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APPLY WORKPLACE SAFETY AND HEALTH IN PROCESS PLANT

LEANERS GUIDE

Version Control Record

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CE 4 Comply with safe work practices and control measures for mechanical and electrical work

4.1 Identify and recognise common mechanical and electrical hazards
4.2 Follow hazards control prevention measures6
4.3 Select and use the correct PPE for electrical work
4.4 Comply with procedures when using and maintaining the machinery
4.5 Proper use and storage of hand tools
4.6 Selection and proper use of hearing protection

CE 5 Comply with safe work practices and control measures when working on specialised operations

5.1 Recognise hazards associated with specialised operations
5.2 Follow preventive measures when working with radiation, steam, gases and chemicals.
5.3 Use and read gas detectors
5.4 Work and comply with Permit-to-Work System
5.5 Use Lock Out Tag Out(LOTO)
5.6 Apply safe work procedures when handling chemicals and related biological materials
5.7 Minimising the effects of prolong exposure to working under the sun
5.8 Follow safety measures for transporting workers on lorries
5.9 Follow the safety use of asbestos

CE 6 Comply with safe work practices and control measures when working at heights

6.1 Select the correct fall protection equipment for the work
6.2 Safe use of fall protection equipment
6.3 Correct way of using and maintenance the ladder at workplace
6.4 Correct way of anchorage at height
6.5 Follow procedures for rescue at height
6.6 Proper disposal of debris and housekeeping while working at height
6.7 Correct use of ladder
6.8 Caring and maintaining fall protection equipment

CE 7 Comply with safe work practices and control measures when working in a confined space

7.1 Recognise what constitutes a confined space
7.2 Identify hazards when working in a confined space
7.3 Follow measures to prevent and control hazards when working in confined space
7.4 Check and read gas meter
7.5 Perform rescue for confined space
7.6 Select and use the correct PPE for confined space
7.7 Follow emergency procedures for evacuation

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INTRODUCTION

Learners will be taught on the practical approach in using various tools, tactics, tips and know-how, contextualised to the needs of different sectors, including building and engineering construction services. Learners will also acquire a deeper skill set as they learn how to match these skills to different situations and have the knowledge and expertise at their disposal.

Apply Workplace Safety And Health In Process Plant is one of the skills that comes under all process sectors for competency level 1.

COURSE OVERVIEW

Performance Statement		Assessment Method
CE 1	Identify the roles and responsibilities under the Workplace Safety and Health Act	W/O A, PP
CE2	Identify and prevent fire and explosion hazards at the workplace	W/O A, PP
CE3	Comply with safe work practices and control measures for material handling	W/O A, PP
CE4	Comply with safe work practices and control measures for mechanical and electrical works	W/O A, PP
CE5	Comply with safe work practices and control measures when working on specialized operations	W/O A, PP
CE6	Comply with safe work practices and control measures when working at Heights	
CE7	Comply with safe work practices and control measures when working in a confined space	
W/OA: Written/Oral Assessment ; PP : Practical Performance		

Underpinning Knowledge		Assessment Method
UK1	• Principles of the new Workplace Safety and Health (WSH) Framework • Duties and responsibilities of a worker under the WSH Act • Penalties for non-compliance • Roles and activities of the Workplace Safety and Health Committee • Purpose and agenda of a toolbox meeting • Types of personal protective equipment (PPE) • Common hazards associated with the misuse of PPE • Types of safety signs and instructions relating to the use of PPE, their importance and purposes • Types of safety devices and emergency equipment	W/O A, PP
UK2	• Fire triangle and the chemistry of fire • Basic properties of flammable gases and chemicals • Types of combustible material • Types of fire hazards at workplace and sources of ignition • Permit-to-Work System • Types of firefighting equipment • Reporting procedures for fire hazards at workplace • Procedures to respond to fire emergency • Types of solvents for chemical cleaning • Risks when working in a confined space, severity of consequences and likelihood • Symptoms of persons exposed to typical atmospheric hazard • Methods to prevent and control confined space hazards	W/O A, PP

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Underpinning Knowledge		Assessment Method
UK3	• The need for authorized use of machine and equipment and the dangers of unauthorized use • Methods of manual handling of load and prevention measures • Methods of mechanical lifting • Terms used in lifting operations • Roles, responsibilities and duties of rigger and signalman • Crane operations and lifting equipment • Dangers and hazards associated with dangerous lifting of metal structures • Importance of good housekeeping of materials	W/O A, PP
UK4	• Common mechanical and electrical hazards and their associated risks • Dangers of electricity and the effect on the human body • Preventive and control measures against mechanical hazards • Preventive and control measures against electrical hazards, including types of PPE for electrical works • Safe work practices for mechanical and electrical works Common noise hazards, consequences and types of hearing protection	W/O A
UK5	• Types of specialized operations • Chemical and biological hazards and their consequences • Types, effects and dangers of radiation • Hazards when working under the sun for prolong period • Common safe work procedures at workplace for handling specialised operations • The importance of Permit-to-Work System and types of permit Measures to enhance the safety of workers transported on lorries	W/O A, PP
UK6	• Responsibilities of the worker and authorized person in working at height • Competent person authorized to erect scaffold and platform • Safe means of access and egress at workplace • Preventive measures for working at height • Types of fall protection equipment • Ladder safety	W/O A, PP
UK7	• Types of confined space • Common hazards when working in confined space • Common causes of oxygen enrichment • Ventilation for confined space and testing of atmosphere • Responsibilities of persons when working in confined space • Permit-to-work system for confined space • Preventive measures for working in confined space • Confined space entry and safe work practices • Emergency procedures while working in confined space • Importance of a buddy system	W/O A, PP
	End course assessment ▪ MCQ paper set 1 ▪ MCQ paper set 2 ▪ MCQ paper set 3 ▪ MCQ paper set 4	WA MCQ

W/OA: Written/Oral Assessment ; PP : Practical Performance

Assessment Instruments	Duration
W/OA: Written Assessment PP: Practical Performance	1.0 hour
Total Assessment time per candidate	1.0 hour

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Competency Elements (CE) and Underpinning Knowledge (UK)

CE 1: Identify the roles and responsibilities of an employee under the WSH Act

1.0 Introduction

- This section focuses on knowing your responsibilities as a general worker under WSH Act and discharging it responsibly which include the use of personal protective equipment (PPE) provided for the work.
- It also covers how to interpret different types of safety signs and instructions, and how to follow workplace housekeeping procedures.
- Equally important is to know the underlying reasons of using PPE, following safety signs and instructions, and keeping the workplace clean and safe at all times.

1.1 Comply with the requirement of WSH Act

What is the Workplace Safety and Health Act?

- It is a framework to cultivate good safety habits and practices at the workplace. Every person at the workplace, from the top management to the worker, must take reasonably practicable steps to ensure the safety and health of every workplace and worker

Objective of Workplace Safety and Health Act (WSHA)

§ Manage workplace safety and health proactively.
§ Everyone to observe safety and health.
§ Aimed at reducing deaths at workplaces.

Three Guiding Principles:

1. Reduce risks at source.
2. Industries to take greater ownership.
3. Higher penalties for poor safety management.

Workplace Health and Safety Act

- The WSH Act requires every person at the workplace to take reasonably practicable steps to ensure the safety and health of every workplace and worker.
- If you are a person who erect, install or modify machinery or equipment and persons in control of machinery for use at work
  - ➢ You must ensure as far as reasonably practicable the machinery of equipment erected, installed or modified is safe and without health risks when properly used

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Duties of persons at work

- to use in such manner so as to provide the protection intended, any suitable appliance, protective clothing, convenience, equipment or other means or thing provided; and to co-operate with his employer or principal and any other person
- No person at work shall willfully or recklessly interfere with or misuse any appliance, protective clothing, convenience, equipment or other means or thing provided
- Any person at work who, without reasonable cause, willfully or recklessly does any act which endangers the safety or health of himself or others shall be guilty of an offence.
- You must adhere to safe working procedures and principles introduced at the workplace.
- You should not endanger yourself or others working around you through unsafe behavior.
- You should not tamper with any safety device or undertake any willful or reckless acts.
- You should also always correctly use any personal protective equipment provided at work.

DO's
Know risk in work
Follow company's safe work procedure and practices
Follow procedure in respond to workplace emergencies
Put on personal protective equipment
Report unsafe act and practice to superior
Don't
Do not alter or remove any safety devices

Penalties for Non-Compliance

Liabilities and Penalties

- Any person who fails in his duties (as stated in the Act) can be fined up to $1,000 and, in the case of a second or subsequent conviction, up to $2,000.
- General maximum penalties for offences for which no penalty is prescribed under the Act (Refer to table)

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The Workplace Safety and Health Act states a general maximum penalty for offences.

Offender Category	Maximum Fine (1st conviction*)	Maximum Fine (2nd and subsequent convictions**)	Maximum Imprisonment	Conditions
Individual persons	$200,000	$400,000	2 years	Either or both
Corporate Body	$500,000	$ 1 million	Either or both	
Persons at work who misused or failed to use protective equipment provided	$1,000	$2,000		

*** 1st conviction for an offence that causes the death of another person.**
**** 2nd & subsequent conviction of same offence that causes the death of another person**

Workplace Safety and Health Committee - General roles and activities

- To discuss matters relating to the safety and health of the persons at work at the workplace.
- To discuss on how to improve safety and health issues at the workplace.
- To assist in the inspect and examine any machinery, equipment, plant, installation, etc for any unsafe act and unsafe condition in the workplace.

1.2 Participate in a tool box meeting

Tool box meeting

- Every morning, all workers need to attend daily tool box meeting.
- WSH personnel will talk on Safe Work Procedure/Permit to Work especially on hot work, confined space, lifting operations, working at height, etc.
- Some organization will have a smaller group briefing after Tool Box Meeting at the section where works will be carry out. Details on the task to be perform, how many workers inside the confined space, working at height preparation, etc.

1.3 Select and use the appropriate personal protective equipment provided for the work in compliance with WSH Act

- Personal protective equipment known as PPE act as a final barrier between users and the hazard.
- Wearing of PPE does not control hazard at source but relies on behavior modification for successful control
- To achieve the successful control of the hazard through use of PPE it depends on the following:
  - Correct PPE is chosen for the job or task
  - PPE is worn correctly and at all times when required
  - PPE is used correctly and should not be modified for other purpose
  - PPE is maintained in good condition at all times

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The most common types of PPE are illustrated in the following table:

Types of PPE		Uses of PPE
Overalls		• Wear approved overalls to provide maximum protection to your body against splashes of liquids, dust and heats. • For example, when handling, mixing or transferring of chemicals, when performing welding, blasting, hot work, oxy-acetylene cutting, etc. • Make sure the overalls are worn correctly and should be not be worn loosing.
Safety Helmet	 	• Wear hard plastic or metal materials helmet to protect you from falling or flying objects. • If you are involved in performing outdoor tasks such as working in confined space, construction site, erecting of platforms, maintenance oil and gas pipes, etc be sure to wear approved helmet provided. • Do not wear unapproved helmet • Do not wear the helmet backward • Do not paint or modify the helmet • Check helmet condition for wear and tear before use such as crack, dents, missing chin straps, missing inner liner, etc.
Face Shield		• Wear approved face shield to provide maximum protection to face and eyes. • Most common use for works such as welding, grinding, cutting, powder coating, etc where sparks, dust or fume have the potential come into contact with your eyes and face
Safety Goggles	 	• Wear approved goggles to provide maximum protection to eyes. • Most common use for works such as welding, grinding, cutting, powder coating, etc where sparks, dust or fume have the potential come into contact with your eyes

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Types of PPE		Uses of PPE
Safety Shoes	 	• Wear approved safety shoes that provide maximum protection for your feet • Do not wear slippers or sandals when doing cleaning jobs • Slips, trips and falls can often be prevented with safety shoes
Respirators / Masks	 	• Wear approved respirators or masks that provide maximum protection to the inner parts of body. • A respirator is a device designed to protect the wearer from inhaling harmful dusts, fumes, vapors, and/or gases as well as protect themselves from diseases potentially spread through the air.
Ear plug / ear muffs	  	• Wear approved ear protection working in areas with excessive noise (above 85 dBA) and in the vicinity where following process take place: ❖ Pneumatic chipping ❖ Arc gouging ❖ Grinding ❖ Grit blasting ❖ Beside generators and air compressor sets or equipment and etc.
Safety Gloves	 	• Wear approved hand protection when employee's hands exposed to hazards such as: ❖ Those from skin absorption of harmful substances. ❖ Cuts ❖ Abrasions ❖ Punctures ❖ Chemical burns ❖ Thermal burns ❖ Temperature extremes ❖ Electrical burns

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Types of PPE		Uses of PPE
Safety Harness/Safety Belt	 	• Wear approved safety harness/safety belt where person is liable to fall more than 2 metres • There must be sufficient and secure anchorage for the safety harness/safety belt • Such anchorage shall not be lower than the level of the working position, points should be ideally above waist height • When that is not possible anchor points below waist height should be used
Gas Detector	 	Use approved gas detector to detect presence of oxygen, toxic / flammable gases in the workplace. • Detection shall be reliable and precise • TLV (threshold limit values for an 8 hour working day) shall be monitored. • Sensor measures oxygen, toxic/flammable gases level and give off audible and visual alarm when atmosphere exceeds concentration alarm setting • When alarm sounded, > Permissible Exposure Limit. leave area immediately • Do not re-enter area without permission

Remember: PPE should only be considered when other control methods such as elimination/substitution, engineering and administrative controls are unworkable or impractical to be implemented.

1.4 Maintain and Store of PPE provided in accordance with organizational Procedures

- Store inside the room temperature
- Discard it when damaged
- Fall Protective Equipment must be inspected before and after performed tasks

1.5 Interpret and follow Safety Signs & Instructions at workplace

The purpose of a safety sign is to alert persons to a specific hazard and how the hazard can be avoided.

The important of safety signs are to tell people what they should or should not do; where or where not to go and provide simple instructions or graphics to help people understand

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what they should or should not do. These signs ensure that people are aware of hazards or dangers and help to avoid injury.

