



MF-COM-123E-1

APPLY WORKPLACE SAFETY AND HEALTH IN SHIPYARD (GENERAL TRADE)



LEARNER'S GUIDE

Version Control Record

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For Enquiries and feedback please email admin@efg.com.sg



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Introduction

Course Aim

This Competency Unit aims to equip workers with the Workplace Safety and Health knowledge and skills before they start work in the shipbuilding and ship repairing related industry.

Course Objectives

At the end of the course, the learners shall be able to:

- Understand legal obligations in workplace safety and health
- Identify hazards in a shipyard
- Recognise the different types of industrial safety signs
- Understand the application process for safety permit prior to hot work
- Don personal protective equipment
- Apply safety precautions when working with different hazards
- Respond to fire and emergency

This unit covers the following underpinning knowledge item which could be taught in the classroom via a combination of lectures, discussions and case-studies.

UK1. Legal Obligation

UK2. Fire and Explosion Hazards

UK3. Prevention of Fires and Explosion

UK4. Preventive Measures for Specialised Operations

UK5. Preventive Measures for Material Handling

UK6. Preventive Measures for Mechanical and Electrical Works

UK7. Preventive Measures for Working at Height

UK8. Preventive Measures for Working in Confined Space

UK9. Personal Protective Equipment

Course Duration

Facilitated Learning (Theory): 7 Hours

Assessment: 1 Hours

Attendance Requirement: 100%

Certification:

Upon successful completion of the whole course of training and passing the assessments, learners will be awarded the WSQ certificate

Assessment method and duration

Assessment consists of:

S/NO	Assessment Instrument	Duration
1	Written Test Paper (40 MCQ)	60 min

Passing marks for written assessment: 60%

Passing marks for practical assessment: C / NYC



LESSON 1

PS1. UNDERSTAND LEGAL OBLIGATIONS IN WORKPLACE SAFETY AND HEALTH

Lesson Outline

S/NO	Topics
UK1	Legal Obligation

Learning Objectives

After this lesson, the trainees should be able to:-

- Duties and responsibilities of employees
- Workplace Safety and Health Act
- WSH (Shipbuilding and Ship-repairing) Regulations 2008
- WSH Work At Heights Regulations 2013 & WSH
- Work At Heights (Amendments) Regulations 2014
- Penalties for non-compliance
- WSH Committee – General roles and activities
- Tool box meeting

Workplace Safety And Health Statics

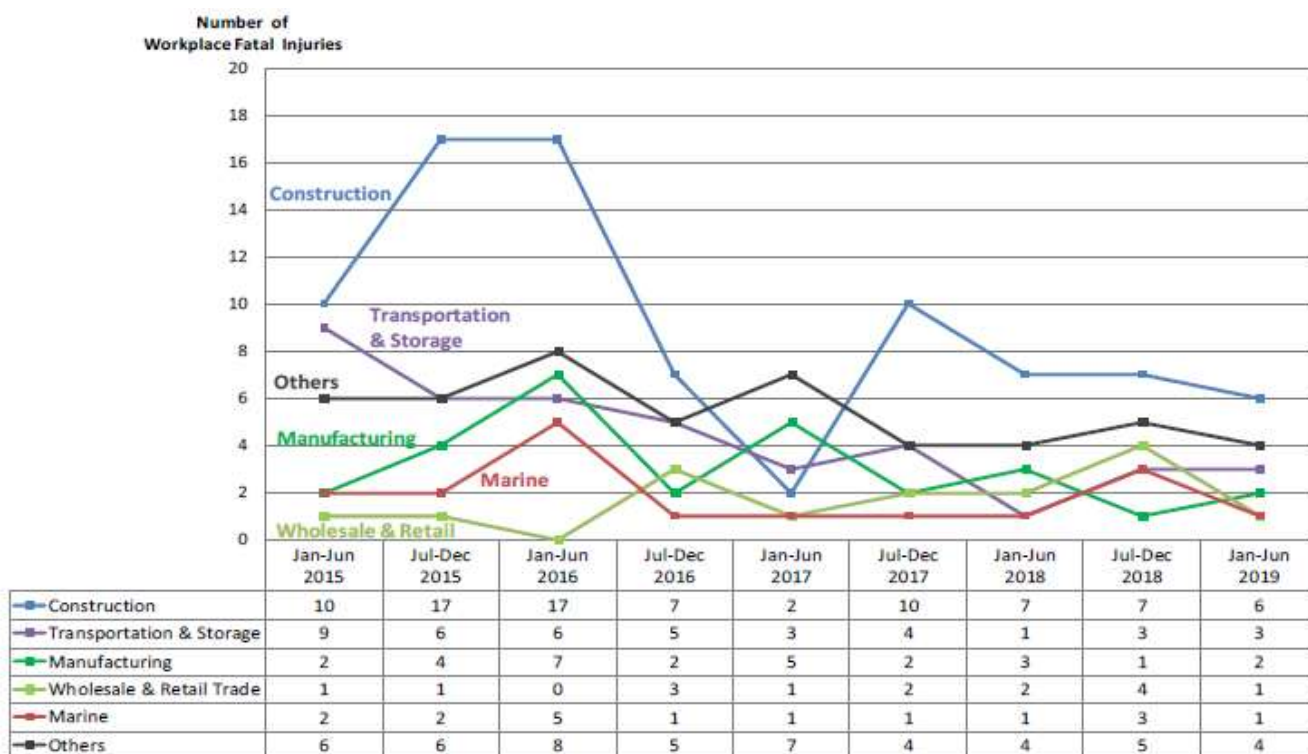


Figure 3: Number of workplace fatal Injuries by industry, 2015-2019

MARINE

There was 1 workplace fatal injury in 1H 2019 for the Marine industry⁹. However, the workplace fatal injury rate increased slightly from 1.4 in 1H 2018 to 1.5 in 1H 2019 due to reduced employment size of the industry.

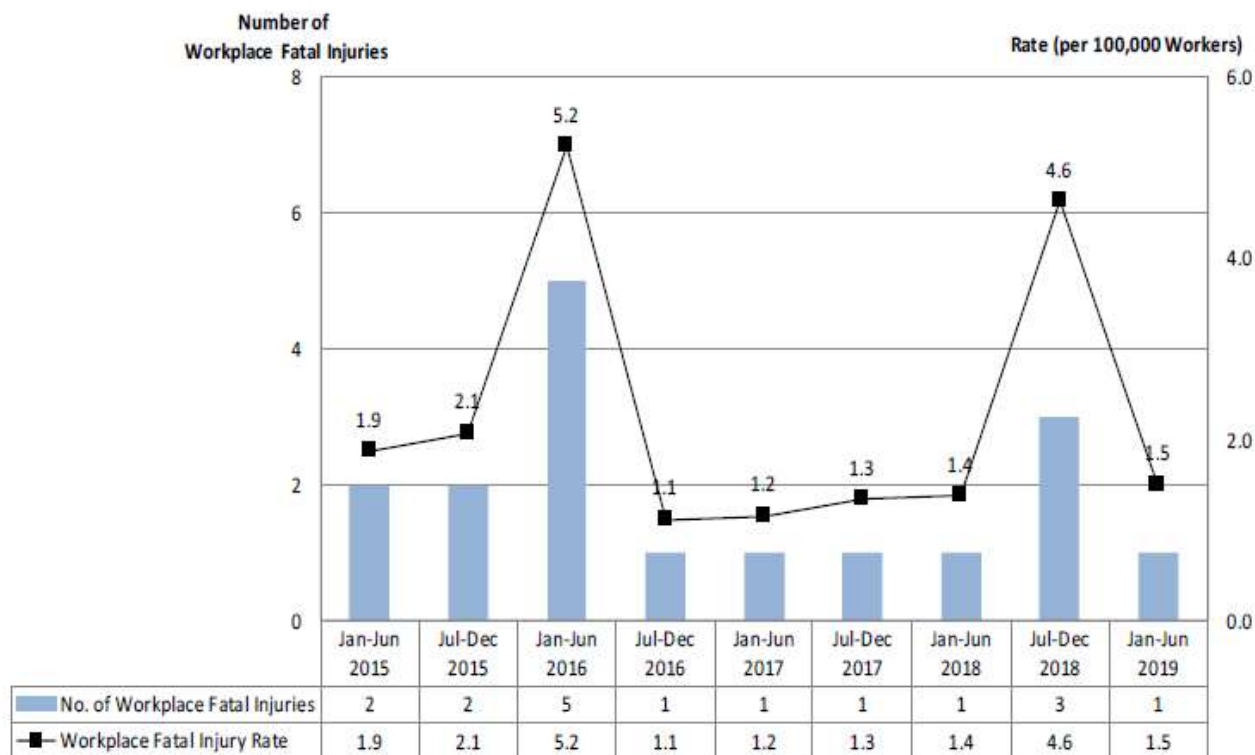


Figure 6: Number and rate of workplace fatal injuries for Marine industry, 2015-2019



1.1 Duties and responsibilities of employees

Employee

- Follow the safe working procedures and principles introduced
- Do not engage in any unsafe act that may endanger yourself or others working around you.
- Use, in proper manner, any personal protective equipment, devices, equipment's or other means provided to secure your safety, health and welfare while working. You must not temper or misuse such items provided.

1.2 Workplace Safety and Health 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.

Source: <http://www.mom.gov.sg/legislation/occupational-safety-health/Pages/workplace-safety-health-act.aspx>

1.3 WSH (Shipbuilding and Ship-Repairing) Regulations

Shall apply to any work carried out in a shipyard or on board a ship in a harbour in connection with;

- ✓ the construction, re-construction, repair, refitting, fitting, painting, finishing, furnishing or breaking up of a ship;
- ✓ the scaling, scurfing or cleaning of boilers (including combustion chambers and smoke boxes) in a ship;
- ✓ the cleaning of any tank, bilges or holds in a ship; and
- ✓ the survey or inspection of a ship or its contents (where such survey or inspection is not carried out by the crew of the ship).



Safety and Health Management System

Occupier of a shipyard to implement and maintain at all times a safety and health management system for the purpose of ensuring the safety and protecting the health of every person in the shipyard.

Workplace Safety and Health Committee

- Monthly Committee Meeting & Inspection
- Management & Employees
- Plan, Review, Coordinate, Inspection, Discuss & rectify observations
- Accident investigations
- Promote safety practices

The WSH (shipbuilding and ship-repairing) Regulation requires every person at the workplace to take reasonably practicable steps to ensure the safety and health of every workplace and worker

Safety & Health Training

It shall be the duty of employer to ensure that the person does not carry out any hazardous work like; Hot work, Painting, Blasting, etc.

Unless he has undergone a safety and health training course approved by the Commissioner.

VSCC Meeting

- To establish a vessel safety co-ordination committee for that ship.
- Committee to meet daily including holidays.

PTW System

Occupier of a shipyard to implement a permit-to-work system.

Duty to Report Incompatible Work

It shall be duty of person to report incompatible work to supervisor.

Inspection of Hot-Work Area

It shall be the duty of the responsible person to:

- To ensure hot work area are marked
- Fire watch man is provided

Smoking

It shall be the duty of the responsible person to ensure no person smoke in any place other than designated area.

Safety Signs

- It shall be the duty of the responsible person
- To provide safety sign placed at suitable locations.

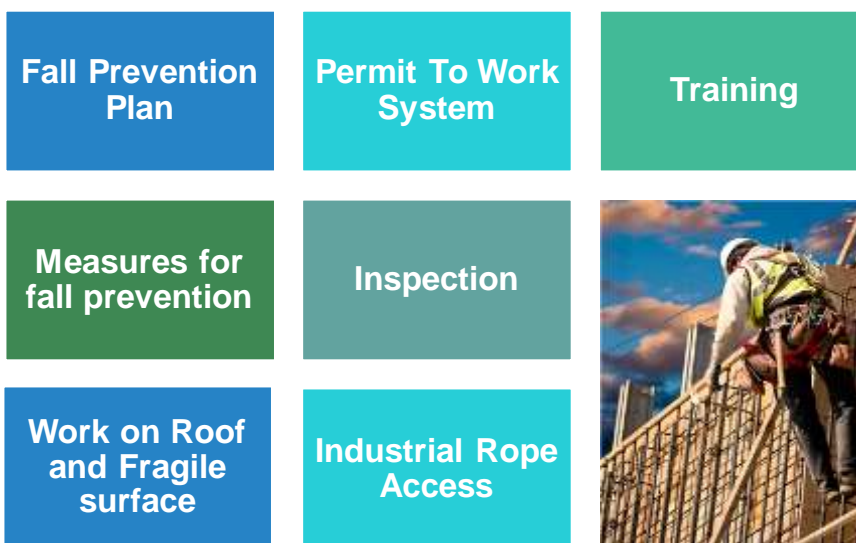
Measures for Hot-Work

It shall be the duty of the responsible person to ensure:

- All welding equipment are inspected every 30 days by Competent person
- All gas cutting equipment are inspected every 14 days by competent person.

1.4 WSH (Work at Height) Regulations + Amendments

Key provision the WAH Regulation



Where is work at height?

What is work at height?

- in or on an elevated workplace from which a person could fall;
- in the vicinity of an opening through which a person could fall;
- in the vicinity of an edge over which a person could fall;
- on a surface through which a person could fall; or
- in any other place (whether above or below ground) from which a person could fall, a distance of more than 3 metres;





Penalty

Any person who carries out any hazardous work at height in a factory without a permit-to-work first issued by the authorised manager in respect of that hazardous work at height shall be guilty of an offence and shall be liable on conviction to a fine not exceeding \$20,000.

WSH (Work at Height) Regulations Amendments

Feedback from the small and medium enterprises in lower risk sectors, who expressed concerns about operational constraints when implementing the PTW as required under the Regulations.

Taking these concerns into consideration, MOM has reviewed and refined the PTW requirements to apply only to workplaces defined as Factories under the WSH Act, instead of all workplaces.

The requirement for the WAH Safety Assessor and Authorised Manager to be a separate person will be removed.

These changes are incorporated in the WSH (WAH) (Amendment) Regulations 2014 which came into force on 1 May 2014.

1.5 Penalties for Non-Compliance

For Individuals	\$200,000 and/or 24 months' jail. Double for repeated offences
For Corporations	\$500,000 fine. Double for repeated offences
For Repeated Offenders	Maximum fine is doubled.
Failure of individual worker	\$1000 for the first offence fail to use protective equipment. \$2000 for the second offence.

1.6 WSH Committee Roles and Activities



1.7 Tool Box Meeting

- Tool Box Meetings shall be held daily by each contractor before start of work.
- It is compulsory for all workers to attend daily tool box meetings.
- Workers shall strictly follow all safety and health requirements briefed during tool box meetings.
- Workers are also encouraged to raise their concerns / feedbacks related to safety and health during meetings.

