EFG TRAINING SERVICES
PRIVATE LTD

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

WP02-PR-306E-1

SUPERVISE WORKPLACE SAFETY AND HEALTH IN MARINE INDUSTRY

LEARNER'S GUIDE

Version Control Record

Version	Effective Date	Changes	Author	Approved By
01	Dec 2020	First Issue SSG	EFG Training Services	Rosli Pitchy

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

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

LESSON 4
PS4 Identify WSH hazards, evaluate and control risks in marine industry in accordance with risk management process (Part 1)
UK11 Typical shipbuilding and ship repairing activities
UK12 Typical WSH hazards in Marine industry
UK13 WSH control measures

UK11 Typical shipbuilding and ship repairing activities
UK12 Typical WSH hazards in Marine industry
UK13 WSH control measures

Sub-topic

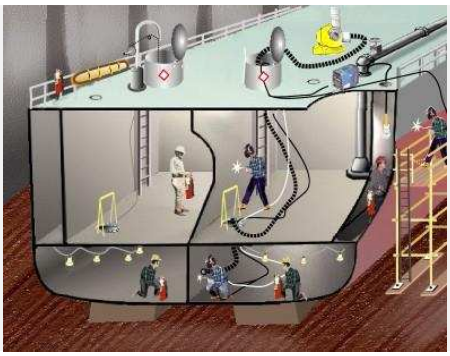
- Mechanical Hazards
- Hot work
- Electrical Hazards
- Surface treatment
- Material Handling
- Working at height
- Confined space entry
- Health Hazards
- Other physical hazards

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

UK11 Typical Shipbuilding and Ship Repairing Activities

Typical shipbuilding and ship repairing activities:

- Confined space entry
- Hot work
  - Cutting, burning & welding
  - Gas cutting & welding
  - Electrical arc welding
  - Grinding
  - Gouging
  - Drilling



- Surface treatment
  - High pressure water jetting or steam cleaning
  - Shot blasting, grit blasting & chipping
  - Spray painting

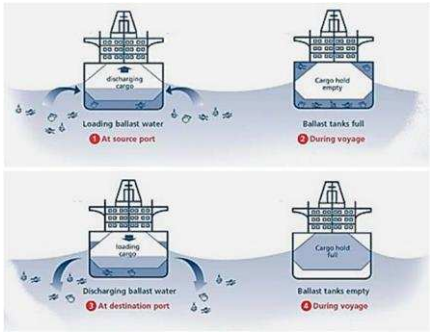
- Material handling
  - Forklift trucks
  - Crane operations & lifting equipment
  - Manual handling
  - Manual lifting
  - Mechanical handling

- Working at height
  - Scaffolding & staging
  - Mobile tower scaffolding
  - Mobile Elevating Work Platform (MEWP)
  - Dock arm
  - Man cage

- Others
  - Abrasive blasting
  - Asbestos work
  - Tank cleaning
  - Radiography
  - Signalling & Rigging
  - Pipe-Fitting
  - Steel-Fitting
  - Electrical Installation
  - Mechanical Installation
  - Ballasting and De-ballasting
  - Bunkering and debunking
  - Transferring of oil
  - Repairing and maintenance of hydraulic system
  - Pressure testing

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Ballasting / De-Ballasting



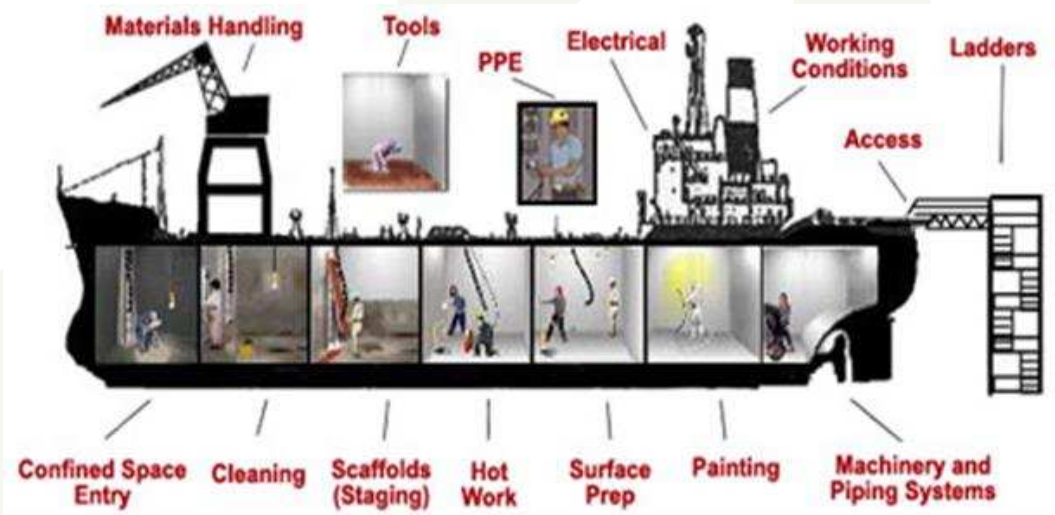
What is Ballasting?

Process of filling the tanks with water for stability of vesse

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.



Welding

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Confined Space

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.



Steam Cleaning

- **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, repla 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.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Steam Cleaning – Preventive Measures

- **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.

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, tumors 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.

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.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Work with steam boiler and pipes

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 situations and we will discuss these in the following slides.

Steam Pressure. Excessive steam builds 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.


No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Other Activities

Marine Metal Scaffolding	
Marine Mechanical Installation	
Dockside Tower crane Operation	

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Blasting and Painting	

Typical physical environment of marine industries

Noisy Working Environment

- Grinding, gas cutting and welding works create noisy working environment
- Generally, the noise level in the work area is in the noise range of more than 90 dBA.

Hazardous Climatic Conditions

- working in confined space, blasting and painting create climatic condition with hazardous fumes and oxygen deficiency.
- highly dangerous to workers

Working at Heights

High scaffolds are constructed to perform works such as welding, blasting, painting, jet washing etc

Hot Climatic Conditions

Most of the key types of works have to be performed either in open atmosphere or where hot works like welding and gas cutting are performed.

Working inside tank

Below deck work activities and inside tank cleaning work activities are generally performed either below ground level or below deck level.

Manual Works

Heavy manual work is required in marine industries involving manual carrying and transporting of marine materials.

Thermal Extremes

- 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:

  a) Heat Stroke

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

b) Heat Exhaustion
c) 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.

UK12 Typical WSH Hazards in Marine industry

UK13 WSH Control Measures

Typical WSH hazards in Marine industry:

- **Common hazards in confined space**
  - Oxygen deficiency & oxygen enrichment
- **Hazards in hot work**
  - Fire & explosions
- **Mechanical Hazards**
  - Machine safety - guarding of common hand tools and machines, e.g.
  - Hand grinder
  - Metal disc cutter
  - Portable ventilators
- **Electrical hazards**
  - Using unsafe equipment
  - Electrical shock /Electrocution
  - Electrical injuries
- **Work at height hazards**
  - Falling from height
  - Falling object
- **Occupational health hazards**
  - Chemicals & toxicology
  - Noise

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

- Vibration
- Heat
- Radiation
- Poor lighting

- **Ergonomic hazards**
- Manual handling
- Working posture

- **Incompatible work activities**
- **Drowning**
- **Chemical Hazards**

WSH Control Measures

Elimination / Substitution

(A) Materials

- replacement of cancer- and mesothelioma-causing asbestos fibres by safer synthetic substitutes (glass foam, rock and glass wool)
- removal of benzene (which causes leukaemia) as an industrial solvent and replacement by less hazardous aromatic solvents (e.g. xylene)
- replacement of beach and river sands, which have high quartz contents, as abrasive blasting agents, with low quartz content materials (ilmenite, zircon, copper slag) etc

(B) Processes

- use a palletised form of masterbatch instead of a dusty powder (e.g. lead stabilisers in PVC pipe production)
- use a gelled form of organic solvent which reduces the rate of vapour emissions (e.g. gelled styrene, gelled paint strippers)
- choose a manufacturing route which does not give off hazardous by-products (e.g. the unwanted by-product of dioxin in herbicide manufacture)

Engineering out the hazard

(A) Isolation

- the use of interlocked doors or barriers to prevent entry into an area while toxic substances are present
- remote storage of hazardous materials (e.g. explosives, fuel tank farms)
- separating materials that could create hazards by coming into contact with each other by accident (e.g. oxidants and fuels).

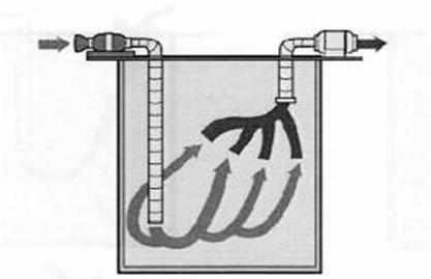
(B) Containment

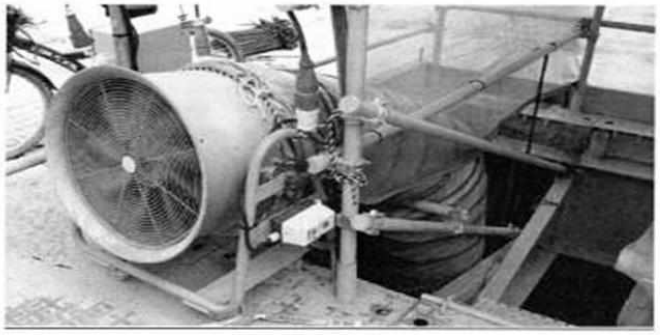
- a whole process is totally enclosed and coupled with an exhaust extraction system
- a remotely controlled laboratory to handle radioactive isotopes
- gas-tight systems used in chemical processing or in many sterilising or fumigation procedures.

(C) Ventilation

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

The engineering control of air contaminants by dilution or local exhaust ventilation in confined spaces





Administrative Control

(A) Education and Training

- The (WSH Regulations) require training and induction of workers. Provision of information, such as the mandatory availability of a material safety data sheet, is an administrative control mechanism.
- Training programs should be formalised and administered throughout the length of employment.
- Training should always incorporate the practical aspects of a job and include some form of competency assessment.

(B) Safe Work Procedure

- In Singapore, the local WSH regulations require companies to develop, implement and maintain safe work procedure for handling hazardous chemicals.
- The written procedure is expected to cover aspects of safe storage, application, and disposal in normal or emergency situations.

(C) Worker Rotation and Removal from Exposure

- in the lead industry, workers may be removed if blood lead levels exceed a certain level, and remain removed from further lead exposure until blood lead levels fall to an acceptable level
- Radiation workers are restricted to a maximum radiation dose over a specified time period

Personal protective equipment

- PPE represents the absolute last resort;
- beyond the PPE is the unprotected worker and inevitable exposure if the PPE is not correctly selected, maintained and used.
- Even though PPE is on the bottom of the hierarchy it is still widely used and accepted as a back-up and supplement for other controls.
- There will also be situations where higher level controls cannot be used and PPE will be the only practicable solution.

Personal protective equipment - respiratory protective equipment (RPE)

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg



There are many tasks where the use of respiratory protective equipment (RPE) is an established method of protection for reasons such as:

- other control methods are far too costly or impracticable (e.g. electrical power may not be available, or ventilation controls cannot be arranged around a large open formwork metal structure)
- the task may be carried out at various locations (e.g. a pesticide applicator providing termite treatments to buildings)
- the task may involve only short-term exposures (e.g. one job lasting 2 hours per month)
- exposure may be only trivial, not requiring elaborate controls (e.g. nuisance dust exposure

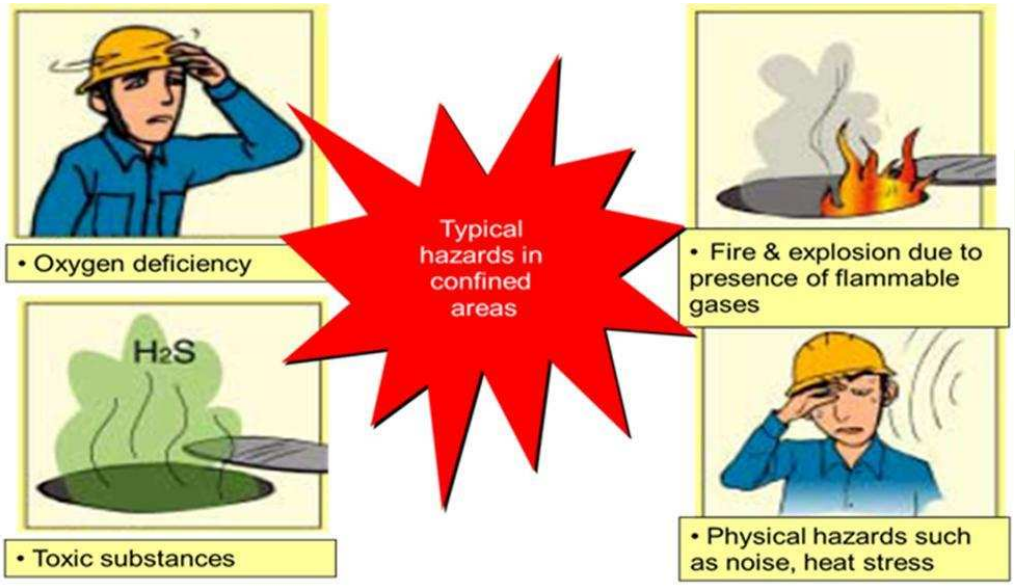
Confined space hazards and control measures

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

- Atmospheric hazards
  - ✓ Oxygen Deficiency (O_2 level below 19.5%)
  - ✓ Oxygen Enrichment (O_2 level above 23.5%)
  - ✓ Flammable gases (Petroleum vapours, Paint Vapours etc)
  - ✓ Toxic gases (H_2S, CO etc)
- Physical hazards
  - ✓ Noise
  - ✓ Extreme Temperature
  - ✓ Engulfment
- Mechanical hazards
- Electrical hazards
- Other Hazards

Confined space hazards and control measures

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg



Atmospheric Hazards – Gases

FLAMMABLE

Accumulation of flammable gases in the confined spaces can result in FIRE & EXPLOSION

- Methane
- Petroleum vapours
- Paints and solvent vapours
- Leakage of fuel gases such as LPG and
- Acetylene

TOXIC

Common types of toxic gases in confined spaces:

- Hydrogen Sulfide
- Carbon Monoxide
- Welding fumes
- Benzene, petroleum vapours, etc

WSH (Confined Space) Regulations 2009

Responsibilities of Occupier

- Shall make a record of the description and location of the confined space
- Shall inform persons who are liable to be exposed to the hazards of the confined space, of the existence and hazards of the confined space
- Shall ensure that warning signs are displayed at all confined spaces.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

- Shall ensure that the means of entry into and egress from any confined space in the workplace are safe and without risks to the health of every person entering or leaving the same.
- Shall evaluate the necessity of entering and working in the confined space

Responsible Person

- Shall ensure that the entrance cover of the confined s is not removed unless the confined space is depressur and rendered safe for opening
- Shall ensure that there is sufficient and suitable lightir least 50 lux, for such entry into or work in the confine space.
- Shall ensure that all portable hand-held lightings are operated at a voltage not exceeding 55 volts (AC) or 1 volts (DC).
- Shall ensure that adequate and effective ventilation is maintained.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

WSH (Confined Space) Regulations 2009

Responsible person shall appoint

- Authorized Manager
- Confined space safety assessor
- Confined space attendant
- Shall ensure that the atmosphere in the confined space is tested
- Shall ensure that a competent person (CSSA) tests the atmosphere of a confined space prior to entry by any person into the confined space and periodically at intervals not exceeding 8 hours.
- Shall ensure that test records are kept for not less than 2 years

Authorised Manager

Issue the confined space entry permit when the condition of confined space is safe to enter to work.