The five main types of safety sign which denote different aspects of health and safety in the workplace are illustrated in the following table:

Types of Safety Signs		Purpose of Safety Signs
Prohibition "Stop!"	 **Colour:** A red circular band with a diagonal cross bar on a white background.	**Purpose:** To indicate that a certain behavior is prohibited. **Meaning:** You must not / Stop / Do not
Mandatory "Obey"	 **Colour:** A blue circle with a white symbol.	**Purpose:** Indicates that a specific course of action must be taken. **Meaning:** Carry out instructions shown / You must / Do / Obey
Hazard "Danger"	 **Colour:** A yellow triangle with a black border and black symbol.	**Purpose:** To warn of any type of hazard. **Meaning:** Danger / Beware / Careful / Hazard / Caution
Safe Condition - "Safety"	 **Colour:** A green oblong or square with a white symbol or text.	**Purpose:** To provide information about safe conditions. **Meaning:** The safe way | Where to go in emergencies | First aid
Fire Equipment "Fire"	 **Colour:** A red oblong or square with a white symbol.	**Purpose:** To describe the location of firefighting equipment. **Meaning:** Type of fire fighting equipment / Location of fire fighting equipment

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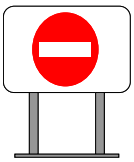
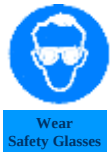
There are numerous types of safety signs and instructions as illustrated in the following table:

Types of Safety Signs		Instructions
Prohibition (Red in colour) such as:		
No Entry Sign		• Vehicle entry permit must be obtained for entry into roads • Drivers to ensure that the signs are returned to original position after entry or exit.
No photography Sign		• Camera is strictly prohibited and no photo taking at the company premises area.
No Smoking Sign		• Smoking is strictly prohibited at all times except at designated smoking rooms only • This includes No smoking in vehicles on site roadways and car parks
No Hand Phone Sign		• Hand phone is strictly prohibited at the process plant or highly flammable area.
No Naked (Open) Flame Sign		• If you see a No Open Flames sign, this usually implies there is a flammable or combustible material nearby
Mandatory (Blue in colour) such as		
Head Protection must be worn Safety Helmet Sign		• Safety helmet with chin strap must be worn in operational worksite at all times for protective against head injuries
Eye Protection must be worn Safety Glasses Sign		• All personnel while entering working area must wear safety glasses • It is important to wear the correct type to give the required protection

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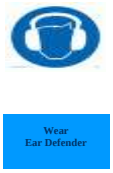
Types of Safety Signs		Instructions
Ear Protection must be worn Ear Defender Sign		• Ear defenders must be worn when working in this areas with excessive noise (above 85 dBA) and in the vicinity where following process take place at generator and air compressor.
Hand Protection must be worn Hand protection safety sign		• Chemical resistant rubber gloves must be worn when handling acids, alkalis, or other corrosive chemicals
Foot Protection must be worn Safety Shoes Sign		• Approved type safety shoes must be worn when entering the working place
Hazardous/Warning (Yellow in colour) such as:		
Danger. Electrical hazard High Voltage Sign		• Work on high voltage equipment, be award on electrical hazards. which is dangerous when amount of electricity it take to injure person and can cause death
Caution: Radioactive Material Sign		• Caution, radiation work was in progress. Be aware of radioactive materials.
Caution: Corrosive Sign		• Chemical are corrosive • Use proper PPE when handling
Warning: Biohazadous sign		• Biohazadous materials handled in laboratory • Biosafety level of laboratory
Caution: Slippery Floor Sign		• Caution, floor slippery, due to spillage of oil and chemicals, must be clean up immediately

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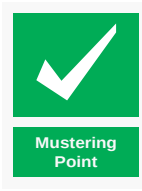
Types of Safety Signs		Instructions
Information (Green in colour) such as:		
Fire Escape Route & Emergency Exit Sign		• An exit route is a continuous and unobstructed path of exit travel from any point within a workplace to a place of safety.
Mastering Point / Assembly Sign		• In the event of an evacuation, persons should assemble at the nearest safe assembly area
Emergency Showers / Eyewash Sign	 	• Emergency showers and eyewash provide on-the-spot decontamination. They allow workers to flush away hazardous substances that can cause injury
First Aid Sign		• First Aid is the initial and immediate attention provided to a person suffering an injury or illness.
Fire Information (Red in colour) such as:		
Fire Alarm Sign		• Fire alarm system is designed to detect the unwanted presence of fire by monitoring environmental changes associated with combustion. In general, a fire alarm system is either classified as automatic, manually activated, or both.
Fire Hose Sign		• Fire hose is a high-pressure hose used to carry water or other fire retardant (such as foam) to a fire to extinguish it.
Fire Extinguisher Sign		• Fire extinguisher is an active fire protection device used to extinguish or control small fires, often in emergency situations.
Fire Hose Reel		• Fire hose reels are located to provide a reasonably accessible and controlled supply of water to combat a potential fire risk. The length of a fully extended in 30 m.

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1.6 Follow Road Safety Signs

All foreign workers must understand the various types of safety signs

1.7 Identify Safety Devices & Emergency Equipment

Safety devices is to ensure that such devices and structures designed, constructed, assembled, maintained and can be operated safely to prevent any injuries can happen in the workplace. For example:

Types of Safety Devices		Instructions
Fixed guards		• The purpose of the machine fixed guarding is to eliminate or reduce the potential risk of being caught by rotating machine parts
Safety barriers	 	• Safety barriers are designed to protect personnel and critical equipment. Which are finished as standard in high visibility orange to comply with health and safety regulation

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Types of Safety Devices		Instructions
Safety covers		• Safety covers are designed to provide a barrier, is a last defence for onsite construction machinery is noise enclosure cover
Safety Signage	 	• Safety signages are displayed to play a critical role in maintaining assets safety. The main purpose is to provide information in warning, hazard, danger and caution alert information and instructions.
Emergency button	 	• It is the purpose of an Emergency-Stop device to deflect or minimize the risk as quickly as possible and optimally in the event of an emergency arising.
Lock-out and tag-out devices	 	• The Lockout/Tag out is to shut down equipment, isolate it from its energy source(s), and prevent the release of potentially hazardous energy while maintenance and servicing activities are being performed. 
Fume Hood		• To [illegible] substances or irritating fumes away from QC & QA lab area, serve as a protection device for worker

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Types of Safety Devices		Instructions
Pressure Relief Valve		• Purpose is used to release any excessive pressure when pressure reach certain limit by means of opening of valve via spring action mechanism
Interlock Switch		• Purpose is used to prevent unsafe access to dangerous condition such as high voltage facility. Usually install at enclosure door
Local Exhaust Ventilation		• Purpose is used to control the release of hazardous airborne substances from a operation into workplace environment
Mechanical and electrical interlocks		• Mechanical and electrical interlocks are the restraint device, need two hand control
Fire Sprinkler System	 	• A **fire sprinkler system** is an active fire protection measure, consisting of a water supply, providing adequate pressure and flow rate to a water distribution piping system, onto which fire sprinklers are connected. Which used in factories and large commercial buildings.
Fire Alarm System		• An automatic **fire alarm system** is designed to detect the unwanted presence of fire by monitoring environmental changes associated with combustion. In general, a fire alarm system is either classified as automatic, manually activated, or both. Automatic

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Types of Safety Devices		Instructions
		fire alarm systems can be used to notify people to evacuate in the event of a fire or other emergency, to summon emergency forces aid, and to prepare the structure and associated systems to control the spread of fire and smoke.
Fire Extinguisher		• A **fire extinguisher** is an active fire protection device used to extinguish or control small fires, often in emergency situations. a fire extinguisher consists of a hand-held cylindrical pressure vessel containing an agent which can be discharged to extinguish a fire.
Emergency Exit Light		• An exit route is a continuous and unobstructed path of exit travel from any point within a workplace to a place of safety.
Spill Containment Kit		• Purpose is to contain chemical / oil materials when there is a spillage • Respond quicker to spills and help reduce the chance of slip-and-fall injuries in aisles, hallways, checkout lines, restrooms and other workplace areas.
First Aid Kit		• Familiar the location of first aid kit • Attached the first aider name list is able to administer first aid • One first aid box for every 25 persons or less employed

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Types of Safety Devices		Instructions
Eyes Wash / Shower Area		• Eye wash / shower is provide within the work area for immediate emergency use for quick drenching or flushing of the eyes and bodies where the eyes or body of any person was exposed to injurious corrosive materials.

1.8 Carry out housekeeping of workplace in accordance with organizational procedures

Follow Workplace Housekeeping Procedures

To maintain a good housekeeping at the workplace it is a necessary requirement to follow the workplace housekeeping procedure. Personal hygiene, a safe working environment, and efficient operation are augments of good housekeeping. Accidents and injuries are avoided and productivity improved where carries out an effective housekeeping at the workplace. Workers should report any unusual conditions or hazards as well as obeying posted warning signs at the workplace.

The typical housekeeping procedures are:

- Obtain permit-to-work if required (especially working on site).
- Remember to wear PPE where required
- Before commencement of work activities:
  - ✓ Check that the work area or worksite is free of hazardous item or obstruction
  - ✓ Check working tools and equipment are clean and not faulty
  - ✓ Check chemicals and supplies are safe for use
- Barricade or isolate any hazardous items found. Inform supervisor for necessary action.
- Remove any obstruction and dispose it at designated locations or bins.
- While working keep the work area or worksite as tidy and clean as possible:
  - ✓ By not leaving things unattended such as tools and equipment.
  - ✓ Do not throw rubbish or waste generated from work activities carelessly on the floor or around the work area instead dispose it at designated locations or bins.

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- Upon completion of work activities:
  - ✓ Clear all waste, obstructions or hazardous items
  - ✓ Check and confirm all tools and equipment are not damaged and in good working conditions before returning to allocated storage area
  - ✓ Clean and keep all tools and equipment, chemicals and supplies in their allocated storage area
  - ✓ Any faulty or damage tools and equipment must be tagged and reported to supervisor for action

The following table illustrated the dos and don'ts of housekeeping at workplace to ensure safe working conditions for you and other users:

<table>
<tr><th>Areas</th><th>Types of Criteria</th><th colspan="2">Instructions (DO NOT / DO)</th></tr>
<tr><td rowspan="2">Walls and Ceilings</td><td rowspan="2">– Walls and ceilings should be clear of unused appendages, such as empty hangers or all types, piping conduit, electric wires or cables, clamps or cleats, bolts, screws, nails, string or cord, rope, tape, wire, rags, signs, equipment (electrical or mechanical), or other articles not essential to the operation of the department.
– Electric cords should be utilized in a safe manner. Loose paint should be removed.
– Holes in walls must be repaired or covered.</td><td colspan="2">  </td></tr>
<tr><td>DO NOT removes ceiling boards or use ceiling void (i.e. space above suspended ceiling) for storage.</td><td>DO ensure all ceiling boards are in place, not missing, or damaged and refrain from using ceiling voids for storage purpose.</td></tr>
<tr><td>Floors / Stairways</td><td>– Floors and stairways should be clearly marked and kept clear of objects that can cause trips and falls.
– Floors area should be wide enough to accommodate peoples comfortably and safely. Warning signs and</td><td colspan="2">  </td></tr>
</table>

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<table>
<tr><th>Areas</th><th>Types of Criteria</th><th colspan="2">Instructions (DO NOT / DO)</th></tr>
<tr><td></td><td>mirrors can improve sight lines at blind corners</td><td>DO NOT store equipment and block corridors, walkways, or passageways that form parts of the emergency escape route at your workplace.</td><td>DO ensure all ceiling boards at the workplace are in place, no missing/damaged and keep ceiling voids clear from any storage.</td></tr>
<tr><td rowspan="3">Spill Control</td><td rowspan="3">– The best way to control spills is to stop them before they happen. Regularly cleaning and maintaining machines and equipments is one way to do this.
– It is important to follow cleanup procedures as indicated on the Safety Data Sheet (SDS).
– Spills must be cleaned up immediately. Absorbent material is useful for wiping up greasy, oily or other liquid spills. Used absorbents must be disposed of properly and safely.</td><td colspan="2">  </td></tr>
<tr><td colspan="2">.
  </td></tr>
<tr><td>DO NOT wet the floor. This will cause slippery, trip and fall hazards.</td><td>DO All floor at workplace shall be keep dry to prevent trip and fall.
Use drip pans and guards where possible spills might occur</td></tr>
</table>

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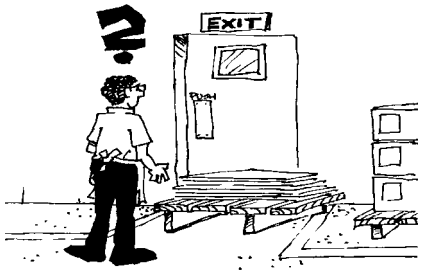
<table>
<tr><th>Areas</th><th>Types of Criteria</th><th colspan="2">Instructions (DO NOT / DO)</th></tr>
<tr><td rowspan="2">Tools and Equipment</td><td rowspan="2">– Keeping tools neat and orderly can be very important to everyone's safety, whether in the tool room, on the rack, or on the bench.
– Discarded or lying objects on the ground can cause others to trip and fall and may also blocked access to fire exits.</td><td colspan="2"> 
</td></tr>
<tr><td>DO NOT block the fire escape route and fire exist at workplace. All the discarded object must be keep in the designated waste bins.</td><td>DO the house keeping and returned the tools and equipment to the original storage area after used. All discarded or lying objects should keep at an designated safe area, to prevent trip and fall hazards.</td></tr>
<tr><td rowspan="2">Maintenance</td><td rowspan="2">– A good maintenance program provides for the inspection, maintenance, upkeep and repair of tools, equipment, machines and progresses.
– Machines and equipment that are brought into a maintenance and storage area should be cleaned before they are taken out of their original area.</td><td colspan="2">  </td></tr>
<tr><td>DO NOT use cardboard boxes, wooden crates or other receptacles that are made of combustible material as makeshift rubbish bins at your maintenance workshop area.</td><td>DO provide and use proper rubbish bins, preferably those made of non-combustible material like metal.</td></tr>
</table>

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<table>
<tr><th>Areas</th><th>Types of Criteria</th><th colspan="2">Instructions (DO NOT / DO)</th></tr>
<tr><td rowspan="2">Storage</td><td>– Stacking cartons and drums on a firm foundation and cross tying them, where necessary reduces the chance of their movement.</td><td colspan="2">  </td></tr>
<tr><td>– All water and air hoses must be properly stored on the appropriate hangers</td><td>DO NOT accumulate unwanted items at your workplace.

Stored materials should not obstruct stairs, exits, fire equipments, emergency escape route, eyewash/showers or first aid stations, all storage areas should be clearly marked</td><td>DO dispose of unwanted items at regular intervals to ensure good housekeeping at your workplace.

.</td></tr>
<tr><td rowspan="2">Fire Prevention</td><td rowspan="2">– Flammable, combustible, toxic and other hazardous materials should be stored in approved containers in designated areas that are appropriate for the different hazards that they pose.
– All combustible and flammable material must be present only in the quantities needed for the job and kept in safety cans during use.
– Fire doors, extinguishers, hoses, exits, safety showers/eye wash station, etc. must be kept unobstructed.</td><td colspan="2">  </td></tr>
<tr><td><u>For chemicals:</u>

DO prepare dip tray for all the chemical substance storage. Any spillage at the workplace shall be clean up immediately to</td><td><u>For chemicals:</u>

DO NOT mixed the incompatible chemical substances into one storage area. This may cause fire explosion.</td></tr>
</table>

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<table>
<tr><th>Areas</th><th>Types of Criteria</th><th colspan="2">Instructions (DO NOT / DO)</th></tr>
<tr><td></td><td></td><td>prevent others to trip and fall, or exposed to chemicals. Oily or greasy rags should be placed in a metal container and disposed off regularly</td><td></td></tr>
<tr><td rowspan="2">Office desks, files</td><td rowspan="2">– Drawers, lockers, desks and file cabinets should be neat and orderly.
– Storage on tops of desks, file cabinets and cupboards must be kept to a minimum.
– Damaged office equipment should be removed immediately.</td><td colspan="2">  </td></tr>
<tr><td>DO NOT lift the files accumunate too much at the desk tops and the floor area.</td><td>At the end of the day, all desk tops and tables should DO neat and the desk chairs and telephones properly aligned.</td></tr>
<tr><td rowspan="2">Process Plant area</td><td rowspan="2">– Plant grounds should be free from trash, rubbish and dumps.
– Walks and roadways should be free from obstacles.
– Signs and notices should be properly mounted and in good condition.</td><td colspan="2">  </td></tr>
<tr><td>DO NOT erects or constructs unapproved structure for the electrical cable trenching as it will causes obstruction at the workplace.</td><td>DO keep all the electrical cable and piping hose from obstructing the walkway. This is to prevent trip and fall during fire evacuation.</td></tr>
</table>

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CE 2: Identify and prevent fire and explosion hazards at workplace

Introduction

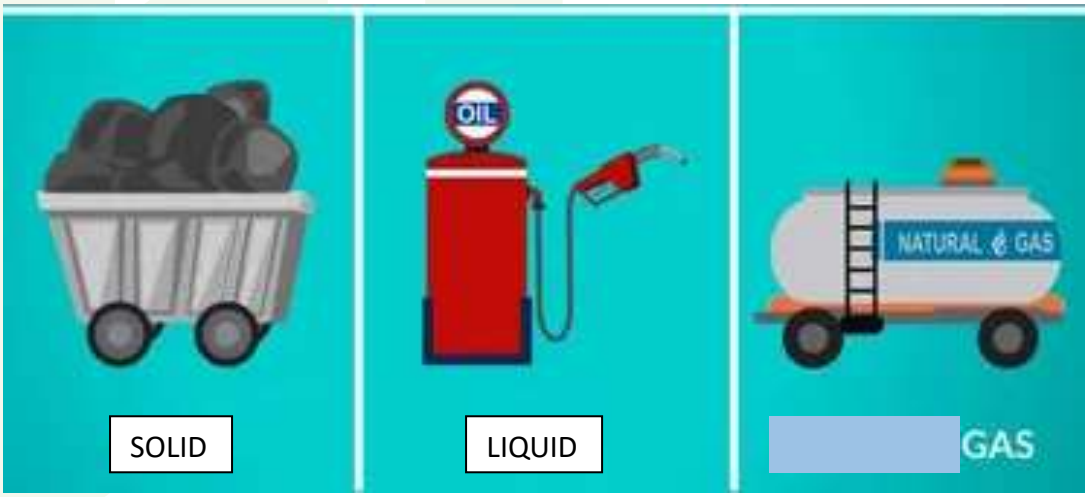
- This section focuses on identify and prevention of fire hazards at workplace.
- Knowing the safe work procedure of permit to work system at workplace especially hot work permit.
- Knowing the response during the fire emergency and procedure to take precaution while carry out work at workplace.
- Learn the chemical such as solvent and the hazards of the chemical to user and how to store the hazards chemical substances.