LESSON 2

PS2. IDENTIFY HAZARDS IN A SHIPYARD

PS3. RECOGNISE THE DIFFERENT TYPES OF INDUSTRIAL SAFETY SIGNS

Lesson Outline

S/NO	Topics
UK2	Fire and Explosion hazards

Learning Objectives

After this lesson, the trainees should be able to:-

- Chemistry of Fire – Fire Triangle
- Types of Combustible Materials (Fuel)
- Where Combustible Materials are found
- Liberation and Accumulation of Flammable
- Gases/Vapours (Fuel)
- Sources of Ignition (Heat)

2.1 Chemistry of Fire - The Fire Triangle

If any one of these elements is not present (or is not present in a proper proportion) the fire or explosion will not occur.

- Oxygen: To sustain combustion
- Heat: To ignite the fire
- Fuel: To produce chemical reaction



Fire Safety, at its most basic, is based upon the principle of keeping fuel sources and ignition sources separate.

Types of Fire

There are three basic types of fires commonly found at the workplace:

1. Class 'A' Fire
2. Class 'B' Fire
3. Class 'C' Fire



1. Class 'A' Fire

Refers to general fire involving fuels such as paper, wood and other combustibles.

2. Class 'B' Fire

Refers to fire involving fuels such as oil and chemicals (flammable liquids) or flammable gases such as LP, Acetylene, etc.

3. Class 'C' Fire

Refers to electrical fire.

2.2 Types of Combustible/Flammable Materials

- Solids – Woods, plastics, papers, rubbers
- Liquids – Oil, petrol, chemicals, paints, solvents, LNG etc.
- Gaseous/Vapours – Petrol, paints, hydrogen, methane, acetylene etc.
- Flammable gas & vapor's pose a serious risk of fire and explosion in shipyard
- Various gases are used in ship repair activities & some of these are extremely flammable.
- Sometimes liquid fuel gives off vapors which is flammable and could cause fire and explosion



2.3 Common Sources Of Fuel

- Non-gas freed tanks which had contained petroleum products.
- Vapors from sludge removal/tank cleaning.
- Gas hose leaks such as acetylene, LPG.
- Vapors from flammable solvents.
- Vapors from spray painting.
- Bunkering operations.



Places Where Fuel Can Be Found

Fuel can be found almost anywhere on board a ship.

Some common places are listed below.

- Engine room
- Pump room
- Cargo tanks, including fuel oil tanks
- Pipe lines

Places Where Fuel Can Be Found



Confined Spaces



Engine Room

2.4 Liberation & Accumulation of Flammable Gases & Vapours

- Flammable gas & vapours pose a serious risk of fire and explosion in shipyard.
- Various gases are used in ship repair activities & some of these are extremely flammable.
- Sometimes liquid fuel gives off vapour which is flammable and could cause fire and explosion.
- Leakage Of Fuel And Produce Gases
- Perform Tank Cleaning And Removing Sludge
- Dismantling Of Valves And Pipelines
- Bunkering Operations/Transferring Of Oil
- Perform Painting Works In Confined Spaces
- Chemical Cleaning Of Boilers And Condensers
- Cleaning Of Electrical Switchboard With Flammable Solvents.

2.5 Sources of Ignition

- Hot-work
- Lighted cigarette butt
- Static electricity
- Lighted match, spark igniter
- Non-flameproof lighting
- Electrical spark
- Welding/ Grinding



Common Ignition Sources

- Hot work Activities
- Naked Flame
- Uncontrolled Burning
- Grinding
- Welding



LESSON 3

PS4. UNDERSTAND THE APPLICATION PROCESS FOR SAFETY PERMIT PRIOR TO HOT WORK
PS6. APPLY SAFETY PRECAUTIONS WHEN WORKING WITH DIFFERENT HAZARDS
PS7. RESPOND TO FIRE AND EMERGENCY

Lesson Outline

S/NO	Topics
UK3	Prevention of Fires and Explosion

Learning Objectives

After this lesson, the trainees should be able to:-

- Safety work procedures for Hot Work:
 - Cutting, burning & welding
 - Gas cutting & welding
 - Electrical arc welding
 - Grinding
- Permit-to-Work System
- Procedures to respond in cases of fire emergency
- Use of Solvents for Chemical Cleaning
- Control and Storage of Chemicals

3.1 Safety Work Procedures for HOT-WORK

Hot work is defined as cutting and welding operations for work activities that involve the use of portable gas or arc welding equipment, or involve soldering, grinding, or any other similar activities producing a spark, flame, or heat.

Hot work is classified as any work that generates heat or sparks.

Examples of hot work:

- Welding
- Oxy-fuel gas cutting
- Grinding
- Drilling
- Brazing





General Cutting and Welding Controls

- **Hot Work Permits**
- Training
- Ventilation and Atmospheric Testing
- Fire Protection
- Personal Protective Equipment
- Cutting and Welding in Confined Spaces
- Storage and Handling



Safe Work Practices

- Inspection work area & equipment
- Remove Combustible Material
- Gas Free
- Fire Fighting
- Watchman

The following safety devices must be installed for oxy-fuel cutting equipment:

1. Non-return valve
2. Flashback arrestors
3. Jubilee clips shall not be used for hose connections as these clips can cause leaks when the clips are being tightened or loosened (cut into the hoses).
4. The clips on the right shall be used for hose connections.

Safe Work Procedure for Hot Work

- Ensure that all combustible materials are first removed from work area prior to commencement of hot work.
- Ensure valid hot-work permit in place.
- Check to ensure all hot-work tools in good condition.

Before carrying out any hot work with oxy-fuel equipment, do the following:

- Check gas hoses and its fittings to ensure no damage;
- Wear the necessary PPE.

Gas Equipment to be of Good Construction

All equipment used for hot-works shall be:

- Of a design that is suitable for the gas or vapour being used;
- Of good construction and sound and suitable material;
- Free from defects; and
- Properly maintained.





All equipment and fittings including gas hoses, torches, blowpipes, pressure regulators, nozzles and connections, shall be inspected and tested by a competent person or the safety officer once in every **14 days** to ensure that they are free from defects and leaks.

- During breaks, turn off the gas supply at the manifold and disconnect the hoses.
- Remove gas hoses from the confined spaces at the end of the day and place it neatly on the deck.
- Pressure gauges on gas cylinders to be in good condition.
- Shut off gas valves and remove gas hoses from confined space after work

Gas Cutting

- DO NOT use damaged Pressure Gage.
- DO NOT use Jubilee Clips to fasten gas hose.
- Oxygen and Acetylene Cylinder Cages must be kept at least 6 m apart from each other.
- Oxygen or acetylene cylinders shall be kept at a distance of at least 6 m from hot work area.
- Ensure Flashback Arrestors and non-return valve in place before igniting the Cutting Torch.
- Check that there are approved flashback arrestors.

Red - acetylene

Blue – oxygen

- Approved clips to be used
- Proper wrench for opening gas cylinder
- Check that both pressure gauges for each cylinder are not damaged.
- At the end of work day, all gas hoses inside confined spaces must be moved out.
- Cylinders to be stored in upright position.
- Ensure all gas cylinders are supported on trolleys.
- Cylinders are kept secured.



Fire Watchman

- A person trained in firefighting shall be appointed as a Fire watchman to monitor the hot-work.
- Standby firefighting equipment.

During Hot Work:

- Fire watchman will monitor hot work
- If the Shipyard Competent Person discovers a change that could adversely alter safe conditions (such as a missing fire watch, ventilation failure, piping system leak, or hazardous materials spill), work must be stopped.
- Work may not be resumed until the affected space is visually inspected and re-evaluated



Welding

- Only trained personnel are allowed to perform welding works
- Must attend and pass SSIC Hot work course for shipyard
- The PPE required when performing this operation must provide protection from:
 - i. Radiation
 - ii. Metal fumes and welding gases
 - iii. Electrical current
 - iv. Hot metal
 - v. Noise

Note: Shielded arc welding produces high levels of toxic gases (such as Nitrous Oxide (NOx)).

Arc-Welding

- Welding equipment's and cable to be inspected
- Welding set to be earthed
- Welding cable to be separated from gas hoses to prevent fire.
- Welding cable need to lay in such a way not to cause any obstruction.
- Welding set to be switched off and welding rod to be remove from holder during break and end of the work.
- Do not weld in wet condition and during rain.
- Welding cables and electrodes must be inspected by competent person at least **once every 30 days**.

Inspection of Equipment

- All equipment and fittings including the safety devices used for the purpose of carrying out hot-work shall be inspected and tested by a competent person regularly to ensure that they are free from defects and leaks.

Adequate Ventilation

- Where welding or cutting operation is to be carried out in a confined space, adequate ventilation shall be provided.

Welding and Cutting on Containers that held Flammable Substances

- No welding or cutting operations shall be carried out on any container that has held any explosive or flammable substance unless :
 - i. Container has been thoroughly cleaned by steam or other effective means and is completely free from combustible gases or vapours; or
 - ii. Air in the container has been replaced by an inert gas.

Grinding

- Ensure grinding machine is not defected
- The machine must be inspected by qualified person
- Use face shield prior commencing grinding job
- Use correct disk for grinding machine.
- Do not use over size or smaller disk.
- Do not remove safety cover of the machine
- For pneumatic machine ensure that hose connection is done properly.

3.2 Permit-To-Work System

Under the WSH (Shipbuilding & Ship-Repairing) Regulations 2008, the occupier of a shipyard and the master, owner or agent of ship in a harbour shall:

- Implement a permit-to-work system;
- Appoint a safety assessor;
- Ensure that no high risk work is carried out without a permit-to-work.

The Permit-To-Work system was established as a tool to control all hazardous works carried out in the shipyard, especially on board the ship, so that these works can be carried out safely without any incident and injury to workers.

Types of Works Requiring PTW

- Hot Work
- Use of Chemicals
- Spray Painting
- Confined Space Entry
- Testing/dismantling of oil pipes/oil valves and heating coils (steam)
- Bunkering and transferring of fuel oil
- Repair/maintenance of ship's hydraulic system
- Ballasting/de-ballasting of ship
- Grit-blasting work in confined space
- Radiography




Application for Permit-To-Work

Stage 1: Application by Trade Supervisor or Foreman

The supervisor shall submit his application to safety assessor for endorsements.

Stage 1:
Application by Trade Supervisor or Foreman

Permit No :	RA No :
Location :	Date :
Work to be done :	Valid from:
	Valid to :
Company :	
State safety & health measures taken:	
Supervisor Name :	No. of Workers :
Signature :	



The supervisor shall submit his application to safety assessor for endorsements.

Evaluation of Permit-To-Work

Stage 2: Evaluation by the Safety Assessor

Upon completion of the site inspection and the Safety Assessor is satisfied that the high risk work can be carried out safely, he shall endorse the application for the permit-to-work by signing Stage 2 and forwarding the application to the ship repair manager.

Approval of Permit-To-Work

Stage 3: Approval of PTW by Ship Repair Manager

The SRM shall then issue the Permit-To-Work by signing stage 3 of the PTW.

Permit on Display For Inspection

Permit must be readily available for inspection.

Completion of Work

Stage 4: Notification of Completion of Work

Upon completion of the work, the trade Foreman/Supervisor shall sign Stage 4 of the Permit-To-Work and hand over the permit to the Safety Assessor.

Before you start work, apply for a work permit.

Before you start work, apply for a work permit.

PTW Before Work

- No work should commence in the shipyard unless there is a valid permit-to-work.
- Remember:

NO PERMIT - NO WORK!

Permit must be readily available for inspection.



Fire Prevention

Housekeeping:

- Remove combustible materials
- Keep flammable liquids in approved safety cans and cabinets
- Labeled all chemical containers
- Keep flammables and combustibles away from ignition sources

Always ensure that the following items are in good working condition and are stored or disposed of correctly:

- Electrical tools & extension cords
- Gas cutting equipment's
- Segregate flammable/combustible liquids & gases
- Saturated solvent rags



3.3 Procedure to respond in cases of fire emergency

- In the event of an emergency, the emergency alarm will be activated.
- Remain calm.
- Listen for announcements.
- When an emergency is confirmed, stop work and switch off all equipment/machinery.
- Evacuate the ship in an orderly manner.

What Should You Do?

- ✓ Upon hearing siren, STOP WORK
- ✓ Shut or turn off all equipment
- ✓ Evacuate to Emergency Assembly Area



**CALL FOR HELP..... , DIAL NUMBERS
LEAVE THE PLACE IN AN ORDERLY MANNER**

- Follow the evacuation signs to the emergency assembly area.



- Remain at the assembly area for head count and do not leave the assembly area until told to do so by your supervisor.



3.4 Use of Solvents for Chemical Cleaning

What types of Chemicals?

Chemicals include the followings:

- Acids like hydrochloric acid, sulphuric acid etc.
- Alkaline like potassium hydroxide, calcium hydroxides etc.
- Solvents like acetone, toluene, and xylene.
- Many chemicals used in industries are harmful to health.
- Some are flammable and can cause fire and
- Others may be toxic, corrosive, reactive or even radioactive.

Important to know what chemicals are used and the appropriate measures to prevent or minimize the hazards

Precaution while using solvent for chemical cleaning:

- Ensure chemical-cleaning permit has been obtained before work commences.
- Cordon off the affected work area.
- Display chemical cleaning signboards.
- Display no-smoking and no hot-work signboards.
- No spark producing equipment in the confined spaces.
- Switch off engines, generators nearby.
- Display SDS on site or made available



3.5 Control and Storage of Chemicals

- Keep containers closed and tightly sealed when not in use.
- Store in proper & designated storage area
- Do Not use chemical in an unlabelled container.

Safe Storage of Chemicals

- Place container under shelter on weather deck.
- Rope off area and keep sources of ignition away.
- Display no-smoking and no hot-work signboards.
- Cover containers when not in use.
- Get SDS and make available
- Isolate from combustible materials
- Segregate flammables & toxic chemicals
- Use all required PPE
- If any spill contains it and dispose through licensed cor
- Clean up any spill according to SDS procedures.



What is SDS?

The Safety Data Sheet (SDS) provides you, the necessary information to work safely with chemicals. SDS contains health, safety and relevant information about chemical substances.

Why SDS is required?

SDS helps to control of chemical hazards

- SDS helps to correctly used so as to safeguard and protect the lives and health of those personnel handling the chemicals.
- Tells you whether the substance is stable.
- Tells you how chemical enter your body and signs and symptoms of exposure,
- Tells you what to do if there is a leak;
- Tells you what type of PPE to be used when handling particular chemicals.
- Tells you how to handle and store chemical substance.



Basically, control measures can be applied at:

- The source where chemicals are located or emitted;
- Along the path i.e. between the source and the receiver; and
- At the receiver or the exposed person.

