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Acknowledgements
The logistics industry contributes significantly to our country’s economy and supports many other economic activities.

Warehouse assistants, deliverymen and container drivers can be exposed to a variety of health and safety hazards at work depending on their specific tasks. Musculoskeletal disorders and injuries can arise from manual handling activities. Workers may be exposed to chemicals, noise, vibration and thermal stress. Accidents include falls, being hit by falling objects, crushing injuries, electrocution and fire and explosion.

Work-related injuries and diseases may occur as a result of unsafe acts and conditions. Unsafe acts occur when employees are unaware of the hazards and the proper work practices, e.g., not adopting the proper lifting methods. Unsafe conditions arise out of ignorance or lack of diligence in ensuring a safe and healthy working environment, e.g., a slippery floor. Work-related accidents and diseases can be prevented by identifying the hazards and taking appropriate preventive measures.

These guidelines provide information and guidance on the identification of work hazards and their prevention. Employers should work together with employees to establish a safe and healthy working environment.
HEALTH HAZARDS
Manual handling of materials is one of the most common activities in a warehouse. It includes lifting, lowering, pushing, pulling, carrying or holding an object. Injuries to the back, neck, shoulders, arms and hands can occur during manual handling. Musculoskeletal injuries could result from a single episode such as lifting a very heavy load or slipping and falling. However, more often it is the result of gradual wear and tear from repetitive and prolonged manual activity. Recovery from some of these injuries may take time and further injury may occur, making the problem worse. Therefore it is important to identify the risk factors and take preventive actions to minimise the risk.

**Factors that Increase the Risk of Injury**

- **Heavy or bulky loads**

  The heavier the load, the greater the risk of injury. Regularly lifting loads over 25 kg can result in a higher risk of back injury. A bulky object is more difficult to lift because it cannot be brought close to the body. Lifting a bulky object may also force one into an awkward and unbalanced position or cause obstruction of vision.

- **Awkward postures**

  Prolonged awkward postures increase stress on the muscles and ligaments. Examples of awkward postures include bending or twisting the back during lifting or working with the arms above shoulder height to retrieve objects.
• **Position of the load**

A load lifted far from the body puts more stress on the back than the same load lifted close to the body. The preferred range of lifting is between the knee and shoulder height. Lifting above and below this range is more hazardous.

• **Incorrect manual handling methods**

Inexperienced, untrained and unskilled employees may be at greater risk of injury.

• **Poor workplace design**

Poor layout of the workplace increases the risk of injury. Shelves that are too deep, too high or too low causes unnecessary bending or stretching. Lack of space to move freely, unsuitable dimensions of furniture and equipment, poor lighting, slippery floors, and poor housekeeping also increase the risk of injury.

• **Prolonged, repetitive and fast-paced work**

The risk of injury increases when the task is carried out more often, faster or over a longer period. Staff shortages, unrealistic targets and insufficient rest breaks may increase the risk of injury. This is of particular concern for deliverymen who have to meet a very tight schedule.

**Good Ergonomic Practices for Warehouse Workers**

Warehouse workers receive and unload goods from trucks, move and store them. They also pick, pack and load goods onto the delivery trucks. This involves manual handling, pushing and pulling of jacks and trolleys, and handling of powered vehicles and equipment. They may also have to work on very tight time schedules.

The risk of manual handling injuries may be reduced by re-designing the hazardous task and the work environment. Proper equipment and
training in the proper lifting and carrying methods should also be provided to prevent back strain and injury.

- **Eliminate manual handling of heavy loads**

  Wherever possible, use automation or lifting equipment such as fork lift trucks, cranes and hoists to minimize the manual lifting of heavy loads.

- **Modify workplace lay-out**

  Re-arranging the layout or design of plant, equipment or furniture, and sequence of operations can reduce twisting, stretching and stooping.

  Eliminating height differences can reduce bending and lifting from the floor.

  This can be done by using a height-adjustable trolley, level loader or a forklift to raise the level of the pallet.
Heavier and more frequently used objects should be stored at waist level as this is a safer level for handling.

Using a pallet turntable reduces the need to stretch over to retrieve the load.

Conveyor belts can help reduce lifting and carrying.

- **Modify the load**

  The use of smaller and less heavy packaging can reduce the load and its bulkiness, e.g., a load of 30 kg can be re-packaged into two 15 kg packages.

  For heavy loads, the weight should be indicated on the load to warn workers. Suitable handles or hand grips may help improve the handler’s grasp.
• **Use pallet jacks and trolleys to move goods**

- Ensure that the load on the pallet is even
- Pull manual pallet jacks on the level ground
- Walk slowly
- Back pallet jacks down ramps or into closed areas, e.g., elevators
- Lubricate the wheels and hydraulic handles regularly
- Do not use if the fork wheels are out of alignment or when the fork lifts unevenly

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• **Practise good manual handling methods**

**PROPER HANDLING TECHNIQUES**

Workers performing manual handling tasks should be trained on proper handling technique

**Step 1:** Assess the load and plan the lift. Do you need help? Can you use some lifting equipment? Clear the path of any obstructions.

**Step 2:** Grasp the object firmly and hold the object close to the body.

**Step 3:** Lift the object by pushing up on your legs. Avoid jerking or twisting your back.

**Step 4:** Ensure feet are stable and good grip on object before moving off.
Stock Picking

Musculoskeletal injuries may result from overstretchesfing or exertion during retrieval of items from shelves

Bending and forward stretching to reach loads stored in deep shelves

- Lift with wet or oily hands
- Turn by rotating at the waist
- Lift heavy items if you are not in good physical condition
- Jerk to lift an object off a surface
- Drop an item to put it down
- Run when carrying
- Hurry up or down stairs or ramps
- Carry items by the straps or tapes
A trolley with a ladder allows workers to pick items from higher shelves and place them on the trolley but care should be taken to avoid twisting the back.