2.1 Identify fire hazards associated with the workplace and report to appropriate person in accordance with organizational procedures.

- In order for combustion to take place the three essential elements of fire have to be brought together – **fuel, oxygen** and source of ignition(**heat**)

Type of combustible materials (Fuel)

- Solid - wooden, plastic, paper, rubbers, etc…
- Liquid - raw oil, cylinder oil, hydraulic oil, solvent paint etc…
- Gas and Acetylene - LPG, paint, gases that release from raw oil etc…



Sources of Heat

- Hot works : Grinding, welding, gas cutting, etc.
- Electrical heat
- Naked flames
- Smoking

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Classification of fires (Fuels)

Class A: fires involving solids such as wood, paper or plastics (usually material of an organic nature)

Class B: fires involving liquids or liquefiable solids such as petrol, oil, paint, fat, or wax

Class C: fires involving gases such as liquefied petroleum gas, natural gas or acetylene

Class D: fires involving metals such as sodium, magnesium, aluminum and many metal powders

Class E: fires involving electrical apparatus such as electricity are a source of heat.

Class F or K: fires involving cooking oils and fats

Methods of heat transmission and fire spread

Convection:

- The movement of hotter gases up through the air (hot air rises), e.g. smoke and hot gases rising up at staircase through an open door.
- Control Measure: Protection of openings by fire doors and the creation of fire resistant compartments in buildings.

Conduction:

- The movement of heat through a material (usually solid), e.g. a metal beam or pipe transmitting heat through a sold wall
- Control Measure: insulating the surface of a beam or pipe with heat resistant materials.

Electrostatic:

- Sudden flow of electricity between 2 objects with different charge built up when contacted with each other, e.g. electric spark discharge or electric shock experienced by personnel.
- Control Measure: Establish electrostatic protective areas to be free of static build up, using control measures to prevent static charges built. E.g. Not using a insulated container (plastic) for draining purposes or prevent splash filling of liquids.
- To remove static charges provide antistatic devices, bonding, grounding and controlling humidity

Electrostatic charge is generated whenever there is friction between 2 bodies moving relative to one another. Charge generation occurs in liquid systems at the interface of any 2 unlike materials, so a static charge will be generated in any moving fluid, with positive or negative charges moving from the fluid onto the bounding surface.

The causes of electrostatic charge generating include the following examples:

- Friction caused by fluid flowing in pipes
- High fluid velocities
- Fluids flowing in ungrounded pipes and hoses
- Passage of fluids through filter elements or other microporous structures
- Generated by turbulence in the liquids and by pumping elements, especially centrifugal pumps
- Fluid discharging on to the free surface of the reservoir

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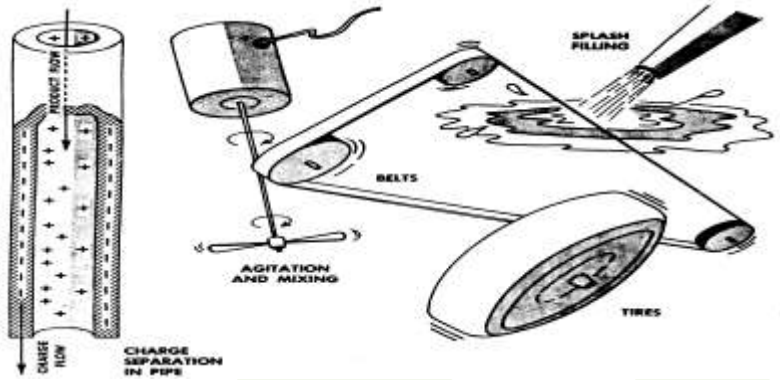
- When free air is present in the liquid, for example, in bearing and paper machine return lines
- Imparted into the liquid when component surfaces sliding is relative to one another

Danger of static electricity

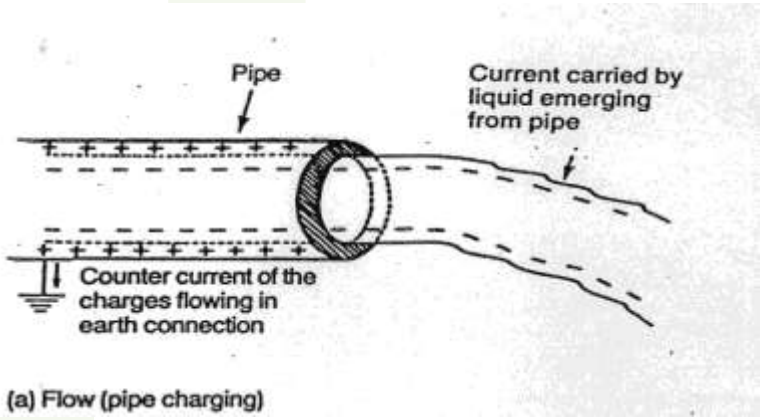
Generation of static electricity



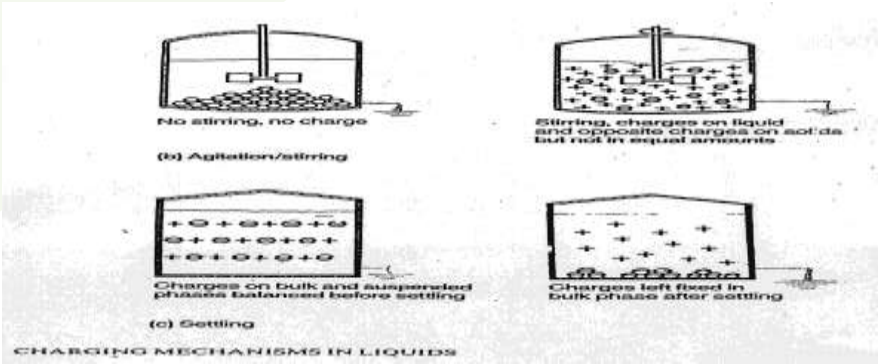
Discharge of static electricity can create severe hazards in industries dealing with flammable substances, where a small electrical spark may ignite explosive mixtures.

Static charge can be mitigated by

- limiting the flow velocity to < 1 m/sec for less viscous stuff
- limiting the flow velocity to < 7 m/sec for viscous stuff



Protection against static discharge by



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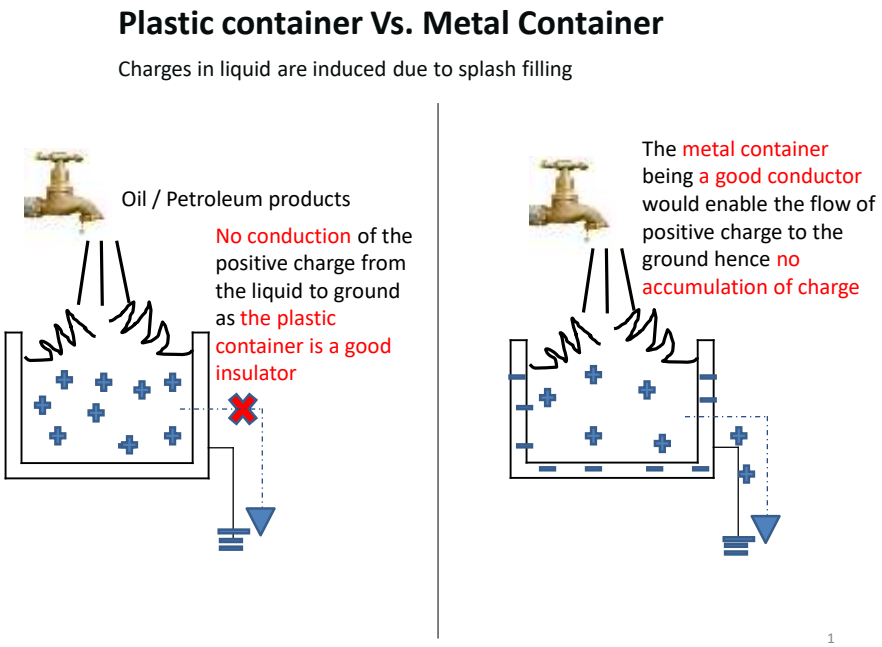
- Control humidity
- Antistatic additive
- Adding a conductive mesh (grounding) downstream of the filter material
- Increasing the filter size, reduce the flow density
- Increase the time for the charge to decay (Settling time)



Radiation:

- Transfer of heat as invisible waves through the air (the air or gas is not heated but solids and liquids in contact with the heat are), e.g. items or waste containers stored too near to a building may provide enough radiant heat to transfer the fire to the building if they are ignited.
- Control Measure: separation distances or fire resistant barriers.

Direct Burning:

- Combustible materials in direct contact with naked flame, e.g. Curtains or carpet tiles may be consumed by combustion and enable fire to be transferred along them to other parts of a building.
- Control Measure: the use of retardant materials.

2.2 Interpret the types of fire safety signs and instructions

- *Emergency exit*
- *Fire extinguisher*
- *Fire hose reel*
- *Fire hydrant*
- *Call Point*
- *No smoking*
- *No naked light*
- Assembly Point

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2.3 Check safety signs and instructions at workplace for inadequacy and report to appropriate person in accordance with organisational procedures

The purpose of a safety sign and instructions is to alert persons when emergency occur.

The important of safety signs are to tell people what they should or should not do; where or where not to go and provide simple instructions or graphics to help people understand what they should or should not do. These signs ensure that people are aware of hazards or dangers and help to avoid injury.

2.4 Work in accordance with an issued Permit-To-Work (PTW)

Main Elements of PTW:

- A description of the task to be performed
- An indication of the duration of the validity of the permit
- The isolations that have been made and the additional precautions required
- Details and signature of the person authorizing the work such as Project Manager or any deputy who appointed by Project Manager with letter of appointment
- An acknowledgement of acceptance by the worker carrying out the task, who would then need to indicate on the permit that the work has been completed and the area made safe in order for the permit to be cancelled

A permit to work system is a formal safety control system designed to prevent accident injury to personnel, damage to plant, premises and product particularly when work with foreseeable high hazard content is undertaken and the precautions required are numerous and complex.

Hot Work

- Typically involving welding operation s such as pipe work where the risk of sparks may ignite nearby flammable materials. Fire equipment and fire fighter must be deployed.

Electrical Work

- Electrical equipment such as transformer will required safety isolation, access and egress, work at a height and heavy lifting to be manning.

Machinery Maintenance

- Machinery / Plant maintenance may be spread over different flooring of building such as power generation plant, flour mills or lift systems

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2.5 Follow safe work procedures for Hot Work

- Controls and ensure all work are carried out under the safest possible condition
- Specifies the work to be carried out and the necessary precautions to be taken before work is allowed to start
- Work is authorized and preformed by designated personnel
- An essential part of safe system of work for many maintenance activities
- Demonstrates that all foreseeable hazards have been examined
- PTW is a formal approved checklist and to ensure that all the elements of a safe system of work are in place before persons are allowed to enter or work in the hazardous work area. No person shall enter or work, without a valid entry Permit-to-Work
- This is to prevent any serious fire accident from happening.
- This apply to any works that produce heat, welding spark, spark grinding etc ...
- Using too much solvent can be dangerous, and can easily cause a fire when the source of heat is nearby.
- For painting work, the paint fume is flammable gas.
- Also for those perform repair work on hydraulic oil system inside a chemical tank or confined space area

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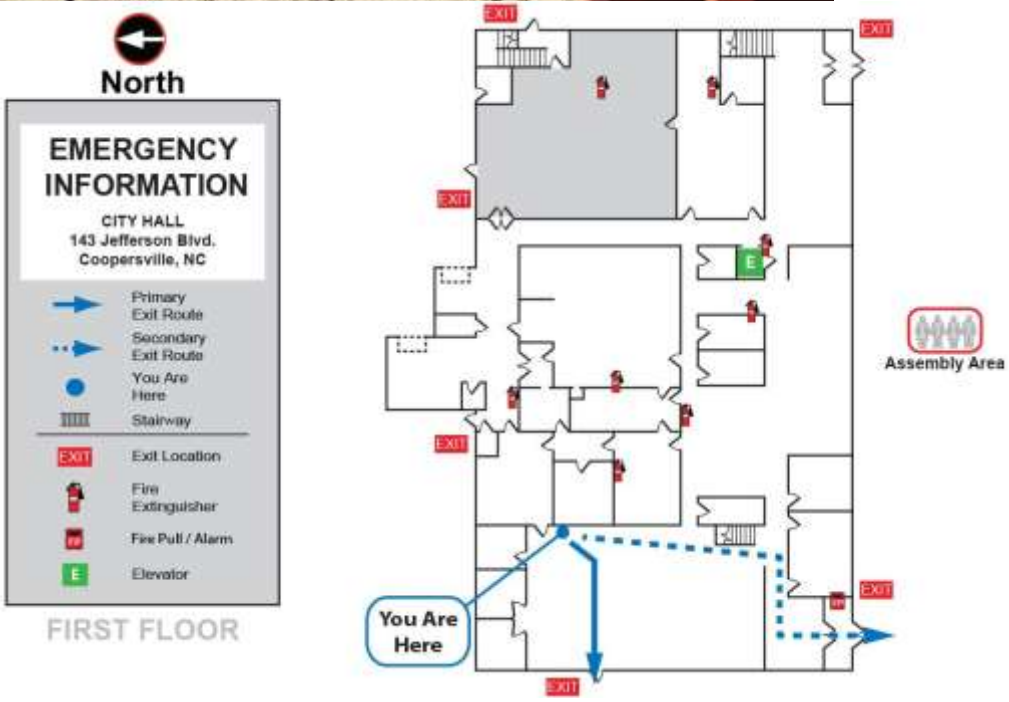
2.6 Follow organizational procedures to respond to a fire emergency

- It should be the duty of the responsible person to appoint a person who has been trained in fire fighting as a fire watchman where any hot work is carried out in chemical plant or in confined space tank
- It should be the duty of the responsible person to ensure that the fire watchman is provided with suitable and adequate firefighting equipment. It should be the duty of the fire watchman
- To keep watch over the area in which the hot work is being carried out and the surroundings throughout the duration of the hot work; and to extinguish or control the fire if it is within his means to do so
- To report to Singapore Civil Defence Force if unable to control the fire.



