



GLOBAL SAFETY STUDIES
Safety Training & Consulting

(An ISO 9001-2015 Certified Safety Training and Consulting Organization)

**DIPLOMA IN FIRE & SAFETY
ENGINEERING**

**DIPLOMA IN INDUSTRIAL
SAFETY**

(APPROVED BY BSS, GOVT. OF INDIA)

**NATIONAL SAFETY DAY – 4th
MARCH**

**NATIONAL FIRE DAY- 14th
APRIL**

WHY SAFETY ???



WHY SAFETY???

- MORAL**
- LEGAL**
- FINANCIAL**



MORAL

- Humanitarian reason, employer (owner or client) have the moral responsibility to provide
 - Safe Work Place
 - Safe Equipments / Tools
 - Safe Working Condition



LEGAL

- As per the law,
 - Organization should full fill the legal requirement
 - To avoid fines and penalties



FINANCIAL

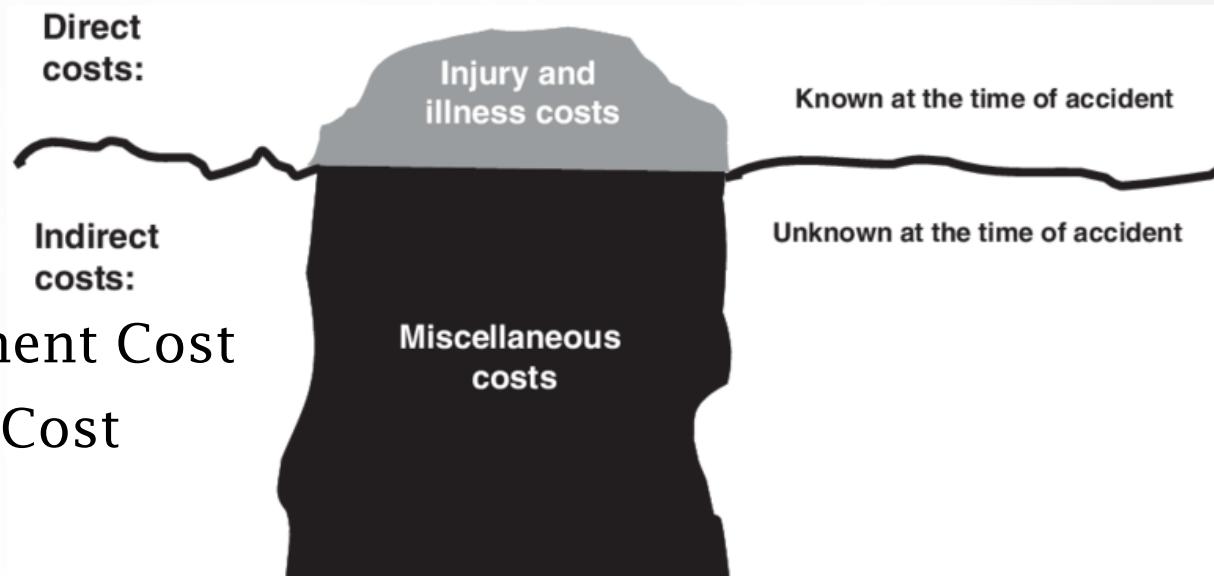
- When an accident occurs, direct and indirect cost plays important role
- DIRECT COST
 - INDIRECT COST



DIRECT COST

- Costs directly accumulated from the accident
 - Measureable Cost
 - Directly From The Accident
 - Insured Cost
 - Examples*

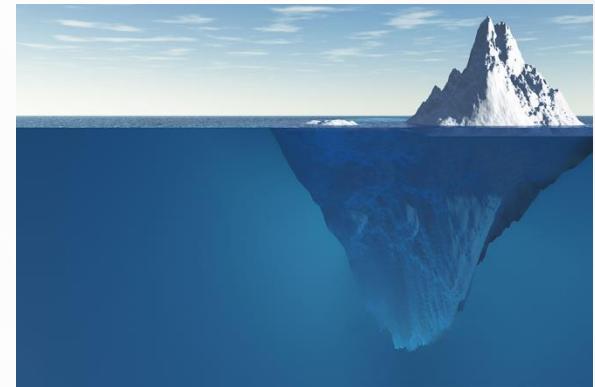
- First Aid Cost
- Medical Treatment Cost
- Compensation Cost



INDIRECT COST

- Cannot be measured which arises indirectly as the consequence of the event

- Hidden Cost
- Not Usually Insurable
- Examples*



- ✓ Cost of overtime as a result of the accident
- ✓ Cost of selecting, employing, training, educating new employees training for new workers

HSE

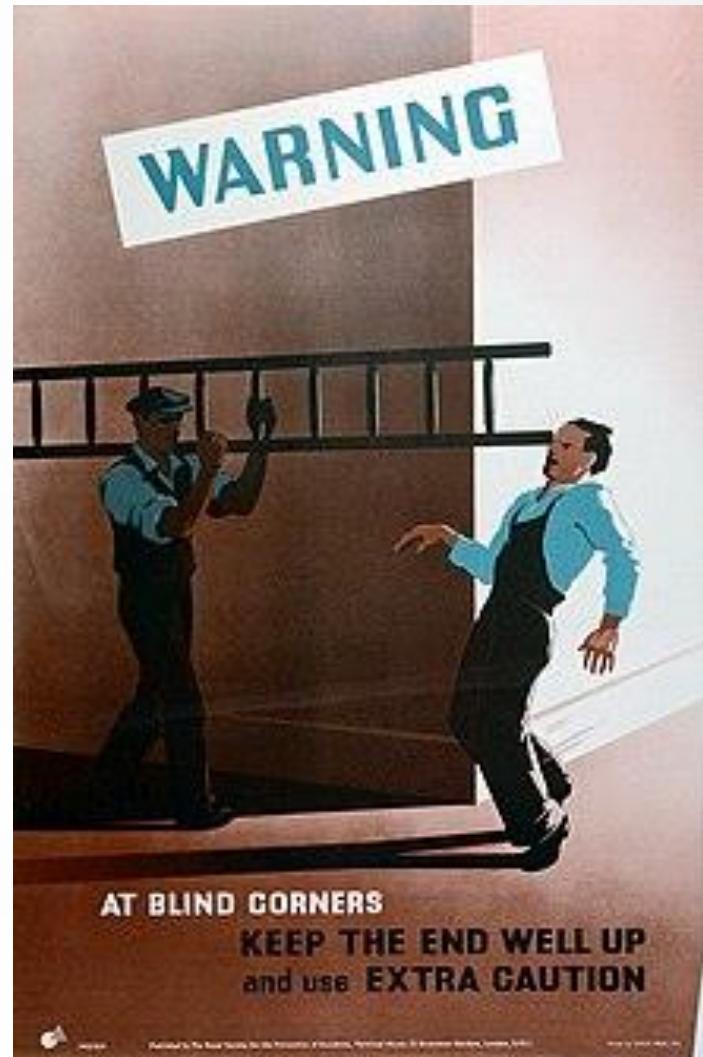
H - HEALTH

S - SAFETY

E - ENVIRONMENT

HEALTH

- Health is a state of complete physical, mental and social well being
- not merely the absence of diseases or infirmity



SAFETY

- condition of being protected from injury



SAFETY

A photograph showing a person's hand holding a blue marker, writing the word "SAFETY" in large, blue, sans-serif capital letters on a white background. A horizontal blue line is drawn underneath the word.

ENVIRONMENT

- Environment means surroundings
- Surrounding in which an organization operates
- Avoid pollution of **Air, Water, Land**
- Not to effect the natural resources, flora human and their inter relationship



DUTIES & RESPONSIBILITIES OF HSE OFFICER

- 1. Ensuring compliance with respect to health, safety, environmental as per the company, project HSE plan & statutory regulation**
- 2. Ensuring & monitoring implementation of HSE policy & plan**
- 3. Interacting & coordinating with client and other agencies**
- 4. Monitoring safety procedure & their complaints**
- 5. Ensuring and monitoring all working personal**

- 6. Conducting and organizing HSE training program**
- 7. Conducting internal safety audit, safety meeting, mock drill, emergency evacuation drill**
- 8. Organizing HSE promotional activities**
- 9. Reporting and recording of accident investigation**
- 10. Inspect the work place to identify hazard**
- 11. Making report to the findings and**

13. Preparing & updating company Safety Manual, HSE Plan, Job Safety Plan, Job Safety Analysis, Site Safety Rules, Emergency Plan

14. Ensure the availability and quality of PPE

15. Guiding and advising latest HSE norms and regulations to the management

16. Coordinate and maintain waste management systems

17. Review and update safety policies



FIRE

FIRE



**Fire is a chemical chain reaction between Fuel,
Heat and oxygen**

CLASSIFICATION OF FIRE

	DESCRIPTION	EXAMPLE
A (Solid)	Fire involving ordinary combustible <u>solid</u> materials	Wood, Paper, Textiles
B (Liquid)	Fire involving flammable <u>liquids</u>	Petroleum Products, Paints
C (Gases)	Fire involving gases or liquefied <u>gases</u>	LPG, H ₂ S, H ₂
D (Metal)	Fire that occur in combustible <u>metals</u>	Sodium, Zinc, Potassium, Mg

METHODS OF HEAT TRANSFER

CONDUCTION

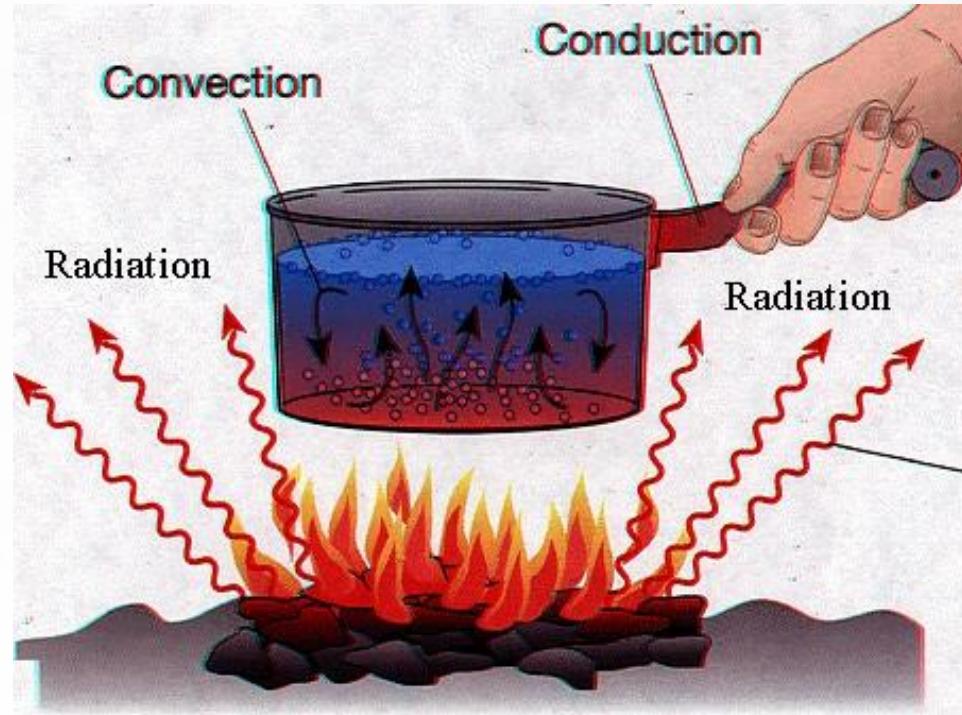
Heat transfer through a medium of solid body

CONVECTION

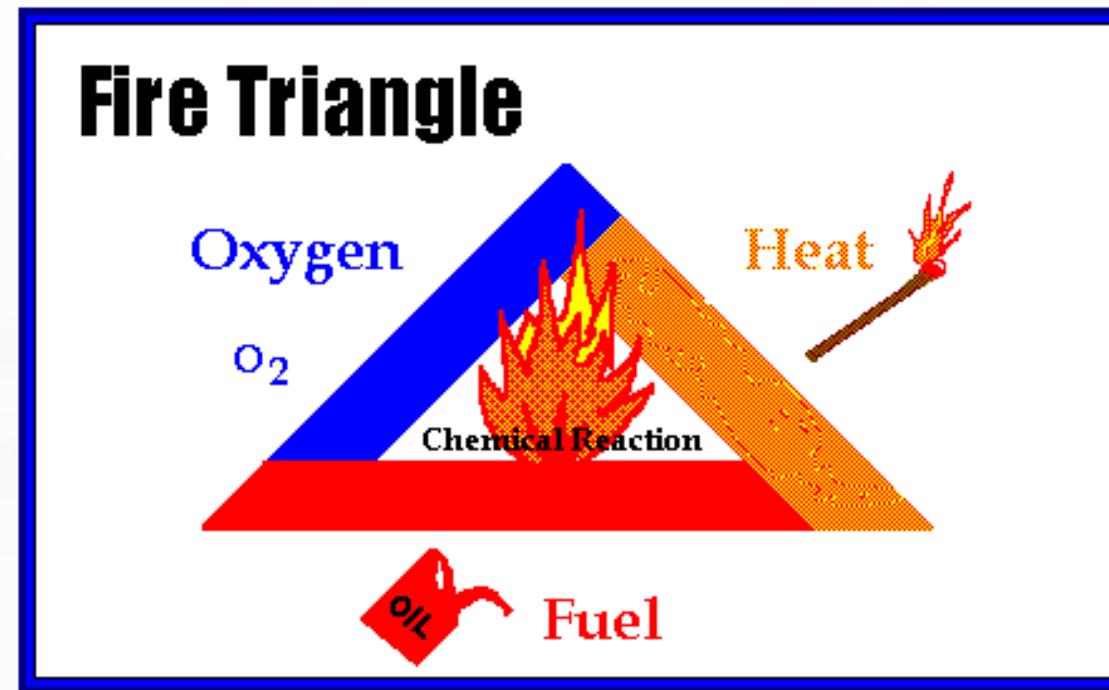
Heat transfer through upward motion of heated matters

RADIATION

Heat transfer through air heat wave



FIRE TRIANGLE



EXTINGUISHING METHODS

STARVATION

Limitation or **removal of fuel** from the scene of fire is known as starvation

SMOTHERING or BLANKETING

Limitation or **removal of oxygen** from the scene of fire is known as smothering

COOLING

Limitation or **removal of heat** from the scene of fire is known as cooling

EXTINGUISHING METHODS

STARVATION

-

REMOVAL OF FUEL

SMOTHERING

-

REMOVAL OF OXYGEN

COOLING

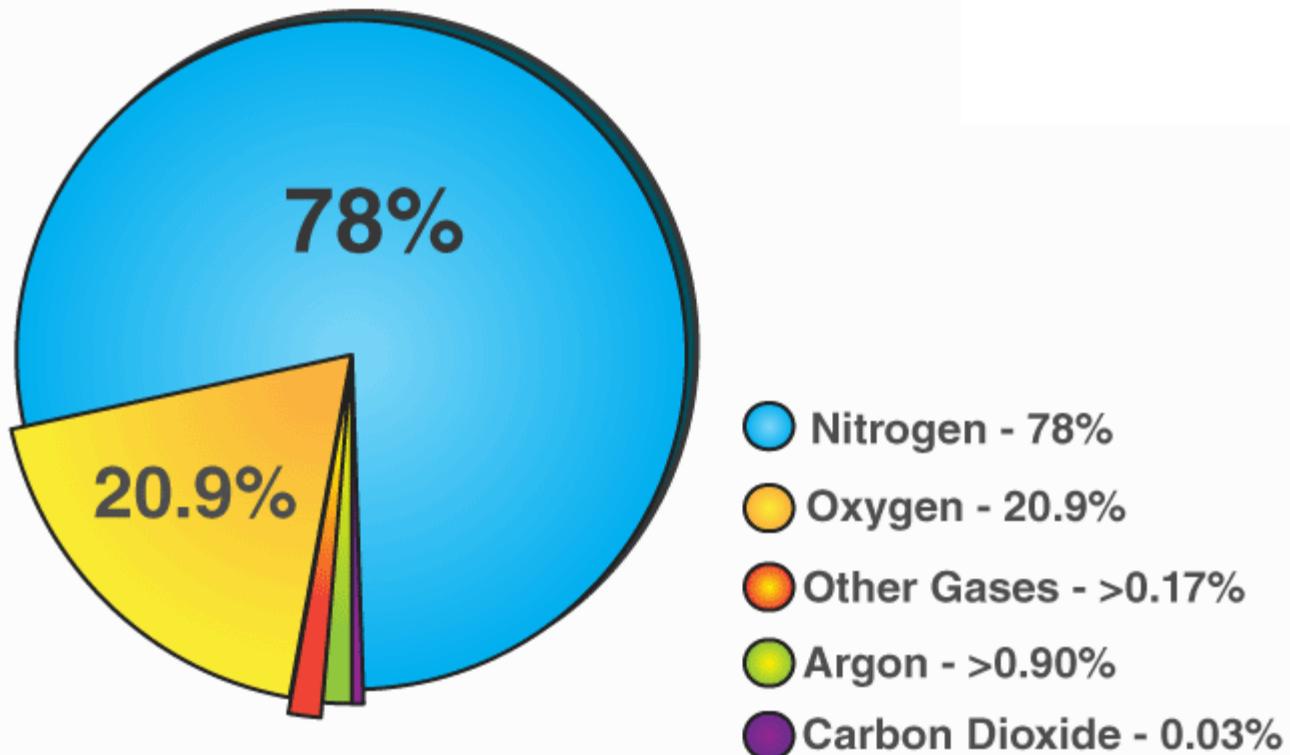
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REMOVAL OF HEAT

EXTINGUISHING MEDIA

- WATER
- FOAM
- DCP (**DRY CHEMICAL POWDER** - NaHCO₃ , NH₄H₂PO₄)
- CO₂
- SAND

COMPOSITION OF AIR





HOW TO USE FIRE EXTINGUISHER

- It is easy to remember how to use a fire extinguisher, you can remember a shot form **PASS** which stands for

Pull

Aim

Squeeze

Sweep

1. Pull the pin



2. Aim the nozzle



3. Squeeze the lever



4. Sweep side to side



Fire Safety

There are **four** essential steps to take if you discover a fire:

R**Rescue**

anyone in immediate danger of the fire.

A**Alarm**

Activate the nearest fire alarm **and** call your fire response telephone number.

C**Contain**

fire by closing all doors in the fire area.

E**Extinguish**

small fires. If the fire cannot be extinguished, leave the area and close the door.

**You
should
know:**

- Locations of nearest fire extinguishers and alarm pull boxes
- The fire location - room number and building
- All fire exits in your work area

How to properly operate a Fire Extinguisher

P**Pull**

the pin, release a lock latch or press a puncture lever.

A**Aim**

the extinguisher at the base of the fire.

S**Squeeze**

the handle of the fire extinguisher.

S**Sweep**

from side-to-side at the base of the flame.