Confined space safety assessor (CSSA)

- test the atmosphere of the confined space prior to entry by any pe
- Record the results of the test in the confined space entry permit
- Endorse the application for the confined space entry permit

Confined space worker

- Shall ensure that the confined space entry permit has been issued in respect of such entry into or work in the confined space
- Display his name and identification badge at the entrance to the confined space

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Others

A written rescue operation plan shall be established for the purpose of rescuing persons in a confined space.

A confined space rescue drill shall be held at least once in every 12 months.

Contravention	1st offence	Continuing offence
Confined space entry w/o valid permit	≤ $20,000	
Fail to appoint CS personnel	≤ $20,000	
Fail to display ID badge	≤ $1,000	≤ $5,000
Regulatory violation	≤ $20,000 & / or 2 years imprisonment	

Mechanical Hazards and control measures

Mechanical Hazards - Machine safety - guarding of common ha
tools and machines, e.g. hand grinder, metal disc cutter, portal
ventilators

Mechanical hazards are a major cause of workplace injuries in Singapore. Amongst the most

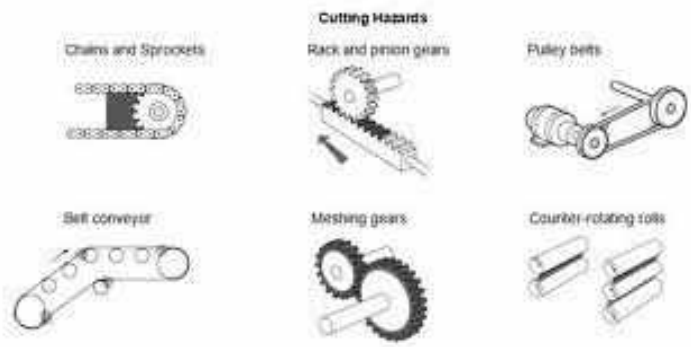
severe and disabling injuries caused by mechanical hazards ar

a) Amputations of limbs
b) Deep cuts
c) Crush of limbs

Mechanical Hazards and control measures

Mechanical hazards may include:

a) Contact or entanglement with the machinery;
b) Trapping between the machine;
c) Contact or entanglement with any material in motion;
d) Being struck by ejected parts of the machinery;
e) Being struck by material ejected from the machinery.



No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Machine guarding

Moving or rotating parts of machines must be guarded to prevent the limbs from coming into contact or getting caught in them

Following are some types of common safety guards:

1. Fixed Guard
2. Interlocking Guard
3. Adjustable Guard
4. Self-Adjusting Guard
5. Push-Away Guards

Safety devices

Following are some types of common safety devices:

1. Presence Sensing Devices
2. Pull-Back Devices
3. Two-Hand Control Devices

Lock-Out Tag Out (LOTO) of ships facilities (including blanking of pipelines and isolation of ships firefighting system)

- Lock-Out Tag-Out Procedures are important safe w practices
- it carried out to prevent any part of the machinery equipment from being Inadvertently activated and causing injury to persons carrying out maintenance repair work at the machine.

Hotwork

Fire and explosion and control measures

<u>**Fire spreads**</u> by transferring the heat energy from the flames in three different ways:-

- Conduction
- Convection
- Radiation

Special circumstances

- <u>Rollover</u> occurs when ignited fire gases, or incompletely burned fuels, rise to the ceiling, and spread out horizontally
- <u>Flashover</u> is the sudden, simultaneous ignition of everything in a room.
- <u>Back-draft</u> is an explosion that occurs when oxygen is introduced into a room full of hot gases.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Classifying fire

Fire classifications could be based on fuel type:

- **Class A:** Ordinary combustible materials, such as wood, cloth, paper, rubber and many plastics.
- Extinguish by cooling the fuel to a temperature that is below the ignition temp. Water and other extinguishing agents are effective.

- **Class B**: Flammable liquids (burn at room temperature) and combustible liquids (require heat to ignite). Petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases. High fire hazard; water may not extinguish.
- Extinguish by creating a barrier between the fuel and the oxygen, such as layer of foam.

- **Class C**: Fuels that would be A or B except that they involve energized electrical equipment.
- Special techniques and agents required to extinguish, most commonly carbon dioxide or dry chemical agents. Use of water is very dangerous because water conducts electricity.

- **Class D**: Combustible metals, such as magnesium, titanium, zirconium, sodium, lithium and potassium.
- Extinguish with special powders based on sodium chloride or other salts, also clean dry sand.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Hot Work – Welding and Cutting

As stipulated by the WSH (S&SR) Regulations, 2008,

- No gas cylinder, which contains or has contained oxygen or any flammable gas or no LPG cylinder shall be taken –
  - ✓ Below the weather deck of a ship under repair; or
  - ✓ Below the topmost completed deck of a ship under marine
- Gas manifolds shall be clearly identified and in safe & accessible location.
- Hot work equipment, pipelines and gas hoses shall be of good marine, free from defects and properly maintained.

Good Practice

Cylinders are properly stored in a secured place with fall protection and warning signs. Acetylene and Oxygen cylinders are kept separately.

Bad Practice

Cylinders are stored in an unsecured place without any fall protection or warning signs. Acetylene and Oxygen cylinders are kept close to each other.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Bad Practice

Damaged hoses are used in the cylinders.

As stipulated by the WSH (S&SR) Regulations, 2008

For Oxygen and acetylene tank, the following must be installed

- Non-return valve between gas torch inlet and gas hose of every oxy-fuel equipment
- Flash-back arrestor at every fuel gas and oxygen outlet and pressure regulator outlet.
- Anti-leakage device – confined space oxygen and fuel gas line

During break

- Supply valve of gas cylinder and manifold shall be closed
- Gas torch, manifold and hoses shall be taken to the weather deck.
- If it is not practicable, ventilation shall be provided for the work area
- Only competent person shall perform inspection and maintain register

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Inspection of	Frequency
All electrode holders, welding cables, cable connectors and other arc welding equipment	30 days
All gas hoses, torches, blowpipes, pressure regulators, nozzles and connectors	14 days
All safety devices, such as the non-return valve, flashback arrestor and anti-leakage devices	12 months

- No welding is permitted in wet condition.
- For confined space hot work and hot work involving toxic or harmful substances
  - ✓ Adequate ventilation or local exhaust ventilation must be provided
  - ✓ Forced ventilation and breathing apparatus must be provided
- Hot work on containers that held flammable materials
  - ✓ Container shall be cleaned by steam and be free from combustible gases
  - ✓ Container atmosphere shall be rendered non-flammable or non-explosive

Isolation Of Ship Fire Fighting System

- Isolating valves to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main shall be fitted in an easily accessible and tenable position outside the machinery spaces.
- A valve shall be fitted to serve each fire hydrant so that any fire hose may be removed while the fire pumps are in operation.
- Relief valves shall be provided in conjunction with fire pumps if the pumps are capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants and hoses.
- In tankers, isolation valves shall be fitted in the fire main at the poop front in a protected position and on the tank deck at intervals of not more than 40 m to preserve the integrity of the fire main system in case of fire or explosion

Electrical Hazards and Control Measure

WSH(GP) Regulation 14

It shall be the duty of the occupier of a factory to ensure that every electrical installation and electrical equipment in the factory:

- Is of good construction, sound material and free from defects; and
- Is used and maintained in such manner so that it is safe to use.
- It shall be the duty of the occupier of a workplace to ensure that all reasonably practicable measures are taken to protect any person against the risks of electric shock arising from or in connection with the use at work of any electrical installation or equipment in the workplace

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

WSH (Shipbuilding & Ship-Repairing) Regulations 2008

Regulation 53 (6)

Any portable hand-held electrical equipment used in any confined space shall be operated at a voltage not exceeding alternating current (AC) 55 volts between the conductor and earth or direct current (DC) 110 volts.

Regulation 53 (7)

All temporary electrical installations supplying electricity to any portable electrical equipment shall be protected by an effective residual current circuit breaker (RCCB) with a tripping current not exceeding 30 mA.

Regulation 54

All AC electric arc welding equipment for use in a shipyard shall be fitted with an effective low voltage shock preventer and it shall be inspected and tested by a competent person once every 6 months.

Wiring System

Flexible cords of portable electrical equipment shall not exceed 3m in length or such length as supplied by the original equipment manufacturer.

Extension cables passing through hatch covers, manholes, doors, etc, are to be adequately protected against mechanical damage by means of suitable device or equipment.

All cables to be installed without obstruction to the use of passageways, walkways, ladders and stairs.

Cables passing through doorframes, hatches, manholes, etc shall be protected from mechanical damages likely to be caused by closing of doors, covers, lids or sharp edges.

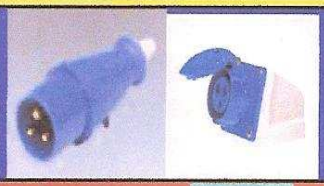
Socket outlet assembly (SOA) shall be used for the connection of portable electrical equipment.

All socket outlets shall be protected by a residual current circuit breaker having a rated residual current not exceeding 30mA.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Socket Outlet Assembly

Color Coding for Plugs and Socket outlets

Operating Voltage (V)	Colour	Examples
55	White	
110	Yellow	
230	Blue	
400	Red	

Light Fixtures

Light fixtures used outdoor or at locations where there is likelihood that such fixtures are subject to splashing water, shall be of the weatherproof type.

Temporary lights and equipment installed in areas where explosive gas atmospheres may be present, shall be of the flameproof type.

Portable hand lamps supplied through flexible cords shall be:

a) protected against dust and water;

b) equipped with a strong guard over the cover; and

c) equipped with an insulated handle.

Electrical Welding System

Welding machines must be equipped with low voltage shock preventors.

The low voltage shock preventors shall be housed in a weatherproof metal casing and locked to prevent tampering by welders and other unauthorised persons.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Inspection, Testing And Maintenance

Before commencement of work, every person shall inspect the electrical equipment.

Socket outlet assembly shall be checked for damage and all RCCBs shall be tested.

All temporary electrical installation shall be inspected by a skilled person at least once a month.

Dangers of Electricity include a variety of hazards that include Electric Shock, Physical Burns, Neurological Damage and Ventricular fibrillation resulting in death.

- Burns
- Ventricular fibrillation
- Neurological effects
- Arc Flash

What work practices help protect you against electrical hazards?

Electrical accidents are largely preventable through safe work practices. Examples of these practices include the following:

- de-energizing electric equipment before inspection or repair,
- keeping electric tools properly maintained,
- exercising caution when working near energized lines, and
- using appropriate protective equipment.

Effects Of Electricity On Human Body

1 mA	**A faint tingle is felt.**
5 mA	Slight shock is felt. The average person can break contact with the circuit
6-30mA	Slight shock is felt. The average person can break contact with the circuit
30-50mA	A person will experience extreme pain, respiratory arrest and severe muscular contractions. A person may not be able to break contact with the circuit and death is possible.
50-100mA	A person will experience severe muscular contraction and nerve damage and death is very likely.
50-100mA	Cardiac arrest, severe burns and certain death.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Electrical Shock and Electrocution

The potential for electric shock hazards is great in the shipyards because workers stand on metal decks and often work in a wet environment.

- Electricity travels in a closed circuit through a conductor.
- A person will experience an electric shock when he/she becomes part of the circuit. i.e. current enters the body at one point and leaves through another.

Severity of the Electric Shock

The severity of an electric shock is affected by the following 3 factors:

1) The amount of current flowing through the body;
2) The path of the current through the body;
3) The length of time the current flows through the body.

Electrical Injuries

Electrical burn

A person may experience electric burns when the person comes into contact with an energized part. Typically, burns occurs on hands.

High current can cause internal burns if allowed to pass through the body.

Electrical Hazards

Typical unsafe condition and practices

Damaged Wiring

Damage Insulation

Recognition Of Hazardous Situation

Wires which are squashed or damaged

– Plug receptacles that appear to be loose or damaged
– Cords/cables with holes in the insulation
– Sparks or arcing between tool and work surfaces
– Tingling sensation when using hand tools

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Preventive maintenance & preventive measures

- Earth Leakage Circuit Breaker or ELCB is also known as Residual Current Circuit Breaker or RCCB

Current Operated RCCB

- Works on the principle that the current flowing in the "live" and "neutral" conductors is the same, provided there is no leak/fault.
- What goes into the equipment or "load" through the "live" conductor must return through the "neutral" conductor.
- When the current in these two conductors is not the same, means the current must have leaked somewhere.
- When a leak occurs, the current in the "neutral" conductor will be smaller than the current flowing in the "live" conductor, thus causing the trip coil in the RCCB to open the circuit.

Installation Of Circuit Breakers

When there is an excessive current flow in a circuit, the bi-metal strip in the circuit breaker will release a spring-loaded switch that will open the circuit.

Installation of fuses

Fuses are the most common types of safety devices used to protect equipment against overloading of electrical circuits.

When there is an overload of current, the metal wire in the fuse will melt, thus disconnecting the circuit

Double Insulated Fixture

Double layer of flexible but tough molded insulation protection over the current carrying conductors.

Double insulated appliances do not have any grounding conductor. Only "live" and "neutral" pins.

Surface Treatment & Specialised Operation Hazards and control measures

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.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

High Pressure Washing/Water Jetting – Preventive Measures

- This operation is are hazardous to people and to electrical, hydraulic and pneumatic equipment. The workers must be aware of the hazards and follow company procedures including the use of appropriate PPE, to avoid injury.
- Pressure settings must be correct for the work.
- The lance must not be directed at any part of the human body.
- Check all hoses for damages or leaks.
- Ensure that all connections are tight and secure.

- **Debris**

  Water jetting and steam cleaning are used to dislodge surface particles which can be propelled through the air This may cause injury (particularly to the eyes) to the worker or to other persons nearby. Use proper eye protection.

- **Trip Hazards**

  The pump and its supply lead or hose and delivery hoses should b[illegible]ot cause an obstruction to people.

- **Emergency Escape**

  The equipment and its leads and hoses must not obstruct an emergency escape route or the closing of fire doors, bulkhead doors or other safety critical protective provisions.

- **Noise**

  Where the equipment generates a high level of noise, provision must be made for hearing protection for the worker involved and of other personnel in the area

- **PPE**

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

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

- **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.

- **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.

Steam Cleaning – Preventive Measures

- **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.