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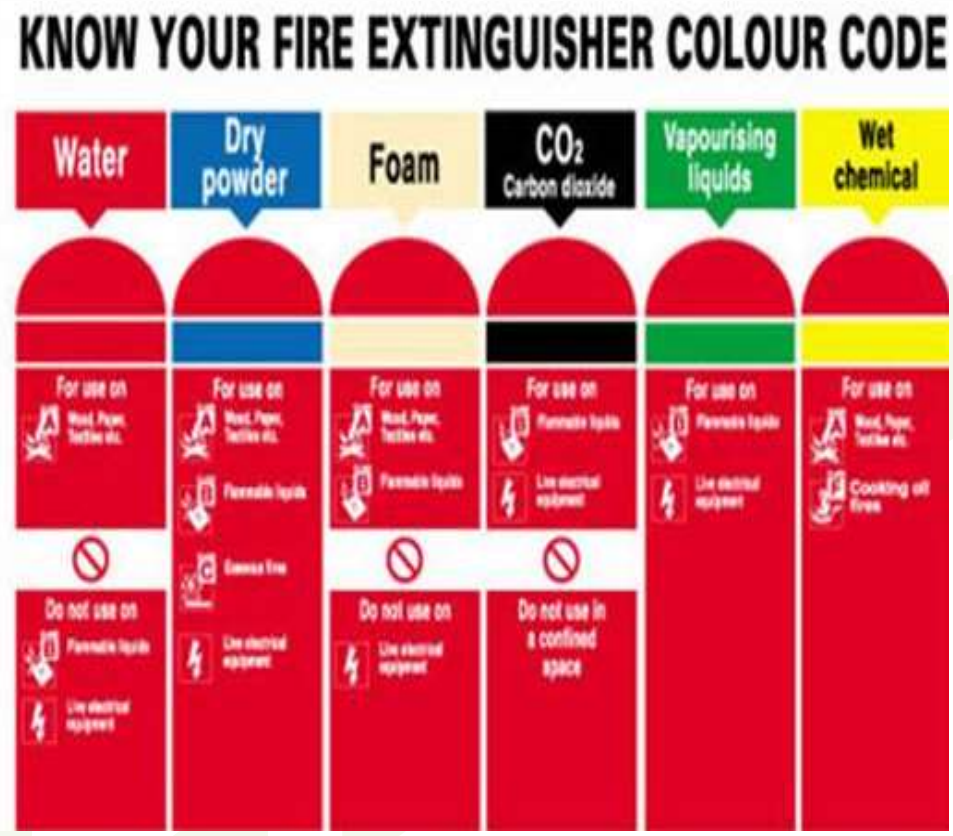
Fire Classification	Fire Risk	Water	Foam	CO2	Powder	Wet Chemical
Class A	Wood, Paper, Textiles and Fabrics	√	√		√	
Class B	Flammable Liquids - Petrol, Oil, Paints		√	√	√	
Class C	Flammable Gases				√	
Class D	Metal Fires				Special Powder Only	
Class E	Electrical Fires			√	√	
Class F	Cooking Oils and Fats					√



Operation of an extinguisher # Remember - PASS

2.7 Report unsafe working conditions and potential fire hazards to appropriate person in accordance with organizational procedures

- For confined space report to Attendant immediately
- For work activities report to immediate superior or foreman immediately and stop work if hazards endanger and threaten life

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2.8 Select and use the correct solvents for chemical cleaning

- Before commence the work, ensure that the cleaning permit is approved.
- Preparation - Seal the work area properly with red/white tapes.
- Hang the cleaning permit outside or near the work area, this is to show that the 'Chemical cleaning work is in progress'.
- Need to hang – "Strictly No Smoking Near this Area". Sign
- No welding spark or grinding spark is allowed near to this area or on the top of this work area.
- Switch 'OFF" all generator engines near to these work area.
- If cleaning work is not complete in time, - a new cleaning permit is needed and wait for the approval.

2.9 Store and control chemical Safely

Store all flammable or chemical in proper safety cabinets Need to indicate what is stored inside (look out for SDS) and locked cabinets

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CE 3 Comply with safe work practices and control measure for materials handling

Introduction

- This section focuses on knowing the method/step of manual handling.
- Knowing the safely operational use of machine equipment.
- Stated the step of rigging and slinging of lifting.
- Identify the correct PPE use for manual handling.

3.1 Use the correct method of manually handling of load

- Step 1: Assess the load and plan the lifting process. Need any help? Can use other lifting equipment? Clear the path for any obstructions.
- Step 2: Place the feet. 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 is stable and good grip on object before moving off.

3.2 Carry out proper use of machine equipment

- For heavy items. Always use mechanical lifting machine
- Use Mechanical Equipment or Devices whenever practicable, trolleys, stackers, levers, hooks or crowbars to move the object.

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3.3 Follow rules and procedures when operating mechanical lifting equipment

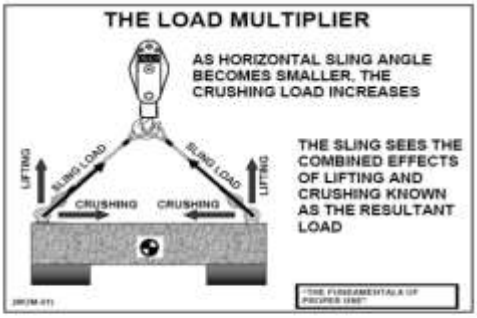
- Riggers must ensure load is secure, stable & balanced.
- Signalman must verify with riggers that load is properly rigged before he gives signal to crane operator to lift load.
- Signalman must be attired in such a way as would be distinctively identifiable as a signalman

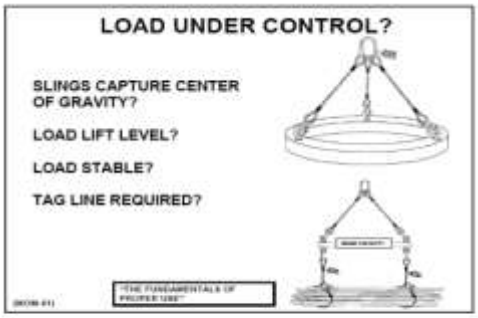
Figure 1: Signalman attire

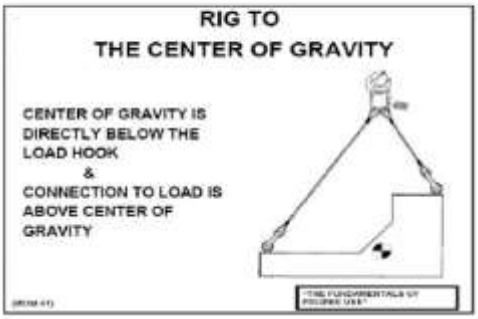
Figure 2: Rigger attire

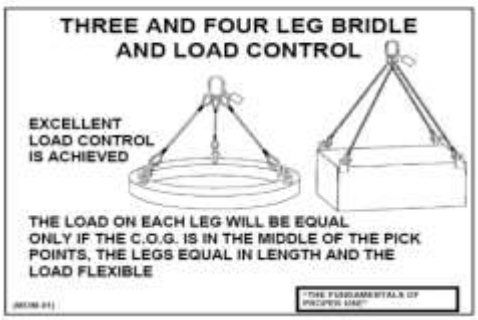
3.4 Comply with the safe rigging and slinging method of lifting

- Lifting frame being use for rigging
- Rigging method and centre of gravit









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3.5 Coordinate the use of lifting machines/equipment

- The Standard Hand Signals. These same signals are officially used all over the world
- The signalman becomes the eyes of the crane operator. Often, the operator can't see the load; it is out over a flat roof or the other side of a wall, etc. Even when the load is right in front of him, he can't see through it.
- The signalman has to be aware of the path the load will follow for each signal he chooses.
- Crane signals are designed to tell the operator what function of the crane to activate and in what direction. A crane hand signal causes a load to move with respect to a *crane*, not a building or road. The crane moves when and where the signalman directs. This also means: THE CRANE IS *NOT* TO MOVE WHEN THERE IS NO SIGNAL VISIBLE! Your job site will be more efficient and safer if your signalman continuously signals as long as he desires motion of the crane. In other words, if the crane operator ceases to see a signal, he should smoothly stop the crane and let go the controls.
- Be sure your signals are visible to the operator. The perception is that if you can make eye contact with the crane operator, he can automatically see your signals.
- When crane operator have a difficulty of visibility with signalman. Communication device need to be used.

Main Hoist	Auxiliary Hoist	Hoist Load	Hoist Load Slowly	Stop
Raise Boom	Raise Boom & Lower Load	Lower Load	Lower Load Slowly	Emergency Stop
Lower Boom	Lower Boom & Raise Load	Swing Boom	Swing Boom Slowly	Travel (mobile eqpt)
Retract Boom 2 hands	Retract Boom 1 hand	Extend Boom 2 hands	Extend Boom 1 hand	Dog Everything

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3.6 Select and use the correct PPE for Manual Handling

- Are there any sharp or point edges?
- Is it enough to prevent injuries or occupational diseases?
- Does the PPE fit you correctly?
- Does the PPE wear out easily?
- Is it based on chemical properties of the substance?
- Does it minimize contact with chemicals?
- Is it easy to clean and maintain?

- ❑ Safety boots
- ❑ Protective gloves
- ❑ Helmets
- ❑ Working apron or overalls
- ❑ Goggles or safety glasses
- ❑ Face mask or respirators

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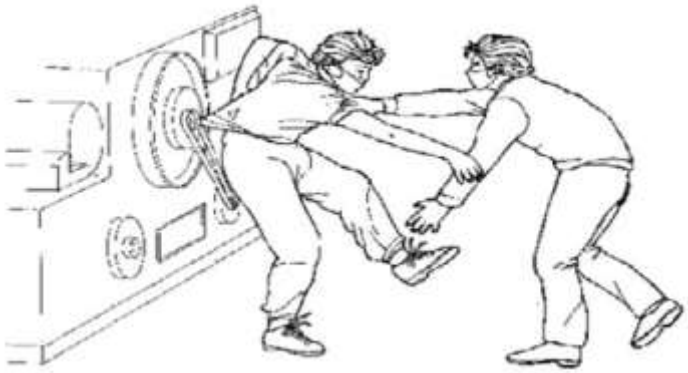
CE 4 Comply with safe work practices and control measures for Mechanical and Electrical Works

Introduction

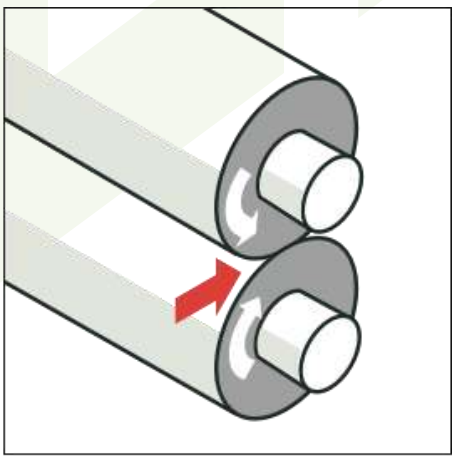
- This section focuses on identify mechanical and electrical hazards at workplace.
- The control measure on the mechanical and electrical hazards.
- Stated the correct use of PPE for electrical work at workplace.
- Proper use and usage of portable hand tools.
- Identify the potential noise hazards and proper use of protection on the noise induced deafness.

4.1 Identify and recognize common mechanical and electrical hazards

Entanglement: - Loosing clothing, jewellery, long hair, etc. increase the risk of entanglement. Example of rotating action hazards include couplings, drill chucks/bits, flywheels, spindles and shafts (especially those with keys/bolts)



Drawing-in/pulled-in
When a belt runs round a roller an in-running (pinch point) is created between them (in the direction of travel), inward movement draws in any part of the body presented to it. Examples of drawing-in (in-running/nip) hazards are V-belts such as on the drive from a motor to the drum of a cement mixer, meshing gears and conveyors.



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Friction and abrasion

Friction burns and encountering rough surfaces moving at high speed, e.g. sanding machine, grinding wheel etc. can cause abrasion injuries.

Cutting

Saw blades, knives and even rough, especially when moving at high speed, can result in serious cuts and even amputation injuries. The dangerous part can appear stationary. Examples of cutting hazards include saw, slicing machines, abrasive cutting discs, chains (especially chainsaws), etc.

Shear

When two or more machine parts move towards/past, one another a “trap” is created. This can result in a crush and amputation injuries. Examples of shearing/crushing action hazards include scissor lifts, power presses, guillotines etc.

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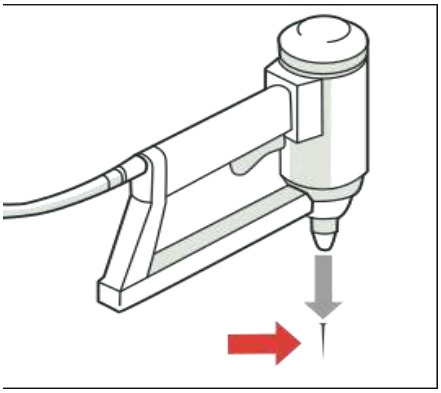
Stabbing and puncture

The body may be penetrated by sharp pieces of equipment, or material contained in the equipment, e.g. fixing materials such as nails fired into a part of the body, or a drill bit puncturing the hand.



Impact

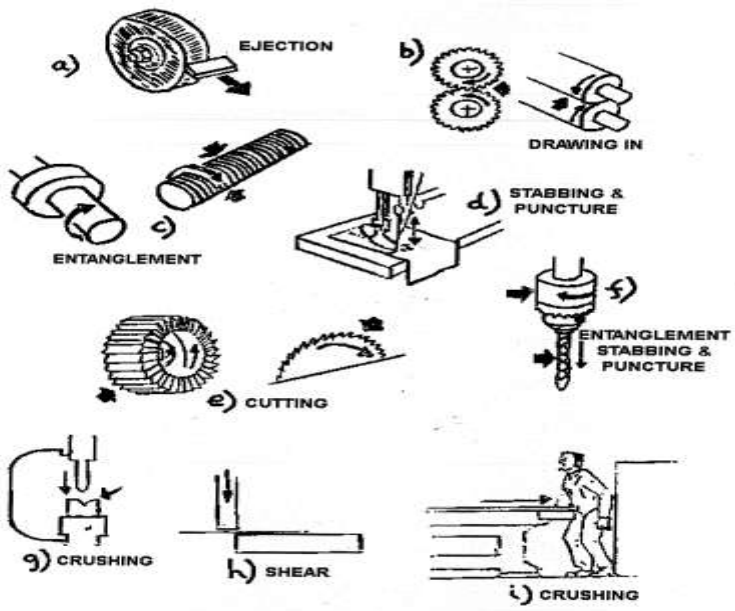
Impact is caused by objects that strike the body, but do not penetrate it. They may cause the person or part of the person to be moved, sometimes violently, resulting injury e.g. struck by the jib of crane/excavator or materials on a hoist or the moving platter of a machine like a surface grinder.

Crushing

Cause when part of the body is caught between either two moving parts of machinery or a moving part and a stationary object, e.g. the platform hoist closing together with the ground or an overhead beam, moving parts of piling equipment or the calipers of a spot welding machine.

Ejection

When pieces of material being worked on or components of the machinery are thrown or fired out of the equipment during operation they represent an ejection hazard. Examples part s of a shattered grinding wheel, sparks, swarf (waste metal shavings) or a nail from a nail gun.



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4.2 Follow hazards control prevention measures

You should:

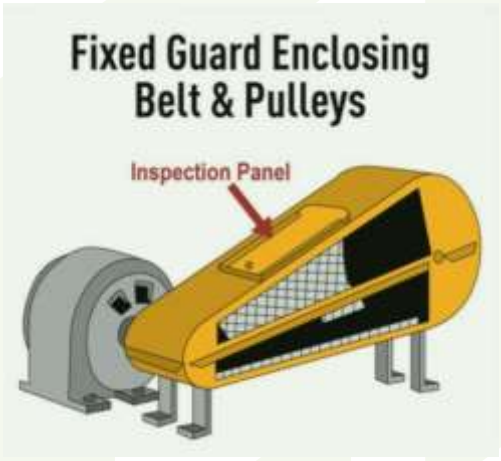
- Conduct visual check on machine before starting operation.
- Ensure machine guards are in place before operating the machine.
- Stop the machine if it is operating abnormally.
- Report any unsafe condition, near miss or incident to your supervisor.
- Adhere to all safe work instructions and procedures.
- To be train on the equipment operating procedure

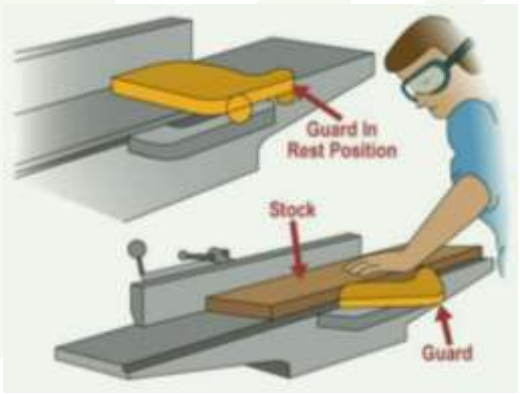
Types of hazards control measures

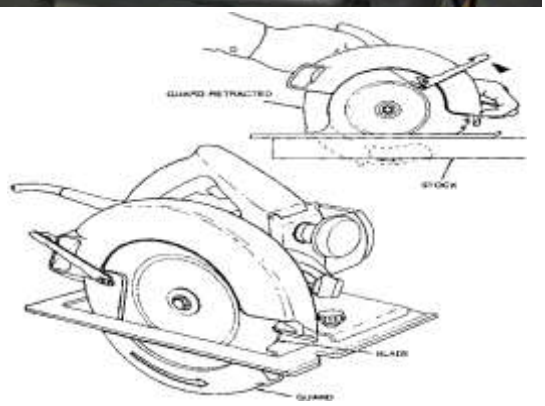
- Machine guarding
- Using devices, e.g. sensor, gates, etc
- Distance
- Use of automatic or semi-automatic fed and ejection/robots

Types of machine guarding

- Fixed guard
- Interlocked guard
- Adjustable guard
- Self-adjusting guard







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4.3 Select and use the correct PPE for electrical work

PERSONAL PROTECTIVE EQUIPMENT AND PROTECTIVE CLOTHING

Workers shall wear appropriate personal protective equipment (PPE) and protective clothing to protect them from hazards of high-voltage apparatus.