CLASSIFICATION OF FIRE EXTINGUISHER

Class of Fire	Type of Fire	Type of Extinguisher
A	Ordinary combustibles: wood, paper, rubber, fabrics, and many plastics	Water, Dry Powder,
B	Flammable Liquids and Gases: gasoline, oils, paint, lacquer, and tar	Carbon Dioxide, Dry Powder Foam
C	Fires involving Live Electrical Equipment	Carbon Dioxide, Dry Powder
D	Combustible Metals or Combustible Metal Alloys	Special Dry Powder

TYPES OF FIRE EXTINGUISHER

WATER



TYPES OF FIRE EXTINGUISHER

FOAM



TYPES OF FIRE EXTINGUISHER

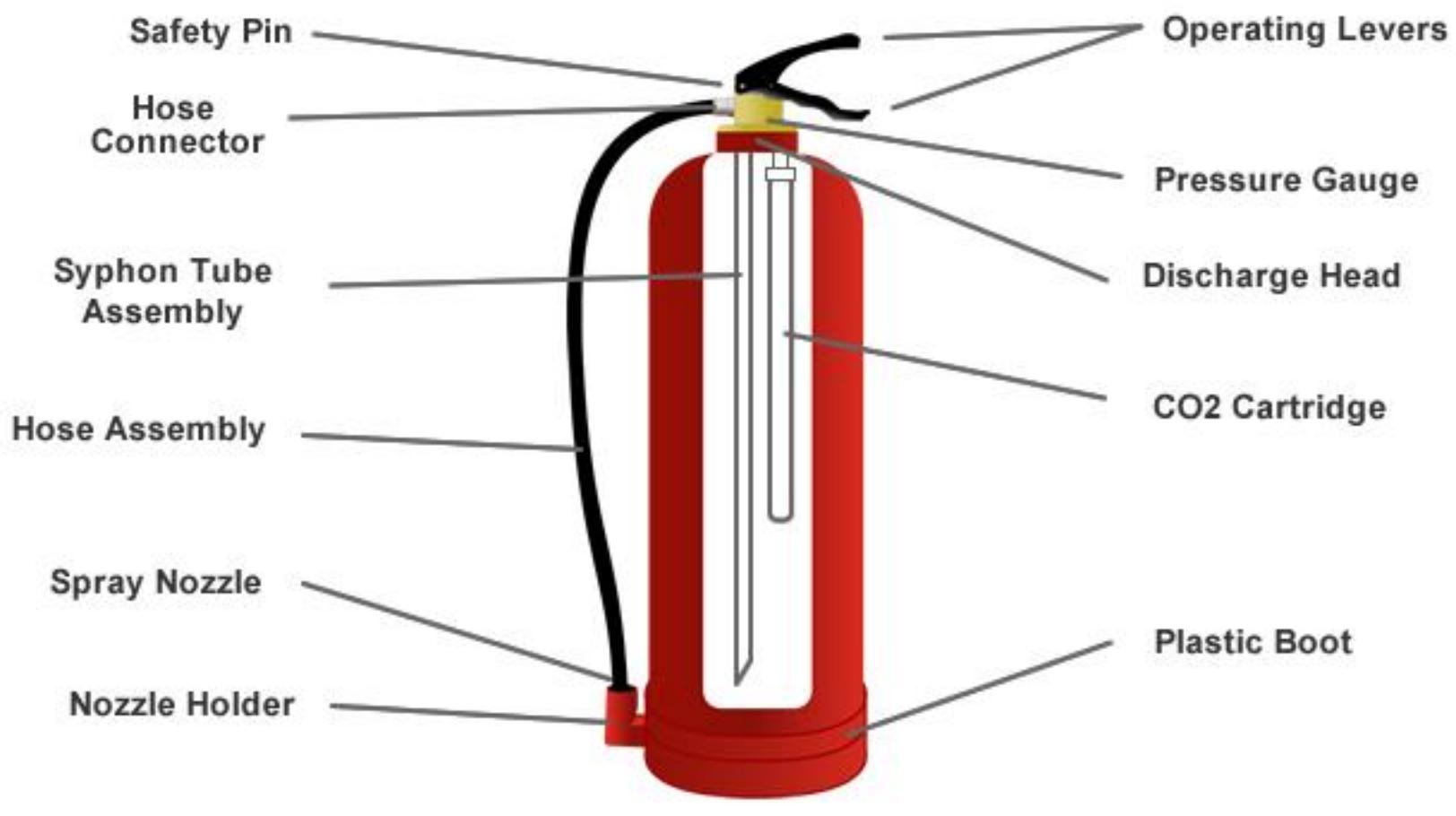
D - DRY

C - CHEMICAL

P - POWDER



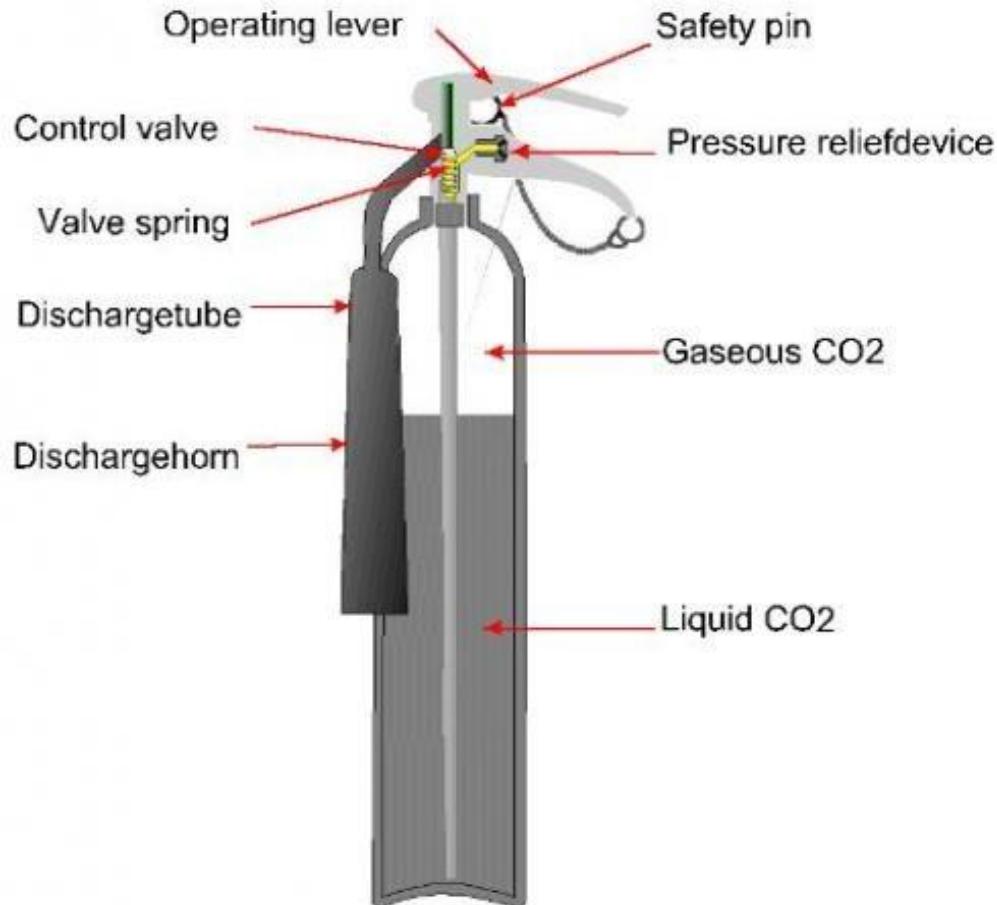
FIRE EXTINGUISHER ANATOMY



FIRE EXTINGUISHER ANATOMY

CO₂ TYPE

Carbon dioxide extinguisher



COLOUR OF EXTINGUISHER

WATER

- **RED**



FOAM

- **CREAM**



DCP POWDER

- **BLUE**

CARBON DIOXIDE

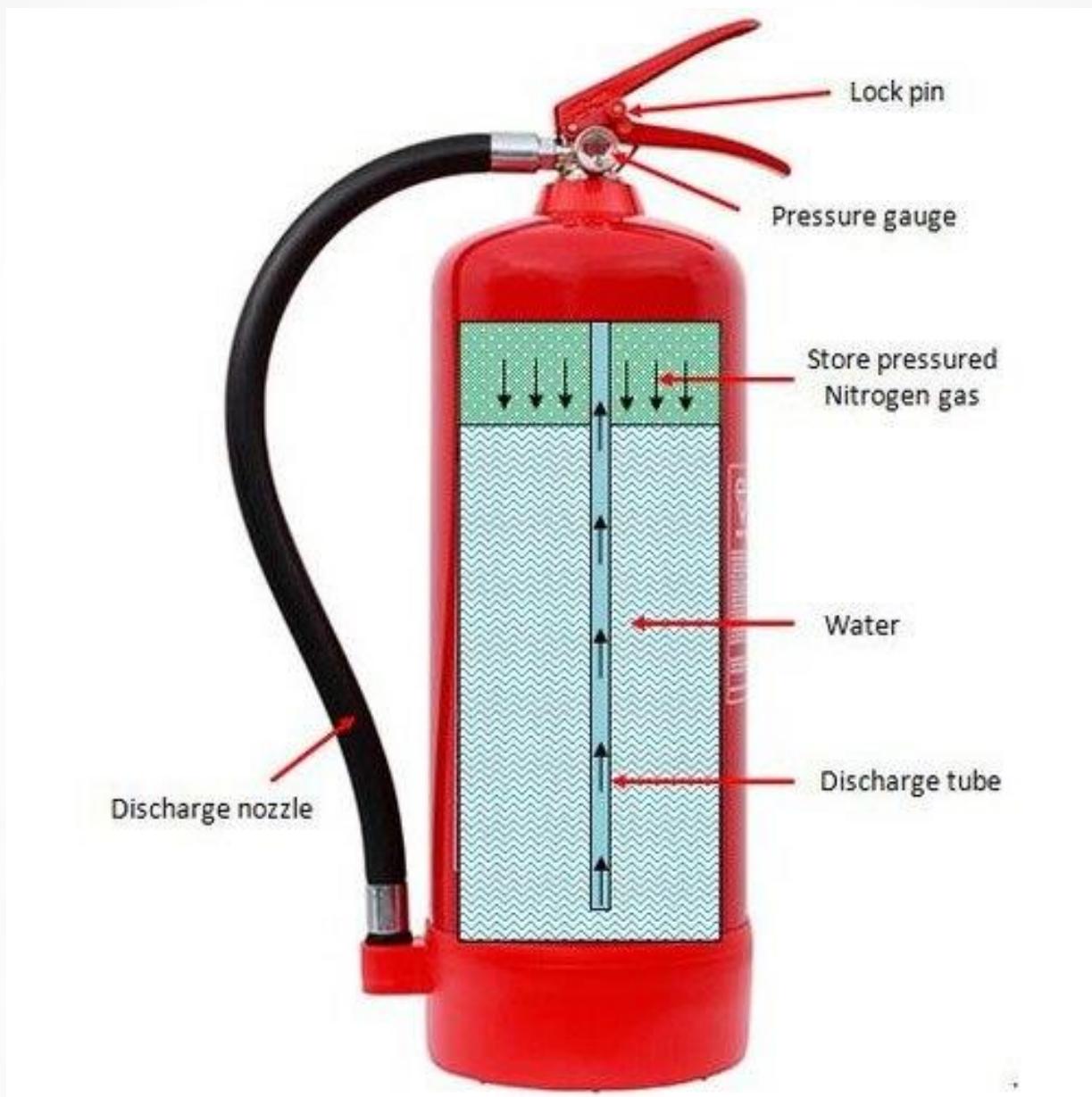
- **BLACK**



TYPES OF EXTINGUISHERS

STORED PRESSURE

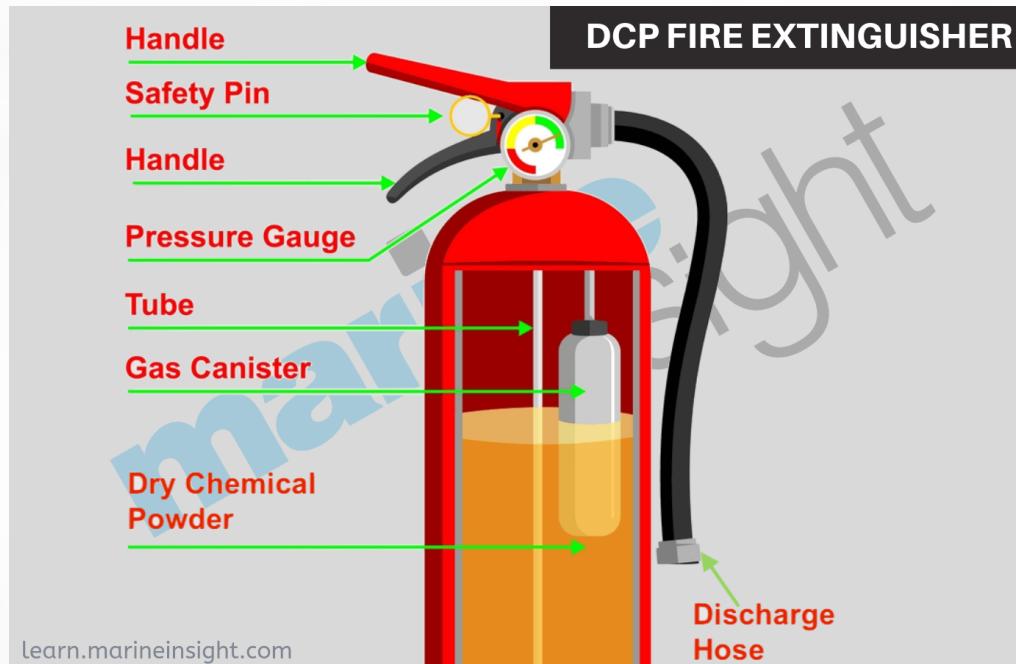
- Stored pressure fire extinguishers are easily the **most common type**
- In these units, the **expellant (propellant)** is stored in the **same cylinder as the agent itself**
- **Different agents (Water, Foam, DCP Powder)** used in the fire extinguisher may require different propellants (**Nitrogen, Dry Air**)
- Dry Chemical Extinguishers typically use **Nitrogen or Dry Air** as propellant
- Water and Foam Extinguishers typically use **Dry Air** as propellant

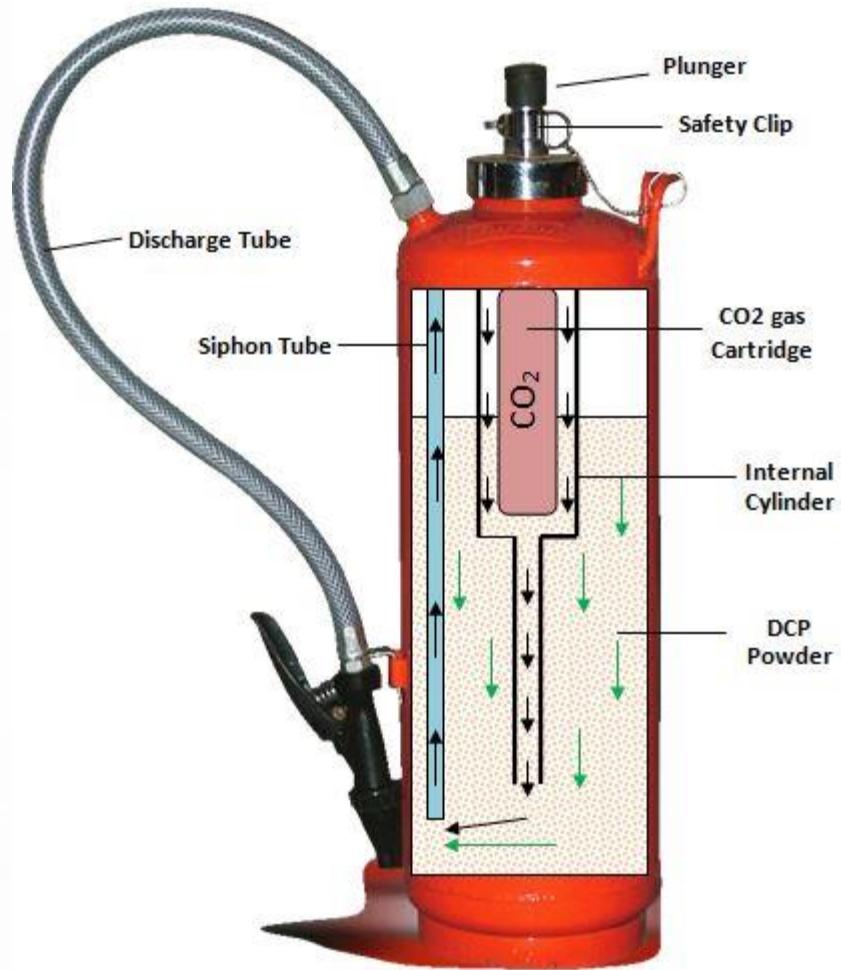
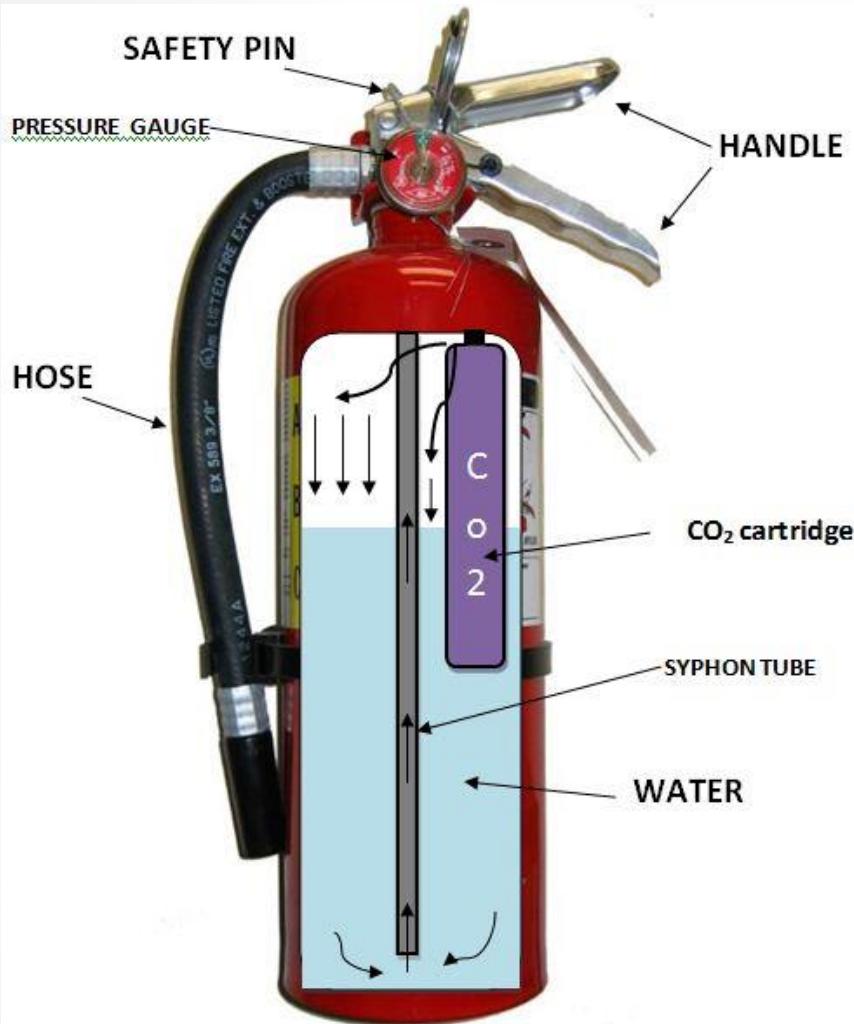


TYPES OF EXTINGUISHERS

CARTRIDGE TYPE

- In cartridge operated units, the dry chemical is stored in the **non-pressurized cylinder**
- while the propellant; either “**Dry Air**” or **Nitrogen** is stored in a **separate cartridge** located on the side of the unit





ADVANTAGES OF DCP

- Harmless to skin
- Non-conductor of electricity
- Good for blast fire
- Better than CO_2 - on liquid fire
- Non-toxic and non-corrosive

DISADVANTAGES OF DCP

- DCP cannot be used on metal fire like Na, Mg
- DCP cannot be used to produce inert atmosphere to prevent gas/vapour

FIRE EXTINGUISHER CHECKLIST

SI.NO	LOCATION	TYPE	PRESSER GUAGE	SAFETY PIN	DUE DATE	OUTER CYLINDER	HOSE NOZZLE	REMARK
1	Workshop	ABC	✓	✓	10/22	✓	✓	Nil
2	Office	CO2	✓	✓	10/22	✓	✓	Nil

DEFINITIONS

ACCIDENTS

- Accident is an unplanned event **that cause** personal injury, property damage, equipment damage or environmental pollution

INJURY

- Injury is harmful condition / damage to body as a result of an accident

HAZARD

- Hazard is a potential to cause harm to the body

DEFINITIONS

RISK

- Risk is the combination of **Likelihood** (chance) of occurrence accident and **Consequence** (Severity) of the accident

$$R = L \times C$$

NEARMISS

- Near miss is an unplanned event which **does not cause** any personal injury, property damage, equipment damage or environmental pollution but **it has potential to cause accident**. (In feature)

TOOL BOX TALK

- Tool box talk is a **pre-job meeting** in which supervisor / safety officer will explain about the job to be done and the hazard present in that job

DEFINITIONS

Who is a **COMPETENT PERSON** ?