Specialised Operations

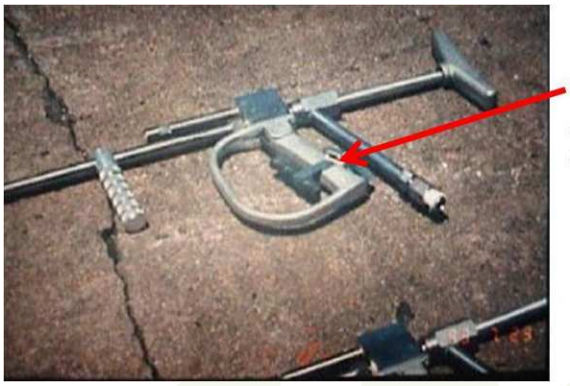
Hydro – Blasting/Cleaning

- Hydro-blasting or cleaning operations involve the use of water under a very high pressure.
- This high-pressure water can be dangerous and can cause serious injuries if safe work procedures not followed.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Safe Work Practices

- Wear the appropriate PPE, such as face shield, hearing protection, safety helmet, waterproof overalls and glc waterproof safety boots.
- Dead man switches/triggers must never be taped or t so the equipment stays in the 'On' position.
- Never point the gun at other employees.
- Check all hoses and fittings for defects daily before commencing the hydro-blasting works.



Dead man trigger tied. If the gun is dropped, it will whip about wildly

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, tumors 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.

Shot Blasting, Grit Blasting & Chipping

- Grit blasting is a high-pressure Surface Preparation activity normally for painting.
- It may cause serious accident if not handled properly.
- Surface preparation activities includes:
  1) Power tooling/chipping
  2) Abrasive blasting (dry & wet)
- Power Tooling Equipment

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

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

- Abrasive Blasting Equipment

  (abrasive blasting pot, blasting stand, air compressor, air dryer, abrasive blasting hoses and nozzles, dead man switch, Carbon Monoxide (CO) monitor)

- Safety precaution to take:
  a) Blasting equipment must be certified.
  b) Trained person will do blasting job.
  c) Use air supply blasting hood while blasting.
  d) Do not go near blasting area, use dust mask.
  e) Blasting hose and equipment will be inspected.
  f) Hose joint to be secured using whip arrestor.
  g) Sign board and notice to be displayed.
  h) Blasting area to be fully covered by canvas.

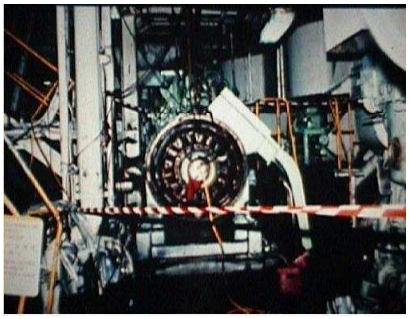
Work with steam boiler and pipes

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

a) Valid chemical cleaning permit;
b) Display safety signs at work area;
c) Barricade affected work area;
d) Ensure no hot works nearby;
e) Chemical containers shall be labelled stored in a proper place.

Work with steam boiler and pipes

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

	▪ 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.

- Barricade area and display safety signs before carrying out any works on the steam boiler or pipes.
- Before performing any repair works on the steam boiler and pipes, ensure these equipment are cooled down to ensure no remaining steam.
- Ensure there is a valid permit-to-work for the works involving steam boiler and pipes.
- Isolate the boiler you are working on in a multi boiler system.
- Provide adequate ventilation and lighting when working in the boiler.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Material Handling

Types of material Handling equipment commonly used in marine industry

- Forklift trucks
- Crane Operations & Lifting Equipment
- Manual Handling
- Manual lifting
- Conditions of Materials
- Manual Handling Regulations
- Mechanical Handling

Forklift trucks

Forklift accidents are a common occurrence at workplaces in Singapore. In the past year, many workers are killed by forklift accidents.

Common causes of death in forklift accidents are:

- Workers fatally crushed by overturned forklifts;
- Workers crushed in between objects and a forklift;
- Workers run over by a forklift;
- Workers struck by moving forklifts.

Safe Operation Of Forklift

1. Operator must Inspect the forklift prior to use and report for any damage to the supervisor
2. Report all unsatisfactory or unsafe conditions of the forklift to immediate supervisor and do not operate an unsafe vehicle.
3. Approach the material on the racks with caution. Ensure the forks do not hit the racks or any worker.
4. Ensure the weight of the material is within the safe lifting capacity of the forklift.
5. Travel in reverse, if the material being carried obstructs forward view.
6. When operating the forklift in tight spots, be vigilant of other employees in the vicinity. Sound the horn as a warning, especially around corners.
7. Do not travel with the load elevated.
8. Keep hands and arms clear of chain, rollers and other potential crush/pinch points.
9. Maintain a safe speed and following distance from other vehicles.
10. Avoid sharp turns at high speed.
11. Never lift anyone on the forks or carry passengers on the forklift.
12. Do not raise or lower the load while the forklift is in motion.
13. Sound the horn, especially at blind spots.
14. Slow down when operating on wet and slippery floors/ground.
15. Do not operate the forklift under the influence of medications.
16. Do not lift load with one fork.
17. Park the forklift in the designated location.
18. Lower the forks, set the brakes and switch off the engine and remove the key.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Crane Operations & Lifting Equipment

- Every mobile or tower 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.
- Authorised Examiner inspection every year
- 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 logbook or sheet.
- The maintenance carried out on a mobile or tower crane must be in accordance with manufacturer's instructions and properly documented in the log.
- Operation logs shall indicate the heaviest load lifted, cycles of lift and hours of operation of the crane on a daily basis.

Crane Operations and Lifting Operations – Safe Operation of Ship Cranes

- It is the employer's duty to ensure that only trained and competent personnel are allowed to operate the ship cranes.
- The operator must conduct an operational check on the crane and its lifting gears daily before use.
- The operator shall also ensure that the ship crane is properly maintained and inspected at regular intervals to ensure that it continues to be in safe working condition
- The employer is also required to ensure that the operator is familiar with the risks associated with the operation of the ship crane and the measures taken to reduce the risks

Common Systemic Failures Of Accidents Involving Lifting Equipment

- No risk assessment conducted for the lifting operation
- No implementation of the control measure identified even when risk assessment had been conducted
- Lack of lifting plan and hazard analysis for each lifting operation
- Absence of management system for lifting personnel
- Failure to adopt a proper rigging method
- Poor control and maintenance of lifting machine and lifting gears
- Poor site control, i.e. workers were allowed to walk or work under suspended loads and lack of barricades for the lifting zone

Competency of Personnel

Employers of personnel involved in a lifting operation such as the operator, rigger, signalman and lifting supervisor have the duty to ensure that these personnel are trained to carry out their task competently and safely.

Additional training and supervision should be provided for new and inexperienced workers as this group of workers is less competent and lacking in experience.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Crane Operations and Lifting Operations – Lifting gear

WSH(GP) Regulation

20.—(1) No lifting gear of whatever material shall be used in a workplace unless an authorised examiner has —

(a)tested and examined the lifting gear; and

(b) issued and signed a certificate of test and examination, specifying the safe working load of the lifting gear. [S 517/2011 wef 10/09/2011]

(2) The certificate of test and examination referred to in paragraph (1)(b) shall be kept available for inspection.

(3) Every lifting gear used in a workplace shall be thoroughly examined by an authorised examiner at least once every year or at such other intervals as the Commissioner may determine.

Lifting appliances and lifting machines

21.—(1) No lifting appliance or lifting machine shall be used unless an authorised examiner has

(a)tested and examined the lifting appliance or lifting machine; and

(b)issued and signed a certificate of test and examination, specifying the safe working load of the lifting appliance or lifting machine.

(2) The certificate of test and examination referred to in paragraph (1)(b) shall be kept available for inspection.

(3) Every lifting appliance and lifting machine shall be thoroughly examined by an authorised examiner at least once every year or at such other intervals as the Commissioner may determine.

Liftin Team

- Appointment of Lifting supervisor, Rigger and signalman
- Riggers must ensure load is secure, stable & balanced.
- Signalman must verify with riggers that load is properly rigged before he gives signal to crane operator to lift load.
- Signalman must be attired in such a way as would be distinctively identifiable as a signalman
- Rigger must check all wires ropes & lifting equipments before using it

The Lifting team - riggers, signal man and lifting supervisor are responsible to inspect all lifting gears, chain, wire rope.

Establish and implement a lifting plan

where any lifting operation involving the use of any crane is carried out in a workplace.

WSH (Operation of Crane) Regulation

Reg (4). —

(1) Where any lifting operation involving the use of any crane is carried out in a workplace by a crane operator, it shall be the duty of the responsible person to establish and implement a lifting plan.

(2) It shall be the duty of the responsible person to ensure that the lifting plan is made available for inspection upon request by an inspector.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Lifting Plan

General

- The Lifting Plan is a set of plans which is created for use in any crane lifting operation. All lifting operations shall be accompanied by a lifting plan supported by a risk assessment, a safe work procedure and/or method statement, and PTW.
- Frequent or routine lifting operations may only require a basic lifting plan supported by an on-site risk assessment and briefing to related personnel. High risk or complex lifts however, requires additional engineering design efforts to ensure that the lifting is conducted safely.

Elements of a Lifting Plan

The lifting plan shall include but not be limited to the following considerations:

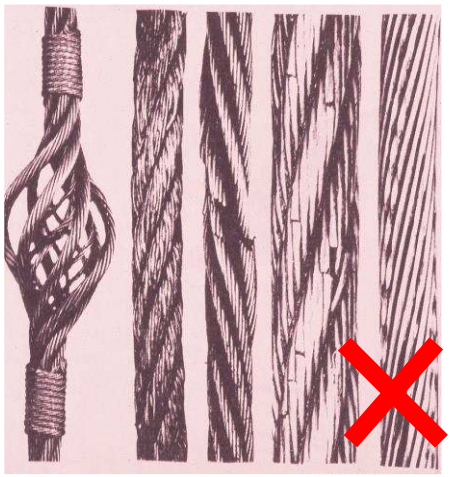
- The personnel required
- The personnel's roles, responsibilities and competencies
- Compliance to statutory requirements and manufacturer's operation manual for the lifting equipment
- Permit-to-Work system which is mandatory for all lifting operations.
- Nature and weight and dimension of load – including the NET and GROSS weights.
- Type and location of lifting / rigging points.
- Selection of appropriate lifting equipment, lifting gear and appliances.
- Application of the correct lifting methods
- Application of the correct lifting methods
- Position of lifting equipment, personnel and of the load, before and after the lift operation.
- The work site operation including proximity of other lifting equipment and work activities.
- Requirements to erect / dismantle the lifting equipment.
- Assessment of the need for tagline to control movement of the suspended load.
- Means of communication during lifting operations.
- Environmental factors detrimental to the lifting operations such as ground conditions, adverse weather, wind, and poor illumination.
- Ensuring a system for reporting any defects is in place.
- Provision of a safe place of work for all personnel during lifting operations

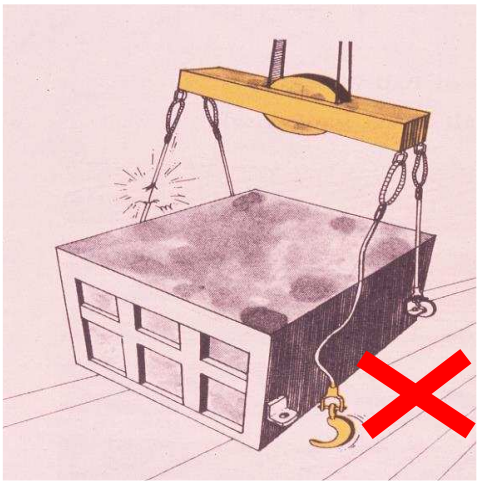
Reference: COP Safe Lifting Operations in the Workplaces Ver 2014

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

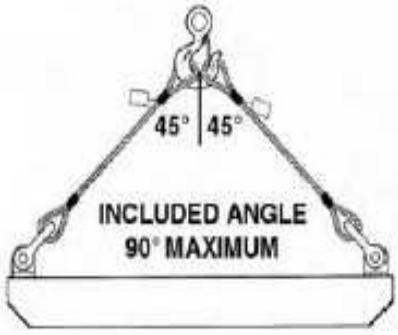
Recommended Rigging Practices

Rigger must check all wires ropes & lifting equipment's before using it

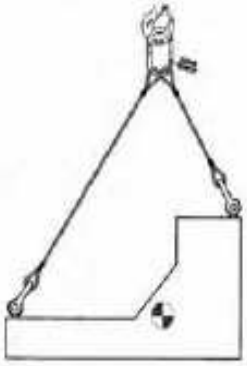




Recommended Rigging Practices



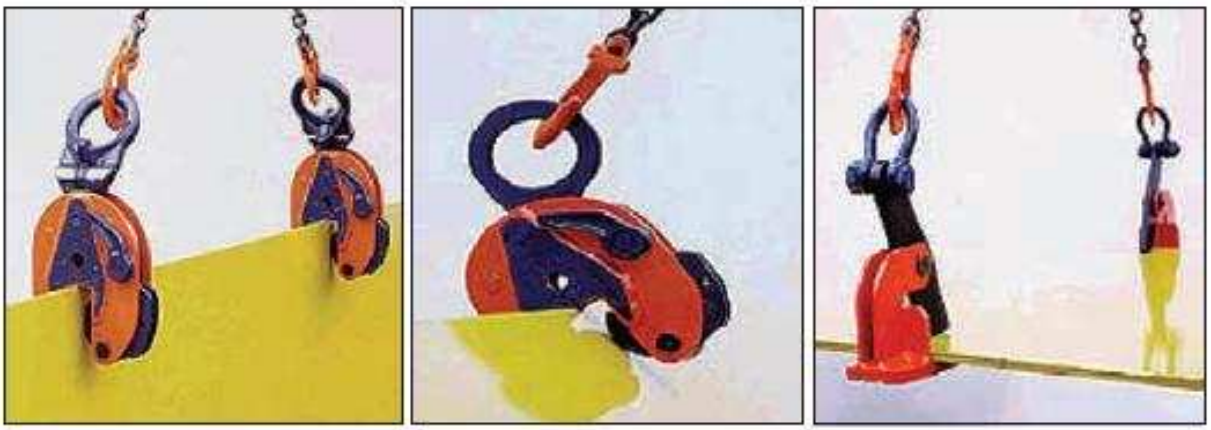
For rigging configurations with two legged slings, the included angle should not exceed 90° and the slings must sit in the base of the hook and clear of the latch to prevent fouling of the latch.



Good load control starts with rigging to the centre of gravity directly below the hook.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Recommended Rigging Practices

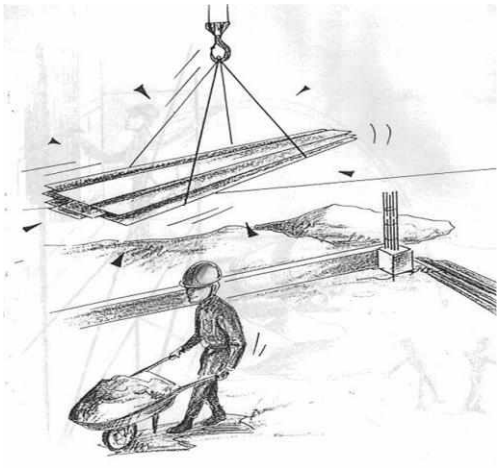


The clamps should be applied to the load in accordance with the instruction manual and it should not handle any load for which it is not designed for. It is important to note that unless stated, the clamp should not be used to lift more than one plate at a time in a vertical lift.