- Design shelf height and depth to minimize back bending and forward stretching
- Avoid twisting the back during retrieval of items

Packing and Shrink Wrapping

Risk include musculoskeletal injuries from repetitive manual handling and awkward postures

- Use rolls that are lightweight for manual wrapping
- Use an automated pallet wrapping device if available
- Raise the height of the pallets to reduce back bending
Good Ergonomic Work Practices for Deliverymen

Deliverymen load and unload goods to and from the delivery truck and transport them to the various outlets on a very tight schedule.

Manual handling activities carried out at a fast pace are common. Space constraints in the delivery truck and poor design in some receiving outlets can result in limited access and awkward postures.

Good work practices, the provision of sufficient man-power, a reasonable schedule, good planning of the routes and proper equipment are important measures in the protection of the health and safety of the deliverymen.

Use of Trolleys to Move Goods

- Place loads evenly to prevent tipping
- Load and secure items so that they will not slip or fall
- Do not overload or pile loads too high so as not to obstruct view
• Push rather than pull carts and trolleys on level ground

• Do not place hands where they may be hurt by doorways, walls or other objects being passed by

• Walk at appropriate pace when pushing

• Ensure carts and trolleys are properly maintained, e.g., wheels aligned and parts regularly lubricated

• Wear gloves and safety shoes

Safety shoes protect feet and prevent slipping

Corrugated floor of the truck reduces friction and allows sliding of goods

Trays with handles allow better grip

Two men working as a team

Stackable trays provide stability

Use of the J hook reduces bending

Ramps are provided at entrance
Provision of an automated tail-gate will reduce manual lifting of the goods from the truck to the ground level.
Some warehouses store chemicals and pack them into containers or bags. Warehouse assistants who handle or pack chemicals and deliverymen who transport them may be exposed to the chemicals.

Hazardous chemicals may be corrosive, irritating, toxic, flammable or carcinogenic. Direct skin contact with some chemicals may cause burns or skin rashes from irritation or allergy. Chemical spills and splashes may damage the eyes. Volatile chemicals, such as solvents, can be inhaled. High concentrations of vapour or gas can accumulate particularly in poorly ventilated and confined areas. It is therefore important that employees who work with chemicals are aware of the hazards, trained in handling the chemicals and follow safe work practices to avoid chemical exposure.

**Chemical Hazards**

Using a local exhaust ventilation during chemical filling

Wearing proper personal protective equipment when packing powdered chemicals
**Safe Work Practices for Handling Hazardous Chemicals**

- Provide local exhaust ventilation where there is a risk of inhalation
- Provide emergency showers and eye wash where corrosives are handled
- Wear suitable personal protective equipment
- Do not allow unauthorised access to hazardous chemicals
- Inspect chemical stores regularly to check for deterioration or leakage
- Keep stored quantity to a minimum
- Ensure that all chemical containers are properly labelled and warning signs are displayed in and around areas where chemicals are stored
- Ensure that every stored chemical has a Material Safety Data Sheet (MSDS). The classification of chemicals, labelling of chemical containers and format of MSDS should follow the Globally Harmonized System of Classification and Labelling of Chemicals
- Arrange for medical examinations for staff exposed to chemicals listed under the Factories (Medical Examinations) Regulations

**Storing Flammables**

- Store flammable solvents in safety containers and keep flammable liquids in steel cabinets away from any heat source
- Do not keep flammable liquids on open shelves
- Do not store flammable liquids in refrigerators
- No smoking or naked flame should be allowed at or near the storage area
- Suitable fire-fighting equipment should be available at the storage area
**Storing Toxics**

- Store toxic chemicals in proper containers
- Highly toxic chemicals should preferably be stored in double containment and kept under lock
- Do not store toxic chemicals on high shelves where there is a risk of dropping during transportation

**Storing Corrosives**

- Store acids or alkalis in plastic or other suitable containers
- Keep strong acids and bases in separate cabinets, preferably with catch trays
- Store the main stock of concentrated acids and bases as near to the floor as possible

**Storing Reactives**

- Store in isolated, cool, dry areas and away from direct sunlight
- Keep open flames and other sources of heat away
- Avoid shock, friction and all forms of impact on the chemicals
- Do not store incompatible materials near each other to prevent accidental contact
- Keep chemicals which readily absorb moisture or react violently in tightly sealed containers or desiccators

**Useful Guidelines for Controlling Chemical Hazards**

- Guidelines on Prevention and Control of Chemical Hazards
- Guidelines on Risk Assessment for Occupational Exposure to Harmful Chemicals
- Guidelines on Local Exhaust Ventilation
- Guidelines for Material Safety Data Sheets
### Chemical Spills

- Isolate the area and contain the spill to prevent it from spreading through drains or any other openings.

- Follow appropriate decontamination procedures when handling toxic chemical spills. Refer to the MSDS for specific recommendations.

- Dilute acids with care. Always add acid to water, never add water to acid.

- If a strong corrosive chemical is spilled, use a neutralizing agent to neutralize it before flushing with water or using an absorbent to absorb it.

- If a flammable liquid is spilled, turn off ignition and heat sources, and turn on the exhaust ventilation system if it is safe to do so. Evacuate all personnel from the spillage area if necessary.