Workers authorized or required to work on high-voltage systems shall be completely familiar with the PPE and protective clothing they need for adequate protection while working on such systems.

TYPES OF FIRE RESISTANT FABRICS

Chemically dependent fire resistant fabrics are treated with flame retardant chemicals added to the fiber or treatments applied to the fabric. These treatments are activated by heat and produce gases that smother the flame. Typically, these fabrics have a definite life as defined by the manufacturer. This is usually defined by the number of home or commercial washings the garment is exposed. Inherently fire resistant fabrics, by their composition, do not burn in air. The fire resistance of this fabric is not affected by washing.

CLOTHING SYSTEMS

All clothing worn by affected workers should be considered part of the workers protective clothing system. This includes rainwear, cold weather wear and underclothing. Protective clothing should provide a good functional fit to increase the protection and comfort of the clothing. When required, protection can be increased by wearing single or multiple layers of flame-resistant outer garments over non melting clothing. Sleeves and shirts should be fully buttoned and appropriate neck, head, and hand coverings provided.

WORK CLOTHES

Work clothes should be made of natural materials, such as cotton or wool, or fire resistant materials and should have full length sleeves. Sleeves should be rolled down for greatest protection.

FIRE-RESISTANT (FR) CLOTHING

FR materials, such as flame-retardant treated cotton, meta-aramid, para-aramid, and polybenzimidazole(PBI) fibers provide thermal protection. These materials can ignite but will not continue to burn after the ignition source is removed. FR fabrics can reduce burn injuries during an arc flash blends, para-aramid adds strength to a fabric to prevent the fabric from breaking open due to the blast shock wave and high thermal energy of the arc.

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EYE PROTECTORS

Whenever eyes are in danger of being injured, workers shall wear safety goggles or other eye protectors meeting ANSI standards. When the work being performed dictates, workers should wear nonmetallic and nonconductive eye protection. Appropriate PPE is needed to protect workers from arc flash hazards.

METAL FASTENERS

Workers shall not wear articles such as loose chains, keys, watches, or rings if such articles increase the hazards associated with inadvertent contact with energized parts or can become caught under or snagged while climbing off or on structures, equipment or vehicles.

WORK GLOVES

When insulated gloves suitable for high-voltage are not required, otherwise suitable work gloves should be worn while handling materials and equipment to prevent the possibility of slivers, cuts, and skin irritation.

SHOES

Workers should wear shoes or boots that comply with the requirements of ANSI Z41. No metal parts shall be present in the sole or heel of the shoes where nonconductive shoes are required.

HARDHATS

Workers should wear approved hardhats when working aboveground on poles, structures, or buildings or in trees. Workers shall wear hardhats when working on the ground near poles, structures, buildings, or trees in which work is being done. Workers shall wear hardhats when visiting or observing in areas where overhead work is being done.

4.4 Comply with procedures when using and maintaining the machinery

Licence Electrical Worker (LEW)

All electrical work must be undertaken or carried out by a licensed electrical worker. Such work have to be tested before the supply is turned on. These include:

- New wiring
- Rewiring
- Extensions

Emergency switch is provided when emergency stopping of machine is necessary, and hence, the switch shall

- Be easily accessible to the operator; and
- Be designed for unexpected activation
- When necessary, buddy system shall be considered.

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Lockout / Tagout (LOTO) Procedure

What must be included in the LOTO Procedure?

- A statement on how to use the procedures;
- Steps to shut down, isolate, block, and secure machines;
- Steps designating the safe placement, removal, and transfer of LOTO devices and identifying who has responsibility for the LOTO devices; and
- Requirements to determine and verify the effectiveness of lockout devices, tagout devices, and other energy-control measures.

What must workers do before maintenance activities?

- Prepare for shutdown;
- Shut down the machine;
- Disconnect or isolate the machine from the energy source(s);
- Apply the lockout or tagout device(s) to the energy-isolating device(s);
- Release, restrain, or render safe all potential hazardous stored or residual energy. Regularly inspect to avoid re-accumulation of energy if necessary.
- Verify the isolation and de-energization of the machine.

What must workers do before removing LOTO device and reenergize the machine?

- Step 1: Inspect machines or their components to assure that they are operationally intact and that nonessential items are removed from the area; and
- Step 2: Check to assure that everyone is positioned safely and away from machines.

What are the limitations for tagout devices?

- A tagout device is a prominent warning of the hazards;
- Tags do not provide the physical restraint of a lock;
- Tags may evoke a false sense of security;
- Therefore, lockout devices are considered more secure and more effective than tagout devices in protecting employees from hazardous energy.

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Before using any machine, you should:

- Be trained by qualified person/agent
- Clarify any doubt on machine usage
- Have the correct certificate, if required by law
- Inspect the machine for good condition (or inspected by qualified persons)
- Do not operate machine unless authorized

Before using any machine, you should ensure that:

- Proper PPE is used to conduct the work
- The PPE is in good condition
- Proper training has been given on how to use PPE

4.5 Proper use and storage of hand tools

Hand tools are tools powered manually, examples axes, hammer, and screwdrivers, therefore the biggest hazard would arise from errors made by the user such as striking a finger whilst using a hammer or curs from a saw.

4.6 Selection and proper use of hearing protection

Hearing Protectors

Types

- Ear-muffs
- Ear-plugs
- Banded ear-plugs
- Special types(e.g. communication ear-muffs)

Selection

- Noise reduction rating
- Wearer's comfort
- Working environment & activity
- Skin disorder or ear problem
- Compatible with helmets, spectacles

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Proper Usage

- Period of use
- Correct fitting
- Guidance/Training of use & maintenance
- Care and maintenance
- Inspection and replacement
- Supervision of proper usage

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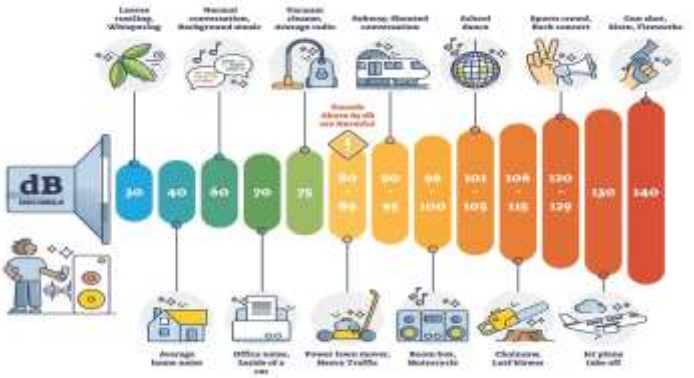
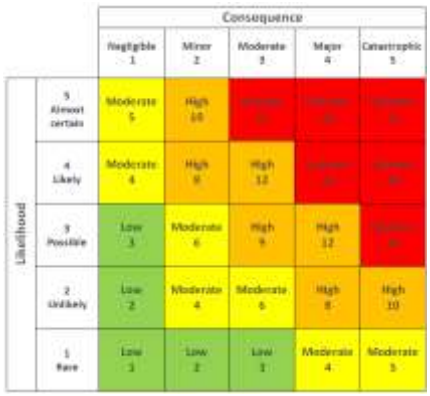


4.7 Risk Assessment

Why should we do Risk Assessment?

- Allows us identify the hazards at the workplace and implement effective risk control measures before they escalate into accidents and injuries
- Workplace Safety and Health (Risk Management) Regulations – September 2006



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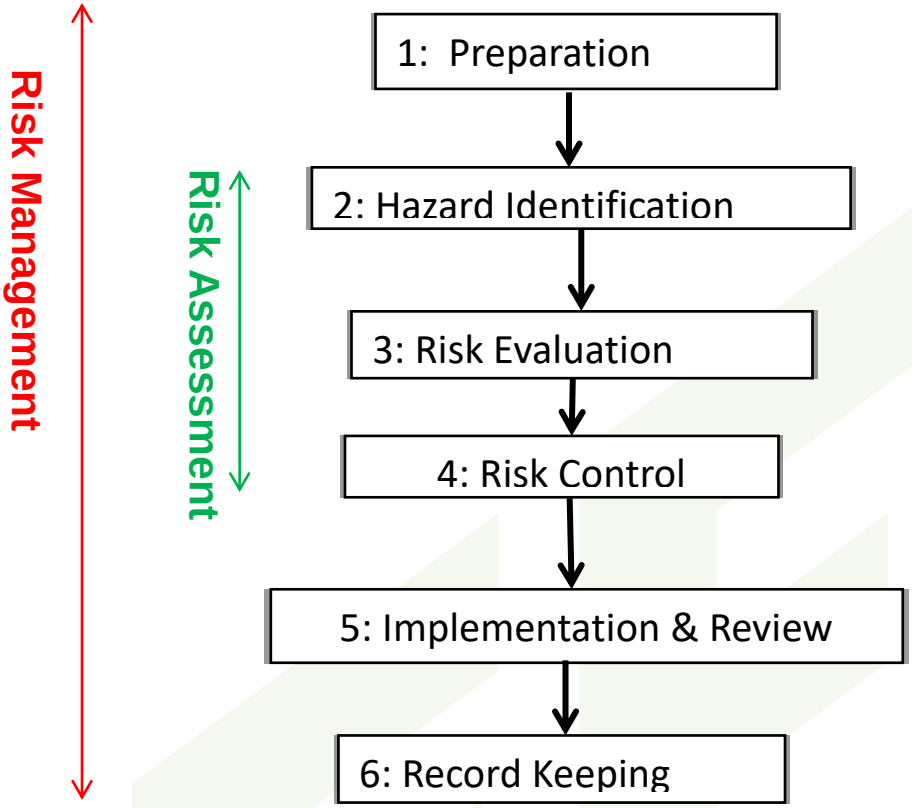
WHAT IS RISK MANAGEMENT / RISK ASSESSMENT?



3 main process:

1. Hazard Identification
Identifying the hazards in the workplace(s) under your control

2. Risk Evaluation
Assessing the risks presented by these hazards, reduce or eliminate

3. Risk Control
Putting control measures in place to reduce or eliminate the risk of these hazards causing harm according to Hierarchy of Control

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CE 5 Comply with safe work practices and control measures when working on specialized operations

Introduction

- This section focuses on specialized operations such as radiation, steam, gases, and chemical hazards.
- Understudy the use and read the gas detectors.
- Correct method for handling chemical and biological materials.
- Knowing the heat related illness while working under the sun.

5.1 Recognize hazards associated with specialized operations

Biological Hazards

Diseases or illnesses can occur from biological sources:

- Microorganisms (e.g., bacteria, viruses, fungi, molds)
  - West Nile virus
  - Lyme Disease
  - Histoplasmosis (fungus in bird droppings)
  - Hantavirus
- Plant toxins
  - poison oak & sumac;
  - stinging nettles

Some of these diseases are minor infections; others can be serious or deadly.

Exposure may occur during demolition, renovation, sewer work, work on air handling systems, or other construction work from contact with contaminated or disease-carrying:

- soil
- water
- insects (mosquitoes, ticks)
- bird or bat droppings
- animals
- structures

What is H2S?

- Hydrogen sulfide has an important role in traditional qualitative chemical analysis, where it precipitates metals with insoluble sulfides.
- Hydrogen sulfide is extremely poisonous (more toxic than hydrogen cyanide)

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H2S detectors

- Use personal gas monitor that able to detect CO, O2, H2S, HCN or CL2.
- H2S detectors Protects personnel from unsafe concentrations of a number of dangerous gases.
- Use H2S detectors will provide audible, visual and vibration alarms when any of the preset limits are exceeded

All chemicals exist in one of three forms:

The physical form of the hazardous chemical can affect how hazardous it is and how it enters the body

- Solid
- Liquid
- Gas

Hazardous Chemicals – Dusts

- Some chemicals are solids in the form of powders or dust.
- Dust can be released into the air by cutting, drilling, grinding or sanding.
- Dust can also be stirred up by dry sweeping and inhaled.

Dust or powders can be inhaled when they become airborne. For example, cutting brick or cinder block without water can generate lots of airborne dust that contains quartz (silica). Dry sweeping can do the same. If silica dust is inhaled it can scar the lungs and cause breathing problems.

Hazardous Chemicals – Dusts

- Dust in the air can settle out on work surfaces, cups, plates, utensils, and food.
- The settled dust can be swallowed with food or drinks.
- If the dust is hazardous, it can cause health problems.
- This is real problem with lead dust.

Hazardous Chemicals - Solids – Fumes and Fibers

- Fumes are extremely small droplets of metal formed when the metal has been vaporized by high temperatures (usually welding)
- Some solids are fibers which can be similar to dusts but they have an elongated shape (like asbestos or fiberglass)
- Metal fumes are formed during welding. Because of their tiny size, they are easily inhaled deep into the lungs and can be absorbed into the blood stream. Sometimes the word “fumes” is used for chemicals gases or smoke in the air, but this is the more accurate definition.
- Asbestos is one of the most hazardous dusts in fiber form because of the damage it can do to the lungs. Fiberglass does not damage the lungs, but can be irritating to the nose and throat.

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Hazardous Chemicals – Liquids

- Liquid chemicals in direct contact with the skin can cause skin problems.
- Some liquids can be absorbed into the body through the skin.
- Liquids can be sprayed and form mists or evaporates and form vapors which can be inhaled.
- Typical hazardous liquids are various types of solvents. These chemicals can dry the skin out, cause an allergic reaction or have other direct effects on the skin. Some liquid solvents are flammable and can be a fire hazard as well.

Hazardous Chemicals - Liquids (Mists)

- Mists can also be inhaled.
- Mists can settle on the skin and be absorbed into the body.
- Airborne mists can also settle out and contaminate food or drink.
- The most common exposure to mists is from inhalation. A common example of a mist exposure at work is paint overspray.

Hazardous Chemicals - Gases and Vapors

- Gases are chemicals that are in the gas phase at room temperature.
- Vapors evaporate from substances that are liquids or solids at room temperature.
- Gases and vapors enter the body by inhalation.
- Chlorine and methane are examples of gases. Most liquid solvents release vapors. Examples are acetone, paint thinner and gasoline. Gases do not normally pass through the skin.

Chemical Exposure Limits

- Many chemicals have exposure limits, or allowable amounts of a chemical in the air.
- These limits are often called “Permissible Exposure Limits” or “Threshold Limit Values”.
- They are based on 8-hour average exposure or ceiling or peak levels.
- Levels must be kept below these limits for safety.
- Permissible exposure limits are also called PELs and threshold limit values are called TLVs. DOSH regulations have PELs for about 600 chemicals. Often the MSDS will list the OSHA PEL which can be different from the DOSH PEL. The limits are usually expressed as parts per million (ppm) or milligrams per cubic meter (mg/cu. meter). Your exposure to chemicals cannot exceed these limits.

Limits of Flammability

- The limits of flammability are the range that a mixture of air and vapor is flammable.
- Mixtures can be too lean (not enough vapor) or too rich (too much vapor) to ignite and burn.
- An example is an automobile engine. Even though gasoline is very flammable, the car won’t run if the mixture is too rich (too much gasoline vapor) or too lean in the carburetor or fuel injection system.