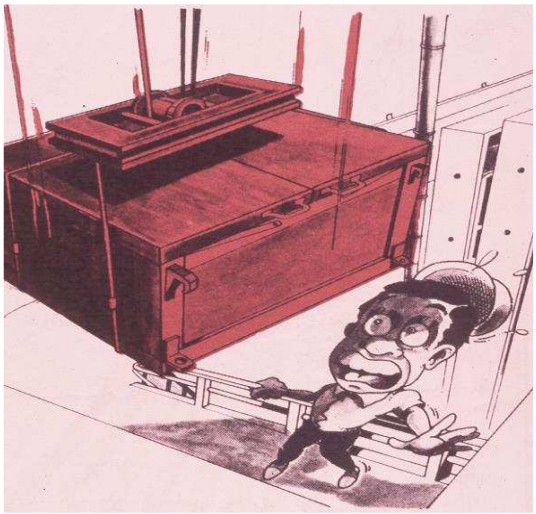
Ensure that

- The plate surface is free of grease, oil, dirt or other contaminants that may impede the contact of the teeth with the plate.
- The load is completely at the back of the clamp throat before locking or using the clamp

Do not walk under suspended loads



Riggers must ensure that the load is properly secured and site personnel must stay clear during lifting works.



No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Manual Handling

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.
- Manual lifting is when an object is lifted an moved from its initial position upwards, downwards and/or horizontally and walk and place the load.

Types of Injuries Related to Manual Handling

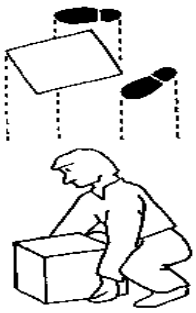
Unsafe manual handling can result in the following types of injuries:
- muscle sprains and strains; - back injuries;
- injuries to tendons, tissues, ligaments in the wrist, arms, neck, shoulders or legs;
- abdominal hernias

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Use the correct method of manually handling of load

Step 1: Assess the load and plan the lifting process. Need any help? Can use other lifting equipment? Clear the path for any obstructions.

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



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

Step 4: Ensure feet is stable and good grip on object before moving off.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

A back injury is a permanent injury

- Worker must learn how to take care their own body because nobody cares how you work.
- Never bend down when lift up heavy load or never force yourself, you will get back injury.
- Once you get a back injury and confirmed by doctor and this will be permanent for life.

For heavy items

Always use mechanical lifting machine

Whenever practicable, trolleys, stackers, levers, hooks or crowbars to move the object.

Fall from height and control measures

Hazards in working at height				
Activity	**Safety Hazard**	**SWP Ref,**	**Health & Safety Risk**	**Persons-at-Risk**
Use of a frame ladder	Fall from height -	IMW 080 – Ladders and Step Ladders; IMW 082 – WAH; IMW 083 – PPE; IMW 085 – Housekeeping; IMW 091 – PTW; IMW 114 – FPP;	Body injuries/Death	Technician / Nearby people
	Falling Object		Body injuries; Damage to properties	Technician / Nearby people; Materials used.
Working platform	Fall from height	IMW 119 – Opn of MEWP; IMW 082 – WAH; IMW 083 – PPE; IMW 085 – Housekeeping; IMW 091 – PTW; IMW 114 – FPP;	Body injuries/Death	Technician / Nearby people
	Falling Object		Body injuries; Damage to properties	Technician / Nearby people; Materials used.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Hazards of working at height

- Fall from height
- Struck by object that falls from height
- Drowning if fall into pit or sea

Examples of work practices that can cause person falling from height:

- Work being done on or near fragile surfaces such as skylights, badly rusted corrugated iron or fibreglass roofs, with no guarding, safety mesh, catch platforms, or alternative fall protection measures in place.
- Boom-type elevating work platforms such as cherry pickers, travel towers, boom lifts etc being used with no secure line and safety harness in place connecting the worker to the basket to reduce the risk of a fall from the basket.
- Maintenance work such as gutter clearing, painting or roof restoration being done from a roof when there is no guarding or fall protection measures used.

The latest regulation, WSH (Work at Height) Regulations 2013, provides the detailed requirements on how such hazards can be minimized by regulating the working at height work activities.

WSH (Work At Height) Regulations 2013

Definition of Work at Height

Work at Heights is defined as to work:

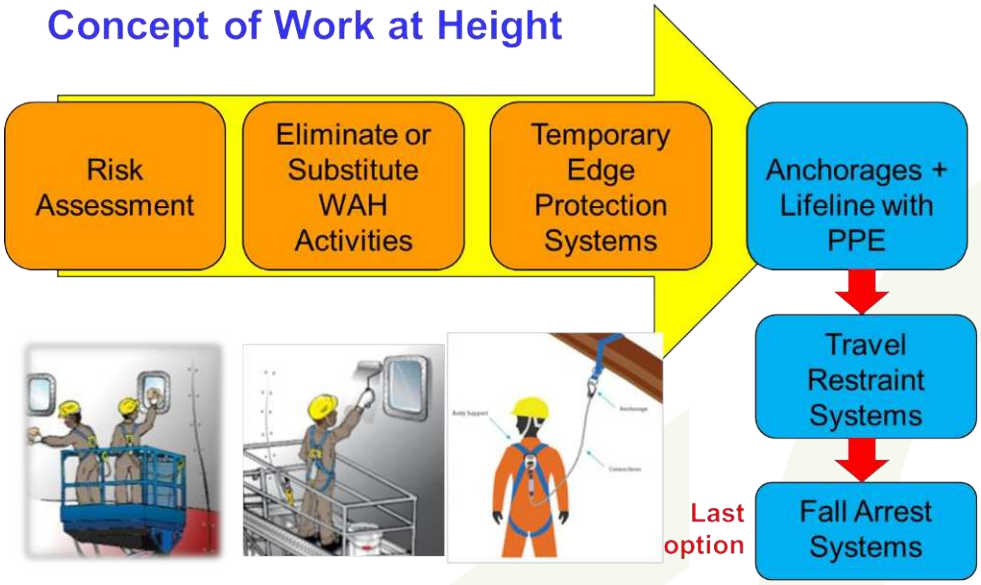
- In an elevated workplace from which a person could fall
- Near a floor opening through which a person could fall;
- Near an open edge over which a person could fall;
- On a surface through which a person could fall (eg.fragile surfaces);or
- In any other place (whether above or below ground) from which a person could fall from one level to another and the person or other person would be injured due to the distance of the fall.

WSH (Work At Height) Regulations 2013

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.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg



Training and Supervision for Persons at Work

Person carrying out work at height

- to receive adequate safety and health training to familiarize himself with the
- hazards associated with work at height and precautions to be observed must be under immediate supervision of a competent person

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.

Permit to work system

Source: ACOP Working at Height Safely

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Fragile Surface

- Glass
- Ceramic Tiles
- Corroded Metal Sheet
- Asbestos Sheet

Workplace Safety and Health (Work at Heights) (Amendment) Regulations 2014

The key changes are incorporated in the WSH (WAH) (Amendment) Regulations 2014 which came into force on 1 May 2014. These key changes are:
The PTW requirements will apply only to workplaces defined as Factories under the WSH Act, instead of all workplaces.
The requirement for the role of the Work at Heights (WAH) Safety Assessor and Authorized Manager to be carried out by different persons has also been removed.
With the exception of the PTW and FPP requirements, all other general provisions under the Regulations continue to apply to all workplaces on 1 May 2014.

Relevant WSH Legislations/CP/SS related to WAH

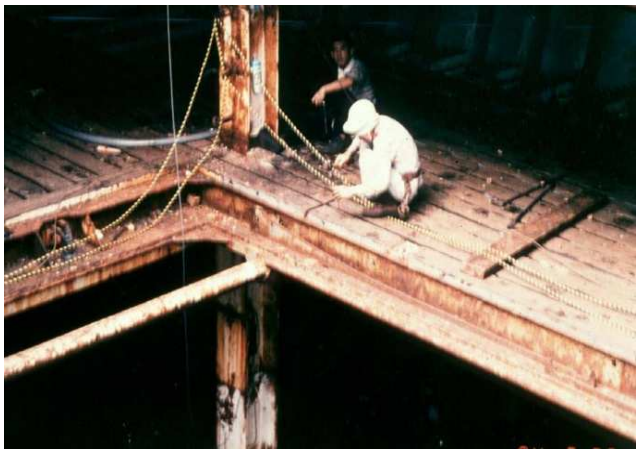
- WSH (Risk Management) Regulations
- Code of Practice RM2.0
- Code of Practice for Working Safely at Height
- SS528: 2006 Part 1 to 6- Personal Fall-Arrest Systems

Falling from height Hazards in Marine industry

Rigger working at Open edges without tproper anchorage point

Working at Open Edges

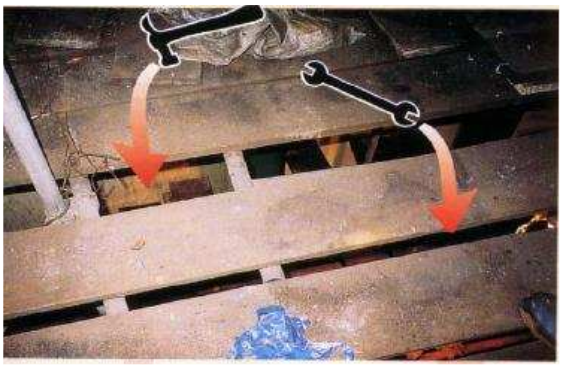
No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg



Working near open edge

Taking short cut

Unsafe staging



Unsafe Platform

Poor housekeeping Trip and Fall

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Safety Programme for Working At Height

Alternatives to Work at height.

Examples of elimination include:

- Prefabrication of roofs at ground level.
- Using pre-cast or tilt-up concrete construction instead of concrete walls constructed in situ.
- Using paint rollers with extendable handles.
- Using remote released shackles for crane lifted loads positioned at height

Access to and egress from work areas inclusive of safety warni

Access and Egress are means:

- For people to get to and move around in the work area.
- Access to workplace using ladder, stair, access platform or a ramp.

Roof Access

Use proper stair tower scaffold

Photo source: WSH Guideline on working safely on roof

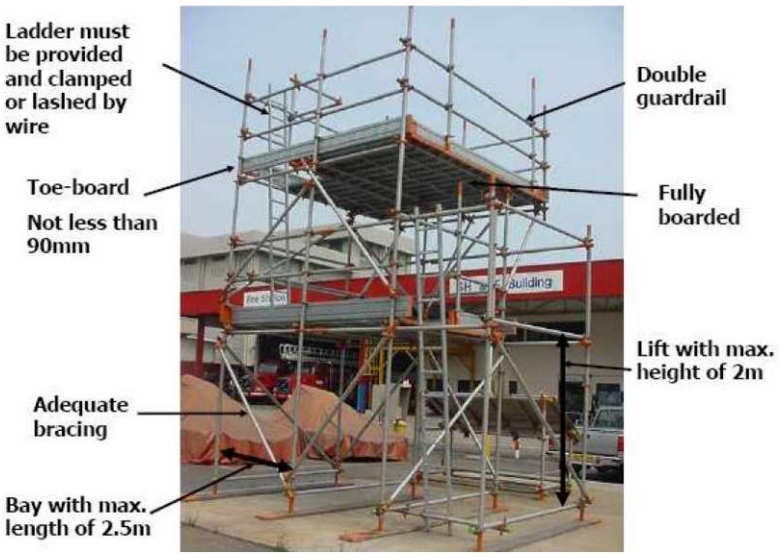
Roof Access

- Crawling board
- Access platform
- Mobile Elevated Work Platform

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Properly Erected Scaffold

- Scaffold or staging are devices used to provide an elevated working surface.
- The scaffold must be properly constructed, level and plumb with all bracings properly installed.
- 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.



Safe access to and egress for scaffold

- All scaffold must have and designated access
- Safety sign state that it is safe for use
- Scaffold access must be checked & certified safe by Scaffold supervisor

Tower Scaffold

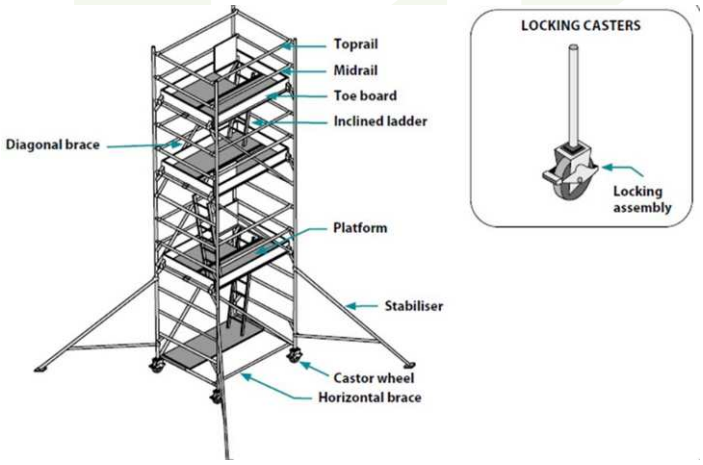


Photo source: WSHC ACOP Working Safely at Height

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

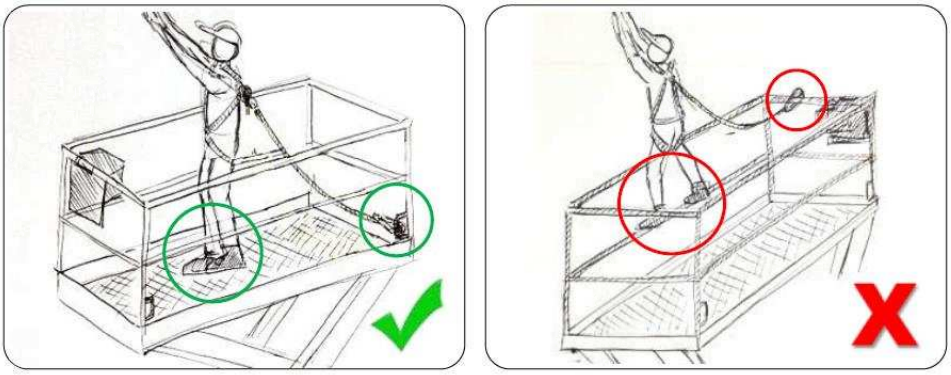
The height of a tower scaffold must not exceed 3 times its lesser base dimension unless the scaffold is effectively tied to the building or structure. However, even if tied, the tower scaffold shall not exceed 8 times the lesser of the base dimensions.

A tower scaffold should only be used on firm ground. Effective locking devices must be attached to the castors in order to hold the scaffold in position.

MEWPS

- Operator must be trained to operate MEWP
- No overloading
- Safety devices
- Safe access
- Work area must be cordon off
- No standing under the platform
- Operator wear safety harness and anchored to life-line or secured anchor point

Safe Usage of MEWP



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

Source: WSHC ACOP for Working Safely at Height

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Philosophies of Fall Protection

Stop/Prevent The Fall

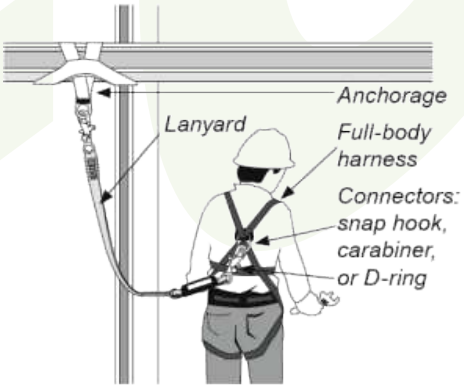
- Restraint/Positioning
- Guardrails
- Scaffold/MEWP
- Controlled Access Zones
- Controlled Working Zones

Catch The Fall

- Fall Arrest
- Safety Nets
- Catch Platforms
- Airbag

Fall Arrest Systems

A personal fall-arrest system



What is a fall arrest system?