### List of chemicals and their incompatible chemical(s)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Incompatible Chemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid</td>
<td>Chromic acid, nitric acid, hydroxyl-containing compounds, ethylene, glycol, perchloric acid, peroxides and permanganates</td>
</tr>
<tr>
<td>Acetone</td>
<td>Concentrated nitric and sulphuric acid mixtures</td>
</tr>
<tr>
<td>Acetylene</td>
<td>Chlorine, bromine, copper, silver, fluorine and mercury</td>
</tr>
<tr>
<td>Alkali and alkaline earth metals, such as sodium, potassium, lithium, magnesium, calcium, powdered aluminium</td>
<td>Carbon dioxide, carbon tetrachloride, and other chlorinated hydrocarbons (Also prohibit water, foam, and dry chemical on fires involving these metals- dry sand should be used)</td>
</tr>
<tr>
<td>Ammonia (anhydrous)</td>
<td>Mercury, chlorine, calcium, hypochlorite, iodine, bromine and hydrogen fluoride</td>
</tr>
<tr>
<td>Ammonium nitrate</td>
<td>Acids, metal powders, flammable liquids, chlorates, nitrites, sulphur, finely divided organics or combustibles</td>
</tr>
<tr>
<td>Aniline</td>
<td>Nitric acid, hydrogen peroxide</td>
</tr>
<tr>
<td>Arsenic materials</td>
<td>Any reducing agent</td>
</tr>
<tr>
<td>Azides</td>
<td>Acids</td>
</tr>
</tbody>
</table>

**Chemical Spills**

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Other Health Hazards

Noise Hazard

There are certain areas in the warehouse where staff may be exposed to a noisy process or equipment, e.g., moving empty drums in the drumming line or driving a forklift with a noisy engine. Long term exposure to excessive noise may lead to hearing loss.

To prevent hearing loss, a person should not be exposed to noise levels exceeding 85dBA for 8 hours a day or its equivalent. Where the permissible exposure level is exceeded, measures should be taken to reduce the noise exposure.

<table>
<thead>
<tr>
<th>Sound Pressure Level dB(A)</th>
<th>Maximum Duration Per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>85</td>
<td>8 hours</td>
</tr>
<tr>
<td>88</td>
<td>4 hours</td>
</tr>
<tr>
<td>91</td>
<td>2 hours</td>
</tr>
<tr>
<td>94</td>
<td>1 hour</td>
</tr>
<tr>
<td>97</td>
<td>30 minutes</td>
</tr>
<tr>
<td>100</td>
<td>15 minutes</td>
</tr>
<tr>
<td>103</td>
<td>7.5 minutes</td>
</tr>
<tr>
<td>106</td>
<td>4 minutes</td>
</tr>
<tr>
<td>109</td>
<td>2 minutes</td>
</tr>
<tr>
<td>111</td>
<td>1 minute</td>
</tr>
</tbody>
</table>

Permissible exposure levels showing the corresponding length of time allowed for the various noise levels

Some Noise Control Solutions

- Replace noisy machinery with quieter substitutes
- Locate noise sources away from hard walls or corners
- Isolate or enclose noise sources
- Construct suitable noise enclosures or barriers
- Line interior surfaces with sound absorbing materials
- Maintain machinery and equipment at regular intervals
- Wear ear plugs or ear muffs

Useful Guidelines for Controlling Noise Hazard

- Guidelines on Industrial Noise and Vibration Control
- Hearing Conservation Programme Guidelines

Use suitable hearing protection

Enclose noisy machinery to reduce noise in the warehouse
**Vibration Hazard**

Warehouse workers who operate forklifts or other powered vehicles and those who drive or sit in delivery trucks may be exposed to vibration hazards. Prolonged and excessive exposure to whole body vibration may lead to lower back pain and disorders of joints and muscles.

**Some Vibration Control Solutions**

- Provide sufficient cushioning or vibration absorbers on the seats of vehicles
- Maintain machinery and equipment at regular intervals

*Delivery truck drivers may be exposed to severe vibration hazards*

*A well cushioned seat reduces vibrations to the driver*
Thermal Stress

Some warehouse workers may work under extreme temperature conditions, e.g., a deliveryman unloading goods under the hot sun or a warehouse operator working in a cold storage room. Such environments can be very uncomfortable and may affect workers’ health. An environment that is too hot can lead to headaches, fatigue and heat disorders like heat strokes, heat cramps and heat exhaustion. An environment that is too cold can lead to hypothermia and frostbites.

Avoid wearing thick clothing when unloading cargo under the sun

Preventing Heat Stress

- Provide appropriate ventilation through a carefully planned and laid out exhaust and air conditioning system in enclosed spaces
- Provide shelters for the loading / unloading bays to shield against the sun
- Provide adequate openings in the warehouse to allow fresh air exchange
- Implement and follow an appropriate work-rest schedule
- Avoid thick clothing
- Drink plenty of water to replenish water lost through dehydration

Controlling Cold Exposures

- Avoid standing directly in front of or below refrigeration vents
- Provide thermal insulation for metal handles and tools
- Provide adequate and suitable clothing and gloves
**Lighting**

Poor lighting in the warehouse can cause eye strain and contribute to serious accidents. Adequate lighting should be provided for workers to be able to see clearly the task and machinery they operate.

<table>
<thead>
<tr>
<th>Type of Interior or Activities</th>
<th>Maintenance Illuminance (Lux)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corridors and walkways</td>
<td>50</td>
</tr>
<tr>
<td>General storage</td>
<td>80</td>
</tr>
<tr>
<td>Storage routinely involving reading tasks</td>
<td>160</td>
</tr>
</tbody>
</table>

*Difficulty in seeing in a badly lit warehouse*
SAFETY HAZARDS
Hazards from Operation of Powered Vehicles

Most warehouses make use of powered equipment to handle or move materials. Powered equipment can be divided into two types: the built-in type which includes conveyor systems, narrow aisle systems, automated storage and retrieval systems; and the vehicular equipment which moves on wheels or treads, such as forklifts, reach trucks, platform lifts, mobile cranes, etc.