- One who is capable of identifying and predicting hazards in the work place - Competent Person

STANDARD SAFETY SIGNAGE

MANDATORY- BLUE & WHITE



STANDARD SAFETY SIGNAGE

PROHIBITION - **RED & BLACK**



STANDARD SAFETY SIGNAGE

WARNING- **YELLOW & BLACK**



STANDARD SAFETY SIGNAGE

SAFE CONDITION- GREEN & WHITE



STANDARD SAFETY SIGNAGE

FIRE EQUIPMENT



FIRE FIGHTING EQUIPMENTS

- FIRE BLANKETS
- HOSE REELS
- FIRE FIGHTING HOSE
- FIRE MONITOR
- FIRE HYDRANT
- SPRINKLER SYSTEM



FIRE FIGHTING EQUIPMENTS

FIRE BLANKETS



FIRE FIGHTING EQUIPMENTS

HOSE REELS



HOSE REEL DRUM | K 912-H & K 912-M

FIRE FIGHTING EQUIPMENTS

FIRE FIGHTING HOSE



FIRE FIGHTING EQUIPMENTS

FIRE MONITOR



FIRE FIGHTING EQUIPMENTS

FIRE HYDRANT



FIRE FIGHTING EQUIPMENTS

SPRINKLER SYSTEM



FIRE DETECTORS

SMOKE DETECTOR



FIRE DETECTORS

HEAT DETECTORS - Temperature Sensor



COMMON CAUSES OF FIRE

- Spark from electricity
- Smoking
- Hot Work
- Naked Flame
- Hot Surface
- Spark from Vehicles
- Static Electricity
- Lightning

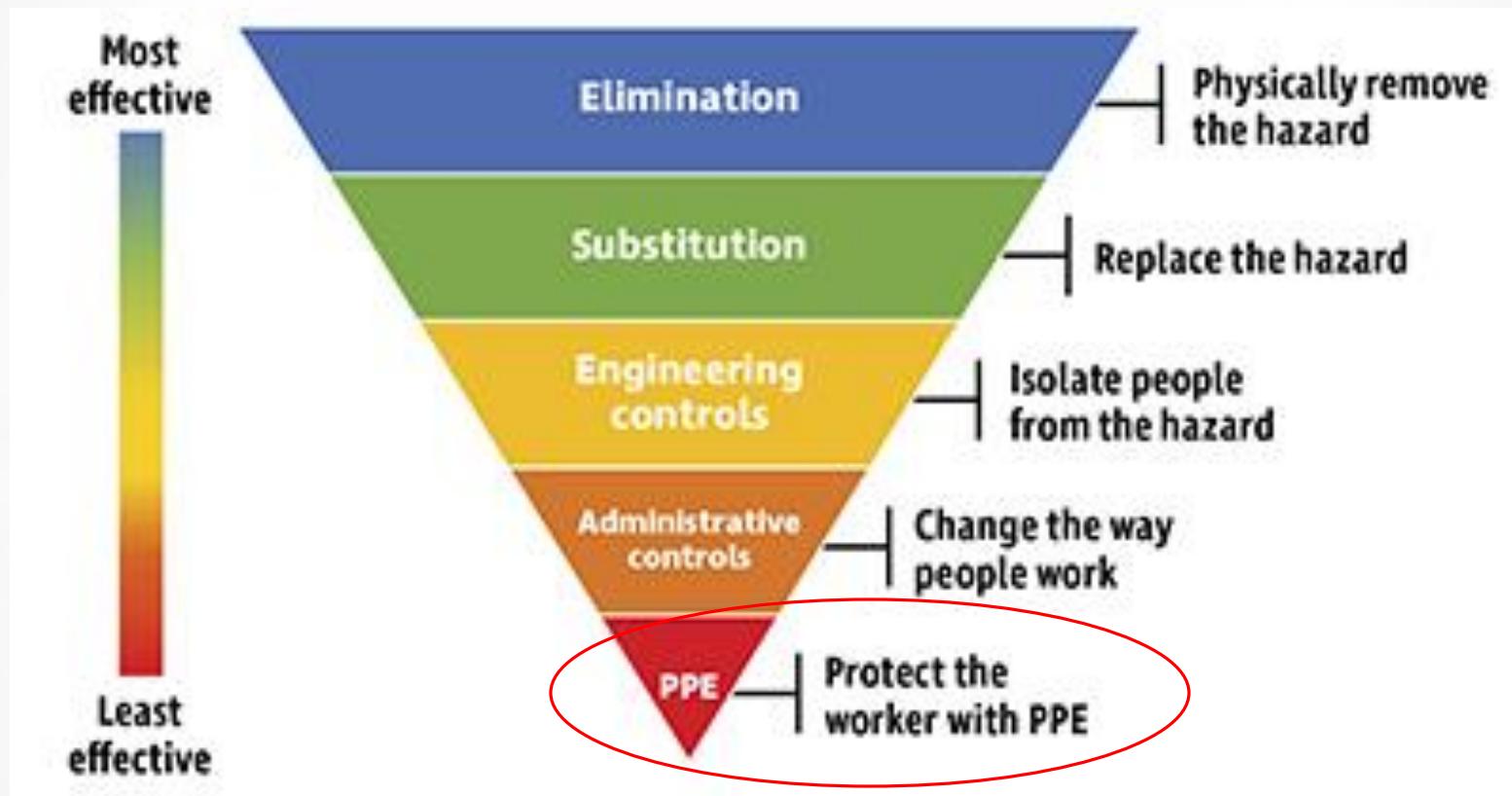
CONSEQUENCE OF FIRE

- People get Injured & Killed
- Damage to equipment/Building
- Environment Damage

**PERSONAL
PROTECTIVE
EQUIPMENT**

(PPE)

Hierarchy of Risk Control



PPEs

Protection Matters

Ear Protection

- use in noisy areas to avoid hearing loss

Respiratory Equipment

- use to protect from inhaling dust and other contaminants

Safety Gloves

- use to protect your hands from injury

You only have one body!

Safety Helmet

- use to protect your head from falling objects

Safety Glasses

- use to protect eyes from flying particles

Reflective Clothing

- use to make sure you are highly visible to other personnel

Safety Shoes

- use to protect your feet from falling or rolling objects



PERSONAL PROTECTIVE EQUIPMENT

PPE is equipment that will protect the user against health or safety risks at work



TYPES OF PPES

□ Respiratory Protective Equipment

e.g. SCBA, Air Respirators etc.



□ Non-Respiratory Protective Equipment

e.g. Hard Hat, Gloves, Goggles, Safety Shoes etc.



NON-RESPIRATORY PROTECTIVE EQUIPMENTS

COMMON PPE

- Head Protection
- Eye & Face Protection
- Hand Protection
- Foot Protection



HEAD PROTECTION

- Prevention of head injuries is an important factor in every job
- Head Injuries are caused by **falling, flying object** or by **jumbling** the head against a fixed object



HEAD PROTECTION

HEAD INJURIES



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EYE & FACE PROTECTION

- To protect face from flying particle, splashing liquids, chemicals, chemical gas, vapours, potentially injurious light radiation suitable eye protector equipment to be given

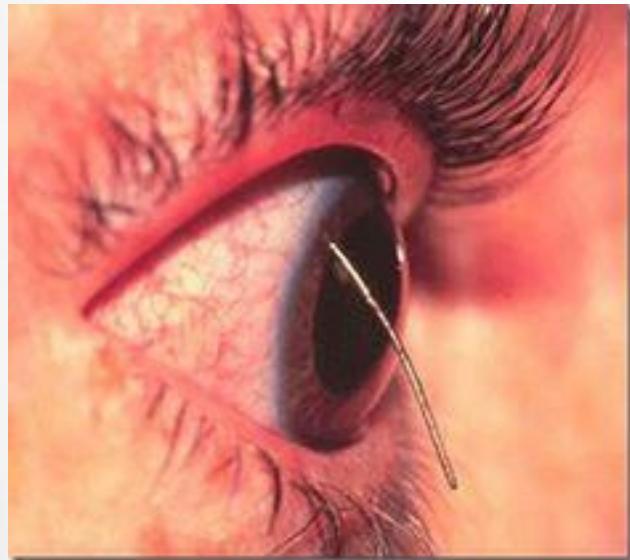


TYPES OF EYE & FACE PROTECTION

- Safety Glasses
- Safety Goggles
- Face Shields
- Welding Goggles
- Laser Safety Glass



EYE & FACE PROTECTION



FOOT PROTECTION

- To protect feet and leg from falling objects, sharp objects, hot surface and wet surface suitable feet / leg protector equipment to be used
 - Safety shoes should be sturdy and acts as a protective covering to toe
 - Some shoes contain metal insole to protect feet from puncture wounds



FOOT PROTECTION



HAND PROTECTION

- Hand protection equipment must be given to protect from hands from burns, abrasion, cuts, punctures, bruise, chemical exposure



HAND PROTECTION



TYPES OF GLOVES

- Leather Gloves
- Cotton Gloves
- Chemical Protection Gloves
- Insulated Rubber Gloves
- Welding Gloves



EAR PROTECTION

- Hearing protection device, also known as a HPD, is an ear protection device worn in or over the ears while exposed to hazardous noise (>85dB, 8hrs) to prevent noise-induced hearing loss
 - Ear Muff
 - Ear Plug



HEARING PROTECTORS

- Ear Plugs - Preferred (20-30 dB)
- Ear Muffs - 2nd Choice (15-30 dB)
- Double Hearing Protectors (plug & muff) used for levels over 115 dB



NOISE LEVELS

- Measured in decibels (dB)
 - * Whisper - 10-20 dB
 - * Speech - 60 dB
 - * Noisy Office - 80 dB
 - * Passing Truck - 100 dB
 - * Jet Engine - 150 dB
- Osha Limit - 85 dB



PERMISSIBLE EXPOSURE LIMIT - PEL

permissible noise exposure

Duration per day (hours)	Sound Level (dB)
8 HOURS	90 dB
4 HOURS	95 dB
2 HOURS	100 dB
1 HOURS	105 dB
$\frac{1}{2}$ HOURS	110 dB
$\frac{1}{4}$ HOURS	115 dB

RESPIRATORY PROTECTIVE EQUIPMENT

- Respiratory protective equipment are life saving equipment



TYPES OF PROTECTIVE DEVICES

- Air Purifying Devices (APD)
- Air Supplying Devices (ASD)
- Combination of air purifying and air supplying devices



AIR PURIFYING DEVICES

- Air purifying device cleans the contaminated atmosphere

Various types of air purifying device

- * Mechanical Filter Cartridge
- * Chemical Cartridge
- * Gas Mask
- * Powered Air Purifying Devices



AIR PURIFYING DEVICES



**Exposure to
silica dust in
construction
work**



AIR SUPPLYING DEVICES

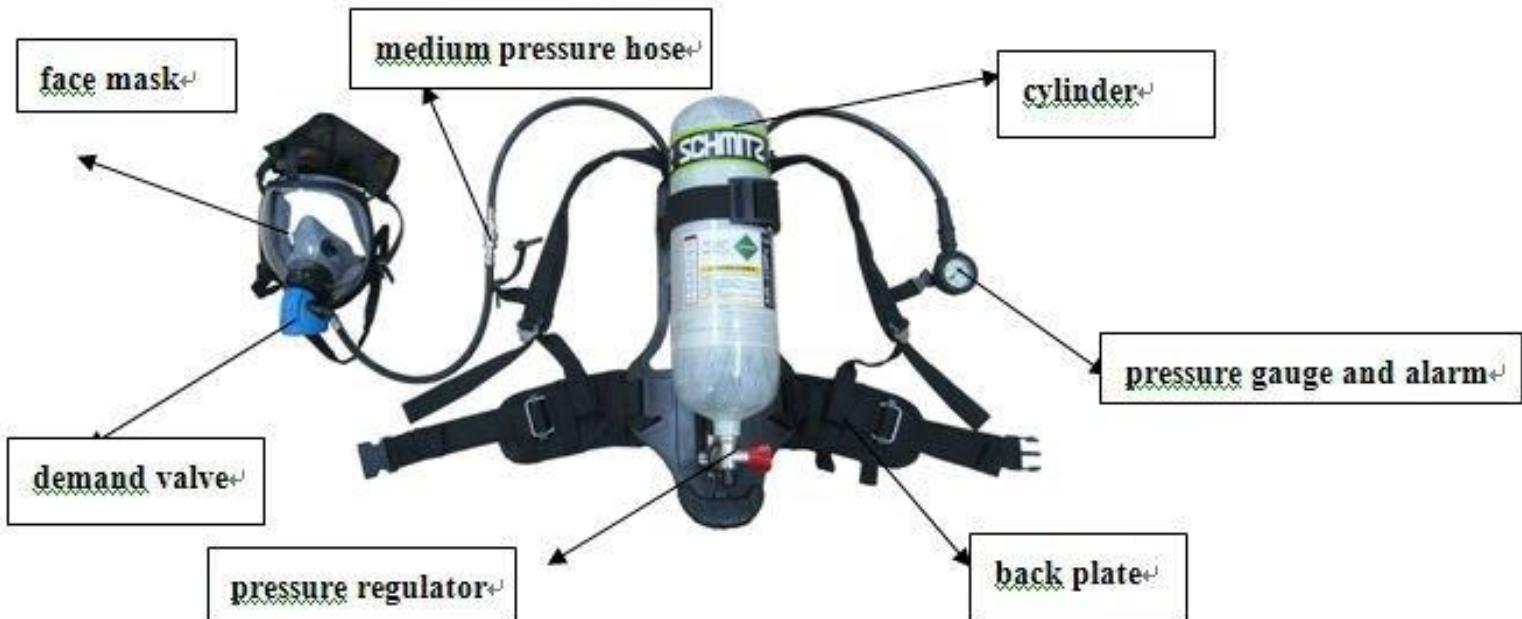
- Air supplying devices provide respirable atmosphere to the wearer, independent of the ambient air

Types of Air Supplying Devices

- Self Contained Breathing Apparatus (**SCBA**)
- Compressed Air Breathing Apparatus (**CABA**)
- Emergency Escaping Breathing Apparatus (**EEBA**)
- Air Line Respirator (**ALR**)



BREATHING APPARATUS ANATOMY



SAFETY INSPECTION

Definition

- It is the process of identification of hazards
- It helps to give control measure

During a Site Safety Inspection

- House Keeping
- Safety Sign Board
- Welfare Facility
- Fencing & Security
- Stores & Storage System
- Fire Extinguisher

- Fire Procedures
- First Aid Facility
- PPE (Personal Protective Equipment)
- Barricading
- Scaffolding & Working Platform
- Ladder
- Cranes & Lifting Equipment
- Excavation
- Confined Space
- Electricity
- Over Head & Under Ground Services
- Electrical Equipment & Tools
- Welding Equipment
- Hazardous Substances To Health
- Other Hazards

HOUSE KEEPING



GLOBAL SAFETY STUDIES

HOUSE KEEPING

Definition

- Place for everything and everything in its proper place

Good House Keeping is the key to Safety

House Keeping
is
Everyone's Responsibility

HOUSE KEEPING

Benefits of House Keeping

- Good house keeping **prevents** accidents and injuries
- Good house keeping **save** space, time and materials
- When a work place is clean workers **feel better, think better, and do better**
- **Good impression** with visitors
- Hazard elimination



HOUSE KEEPING

Accidents due to poor house keeping

- **Tripping** over loose objects on floors, stairs and platforms
- Falling objects cause **hit injury**
- **Slipping** on greasy, wet or dirty surface



HOUSE KEEPING

INJURIES FROM SLIP FALL & TRIP FALL

- Broken bones
- Back or spine injury
- Sprains
- Death



HOUSE KEEPING

GOOD HOUSE KEEPING

- All material should be properly stored
- Keep bolts, nuts, etc... in a tray/ bucket
- Pipes, scaffold materials, etc... are potential trip hazard. Don't store in the walkway
- Don't store materials on working platform and near access Ladder / Stair
- Don't route cables & hoses through staircase / ladder posing potential trip hazard
- Don't drain sticky material/oil on floor posing slip fall hazard

HOUSE KEEPING

- Don't use fire water for cleaning
- Don't block access to fire and emergency equipment



HOUSE KEEPING

Good House Keeping Checklist

- Walls cleans
- Window cleans
- Provide proper lighting system
- Platform in good condition
- Stairs clean and dry
- Free from oil, grease etc...
- Safe and free access to work position
- Employees Facilities
- Waste Disposal
- Storage
- Tools and Equipment

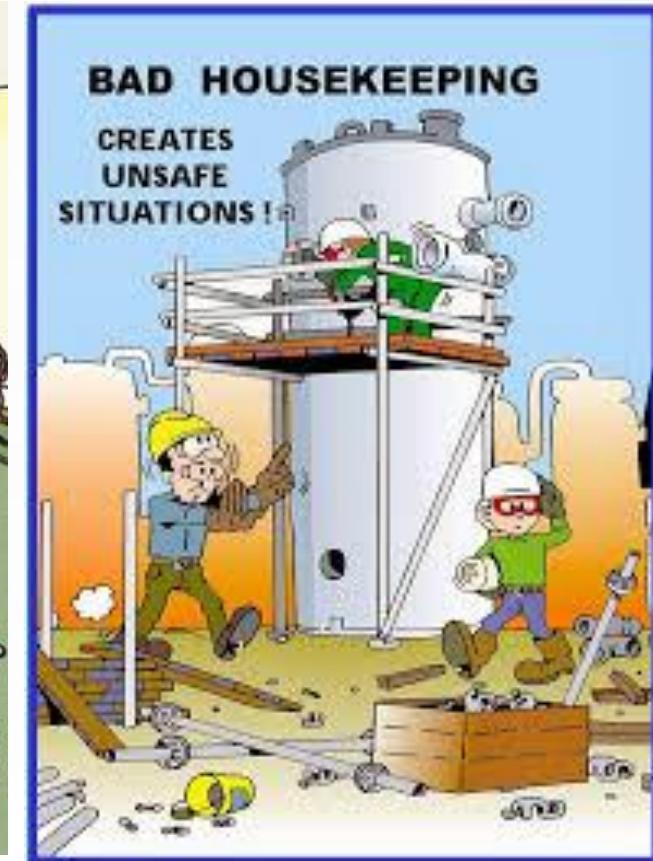
HOUSE KEEPING

WHAT IS YOUR FAVORITE PLACE TO WORK ?



HOUSE KEEPING

BAD HOUSEKEEPING



Example: Waste container over flowing

HOUSE KEEPING

GOOD HOUSE KEEPING



HOUSE KEEPING

BAD HOUSE KEEPING



ENVIRONMENT



GLOBAL SAFETY STUDIES

ENVIRONMENT

DEFINITION

Environment means the **surrounding** in which as **organization operate** including Air, Water, Land, natural resources, flora human and their inter relationship.



ENVIRONMENT

TYPES OF POLLUTION

- AIR POLLUTION
- WATER POLLUTION
- LAND POLLUTION



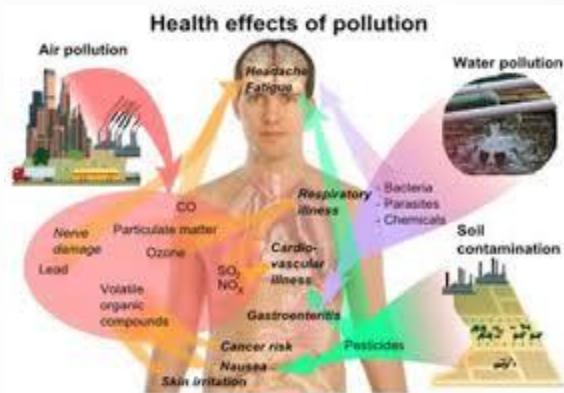
Land Pollution



ENVIRONMENT

Effects of pollution

- Reduced lung functioning
- Irritation of Eyes, Nose, and Mouth
- Asthma attack
- Respiratory disease
- Reduce energy level
- Head ache
- Mental disorder
- Cancer
- Death



ENVIRONMENT

How to save environment

- Do not waste water
- Prevent pollution on the ground, air, and water by avoiding any chemical spills
- Ensure all waste is collected and placed in to the specific containers
- Use toilet facilities
- Do not burn waste
- Do not kill any wild
- Report any chemical spills
- Site vehicle to have spill kits
- Store chemical only in the approved storage area where spill kit are available

WASTE MANAGEMENT

WHAT IS WASTE MANAGEMENT ???..

- Waste management - safely disposing the by-product of a process or a work to the environment (after proper treatment, if necessary)
- So that **no threat** for livings, properties and environment exists

WASTE DISPOSAL

CLASSIFICATION OF WASTE

- HAZARDOUS WASTE
- NON-HAZARDOUS WASTE



WASTE MANAGEMENT

**General waste
non-hazardous**



WASTE DISPOSAL

HAZARDOUS WASTE

- Highly flammable waste
- Chemical waste
- Toxic waste
- Corrosive waste
- Electronic waste



WASTE DISPOSAL

NON-HAZARDOUS WASTE

- House waste
- Food waste
- Paper
- Wood
- Cotton



WASTE DISPOSAL

SEGREGATION (பிரிக்கு வைக்கல்)

Waste must be segregated to prevent the mixing and contamination of one type of waste with another.

It usually requires separate as well as secure storage for each type waste with clear identification



Movement

- People Movement
- Vehicle Movement

**MOVEMENT
OF
PEOPLE**

MOVEMENTS OF PEOPLE

Hazard: Slip Fall & Trip Fall

Cause of Slip Hazard

- Smooth floor surface
- Wet
- Oil and Grease
- Frost and Ice



MOVEMENTS OF PEOPLE

Cause of Trip Hazard

- Uneven or loose floor surface
- Trailing cables
- Object at floor



MOVEMENTS OF PEOPLE

Control Measures

- Good House Keeping
- Risk Assessment
- Maintenance of Machinery
- Slip Resistance Surface
- Spillage Control kit
- Use of proper signage and PPE
- Lay cables / Cable Rails
- Designated Walk Ways



**MOVEMENT
OF
VEHICLE**

VEHICLE COLLISION



GLOBAL SAFETY STUDIES

VEHICLE COLLISION

Collision can occur between the vehicle

- Other Vehicle
- Pedestrians
- Fixed object



VEHICLE COLLISION

Factors that increase the Risk of Vehicle Collision

- Driver Error

Example: Driving Too Fast

- Inadequate Lighting
- Reversing without the help of a banks man
- Bad Weather Condition
- Obstructed Visibility
- Poor design of Pedestrian Walkways and Crossing point
- Lack of Vehicle Maintenance

Example: Break Failure

MAIN CAUSES OF ACCIDENT

ACCIDENT

Accident is an **unplanned event** that results Personal Injury or Property Damage or Equipment Damage or Environmental Pollution.