- A personal fall arrest system is a collection of components that work in conjunction to:
- Safely stop a person from falling an uncontrolled distance; and
- Reduce the impact of the fall.

Collection of components that work in conjunction to reduce the impact of the fall.

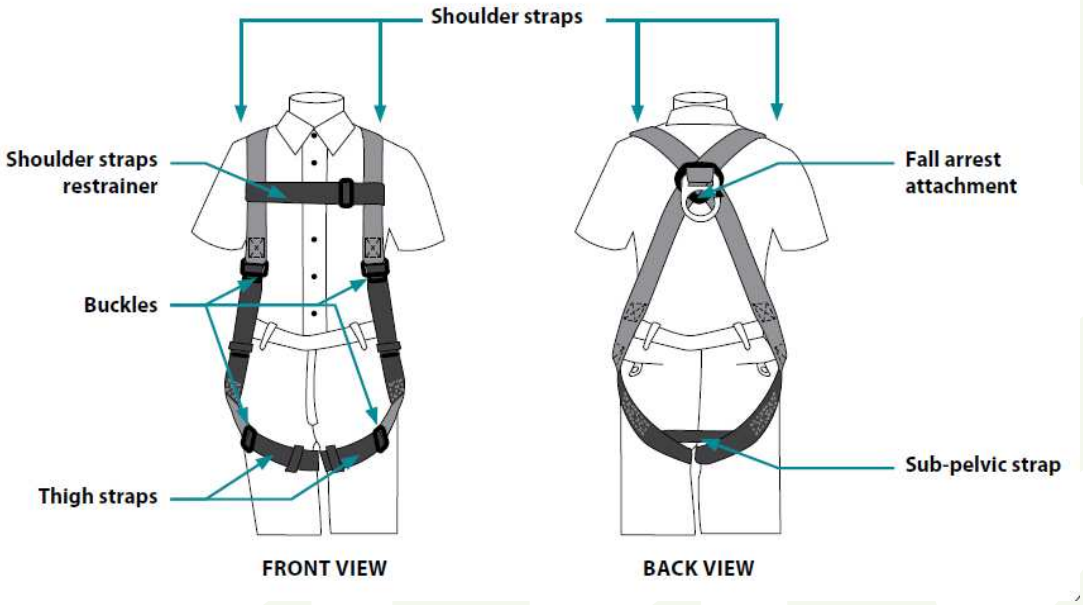
Used where workers are required to carry out their work near an unprotected edge.

Safely stop a person from falling an uncontrolled distance; and

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Body Harness

- Body Support Device
- Distributes fall the arrest forces across shoulders thighs and pelvis.

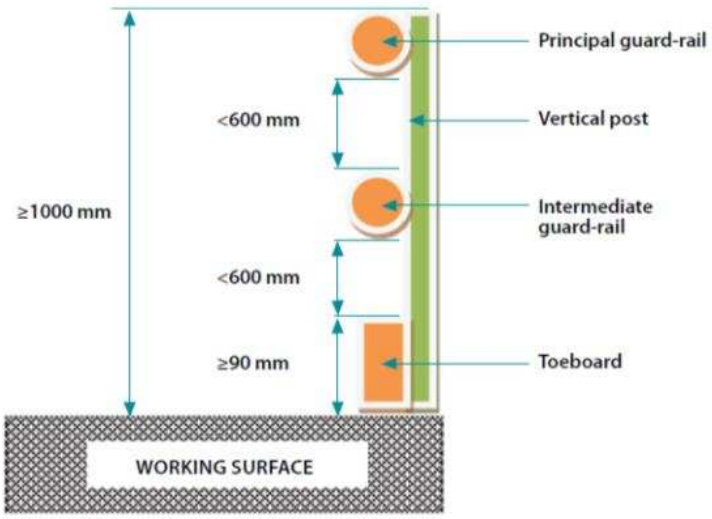


Fall Prevention System

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



No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Edge Protection

- Guardrails
- Locations that require edge protection
- Requirements (height, strength…etc)
- Access points

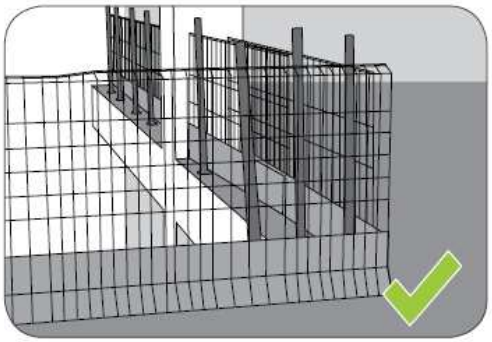


Figure 6.1: Perimeter guard-railing.

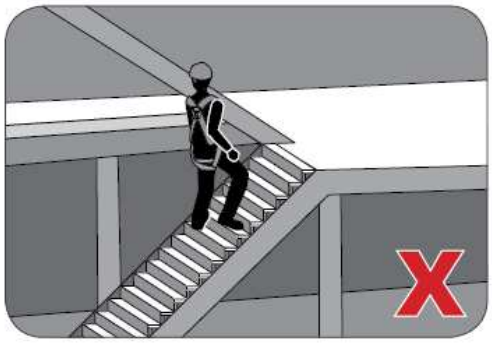
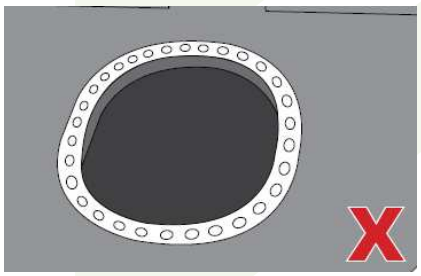


Figure 6.2: Unprotected stairways pose a falling hazard.

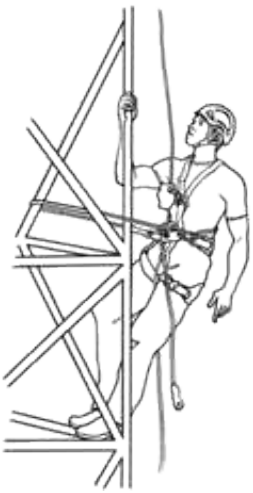
Photo source: WSHC ACOP Working Safely at Height

Guarding of Openings



Work Positioning Systems

A work positioning system is a system of components attached to a vertical life safety rope and includes a full body harness, descent controllers and positioning lanyards used to support or suspend a worker at a work position



No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Travel Restraint System

"Travel restraint system" means a system consisting of a full-body harness or restraint belt, attached to one or more lanyards, each of which is attached to an anchorage line or anchorage point, designed to restrict the travelling range of a person wearing the full-body harness or restraint belt so that the person cannot get into a position where the person could fall off an edge of a surface or through a surface.

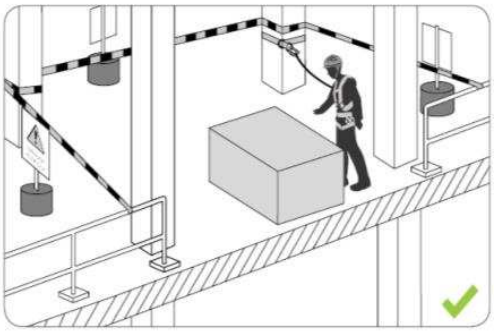
Travel Restraint System

10. Where a **travel restraint system** is used in a workplace, it shall be the duty of the responsible person of a person who carries out or is to carry out any work at height to ensure that

(a)the travel restraint system

(i) is of good construction, sound material and adequate strength;
(ii) is free from patent defects; and
(iii) is suitable and safe for the purpose for which it is intended; and

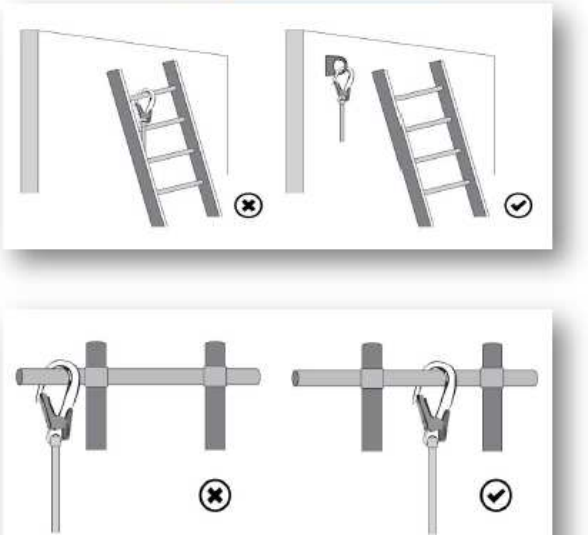
(*b*) every person using the travel restraint system is trained in the safe and correct use of the system



Correct/Incorrect Anchorage Points

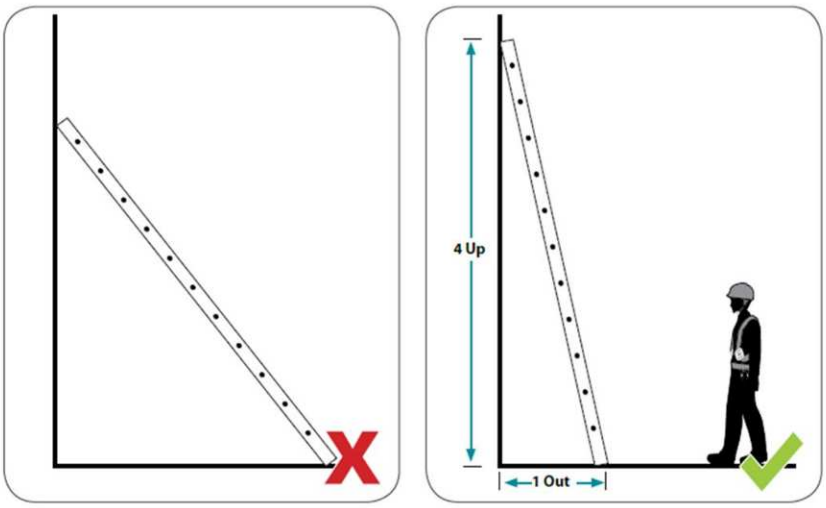
The following areas should never be used as anchor points *unless* the minimum **structural** requirements have being determined to be safe and approved by a *competent* person:

- Standard Guardrails/ Railings
- Ladders/ Rungs
- Scaffolding
- Light fixtures
- Conduit/ Plumbing/ Ductwork/ Pipe Vents
- C-Clamps
- Wiring Harnesses
- Rebar (except for positioning during formwork)
- Another lanyard
- Roof Stacks, Vents or Fans
- Any point which does not meet the structural requirements.

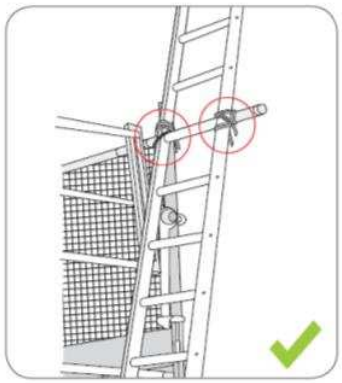


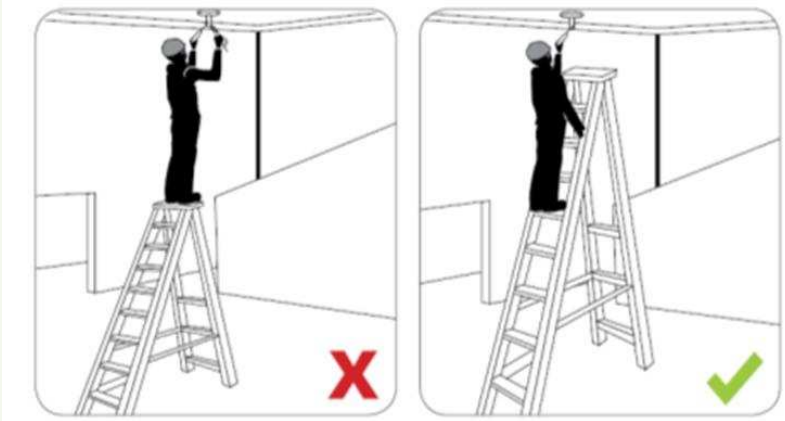
No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Ladders and Step Platforms



- Maintain 1:4 ratio
- Not To Stand on Top 3 rungs of the A frame Ladder
- Use Step Platform
- Secure the ladder
- Above 3 meter, cage is required





Safe use of ladder - WSHC

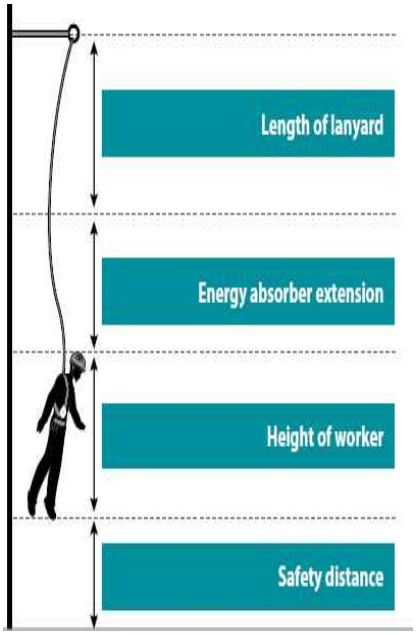
No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Understanding Fall Factor

Calculation of Fall Clearance Distance

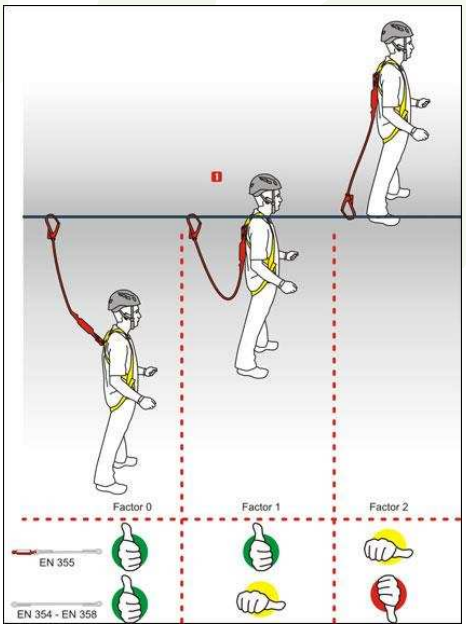
For a harness, lanyard with energy absorber assembly

- Clearance Height = Length of Lanyard + Length of Energy Absorber Extension + Height of Worker + Safety Distance (usually taken as 1m)



6m

ts



Total : 6m

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Hanging Scaffold

Erection and Dismantling, its Safety Requirements

Completely dismantle scaffolding as soon as it is not required.

Where scaffolding is incomplete attach signs warning it is not to be used.

Make employees fully aware:

- of their legal obligation not to put their own safety at risk.
- all work at a height is inherently dangerous regardless of how short or minor it is.

- Provide those who use scaffolding with ng.
- Persons who erect tower scaffolding sh .
- Make sure all work areas are adequately d for storage is periodically checked.
- Scaffolding boards should be checked that they suitable for continued use before they are reused

Working at height - Dock Arm

Hazards

Mechanical failure

Inadequate maintenance may cause failure ir use with consequent risk to users.