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Flammable Liquids

Lower Flammable Limit (LFL)

- In most work situations, the "lower flammable limit" (LFL) is the main concern.
- Vapors from flammable liquids can be found in the workplace, but are often too diluted to catch fire or explode.
- However, these vapors can quickly go above the LFL in small room or confined space like a tank.
- Vapors that exceed the LFL are usually toxic as well, and lower the amount of oxygen. So if the explosion or fire doesn't harm you, the toxicity or lack of oxygen probably will. LFL is sometimes called LEL – lower explosive limit.

Hazards of Metals

- Metals can be both physical hazards and health hazards.
- Some metals can ignite and explode – magnesium, or dusts/filings of other metals such as aluminum.
- Some metals are almost non-toxic – iron, aluminum.
- Others are very toxic – mercury, lead, cadmium, beryllium.
- Metals can present different hazards from poisoning to explosions and fire. Metals can cause health effects such as elevated blood pressure, brain damage, kidney failure and death. Pieces or articles of metal are not usually hazardous, it's when they are found in other products or are welded, cut or grinded, creating dust or fume that can then be inhaled. A few metals can actually burn rapidly and intensely if they are in a powder form. Airborne dusts and filings of some metal such as aluminum can explode when ignited. Some metals are carcinogenic – ex. chromates found in paints or in metal plating.

What is a "hazardous chemical"?

- A hazardous chemical is any chemical that can do harm to your body.
- Most industrial chemicals can harm you at some level.
- It depend how much gets into your body.

How do hazardous chemicals affect the body?

It depends on several factors:

How the chemical enters the body

- The physical form of the chemical.
- The amount of chemical that actually enters the body - the dose.
- How toxic (poisonous) the chemical.
- A poisonous chemical will not do you any harm, obviously, if it does not enter your body.

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There Are Four Routes of Entry:

- **Ingestion** – swallowing the chemical
- **Inhalation** – breathing in the chemical
- **Absorption** – the chemical soaks through the skin
- **Injection** – forceful biological/chemical breach into body by injury such as cut

Inhalation is typically the most common way chemicals can enter the body in a work situation. Skin absorption is less common, but can occur with some solvents and pesticides. Ingestion and injection are usually not a major problem in the workplace except in certain situations.

Ingestion (Swallowing)

- Chemicals that are swallowed are absorbed in the digestive tract.
- Chemicals can rub off dirty hands and contaminate food, drinks or tobacco products.
- Chemicals in the air can settle on food or drink and be swallowed.
- This is another good reason to wash your hands before eating, drinking or smoking.

Inhalation (Breathing)

- Chemicals in the air are breathed in through the mouth or nose.
- Gases & vapors are absorbed through the lungs directly into the bloodstream.
- The size of dust particles or mist droplets can affect where the chemical settles in the respiratory tract.
- Where the particles or mist settles in the respiratory tract determines what symptoms or diseases will develop. Some chemicals settle in the nose and throat, some go deeper into the lungs. The chemicals that go deeper in the lungs often cause more damage. Fine dust usually goes deep into the lungs.

Skin Absorption

- Some chemicals can pass through the skin into the body.
- These chemicals can then cause various health effects.
- Some chemicals are absorbed through the skin more easily than others. Many insecticides and some solvents are easily absorbed through the skin. Also, some chemicals will have a direct effect on the skin without being absorbed through the skin. More about that later.

Injection

- A forceful breach of the skin perhaps as a result of injury can carry harmful substances through the skin barrier.
- The forced injection of a gent into the body provides an easy route past the skin which usually acts as the body's defense mechanism and protects people from the effects of many agents that do not have the ability to penetrate.
- For example handling broken glass which cuts the skin and transfer a biological or chemical agent into the body.

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Radiation

- We must take Safety precautions
  When working near to radiation work area
- Workers been advice to stay away when this safety sign display near to our work area it means work in progress and this indicate that presence of radiation hazards and there's high risk of radioactive exposure.
- Follow the safety sign board or ask your supervisor/foreman for advice.
- Ensure that the permit for radioactive work is approved, brief to those assigned to do the work.

Health Hazards – Ionizing Radiation

- X-rays and gamma rays from equipment used to gauge the density and thickness of pipes, to inspect welds, or for detecting weakness of metal structures
- radioactive isotopes from flow meters
- Health effects: increased risk of developing cancer and genetic disease.

Health Hazards – non-ionizing radiation

- ultraviolet light from sunlight & welding
- infrared radiation from torch welding and cutting
- radio waves from radio transmission devices (roof-top dishes & antennas)
- lasers used for aligning, ranging, and surveying are usually low-powered but can cause eye injuries if directly viewed for extended time
- Health effects:
  - skin cancer
  - eye damage
  - premature skin aging
  - burns

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Safe Work Procedure and preventive measure:

Radiation Protection

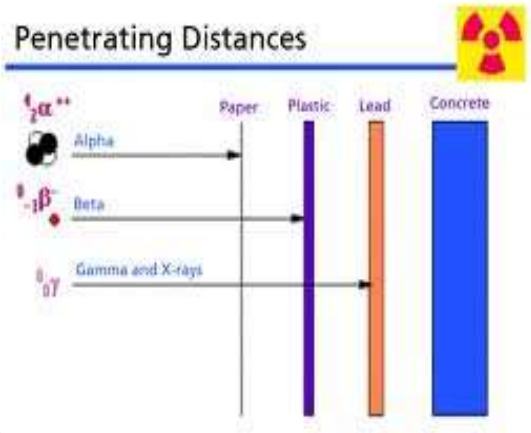
- **Shielding**
- **Increase distance**
- **Reduce exposure time**

Warning signs and restricted radiation

- area against unauthorized entry

Personal monitoring

Radiation survey after source retraction



5.2 Follow preventive measures when working with radiation, steam, gases and chemicals

Safe Work Practice

Before working on any kind of chemical, always refer to the Safety Data Sheet (SDS) document first.

- Use proper & correct PPE set.
- Ensure of proper eye protection and correct hand gloves.
- Ensure that the hand gloves are in good working condition after using. if the hand glove found to be damage, stop work we need to change for other type and check your skin.

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Safety Data Sheet (SDS)

Names of hazardous chemicals in a product, -
Acetone
Physical and chemical properties of the product, -
Colourless liquid
Physical hazards of working with the product,
Highly flammable
Health hazards of working with the product (including signs and symptoms of overexposures),
Causes eye irritation
The main way the chemical enters the body,
Inhalation
The legal limit allowed in the air
250 PPM
If the chemical is a carcinogen
No
Precautions for safe use of the hazardous chemical,
Avoid breathing mist, spray vapors
Exposure control methods, including personal protective equipment,
Face shield, protective clothing
Emergency and first aid procedures,
Remove victim into fresh air
The date the SDS was prepared or revised,
04/24/2018
Name, address and phone number of the person responsible for the information in the SDS
LabChem, Inc. Jackson's Pointe Commerce Park Building 1000, 1010 Jackson's Pointe Court Zelienople, PA 16063 - USA

5.3 Use and read gas detectors

Multi-Gas Monitor

- 1 to 4-gas monitoring for O2, LEL, CO, H2S
- Standard vibrating, 90 dB audible and ultra bright visual alarms
- 18-hour runtime with integral Li-ion battery pack
- Low, High, STEL, and TWA user adjustable alarms
- Standard 50-hour data logging capability

- ✓ Oxygen – range between **19.5% to 23.5 %**
- ✓ Combustible gas limit: less than **10 % of LEL**
- ✓ Toxic gases(H2S and CO): Within their **P.E.L** values.

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5.4 Work and comply with the Permit-To-Work (PTW)

Main Elements of PTW:

- A description of the task to be performed
- The duration of the validity of the permit
- The isolations that have been made and the additional precautions required
- Details and signature of the person authorizing the work such as Project Manager or any deputy who appointed by Project Manager with letter of appointment
- An acknowledgement of acceptance by the worker carrying out the task, who would then need to indicate on the permit that the work has been completed and the area made safe in order for the permit to be cancelled

5.5 Use Lockout/Tag out) LOTO)

LOTO is used to control the unexpected release of energy:

- Electricity
- Steam
- Gas

Lockout/Tagout (LOTO) Procedure

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What must be included in the LOTO Procedure?

- A statement on how to use the procedures;
- Steps to shut down, isolate, block, and secure machines;
- Steps designating the safe placement, removal, and transfer of LOTO devices and identifying who has responsibility for the LOTO devices; and
- Requirements to determine and verify the effectiveness of lockout devices, tagout devices, and other energy-control measures.

What must workers do before maintenance activities?

1. Prepare for shutdown;
2. Shut down the machine;
3. Disconnect or isolate the machine from the energy source(s);
4. Apply the lockout or tagout device(s) to the energy-isolating device(s);
5. Release, restrain, or render safe all potential hazardous stored or residual energy. Regularly inspect to avoid re-accumulation of energy if necessary.
6. Verify the isolation and de-energization of the machine.

What must workers do before removing LOTO device and reenergize the machine?

- Step 1: Inspect machines or their components to assure that they are operationally intact and that nonessential items are removed from the area; and
- Step 2: Check to assure that everyone is positioned safely and away from machines.

What are the limitations for tagout devices?

- A tagout device is a prominent warning of the hazards;
- Tags do not provide the physical restraint of a lock;
- Tags may evoke a false sense of security;
- Therefore, a lockout device is considered more secure and more effective than tagout devices in protecting employees from hazardous energy.

5.6 Apply Safe Work Procedure when handling chemicals and related biological materials

Method of Control:
Elimination

- Prohibition in using the chemical as such not available and prevent re-entry even for the sample of research.

Reduction by substitution

- The substitution of a less toxic substance in place of a more high toxic substance such as toluene substituted by benzene, glass fiber for asbestos, water based adhesives for solvent based adhesives.
- Mixing the dry products such as cement for the pre-ordered thus to avoid additional contact with the chemical substance and dust accumulated on air
- while mixing at site .
- Dust generated by demolition process by watering so that the dust becomes liquid slurry.

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Reduced time exposure and significance of time weighted averages

- By reduce the basis of occupational exposure limits such as long term exposure limits (8 hours time weighted average value) and short term exposure limits (15 minutes weighted average value).
- The total exposure to noise (not exceeded 85 dBA) for 8 hours per day for 5 days per week.
- At the means of job rotation and wearing the PPE.

Enclosed the hazards

- Putting lids on chemical substances that had volatile vapours such as tins of solvent based products
- Enclosed and contained sources such as noise for the operating machinery at indoor by building the layer of sound proof material around it, acoustic enclosures, laboratory fume cupboards.

Segregation of people

- By distance
  - Minimum workers at biological or toxic hazards are distanced(segregated)
- By age and gender
  - Protection of young workers by relevant legislations to prohibit employment of young person at the operations/processes.
- By time
  - Restricted certain hazardous operations such as radiation and non destructive test by periodically scheduled and deploy small group of workers in the operations.

Local exhaust ventilation

- Receptor hoods such as fume cupboards and kilns
- Captor hoods(used for welding and milling operations)
- High velocity low volume flow systems such as used on a grinding tool.

Respiratory protective equipment

- Filtering face piece
- Half mask respirator
- Full face respirator (breathing apparatus)
- Powered air purifying respirator
- Powered visor respirator

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Other protective equipment and clothing

- Eye protection (goggles and safety spectacles, welding visor/face shields)
- Head protection (safety helmet, scalp protectors/bum caps)
- Protective outer clothing (PVC of high visibility to alert traffic)
- Protective inner clothing (overalls, aprons)
- Gloves (chemical, thermal, mechanical gloves such as latex, nitrile, PVC, butyl)
- Footwear (safety boots/shoes)
- Ear protection (ear muff, ear plug)

5.7 Minimizing the effects of prolong exposure to working under the sun

Why is it important to know about and address outdoor heat exposure?

- Hot weather can cause metal and physical fatigue
- Extra care is needed when working and driving
- Heat exposure can cause heat-related illness under certain conditions

Heat – related illness

- Happens when the body is not able to cool itself and the body overheats
- Can cause injury, disability or death
- Is preventable

Where does heat illness happen?

- Heat illness can affect anyone
- It can happen in logging, construction projects, landscaping, agriculture, field work, transportation,

Proper hydration is key to preventing heat illness

Do

- Drink plenty of water
- Start work well hydrated
- Consider sports drinks for electrolyte replacement when sweating a lot

Avoid

- Drinking pop and other sugary drinks
- Drinking lots of coffee and tea
- Drinking alcohol
- Waiting for thirst before drinking water

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Types of Heat Illnesses

There are 5 main kinds of heat illness:

- Heat rash- often under clothing
- Heat cramps- in arms or legs with physical labour. Can be caused by the loss of electrolytes from sweating.
- Fainting- can occur when person not used to heat.
- Heat exhaustion- more serious effect.
- Heat stroke- can be fatal.

Remember: to prevent heat illness

- Drink water frequently
- Know the signs and symptoms of heat related illness and take them seriously
- Consider sports drinks when sweating a lot
- Avoid alcohol, caffeinated drinks, and heavy meals before or during work
- Work smart
- Acclimate
- Wear appropriate clothing
- Take regular breaks
- Keep an eye on your buddy

5.8 Follow safety measures for transporting workers on lorries

Safety Regulations For Lorries Carrying Workers

Under the Road Traffic Act, lorries cannot be used for private passenger transport. However, the Road Traffic Act provides an exception for owners and hirers of lorries to use their vehicles to transport their workers to and from their lodgings and places of work, or between their places of work, subject to the following requirements:

1. The lorry must not travel faster than the posted road speed limit or the vehicle speed limit of 60 km/h, whichever is lower.
2. The front passenger seat(s) in the lorry's cabin must be occupied before workers can be carried on the rear carriage deck.
3. Workers carried on the carriage deck of lorries must be properly seated in a manner that would not cause them to fall off the vehicle.
4. No part of the seated worker, when he is in a seating position shall be more than 1.1 metres from the carriage deck. This is to lower the risk of a worker falling off from the back of a lorry.
5. Lorries registered before 1 January 2010 and used to transport workers will continue to display MPC label with white characters on a black background. Lorries registered on or after 1 January 2010 and used to transport workers will display MPC label with black characters on a yellow background.

5.9 Follow the safety use of asbestos

Relevant Safety & Health Legislations

- The Factories (Asbestos) Regulations
- The WSH (Medical Examinations) Regulations

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Section 8 – Protective Equipment

- Suitable personal protective equipment must be provided and used wherever asbestos dust is likely to escape.
- They include:
    - (a) Suitable respiratory protective equipment
    - (b) Protective clothing

- All personal protective equipment provided shall be properly maintained.
- Respiratory protective equipment should not be shared
- All workers must be fully instructed and trained in the proper use

Asbestos and Effects on Health

What is Asbestos?

Asbestos is a mineral fiber that occurs in rock and soil.

Types of Asbestos

Examples of friable asbestos materials:

- Asbestos thermal insulation (e.g. boiler and pipe insulation, and sprayed asbestos applied for fire protection, anti-condensation and acoustic control)
- Asbestos ceiling tiles or wall panels

Examples of non-friable asbestos materials:

- Corrugated asbestos roof sheets
- Wall cladding
- Floor covering
- Cement piping
- Friction products
- Window/flower boxes
- Ironing board panels

Asbestos was commonly used in:

- cement sheeting (fibro)
- drainage and flue pipes

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- roofing, roof sheets, rubbish chutes, guttering and flexible building boards (eg Villaboard, Hardiflex, etc). Similar cement sheeting products are used today, but are 'asbestos free'
- ceiling and wall panels
- textiles(e.g. insulation cloth)
- Friction materials(e.g. gaskets, brakes, clutches and conveyor belts

Health Effects From Exposure to Asbestos

- Exposure to asbestos increases your risk of developing lung disease. That risk is made worse by smoking. In general, the greater the exposure to asbestos, the greater the chance of developing harmful health effects.
- Disease symptoms may take many years to develop following exposure.
- Asbestos-related conditions can be difficult to identify. Healthcare providers usually identify the possibility of asbestos exposure and related health conditions like lung disease by taking a thorough medical history. This includes looking at the person's medical, work, cultural and environmental history.
- After a doctor suspects an asbestos-related health condition, he or she can use a number of tools to help make the actual diagnosis. Some of these tools are physical examination, chest x-ray and pulmonary function tests. Your doctor may also refer you to a specialist who treats diseases caused by asbestos.