Some common hazards linked with the use of such equipment are collision, being caught in between objects, being struck by falling objects and being crushed by the equipment. Thus, it is important that all persons operating these equipment are sufficiently trained in the safe operation of the equipment. This equipment should be inspected daily to ensure they are in good working condition before they are used.

Built-In-Type

- **Statutory lifting equipment**
  Statutory lifting equipment refers to hoist and lift, lifting gear, lifting appliances and lifting machines. This equipment must be inspected by Approved Persons within a specified time period.

- **Conveyor system**
  Usually roller and belt conveyors are used to move materials. Rotating mechanisms such as these can grip clothing or hair, or through skin contact, force an arm or hand into a dangerous position.

**Use Conveyor with Care**

- Guard the gears, chain drives, and revolving shafts of live roll conveyor
- Install warning devices and controls for emergency stops at convenient places
- Announce the shut down of the machine, shut off power, lock the switch and put up warning signs before repair and cleaning work is done
- Conduct regular inspections for defects
- Refrain from wearing loose or frayed clothing or jewellery that could get caught
- Do not try to reach into any moving parts of the machinery with your fingers
Narrow Aisle System

In order to maximize the space usage and storage effectiveness, the aisles in between racks are often very narrow. Some powered industrial equipment are designed to be used at these narrow aisles.

Operating Narrow Aisle System

- Follow manufacturer’s operating procedure
- Allow only trained operators to operate the machine
- Ensure load capacity is not exceeded
- Inspect machine daily before using
- Do not stand on elevated fork or use forks to move workers
- Do not remove any safety interlocks from the system

Automated Storage and Retrieval System

Automated guided vehicles do not need an operator. They follow prearranged routes controlled by sensors which follow light beams or induction tape.

Use Automated Guided Controlled Vehicles with Care

- Follow manufacturer’s operating procedure
- Inspect the automated guided vehicles regularly
- Announce the shut down of the machine, shut off power, lock the switch and put up warning signs before repair and cleaning work is done
- Do not remove any safety interlocks from the system
- Do not obstruct aisles used by the automated vehicle even temporarily
Vehicular Equipment

- **Forklift**

The forklift is commonly used in most warehouses. The type of hazard present in a location determines whether diesel, electric, gasoline, or liquefied petroleum gas-powered forklift may be used and the additional safeguards that must be present.

Battery-charging installations must be located in areas designated for that purpose. Facilities must be provided for flushing electrolyte for fire protection, for protecting charging apparatus from damage by trucks, and for adequate ventilation for dispersal of fumes from gassing batteries. There must be no smoking in the charging area, and special care must be taken to avoid electrolyte spray. Open flames, sparks, or electric arcs in battery-charging areas should be prohibited at all times.

**Drive Forklift Carefully**

- Only a trained and authorised operator, who has passed the Forklift Driver’s Training Course, is allowed to operate the forklift
- Follow manufacturer’s operating procedure
- Carry out daily checks before operation
- Inspect the load before lifting to ensure loose materials do not fall off during lifting
- Do not ride on forklifts
- Do not raise load over other workers
- Do not exceed the rated capacity

**Stacker**

Sometimes stackers are used to help in the transportation of materials in the warehouse for storage.

**Safe Use of Stacker**

- Employer should provide sufficient training for workers before they start to operate the stacker
- New workers should be under the direct supervision of experienced workers
- Follow manufacturer’s operating procedure
- Carry out daily checks before operation
- Do not exceed the rated capacity
Falling Hazards from Material Storage

Materials/goods should be stored properly to prevent them from becoming hazards.

Safety Tips for Material Storage

- Keep stored materials on firm foundation
- Use supporting structures to ensure stability and prevent collapse
- Store materials in a stable manner
- Do not pile materials to obstruct lighting
- Do not obstruct fire fighting equipment, e.g. sprinkler, fire hoses, fire extinguishers
- Do not obstruct emergency showers and eyewashes, or spill clean-up equipment
- Do not exceed the load ratings of floors, shelves, etc
- Do not store material against partitions unless the partitions are able to withstand the pressure
- Do not store loose materials or liquids in raised areas above work areas

Beside proper storage of materials, employers also have to provide safe means of access to and egress from the stored material for workers at all times. For example, access such as ladders can be provided to access the stored material. The ladders used in the factory must be well constructed and properly maintained. They must also be securely fixed or held by person to prevent slipping. In addition, if worker is expected to work at a height, methods must be established to ensure the worker is safe, e.g. provision of effective barricades, safety harnesses and independent lifelines.
Electricity is useful if it is properly used and if electrical equipment is properly installed, maintained and operated. However, if it is not properly operated, it may cause electric shocks, burns, fire or explosions and even death.

**Electrical Hazards**

**Electrical Safety**

- Do not use defective electrical equipment
- Do not attempt to repair electrical installation; leave it to the trained electricians
- Insulate wires to prevent contact with electrically energized wires
- Use electrical protective or safety devices such as fuses and circuit breakers to limit or shut off the flow of electricity in the event of a ground fault, overload or short circuit in the wiring system
- Provide workers who are required to carry out work using electrical equipment or work on live conductors with PPE such as boots, insulating gloves
When the surrounding workspace contains flammable substances or explosive mixtures of liquids or gases, a small amount of heat can cause the substance or mixture to ignite and cause a fire or explosion. The accumulation of static electricity can become a source of ignition and increase the risk of fire and explosion. Static electricity is created due to the interaction between objects of different materials or through the movement of dusts or powders. The charges accumulated in the form of static electricity on any insulated object can be discharged when a person touches the object. If this is associated with a dust cloud or flammable substances in the surrounding workplace, an explosion is likely to occur.