Unauthorised use

Operation by personnel who are not trained its use may cause serious injury.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Pre operation Procedures

The following actions should be included in the procedures:

- Grease the moving parts regularly;
- Check hydraulic leads;
- Check for corrosion of the dock arm rails;
- Check for damaged or missing handrails; and
- Check for mechanical or electrical malfunction of the controls.

During Operation

Only trained personnel may operate the dock arm;

- The operator must be at the controls whenever the dock arm is in use;
- Check that there is no obstruction along the travelling path of the dock arm;

Maintain communication between the operator and the personnel on the working platform before raising or lowering the arm;

Personnel on the working platform must anchor their safety belts to the handrail;

Only two personnel may be on the working platform at any one time; and

There must be enough clearance between the working platform and ship side to avoid a collision.

After operation

The dock arm must be anchored at the designated location;

The power to the dock arm must be switched off and the control key removed; and

Any damage or malfunction of the dock arm must be reported to the maintenance authority.

Working at height - Man cage

It is important for employers and others responsible for selecting, specifying and managing man cages on site to understand the risks associated with the use of a man cage and take adequate precautions to eliminate or control those risks. Planning is crucial to their safe operation.

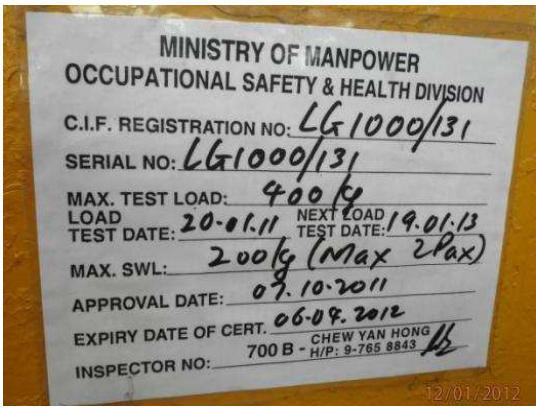
The law requires a risk assessment to be carried out before starting any work at height. If the assessment says that the work can be carried out in a way that avoids having someone working at height, then this must be done.

However, if the assessment confirms that there is no alternative to working at height then the work must be properly planned and organised in advance by a competent person to make sure that the most suitable work equipment is chosen, taking into account the nature of the work.

One of the biggest risks in using boom type platforms is being thrown out of the basket if the boom swings, jolts or tilts away from the machine's centre of gravity, or if the operator overreaches (usually by standing on the guard rails).

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Risk assessment must consider the use of personal fall protection equipment. A hard hat with chinstrap and high visibility clothing should also be worn



Health Hazards and control measures

Chemical Hazards and Routes of Entry

Chemical exposure can arise through direct use or from by-products. Exposure to chemical hazards occurs in the following ways:

Inhalation of airborne contaminants, including:

- dusts—silica, coal, asbestos, lead, cotton, wood, cement
- mists—acid mists, chrome plating
- gases—chlorine, sulphur dioxide, ethylene oxide, ozone
- fumes—smoke, metal fumes from welding
- vapours—chlorinated and aromatic solvents, amines, ethers, alcohols

Through skin contact, including:

- direct absorption through skin—pesticides, phenol
- action on eye and mucous membranes—acids, irritating effect of vapours
- corrosive action on the skin—acids, alkalis, phenols
- solvent defatting of skin—toluene, methylene chloride
- photosensitising agent to skin—creosote, bitumens
- allergenic action on skin—nickel, chromium.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Through ingestion, for example

– consume food contaminated with lead or mercury

Safety Data Sheets (SDS)

The key information available on SDS includes:

1. Identification of the substance and its manufacturer
2. Composition/information of its ingredients
3. Hazard identification
4. First aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure control and personal protection
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicological information
12. Ecological information
13. Disposal consideration
14. Transport information
15. Other information

Exposure standards

- Exposure standards are used to ensure that there is adequate control of exposure to hazardous substances in the workplace.
- They are not precise divisions between acceptable and unacceptable working conditions but are believed to represent concentrations to which most workers may be exposed day after day during their working lives without suffering adverse health consequences.

Control of Chemical Hazards

Introducing controls requires knowledge of:

- the hazard
- the degree of risk from the exposure
- routes of entry
- various practicable control strategies—that is, the Hierarchy of Controls: elimination,
- substitution, isolation, ventilation, administrative controls, personal protection
- how much control is required
- comparative effectiveness of different control procedures
- the relative costs of implementation
- maintenance and testing procedures for control procedures
- user acceptability

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

The following situations are examples of best choice for workplace control:

- replace cancer-causing chemicals rather than controlling them, unless they are essential to the workplace (e.g. potent drug treatments in a hospital)
- an expensive dust-control system would not be recommended for intermittent or infrequent exposures (e.g. a job undertaken for 3 hours every 6 months) where respiratory protection would suffice half-face respirators, which might technically provide good protection, would not be recommended for a worker permanently employed on an acid pickling line;
- control of the acid aerosol by suppression and ventilation would provide a more acceptable long-term solution
- a worker requiring access to the same acid pickling line for 5 minutes per day can be adequately protected by the appropriate half-face respirator.

Other Physical hazards and control measures

- **noise**—absorbed though the ear; some very low frequency (infrasound) and ultrasonic sounds are absorbed directly by the body
- **vibration**—received by body in contact with vibration
- **light**—visible, ultraviolet and infrared are received by both the eye and the skin;
- the eye is susceptible to laser energy; poor lighting may also be a workplace health hazard
- **heat**—absorbed by all parts of the body
- **cold**—cold environments experienced by whole of body; extremities in contact with cold
- **pressure**—extremes affect areas of body with gas spaces: lungs, teeth, sinuses, inner ear
- **electromagnetic non-ionising radiation**—microwaves, radiofrequency and very low electromagnetic radiation are received directly by the body
- **ionising radiation**—X-rays, radioactive decay energies: α (alpha) particles, β (beta) particles and γ (gamma) rays are received directly by the body

Noise Hazards and control measures

Maximum exposure for various equivalent continuous noise levels

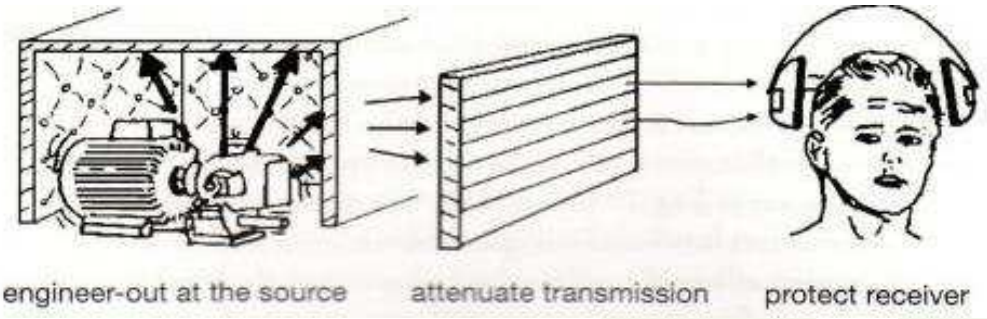
Limiting dB(A)	Maximum exposure period allowed to stay within LAeq,8h 85 dB(A)
85	8 hr
88	4 hr
91	2 hr
94	1 hr
97	30 min
100	15 min

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Controlling of Noise Hazards

Workplace noise control strategies fall into three categories and are indicated here in order of most effective to least effective:

1. Engineering-out the noise hazard (*source* of noise)
2. Attenuating the noise hazard (*transmission* of noise)
3. Hearing protection programs (*reception* of noise)



1) Control at source: elimination or modification of noise source or process
2) Control of transmission path: enclosures, barriers, machine mountings, sound-proofed control rooms, room sound absorbers, etcetera.
3) Hearing protectors should not be seen as a noise control device but rather a temporary way of minimizing a worker's noise exposure by reducing the noise that enters the ear canal.

Engineering Controls

- Substitution of processes
- Control of noise transmission path
- Isolating the noise source from the worker
- Noise can be reduced by preventing much of it reaching the worker

Types of hearing protectors

- Acoustic helmets
- Ear canal caps
- Earplugs
- Earmuffs

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Heat related illness

The Basic Forms of Heat Illness

- Heat rash
- Heat cramps
- Fainting (or heat syncope)
- Heat exhaustion
- Heatstroke

Prevention of Heat Stress

- Reducing the workload factor.
- Reducing radiant heat load
- Increasing air speed with fans if air temperature is <38°C
- Decreasing air speed if air temperature is >42°C.
- Dehumidifying air to increase evaporative cooling from sweating,
- Limiting the time exposure to the hot work by
- Restricting overtime work in hot environments
- Providing specialised vortex air-cooled or ice/phase change vests for some continuous demand tasks.

Acclimatisation

Workers in hot environments can become acclimatised as a way of reducing the heat strain. Acclimatisation produces a lower heart rate and higher sweat rate with more dilute sweat. There are different rates of change in the acclimatisation process which have been broken up into three specific phases:

1. Initial phase
2. Intermediate phase
3. Third phase

Generally new workers in hot environments must be permitted 1 to 2 weeks to acclimatise.

Ergonomic Hazards & Control measures

- Ergonomic hazards refer to workplace conditions that pose the risk of injury to the musculoskeletal system of the worker.
- Ergonomic hazards include repetitive and forceful movements, vibration, temperature extremes, and awkward postures that arise from improper work methods and improperly designed workstations, tools, and equipment.
- Common ergonomic injuries include carpel tunnel syndrome and related maladies of the wrist and hand. These can include tendonitis, trigger finger, hand/arm vibration disease, deQuervain's disease, and myalgia.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Control of Ergonomic Hazards

For repeated actions and sustained postures:

- Provide mechanical aids (e.g., arm and wrist rests) to employees that do repetitive computer work
- Incorporate task rotation
- Modify the work load required of the individual in a particular time frame

For work requiring lifting, carrying, hoisting, pushing, and related activities:

- Provide gloves to the employees that improve their grip on the object
- Reduce the working load, reducing stress to various body parts
- Incorporate rollers and powered belt conveyers to move material
- Utilize handles to make it easier to grip items

For prolonged contact stresses from tools and equipment:

- Use elongated handles on tools, such as scissors and pliers
- Utilize rounded edges on handles and work benches
- Utilize proper tools for impact or striking activities
- Avoid tasks that require the individual to lean on wrists, elbows, or the abdomen
- Provide cushioned tool grips

For posture of the employee:

- Ensure that the workstation, tool design, and tool shape are such that it will allow the employee's body to maintain an unstrained and comfortable position

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

LESSON 4
PS4 Identify WSH hazards, evaluate and control risks in marine industry in accordance with risk management process (Part 2)
UK9 Risk management process
UK14 Methods for hazard identification

Sub-topics

WSH (Risk Management) Regulations

- Hazard identification
- Risk evaluation
- Risk control – Hierarchy of Controls

Take home assignment to complete a risk assessment form

UK9 Risk Management Process

Legal requirement of WSH (Risk Management) Regulations and penalties

Risk assessment

3.—(1) In every workplace, the employer, self-employed person and principal shall conduct a risk assessment in relation to the safety and health risks posed to any person who may be affected by his undertaking in the workplace.

(2) The Commissioner may determine the manner in which the risk assessment referred to in paragraph (1) is to be conducted.

Elimination and control of risk

4.—(1) In every workplace, the employer, self-employed person and principal shall take all reasonably practicable steps to eliminate any foreseeable risk to any person who may be affected by his undertaking in the workplace.

(2) Where it is not reasonably practicable to eliminate the risk referred to in paragraph (1), the employer, self-employed person or principal shall implement —

(a) such reasonably practicable measures to minimise the risk; and

(b) such safe work procedures to control the risk.

(3) The measures referred to in paragraph (2)(a) may include all or any of the following:

(a) substitution;

(b) engineering control;

(c) administrative control;

(d) provision and use of suitable personal protective equipment.

(4) The employer, self-employed person or principal shall specify the roles and responsibilities of persons involved in the implementation of any measure or safe work procedure referred to in paragraph (2).

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Provision of information

6.—(1) In every workplace, the employer, self-employed person and principal shall take all reasonably practicable steps to ensure that any person in the workplace who may be exposed to a risk to his safety and health is informed of —

(a) the nature of the risk involved; and

(b) any measure or safe work procedure implemented under regulation 4(2).

(2) The employer, self-employed person and principal shall comply with paragraph (1) whenever any risk assessment referred to in regulation 3(1) is revised, or where any measure or safe work procedure implemented under regulation 4(2) is changed.

Offences

8. Any employer, self-employed person or principal who contravenes regulation 3(1), 4(1), (2) or (4), 5, 6 or 7 shall be guilty of an offence and shall be liable on conviction —

(a) for a first offence, to a fine not exceeding $10,000; and

(b) for a second or subsequent offence, to a fine not exceeding $20,000 or to imprisonment for a term not exceeding 6 months or to both.

Introducing Risk Management 2.0

- Why do we need to enhance RM?
- RM journey
- Effective On-site RM implementation
- Upstream Risk Control Measure
- Holistic RM
- Risk Evaluation for health managers
- Duties of Employers
- The way forward

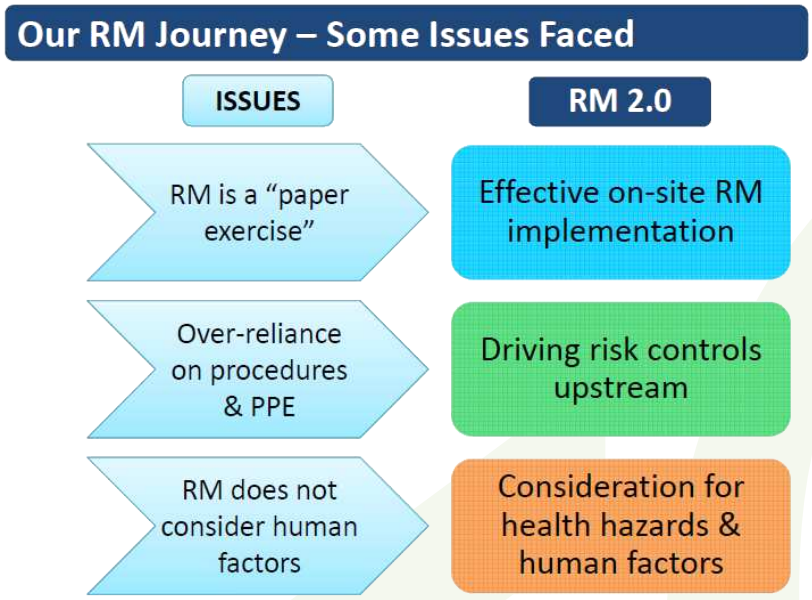
Risk Management was introduced in 2005

3 key principles

1. reduce risk at source
2. Greater industry ownership
3. higher penalties for unsafey management

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

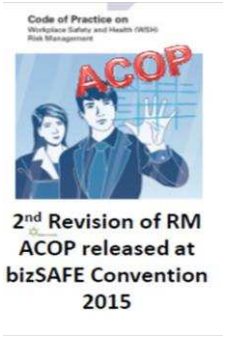
Risk Management 2.0



RM2.0 was released in BizSafe convention 2015.