- Unsafe Action**
- Unsafe Condition**



UNSAFE ACTION

Definition

Where the **action of the people** in the work place directly cause or contribute to the incident

- Use wrong tools
- Arranging or placing object unsafely
- Using equipments unsafely
- Operating without permission

UNSAFE ACTION

- Working At Unsafe Speed
- Using Defective Equipment & Tools
- Failure to use of PPE
- Improper Lighting
- Smoking
- Horse Play
- Not Using Safety Devices
- Not Reporting Safety Problems
- Working under the Influence of Alcohol

UNSAFE ACTION



UNSAFE CONDITION

DEFINITION

WHERE THE **PHYSICAL CONDITION** AT THE WORK PLACE, OR METHODS OF WORK, DIRECTLY CAUSE OR CONTRIBUTE TO THE INCIDENT

- INADEQUATE GUARDING
- DEFECTIVE TOOLS
- INADEQUATE VENTILATION
- EXCESSIVE NOISE

UNSAFE CONDITION

- NO PERSONAL PROTECTIVE EQUIPMENTS
- WET AND SLIPPERY SURFACE
- BAD HOUSEKEEPING
- UNSAFE LIFTING
- UNSAFE EQUIPMENTS
- UNSAFE SYSTEM OF WORK
- UNSAFE ENVIRONMENTAL CONDITIONS

UNSAFE CONDITION



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DOMINO THEORY

- 88% of accidents due to unsafe action
- 10% of accidents due to unsafe condition
- 2% Unavoidable Accidents

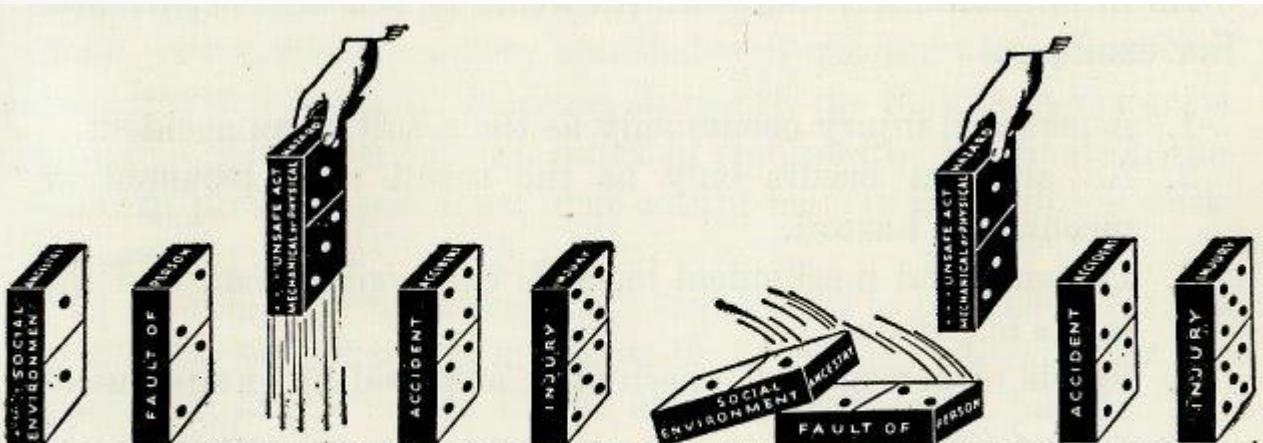
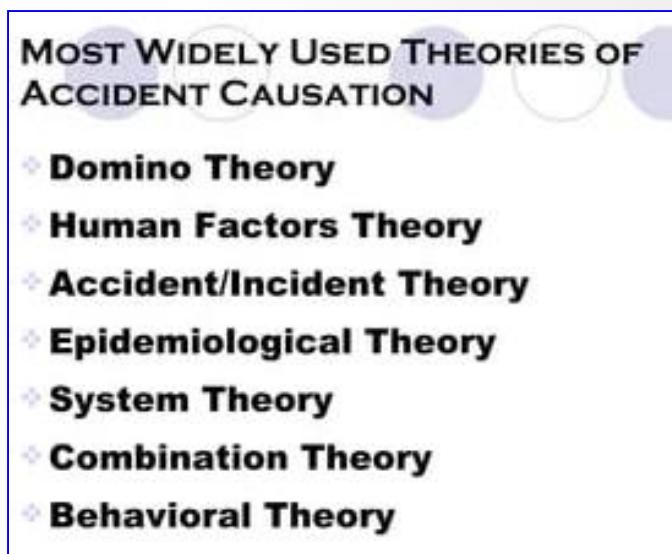


FIG. 4. The unsafe act and mechanical hazard constitute the central factor in the accident sequence.

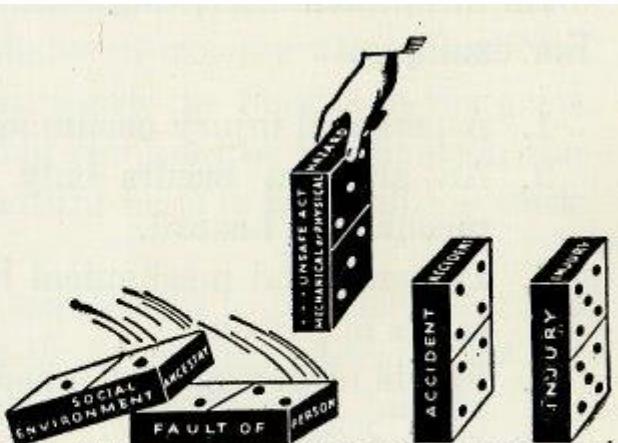
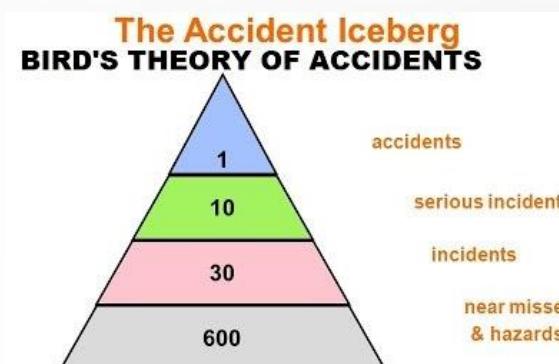


FIG. 5. The removal of the central factor makes the action of preceding factors ineffective.



ELECTRICAL SAFETY



GLOBAL SAFETY STUDIES

ELECTRICAL SAFETY

ELECTRICITY

- Flow of electron in a conductor in a closed circuit
- Flow of current only possible by voltage source

HUMAN REACTION (at 60Hz)	CURRENT (milliamperes)
PERCEPTION—A slight tingling sensation	1.1
CAN'T LET GO—Arm and hand muscles close involuntarily (120 lb. person)	10.0
CAN'T LET GO—(175-lb. person)	16.0
CAN'T BREATHE—Paralysis of the chest muscles	18.0
HEART FIBRILLATION—Rapid irregular contractions of the heart muscles—could be fatal.	65.0

ELECTRICAL SAFETY

ELECTRICAL HAZARD

- PRIMARY HAZARD
- SECONDARY HAZARD

PRIMARY HAZARD (**B-SAFE**)

- BURN**
- SHOCK**
- ARC FLASH**
- FIRE**
- EXPLOSION**



SECONDARY HAZARD

- Person fall from height
- Lose of information
- Dropping of tool and objects
- Unexpected movements of machinery
- Health hazard due to release of Toxic Gas & Production of UV rays
- Environmental Hazard

ELECTRICAL SAFETY

Effects of Electrical Shock

- Damage to nervous system
- Irregular heart beat
- Internal burns
- Stop breathing
- Skin surface burn

ELECTRICAL SAFETY

Major Cause of Electrical fire

- Overloading of circuit
- Octopus wiring
- Improperly rate circuit
- Poor damage insulation
- Poor connection
- Flammable materials

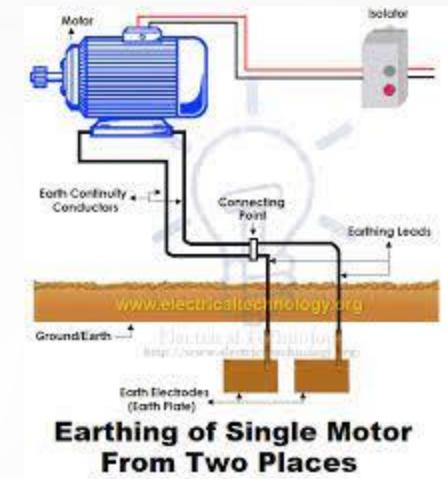
ELECTRICAL SAFETY

ELECTRICITY PROTECTIVE DEVICES

- FUSE
- EARTHING
- ISOLATION
- ELCB
- MCB
- RCD

SAFETY ARRANGEMENTS

- Proper Inspection
- Use Distribution Board (DB)
- All cable joints made with Industrial Plug
- Give proper Earthling (Double Earthling)
- Use proper PPE
- Generator area to be cleaned properly
- No flammable material near DG
- Provide Extinguisher, Sign Board and Barricading around the DG
- Don't lay cables on wet area



ELECTRICAL SAFETY

INDUSTRIAL PLUG.



ELECTRICAL SAFETY

Emergency Action

- Don't touch the casualty
- Call for help
- Isolate from the power supply
- Call for ambulance
- Check for breathing
- Treat burns
- Treat for physical shock
- Ensure medical assistance

LOTO

(LOCK OUT TAG OUT)



LOTO

Definition

Lockout means **physically neutralize all energies in a piece of equipment** before beginning any maintenance or repair work.

Lock out generally involve , Stopping all energy flows and provide a tag to help

Isolation Types : Mechanical and Electrical



LOTO: COLOUR CODE

ELECTRICAL DEPT

- RED

MECHANICAL DEPT

- YELLOW

INSTRUMENTATION DEPT

- BLUE



LOTO

DIFFERENT TYPES OF LOCKS



ISOLATION

Electrical isolation is the **separation between two circuits** that restricts the Direct Current (DC) and any unwanted Alternating Current (AC) in a power supply.

Isolation prevents dangerous voltages to the operator in the event of an electrical fault/failure or during a surge from lightning.



SCAFFOLDING



SCAFFOLDING

DEFINITION

Scaffolding is a **temporary elevated platform** to **do the height work safely**

INTRODUCTION

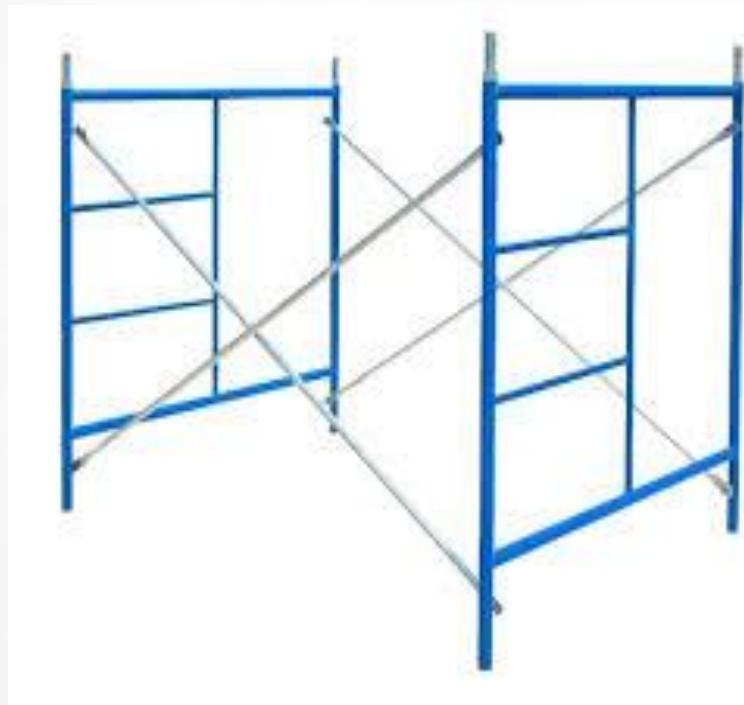
It is estimated that **2.3 million** construction **workers** deal with scaffolding **each year**. More than **10,000** workers are **injured** and **80** are **killed** in scaffolding related accidents

TYPES OF SCAFFOLDS

- Frame Scaffolding
- Tube and Clamp Scaffolding
- Modular System Scaffolding
- Rolling Scaffolding (Mobile Scaffolding)
- Suspended Scaffolding

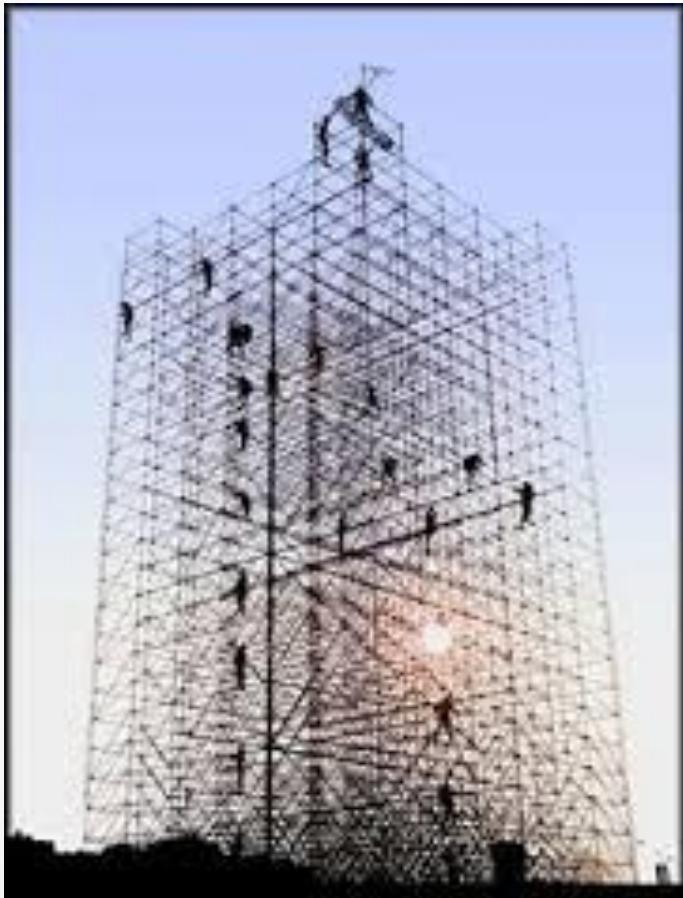
TYPES OF SCAFFOLDS

FRAME SCAFFOLDING



TYPES OF SCAFFOLDS

TUBE AND CLAMP



TYPES OF SCAFFOLDS

MODULAR SYSTEM SCAFFOLDS



TYPES OF SCAFFOLDS

ROLLING SCAFFOLDING (MOBILE SCAFFOLDING)



TYPES OF SCAFFOLDS

SUSPENDED SCAFFOLDING



TYPES OF SCAFFOLDING

(BASED ON WORKING LOAD)

- LIGHT DUTY SCAFFOLD
- MEDIUM DUTY SCAFFOLD
- HEAVY DUTY SCAFFOLD
- SPECIAL DUTY SCAFFOLD

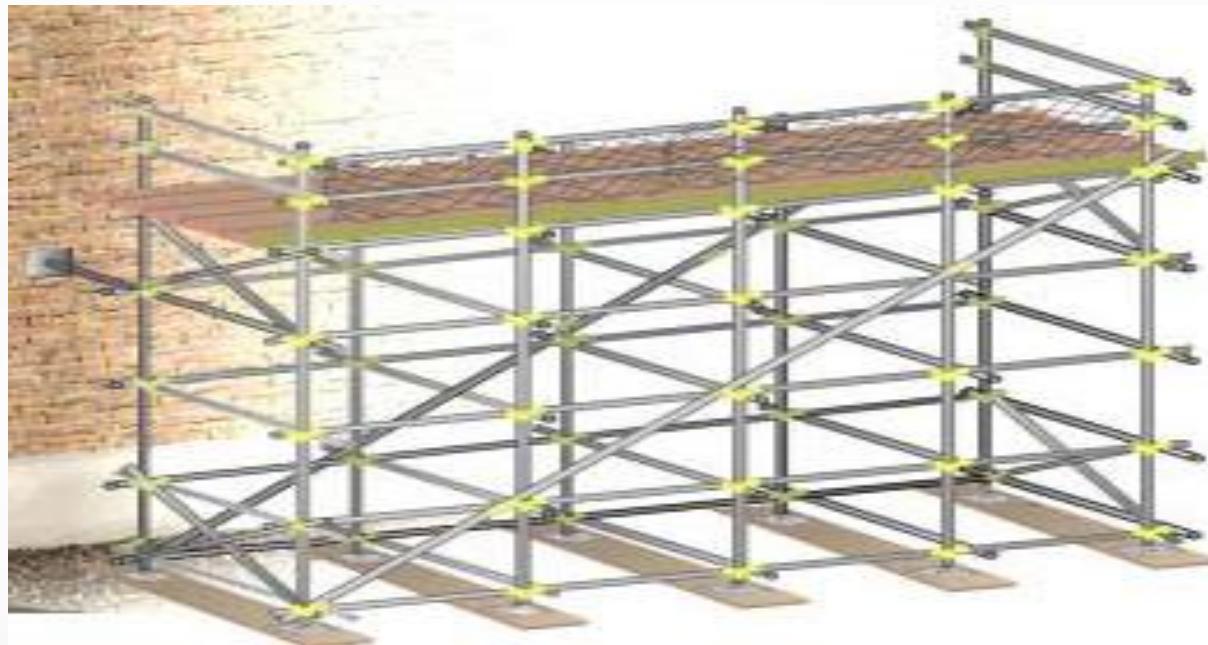
LIGHT DUTY SCAFFOLD

Scaffold designed and constructed to carry a working load **not exceed 150kg/m²**



MEDIUM DUTY SCAFFOLD

Scaffold designed and constructed to carry a working load **not exceed 200kg/m²**



HEAVY DUTY SCAFFOLD

Scaffold designed and constructed to carry a working load **not exceed 250kg/m²**



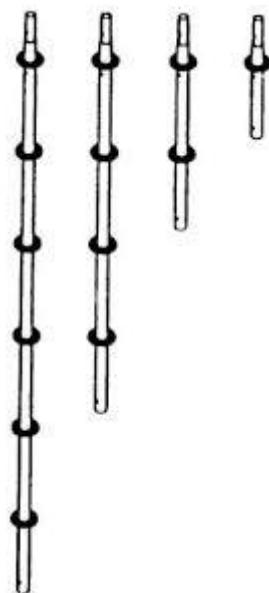
SPECIAL DUTY SCAFFOLD

SCAFFOLD DESIGNED AND CONSTRUCTED TO CARRY
SPECIFIC TYPE OF OBJECTS



COMMON PARTS OF SCAFFOLD

- Sole board/ sills
- Base plate
- Standard/ post
- Ledger
- Brace
- Transom
- Coupler
- Working platform
- Guard rails
- Access ladder



LEDGER



COMMON PARTS OF SCAFFOLD

SOLE BOARD/SILLS

SILVER OAK WOODEN PLANK SUPPORT BASE PLATE AT GROUND.