Three of the major health effects associated with asbestos exposure are:

- lung cancer
- mesothelioma, a rare form of cancer that is found in the thin lining of the lung, chest and the abdomen and heart
- asbestosis, a serious progressive, long-term, non-cancer disease of the lungs

See Your Doctor

Individuals exposed to asbestos should inform their doctor of their history and any symptoms. An exam, including a chest x-ray and a lung function test, may be recommended.

Symptoms may not become apparent until long after exposure. If you have any of the following symptoms, you should consult your doctor without delay:

- Shortness of breath.
- A cough or a change in cough pattern.
- Blood in the fluid coughed up.
- Pain in the chest or abdomen.
- Difficulty in swallowing or prolonged hoarseness.
- Significant weight loss.

Standard work procedure when using asbestos:

Do not disturb soil or any other material thought to be contaminated with asbestos fibres. Short-term precautions to minimise exposure include:

- spraying with water to prevent soil/dust from becoming airborne, being careful around electrical fittings.
- covering with plastic sheeting or a tarpaulin if possible to avoid exposure to the weather.
- preventing access by children, and/or pets.
- cover children's toys.

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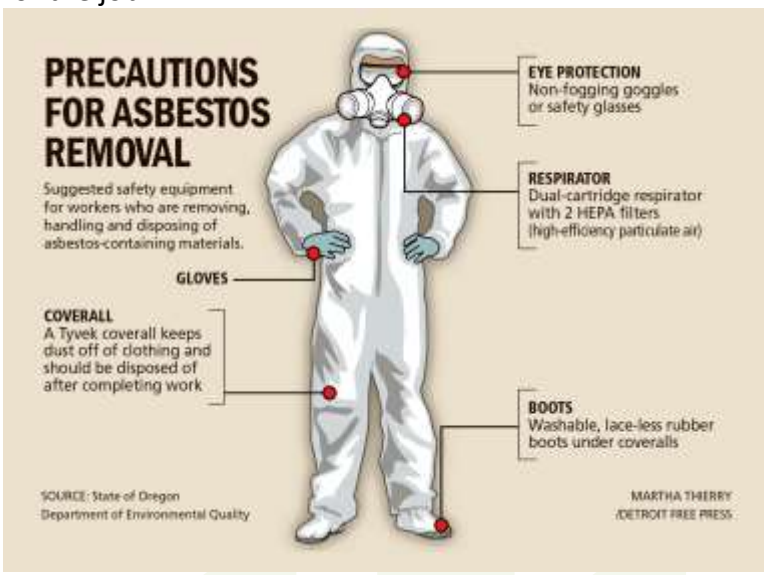
- use wet cleanup procedures used rather than dry sweeping or vacuuming.
- where loose fibre asbestos insulation may have been installed do not enter the roof space & restrict access to the roof cavity through the man-hole and vents.

If you must enter areas of your home thought to be contaminated with dust containing asbestos fibres use the appropriate approved respirator or dust mask recommended for the job.



CE 6 Comply with safe work practices and control measures when working at Heights

Introduction

- This section focuses on work related at height such as using fall protection equipment, correct way of maintenance and inspection of fall protection equipment.
- Stated the correct way of using and maintenance the ladder at workplace.
- Understanding the correct way of anchorage at height.
- Knowing the proper rescue at height.
- Knowing the procedure of disposal debris at height.

6.1 Select the correct Fall Protection Equipment for the work

What is fall protection and when is it required?

- "Fall protection" means personal fall protection equipment worn by employees working at heights, safety nets, catch platforms, warning lines, and guard rails along elevated surfaces.
- Fall protection of some type (usually guardrails) is required when employees work at a height of 1 meter (4 feet) or more in all workplaces.
- In construction, personal fall protection equipment or equivalent protection is required when workers are at heights of 3 meter (10 feet) or more.
- In some types of work or industries, fall protection is specified at different heights.

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The purpose of fall protection is to either prevent a fall before it occurs or stop a fall after it occurs.

There are 3 categories of fall protection:

- Restraint systems – prevents a fall from occurring
- Arrest systems – stops a person after falling
- Positioning device systems – keeps a person in position and stops fall within 0.5 meter(2 feet)

Some Equipment Do's and Don'ts

- Do inspect for wear and damage before use.
- Do remove from service after a fall for inspection.
- Don't use to lift materials.
- Don't attach to guardrails or hoists.

6.2 Safe use of Fall Protection Equipment

Some Fall Protection Always Required

- There are some instances in which fall protection (guard rails) is always required, no matter what the fall distance is.
- For example, regardless of height, all open-sided floors, walkways, platforms, or runways above or adjacent to dangerous equipment, pickling or galvanizing tanks, degreasing units, or similar hazardous equipment, must be guarded with a standard railing and toe board.

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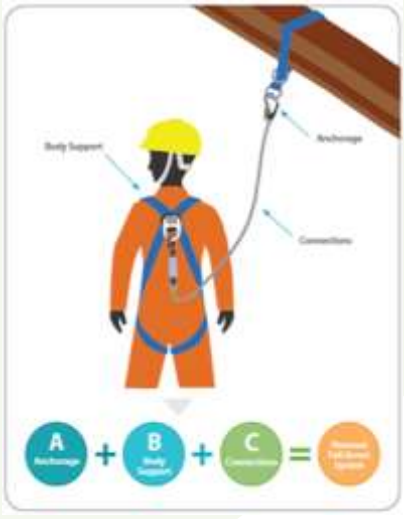
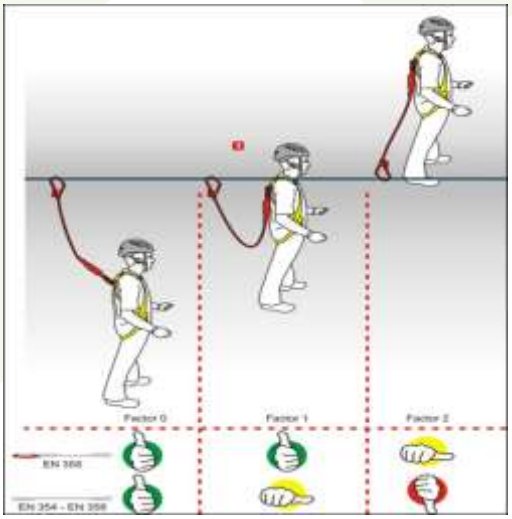
Mobile Elevated Work Platforms (MEWP)

Mobile Elevating Work platforms (MEWP)
Safety harness and lanyard devices fixed to attachments points provided and approved by the manufacturer must be used by all occupants, regardless of the height.

Full Body Harness

- A full body harness is a common fall arrest system used in roofing.
- A full body harness stops a fall in progress and minimizes the force of the fall to your body.
- Waist belts not allowed because a fall will usually result in injury.





- ✓ The attachment point on a full body harness is a D-ring on your upper back.
- ✓ It must be a commercial ANSI Class III harness. Recreational climbing harness are not allowed.
- ✓ Be sure to use a size that fits you properly.
- ✓ Some fall arrest gear comes with a shock-absorbing lanyard.
- ✓ Must be adjusted to prevent hitting ground or lower level.
- ✓ In a fall, the equipment stretches several feet.

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6.3 Correct way of using and maintenance the ladder at workplace

Ladder Safety in Construction

- Falls from ladders are one of the **leading causes of injuries** in the construction trade.
- The majority of the falls are caused by **misuse, faulty ladders or carelessness**.

Common causes of ladder injuries

- Improperly **getting on or off** the ladder
- Loss of **balance**
- **Setting up** the ladder improperly
- **Overreaching** while on the ladder
- **Mis-stepping or slipping** while climbing or descending

Other causes of falls from ladders

- Lack of **training** on safe ladder use
- Using the **wrong type ladder** for the job
- Exceeding the ladder **weight capacity**
- **Climbing ladder** with tools or material in hands
- **Climbing or descending** not facing the ladder
- **Oil, grease or mud** on ladder rungs
- Ladder **not secure** at the base or top
- Ladder **not set up** at the proper angle
- Ladder **not extended 3 feet** above upper surface
- Using the **top step** of a step ladder
- Placing ladder on **unstable surfaces**
- **Over-reaching** beyond the side rails of the ladder

Ladder Positioning

Position ladders so that they are:

- Not in the **paths** of workers walking through,
- Not in **front of unblocked** exits,
- Not in **front of doors** that can open out into the ladder,
- Not on **boxes, barrels or other unstable surfaces**,
- On **solid footing** and level at the bottom,
- **Stable at the top** with each rail supported equally,
- **Against a structure** capable of supporting the intended load,
- Away from **debris** and other hazards.

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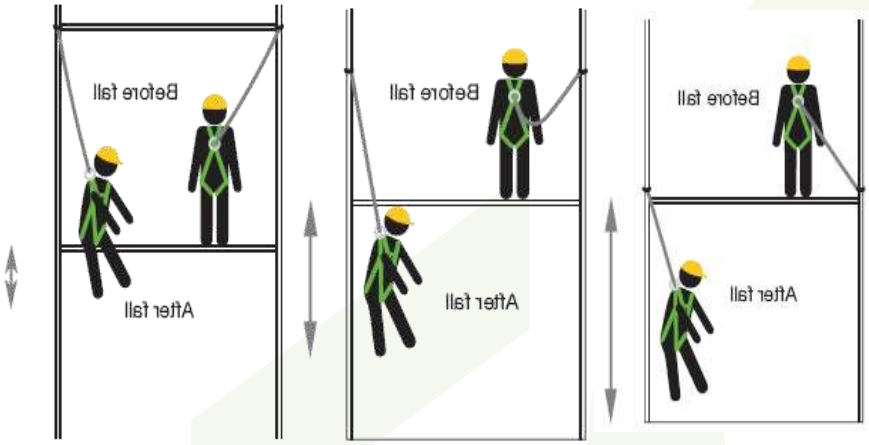
6.4 Correct way of anchorage at height

Fall arrest equipment is only as good as the anchor

- An anchor must be able to withstand 2268kg (5000 lbs.) of force without failing.
- Manufactured anchors must be installed according to manufacturer's instructions.
- Check pre-installed anchors before using.
- In a fall, your life depends on the anchor holding.



6.5 Follow procedures for rescue at height

Self-rescue or assisted rescue using ladders, aerial lifts, forklifts, etc.

Some studies have indicated permanent damage to the lower extremities when the worker hangs for more than twenty (20) minutes

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6.6 Proper disposal of debris and housekeeping while working at heights

Construction chute is use for all the high rise building construction and demolition. Housekeeping for every floor play an essential roles in this area.

6.7 Correct use of ladder

Keep Ladders in a Good Condition

Ensure the following:

- **Side rails** aren't bent, broken, or split
- **Rungs, cleats, or steps** aren't bent, broken, or missing
- **All bolts and rivets** are in place and securely tighten
- Joint between the **side rails and the individual rungs/steps** is tight
- **Safety feet** are not excessively worn
- **Hardware and fittings** are securely attached and working properly
- **Ropes** aren't frayed or badly worn
- **Moveable parts** operate freely without binding or excessive play.
- **Metal components** aren't corroded.
- No other **faulty or defective components** exist.
- Any **auxiliary equipment** is securely attached, not excessively worn and functions properly.

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6.8 Caring and maintaining fall protection equipment

Fall protection systems and components must also be inspected regularly for wear or damage by a competent person. These include not only personal fall protection systems, but also safety nets, warning lines, hardware, and all parts of fall protection systems you use.

The competent person must also train the workers to properly inspect and maintain fall protection systems. Do not forget to inspect other personal protective equipment you may use.

Use the following guidelines for inspecting your fall protection equipment before each use as well as for the regular inspection and maintenance care.

Inspect all components of your personal fall protection system. Look for the following signs of wear and damage:

Bending webbing into an inverted "U" will show:

- Damaged fibers: cuts, tears, abrasions, frays
- Deformations: stretching
- Damage from chemicals, acids, heat, corrosion, or mold
- Kinked material

Check D rings for:

- Cracks, breaks, rough or sharp
- Free movement

Check tongue and buckle for distortions for:

- Distorted or broken grommets
- Additional punched holed (not allowed)

Check ropes for:

- Abrasion, frays or internal damage
- Free movement

Check connecting hardware and anchors for:

- Proper locking/releasing
- Loose or deformed connectors and anchors
- Incompatibility

- If a personal fall arrest system is subjected to a fall, don't use it again until a competent person determines that it's safe.
- Store your personal fall protection system in its own bag or other suitable container in a protected place where it cannot be damaged. If you have a soft-sided case or bag, do not place or store other materials on top of it.
- If you use manila, plastic or synthetic rope for top rails or midrails of a guardrail system, inspect it frequently to make sure that it maintains its required strength.
- If you use safety nets, inspect them at least once a week for wear and damage. Remove defective nets from service.
- Inspect reusable components, such as rails and safety boots or bases for guardrail posts,

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- Any defective parts found must be removed from service until repaired or replaced. If their function or strength has been adversely affected, they must be discarded.

CE 7 Comply with safe work practices and control measures when working in a confined space

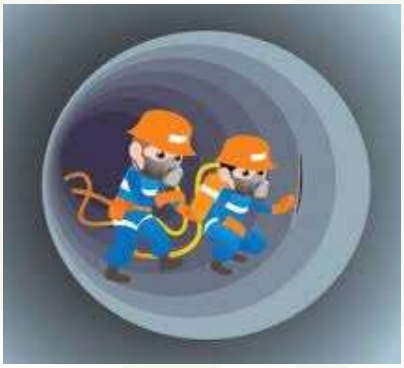
Introduction

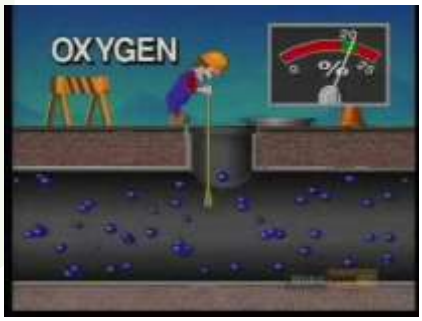
- This section focuses on identify hazards and control measure at confined space workplace.
- How to check and read the gas meter.
- Knowing how the emergency preparedness for confined space rescues and evacuation.
- Select and use the PPE at confined space.

7.1 Recognize what constitutes a confined space

Confined Space Definitions

- " Confined space " means any chamber, tank, manhole, vat, silo, pit, pipe, flue and shall include any enclosed space, in which —
  - dangerous gases, vapours or fumes are liable to be present to such an extent as to involve risk of fire or explosion, or persons being overcome thereby; or
  - the supply of air is inadequate, or is likely to be reduced to be inadequate, for sustaining life; or
  - there is a risk of engulfment by material.





Confined Space Characteristics

A confined space is any enclosed or partially enclosed area that:

a) is not primarily designed or intended for human occupancy;

b) has a restricted entrance or exit by way of location, size or means;

c) may contain a hazardous atmosphere;

d) contains material that could trap or bury an entrant;

e) has such shape that an entrant could become trapped or asphyxiated;

f) can present a risk to the health and safety

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Exposure to chemicals or lack of oxygen in confined spaces can be deadly.

- Airborne chemicals can quickly reach dangerous levels in confined spaces that are not ventilated. Carbon monoxide, hydrogen sulfide, welding fumes and solvent vapors are typical confined space chemical hazards.
- In some confined spaces, oxygen deficiency will cause the person entering to instantly collapse.
- As many co-workers who attempt rescue die in confined spaces as the original worker who collapsed.
- Confined spaces include manholes, sewers, vaults, tanks, and boilers in new construction or in repair and maintenance work.

7.2 Identify hazards when working in a confined space

Type of hazards found in the confined space work area

- Mechanical Hazards
- Electrical Hazards
- Welding / Cutting Hazards
- Engulfment Hazards
- Noise Hazards
- Thermal Hazards
- Other Physical Hazards

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7.3 Follow measures to prevent and control hazards when working in confined space

- Prevention and Control of Confined Space Hazards
- Removal of sludge, purging and air ventilation Of Confined Space for entry or continuous occupancy.
- Including dilution and local exhaust ventilation; Engineering and Administrative control.