LESSON 4

PS6. APPLY SAFETY PRECAUTIONS WHEN WORKING WITH DIFFERENT HAZARDS

Lesson Outline

S/NO	Topics
UK4	Preventive Measures for Specialised Operations

Learning Objectives

After this lesson, the trainees should be able to:-

- Ballasting and De-ballasting
- High Pressure Spray Painting/Washing
- High pressure water jetting or steam cleaning
- Radiography work
- Shot blasting, grit blasting & chipping
- Work with Steam Boilers and Steam Pipes
- Work under Hot sun (eg. topic on heatstroke) Health Hazards (eg. absorption, inhalation and ingestion)
- Permit-to-Work System
- Measures to enhance the safety of workers transported on lorries
- Case study

4.1 Ballasting / De-Ballasting

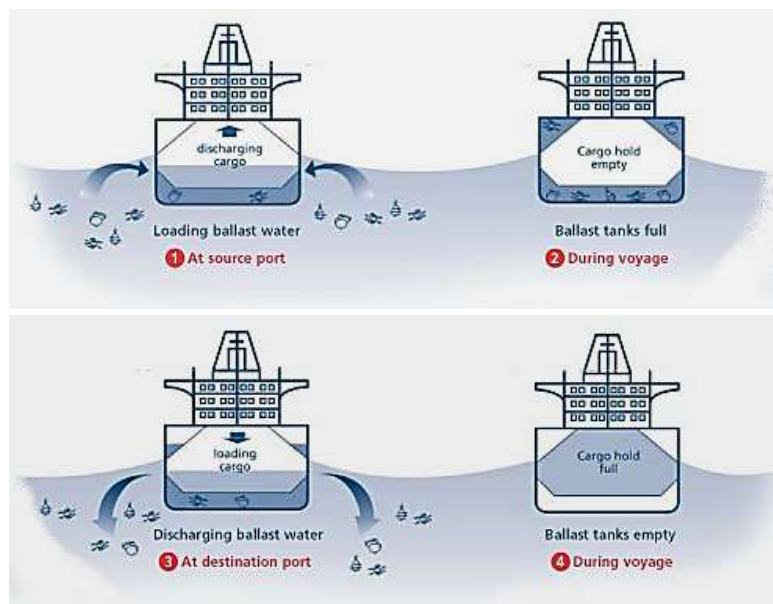
What is Ballasting?

Process of filling the tanks with water for stability of vessel.

What is De-Ballasting?

Process of removing water from the tanks.

- Before commencing ballasting/de-ballasting works; ensure there is valid ballasting/de-ballasting permit.
- Display warning signs.
- Ensure no one in the tank prior to the operation.



4.2 High Pressure Spray Painting / Washing

- Check spray paint hoses and equipment to ensure no damage.
- All hose connections shall be secured.
- Never touch the tip of the nozzle.
- Never point the spray gun nozzle in the direction of anyone.
- Release the pressure from the hose prior to disconnecting the hose.
- No hot work shall be carried out nearby.

4.3 High Pressure Washing/Water Jetting– Preventive Measures

- Blasting or cleaning operation involving use of water/steam under very high pressure.
- Can cause serious injuries if safe work procedures not followed.

- PPE

Specify the PPE to be used by workers involved in this work. This will include waterproof clothing, waterproof boots and goggles or facemask.

- Preparation

Supervisor to ensure that other personnel cannot be injured by the operation.

Barriers and warning signs should be erected around the area or work carried out at a time when other workers are not within range.



Steam Cleaning – Preventive Measures

▪ High Pressures

Use only high pressure armoured or wire-reinforced steam hoses, to eliminate the possibility of bursting under high pressure.

▪ Hose Maintenance

- ✓ Always inspect your hoses before use. If your hose is damaged, replace it. Make sure all hose connections are tight and proper.
- ✓ If a hose does become kinked, untwist it to remove the kinks.
- ✓ When you are done with the cleaning job, roll or coil the hose and put it away. Never leave it where it could be run over or otherwise damaged.

▪ Uncontrolled Hose

Be cautious around a steam hose that has been allowed to cool. Water may have condensed inside the hose and could be released when the valve is opened. This can cause the hose and nozzle to whip violently.

▪ Electric Shock

Water and electricity do not mix. Cover electrical fixtures. Never spray directly at any electrical equipment. Do not turn the power back on until you are sure everything is absolutely dry.

▪ Poor Visibility

Operators should direct the steam away from themselves. Plan the work so you do not have to walk into a vapor cloud. If you become enveloped in a cloud, stop work, wait for it to dissipate and warn other workers away.

4.4 Radiography Work

- Exposure to high doses of ionizing radiation can cause skin burns and radiation sickness.
- Exposure to low doses of ionizing radiation causes cancer, tumours and genetic damage
- Sunburn is one of the effects of ionization.
- When you see this sign, it means radiation work is in progress and stay clear of the area.



PPE and Precautions

When you see this sign, RADIATION WORK is in progress and you must stay clear from the area

4.5 Shot Blasting, Grit Blasting & Chipping

- Blasting or cleaning operation involving use of grit/sand under very high pressure.
- Can cause serious injuries if safe work procedures not followed.

Power Tooling Equipment

(Air compressor, air manifolds, pneumatic power tools, electrical power tools, hoses for power brushing).

Safety precaution to take:

- i. Blasting equipment must be certified.
- ii. Trained person will do blasting job.
- iii. Use air supply blasting hood while blasting.
- iv. Do not go near blasting area, use dust mask.
- v. Blasting hose and equipment will be inspected.
- vi. Hose joint to be secured using whip arrestor.
- vii. Sign board and notice to be displayed.
- viii. Blasting area to be fully covered by canvas.



4.6 Work with steam boiler and pipes

Before commencing any chemical cleaning works, ensure the following safety precautions are in place:

- i. Valid chemical cleaning permit;
- ii. Display safety signs at work area;
- iii. Barricade affected work area;
- iv. Ensure no hot works nearby;
- v. Chemical containers shall be labelled and stored in a proper place.



Melt down. This is a result of the heating surface metal reaching its melting point. It is a result of the boiler operating on very low water conditions. This by itself will not cause an explosion but will do major damage to the boiler and create a dangerous situation which could lead to an explosion.



Thermal Shock This is a condition where low water causes the heating surfaces to become overheated and then cooler water is added. The water then flashes to steam which expands 1600 times its volume as water and causes the explosion because there is not enough room for the steam to expand



Combustion explosions. These can be a result of gases which build up and an ignition source ignites the gases. This can happen inside the boiler or outside. There are safety devices in place to avoid these situation and we will discuss these in the following slides.

Steam Pressure. Excessive steam build up which exceeds the design pressures of the vessel. There are also safety device to prevent this. Can cause serious injuries if safe work procedures not followed.

- Ensure a Chemical Cleaning Permit has been Approved and Issued by the SRM.



- Barricade the affected chemical cleaning work area.



- Display Safety Signs at the affected work area.



- Wear the proper PPE when handling and exposed to chemical hazards.



4.7 Work Under Hot Sun

- Thermal Extremes is another common health hazard in the shipyards.
- Workers work in hot conditions especially in confined spaces where the temperatures can rise during a hot day.
- Following are some common heat related disorders:
 - Heat Stroke
 - Heat Exhaustion
 - Heat Cramps

Heat Stroke

Body unable to regulate body temperature and causes the body temperature to rise to dangerous levels.

Heat stroke is the most critical disorder and occurs when the body temperature rises above 41C and can be fatal.

Heat Exhaustion

Body loses fluids and causes dehydration.

Heat Cramps

When body loses excessive salt through sweating, worker will experience muscle cramps.

Heat Stress Condition

Condition	Causes	Signs and Symptoms	Treatment
Heat cramps	Fluid loss and electrolyte imbalance from dehydration	<ul style="list-style-type: none"> Painful muscle cramps, especially in legs and abdomen Faintness Profuse perspiration 	<ul style="list-style-type: none"> Move affected worker to cool location Provide sips of liquid such as Gatorade® Stretch cramped muscles Transport affected worker to hospital if condition worsens

Protection Against Heat Stroke

- Tell your supervisor immediately if you are unwell or experience any of the following:
 - i. Tiredness
 - ii. Confusion
 - iii. Drowsiness
 - iv. Headache
 - v. Nausea
 - vi. Fainting
- Drink plenty of water to keep the body cool and hydrated.
- During breaks, move to a cooler place to rest.
- If you feel giddy or get cramps, immediately move to a cool place and rest.
- Wear loose fitting and light coloured clothing when working in hot environment.
- If your colleague gets heatstroke, immediately:
 - i. Move him to a shady area;
 - ii. Loosen or remove his clothing;
 - iii. Apply cool water to his skin and fan him;
 - iv. Place ice packs under his armpits and groin area; and
 - v. Quickly call 995 for an ambulance.

How to prevent?

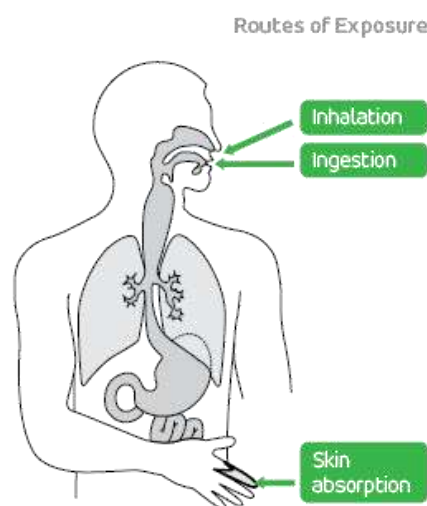
- Drink water every 15 minutes, even if you are not thirsty.
- Rest in the shade to cool down.
- Wear a hat and light-colored clothing.
- Learn the signs of heat illness and what to do in an emergency.
- Keep an eye on fellow workers.
- Refer to hospital



4.8 Health Hazards

Routes of Entry / Health Effects

- Chemicals can enter the body (routes of entry) by:
 - i. Inhalation through the lungs;
 - ii. Absorption through the skin;
 - iii. Ingestion through the mouth.
- Inhalation is most common route of entry.

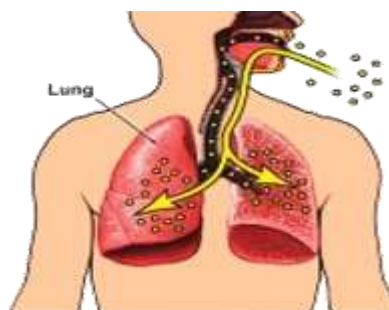


Routes of Entry

Inhalation

Inhalation for Industrial exposures to chemicals, the most important route of entry is inhalation. i.e. through the nose.

- Can cause headache, nausea, vomiting, burns and cancerous



Ingestion

- Chemical enters the body through the mouth when we drink or eat with dirty hands which have been exposed to chemicals or eating at work areas where chemicals are present.
- Can cause stomachs irritation, upset, vomiting, burns and cancerous



Absorption

Can cause dermatitis such as skin irritation, burns and cancer



4.8 Health Hazards

- Local effects - stomach irritation and stomach upset.
- Systemic effects - an increase in the blood alcohol level, which can cause damage to brain cells.
- Acute effects - drunkenness, headache and a hangover.
- Chronic effects - permanent liver damage, which can have a latency period of many years.

Sources of Biological Hazards may include bacteria, viruses, insects, plants, birds, animals, and humans.

These sources can cause a variety of health effects ranging from skin irritation and allergies to infections (e.g., SARS, COVIDS), cancer and so on.

Airborne contaminants occur in the gaseous form (gases and vapors) or as aerosols. In scientific terminology, an aerosol is defined as a system of particles suspended in a gaseous medium, usually air in the context of occupational hygiene, is usually air.

Taking Your Meals

Do Not Eat

When handling any chemicals materials.

- Never use thinner to clean your hand, instead use soap & brush.
- Wash your hand before you taking your meal.



Protective Clothing and Appliances

Wearing of Additional PPE is necessary when handling chemicals. Eg. Face Shield, Respirator, Goggles, Rubber Gloves, Chemical Suits, Etc.

Proper disposal of wastes

Improper disposal of wastes may lead to illness

Personal Hygiene

Good hygiene habits

- Wash hands before consuming food or drink
-

Changing & Washing Facilities

- Wash yourself thoroughly after work
- Area must be kept clean at all times

Good hygiene habits

- Washing and wearing of clean clothes
- Injuries to receive immediate first aid or medical treatment

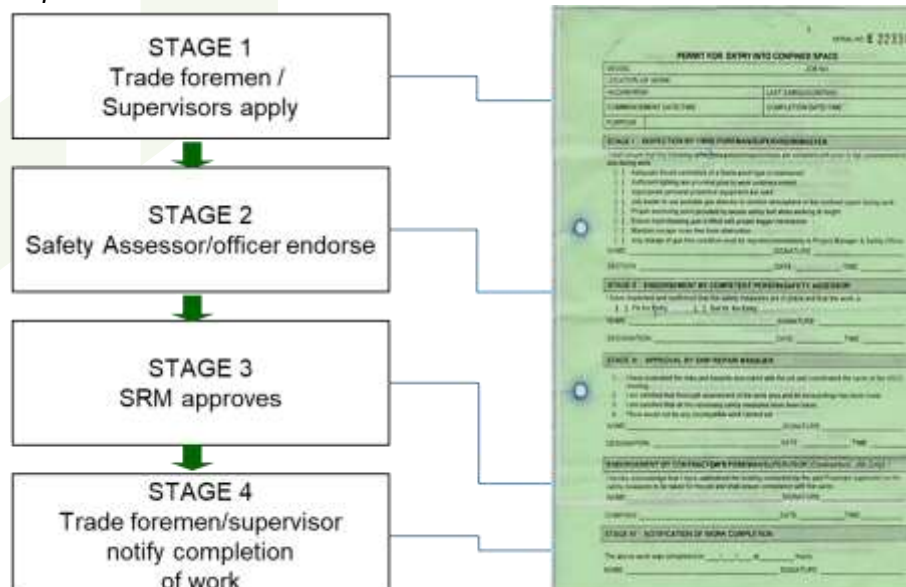
4.9 Permit to Work System

Types of Permit-to-Work Used for Specialised Operations:

- Painting
- Blasting
- Ballasting/De-ballasting
- Testing of heating coil
- Chemical cleaning
- Radiography

Permit-to-Work Detail Pls see Topic 3.2

4.8 Permit to Work System



4.9 Measure to enhance safety of workers transported on Lorries

- The lorry must not travel faster than the posted road speed limit or the vehicle speed limit of 60 km/h, whichever is lower.
- The front passenger seat(s) in the lorry's cabin must be occupied before workers can be carried on the rear carriage deck.
- 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.
- 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.
- If goods are also transported, they must be properly secured such that they will not endanger the workers carried or other road users.
- All light Lorries (G-Plate Lorries with maximum laden weight not exceeding 3,500 kg) used to transport workers are to be fitted with canopies and higher side railings by 1 February 2011.
- Heavy Lorries (X- or Y-Plate Lorries with maximum laden weight exceeding 3,500 kg) will need to comply by 1 August 2011.