COMMON PARTS OF SCAFFOLD

BASE PLATE

IT IS A MILD STEEL SQUARE-PLATE

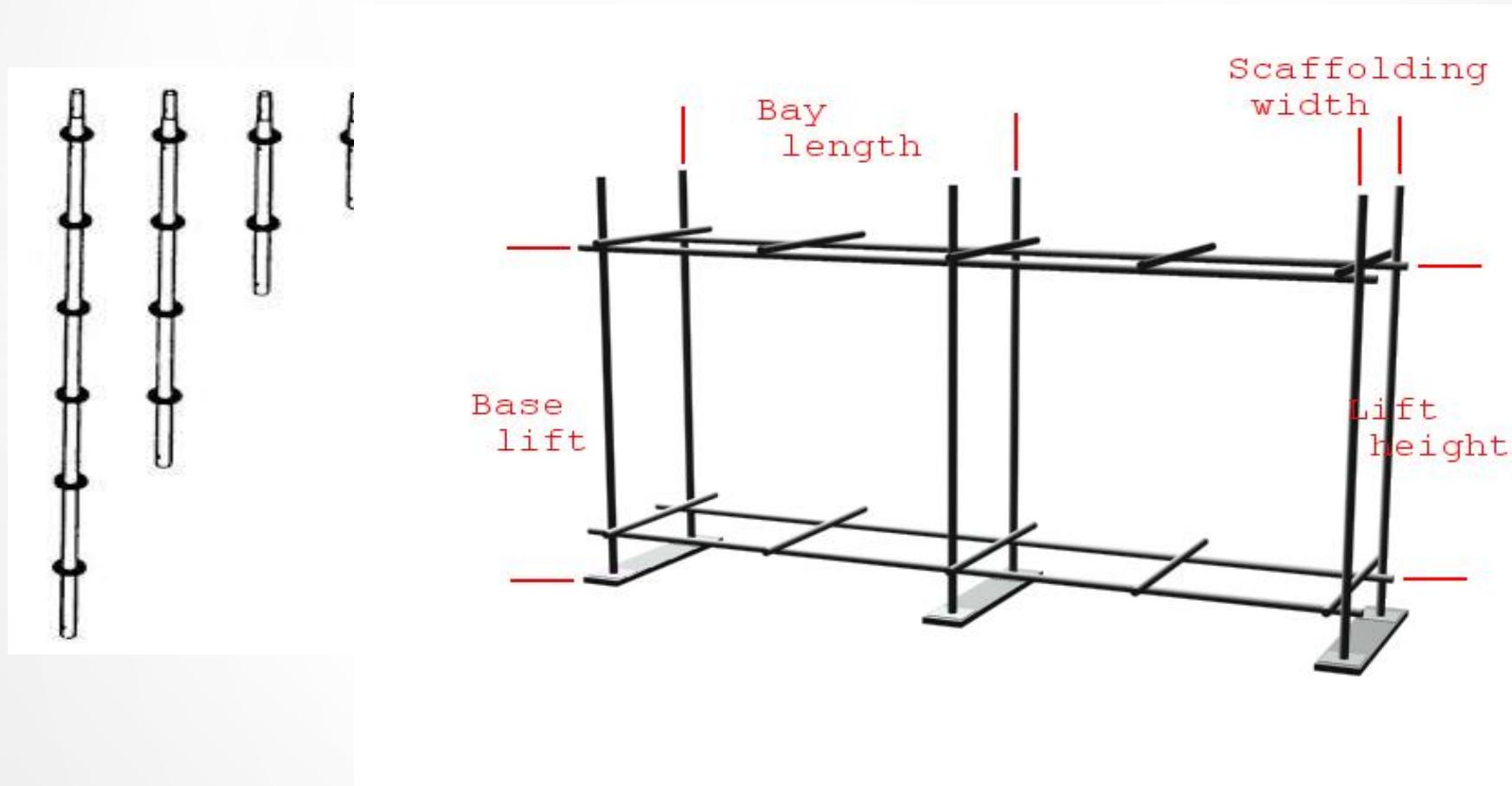


builderbill

COMMON PARTS OF SCAFFOLD

STANDARD/POST

IT IS VERTICAL SCAFFOLD TUBE



COMMON PARTS OF SCAFFOLD

LEDGER

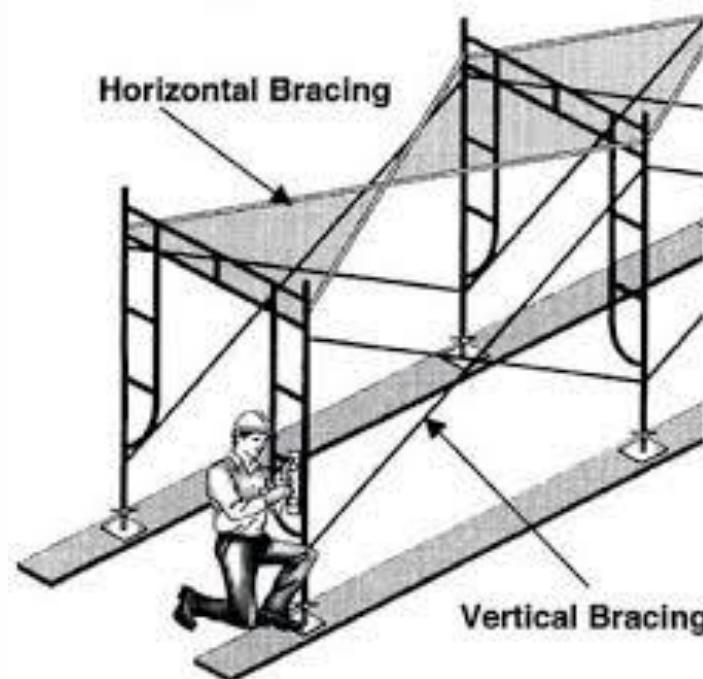
IT IS HORIZONTAL SCAFFOLD TUBE



COMMON PARTS OF SCAFFOLD

BRACE

A TUBE PLACED TO THE VERTICAL AND HORIZONTAL MEMBERS OF A SCAFFOLD AND FIXED TO THEM TO GIVE STABILITY.



COMMON PARTS OF SCAFFOLD

TRANSOM

TUBES FIXED AT RIGHT ANGLE ACROSS THE LEDGERS,
ADJACENT TO EACH PAIR OF STANDAEDS TO
SUPPORT THE SCAFFOLD BOARDS



builderbill



COMMON PARTS OF SCAFFOLD

COUPLER

A DEVICE FOR LOCKING TOGETHER COMPONENT PARTS OF TUBE AND COUPLER SCAFFOLD .



COUPLER

TYPES OF COUPLERS



COMMON PARTS OF SCAFFOLD

WORKING PLATFORM

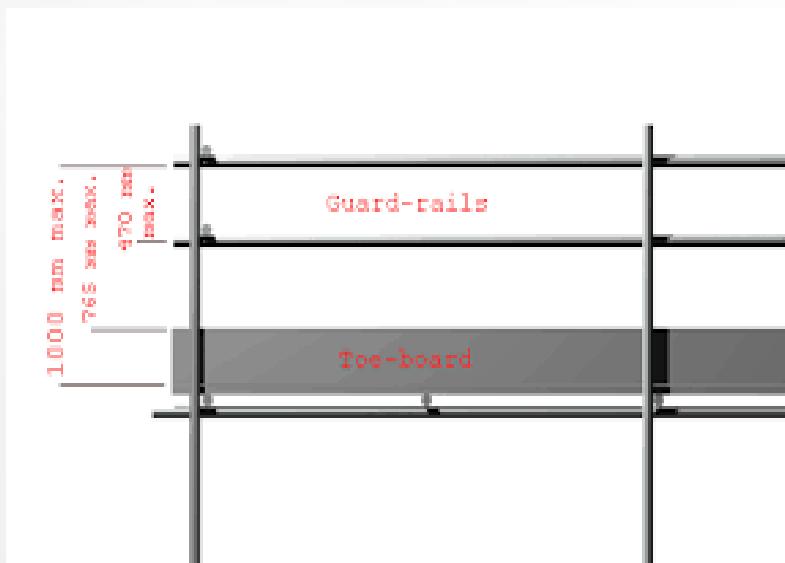
AN ELEVATED WORK SURFACE COMPOSED OF ONE OR MORE PLATFORM UNITS.



COMMON PARTS OF SCAFFOLD

GUARD RAILS

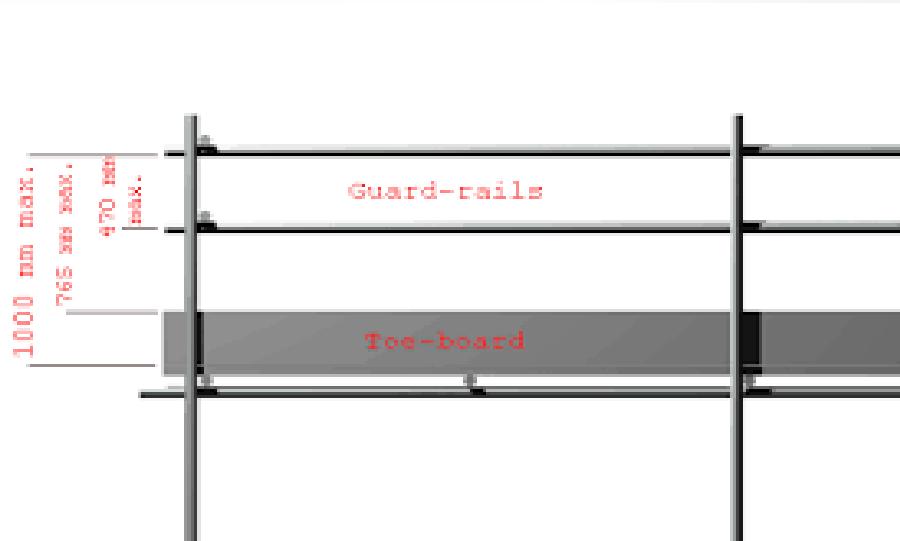
- TOP RAIL
- MID RAIL
- TOE BOARD



COMMON PARTS OF SCAFFOLD

GUARD RAILS- HEIGHT

- TOP RAIL
- MID RAIL
- TOE BOARD

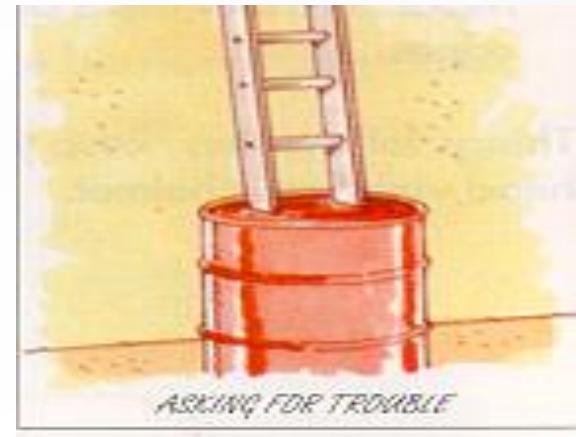


	70 CM		TOTAL- 110 CM
	40 CM		
	15 CM		

LADDER FAIRBEE

Hazards of Ladders

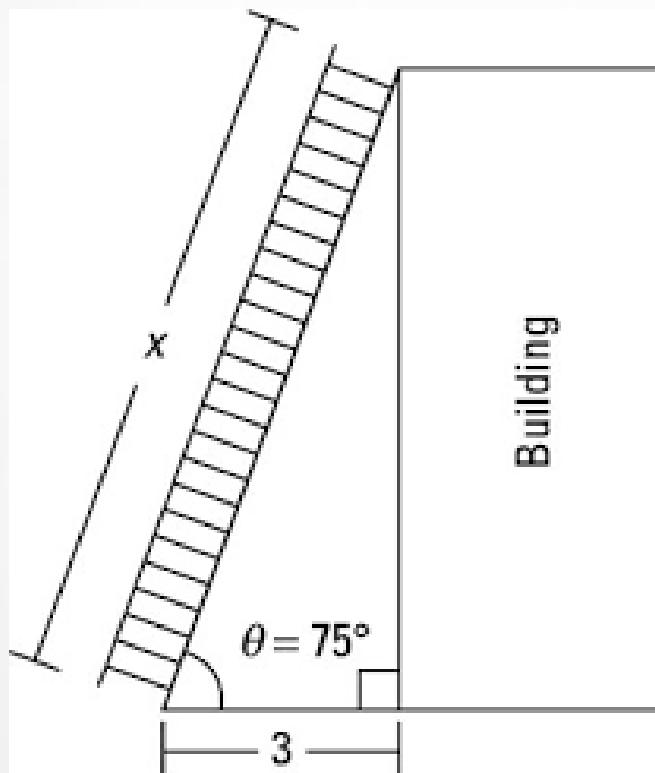
- Don't stand ladder on drum, box or other unstable base
- Never attempt to repair broken ladder
- Never carry load up ladder hoist it up
- When using the metal ladder, , make sure there are no electrical hazard in the near vicinity
- Falling off the ladder



LADDER

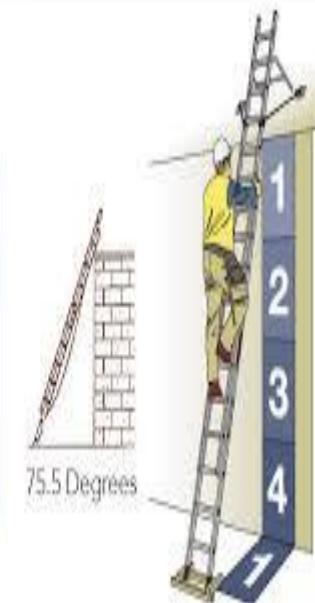
SAFE LADDER PLACING

Ladder should be set at an **angle** of about **75** or one **meter** for every **four meter** rise



4-to-1 Rule

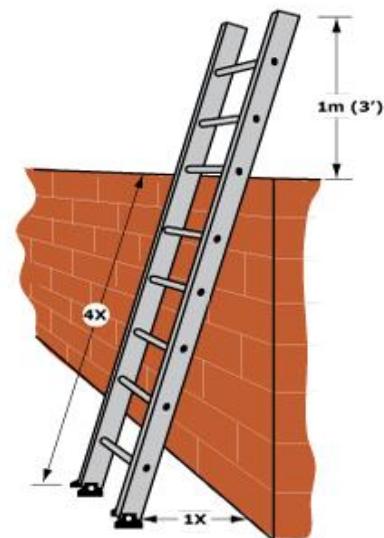
Make sure you can set up your ladder at the required angle, using the 4-to-1 Rule: For every 4 feet (1.2 metres) up, place the base of your ladder 1 foot (0.3 metres) from the wall or upper support that it rests against.



LADDER

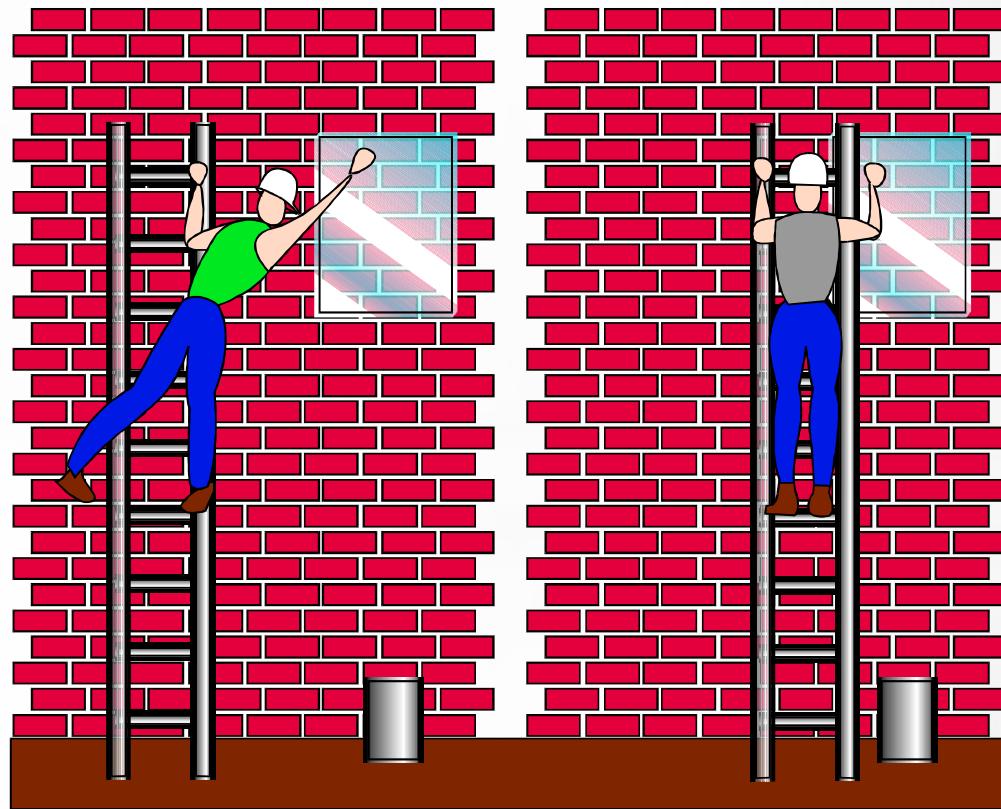
LADDER-SAFETY

- Use only **approved ladders**
- Inspect** before use
- One person** only
- Use **fall arrest if > 6 ft (1.8m)** working from ladder
- Extend 3 feet above access or working level
- use **4:1** lean ratio
- Use **3 point** contact



LADDER

LADDER SAFETY



Unsafe

Safe

LADDER

MONKEY LADDER



HAZARDS - SCAFFOLDING

- Fall from scaffold during erection
- Fall from working platform
- Electrocution- from overhead power lines
- Falling object
- Scaffold collapse

CAUSE OF SCAFFOLD COLLAPSE

- Over loaded working platform
- Soft ground
- Not tied properly with the building
- Brazing insufficient
- High wind
- Incorrect copular
- Scaffold erected by incompetent workers
- Scaffold not inspected prior to use

SAFETY ARRANGEMENTS -SCAFFOLD

- Use appropriate scaffold construction method
- Proper inspection
- Trained and certified worker
- Not exceed (SWL) Safe Working Load
- Erection on a level ground
- 10 feet safe distance from power line
- Proper fall protection system

SCAFFOLD FALL PROTECTION SYSTEM

- Guard Rail
 - a) Top Rail
 - b) Mid Rail
 - c) Toe Board
- Training
- Barricading
- Full Body Harness
- Safety Nets
- Safety Monitoring
- PFAS - Personal Fall Arrest System

SCAFFOLD FALL PROTECTION SYSTEM

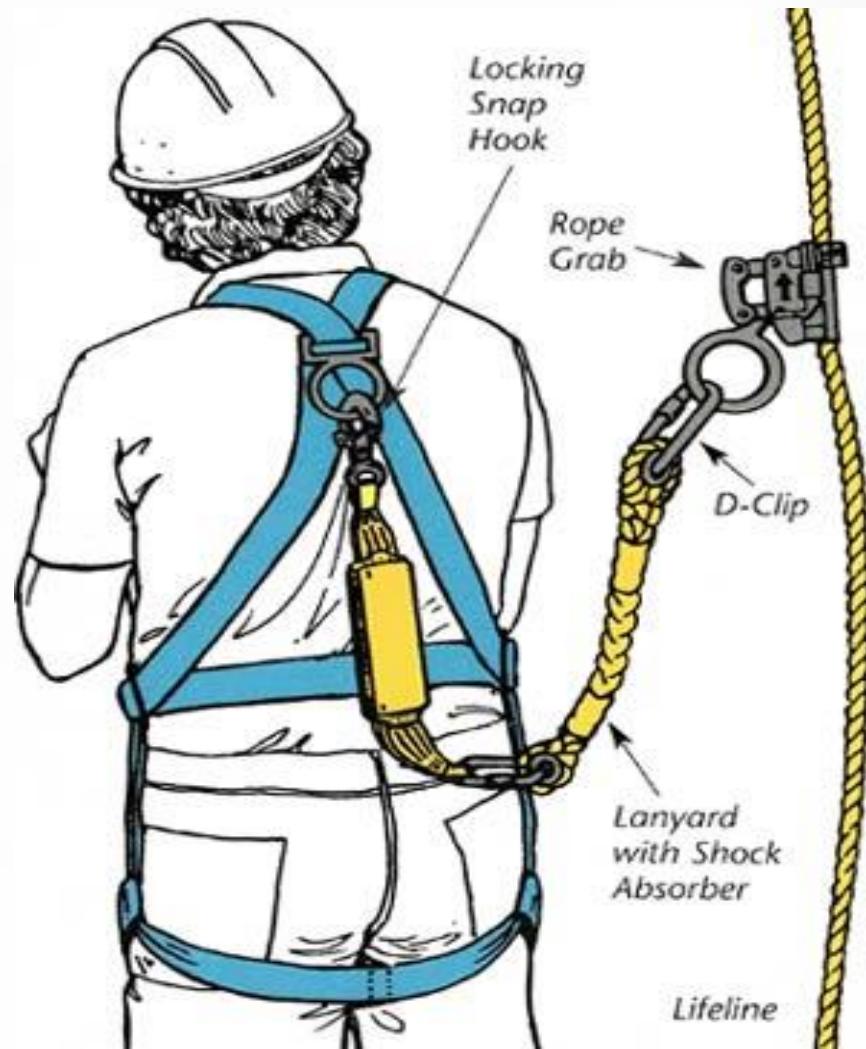
FULL BODY HARNESS



Tie-Back lanyard in use

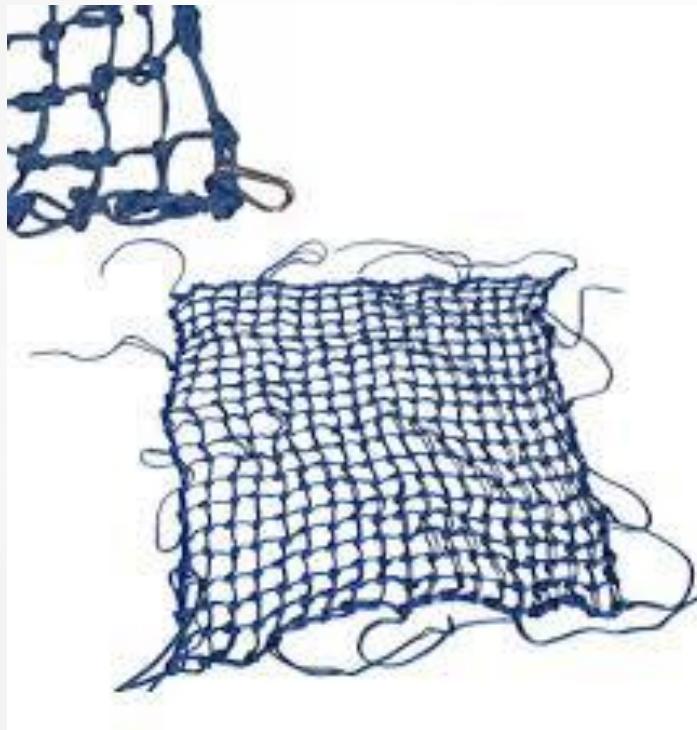
FULL BODY HARNESS

PARTS OF HARNESS



SCAFFOLD FALL PROTECTION SYSTEM

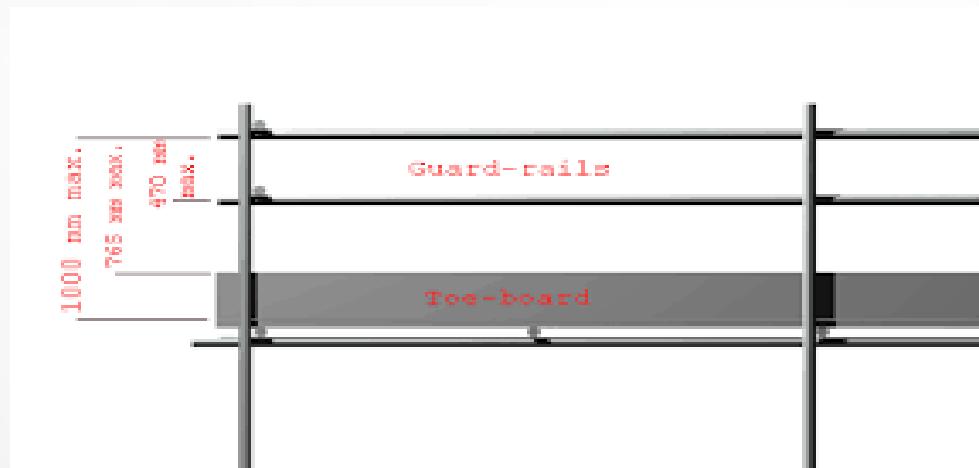
SAFETY NETS



SCAFFOLD FALL PROTECTION SYSTEM

GUARD RAILS

- TOP RAIL
- MID RAIL
- TOE BOARD



SCAFFOLD INSPECTION CHECK LIST

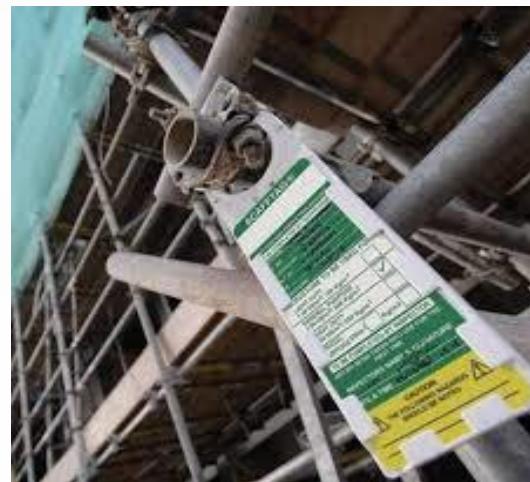
- Check For Missing Planks** On Platform
- Check For Missing Guard Rail** System
- Check For Proper Access**
- Check For House Keeping** On Scaffold Platform
(Loose Materials, Working Waste Etc...)
- Check For Proper Tying Off** Building