**Fire Safety**

- Separate heat source or ignition from inflammable materials, gas or vapour
- Maintain fire fighting equipment, e.g. fire extinguishers, fire hose
- Do not obstruct fire escape passage way
- Ensure workers are familiar with the means of escape

*Do not obstruct fire escape passages*
Management of safety and health should be no different from the way other aspects of the logistics business are managed. Employers are encouraged to develop and implement a comprehensive safety and health programme to prevent workplace accidents and work-related illnesses, and to establish a safe and healthy working environment.

**Safety Policy and Organization**

The management’s commitment is important to ensure the success of the safety and health programme. There should be a written policy which clearly states the management’s commitment and approach towards establishing a safe and healthy work environment. The policy should state the organization’s safety and health philosophy and structure, including objectives and goals to be achieved. It should spell out the duties and responsibilities of both management and staff. The written policy should be endorsed by the top management and communicated to all levels of staff, including contractors.

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**Management Commitment Can Be Demonstrated By:**

- Implementing safety policies, programmes and training with top management support
- Establishing appropriate safety performance goals throughout the organization
- Involvement of management in safety and health activities
- Giving recognition to safety in work performance reviews
- Giving praise to employees who work safely and counselling those who do not

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Responsibilities of Employer and Employee

The employer has a duty to ensure the safety and health of their staff and should take the lead in promoting safety and health in the workplace.

Safety personnel should be appointed to advise management on all occupational health and safety matters, and assist in the implementation of safety and health programmes.

Employees should understand that safety and health is not just the responsibility of the employer, but they too have a role to play.

<table>
<thead>
<tr>
<th>Responsibilities of the Employees</th>
<th>Responsibilities of the Employer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Follow instructions and safe work procedures</td>
<td>• Develop and implement an effective Safety and Health Programme</td>
</tr>
<tr>
<td>• Attend safety training</td>
<td>• Inform all staff of the workplace hazards and ensure that safety rules and safe work procedures are followed</td>
</tr>
<tr>
<td>• Use safety devices and personal protective equipment provided</td>
<td>• Develop a comprehensive safety training programme for all workers</td>
</tr>
<tr>
<td>• Report accidents, incidents, diseases and any workplace hazards to the supervisor or employer</td>
<td>• Provide proper equipment including personal protective appliances</td>
</tr>
<tr>
<td>• Suggest ways to improve safety and health at work</td>
<td>• Provide welfare facilities like rest areas and first aid boxes</td>
</tr>
<tr>
<td></td>
<td>• Document the Safety and Health Programme and keep records of all reported accidents, incidents and diseases</td>
</tr>
</tbody>
</table>
Risk Assessment

It is a good practice to establish systematic procedures for the identification, evaluation and control of both existing and potential hazards in the workplace.

Employers should identify workplace hazards by reviewing both routine and non-routine activities carried out by workers and contractors, and the equipment used. These hazards can be assessed by considering the probability of the hazard and the severity of the injury. Measures can then be developed to control the hazards. Before implementation, it is advisable to test the feasibility of the recommended measures. Documentation of the hazard evaluation process is important.

Risk assessment should be carried out periodically or whenever there is a change in process or equipment used. Risk assessment should be carried out before the development of safe work procedures.

The steps in a risk assessment exercise are summarised in the flowchart below:

**Basic Steps to Risk Assessment**

1. Select activities and equipment for analysis
2. Identify the hazards involved
3. Evaluate the hazards and risk involved
4. Implement measures to control the hazards
5. Evaluate effectiveness of control measures and record findings

Examples of Risk Assessment
Safe Work Procedures

Employers are encouraged to establish safe work procedures for the various types of work carried out in the warehouse. Wherever possible, these procedures should be incorporated into the standard operating procedures for staff to follow. Safe work procedures should be effectively communicated to all staff.

Employers should establish a system to ensure that existing safe work procedures are reviewed whenever new equipment or processes are introduced or there are changes to the operating procedures.

There are legal requirements for safe work procedures for certain work (see table). No work shall commence unless the safe work procedures have been established and implemented.

<table>
<thead>
<tr>
<th>WORK REQUIRING SAFE WORK PROCEDURES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Work on any machinery where the fencing has been removed for the purposes of any examination, lubrication or other operation</td>
</tr>
<tr>
<td>2. Work at a place where a person is liable to fall a distance of more than 3 metres or into any substance that is likely to cause drowning, poisoning, chemical burns or asphyxiation</td>
</tr>
<tr>
<td>3. Work in any confined space</td>
</tr>
<tr>
<td>4. Work involving application of heat, or the potential generation of any source of ignition, where any explosive or flammable substance is liable to be present</td>
</tr>
<tr>
<td>5. Maintenance or repair work on any pressure vessel or lifting equipment</td>
</tr>
<tr>
<td>6. Work on any process, plant, vessel or machinery that is liable to produce or give off to any corrosive, toxic or flammable substance</td>
</tr>
<tr>
<td>7. Work in compressed air environment or under water</td>
</tr>
<tr>
<td>8. Pressurised testing of any pressure vessel or pipes</td>
</tr>
<tr>
<td>9. Spray painting</td>
</tr>
<tr>
<td>10. Dismantling of any pipe or equipment containing steam or substances that are flammable, toxic or corrosive</td>
</tr>
<tr>
<td>11. Any repair or maintenance work carried out on a pressurised hydraulic system</td>
</tr>
<tr>
<td>12. Radiography work</td>
</tr>
</tbody>
</table>
Safety Training

Safety training is important in providing staff with the knowledge and skills to work in a safe manner.