The 3-key thrust of RM2.0 are:

- Effective on-site implementation for risk management
- Driving Key control upstream
- Holistic Risk Management



2nd Revision of RM ACOP released at bizSAFE Convention 2015

Effective on-Site Implementation

Outcome: Work gets done in a safe manner

Improvements needed

Actual implementation of controls on-site and risk controls in RA documents are realised

Allocate resources

- Appoint personnel/team to be responsible for Implement control measures, translate documentation into reality
- Allocate time to educate, brainstorm, put structures in place

Monitor and review effectiveness of risk control

- Seek feedback from users on adequacy and effectiveness of risk controls.
- Risk management initiatives communicated to all stakeholders.
- RA documents should be accessible to all stakeholders, including workers.

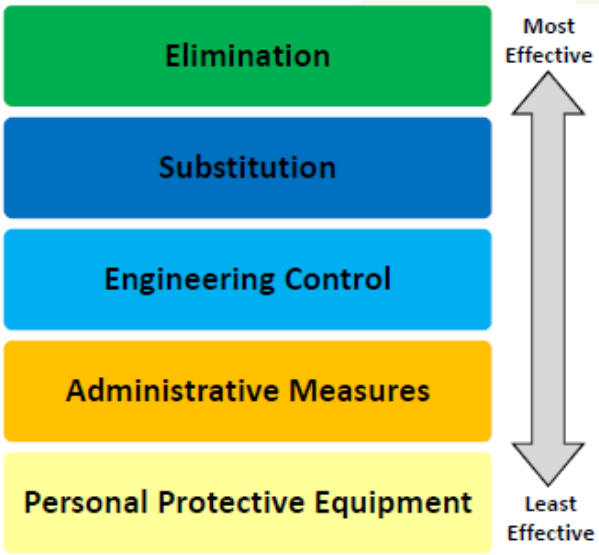
No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

In the revised WSH RM ACOP:

- RM is an integral part of organisational work processes
- Customised and tailored to organisation
- Contributes to achievement of organisation's objectives
- Improves performance of business, WSH compliance and environmental protection
- Takes into account organisational and human factors

Driving Risk Control Upstream

- Apply Hierarchy of Control to reduce risks at source
- The closer to source, risk reduction is more effective and least influenced by human error
- A combination of measures is generally more effective than relying on a single control



Elimination of Hazards at design stage

Design for Safety (DfS)

Consideration for safety of builders, users, public and maintenance personnel at the design stage. E.g. Latest construction method using PPVC, DFMA etc where components are fabricated in factory and only require assemble on worksite reduce the exposure to work at height.

Design Risk Management

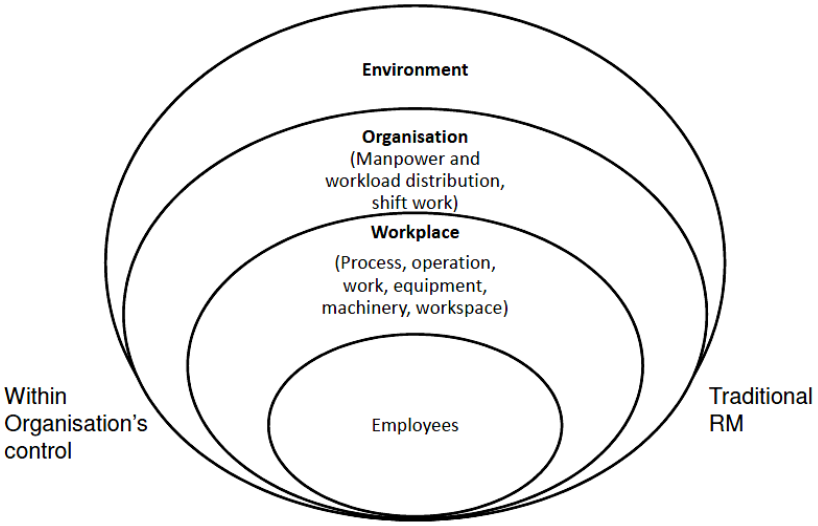
Hazards can be avoided by proper plant design and selection of machinery and equipment

Re-design of work task or activities

- Using rotators to rotate ISO-tanks to enable entrance through manhole from ground
- Provision of conveyer belts for material movement eliminates manual carrying of materials

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Factors influencing WSH within an Organisation



Organisational Factors: Workload Management (Fatigue)

Worker resting on ground of open yard was run over by a seven-tone forklift.

- Driver did not notice the worker was in his path
- both worker and forklift driver had been working beyond 14 hours that day.
- Forklift driver had worked beyond 20 hours on two separate days the week before.
- Long working hours induced fatigue in workers and forklift driver had reduced alertness

Employer may put in place:

- policy on workload management to prevent workers' fatigue
- appointment of multi-functional team to implement Fatigue Management plan.

Human Factors

- Delivery driver with poorly managed diabetes may develop complications such as blurred vision, impaired senses
- May compromise driver's ability to respond to dangerous situations on the road, posing a hazard to other drivers, passengers, pedestrians, including themselves.
- Not a problem if diabetes is under control

Employers can put in place health programmes to help employees manage their health

- Allowing medical service provider to offer optional detailed medical screening services at corporate rates to employees
- Provide healthier food options at the staff canteen
- Encourage off-the-job health and safety

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

RM must consider health hazards

- Relevant risk factors are to be considered for different health hazards
- Exposure assessments should be conducted where possible to estimate employees' exposure to health hazards
- Risk Evaluation for Health hazards conducted by competent persons using recognised methods, acceptable standard procedures and standard calibrated equipment
- Exposure estimates compared with established health exposure standards

UK9 Risk Management Process

Risk Management involves:

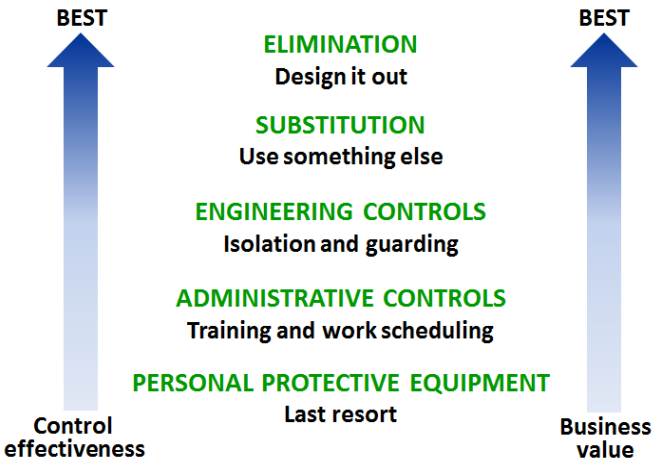
1. Preparation
2. Hazard identification
3. Risk Evaluation
4. Risk Control
5. Record keeping
6. Implementation and monitoring

Risk Assessment

3 basic steps of risk assessments

1. Hazard Identification
2. Risk Evaluation
3. Risk Control

The selection of control measures must be based on the principles of Hierarchy of Control.



Roles and Responsibilities

The Employer should:

1. Designate, assign, appoint or engage a competent person leading a team
2. Ensure that the risk control measures are implemented without undue delay after the completion of risk assessment;
3. Inform all persons working of the risks, and the means to minimise or, where possible, eliminate the risks;
4. Provide a risk assessment register to record the findings of risk assessment.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

The Team Leader should:

1. Have adequate knowledge of the risk assessment method;
2. Recommend appropriate risk control measures to reduce or eliminate the risks identified;
3. Prepare a record of the risk assessment for the employer after completion of the assessment; and
4. Assist management in monitoring the effectiveness of risk control measures after their implementation.

Employees should:

1. Participate in the risk assessment or assist in conducting the risk assessment
2. Adhere to SWPs established to reduce any safety and health risks in the workplace; and
3. Inform their supervisors of any shortcomings in the SWPs or risk control measures

Contractors and Suppliers

Whenever necessary, contractors and suppliers should work with the risk assessment team to identify hazards, evaluate and control the risks that machinery, equipment or hazardous substances may pose.

Preparation

- Plant layout plan
- Process flowchart
- List of work activities in the process†
- List of chemicals, machinery and / or tools used
- Records of past incidents and accidents
- Relevant legislation, codes of practice or specifications
- Observations and interviews
- Inspection records
- Details of existing risk controls
- Health and safety audit reports
- Feedback from staff, clients, suppliers or other stakeholders
- Safe work procedures (SWPs)
- Other information such as safety data sheets (SDSs), manufacturer's instruction manual
- Copies of any relevant previous risk assessments

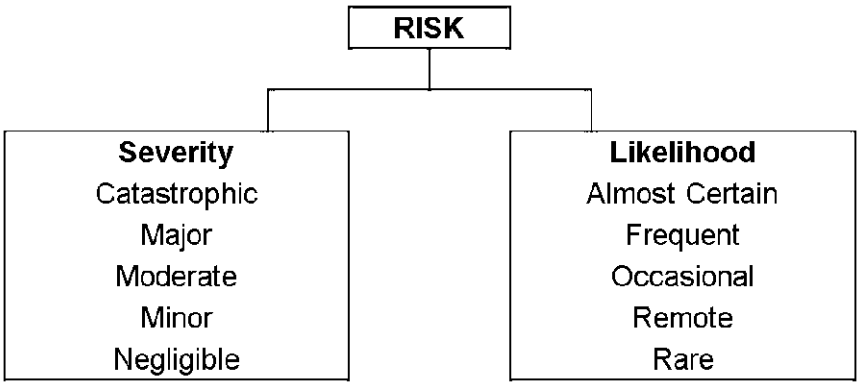
Based on the work process, the steps of each work activity will be listed out in sequence. Each step of the process is referred to as a work activity.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Risk has 2 parts:

Expected **SEVERITY** of the hazard; and

LIKELIHOOD of the occurrence of the accident / incident or ill health; taking into account the existing risk controls.



Severity categories and description

Level	Severity	Description
5	Catastrophic	Fatality, fatal diseases or multiple major injuries
4	Major	Series injuries or life threatening occupational disease (includes amputations, major fractures, multiple injuries, occupational cancer, acute poisoning).
3	Moderate	Injury requiring medical treatment or ill health leading to disability (includes lacerations, burns, sprains, minor fractures, dermatitis, deafness, work related upper limb disorders).
2	Minor	Injury or ill health requiring first aid only (includes minor cuts or bruises, irritation, ill-health with temporary discomfort).
1	Negligible	Not likely to cause injury or ill health

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Likelihood categories and description

Risk Assessment Matrix In the Marine Industry

5 by 5 Risk Matrix

Likelihood

Likelihood	Description
Remote	So unlikely it can be assumed occurrence may not be experienced
Probable	Not likely to occur in company, but possible
Occasional	Likely to occur sometimes in company (1-3 times a year)
Periodical	Likely to occur several times in company (4-10 times a year)
Frequent	Likely to occur repeatedly in company (more than 10 times a year)

Acceptability of risk and recommended actions

Risk level	Risk Acceptability	Recommended actions
Low Risk	Acceptable	No additional risk control measures may be needed. However, frequent review may be needed to ensure that the risk level assigned is accurate and does not increase over time.
Medium Risk	Moderately acceptable	A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as is practicable within a defined time period. Interim risk control measures, such as administrative controls, may be implemented. Management attention is required.
High Risk	Not acceptable	High Risk level must be reduced to at least Medium Risk before work commences. There should not be any interim risk control measures and risk control measures should not be overly dependent on personal protective equipment or appliances. If need be, the hazard should be eliminated before work commences. Immediate management intervention is required before work commences.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Hierarchy of Control Measures

1. Elimination

- Elimination of hazards refers to the total removal of the hazards and hence effectively making all the identified possible accidents, incidents and ill health impossible.
- This is a permanent solution and should be attempted in the first instance. If the hazard is eliminated, the risk associated of the hazard will be eliminated.

2. Substitution

- This involves replacing the hazard by one that presents a lower risk.
- *E.g. Asbestos can be substituted with non-asbestos materials.*

3. Engineering Controls

- Physical means that limit the hazard.
- These include structural changes to the work environment or work processes, erecting a barrier to interrupt the transmission path between the worker and the hazard.
- E.g. Isolation or containment of hazards, machine guarding, manual handling devices/equipment etc.

4. Administrative Controls

- These reduce or eliminate exposure to a hazard by adherence to procedures or instructions.
- E.g. Permit-to-work systems, scheduling of incompatible works etc.

5. Personal Protective Equipment (PPE)

- used only as a last resort, after all other control measures have been considered, or as a short term contingency during emergency / maintenance / repair or as an additional protective measure.
- Eg : Safety boots, helmet, glasses etc.

Safe Work Procedures (SWPs)

Arising from the risk assessment, SWPs for work which may pose safety and health risks should be established and implemented.

Residual Risks

- Residual risks are the remaining risks after implementation of risk controls.
- The risk assessment team should ensure that residual risks are acceptable and manageable; and highlight the residual risks of each of the controls.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Record Keeping

The records should include the following information:

1) Names and designations of risk assessment team members
2) Inventory of work activities by process or location, associated with machinery, equipment and chemicals
3) Hazards identification for each work activity, and possible types of accident or incident
4) Existing risk control measures
5) Risk level for each hazard
6) Recommendations on additional risk controls required
7) Persons involved in implementing the measures on risk reduction
8) Signatures, date and designations of the persons conducting risk assessment
9) Signature, date and designation of management approving or endorsing the Assessment

Implementation & Review

The results of risk assessment must be approved and endorsed by the top management. The employer should as far as is practicable, implement the recommended risk control measures as soon as possible. An action plan should be prepared to implement the measures.

Regular review of the risk assessment plan is critical. While employers are required to review their plans every three years, a review should take place whenever:

1) New information on safety and health risks surfaces;
2) There are changes to the area of work and / or
3) After any accident / incident.

Risk Control measurement Implementation Plan

1. Proposed control measures shall be implemented within a reasonable time frame.
2. Priority will be given to high- risk activity control measures
3. Implementation plan shall contain the following
    - Hazard / Risk
    - Control Measures
    - Implementation Target date
    - Responsible person to implement

Implementation of Control Measures

- To implement control measures and SWP effectively and efficiently, they should be as far as practicable developed at the workplace with the participation of all levels of staff
- Feedback from people implementing control measures and SWP should be encouraged so that improvement to the measures can be made.
- Maintaining control measures & SWP requires scheduled inspections and maintenance.
- Also requires the enforcement of discipline to ensure that people do not tamper with control measures (e.g. by removing machine guards) and SWP

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Review of Risk Assessment Register

- Regular review of the risk assessment plan is critical.
- The Register of hazards and risks shall be reviewed and updated (if necessary):
  - Whenever there is a change in the operations, process, products or services.
  - Whenever there is a new operation, project, process, product or service.
  - Whenever there is new knowledge based on incidents, accidents or other sources.
  - Whenever there are new or changes in legal, company or other requirements.
  - Prior to implementation of any risk control measures.
  - At least every 3 years.

Audit

- The review of risk assessments during audits are useful tools to help maintain the validity and effectiveness of risk assessments and controls.
- Internal audit is an opportunity to check that assessments are in place and up to date.
- Internal audit can also be a useful opportunity to check whether the assessment reflects actual workplace conditions and practice.

Risk Communication

- Management commitment (corporate policy) to communicate “risk assessment information” to the employees, relevant and interested parties, including visitors, contractors, and affected neighborhoods
- Suitable arrangements to be established to ensure effective communication of the above information.