SCAFF TAG SYSTEM

THREE TYPES OF SCAFF TAG

- RED TAG** - Don't use
- GREEN TAG** - OK to use
- YELLOW TAG** - Check with Supervisor

If there is **NO TAG** - **DON'T USE**



WORK AT HEIGHT



WORK AT HEIGHT

DEFINITION

Work there is a risk of fall liable to cause injury

Any work above **1.8 meter** from ground level is called work at height

WORK AT HEIGHT

RESULT OF FALLING FROM HEIGHT

- FATALITY
- SPINAL INJURY
- MULTIPLE BROKEN BONES



WORK AT HEIGHT

HAZARDS OF WORK AT HEIGHT

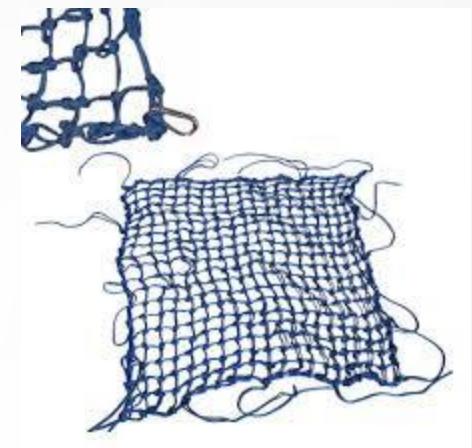
- VERTICAL HEIGHT
- FALLING MATERIALS
- WEATHER
- UN PROTECTED EDGS
- SLOPPING ROOFS



WORK AT HEIGHT

CONTROL MEASURE FOR WORKING AT HEIGHT

- TRAINING
- BARRICATION
- FULL BODY HARNESS
- SAFETY NETS
- PFAS-PERSONAL FALL ARREST SYSTEM
- GUARD RAILS



MANUAL HANDLING



MANUAL HANDLING

DEFINITION

Task which involves people moving or handling or shifting of materials by using bodily force

Example:

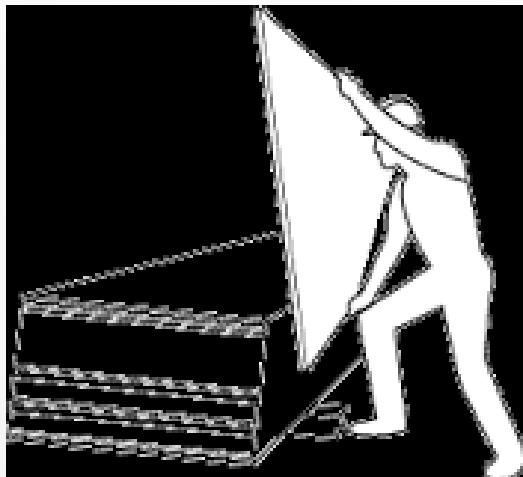
- Lifting
- Lowering



MANUAL HANDLING

Manual Handling Hazards

- Twisting and Turning
- Heavy Load
- Dropping Load
- Sharp Edges
- Hot Load



MANUAL HANDLING

Manul handling injuries

- Back injuries
- Muscular sprain
- Cuts and abrasion
- Fracture
- Open injuries
- Swelling
- Hernia



© Can Stock Photo - csp20659445



MANUAL HANDLING TECHNIQUE

- Assess the load
- Position of feet
- Bend knees
- Leg muscle support
- Back straight
- Arm closed to the body
- Avoid twisting



EXCAVATION



GLOBAL SAFETY STUDIES

EXCAVATION

Definition

Digging of earth surface or making depression on earth surface

Either manually or mechanically

What is Trench ?

Trench is a narrow excavation **depth is greater than width**



EXCAVATION

Excavation hazard

- Cave in
- water accumulation
- Oxygen deficiency
- Toxic and flammable gases
- Falling objects
- People falling
- Side wall collapse



EXCAVATION

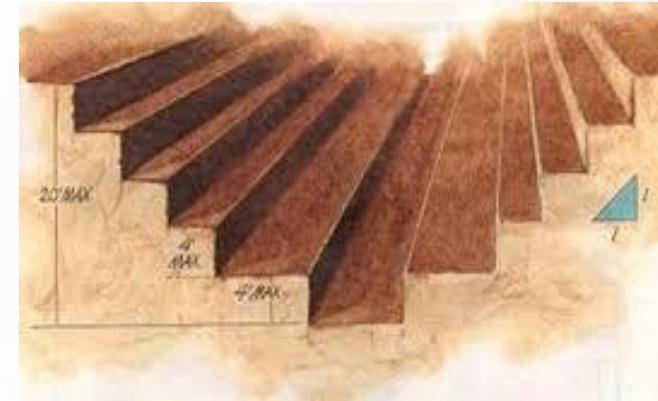
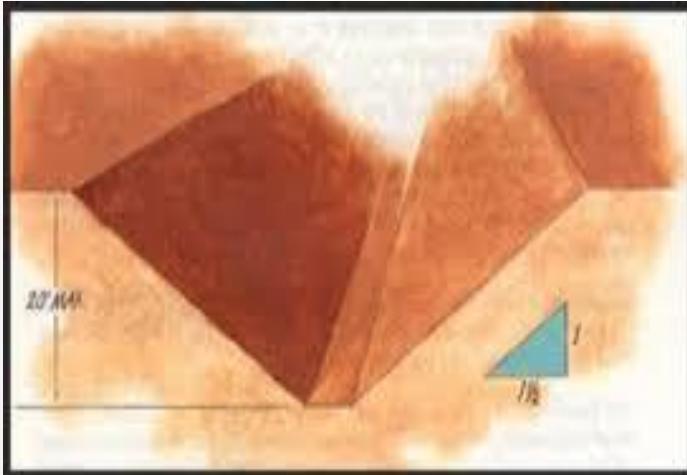
Preventive Measures

- Proper inspection
- Provide sign board
- Barricading
- Suitable side wall protection system (Sloping & Benching, Shoring, Shielding)
- De-watering system
- Proper PPE
- Conduct gas test (O₂, CO, H₂S, Methane)
- Removed soil , two feet from the side
- Around traffic, use reflective vests
- Access ladder

EXCAVATION

EXCAVATION- SUITABLE SIDE WALL PROTECTION SYSTEM

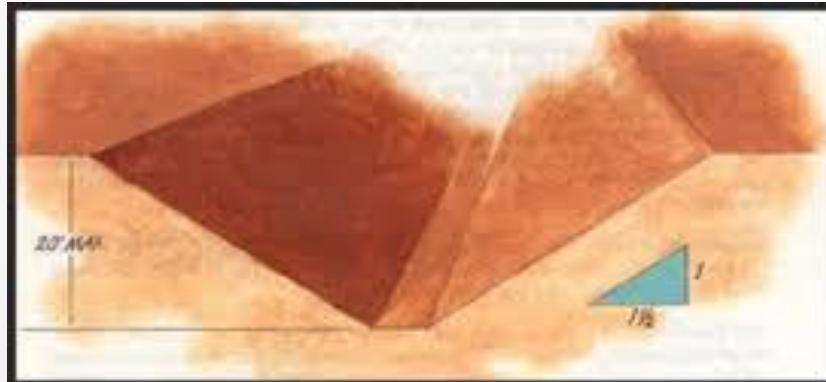
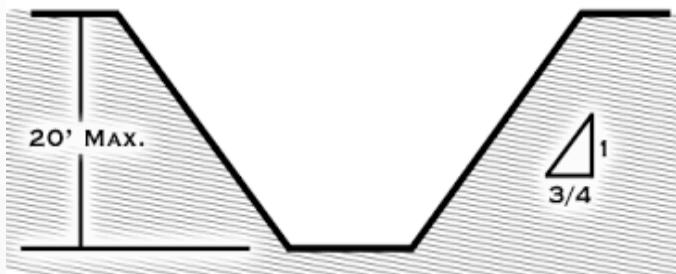
- SLOPING
- BENCHING SYSTEM
- SHORING SYSTEM
- SHIELDING SYSTEM



EXCAVATION PROTECTION SYSTEM

sloping

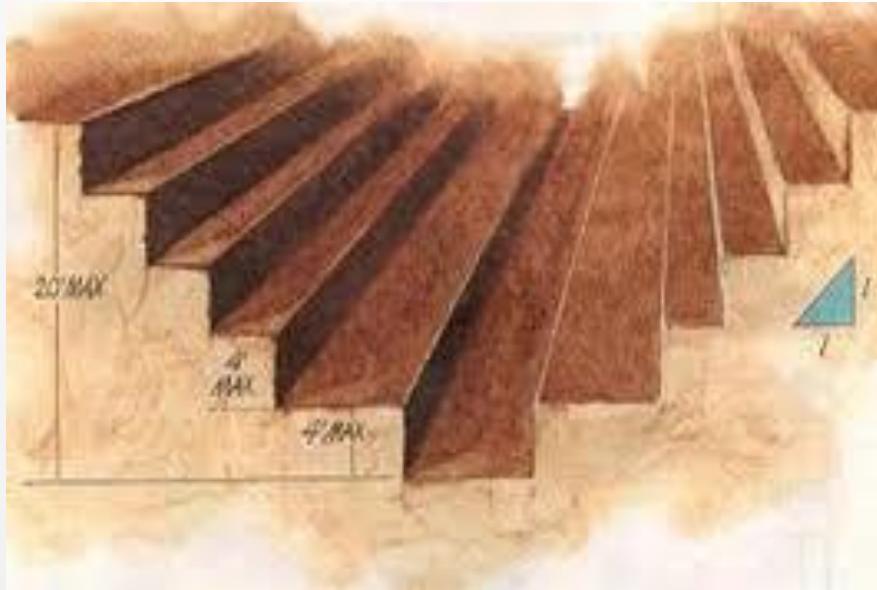
A method of excavating in which the sides of an excavation are laid back to a **safe angle** to prevent cave-in



EXCAVATION PROTECTION SYSTEM

BENCHING

A method of protecting employees from cave-ins by excavating the sides of an excavation to form one or a series of horizontal **steps**



EXCAVATION PROTECTION SYSTEM

SHORING

Hydraulic, timber or mechanical system that support the sides of an excavation , designed to prevent cave-ins



EXCAVATION PROTECTION SYSTEM

SHIELDING

A **structure** that is able to withstand the forces imposed on it by cave-ins, and in the process, protects employees inside the structure



SITE CONDITION SHALL BE CHECKED BEFORE STARTING EXCAVATION

- Traffic
- Nearest structures and their condition
- Soil test
- Over head and under ground utilities (Telephone lines, Electric lines, Water Lines, Other pipe lines)

EXCAVATION

PREVENTION PEOPLE FALLING

- Barricading and Toe board
- Good light and sign
- Crossing point
- Access ladder
- Ladder to extents 1 m above edges of excavation



EXCAVATION

PROTECTION FROM VEHICLES

- Fence or Barricading
- Hand or Mechanical Signal
- Stop Logs
- Grade soil away from excavation
- Good Light



EXCAVATION

General tips

- Any excavation or trench 4 feet or deeper shall be considered on a **Confined Space**
- If the work around the **Traffic Pedestrian Safety** very important
- A **competent person** inspect excavation on daily check adjacent area for possible cave-in failure of protective system and equipment, **hazardous atmosphere** or other hazardous condition.
- Identify the **under ground utilities** by using Site Map, Utilities Detectors, Sign Board and Route Marks

CONFINED SPACE



GLOBAL SAFETY STUDIES

CONFINED SPACE

DEFINITION

Confined space has limited entry / exit, insufficient natural ventilation, lighting and not designed for continuous worker occupancy



CONFINED SPACE

EXAMPLES OF CONFINED SPACES

- STORAGE TANKS
- MANHOLES
- PIPE LINES
- OIL PITS
- WELLS
- DUCTS
- VESSELS



CONFINED SPACE

Hazards of confined space

- Oxygen deficient atmosphere
- Oxygen enriched atmosphere
- Flammable atmosphere
- Toxic atmosphere
- Mechanical and Electrical Hazards
- Engulfment hazards
- High temperature
- Wet surface
- Falling objects
- High Noise
- Poisonous Creature

CONFINED SPACE

Potential Hazards in Confined Space

Oxygen Deficiency

- < 19.5% -23.5% oxygen concentration

Toxic Materials

- Gasoline Fumes
- Carbon Monoxide
- Hydrogen Sulfide
- Welding fumes
- Corrosives



CONFINED SPACE

Combustibles Materials

- Methane
- Hydrogen
- Acetylene
- Propane



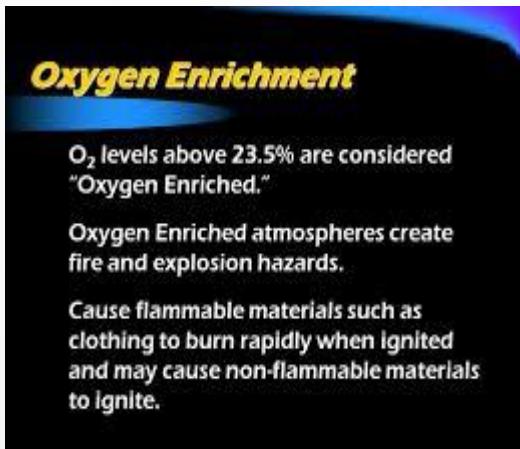
Electricity or Mechanical Hazards

- Mixer
- Crusher

CONFINED SPACE

ATMOSPHERIC HAZARDS

- Oxygen deficiency
- Oxygen enrichment
- Combustible/ flammable materials
- Toxic gases



CONFINED SPACE

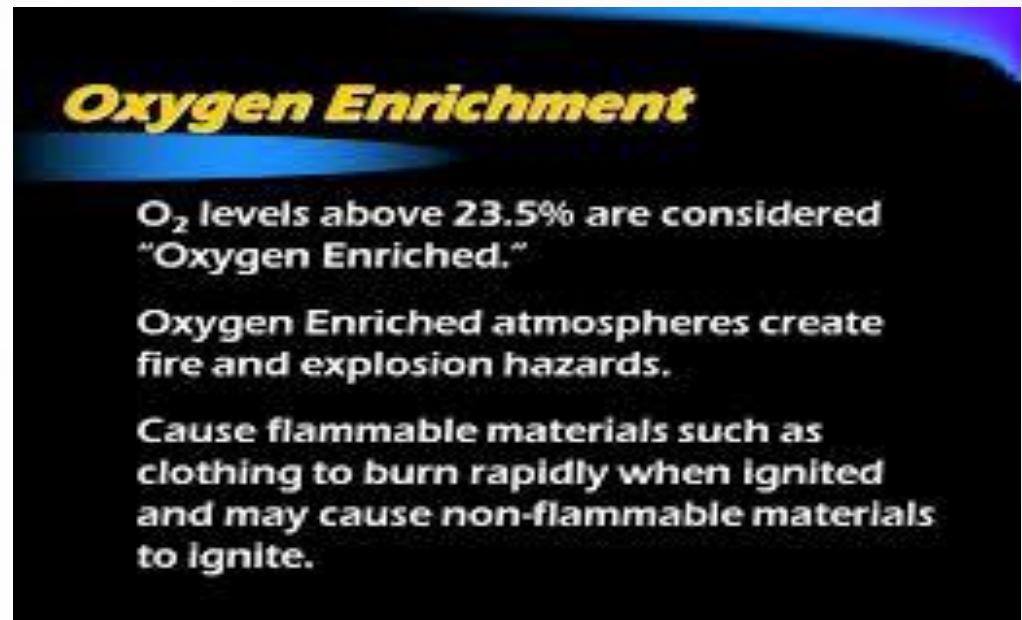
OXYGEN DEFICIENT ATMOSPHERES

19.5%	SAFE ZONE, MINIMUM FOR SAFE ENTRY
15-19%	DECREASED ABILITY TO WORK.
12-14 %	RESPIRATION INCREASES. POOR JUDGMENT
10-12%	RESPIRATION INCREASES. LIPS BLUE
8-10%	MENTAL FAILURE, UNCONSCIOUSNESS, VOMITING, NAUSEA
6-8%	DIFFICULT BREATHING, DEATH IN MINUTES
4-6%	COMA IN 40 SECONDS, DEATH

CONFINED SPACE

Oxygen Enriched Atmosphere

- Oxygen level **above 23.5%**
- Causes flammable and combustible materials to **burn violently** when ignited
- Never use pure oxygen to ventilate
- Never store or place compressed tanks in a confined space



CONFINED SPACE

General Hazards

- Limited Access & Egress
- Limited illumination and ventilation
- Slip fall on wet surface
- High temperature
- Poisonous creatures



CONFINED SPACE

Engulfment Hazards

- Possibility of engulfment by flooding
- Water or Sewage Flow
- Loose, Granular Materials



Source: OSHA, 2011b

CONFINED SPACE

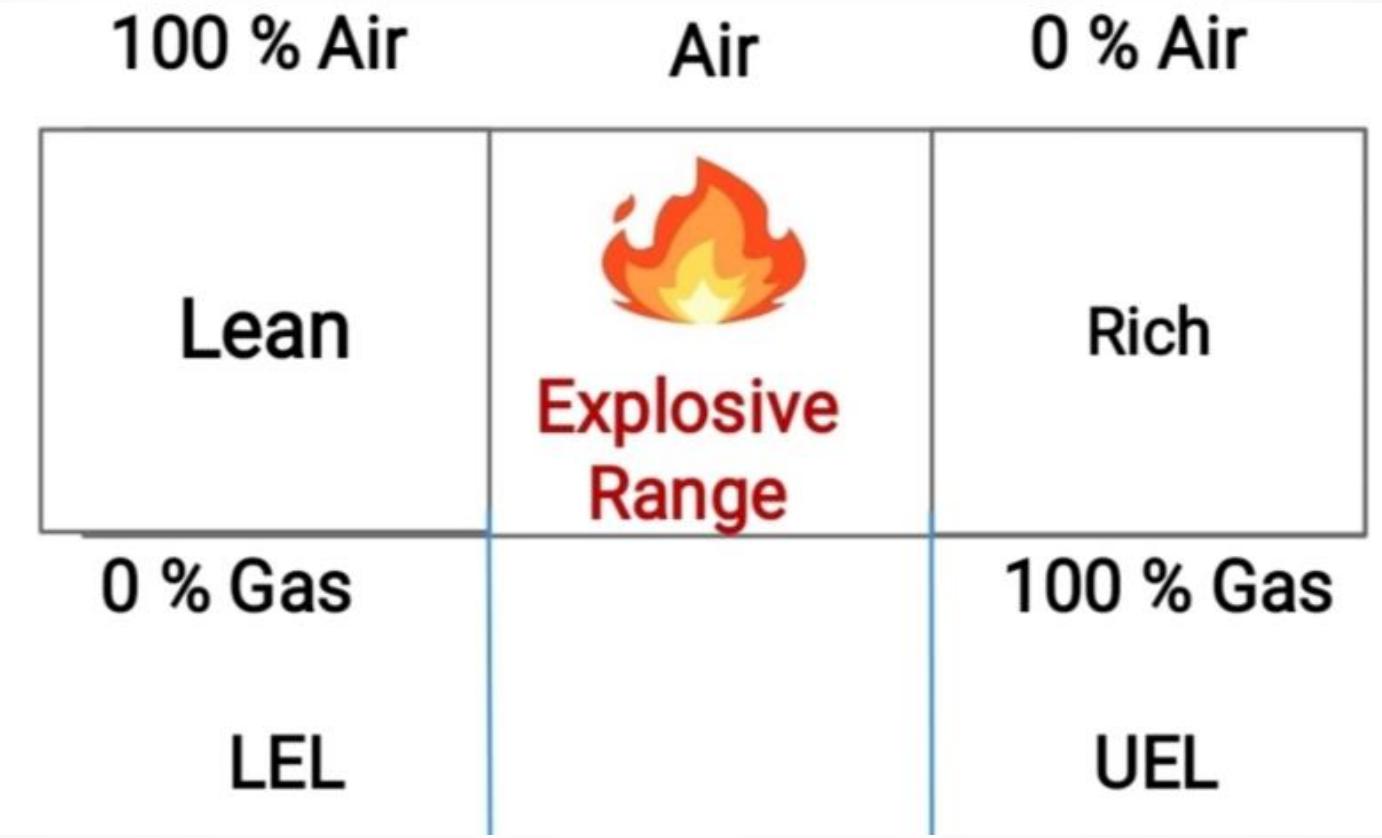
Mechanical and Electrical Hazards

- Unexpected movements of mechanical equipments
- Electric shock



CONFINED SPACE SAFETY ARRANGEMENTS

- Check oxygen level, permissible is 19.5% to 23.5%
- Check for flammable gases, below 10% of its LEL
- Check the concentration of toxic gases available and measure with ppm
- Proper ventilation and illumination
- Isolate the space before entering
- Worker must be trained and qualified
- Provide a **safety attendant** out side
- Use suitable PPE'S
- use extra low voltage equipments (24V)



CONFINED SPACE SAFETY ARRANGEMENTS

- Personal entry/ exit log sheet shall be maintained
- For columns, tanks and other sludge contaminated confined spaces, first entry shall be with airline respirator only
- All man ways shall be barricaded and no entry without permit sign shall be posted



CONFINED SPACE SAFETY ARRANGEMENTS

Mechanical ventilation

- By using filtered compressed air
- By using a blower fan
- by using an exhaust fan



CONFINED SPACE

WHO IS ENTRANT

THE EMPLOYEE WHO WILL PHYSICALLY ENTER THE CONFINED SPACE TO PERFORM THE WORK.WHO MUST BE TRAINED AND EXPERIENCED PERSON.