Note: The side-railings should be fitted up to a height of not less than 700 millimetres from the carriage deck and not less than 300 millimetres from the top of the side-boards.

- For light lorries (G-Plate lorries with maximum laden weight not exceeding 3,500 kg), the height of the canopy structure must not exceed 1.35 times the height of the lorry's cabin when measured from the road surface to ensure the stability of the vehicle.

Lorry owners who wish to use their Lorries to carry their workers must display a Maximum Passenger Capacity (MPC) label on the right side of lorry's rear tailboard indicating the maximum number of workers that can be transported when the carriage deck is empty.



Transporting Workers – Four Simple Steps

4

Simple Steps to a Safer Ride

步安全小措施

பாதுகாப்புடன் பயணத்திற்கு
(சவாரிக்கு) 4 எளிதான
வழிகள்
নিরাপদ যাত্রার জন্য কতকগুলি সহজ ধাপ



1 Fill front seat(s) first
先生滿前座
(முன்பகுதி/அمام) பயணிகளை
அதன் பின்னர் பின்/பின்பு, சரிசென்



2 Comply with height limit
保持在限定的高度內
உயரம் 1.1m-க்கு கீழானவர்கள்
இலாரி/பீமா/பெட் போட



3 Do not carry excess passengers
遵守載客人數的限制
கார்பெட்டி, டிரைவரை, டிரைவரை-
அசிஸ்டன்ட், மற்றும் கார்பெட்டி
அதற்கு மேல் ஏதாவது ஒருவர்



4 Secure onboard cargo/equipment safely
安全地系好卡車上的貨物/儀器
பொருள்/பொருள்/பொருள்/பொருள்
பொருள்/பொருள்/பொருள்/பொருள்
பொருள்/பொருள்/பொருள்/பொருள்



Worker Transportation – Penalties for Non Compliance

• Keep within speed limit of the road or the vehicle speed limit of 60 km/h, whichever is lower.

請遵守時速限制，卡車不可超過每小時60公里的時速。若該道路的限制低於每小時60公里，您就必須遵守該道路的限定时速。



• Fill front seat(s) first in the lorry cabin before carrying workers on the rear carriage deck.

先坐滿前座，才能使用車斗運載工友。



FINE \$500
+ 3 Demerit Points
罰款\$500 + 扣3分

• Do not carry goods dangerously. Secure all goods to ensure safety of the workers carried at the carriage deck or other road users.

切勿危險地運載貨物。所有的貨物必須安全地系好以確保運載工友及其他公路使用者的安全。



FINE \$500
+ 9 Demerit Points
罰款\$500 + 扣9分

• Comply with height limit of 1.1 metres for all seated workers when measured from the carriage deck.

坐在车斗的工友必须保持在限定的高度内。限定的高度从车斗甲板算起，不可超过1.1公尺。



Doubling of Minimum Deck Space

You will need to double the minimum deck space for passengers to 0.744 square metres (or 8 square feet) from 1 August 2011.

从2011年8月1日起，每名工友在车斗的座位空间将增加一倍至0.744平方米(或8平方英尺)。



• Keep within the Maximum Passenger Capacity and do not exceed the number of workers based on the minimum deck space requirement.

If goods or equipment are also transported, the number of workers that can be carried will be reduced according to the remaining deck area available.

遵守限制的载客人数，切勿超载。

如果同时使用卡车运货物或仪器，可运的工友人数将根据剩余可使用的甲板空间相应地减少。



4.10 Case Study

What Happened?

- In a local shipyard a group of two were carrying out hydro jetting operation in a water ballast tank.
- Lighting was not sufficient for the tank and ventilation was also found to be insufficient.
- During Hydro jetting it is required to have a firm grip to the gun however after a prolong period one of the hydro jetter fell on the same level and got laceration by water jet (30,000PSI) to his left calf.
- A check on the hydro jetting guns and face-shield - was in - place. There was no violations on the guns.
- Casualty sustained lacerations on his left calf.

Findings:

- Lighting & ventilation for the tank was not adequate.
- The worker was working prolong period and was exhausted.
- The worker didn't have sufficient training and experience.
- Safe work procedures were not followed.

Learning Points

- Must have adequate training and experience before doing hydro jetting in confined space.
- Worker must take rest at after certain hours during hydro jetting.
- Adequate lighting and ventilation to be provided.

LESSON 5

PS6. APPLY SAFETY PRECAUTIONS WHEN WORKING WITH DIFFERENT HAZARDS

Lesson Outline

S/NO	Topics
UK5	Preventive Measures for Material Handling

Learning Objectives

After this lesson, the trainees should be able to:-

- Authorised use of machine and equipment (Cherry pickers, drilling machines, Forklift trucks, hoisting equipment etc.)
- Crane operations & lifting equipment Manual Handling of Loads
- Mechanical Lifting
- Rigger and signalman
- Good housekeeping (stacking of heavy and irregular objects e.g. pipes, placing of tools etc.)
- Case study

5.1 Authorised use of Machine and Equipment

Under the WSH Act, an employee must:

- Follow the safe working procedures and principles introduced at the workplace.
- Not engage in any unsafe act that may endanger yourself or others working around you. You must not tamper or misuse such items provided.

Training

- All operators of machine and equipment must be authorized
- All operators must receive adequate safety training
- Mandatory Training Required e.g. Forklift, crane operator, scissor lift, boom lift

5.1 Authorised use of Machine and Equipment - Cherry Pickers

- Cherry pickers is a mobile elevated working platform.
- Only trained personnel are allowed to operate and use this.
- Do not overload the work platform of cherry picker.
- Cherry picker to be inspected in every 6 months interval.
- Use safety belt or harness and hook up while working on the platform.

5.1 Authorised use of Machine and Equipment - Drilling Machines

- Safeguarding of moving parts.
- Use of safety glasses by operators.

5.1 Authorised use of Machine and Equipment - Forklift Trucks

- Must be trained and certified
- Must drive only the types of trucks for which they've received certification.

Forklift Accidents



5.1 Authorised use of Machine and Equipment - Hoisting Equipment

Pre-Use Inspection

- All lifting equipment should be inspected by a competent person before each lifting operation.
- This is to ensure that the equipment is suitable, safe and correctly installed for the task.
- All lifting appliance and lifting machines shall be marked with its SWL and a distinctive number for identification

5.2 Crane Operations and Lifting Operations

Only registered crane operator to operate a mobile crane and tower crane. No person shall operate a mobile crane (not being a lorry loader) or tower crane in a workplace unless he is a registered crane operator.

Load Charts, Operation Manuals, Maintenance and Operational Logs

- Every ship crane must be provided with the load chart(s) and operation manual (both written in English) and these are kept in the operator's cabin. An owner has also to arrange for the load chart(s) and operation manual to be in other language understood by the crane operator if he/she does not understand English.
- Maintenance and operation logs/records for their mobile or tower cranes must be properly documented. Crane operator to record operational tests and incidents of failures or malfunctions in the crane's log book or sheet.

Lifting Operations

Recommended Rigging Practices

- Riggers must ensure that the load is properly secured and site personnel must stay clear during lifting works.
- Do not ride on suspended load
- Use Tag Line to control loads



Lifting Equipment

- Lifting appliance and lifting machines shall be marked with its SWL and a distinctive number for identification.
- Lifting appliance and lifting machine shall not be loaded beyond its SWL except by an authorised examiner.
- A lifting machine shall be operated either by a trained person or a person under training who is under the direct supervision of a qualified person.
- A person below the age of 18 years shall not operate any lifting machine or give signals to the operator of any lifting machine.

Guidelines of Lifting Operation – Lifting Supervisor

Most important personnel of the Lifting Team - controls the lifting equipment.

Key competencies of the operator of mobile, crawler or tower cranes:

- ✓ Ability to read and interpret the load capacity chart,
- ✓ Ability to differentiate weight of load and capacity of crane

5.3 Rigger and Signalman

- Be over 18 years of age;
- Undergone approved training courses;
- Riggers rig up loads using cranes;
- Signalman give signals to crane operator.
- Only authorized signalman should give signal to crane operator

Guidelines of Lifting Operation – Signalmen

The appointed signalmen shall:

- Ensure that the immediate areas within the lift are clear of any hazards during maneuver.
- Maintain his / her position so as to ensure line of sight during the controlled phase of the lift and to ensure this position is free of danger.
- Refrain from handling load/rigging simultaneously when giving signal to the crane operator



Guidelines of Lifting Operation –Riggers

The appointed riggers shall ensure:

- All slings, webbings, shackles and other lifting gears used to rig the load are;
- Within the safe working load (SWL) of the lift, in good condition and duly certified.
- The load is rigged up in a such a manner that it is ;stable, balance (centre of gravity beneath the hook) and secure (i.e. no loose items)



5.4 Manual Handling of Loads

What is Manual Handling?

- Manual handling refers to any activity requiring the use of human force to lift, lower, push, pull, carry.
- Since most jobs involve some form of manual handling, the workers are at risk of manual handling related injuries.

Types of Injuries Related to Manual Handling

Unsafe manual handling can result in the following types of injuries:

- Muscle sprains and strains;
- Back injuries;
- Injuries to tendons, tissues, ligaments in the wrist, arms, neck, shoulders or legs;
- Abdominal hernias.



Proper Method of Handling Load

- Observation of load and passage
- Proper grip
- Keep back straight and use leg muscles
- Load close to body
- Do not exceed limit
- Where it is not possible to carry a load alone, get help from colleague.

Proper Manual Handling - Individual



ALWAYS KEEP YOUR BACK STRAIGHT WHILE LIFTING



Step 1: Hold the load firmly

Step 2: Keep the load close to you

Step 3: Lift the load by pushing up your leg

Step 4: Ensure your legs are stable before moving off

5.5 Mechanical Lifting

- If the load is too heavy or big, use mechanical aids such as trolleys, stackers, hoist, forklift, etc. to move the loads to prevent injuries.
- Means lifting with the assistance of lifting equipment.
- Lifting equipment are one of the main contributors of workplace fatalities.
- Accidents involving lifting equipment were mainly due to unsafe lifting operations.
- This included the use of defective lifting equipment and overloading of the lifting equipment.
- Minimize the possibility of back strain, fingers injury or other injuries
- By using mechanical lifting equipment such as a pulley block or an electrically powered hoist.



5.6 Good Housekeeping

- Passageways, fire points and exits are free from obstructions.
- Clean up spill liquid/ grease on machines and floor immediately.
- All cables and hoses shall be run overhead.
- Materials to be stacked properly.
- Use rubbish bin and scrap bin to put rubbish and scrap separately.
- Keep workplace, equipment's and machines clean and tidy.
- Keep tools & equipment's in their proper places after use.
- Using damaged or wrong tools may cause accidents.

Poor housekeeping will result in accidents



• Slip & Fall injuries



Poor housekeeping will result in accidents

5.7 Case Study

Case study - Worker crushed by falling object during lifting operations

What happened?

The deceased and his co-worker were tasked to shift five web frames using a gantry crane. The web frames were to be inserted and welded onto a curve plate assembly. When the last web frame was being hoisted, the deceased slipped and instinctively grabbed onto the web frame, causing it to dislodge from the horizontal clamp and consequently, the frame pinned the

Findings: Root Cause

Evaluation of loss	• 1 worker killed.
Type of contact	• Crushed by falling object.
Immediate cause(s)	• Unsafe act.
Basic cause(s)	• Improper lifting method.
Failure of WSHMS	• Failure to ensure proper and adequate training for workers. • Lifting Supervisor not present during works.

Lesson Learnt

Risk Assessment	• Before any lifting operation, a competent person should verify that the established lifting method is adequate and that the right equipment has been selected for the job.
Safe Work Procedure	• Ensure that safe work procedures are well communicated at all levels, especially to relevant personnel such as on-site workers.
Work Planning	• Newly trained workers must be closely supervised on the job.
Equipment and Tools	• Incompatible use of lifting gear (clamps and hook without shackle).
Training and Awareness	• All persons involved in the work must be adequately trained to be competent at their jobs, as well as aware of the risks and safety precautions required.



LESSON 6

PS6. APPLY SAFETY PRECAUTIONS WHEN WORKING WITH DIFFERENT HAZARDS

Lesson Outline

S/NO	Topics
UK6	Preventive Measures for Mechanical and Electrical Works

Learning Objectives

After this lesson, the trainees should be able to:-

- Mechanical Hazards and Guarding
- Electrical Hazards and Controls
- Hand Tools – Proper usage and storage
- Noise Hazards
- Case study

6.1 Mechanical Hazards and Guarding

Types of Mechanical hazards

- Contact or entanglement with the machinery;
- Trapping between the machine;
- Contact or entanglement with any material in motion;
- Being struck by ejected parts of the machinery;
- Being struck by material ejected from the machinery.
- Mechanical hazards are a major cause of workplace injuries in Singapore.
- Moving or rotating parts of machines must be guarded to prevent the limbs from coming into contact or getting caught in them.

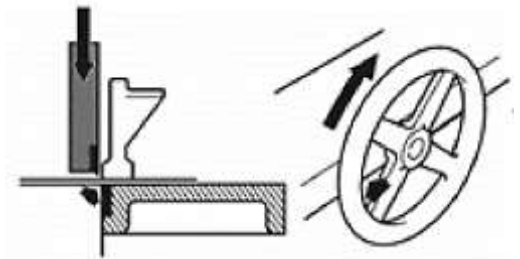
Cutting Hazards

Examples of cutting hazards include all kinds of cutting tools, circular saws, hand saw blades, rotary knives.



Crushing Hazards

Crushing occurs when one part of the machinery moves against another with a part of the body in between.

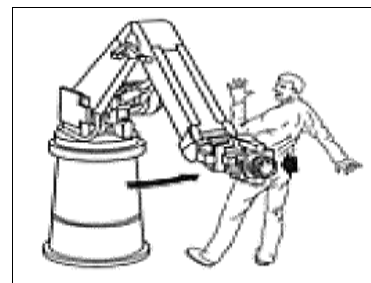


Shearing Hazards

Parts of the body may be sheared in the wrong and unsafe ways

Types of Injuries

- Crush Injury
- Deep Cuts
- Amputation of Fingers



6.1 Mechanical Hazards and Guarding

Fixed Physical Guards on moving parts to prevent accidental contact



Fixed Physical Guards on moving parts to prevent accidental contact

Safe Work Practices

- Learn to Use the tools correctly
- Know the safety procedures
- No Horseplay when using machine or power tools
- Only Trained And Authorized operator can operate on Machine

Safety Guards

Safety guards are physical barriers which prevents access to the danger areas of the machine. Following are some types of common safety guards:

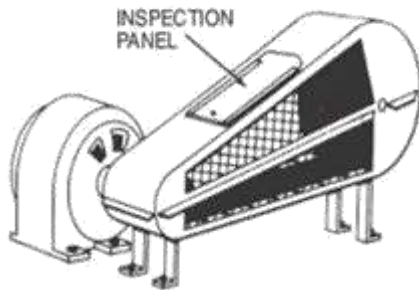
- Fixed Guard
- Interlocking Guard
- Adjustable Guard
- Self-Adjusting Guard



Fixed Guard

- A fixed guard is a guard which is kept closed and in place.
- It should be of robust construction, sufficient to withstand the stresses of the process and environmental conditions.