Confined Space Assessor

A confined space assessor is

- ✓ responsible for testing and monitoring confined space atmosphere.
- ✓ To ensure a safe for entry for all.

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✓ The assessor is adequately trained and competent in his work.

- Permit To Work
- Attendant with communication and rescue equipment's
- Workers with required PPE
- Multi gas detector
- Explosion proof lighting & ventilation system

Training

- Ensure that the persons involved are trained in Confined Space, before allowing them to enter.
- Display the identification badge at the entrance, maintain Log In/Log Out Sheet.

Explosion Proof Lighting And Ventilation System

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Purging and air ventilation

- Forced or supplied ventilation introduces fresh air into the confined space through the use of a mechanical air moving devices such as a blower.
- The constant supply of fresh air in sufficient quantity will help to maintain the level of oxygen in the space within the safe range, as well as to dilute the level of contaminants released in the confined space to an acceptable level

Push – Pull system

- Push-pull system uses a combination of both forced ventilation and exhaust ventilation. It usually provides more effective ventilation of the space than using any of the ventilation system alone, and is recommended for use whenever practicable.

  Push-pull system simultaneously introduces fresh air into the space while removing contaminants by exhausting them

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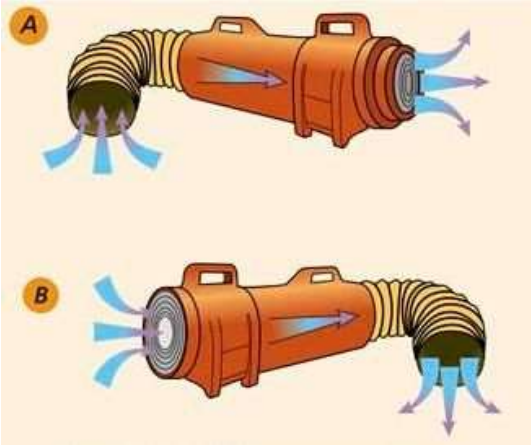
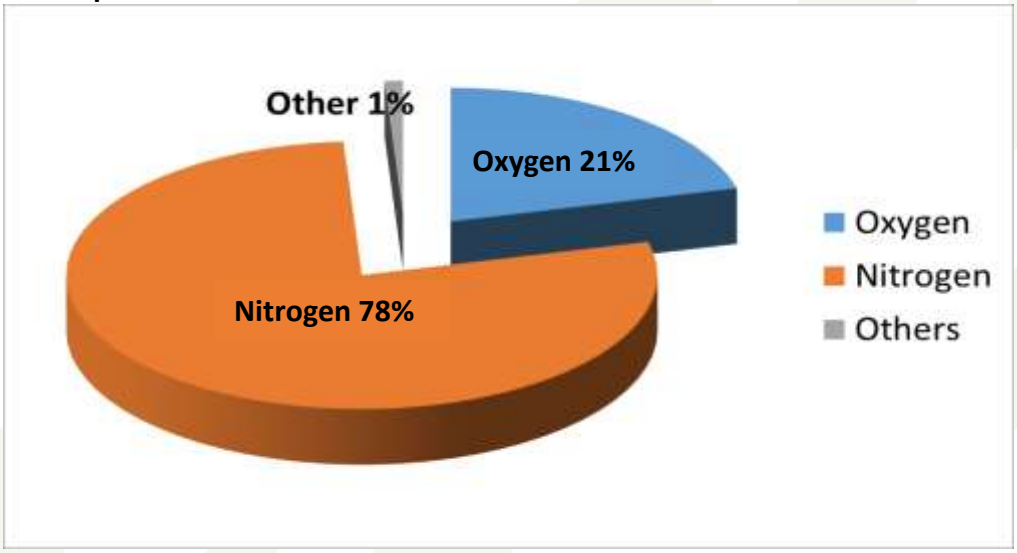


Air composition pie chart



Atmospheric air inside a confined space cannot be assumed of having the normal oxygen level (21%).

Atmospheric Hazards

Airborne chemicals such as

- Carbon monoxide,
- hydrogen sulfide,
- welding fumes and
- solvent vapors

are typical confined space chemical hazards.

In some confined spaces,

- oxygen deficiency

will cause the person entering to instantly collapse.

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As many co-workers who attempt rescue die in confined spaces as the original worker who collapsed.

Oxygen Levels and Effects

Oxygen Level (% by volume)	Effects
23.5 %	Oxygen enriched, extreme fire hazard
20.8%	Normal oxygen level in fresh air
19.5%	Minimum safe entry level
12 - 16%	Increased effort in breathing quicken pulse, impaired co-ordination
6 - 10%	Nausea, vomiting, staggering, immobility, unconsciousness and collapse
< 6 %	Difficulty in breathing, death

What happen if…

1. Lack of Oxygen?
2. Presence of Flammable or Explosive Gases?
3. If poor air ventilation
4. Or lack of Oxygen… CAN KILL A PERSON!

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If happens **LEAVE** the confined space immediately and get fresh air & rest first. – drink water slowly.

HYDROGEN SULPHIDE - H2S

What is H2 S ?

- Hydrogen Sulfide is a colorless, transparent gas with a characteristic rotten-egg odor at low concentrations.
- It is not detectable by odor at high concentrations. As the level of **H2S** increases, the sense of smell is lost!
- Hydrogen Sulfide is a naturally occurring gas mixed with natural gas or dissolved in the oil or brine and released upon exposure to atmospheric conditions.

Exposure to lower concentrations can result in

- eye irritation,
- a sore throat and cough,
- nausea,
- shortness of breath, and
- fluid in the lungs

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Long-term, low-level exposure may result in

- fatigue,
- loss of appetite,
- headaches,
- irritability,
- poor memory, and
- dizziness.

Chronic exposure to low level H_2S (around 2 ppm) has been implicated in increased miscarriage and reproductive health issues.

Parts Per Million	Effects on human
10–20 ppm	borderline concentration for eye irritation
20 ppm	acceptable ceiling concentration established by OSHA
50 ppm	acceptable maximum peak above the ceiling concentration for an 8 hour shift, with a maximum duration of 10 minutes.
50–100 ppm	leads to eye damage
100–150 ppm	olfactory nerve is paralyzed after a few inhalations, and the sense of smell disappears, often together with awareness of danger.
320–530 ppm	leads to pulmonary edema with the possibility of death.
530–1000 ppm	strong stimulation of the central nervous system and rapid breathing, leading to loss of breathing.
800 ppm	lethal concentration for 50% of humans for 5 minutes exposure (LC50).
Concentrations over 1000 ppm	cause immediate collapse with loss of breathing, even after inhalation of a single breath.

Carbon Monoxide - CO

- ❑ Colorless, odorless, and tasteless gas but highly toxic; Slightly lighter than air;
- ❑ Absorbed through breathing and enters the blood stream through gas exchange in the lungs. Combines with hemoglobin to produce carboxyhemoglobin, which is ineffective for delivering oxygen to bodily tissues;

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- ❑ Exposures at 100 ppm or greater can be dangerous to human health. Symptoms such as headache, nausea, vomiting, dizziness, fatigue, and a feeling of weakness;
- ❑ Exposures to carbon monoxide may cause significant damage to the heart and central nervous system, may have severe adverse effects on the fetus of a pregnant woman
- ❑ Chronic exposure to low levels of carbon monoxide can lead to depression, confusion and memory loss.

- ❑ From the exhaust of internal combustion engines (including vehicles, portable and back-up generators, lawn mowers, power washers, etc.);
- ❑ From incomplete combustion of various other fuels (including wood, coal, charcoal, oil, paraffin, propane, natural gas, and trash);
- ❑ From engine-powered equipment such as portable generators; fireplaces; and charcoal that is burned in homes and other enclosed areas; and
- ❑ also a minor constituent of tobacco smoke.

Breath CO monitor displaying carbon monoxide concentration of an exhaled breath sample (in ppm) with its corresponding percent concentration of carboxyhemoglobin

Removal of sludge

An errant used suction pump to clean out tank that filled with chlorinated solvent contaminated sludge. Wear Proper PPE;

- Product previously stored can change the composition of the confined space air environment.
- Check for any toxic gases

7.4 Check and read gas meter

Gas testing & monitoring

- All gas testing results and to be attach with the entry permit.
- Gas testing should be performed on every 4 hours

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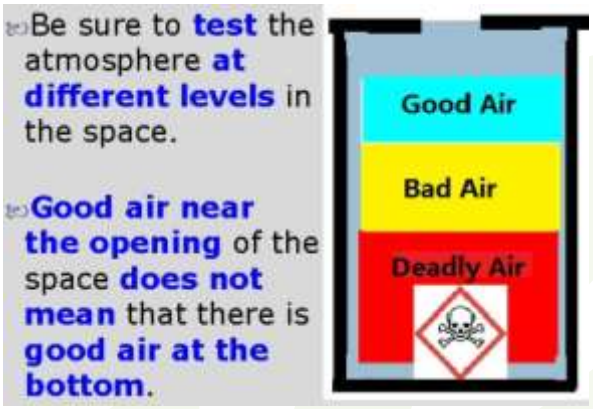
- Record must display at the entrance of the confined space



7.5 Perform Rescue for Confined Space

In Case of Emergency

The rescue equipment shall be ready & available at all time
The rescue personnel are trained and competent to use the safety equipment.

PPE – Respiratory PROTECTION

In work environments, respirators are relied upon when adequate ventilation is not available or other engineering control systems are not feasible or inadequate.

Use of SCBA

Only Supplied Air Respirators (SCBA and air lines) are recommended for use in confined spaces where there is lack of oxygen (oxygen deficiency).

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- SCBA is a system that supplies its own air through a hose or tank and is independent of the surrounding air. It provides reliable protection against hazardous environments.
- The limitation of this system is that it is often difficult to work with, requiring special support equipment and training.
- In addition, because of their weight and restrictiveness, their use requires more physical effort.
- The SCBA must be ready & available at all time and wearing SCBA should take least than a minute.
- At least one or two a man hole supervisor or confined assessor to be trained to use the SCBA sets
- Attendant will assist the rescuer.

Persons who require training on emergency procedure

- Man whole supervisor – those who authorize the entry.
- Entrants – Those who enter & work in the space.
- Attendants – those who serve as stand by person and monitoring the work.
- Assign as Rescuers – those who provide emergency and rescue services

Training of these people should reflect the duties and responsibilities with which they are charged.
During emergency If a trained person is not available at site, untrained personnel should not attempt to do rescue work
When panic situation, never attempt to dash-in to pull someone out. (person may get killed)
Instead call SCDF at 995 and advise them the correct location of the worksite.

There are three types of rescues;

- ✓ Self Rescue
- ✓ Non Entry Rescue and
- ✓ Entry Rescue

Self-rescue

- The individual recognizes a critical condition and exits the space on his / her own.
- Alternatively, an entry monitor, who is outside of the space, may recognize a new hazard and order individuals to leave the space before they are affected.

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- This is the preferred rescue method as it takes far lesser time to wait for someone to come in and retrieve them.

Non-entry rescue

- Involve the attempt to extricate an incapacitated person without having anyone else enter the confined space.
- This can be done via a safety line attached to the personnel in the confined space or by grabbing the personnel with a rope, strap or pole and pulling them to safety.
- Victim is conscious

Entry rescue

- This is a **last resort** option!
- Having more personnel enter an area that has already incapacitated one or more person(s) places the rescuer at considerable risk.
- Entry rescues must be carefully planned and executed to avoid creating more victims in need of rescue.
- Rescuers need to be aware of their surroundings and must re-evaluate their plans immediately if there is any change in the conditions of the confined space.
- In the event of an entry rescue, standby rescuers are recommended in the event that the initial entry rescuer(s) encounter trouble.

7.6 Select and use the correct PPE for confined space

How to Avoid Using Respirators
Use one or more of the following controls to reduce exposure to airborne chemicals:

- Ventilation
- Dust suppression with water
- Eliminate use of chemical
- Substitute with a less toxic chemical
- Isolate or enclose the chemical processes
- Other processing changes

Respirators should be used <u>ONLY</u> if these methods are not feasible or don't reduce exposure.

As an alternative to respirators these control methods should be explored first. It is your choice what method to use. If ventilation is used, local exhaust ventilation is the most effective. Another possible method is to reduce the time of an individual's daily exposure to the chemical. This will not work for chemicals that have a ceiling or peak permissible exposure limit.

Types of Respirators

- Air-purifying respirators – filters air through cartridges or filtering face pieces (dust masks)
- Powered air-purifying respirators – filters air through cartridges with assistance of a blower.

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- Airline respirators – provides unlimited clean air from a compressor.
- Self-contained breathing apparatus (SCBA) – provides 30- 60 minutes of clean air from a tank.
- Escape respirators – provides air for escape only from a small bottle.

Respirators either "purify" contaminated air by means of filters, or provide clean, uncontaminated air from an air compressor or tank.

Air-purifying respirators are sometimes called "negative pressure respirators" because of the negative pressure that occurs inside the mask when the user inhales.

Selection of Respirators

Generally based on:

- ✓ Type of air contaminants present (i.e., articles, vapors, gases);
- ✓ Hazard of exposure (i.e., IDLH, eye irritant, Toxicity);
- ✓ Warning properties of contaminants;
- ✓ Level of exposure;
- ✓ Exposure time;
- ✓ Work activity;
- ✓ Characteristics and limitations of the respirator equipment; and
- ✓ Level of protection needed.

Respirator Fit Test

Fit-testing must be done

- ✓ Must fit properly to prevent leaks around the edges.
- ✓ Beards are not allowed when wearing a tight-fitting respirator because they will leak.
- ✓ Fit-testing must be repeated annually and for any new respirator.

7.7 Follow emergency procedures for evacuation

Emergency Response Plan

- Before anyone is authorized to enter a permitted space, it is crucial to have trained emergency rescue personnel available when an entrant needs help. It is important for

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such personnel to reach the site promptly and know how to deal with the emergency.

- It's "A MUST" to have a written and established rescue operation plan on-site that includes equipment, such as retrieval devices, breathing and resuscitating apparatus, ready for emergency use immediately.
- The severity of accidents can be reduced with timely alerts from attendants outside the confined space.
- A well-trained and fully equipped rescue team can ensure a speedy response in an emergency.

What is an Emergency Response Plan?

An Emergency Response Plan is a plan of action for the efficient deployment and coordination of services, agencies and personnel to provide the earliest possible response to an emergency.

It is a MUST to have a written and established rescue operation plan on-site that includes:

- ❑ Identified critical conditions which require rescue
- ❑ Establishment of Rescue Operation Plans
- ❑ Rescue Arrangements
- ❑ Rescue Considerations
- ❑ Rescue Logistics
- ❑ Training of Rescue Personnel
- ❑ Provision of Rescue Equipment

Establishment of Rescue Operation Plan

- Have names of the designated rescue personnel available;
- Indicate the methods of rescue to retrieve persons inside a confined space;

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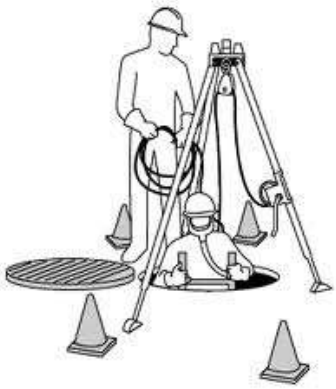
- Prescribe the types and availability of equipment necessary for rescue; and
- Provide an effective means to summon the designated rescue personnel in a timely manner.



Communication;

- An effective and reliable means of communication between entrants inside a confined space, and between entrants and attendants, is required.
- The communication system used can be based on speech, hand signals, telephone, hand held radio, rope, etc. Whatever system is used, it is important that all messages can be communicated easily, rapidly and unambiguously between relevant people

Note that radio frequency/wireless devices may not work effectively in confined spaces such as tanks or sewers, where there is metal or concrete shielding between the interior of the space and the outside.

REVISION OF DOCUMENT

This document is subject to revisions and updates. The revision status is indicated at the cover page of this document, and version number is reflected in the footer throughout this document.

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