CONFINED SPACE

WHO IS HOLE WATCHER/ SAFETY ATTENDANT

The attendant is the **person stamp outside** the confined space and is responsible for assisting the entrant in exiting the confined space and calling for emergency assistance while required



HOLE WATCH- DUTIES & RESPONSIBILITY

- Check oxygen level
- Check flammable gases
- Check toxic gases
- Personal entry/ exit log sheet shall be maintained
- Permit available on location and check validity
- Rescue procedure discussed with workers
- Air supply availed on location
- Proper ventilation and illumination
- Use extra low voltage equipments
- All man ways shall be barricaded and no entry with out permit sign shall be posted
- All recommended PPE's are used

CONFINED SPACE

Confined space- general tips

- There should be **good communication** between entrant and attendant
- Conduct the gas test every hour and test all area of confined space **top, middle, and bottom** of this space.
- Because some gas **heavier than air** some gas light than air .
- Common chance toxic gases in confined space are CO and H₂S

H₂S
HYDROGEN
SULPHIDE



H₂S : HYDROGEN SULPHIDE

Definition

- It is mainly formed by chemical reaction and biological decomposition
- H₂S is one of the dangerous natural gases

Industrial Sources Of H₂S

- Gas Processing, Oil/ Gas Production & Drilling Rigs, Hydrocarbon Refining, Oil Storage Tanks, Sewage Treatment Plants, etc.

H₂S: HYDROGEN SULPHIDE

Properties of H₂S

- Toxicity
- Colorless
- Rotten egg smell
- Heavier than air
- Flammability
- Solubility
- Corrosives
- H₂S is dispersed by the wind



H₂S: HYDROGEN SULPHIDE

Emergency / First Aid Measure

Inhalation:

Remove the victim to fresh air area, provide artificial respiration or oxygen if needed.

Eyes:

Irrigate with plenty of water for 15 min.

Skin:

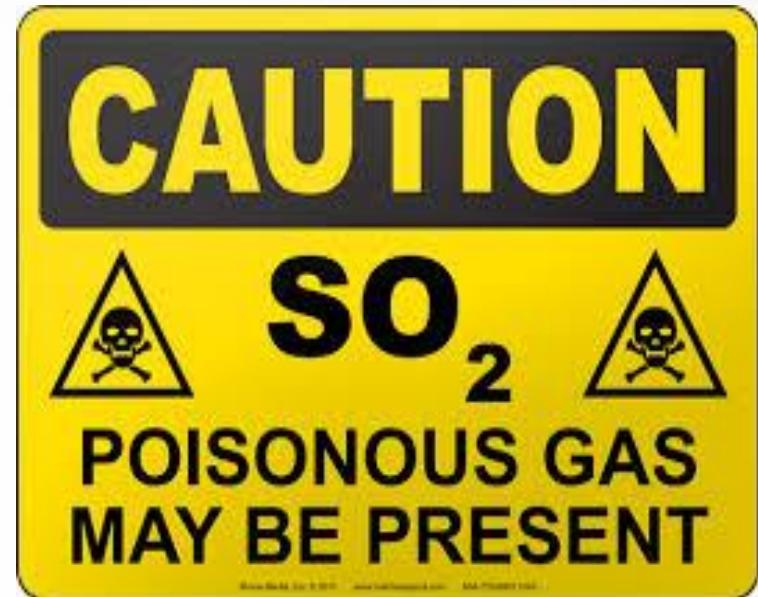
Remove the contaminated clothing and wash the affected area with plenty of water and soap.

Seek medical aid immediately

SO₂ : SULFUR DIOXIDE

Properties Of SO₂

- Highly Toxic
- Colorless
- Heavier than H₂S and Air
- Highly Corrosive
- Non-flammable



H₂S TOXICITY TABLE

H ₂ S concentration	effect On victim
Less than 1 ppm	Detectable by smell
10 ppm	Possible headache
Above 30 ppm	Eye & Respiratory irritation
Above 100 ppm	Loss of sense of smell
Above 500 ppm	Dizziness, Nausea, Abdominal Pain
700 to 1000 ppm	Rapid unconsciousness
Above 1000 ppm	Rapid collapse and death

TYPES OF GAS DETECTORS

- Portable Multi-gas Detectors
- Area Multi-gas Detectors
- Personal H₂S Gas Monitor
- Fixed Gas Detectors



GAS DETECTORS

Portable Multi Gas Detectors

Portable gas detectors are fitted with **electro chemical sensors** and used to test **Oxygen, Toxic, and Flammable gas** levels in the work to comply with the permit to work.

The detector produces an **Audible Alarm, Flashing Visual Alarm** and **Vibrating Alarm** on gas detection at TLV or above.



GAS DETECTORS

Area Multi Gas Detectors.

It is used as a single unit or linked together for area protection .

Monitor levels of **Oxygen, Methane, H₂S, and Carbon monoxide (CO)**



GAS DETECTORS

Personal H₂S Gas Monitor

Personal H₂S gas monitor is maintenance free and calibration free, disposable single gas monitor.

Disposed every two years

The gas monitor produces **Audible Alarm**, vibration, and **bright flashing visual alarm** on H₂S detection at 10 ppm or above.

Note : Personal H₂S gas monitor should not be used for gas testing



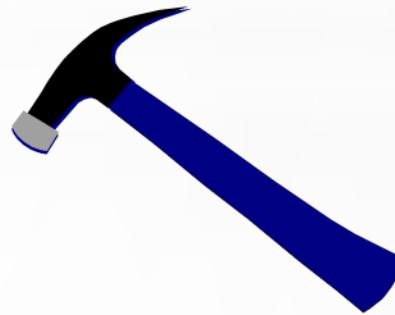
GAS DETECTORS

Fixed Gas Detectors

- Fixed gas detectors are used to monitor H₂S.
- This can be linked to control room by which, we can **identify the exact location** of detection



TOOLS

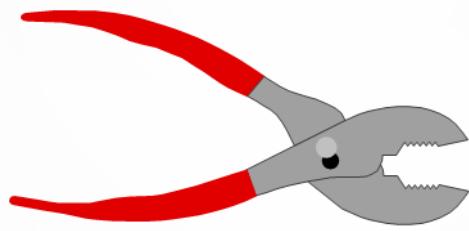


GLOBAL SAFETY STUDIES

TOOLS

TYPES OF TOOLS

- Hand Tools
- Power Tools
- Pneumatic Tools



TOOLS

Common Hazards

- Electric Shock
- Flash Burns
- Falling
- Hand and Eye Injuries
- Cut or losing a body parts
- Ergonomic injuries

TOOLS

Basic Tools Safety Rules

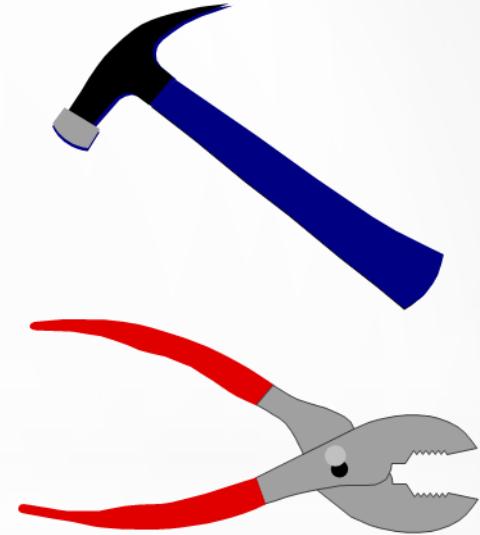
- Maintain Regularly
- Use right tools for the Right Job
- Inspect before use
- Operate according to manufacture instruction
- Use the right PPE
- Use Guards

TOOLS

Hand Tools

Some examples

- Hammers
- Screwdrivers
- Cutters
- Spanners



Hand Tools Hazard

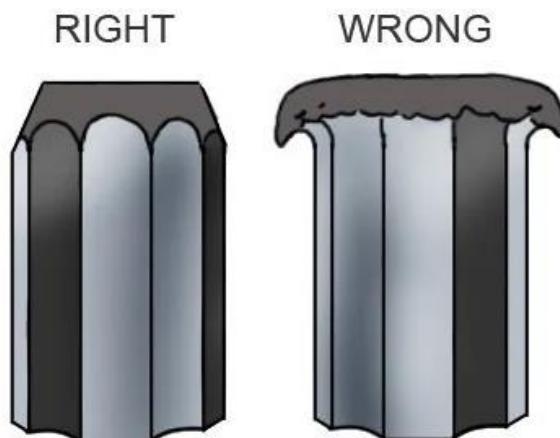
Hazards are usually caused by Misuse and Improper Maintenance

TOOLS

Hand Tools - Safety Tips

- Right tools for the right job
- Good condition
- Proper care and maintenance
- Use proper PPE
- Avoid use of Mushroomed Hammer and Chisel

Normal and Mushroomed Hammer Head



TOOLS

Power Tools

Tools which are run by (electricity) electrical power supply is known as Power Tools

- Electrical Drills
- Electrical Grinder
- Jig Saw
- Electrical Cutter



Power Tool Hazards

- Electrical Shock
- Cut or losing of body parts
- Broken Bones
- Hit



TOOLS

Power Tools - Safety Tips

- Cable, Plugs are in good condition
- Tools use with correct power supply
- Make sure power supply to be properly earthed
- Tools must be switched off before plug in
- Use proper PPE
- Keep tools clean and dry
- Disconnect when not in use
- Proper inspection and maintenance

TOOLS

Safety Tips - Angle Grinder

- Disc RPM must be GREATER than grinder machine RPM
- Validity date - **do not use** in case of expiry

Angle Grinder & Disengaged Disc injuries



TOOLS

Pneumatic tools

Powered by compressed air includes Chipper, Drills, Sander.

Pneumatic tools hazards

- Main hazard is getting **hit by tools**
- **Noise** is an other hazard



TOOLS

Pneumatic Tools - Safety Tips

- Authorized operator
- Regularly maintained and serviced
- Protective guard is correctly fitted before use
- Proper PPE
- Turn off the compressed air main supply before disconnecting
- Leakage of air shouldn't touch by hands
- Never use body for cleaning
- Keep the tool in horizontal position when changing bits or points

FIRST-AID



GLOBAL SAFETY STUDIES

FIRST-AID

In the event of an accident, you should act in the following way;

- Prevent more people from being injured
- Call the Supervisor or the Person Responsible for First Aid Treatment. Call ambulance if necessary
- Aid the injured person

FIRST-AID

AIM OF FIRST AID

- Preserve Life**
- Prevent Deterioration (Condition is Worsening)**
- Promote Recovery**

CPR- Cardio Pulmonary Resuscitation

Remember to spell C-A-B

C: compressions



A: airway



B: breathing



WELFARE FACILITIES AT SITE

Management must provide welfare facilities to the workers

- Toilets
- Washing Facilities
- Drinking Water
- Rest Room
- Prayer Hall
- Smoking Area
- First Aid Facilities
- Facilities for Intake of Meals



PERMIT TO WORK



PERMIT TO WORK

DEFINITION

- Legal Document
- Formal written statement of work

Important fields in PTW:

- ✓ Hazard
- ✓ Risk
- ✓ Safety Precautions / Control Measures
- ✓ Confirmation

Work Permit is an Important Accident Prevention Tool

PERMIT TO WORK

WHAT IS WORK PERMIT SYSTEM ???

- ❑ specifies the work to be done and the precautions to be taken
- ❑ Work permit is an **essential** part of Safe System of Work (**SSoW**) in many maintenance activities

Follow the **SREDIM** principle:

- **S**elect the job to be analysed
- **R**ecord the steps in the process
- **E**xamine the component parts of the job
- **D**evelop control measures
- **I**ninstall the safe system
- **M**aintain and monitor the safe system

PERMIT TO WORK

TYPES OF WORK PERMIT

Hot Work Permit

Cold Work Permit

Confined Space Entry Permit

Electrical Work Permit

Radiography Permit

Vehicle , Machinery Permit

Road Close Permit

Excavation Permit

PERMIT TO WORK

Permit Checklist

- Permit Number :
- Work Request :
/ Work Description
- Hazards/ Dangers :
- Precautions required :
Isolation Details :
Purging System :
Site Preparation :
- Protective & Safety Equipment :

PERMIT TO WORK

- Associated Permits / Certificates
- Gas Test - Authorised Gas Tester
- Sign for Permit Controller, Performing Authority,
Work Site Supervisor
- Permit Controller Shift Change / Transfer
Endorsement
- Area Authority Endorsement

PERMIT TO WORK

Supporting Documents PTW

- Work Method Statements
- Job Safety Analysis
- Risk Assessment
- Training Reports
- Third Party Certificate
- PTW Checklist
- Area Drawing

FORK LIFT



© Can Stock Photo - csp16622518

GLOBAL SAFETY STUDIES

FORK LIFT

Factors that may cause a forklift truck to Overturn

- Driving around corners too quickly
- Uneven loading of the fork
- Driving with the Load Elevated , Especially when going around Corners
- Uneven Tyre Pressure
- Excessive Breaking
- Driving across a Slope rather than straight up or down the slope
- Collision , especially with kerbs

FORK LIFT



OVERLOADING !



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© Mitsubishi Forklift Briefing
www.ForkliftBriefing.com

FORK LIFT

Forklift Safety

- Use safe speed
- Be aware of fork position
- Watch out the blind spots (use blind Spot Mirror)
- Slow down and sound horn at the corner
- Certified forklift operators only
- Inspect the forklift before shift change



FORK LIFT

Pre - use - check - forklift

- Tyre pressure
- Parking Brakes
- Steering
- Fuel, Oil and Water System for Leak
- Batteries
- Lifting and Tilting System
- Audible Warning
- Lights
- Mirrors



FORK LIFT

Parking rules for a forklift

- Apply the hand break
- Lower the fork and tip the forward
- Remove the key
- Park it on level area
- Do not obstruct traffic
- Do not obstruct the pedestrian walkways
- Do not obstruct the emergency escape routes



CRANE & LIFTING EQUIPMENT



GLOBAL SAFETY STUDIES

CRANE

Crane is a mechanical device used to handle the load, materials, structure for lifting and distributing.

TYPES OF CRANES

- MOBILE CRANE
- HYDRAULIC CRANE
- OVERHEAD CRANE
- GANTRY CRANE
- TOWER CRANE



MOBILE CRANE



HYDRAULIC CRANE



OVERHEAD CRANE



GANTRY CRANE



TOWER CRANE



CRANE & LIFTING

CRANE & LIFTING PTW

- Traffic permit
- Method statement
- Job safety analysis
- Training report
- Area drawing
- Lifting plan
- Third party certificates
- Equipments certificates
- Other certificates

CRANE

MAJOR CAUSES OF CRANE ACCIDENTS

- Contact with power lines
- Overturns
- Fall of material
- Mechanical failures





HOW DO ACCIDENTS OCCUR

Instability

Unsecured load, Load Capacity Exceed, or
Ground not level or too soft.

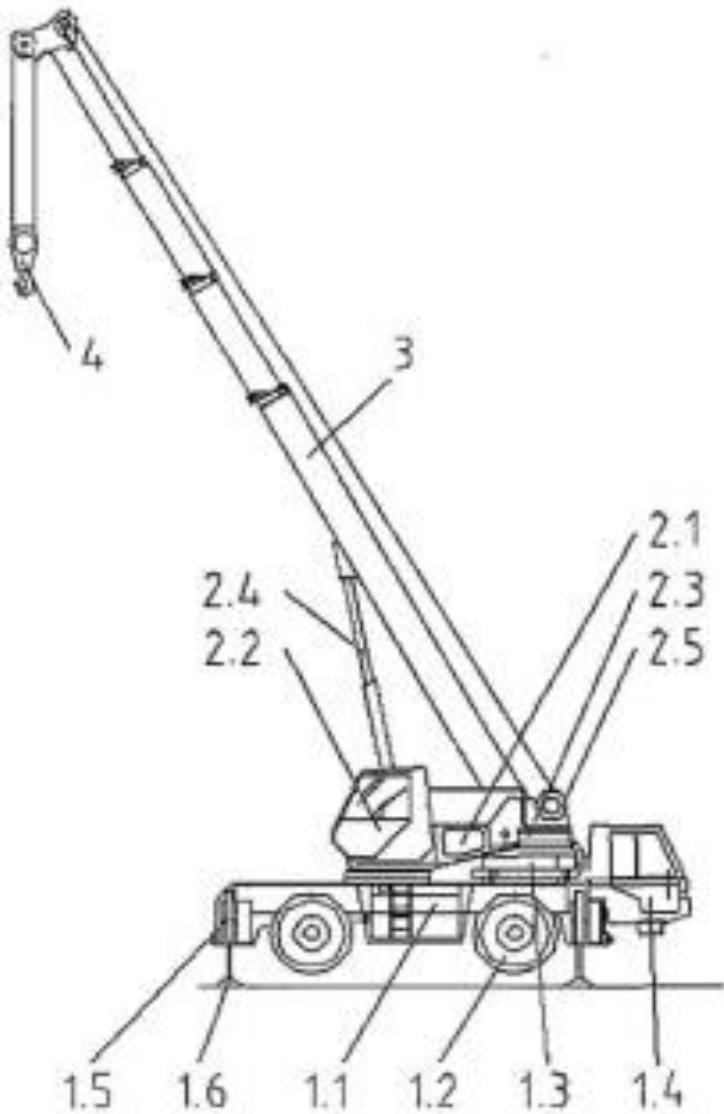
Lack of communication

Point of the operation is a distance from the
crane operator or not in full view of the operator

Lack of Training

Inadequate Maintenance or Inspection

CRANE & LIFTING PARTS



Key

- 1 Undercarriage/Carrier**
 - 1.1 2-axle undercarriage
 - 1.2 Wheel
 - 1.3 Diesel-engine
 - 1.4 Crane Travelling Cabin
 - 1.5 Outrigger beam
 - 1.6 Outrigger plate
- 2 Superstructure**
 - 2.1 Control system
 - 2.2 Crane Operating Cabin
 - 2.3 Counterweight
 - 2.4 Luffing cylinder
 - 2.5 Hoist
- 3 Jib**
- 4 Hook block**

CRANE & LIFTING

Crane hazards

- Improper load rating
- Excessive speeds
- No hand signals
- Inadequate inspection and maintenance
- Unguarded parts
- Unguarded swing radius
- Working too close to power lines
- Shattered windows
- No steps/ guard rails walkways
- No boom angle indicator
- Not using outriggers

CRANE & LIFTING

Crane Operation- Safety Arrangement

- Proper Inspection
- Trained operator with valid License
- Valid Third Party Certificate of all lifting gears
- Proper Barricading and Sign Board
- Load Rating Chart & Operating Manual in the cabin
- Never exceed Safe Working Load (SWL)
- 6m distance from power line
- Experienced Riggers team

CRANE & LIFTING

Crane Operation- Safety Arrangement

- Daily inspection of lifting gears
- Proper communication & signals
- Use tag line , if necessary

CRANE & LIFTING

Who is Rigger Supervisor?