Communication Channels

- Risk Assessment Teams
- Various meetings, including Workplace Safety & Health Committee Meetings and tool box meetings
- Company newsletters and circulars
- Safety & Health Notice board
- Activities such as safety & health talks, contests and campaigns.
- Feedbacks from employees and other parties should be encouraged
- Direct observation and discussion
- Suggestion forms
- Reminder through Tool Box Meetings

Communication Information

- Hazards of the work activities / workplace
- Risks of the hazards
- Control measures, include safe work procedures
- ANY CHANGES of the above based on the review and revision of the respective risk assessments

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Record Keeping

- Keep for at least 3 years.
- Risk assessment form could be used for risk assessment and recording.
- Risk assessment records should be concise and kept in a register.

Records should include the following:

- Names and designations of risk assessment team members.
- Inventory of trades and / or work activities by process or location, associated with machinery, equipment and chemicals.
- Hazards identification for each work activity, and possible types of accident or incident.
- Existing risk control measures.
- Risk level for each hazard.
- Recommendations on additional risk controls required.
- Persons involved in implementing the measures on risk reduction.
- Signatures, date and designations of the persons conducting risk assessment.
- Signature, date and designation of management approving or endorsing the assessment.

RISK ASSESSMENT FORM				
Department		RA Leader: _____ RA Member: _____ _____ _____ Date: _____	Approved by: Name: _____ Designation: _____ Signature: _____ Date: _____	RA Ref No: _____
Location / Process				
Original Assessment Date				
		Last Review Date: _____	Next Review Date: _____	

HAZARD IDENTIFICATION				RISK EVALUATION				RISK CONTROL						
S/No	Work Activity	Hazard	Possible Injury/ Ill Health	Existing Risk Controls	S	L	RPN	Additional Controls	S	L	RPN	Implementation Person	Due Date	Remarks

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Risk Assessment process

Identify Hazards

Types of Hazards	Examples
Contact With	Electricity, chemicals, hazardous substances, heat / cold, radiation, pressure, water, steam, protruding object.
Struck By	Moving / flying / falling objects
Strike Against	Stationary or protruding objects
Caught In, On, or Between	Pinch points, protruding, moving/ stationary objects
Trip & Fall	From height, floor level or below
Overexertion	Ergonomic, manual handling - Lifting, pulling, pushing
Exposure	Toxic gas, vapours, fumes, dust, fiber, noise / vibration, radiation, heat / cold, poor lighting, fire / explosion, biological.

Evaluating Risk

Risk is the chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard.

Likelihood

Probability or frequency of such an event occurring

Severity

Degree or extent of injury or harm caused by the event, or as a result of that event

Risk is made up of 2 parts:

- Expected **SEVERITY** of a possible accident/incident or ill health originating from the identified WAH hazard.
- **LIKELIHOOD** of the occurrence of the accident/incident or ill health taking into account the existing risk control.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Severity

Level	Severity	Description
5	Catastrophic	Fatality, fatal diseases or multiple major injuries.
4	Major	Serious injuries or life threatening occupational disease (includes amputations, major fractures, multiple injuries, occupational cancer, acute poisoning).
3	Moderate	Industry requiring medical treatment or ill-health leading to disability (includes lacerations, burns, sprains, minor fractures, dermatitis, deafness, work related upper limb disorders).
2	Minor	Injury or ill health requiring first aid only (includes minor cuts and bruises, irritation, ill health with temporary discomfort).
1	Negligible	Not likely to cause injury or ill health.

Likelihood

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

Evaluation of Risks

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

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

	Classification of Risk Level
	High Risk
	Medium Risk
	Low Risk

Reduce the Risk Level to an acceptable level by reducing the Likelihood:

Risk Level	Acceptability of Risk	Recommended Actions
Low Risk 1 - 3	**Acceptable**	▪ No additional risk control measures may be needed. ▪ Frequent review and monitoring of hazards are required to ensure that the risk level assigned is accurate and does not increase over time.
Medium Risk 4 - 12	**Moderately Acceptable**	▪ A careful evaluation of the hazards should be carried out to ensure that the risk level is reduced to as low as reasonably practicable (ALARP) with
High Risk 13 - 25	**Not Acceptable**	▪ High risk level must be reduced to at least Medium risk before work commences. ▪ There should not be any interim risk control measures. Risk control measures should not be overly dependent on PPE or appliances. ▪ If practicable, the hazard should be eliminated before work commences. ▪ Management review is required before work commences.

UK13 WSH control measures

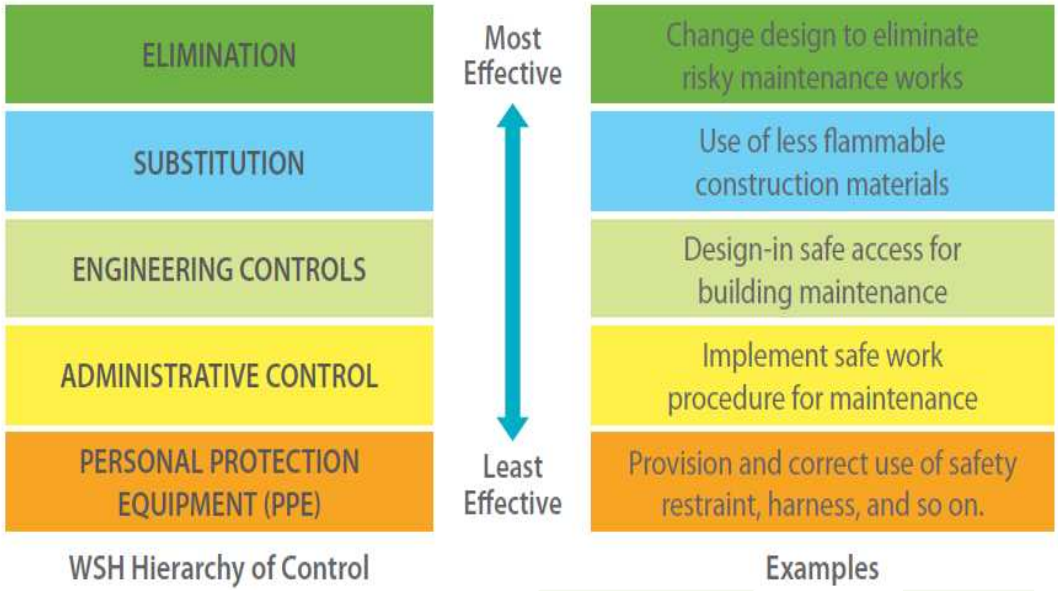
Elimination:

- Removal of source of hazard(s) from work area.
- Most preferred method as it effectively makes all identified possible accidents and ill health impossible.
- Permanent solution which should be attempted in first instance.
- If hazard is removed, all other management controls, such as workplace monitoring and surveillance, training, safety auditing, and record keeping will no longer be required.

- **Elimination is most effective solution**
- **Removal of the hazard or the system of work which presents the risk**

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Principle of Hierarchy of Control



Types of Control Measures	Using Work at Height Examples
1. Elimination Total removal of the hazards	To avoid all height works that are hazardous; if unavoidable, to minimize the exposures as far as reasonably practicable; i.e. to perform all loose roof structural fittings on the ground prior to mounting onto the roof beams.
2. Substitution Replacing the hazards by one that presents a lower risk	Using a Mobile Elevated Work Platform (MEWP) instead of using a ladder to gain access to high places.
Types of Control Measures	Examples
3. Engineering Control Physical means that limit the hazard	Barricades, guardrails, handrails, etc.
4. Administrative Control System of work or work procedures that help to reduce the exposure of workers to the risk of falling	Permit to work systems; Safe Work Procedures; Toolbox briefings prior work commencement; etc.
5. Personal Protective Equipment (PPE) Equipment or devices used by workers as protection against the hazard	Personal Fall Protective Equipment such as Full Body Harness, Lanyards, SRL, etc.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

UK14 Methods for hazard identification

Select the appropriate hazard identification method in accordance with the nature of organisation, which may include:

- Size
- Activities
- Complexities of operations
- Risk profiles
- Resources available

Few methods for hazards identification

a. Safety audits

The safety audits will monitor all activities performed on site, and in particular:

- The basic safety policy and organisation of the company.
- Management commitment and example on safety matters.
- Administration and safety activity.
- Accident reporting and investigation.
- Opportunity of injury – and record of every injury.
- Safety committees.
- Working rules and practices for each company location, including visitors and contractors.
- Compliance with statutory regulations and company standards.
- Behaviour and unsafe acts of personnel and their relationship to compliance with safety rules.
- Activity related certification of employees.
- First Aid certified employees.
- Training needs and activities.
- Hazards review of process equipment for either new or existing facilities.
- Operating procedures.
- Safety work permits.
- Emergency procedures.

b. Workplace inspections - Equipment WSH checklist, WSH Inspection checklist …

Workplace inspections should involve: listening to the concerns of workers and supervisors; gaining a thorough understanding of jobs and tasks; identifying existing and potential hazards; and determining the underlying causes of hazards etc.

Workplace inspections help companies to meet legal requirements on safety and health. The inspections also enable companies to improve operations efficiency, productivity and worker morale through an accident and injury-free workplace.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

c. Job Safety Analysis (JSA) / Job Hazard Analysis (JHA)

JHA is a process that enables us to analyse and identify specific hazards associated with a task and control measures required in a systematic and structured manner. It aims to look for all of the hazards associated with a job/action that may affect the workers or people's safety and health as well as the environment.

Four basic steps of JSA:

- Job Selection - Select the job to be analysed
- Job Breakdown - Break down the job into successive steps
- Hazard Identification - Identify the hazards and potential accidents
- Hazard Control - Develop ways to eliminate hazards & potential accidents

d. FMEA (Failure Modes Effects and Analysis)

FMEA is a method to evaluate potential failure modes capable of producing problems. Features are effects, causes, indications, safeguards, and recommendations/remarks of interest.

FMEA is probably the most commonly used techniques in embedded system design. It looks for consequences of component failures, and uses Risk Prioritisation Number (RPN) to prioritize the control actions

The limitation of FMEA is that it requires expert analysis to decide what to analyse.

e. Analysis of Incident/accident reports and Injury and illness records

Checking incident /accident report is to find out the previous records, including hazardous areas and unsafe behaviour conditions etc.

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Risk Assessment Sample from Safety management system for marine industry

Cargo pump overhaul

Risk Assessment Form			
Company:	Group 2	Conducted by: (Date)	Table 2
Task:	Cargo Pump Overhaul		
Approved by: (Date)	31/10/06	Next Review Date:	30/10/09

1. Hazard Identification				2. Risk Evaluation				3. Risk Control		Reference
No.	Task Step	Hazard	Possible Accident / Ill Health & Persons-at-Risk	Existing Risk Control (if any)	Severity	Likelihood	Risk Level	Additional Risk Control	Action Officer (Follow-up date)	Document for Reference
1	Inspection of pump room	Lack of oxygen, lack of light and toxic gas	Brain damage, falling and fatality	Perform gas check, apply permit, provide adequate lighting				Inform in VSCC and safety briefing	Supervisor	
2	Isolate the system	Struck by spanner	Hand / finger injuries	Use of PPE, use of proper tools	2	2	L		Ship Staff	
3	Dismantling pipe lines	Struck by objects	Hand / finger injuries	Proper PPE and proper tools	2	2	L			
4	Remove dismantle pump casing impeller	Slip and fall	Body injuries	Clean spilled oil using saw dust	3	3	M	Safety briefing and collect the oil in container	Supervisor	
5	Clear access for pump to shift	Falling hazard	Body injuries	Barricade	3	2	M	Safety briefing	Supervisor	
6	Dismantle pump equipment in workshop	Struck by object/ pressurised liquids	Hand / finger and eye injuries	Use proper PPE, barricade and display sign boards	2	2	L		Foreman	

Lifting Pipe

Risk Assessment Form			
Company:	Group 9	Conducted by: (Date)	
Task:	Lifting of Pipes Using Tower Crane		
Approved by: (Date)		Next Review Date:	

1. Hazard Identification				2. Risk Evaluation				3. Risk Control		Reference
No.	Task Step	Hazard	Possible Accident / Ill Health & Persons-at-Risk	Existing Risk Control (if any)	Severity	Likelihood	Risk Level	Additional Risk Control	Action Officer, Designation (Follow-up date)	Document for Reference
1	Assess the weight and CG of the load	Wrong assessment of weight	• Damage to crane and lifting gears due to overloading. • Injure other workers	• Ensure that the load is within the crane capacity • Ensure lifting path is cleared from obstruction	4	1	L	• Reconfirm the weight of the load by a second party • Keep clear from any unauthorised personnel	Foreman/ Supervisor	Safe Work Procedure for lifting operation
2	Arrange proper lifting gear to be used	Wrong selection	• Body injuries • Property damage	• RA briefing for all workers. • Select proper lifting gear • Anchor point check	4	1	M	Lifting can only be carried out with the recommended lifting gears and lifting machines	Foreman/ Supervisor	Safe Work Procedure for lifting operation
3	Hook up lifting gear as co-ordinated with crane operator and signalman	• Falling from height (if rigging is required to be performed at height) • Improper handling	Hand / finger injuries	• To be carried out by a qualified rigger • Appropriate PPE used (hand glove etc.) • Select correct lifting gear for the task (size and capacity) - inspected • All loose items on the lorry must be secured / removed • Ensure tower crane operator, rigger and signalman have clear communication via walkie-talkie	4	1	M	Increase safety awareness through safety briefing/ training	Lifting Supervisor	Safe Work Procedure for lifting operation

No: 3, Soon Lee Street, 01-16,
Pioneer Junction, Singapore - 627606,
Tel: +6563347872 / Fax +6563347891
ROC: 201329358M
Email: admin@efg.com.sg ,
Website: http://www.efg.com.sg

Risk Assessment Sample from Safe management system for marine industry

Grit Blasting

Risk Assessment Form			
Company:	Group 1	Conducted by: (Date)	12/07/2006
Task:	Grit Blasting in C.S (Ballast Tank / Cargo Tank) with Scaffold		
Approved by: (Date)	12/07/2006	Next Review Date:	11/07/2009

1. Hazard Identification				2. Risk Evaluation				3. Risk Control		Reference
No.	Task Step	Hazard	Possible Accident / Ill Health & Persons-at-Risk	Existing Risk Control (if any)	Severity	Likelihood	Risk Level	Additional Risk Control	Action Officer, Designation (Follow-up date)	Document for Reference
1	Entry into C.S	• Oxygen deficiency • Oxygen enrichment • Overcome by toxic gas • Corrosive substance • Trip and slip	• Fatality • Asphyxiation • Body injuries	• Entry permit (PTW) • Continuous atmospheric monitoring • Adequate lighting • Adequate ventilation	5	1	M		Supervisor	
2	Mobilisation of equipment	• Falling hazard • Vehicle incident	• Minor hand / finger injuries • Collision • Fatality	• Trained vehicle / forklift operator • Qualified signalman / rigger • Provide appropriate PPE	2 5	2 1	L M		Supervisor	
3	Setting up and testing of equipment	Struck by compressed air/ hose/ faulty A.R	Body injuries	• Equipment checklist • Adequate safety features • Provide PPE • Checking validity of AR (Air Receiver)	4	2	M		Supervisor	