A programme to identify the safety training needs for each level of staff is useful for making training plans.

Safety training for supervisors is particularly important as they have a major role to ensure that their staff work in a safe manner.

Safety training can be incorporated into the operational training of the staff. Such training can be carried out on-the-job, by trained supervisors, or by external trainers. Training records should be kept and training materials reviewed.

When Should Safety Training Be Conducted?

- During orientation period for new employees
- When new equipment or processes are introduced
- When staff are transferred to another department
- Periodically for existing staff

Group Meetings

Group meetings should be conducted regularly to discuss safety and health issues and disseminate safety and health information to staff, including contractors. Employers should provide adequate facilities for such meetings. All staff should be encouraged to participate.

Daily briefs and de-briefs (toolbox meeting) can serve as effective channels for conveying safety and health messages.

Workplaces with 50 or more workers should form safety committees with representation from management and employees. Details on the establishment of safety committees and its function can be found in the Factories (Safety Committees) Regulations.

Employers should encourage their employees to form Safety Improvement Teams. This will provide them with a channel to contribute ideas and solutions to make their workplace a safer and more productive one.
**Accident, Incident and Disease Investigation and Analysis**

Every accident, incident or disease occurring at the work place should be investigated in order to identify the root causes and prevent similar occurrence in the future.

A system should be established for reporting and investigation of any work-related accident, incident or disease. Lessons learnt from the investigations should be communicated to relevant staff.

Accident statistics should be collected and analysed to identify problem areas and trends.

There are legal requirements for the notification of work-related accidents and occupational diseases to the Ministry of Manpower (refer to the MOM website for details: [http://www.mom.gov.sg](http://www.mom.gov.sg))

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**Some Examples of Occupational Diseases Requiring Notification**

- Industrial dermatitis
- Noise induced deafness
- Repetitive strain disorders of the upper limb

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**In-House Safety Rules and Regulations**

A set of written safety rules and regulations should be established for compliance by staff and contractors. These also serve as a reminder of their safety and health obligations and responsibilities. Key legal requirements can be incorporated into these rules and regulations.

More specific or detailed safety rules and regulations can be developed for specific jobs or processes.

---

**Useful References for Setting Up Safety Rules & Regulations**

- National OSH Legislation and Guidelines
- Relevant Singapore Standards & Codes of Practice
- Overseas Guidelines
Safety Promotion

Employers should establish promotional programmes to create safety and health awareness, and build a strong safety culture at the workplace.

Examples of Promotional Activities

- Safety & Health Talks and Seminars
- Safety & Health Campaigns
- Safety & Health Exhibitions
- Newsletters
- Posters & Pamphlets

Evaluation, Selection And Control Of Contractors

It is not uncommon for logistics companies to engage contractors for certain jobs in their premises. Management should establish a system to evaluate, select and control contractors. Such a system allows management to assess contractors based on their safety policy and procedures, safety performance records, safety training and competency records, before any work is assigned.

Safety Inspection

It is important to establish an effective programme to carry out periodic inspections to identify potential hazards, unsafe acts and conditions in the workplace, as well as to monitor any changes in the work process. Please refer to the sample inspection checklist provided. Such inspections should involve both the management and the employees. The findings from such inspections should be recorded and analyzed. Recommendations and follow-up actions should be properly documented.
Maintenance Programme

An effective maintenance programme should be established for all equipment (e.g., lifting equipment, conveyor system, narrow aisle system, automated storage and retrieval system, forklift, stacker), machinery and tools used. This will help prevent accidents resulting from the failure of such equipment and machinery.

Some Equipment that Require Mandatory Inspection

- Steam Boilers
- Air Receivers
- Steam Receivers
- Overhead Cranes
- Lifting Platforms
- Mobile Cranes

The programme should include the establishment of a complete list of machinery and equipment used within the premises, inspection and maintenance schedules and records. There should also be a system for staff to report any defective or damaged tool or equipment in the course of their work.

Occupational Health Programmes

Occupational health programmes targeted at specific hazards should be established. Each programme should specify the objectives, person-in-charge and component activities and their frequencies.

Examples of Occupational Health Programmes

- Hearing conservation programme
- Management of hazardous substances programme
- Ergonomics programme (Refer to CP92: Code of Practice for Manual Handling, SPRING)
Emergency Preparedness

The establishment and effective implementation of an emergency response plan is crucial in saving lives and mitigating losses should an emergency situation arise.

An Emergency Response Team should also be established, with the duties and responsibilities of each member clearly defined.

Management should ensure that all staff are familiar with the plan and procedures in the event of an emergency. Regular emergency drills and exercises should therefore be conducted. An evaluation of the drill performance should be carried out and lessons learnt used for improving the plan.

**What Should Be Included in an Emergency Response Plan?**

- Procedures for the raising of alarm
- Procedures for the evacuation and rescue of victims
- Provision of the means of rescue and first aid
- Procedures for dealing with spills or other chemical release
- Provision of a means of communication with the relevant government authorities and response agencies.