Fixed Guard Enclosing a Belt and Pulleys



Movable Physical Guards

Movable Physical Guards on rotating parts to prevent accidental contact. This type of guard adjusts itself to accommodate the material a person is working on.

- The design of this guard prevents the access to the moving parts of the machine until it is moved by the work piece.

Lock Out Tag Out (LOTO)

Lock out Tag out is a procedure to protect workers from injuries from energy sources when they service or repair machines and equipment by isolating the energy source.

- Examples of energy sources:

- Electrical,
- Mechanical,
- Pneumatic,
- Hydraulic, etc.

Only workers trained in LOTO procedures are Authorised to apply LOTO.



6.2 Electrical Hazards and Controls

Dangers of Electricity?

- A dangerous condition where a worker could make electrical contact with energized equipment or a conductor, and from which the person may sustain an injury from shock; and/or, there is potential for the worker to receive an arc flash burn, thermal burn, or blast injury
- All live circuits are be in an electrical junction box
- Any exposed live circuit is dangerous
- Electricity, can cause the following accidents:
 - i. Electric Shock and Electrocution
 - ii. Electric Burns
 - iii. Fire and Explosion



Electrocution



Electric Burn



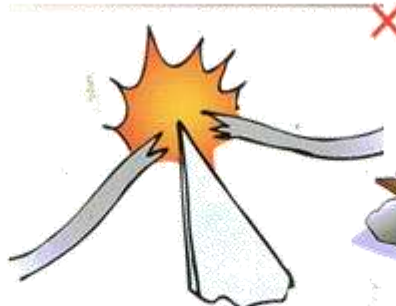
Fire and Explosion

Examples of Unsafe Electrical Conditions

- Do not connect too many sockets in one outlet as it may cause electrical fire
- Do not lay electrical wiring on floors as it can get damaged easily
- Tripping hazard



**Do not lay
electrical wiring on
floors**



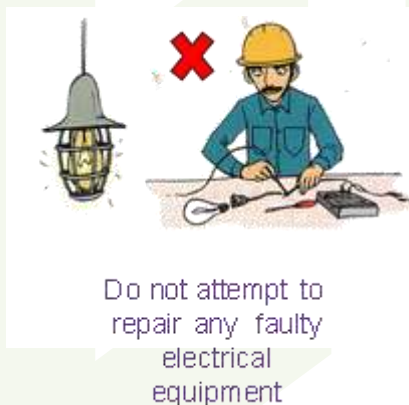
**Can get damaged
easily**



Tripping hazard

Prevention of Electrical Accidents

- Inspect tools for damage before use.
- Inspect electrical cables for damage and other signs of wear.
- Check for damaged switches.
- Inspect the plug for damage.
- Remove defective tool from service.
- Electric hand tools to be repaired by Licensed electrical worker.
- Workers must be trained in the use of electric hand tools.
- Switch off tools before connecting them to power supply.
- Suspend power cords over aisles or work areas to eliminate tripping hazards.
- Pull the plug and not the cord when unplugging the tool.
- Wear PPE such as rubber gloves and safety shoes.
- Damaged electrical cables shall be repaired by qualified electrician.
- Do not lay electrical wiring on wet floors as dangerous and may be electrocuted
- Wires should be hung
- Do not use faulty tools
- Damaged or broken electrical wire is dangerous
- Use only approved plug or socket
- Circuit Breakers (ELCB / RCCB)
 - ✓ Prevent electrical shock
 - ✓ equipment from damages
 - ✓ Prevent Electrical Fire
- Do not attempt to repair any faulty electrical equipment
- Only certified electrician can repair or test faulty electrical equipment
- Report any faulty tools to your supervisor
- Not sure how to use hand tools, consult the manual and your supervisor



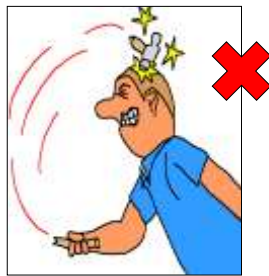
Only certified
electrician can
repair or test faulty
electrical
equipment

6.3 Hand Tools – Proper usage and storage

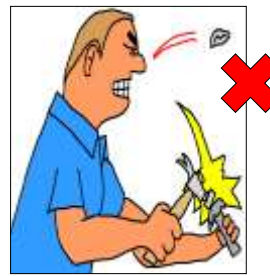
- Use tools only for the purpose for which they were designed.
- Use only tools with insulated handles when working near live electrical circuits.
- Keep the heads of impact tools dressed.

Hand Tool Misuse

- DO NOT make any minor modifications to hand tools.
- Tools must not be carried in clothing.
- Tools that are damaged / defective must be immediately removed from service and sent for repair.
- Always use the correct wrench for the job.
- There is one wrench size for each nut or bolt size.
- The operator is wearing gloves to prevent hand injuries that could result if the tool slips.
- Correct and proper use of hand tools prevents accidents.
- Protect against accidents, use personal protective equipment.
- Understand the use and operation of power tools.
- Use the right tools for the right job.
- Proper Tool Box



Correct and proper use of hand tools prevents accidents.



Protect against accidents, use personal protective equipment.

Warnings

- Always wear eye protection.
- Never use an accessory with a maximum speed rating RPM lower than tool's rated RPM.
- Check tool RPM at least once each day when in use and whenever accessory is changed.
- A warning sticker must be attached to each air tool.

6.4 Noise Hazard

- Noise is unwanted sound. Noise can be produced by many sources - man's vocal cord, a running engine, a vibrating loudspeaker diaphragm, an operating machine tool, and so on
- Effects of noise are hearing loss.
- It may lead to Noise Induce Deafness (NID).

Machinery



Grinding Work



Equipment's



Preventive Measures from Noise Hazard

- Do not exposed to high noise.
- Exposure limit is 85 db for 8 hours a day.
- Use ear plug or ear muff while working noisy area.
- Put warning sign at noisy area in the shipyard or on board ship.



Vessel



Manhole



Ballast Tank

Noise Control Measures

Noise control can be implemented using the following measures:

- Enclose the noise producing equipment
- Create Barrier or partition wall at the noise source
- Pneumatic silencers
- Vibration isolation and damping
- Increase distance
- Maintenance of the equipment

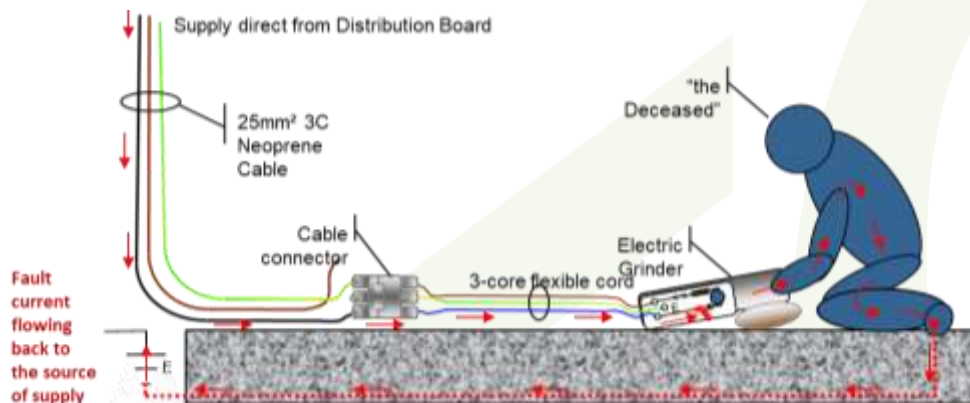


6.5 Case Study

Worker electrocuted to death

Description of Incident

A worker was using an electric grinder when he received a fatal electric shock. The grinder was not earthed due to wrong connection at the distribution board, and a fault in the grinder had resulted in the metallic casing of the grinder to become “live”.



Findings

The electrical wiring was not properly set up, and there was no licensed electrical worker (LEW) engaged for the design and installation of the electrical set up at the construction site.

Electricity supply to the grinder was taken from a distribution board which was not equipped with any residual current circuit breaker (RCCB) protection as stipulated in the code of practice. A RCCB could have saved the worker's life in this case.

Lesson Learnt

A LEW must be engaged to:

- Set up the electrical installation at all construction worksites; and
- Carry out monthly safety inspection of the electrical installation and all mobile generating sets.
- Handheld tools or electrical equipment should be connected to a socket-outlet assembly which is equipped with a RCCB of 30mA tripping sensitivity for safety protection.



LESSON 7

PS6. APPLY SAFETY PRECAUTIONS WHEN WORKING WITH DIFFERENT HAZARDS

Lesson Outline

S/NO	Topics
UK7	Preventive Measures for Working At Height

Learning Objectives

After this lesson, the trainees should be able to:-

- Barricades and handrails
- Catch platform and covered walkways
- Scaffolding & staging (eg. Aerial work platform, Dock arm, Mobile tower scaffolding)
- Lifelines and proper anchorage points Use of ladder
- Proper disposal of debris Case study

WSH (WAH) Regulations

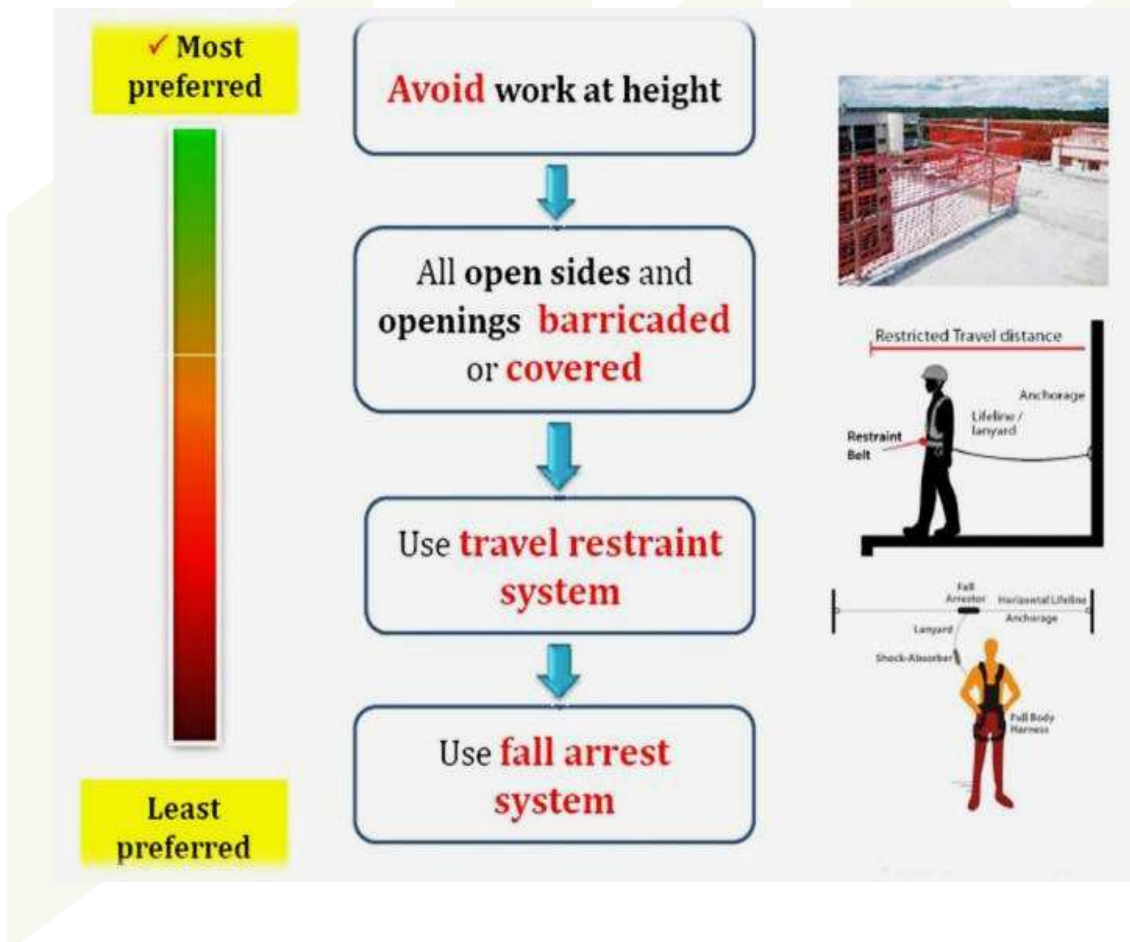
The key provisions in the Regulations were:

- Implementation of the FPP in accordance with any Approved Code of Practice.
- Implementation of the PTW.
- Training requirements for Workers, Supervisors and other WAH personnel.
- Implementation of safety measures while working on roof, near fragile surfaces and by using the industrial rope access system.

WSH (Work at Height) Regulations + Amendments

Where is work at height?

- (a) in or on an elevated workplace from which a person could fall;
- (b) in the vicinity of an opening through which a person could fall;
- (c) in the vicinity of an edge over which a person could fall;
- (d) on a surface through which a person could fall; or
- (e) in any other place (whether above or below ground) from which a person could fall, a distance of more than 3 metres;



Training for all levels, including workers, supervisors, assessors and managers.

- The courses will ensure that managers and supervisors know how to plan and supervise WAH activities.

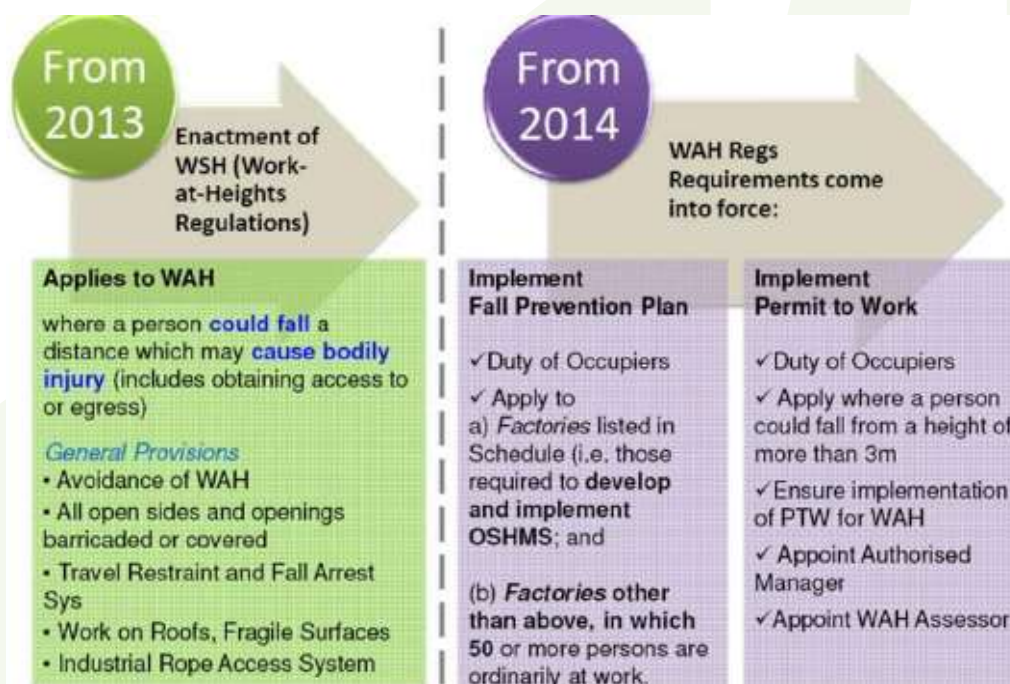
Workers

- Basic WAH Knowledge and understanding.

