, library</td>
<td>40</td>
</tr>
<tr>
<td>Whisper</td>
<td>50</td>
</tr>
<tr>
<td>General office, average conversation</td>
<td>60</td>
</tr>
<tr>
<td>Conversational voice</td>
<td>70</td>
</tr>
<tr>
<td>CNC machine</td>
<td>80</td>
</tr>
<tr>
<td>Typical home music listening levels</td>
<td>85</td>
</tr>
<tr>
<td>Shouting</td>
<td>90</td>
</tr>
<tr>
<td>Auto horn, pneumatic hammer</td>
<td>100</td>
</tr>
<tr>
<td>Loud rock band</td>
<td>110</td>
</tr>
<tr>
<td>Chipping hammer, jet take-off, pneumatic drill at 1m</td>
<td>120</td>
</tr>
<tr>
<td>Jet engine at 30m</td>
<td>130</td>
</tr>
<tr>
<td>Jet engine, threshold of pain</td>
<td>140</td>
</tr>
<tr>
<td>Jet engine close up</td>
<td>150</td>
</tr>
<tr>
<td>Rocket</td>
<td>180</td>
</tr>
</tbody>
</table>

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Figure 87: Face protection.
11. Emergency Response Plan

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

- Workers working on road sidetable 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.

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

The following list of items (non-exhaustive) may be included in the establishment of an emergency response plan:

- procedures for raising of alarm;
- procedures for evacuation and rescue of victim;
- provision of means of rescue and first aid;
- provision of means of communication with relevant government authorities and response agencies; and
- establishing an emergency response team with the duties and responsibilities of each member clearly defined, with emergency contacts.

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

11.1 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.

For more information, refer to the publication, “A Guide to the Workplace Safety and health (First Aid) Regulations” which is available at MOM's website: www.mom.gov.sg'

12. 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 (Scaffolds) Regulations
- WSH (Noise) Regulations
- WSH (Medical Examinations) Regulations
- WSH (First Aid) Regulations
- Management of Hazardous Chemicals Programme
- Fatigue Management Guidelines
- Workplace Traffic Safety Management Guidelines
- Safe Loading on Vehicles Guidelines
- A Guide to the Workplace Safety and health (First Aid) Regulations
- Managing 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
- Guidelines on Working Safely on Roofs

National Parks Board

- Arboriculture User Instructions and Manuals
- Parks Management User 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
13. Acknowledgements

We acknowledge TEHC INTERNATIONAL PTE LTD for their assistance in providing some of the images used in this Guidelines.
Annex 1–Permissible Exposure Limits for Noise

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

<table>
<thead>
<tr>
<th>Sound pressure level, dB(A)</th>
<th>Maximum duration per day</th>
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<td>82</td>
<td>16 hours</td>
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<tr>
<td>83</td>
<td>12 hours 42 minutes</td>
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<tr>
<td>84</td>
<td>10 hours 5 minutes</td>
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<td>85</td>
<td>8 hours</td>
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<td>86</td>
<td>6 hours 21 minutes</td>
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<td>87</td>
<td>5 hours 2 minutes</td>
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<tr>
<td>88</td>
<td>4 hours</td>
</tr>
<tr>
<td>89</td>
<td>3 hours 11 minutes</td>
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<tr>
<td>90</td>
<td>2 hours 31 minutes</td>
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<tr>
<td>91</td>
<td>2 hours</td>
</tr>
<tr>
<td>92</td>
<td>1 hour 35 minutes</td>
</tr>
<tr>
<td>93</td>
<td>1 hour 16 minutes</td>
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<tr>
<td>94</td>
<td>1 hour</td>
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<td>95</td>
<td>48 minutes</td>
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<td>96</td>
<td>38 minutes</td>
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<td>97</td>
<td>30 minutes</td>
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<td>98</td>
<td>24 minutes</td>
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<td>99</td>
<td>19 minutes</td>
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<td>15 minutes</td>
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<td>101</td>
<td>12 minutes</td>
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<tr>
<td>102</td>
<td>9 minutes</td>
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<tr>
<td>103</td>
<td>6 minutes</td>
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<tr>
<td>104</td>
<td>4 minutes</td>
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<td>45 seconds</td>
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<td>109</td>
<td>35 seconds</td>
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<td>110</td>
<td>28 seconds</td>
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<td>111</td>
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<td>112</td>
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<td>122</td>
<td>1 second</td>
</tr>
<tr>
<td>123</td>
<td>&lt;1 second</td>
</tr>
</tbody>
</table>

Annex 2–Sample of a Risk Assessment

<table>
<thead>
<tr>
<th>Hazard Identification</th>
<th>Risk Evaluation</th>
<th>Existing Controls</th>
<th>S</th>
<th>L</th>
<th>Risk Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ref</td>
<td>We do activity</td>
<td>Hazard</td>
<td>Possible Injury / Ill-health</td>
<td>S</td>
<td>L</td>
</tr>
<tr>
<td>1</td>
<td>1 Dissolve insecticide in water</td>
<td>Excessive inhalation of toxic powders</td>
<td>Nervous system effects (workers)</td>
<td>1 (1) Well-ventilated area for mixing (2) Training of workers on proper handling of chemicals (3) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, suitable respirators, chemical resistant glove)</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2 Applying insecticide mixture with a sprayer</td>
<td>Excessive inhalation of toxic fumes</td>
<td>Nervous system effects from over-exposure (workers, members of public)</td>
<td>2 (1) Check hand-held sprayer before use (2) Cordon off area (3) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, chemical resistant glove)</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>3 Applying insecticide mixture with a sprayer</td>
<td>Drifting of toxic fumes into eyes</td>
<td>Eye irritation (Workers, members of public)</td>
<td>3 (1) Cordon off area (2) Prohibit unauthorised entry (3) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, chemical resistant glove)</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>4 Applying insecticide mixture with a sprayer</td>
<td>Excessive skin absorption of toxic chemicals</td>
<td>Skin irritation (Workers, members of public)</td>
<td>4 (1) Cordon off area (2) Prohibit unauthorised entry (3) Wear appropriate personal protective equipment (protective clothing, face shield, safety goggles, chemical resistant glove)</td>
<td>2</td>
</tr>
</tbody>
</table>