**Examples of an Emergency Situation:**

- Fire
- Failure/ collapse of structure
- Hazardous material spills
- Harmful gas leakage

**Useful Guidelines for First Aid Facilities**

- Your Guide to First Aid Facilities in Factories
Documentation and Review of Programme

There should be a system for the documentation and regular review of the programme. This is to facilitate retrieval of relevant documents and to ensure that the programmes remain relevant and effective. All revisions to the safety and health manual should be dated and endorsed by authorised personnel. Recommendations that result from such reviews should be considered and implemented wherever possible.

Resources

- **Sample Inspection Checklist**

The sample inspection checklist can be used when conducting your regular safety inspections. Go over every aspect of your workplace to identify possible hazards, unsafe acts and conditions in the workplace, as well as to monitor any changes in the work process.

The checklist can be adapted to the particular needs of the warehouse.

<table>
<thead>
<tr>
<th>Manual Handling</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are the loads &lt;25 kg in weight?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are heavy loads labeled with the weight?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are the loads easy to grasp?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there provisions to minimize reaching above the shoulder?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there provisions to minimize frequent bending down?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are more frequently used objects stored at waist level?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are carrying distances kept short?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there adequate lighting?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there provisions to minimize exposure to excessive heat or cold?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are workers trained in proper manual handling?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Floors and Walkways</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are aisles clear of materials or equipment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are main aisles at least 1.12 m wide?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are doorways clear of materials or equipment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are carpets or tiles in good condition, free of tripping hazard?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are floors clean and free of oil or grease?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are floors kept dry?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stairs and Ladders</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are ladders safe and in good condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are stairwells clear of materials and equipment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are stairs and handrails in good condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are ladders and stairs provided with anti-slip means?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Electrical Safety</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
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<td>----</td>
</tr>
<tr>
<td>Are electrical wires in good condition?</td>
<td></td>
<td></td>
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<tr>
<td>Is there clear access to electrical panels?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are proper plugs used?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are plugs, sockets, and switches in good condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are portable power tools and electrical equipment in good condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fire Safety</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are fire extinguishers clearly marked?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are fire extinguishers properly installed on walls?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have fire extinguishers been inspected within the last year?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are workers trained to use fire extinguishers?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are flammable liquids properly stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are smoke and fire alarms in place and properly maintained?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are emergency lights in working condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have sprinkler systems been inspected?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are emergency exits clear of materials or equipment?</td>
<td></td>
<td></td>
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<tr>
<td>Are emergency exit signs working?</td>
<td></td>
<td></td>
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<tr>
<td>Are emergency lighting units provided?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Equipment and Machinery</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are equipment and machinery maintained in good condition?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is machinery securely guarded?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are operators properly trained?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are switches clearly marked and easy to reach?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have a lockout procedure in place?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is there enough work space?</td>
<td></td>
<td></td>
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<tr>
<td>Are noise levels controlled?</td>
<td></td>
<td></td>
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<tr>
<td><strong>Chemicals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are Material Safety Data Sheets (MSDSs) provided for all chemicals?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are workers trained in the hazards and preventive measures?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are relevant personal protective equipment provided?</td>
<td></td>
<td></td>
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<tr>
<td>Are containers clearly labelled?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are chemicals properly stored?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are hazardous materials disposed of properly?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there procedures for chemical spills?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First Aid</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the first aid kit accessible and clearly labelled?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Is the first aid kit adequate and complete?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are emergency numbers displayed?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Are there trained first aiders?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Protective Equipment</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>------------------------------</td>
<td>-----</td>
<td>----</td>
</tr>
<tr>
<td>Do workers know where to find personal protective equipment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Eye/face protection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Footwear</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Gloves</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Protective clothing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Aprons</td>
<td></td>
<td></td>
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<tr>
<td>• Respirators</td>
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</tr>
</tbody>
</table>
CASE STUDIES
Case Studies

Confined Space Accidents in ISO Tanks

In year 2002, a worker was found dead inside an ISO tank. He had been assigned to carry out a visual inspection of the tank that had unloaded its cargo of di-octyl phthalate (DOP).

Investigations revealed that nitrogen was used as an expelling agent to unload the DOP from the tank. There was no fresh air purging of the tank after unloading had been done; therefore the tank remained nitrogen rich. The probable cause of death was asphyxiation.

The company was required to review its safe work procedures on confined space work and to implement a permit to work system. Prosecution actions were taken against the company. The company was convicted and fined S$25,000.

In another accident, a worker from a logistics company was found dead in an ISO tank. Investigations showed that he had been exposed to high concentrations of solvent vapours while cleaning the tank with a wipe cloth and thinner. The excessive exposure was likely due to inadequate ventilation in the confined space.

The company had failed to establish and implement safe work procedures for work in the confined space. The atmosphere in the tank was not tested for toxic contaminants and certified safe for work by a competent person. The deceased did not wear a harness with a life line attached, and there was no standby person keeping watch outside.

A stop work order was issued and the company was required to rectify all the faults. Legal action was being initiated against the company and individuals who flouted the law.
Chemical Leak in a Storage Warehouse

A courier company received a package from overseas in its warehouse. The package was to be delivered to a local customer but the contents had leaked and a strong chemical odour emitted from the package. The operators did not contain the spill effectively and the chemical gas affected a number of the workers working nearby. They were hospitalized.

The package containing hazardous chemicals did not have warning labels to warn workers handling it about the dangers of its contents and no accompanying Material Safety Data Sheets (MSDS) for transporters to refer to for safe handling.

The company was required to strengthen training on handling of hazardous substances and emergency situations dealing with hazardous substances.
EXAMPLES OF RISK ASSESSMENT
Examples Of Risk Assessment

Scenario 1 – Transferring Cargo
A warehouse worker is tasked to transfer 100 plastic containers containing toluene and xylene (both are toxic and flammable) from a delivery truck to the warehouse storage shelves. Each container of chemical weighs 20 kg. The work activities involve manually lifting the containers from the delivery truck, stacking them onto pallets and using a forklift to move the pallets onto the storage shelves.