Supervisor

- Ensures all fall prevention measures are implemented.

Permit to Work System



Fall Prevention System

Fall Prevention Systems is a system in preventing falling in working at height.

- The most common prevention system that exists is in the form of a handrail or barrier to prevent crossing over.
- Systems include:
 - Edge Protection
 - Travel Restraint
 - Guarding or Railing
 - Scaffold
 - Tower Scaffold
 - Mobile Elevated Work Platform
 - Suspended Scaffold
 - Mast Climbing Work Platform



7.1 Barricades and Handrails

Fall of Persons from Height

A person may fall from the following places:

- Staging and working platform
- Ladder, stair, access way
- Deck opening (tank opening)
- Open edge of structure

The common causes are:

Improper construction of staging and working platform.

Falling Hazards

- Unguarded staging/platform
- Defective ladder
- Stair and access way without proper guardrails
- Unfenced opening
- Unfenced edge
- Poor lighting
- Poor housekeeping
- Harness not worn/anchored

Causes of Fall From Height

- Improper construction of staging and working platform
- Unguarded staging/platform
- Defective ladder
- Stair and access way without proper guardrails
- Unfenced opening
- Unfenced edge
- Poor lighting
- Poor housekeeping
- Body harness/safety belt not worn; or anchored
- Defective body harness/safety belt
- Collapse of structure (unstable/tilted)



Falling from Height

The main causes of persons falling from height are due to:

Unsafe conditions:

- vi. Improper use and storage of equipment on platforms.
- vii. Open edges on vessels;
- viii. Unfenced openings on deck;
- ix. Improper or no safe access to work area;
- x. Poorly constructed work platforms;
- xi. Poor housekeeping.

Unsafe acts by workers

- i. Taking shortcuts;
- ii. Not following safe work procedures;
- iii. Failure to wear or anchor safety harness/belt;
- iv. Overloading of work platforms;
- v. Removing guardrail/planks of platform;

The safety measures

- Staging/platform must be properly constructed
- Plank must be secured properly
- Ladder, stair, access way must be of good construction and secured
- Guardrails must be provided at open edges of platform, structure, etc.
- Tank/deck opening must be covered/ railed off

Safety in Scaffolds

Guardrails and Toe Boards

- Every side of a work platform or workplace from which a person is liable to fall more than 2 metres shall be provided with guard-rails and toe-boards.



7.2 Catch Platform and Covered Walkways

Struck by Falling Objects

- The common causes are:
 - i. Careless handling of tools
 - ii. Loose or unsecured objects
 - iii. Throwing objects down
 - iv. Horseplay
- Safety measures for preventing such accidents are:
 - i. Wear safety helmet
 - ii. Avoid working under workplace where objects may fall from.

Good practices

- Handle tool carefully.
- Use tool boxes.
- Secure loose objects.
- Use proper containers for storing small loose objects.
- Do not throw object down.
- Provide toe-boards.
- Cordon off areas below places from which objects may fall. Display warning sign.
- Do not horseplay.

7.3 Scaffolding & staging (eg. Aerial work platform, Dock arm, Mobile tower scaffolding)

Properly Erected Scaffold

- Scaffold or staging are devices used to provide an elevated working surface.
- The scaffold must be properly constructed.
- Proper access in the form of ladders must be provided for the scaffolds.
- Platforms to be installed with intermediate and top guard rails.
- Inspect scaffold before use.
- Report defective scaffolds.

Tower Scaffold

- Scaffold above 4m erected by approved scaffold contractors
- Inspected by scaffold supervisor every 7 days
- Movable scaffold with wheels breaks to be activated
- To use and anchor 100% body harness



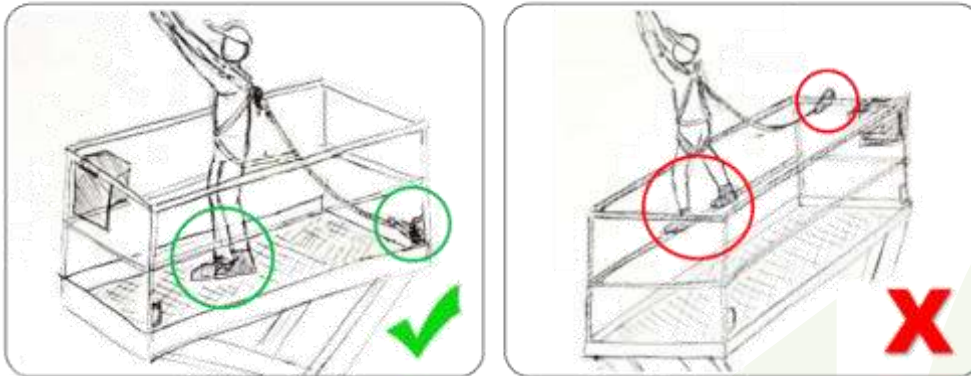
Safety in Scaffolds



- After the scaffold has been erected, the scaffold supervisor will inspect the scaffold and display a green tag, indicating the scaffold is safe for use.
- The scaffold supervisor will inspect the scaffold every 7 days thereafter.

Usage of MEWP

Correct method of working in an MEWP (left) and unsafe practices (right)



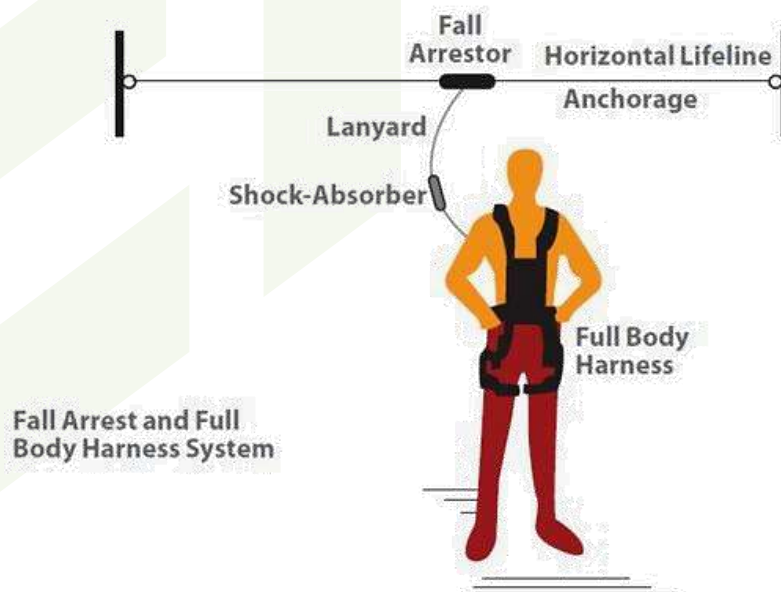
Mobile Elevated Work Platform

- Mobile Elevated Work Platforms operated by trained and competent personnel
- Operated on stable grounds
- Do not overload
- To use and anchor 100% body harness

7.4 Lifeline and proper anchorage point

Fall Arrest Systems

- Used where workers are required to carry out their work near an unprotected edge.
- Safely stop a person from falling an uncontrolled distance; and

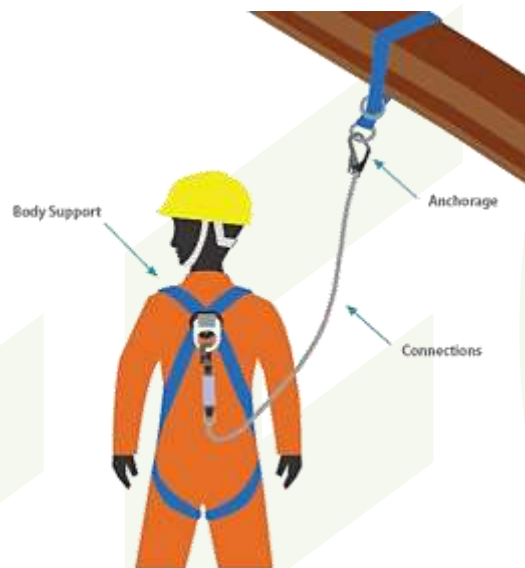


Fall Arrest Systems

Personal Fall Arrest Systems?

Collection of components that work in conjunction to:

- Reduce the impact of the fall.
- In general, a complete personal fall arrest system consists of three vital components:
 - i. Anchorages;
 - ii. Body support; and
 - iii. Connections.



Fall Arrest Systems

- ✓ Anchorage
- ✓ Full Body Harness

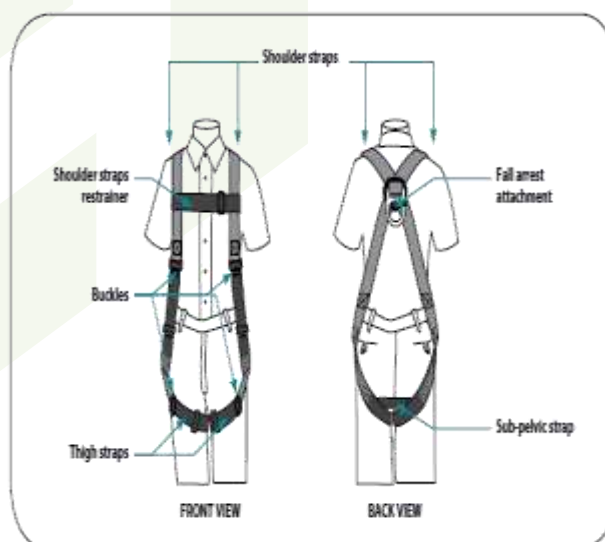


Figure 17.3: Components of a fall arrest harness.

Connectors & Shock Absorbing Lanyards

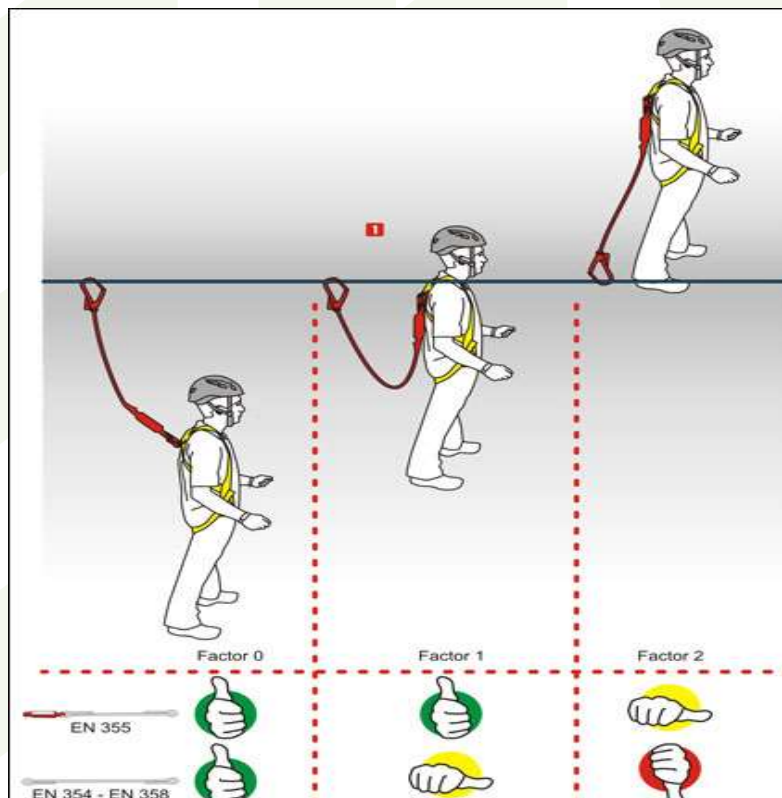


Check your Anchorage Point When Working on Height

Failure to Anchor Properly

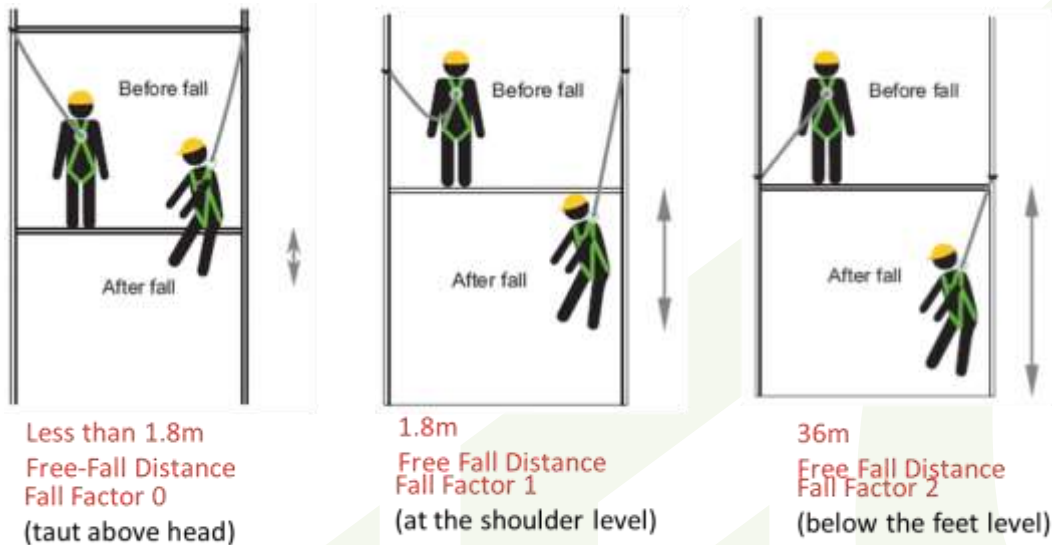
- Not anchored properly when working on height.
- Check the hook to ensure that it is in good condition.

Where to Anchor?



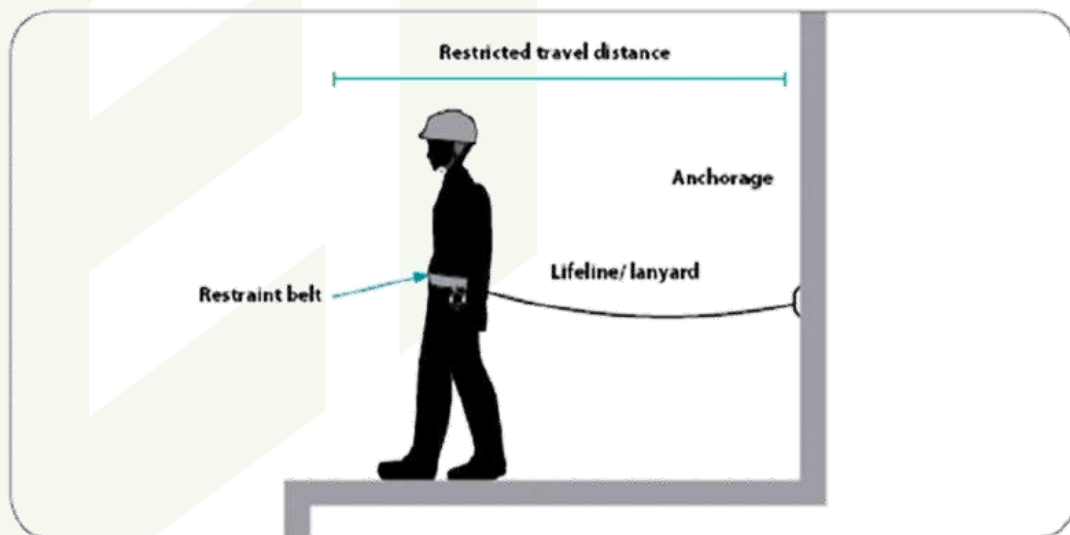
What determines the severity of a fall?

$$\text{Fall Factor (FF)} = \frac{\text{Fall Distance}}{\text{Length of Lanyard}}$$

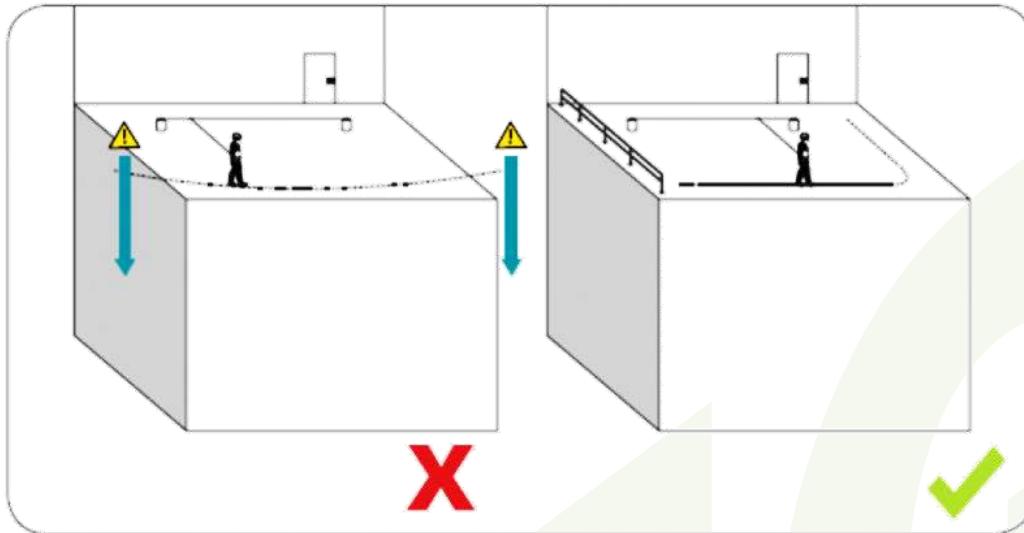


"It's not the fall that hurts you, it's the sudden stop"

Travel Restraint System



The travel restraint system prevents the user from reaching the open side.



Fall Prevention System

Work Position System

- ✓ System under constant load (tensioned) to physically be place or support worker at work.
- ✓ Not to be used as a fall arrest system unless combined with one.

Check on WAH Equipment

Fall Arrest Lanyard (with Shock Absorber)

Three Types of Inspection:

- Pre-use check
- Periodical check
- Thorough Examination

Pre-Use Check:

- Look, Feel and Function Check
 - i. Marking and label
 - ii. Harness
- Stitching and Discoloration
- Wear and tear, Cuts
- Touch and Feel for any signs off fluff worn, broken or cut, on lanyards and webbings.
- Touch and Feel any signs of pitted surfaces and distortions on snap hook and connector.

Lanyard

- i. Wear and tear, cut
- ii. Shock Absorber

Connector

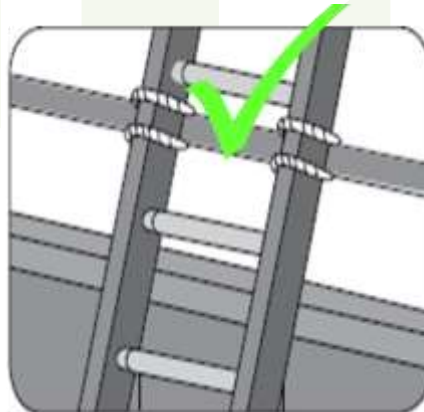
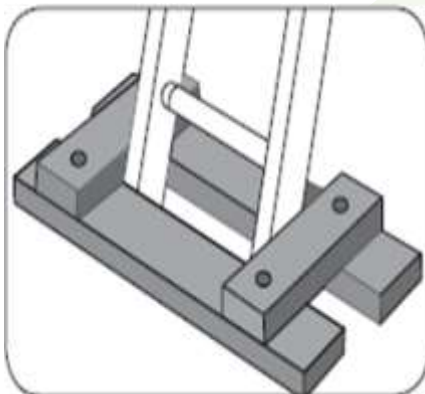
- i. Deformation
- ii. Dysfunction

- Functional test the Snap Hooks and Karabiner safety latch seats within its cavity not being jammed.
- Functional test the latch spring to ensure not distorted and should exert sufficient force to firmly close the latch.

7.5 Safe Use of Ladder

- The rungs or steps must be in good condition and free from grease and oil.
- Check that there are no splinters or sharp edges.
- Check that support brace bolts, locking devices, screws, etc. are in good condition.
- Non-skid safety feet are in place.

Secure ladder top and footing and Insure Secure ladder top and footing



- 4:1 ratio 4 times height to base width
- Buddy System
- Three points of contact
- Tools and materials should not be carried by hand and should be in a tool belt or side pouch.
- Defective and self-construct ladder
- Safe use of ladder and step platform

7.6 Proper Disposal of Debris

1. Place containers of waste oil, organics at designated areas with facilities able to contain spills/leaks.
2. All waste metal scraps to be disposed in designated bin.
3. All general refuse (food waste, paper etc.) to be disposed in designated bins – Do not mix rubbish and scrap.

7.7 Case Study

Scaffolding Accident - Fall From Height

Brief Description

- In December 2003, the deceased and a co-worker were erecting a hanging scaffold at the port side of a vessel.
- While they were erecting the scaffold, the scaffold tilted and the deceased fell into the sea.
- His co-worker who anchored his safety harness to a fall arrestor was saved.

Observations and Findings

- Supervisor was not around during the erection.
- The deceased did not anchor his safety harness.
- The erection process did not follow SWP.

Root Cause Analysis

Evaluation of loss	Fatal
Type of contact	Fall From Height
Immediate cause	1. Inappropriate scaffold design 2. Failure to use PPE properly 3. Lack of proper supervision
Basic cause	1. Lack of knowledge 2. Poor judgement 3. Behavioral-based safety failure
Failure of SMS	1. Failure of Safe Work Practices 2. Failure of safety training

Corrective Measures

- Conduct training for workers to increase their awareness of work hazards.
- Implement stringent safe work procedures.
- Ensure adequate supervision at all times.
- Hanging scaffold be of PE design.



LESSON 8

PS6. APPLY SAFETY PRECAUTIONS WHEN WORKING WITH DIFFERENT HAZARDS

Lesson Outline

S/NO	Topics
UK8	Preventive Measures for Working in Confined Space

Learning Objectives

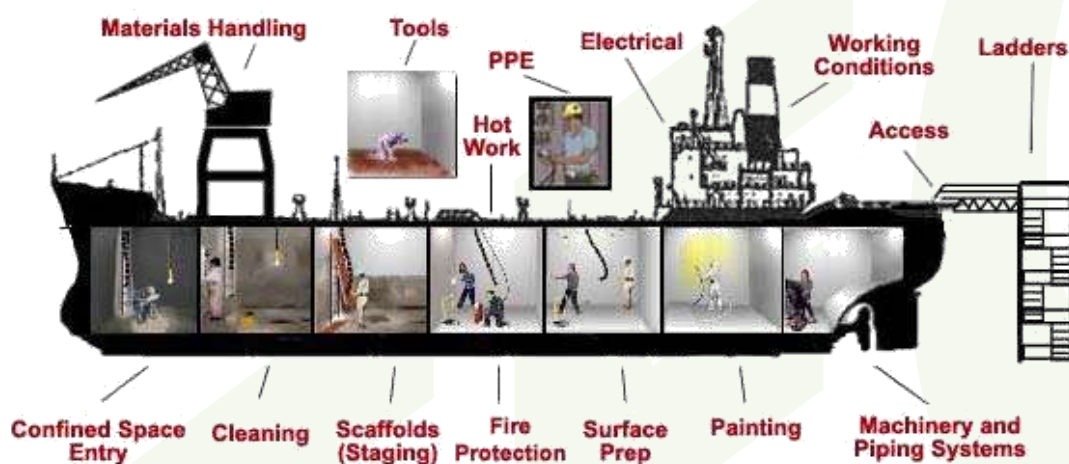
After this lesson, the trainees should be able to:-

- Common hazards in confined space
- Oxygen deficiency & oxygen enrichment
- Ventilation for confined space
- Testing of atmosphere
- Permit-to-Work System
- Case study

Definition of Confined Space

A confined space may be defined as a space having one or more of the following characteristics:

- An enclosed space with poor natural ventilation;
- Has limited or restricted openings for entry or exit;
- Not designed for continuous human occupancy;
- A space that could cause engulfment;
- Contains or likely to contain any of the following:
 - i. An atmosphere with harmful contaminants;
 - ii. An oxygen deficient atmosphere.



Types of Confined Space

Some of the common types of confined spaces in the shipyard are:

- Double bottom tanks
- Fuel oil tanks
- Water tanks
- Cargo tanks
- Pump rooms
- Engine rooms



Vessel



Manhole



Ballast Tank

8.1 Common Hazards in A Confined Space

Hazards in a confined space can be classified into the following types:

- Atmospheric hazards
- Physical hazards
- Mechanical hazards
- Electrical hazards

Not enough air to breath





Atmospheric Hazards

Common types of Atmospheric Hazards:

- Oxygen Deficiency
- Oxygen Enrichment
- Flammable gases
- Toxic gases

Oxygen Deficiency

- i. An oxygen deficient atmosphere is present when oxygen level in the atmosphere drops below 19.5%.
- ii. A person will die due to asphyxiation if he enters a oxygen deficient atmosphere.

Causes of Oxygen Deficient Atmosphere

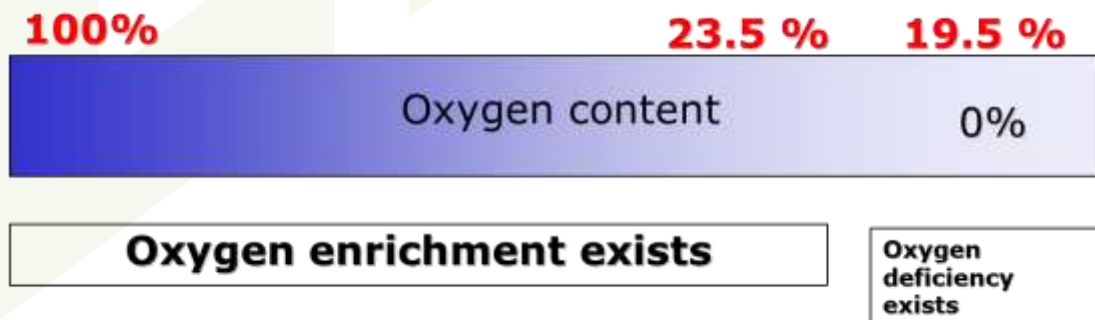
- i. Oxygen displaced by other gases such as nitrogen, argon, carbon dioxide, etc.
- ii. Oxidation process such as rusting.
- iii. Oxygen consumed by bacteria such as in sewers.

1. Oxygen deficiency - oxygen content below 19.5% by volume .
2. Oxygen enrichment - oxygen content above 23.5% by volume.

Causes of Oxygen Enriched Atmosphere

- i. Leakage of oxygen gas hoses in a confined space.
 - ii. Ventilating confined space with pure oxygen.
- **Oxygen Levels**
 - > 23.5% - Oxygen Enrichment
 - 19.5% - 23.5% - Safe levels
 - < 19.5% - Oxygen Deficiency

Effects of Oxygen Levels



Flammable Gases

- i. Methane
- ii. Petroleum vapours
- iii. Paints and solvent vapours
- iv. Leakage of fuel gases such as LPG; and
- v. Acetylene

Toxic Gases

Common types of toxic gases in confined spaces:

- i. Hydrogen Sulfide
- ii. Carbon Monoxide (produced by diesel compressor)
- iii. Welding fumes
- iv. Benzene, petroleum vapours, etc.



Physical Hazards

Noise

- i. High noise levels can cause hearing loss.
- ii. Sources of noise in confined spaces are noisy operations such as use of powered hand tools, knocking, etc.

Temperature Extremes

Temperatures in confined space can rise due to hot weather or hot works carried out in the confined space.

Electrical Hazards

Electric Shock is a possible hazard due to

- Broken lighting
- Cables and Wires
- Limit switches
- Hazards from equipment taken inside



Mechanical Hazards

Mechanical Hazards are caused by unexpected movement of mechanical equipment such as:

- i. Blenders
- ii. Stirrers
- iii. Shafts
- iv. Chain or belt drives



Engulfment Hazards

Suffocation from engulfment and entrapment in grain bins

Thermal stress

There's will be a high and Low temperatures when we inside a confined space area:

- Heat Stress
- Body Sweat
- Feel Dizzy
- Easily to get tired



Other Hazards

- Falling Objects - tools and other objects may fall and strike workers.
- Wet surfaces can cause slips and falls.
- Obstructions such as pipelines in the confined space can cause trips and falls.

Preventive measures

- Gas testing and monitoring equipment
- Ventilation equipment
- Communications equipment
- Lighting equipment
- Emergency equipment
- Other equipment for safe entry

Warning signage must be placed at the entrance to the confined space to prevent unauthorized entry.

Safety Precautions In Confined Space

NEVER attempt a rescue if you do not have the rescue equipment. YOU MIGHT ALSO DIED



- Inform your supervisor and know the Emergency Procedure
- Attempt rescue from outside using rescue retrieval equipment
- If you do not feel well, GET OUT
- Attendant must always pay attention. Do not get distracted
- Open manholes must be barricaded to prevent people from falling into it.