<table>
<thead>
<tr>
<th>No.</th>
<th>Activity</th>
<th>Hazard</th>
<th>Possible Accident/ ill Health &amp; Person-at-Risk</th>
<th>Existing Risk Control</th>
<th>Severity</th>
<th>Likelihood</th>
<th>Risk Level</th>
<th>Risk Control measure</th>
<th>Action Officer (Follow up date)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Carrying the containers of chemical onto the pallet</td>
<td>Unsafe work practice</td>
<td>Musculoskeletal disorders due to manual lifting of 100 20kg containers.</td>
<td>Nil</td>
<td>Moderate</td>
<td>Frequent</td>
<td>High</td>
<td>Provide a mobile conveyor system to transfer the containers from truck to pallets</td>
<td>Warehouse Manager (30 July 05)</td>
</tr>
<tr>
<td>2.</td>
<td>Stacking chemical containers onto the pallet</td>
<td>Falling object</td>
<td>Containers can fall from the pallet and hit the worker</td>
<td>Limit the height the containers are allowed to be stacked</td>
<td>Moderate</td>
<td>Occasional</td>
<td>Medium</td>
<td>Ensure all workers wear safety helmets and safety shoes during stacking</td>
<td>Supervisor (immediate)</td>
</tr>
<tr>
<td></td>
<td>Toxic and flammable substances</td>
<td>Falling containers may break open releasing toxic and flammable substances that affect the worker and others nearby</td>
<td>Nil</td>
<td>Major</td>
<td>Remote</td>
<td>High</td>
<td>Ensure the work area is clear of ignition sources. Provide spill kits and SOPs for emergency situations</td>
<td>General Manager (30 July 05)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td>Driving the forklift</td>
<td>Unsafe work practice</td>
<td>Driving the forklift recklessly can cause death or injury to others</td>
<td>Nil</td>
<td>Major</td>
<td>Occasional</td>
<td>High</td>
<td>Enforce safe driving rules in the warehouse; provide designated pathways for workers</td>
<td>General Manager (25 July 05)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>The Carbon Monoxide gas emitted from forklift engines may accumulate and affect workers in the warehouse</td>
<td>Nil</td>
<td>Moderate</td>
<td>Occasional</td>
<td>Medium</td>
<td>Enforce safety rules - only battery operated forklifts are allowed in the warehouse; diesel driven forklifts are to be used outdoors</td>
<td>Warehouse Manager (immediate)</td>
</tr>
<tr>
<td>4.</td>
<td>Transferring the pallets onto the storage shelves</td>
<td>Falling object</td>
<td>The pallets of chemicals may fall off the shelves during transfer and hit the worker or others nearby</td>
<td>Nil</td>
<td>Major</td>
<td>Occasional</td>
<td>High</td>
<td>Provide enough lighting and a digital camera on the forklift so the worker can see clearly when transferring the pallets onto the shelves. Enforce safety rules - no person is allowed to stand near the forklift during pallet transferring</td>
<td>General Manager (30 July 05)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Falling containers may break open releasing toxic and flammable substances that affect the worker and others nearby</td>
<td>Nil</td>
<td>Major</td>
<td>Occasional</td>
<td>High</td>
<td>Restrict the storage of chemical containers to low level shelves</td>
<td>General Manager (immediate)</td>
</tr>
</tbody>
</table>
Scenario 2 – Cleaning the Inside Walls of ISO Tanks
A worker is assigned to clean the inside walls of an ISO tank which was last used to carry benzene (a carcinogen and highly flammable chemical). The company safety officer consults the Material Safety Data Sheet (MSDS) for benzene before conducting the risk assessment.

<table>
<thead>
<tr>
<th>Hazard Identification</th>
<th>Risk Evaluation</th>
<th>Risk Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td>Activity</td>
<td>Hazard</td>
</tr>
<tr>
<td>1.</td>
<td>Entering into the ISO tank</td>
<td>Falling hazards</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient lighting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Slips and falls</td>
</tr>
<tr>
<td>Flammable vapours</td>
<td>Explosion can result in serious injury or death of entrants and workers near the tank.</td>
<td>Existing safe work procedures for confined space entry</td>
</tr>
</tbody>
</table>
REFERENCES
References

Local References
Ministry of Manpower, Singapore
- Pamphlet on How to Report Accidents
- Pamphlet on How to Report Occupational Diseases
- Guidelines for Industrial Noise and Vibration Control (1999)
- Guidelines on Material Safety Data Sheets

Singapore Standards, Productivity and Innovation Board (SPRING)
http://eshop.spring.gov.sg/cgi-bin/singaporestandards.pl
- CP92: 2002 Code of Practice for Manual Handling
- CP98: 2003 Code of Practice for Preparation and Use of Material Safety Data Sheets (MSDS)
- CP76: 1999 Code of Practice for Selection, Use, Care and Maintenance of Hearing Protectors
- CP74:1998 Code of Practice for Selection, Use and Maintenance of Respiratory Protective Devices

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U. K. Health and Safety Executive

- Getting to grips with manual handling – a short guide
  http://www.hse.gov.uk/msd/hsemsd.htm#manual

The American Society of Safety Engineers

- Warehouse Safety: A Comprehensive Review
  http://www.asse.org/pjuly.htm
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Contributors

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Mr. William Yeo, Principal Physiotherapist
Ms. Jennifer Liaw, Principal Physiotherapist

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