8.2 Oxygen deficiency & oxygen enrichment

What is Asphyxiation?

- An asphyxiant is an agent or event which induces asphyxia or suffocation.
- Asphyxiation can be extremely dangerous, as lack of oxygen can kill a person within minutes.



Oxygen Deficiency

- An oxygen deficient atmosphere is present when oxygen level in the atmosphere drops below 19.5%.
- A person will die due to asphyxiation if he enters a oxygen deficient atmosphere.

Causes of Oxygen Deficiency

- Oxygen displaced by other gases such as nitrogen, argon, carbon dioxide, etc.
- Oxidation process such as rusting.
- Oxygen consumed by bacteria such as in sewers.

Prevention of Asphyxiation

- Ensure a valid confined space entry permit has been issued by the SRM.
- Ensure there is adequate mechanical ventilation is provided prior to entering the confined space.
- Ensure a valid confined space entry permit has been issued by the SRM.
- Ensure there is adequate mechanical ventilation is provided prior to entering the confined space.
- The mechanical ventilation must be running continuously while the work is being carried out in the confined space.
- Warn the others, leave the confined space immediately and inform your supervisor if you start to feel unwell or feel something is not right.

Oxygen Enrichment

- An oxygen enriched atmosphere contains greater than 23.5% oxygen.
- An oxygen enriched atmosphere will cause flammable materials to burn violently in the presence of an ignition source.

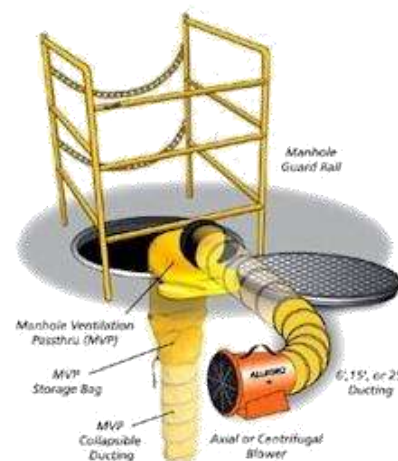
What can cause Oxygen Enriched Atmosphere?

- i. Leak of oxygen hoses in confined spaces can cause the oxygen level in the confined space to increase and thus becomes oxygen enriched.
- ii. Never use pure oxygen to ventilate the confined space.

8.3 Ventilation for confined space

Due to the unique characteristics of confined spaces, natural ventilation is usually not adequate and would require the use of mechanical ventilation. Mechanical ventilation can largely be classified into two main types:

- Forced (supplied) ventilation; and
- Local exhaust ventilation (LEV).



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

Exhaust ventilation is achieved by pulling air out of the confined space and in the process, removing the contaminants from inside the space. LEV is a specific application of exhaust ventilation where the extraction is applied directly at the contaminant source

8.4 Testing of Atmosphere

It is important to monitor the atmospheric hazards in the confined spaced using a calibrated, direct readout instrument. Always test for oxygen first, followed by flammable gases and vapours and then for toxic gases and vapours.

It is critical for the test results to satisfy the following criteria before the entry permit can be issued:

- Oxygen reading: $\geq 19.5\%$ Vol. to $\leq 23.5\%$ Vol.
- Flammable gases and vapours reading: $\leq 10\%$ LEL
- Toxic gases and vapours reading: \leq PEL values

Multi-gas Meter



Toxic Gas
Hydrogen Sulphide
H₂S 0 – 10PPM
Carbon Monoxide
CO 0 - 25PPM

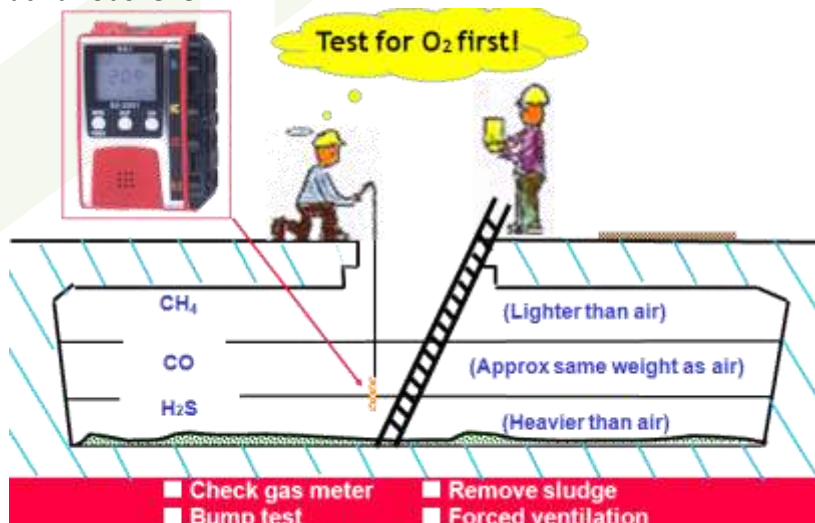


Combustible Gas
LEL 0 – 10%

•Oxygen Level

O₂ - 19.5%-23.5%

- Gas Testing must be carried out before it can be certified safe for entry
- Always test at various level



8.5 Confined Space Entry Permit

- Conduct risk assessment for the confined space.
- Prior to entry into a confined space, the confined space safety assessor shall conduct a gas check of the confined space for oxygen levels, the presence of flammable gases and toxic gases.
- Ensure there is valid confined space entry permit prior to entering the confined space.

No Permit, No Work

Lighting

- Use explosion proof lighting
- 110 volts DC or 55 volts AC
- Must not be less than 50 lux

Communication

Communication may be through:

- a) Walkie – Talkie
- b) Visual contact with entrants
- c) Use sounding system

Isolation

- Establish LOTO procedure
- Trained by qualified person/agent
- To determine and verify the effectiveness of lockout devices, tag out devices, and other energy-control measures.

Continuous Monitoring

- At least one worker in each group of workers shall wear a portable continuous gas monitoring gas meter while working in the confined space.
- This will provide a continuous monitoring of the atmosphere in the confined space.

Display of Name Tags

When entering a confined space, the name or number tags of the persons entering the confined space shall be displayed at the entrance of the confined space.

Confined Space Attendant

Where practicable, a confined space attendant shall be assigned to remain outside the confined space to monitor the activities in the confined space.





Confined Space Attendant

Leave the confined space immediately if feeling unwell or instructed by the confined space attendant.

Confined Space Rescue

- Confined space rescue must only be carried out by
- Alert your supervisor if you detect any emergency in the confined space.



Other equipment

- Self-Contain Breathing Apparatus
- Rescue Tripod
- Fire Fighting Equipment
- First Aid Box, Etc;



Self Contain Breathing Apparatus
Rescue Tripod
Fire Fighting Equipment
First Aid Box, Etc;



8.6 Case Study

Surveyor Suffocated Due To Lack Of Oxygen In Confined Space

The Incident

The deceased was inspecting the barge to determine if it was suitable for material transportation. The day before, he had only managed to survey the external areas of the barge. Thus, it was requested that the manholes of the tanks be opened up the following day for inspection. The next day, about three hours after conducting the inspections alone, the deceased was found lying inside one of the tanks in the barge. The cause of death was cited as 'suffocation from breathing in a vitiated atmosphere'.

Root Cause Analysis

Evaluation of loss	<ul style="list-style-type: none"> 1 worker killed.
Type of contact	<ul style="list-style-type: none"> Suffocation due to lack of oxygen.
Immediate cause(s)	<ul style="list-style-type: none"> Unsafe environment.
Basic cause(s)	<ul style="list-style-type: none"> Lack of communication/clarity on the scope of the survey work. Lack of participation of the occupier of the premises in the survey work.
Failure of WSHMS	<ul style="list-style-type: none"> Failure to ensure that visitors' scope of work was recorded. Failure to ensure that arrangements made to ensure such works were done safely. Failure to put in place an adequate emergency response plan for the rescue of persons in confined spaces.

Lessons Learnt and Recommendations

Risk Assessment	<ul style="list-style-type: none"> Before entering any confined space, all workers should ensure that a permit to work has been issued by a competent person, certifying that all hazards have been assessed and that the confined space is safe for entry. Workers should also check the validity period of the permit.
Safe Work Procedure	<ul style="list-style-type: none"> A competent person must test the atmosphere of the confined space for oxygen, flammable and/or toxic gases and/or vapour and certify that the space is safe for entry before commencing work. The atmosphere needs to be monitored constantly to ensure it remains within safety limits while the work is carried out. Among other criteria, the confined space can only be certified safe for entry if: <ul style="list-style-type: none"> The oxygen level is within 19.5% to 23.5%. The level of flammable gas is less than 10% of the Lower Exposure Limit (LEL). The concentration of toxic vapour and gas is below the Permissible Exposure Limit (PEL).



LESSON 9

PS3. RECOGNISE THE DIFFERENT TYPES OF INDUSTRIAL SAFETY SIGNS

PS5. DON PERSONAL PROTECTIVE EQUIPMENT

Lesson Outline

S/NO	Topics
UK9	Personal Protective Equipment

Learning Objectives

After this lesson, the trainees should be able to:-

9.1 Eye, fall, foot, hand, head, hearing and respiratory protections

9.2 Proper usage and storage

9.3 Signs relating to PPE and other signs relevant to the workplace

9.1 Eye, fall, foot, hand, head, hearing and respiratory protections

Requirements

- Safety Goggles / Glasses
 - Chemical areas, soldering, drilling, Welding, grinding work, lasers etc.
- Face Shields
 - Handling chemicals, welding activities or Dust producing equipment / tools etc.
- Respiratory Devices
 - Confined space, air pollutants i.e.. Hazardous vapors, dusts and gases etc.



Requirements

- Ear Plugs / Earmuffs
 - Noise > 85 dBA
- Safety Shoes
 - Carrying heavy objects i.e. 25 lbs above routinely.
- Safety / Chemical Gloves
 - For handling chemicals, liquefied nitrogen, lasers, Hot-oven, heated vessels.

PPE Selection

Typical PPE for shipyard workers includes:

- Hard hat
- Safety glasses
- Safety boots (hard toed)
- Gloves
- Sleeved shirt
- Long pants (no shorts or cut-offs)
- Hearing protection; and
- Harness
- Respirators



Eye Protection

- Dark Glasses Not Allowed
- Safety Glasses
- Gas-Cutting Goggles
- Goggles

Head Protection - Safety Helmet

- Safety Helmets EN 397
- Bump Caps EN 812

Respiratory Equipment

Always ensure you are using the correct Respiratory Protective Equipment that is suitable for the work or environment.

- Cartridge Type Mask
- Full Face Mask
- Dust Mask
- Fumes Filter Mask



Cartridge Type
Mask

Full Face Mask

Hand Protection



Welding Gloves



Rubber Gloves



For Normal Use
e.g. Manual handling

Foot protection - Safety Footwear

- Use for Painting or Chemical Cleaning
- Take note of the minimum Requirement

Fall protection – Full body Harness

- Use while working at height.
- Use while working on hanging scaffold.
- Scaffolders using safety harness while erecting & dismantling.



Eye & Face Protection

Thousands of people are blinded each year from work related eye injuries. Injuries that could have been prevented, if only people would have used eye or face protection.

Hearing Protection

- Noise Induced Hearing Loss is Permanent.
- Always Use Ear Protection in Noisy Areas.
- Ear-Muffs
- Ear-plugs

Types of Hearing Protection

Many types of hearing protection devices are available. Popular types of hearing protection devices are:

- Foam Earplugs
- PVC Earplugs
- Earmuffs

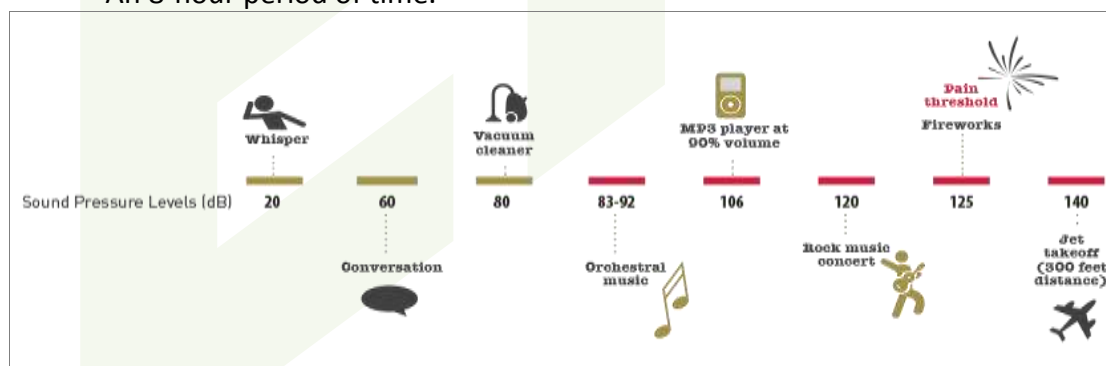


9.2 Proper usage and storage

When to Wear Hearing Protection?

You should wear a hearing protection device whenever you are exposed to noise that is:

- 85 decibels or greater; for
- An 8-hour period of time.



Requirements for Respiratory Protection

- Must provide the right type of respiratory masks (Dust / Organic / Acid Vapor)
- User friendly
- Properly used and worn
- Must be compatible with the job
- Must be evaluated for proper fitting

Types of Respirators

There are two major categories of respirators:



Air Purifying Respirators

These types of respirators include:

- i. Air Purifying Disposable Particulate Masks;
- ii. Air Purifying Half Mask Respirators;
- iii. Air Purifying Full Face Mask Respirators;
- iv. Gas Masks; and
- v. Powered Air Purifying Respirators.



Supplied Air Respirators 465

These types of respirators include:

- i. Airline Respirators;
- ii. Emergency Escape Breathing Apparatus; and
- iii. Self-Contained Breathing Apparatus (SCBA).

CHECK TO ENSURE GOOD AND CLOSE FIT



POSITIVE TEST

NEGATIVE TEST

- Be maintain in good working order
- When not in use, be kept properly to prevent damage
- PPE must be properly looked after and stored when not in use, eg in a dry, clean cupboard. If it is reusable it must be cleaned and kept in good condition

9.3 Safety Signs

Why Safety Signs?

- We are surrounded by all kinds of hazards at the workplace, therefore safety signs were established to warn us of the presence of these hazards.
- Obey all safety signs at the workplace.

Types of Safety Signs

There are basically 4 types of safety signs:

- Mandatory Signs
- Warning Signs
- Prohibitory Signs
- Safety Signs



Mandatory Signs

Mandatory signs means signs that must be complied with.



Mandatory signs mean signs that must be complied with.



Warning Signs

Warning signs warn about the hazards present at the work place.



Prohibitory Signs

Prohibitory signs prohibits actions as described in the signs and must be strictly adhered to.



Safety Signs

Safety signs indicate the presence and location of safety equipment/facilities.



End