Rigger supervisor is a person who has overall control of lifting operation , must be trained and experienced



CRANE & LIFTING

Rigging Equipments & Slings

- Wire rope
- Fiber rope
- Synthetic web sling
- Wire rope web sling
- Chain block
- D- shackles
- I- bolts
- Liver hoist (chain puller)



CRANE & LIFTING

Rigging Equipments & Slings



CRANE & LIFTING

COLOUR CODE - WEB SLINGS

1 TON

VIOLET



2 TON

GREEN



3 TON

YELLOW

4 TON

GRAY



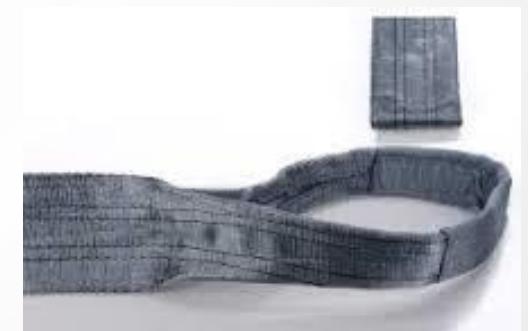
6 TON

BROWN



10 TON

RED



CRANE & LIFTING

Crane Operation- Safety Tips

- Never walk or stand under any suspended load
- All signal must be received from authorized signal man (Rigger)
- Bad Weather - stop lifting (high wind and rain)
- Third party certification for all lifting equipments



MATERIAL STORAGE



GLOBAL SAFETY STUDIES

MATERIAL STORAGE

Prevention of Falling of Materials from Material Stack

Stacking of Materials

- Stack materials separately
- Maximum height for stacking
- Stack vertically
- Use pallets
- Allow sufficient space around stacks
- Protect stack from being struck by vehicles



MATERIAL STORAGES

Safe Storage Materials

- Separate storage area for materials
- Area should be kept clean and tidy
- Warning sign
- Flammable liquids and gases should be stored separately
- Store made of fire resistant materials
- Keep Ignition Source Away
- Fire Fighting Equipments
- Regular Inspection

MATERIAL STORAGES

Safe stacking and storage of flammable materials

- Liquids, solids, gases in separate storage
- Storage oxygen separate from other gases
- Fire - resistance internal storage
- Warring sign / safety sign
- No hot work in near storage area
- Fire fighting equipments provided
- Inspect regularly
- Correctly rated electrical equipments



MATERIAL STORAGES

Safety Rules - Oxygen Cylinder

- Oxygen cylinder should not be kept near combustible materials
- Oxygen cylinder should not be handle with greasy hands or gloves
- Oxygen cylinder their fitting should not be tested with oil based soap solution
- Top cover of the cylinder should be kept in position and screwed safety when not in use
- Cylinder should not be used as rollers for moving materials

HOT & COLD ENVIRONMENT



GLOBAL SAFETY STUDIES

HOT & COLD ENVIRONMENT

Effect of Exposure to Extreme Heat

- Hyperthermia - Dehydration
- Muscle Cramp
- Heat Stress - Increases Discomforts, Headache
- Heat Stroke
- Skin Burn, Skin Cancer



HOT & COLD ENVIRONMENT

EXPOSURE OF COLD ENVIRONMENT

- Frost Bite
- Slip Hazard
- Freeze Burn Injury



HOT & COLD ENVIRONMENT

CONTROL MEASURES

HOT ENVIRONMENT

- Ventilation
- Insulation
- Cool refuges
- Drinking water
- Appropriate clothing
- Job rotation

HOT & COLD ENVIRONMENT

Cold Environment

- Close Ventilation
- Warm Refuges
- Hot Food and Drinks
- Job Rotation
- Remove Ice
- Insulating Jackets

ACCIDENT / INCIDENT REPORTING



GLOBAL SAFETY STUDIES

ACCIDENT REPORTING

ACCIDENT

Accident is an **unexpected event** or unplanned event that **results personal injury** or property damage or equipment damage or environmental pollution.



ACCIDENT REPORTING

Benefits of Accident Reporting & Investigation

- Preventing reoccurrence
- Identifying out- dated procedures
- Improved work environment
- Increased procedures
- Raises safety awareness
- Increased reputation & Morale
- Benefits to all.....

ACCIDENT REPORTING

What should be reported?

- All injuries or Job Related Illnesses
- Near-miss incidents
- Equipment damage
- Potentially **unsafe condition**
- Potentially **unsafe action**

ACCIDENT REPORTING

Accident Report Content (Sample)

Department	-
Supervisor Name	-
Date of Accident	-
Time of Accident	-
Name of Injured Person	-
Works Number	-
Reason for Accident	-
Witnesses	-
Corrective Action	-
Recommendations	-

JOB SAFETY ANALYSIS (JSA)



JOB SAFETY ANALYSIS : (JSA)

Definition

JSA is a careful study of each step in a job, identifying the hazards in each step individually and giving appropriate control measure to reduce the risk

JOB SAFETY ANALYSIS (JSA)

JSA STEPS

- STEP** - 1 - Break the Job in to Basic Steps
- STEP** - 2 - Hazards Identification
- STEP** - 3 - Control Measure

JOB SAFETY ANALYSIS (JSA)

select job	job step	hazard Identification	Control Measure
projector installation	Materials arrangement	Lack of awareness, Supervision, Trip & Fall	awareness for manual handling, good house keeping, qualified supervisor
	working platform construction & dismantling	Unskilled labors, Improper Supervision	Trained & competent worker & supervisor, effective scaffold safety procedure

JOB SAFETY ANALYSIS (JSA)

Select job	Job Step	Hazard identification	Control measure
	Projector mounting	Standard power tools, Lack of training, Supervision	All power tool must be in good condition and inspect well, follow proper installation method

JOB SAFETY ANALYSIS (JSA)

- It helps to inspect the plant
- It helps to identify hazard and prevent accident
- It helps to establish safe work method, working condition.

EMERGENCY PLANNING

EMERGENCY PLANNING

Emergency planning helps to safe guard people and provide information to media.

It helps to avoid confusion and loss



ASSEMBLY POINT

A designated place where people have been told to wait after evacuation of the building during fire or other emergency situations



EVACUATION PROCEDURE

- Sound of alarm
- Get out of the building
- Stay out of the building (Assembly Point)



EVACUATION PROCEDURE

SOUND OF ALARM

**Sound Effect
ALARM**



EVACUATION PROCEDURE

Get out of the building

- No use of lift
- more than two separate routes may be required
- Stairs, corridors and door are fire resistant protection
- Doors open in the direction of travel
- Travel distance should be short
- Adequate width
- Clearly signed
- Emergency lights
- No obstruction



EVACUATION PROCEDURE

Stay out of the building (Assembly Point)

- Safe distance from the building
- Safe location
- Further escape possible if needed
- Clearly signed



MOCK DRILL

A mock drill is a **method of practising** how a building would be evacuated in the event of a fire or other emergency situations



ERGONOMICS



GLOBAL SAFETY STUDIES

ERGONOMICS

Definition

Study of relationship between worker, work, work position (equipment & environment)

- Equipment or Tools or Machinery - they are using
(Example: Computer - IT company)
- Work Place Environment
(Example: Suitability of Lighting)

ERGONOMICS

Asbestos Dust	-	Asbestosis
Vibration	-	Vibration White Finger
Sitting for too long	-	Back Pain, Neck Ache
Lack of lighting	-	Headache, Eye Strain

ERGONOMICS

IT Professional Health & Safety

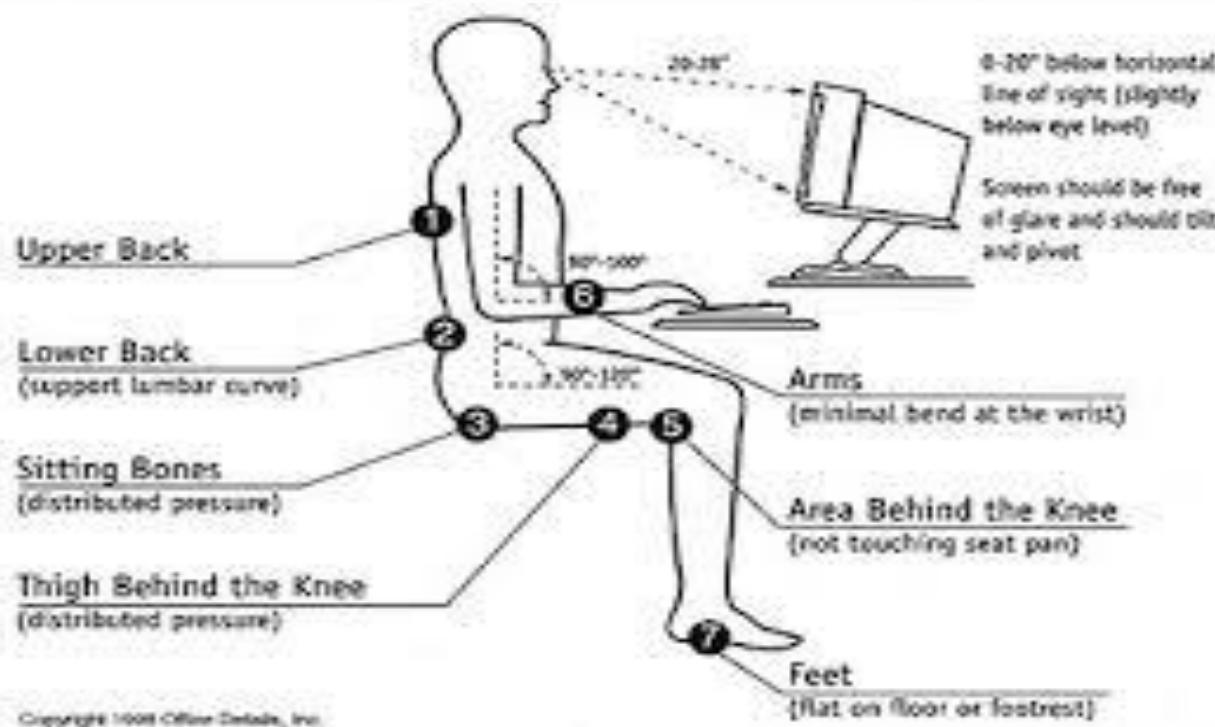
An ergonomically study about computer users health problems & safe operation

Potential Health Effects

- Body Fatigue
- Upper Limb Pains and Discomfort
- Eye Strain
- Headaches
- Neck Ache
- Stress & Fatigue

ERGONOMICS

GOOD ERGONOMIC WORK STATION



HOT WORK



GLOBAL SAFETY STUDIES

HOT WORK

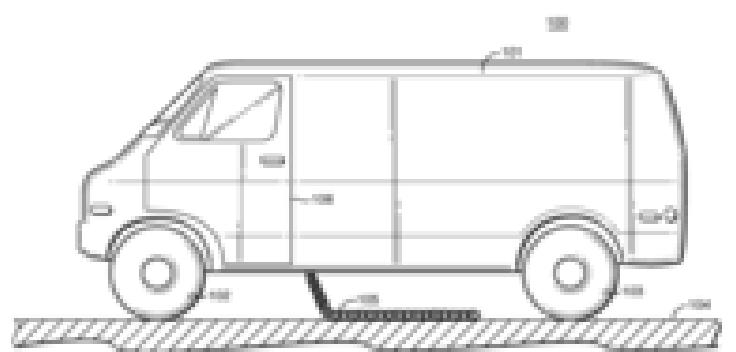
Definition

Any work which uses **Naked Flame** or any source of ignition generation such as **Heat** or **Spark** is called **Hot Work**



SOURCE OF IGNITION

- Sparks from Electricity
 - Smoking
 - Naked Flame
 - Hot Surface
 - Sparks from Vehicles
 - Lightning
 - Static Electricity
- <https://www.youtube.com/watch?v=XKAhx4NdJTs>



HOT WORK

Safety Arrangements / Control Measure

- Booth Preparation
- Proper Inspection
- Check the Hot Work Permit
- Test for Oxygen Level
- Test for LEL
- Trained/ Experienced Worker
- Proper Supervision (Fire Watcher)
- Keep Combustible Material Away
- Suitable Extinguisher
- Proper Ventilation & Illumination
- Proper Housekeeping (5s rule)

HOT WORK

- Inspect Tools and Equipment
- Electric Device - insulated and earthed
- Gas Cylinder - up right position
- Gas Regulator and Pressure Gauge - good condition
- Flash Back Arrestor
- First - Aid Kit
- Barricade and Sign Board



©weldequip



FIRE WATCH

Definition

Look out person assigned in hot work job – Fire Watcher

Hot Work Job Example

Welding

Cutting

Grinding



HOT WORK

Fire Watcher - Duties And Responsibility

- Make sure **flammable** materials and explosive materials are not in the work place
- Check the **Hot Work Permit**
- Check that **area cleaned** or not
- Check area for **No Hot Work Sign** and other **Posted Danger Marking**
- Know exact location of Acetylene and Oxygen **shut off valve**
- Test for **Oxygen Level** and **LEL level**
- Ensure the condition** of Fire Hose, Fire Extinguisher and Fire Blanket

HOT WORK

- Check to see that there is **adequate ventilation**
- Know the location **fire alarm** and **emergency telephone**
- Check the **Barricade & sign board** availability
- Locate **emergency exits** and make sure they are **free of obstruction**

COLD WORK

Definition

The work which **does not** involve source of ignition or naked flame or spark or heat generation is called **cold work**

Example:

Scaffolding , Housekeeping, Manual Handling

DEMOLITION



GLOBAL SAFETY STUDIES

DEMOLITION

Definition

Demolition means total destruction and dismantling of the structures.



DEMOLITION

Demolition Hazards

- Premature collapse
- Work at height
- Live Over Heads
- Asbestos
- Dust
- Explosive
- Manual handling
- Biological hazard
- Sharps edges



DEMOLITION

Control Measures

- Structural surveys
- Hazardous materials removed
- Change of method to reduce people
- Security for the site
- Damping down to Minimise Dust (with water)
- Disconnection of services

MATERIAL SAFETY DATA SHEETS (MSDS)

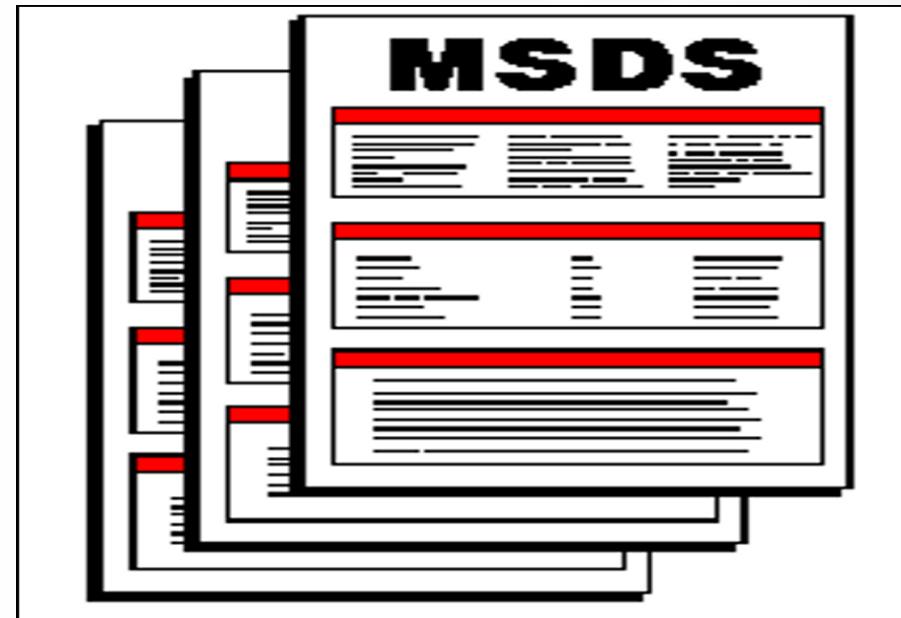


GLOBAL SAFETY STUDIES

MSDS

What is an MSDS ???

- Material Safety Data Sheet
- Developed by chemical manufacturers and importers
- MSDS must be on hand for each hazardous chemical used by the company



MSDS

Where are your MSDS MSDS....

- Must be **readily accessible** to employees during their work shift (Day / Night / General)
- Typically kept in **centralized location**
- Must be **updated** as new information becomes available



MSDS

What information is on MSDS ?

- Chemical Name
- Manufacture Info (Name, Address, Telephone)
- List of Ingredients
- Hazard Identification
- FIRST-AID measure
- FIRE- FIGHTING measure
- Handling and Storage
- Controls and Personal Protection
- Transport Information

RISK ASSESSMENT



GLOBAL SAFETY STUDIES

RISK ASSESSMENT

RISK

It is the probability of the realization of the potential for loss.

RISK ASSESSMENT

Process of identifying hazards and evaluating the risk.

HOW MANY PROCESS STEPS IN RA?

RISK ASSESSMENT

Risk Assessment – 5 Step Process

1. Identify the hazards
2. Identify the people **who** might be harmed and **how** might be harmed
3. Evaluate the risk
4. Record the significant finding
5. Review and Update

RISK ASSESSMENT

HAZARD IDENTIFICATION METHODS

- ✓ Inspection
- ✓ Task Analysis
- ✓ Legislation
- ✓ Manufacturers Information (MSDS)
- ✓ Incident / Accident Data

RISK ASSESSMENT

IDENTIFYING THE PEOPLE AT RISK

- ✓ Worker/ Operator
- ✓ Maintenance Staff
- ✓ Cleaners
- ✓ Contractors
- ✓ Visitors
- ✓ Members of the public

RISK ASSESSMENT

EVALUATE THE RISK

$$\text{RISK} = \text{LIKELIHOOD} \times \text{CONSEQUENCE}$$

What is Evaluation?

By assigning score value to Likelihood and Consequence - risk rating can be calculated

Example:

LIKELIHOOD	CONSEQUENCE
1= Extremely Unlikely	1= Very Minor Injury
2= Unlikely	2= First Aid Injury
3= Possible	3= Lost Time Injury
4= Likely	4= Hospital Treatment
5= Very Probable	5= Disabling Injury

RISK ASSESSMENT

Likelihood	Consequence	Minor Injury	Major Injury	Death
		Manage	Take Action	Take Action
		Monitor	Manage	Take Action
		Monitor	Monitor	Manage

RISK ASSESSMENT

		SEVERITY / CONSEQUENCES					
		LOW	1 X 1	1 X 2	1 X 3	1 X 4	1 X 5
PROBABILITY / LIKELIHOOD	HIGH	5 X 1	5 X 2	5 X 3	5 X 4	5 X 5	
	5	10	15	20	25		
	4 X 1	4 X 2	4 X 3	4 X 4	4 X 5		
	4	8	12	16	20	High Risk	
	3 X 1	3 X 2	3 X 3	3 X 4	3 X 5		
	3	6	9	12	15	Medium Risk	
LIKELIHOOD	2 X 1	2 X 2	2 X 3	2 X 4	2 X 5		
	2	4	6	8	10		
LIKELIHOOD	1 X 1	1 X 2	1 X 3	1 X 4	1 X 5		
	1	2	3	4	5	Low Risk	

RISK ASSESSMENT

A construction company use the following time scales in relation to the risk rating system.

Risk Rating	Action and Time Scale
16 and above	unacceptable work may not started ,additional control must be introduced to reduce below 9.
9 to 15	Tolerable additional control must be introduced as soon as possible and no later than 24 hours after assessment.
5 to 8	Tolerable must be reduce to below 5 within one week
4 or below	Acceptable if simple action can reduce further then must be done within one week.

RISK ASSESSMENT

Recording Significant Findings

Significant findings of a risk assessment should be recorded to provide a statement of the hazard in the workplace, the extent of the risks that they present, and the action taken to control those risks.



GOAL TO IMPROVE SAFETY

- Good house keeping at work site
- Increase good citizens by 100 % PPE
- Job wise risk identification
- Reporting near miss, unsafe acts/condition
- 100% plant specific training and medical
- Learning from incident/accident
- Mobile phone restriction in the plant area
- Zero accident/incident
- Daily and weekly toolbox talk
- Weekly/monthly hand tool inspection
- Monthly inspection of PPE

GOAL TO IMPROVE SAFETY

- Monthly internal safety audit
- New employees job related training and safety induction training
- Behaviour change in technicians towards work safety
- Implementation of awarding system

SAFETY DOCUMENTS

- Project Plan File
- Safety Induction Details
- Tool Box Talk Report
- Daily Observation Report
- Observation Closeout Report
- Safety Inspection Report
- Project JSA/ RA
- Accident/ Incident Report
- Near Miss Report
- First Aid Report
- Third Party Certificate
- Calibration Certificate

SAFETY DOCUMENTS

- Insurance certificate
- Medical certificate
- Weekly HSE report
- Work method statement
- Close out PTW
- MSDS file
- Mock drill report
- Waste disposal record

SAFETY PROMOTIONAL ACTIVITIES

- TRAINING PROGRAM (SAFETY INDUCTION, TBT Etc...)
- SAFETY NOTICE BOARD
- SAFETY BANNERS
- SAFETY STICKER
- SAFETY SIGN
- SAFETY SLOGANS
- SAFETY AWARDS
- MOCK DRILLS



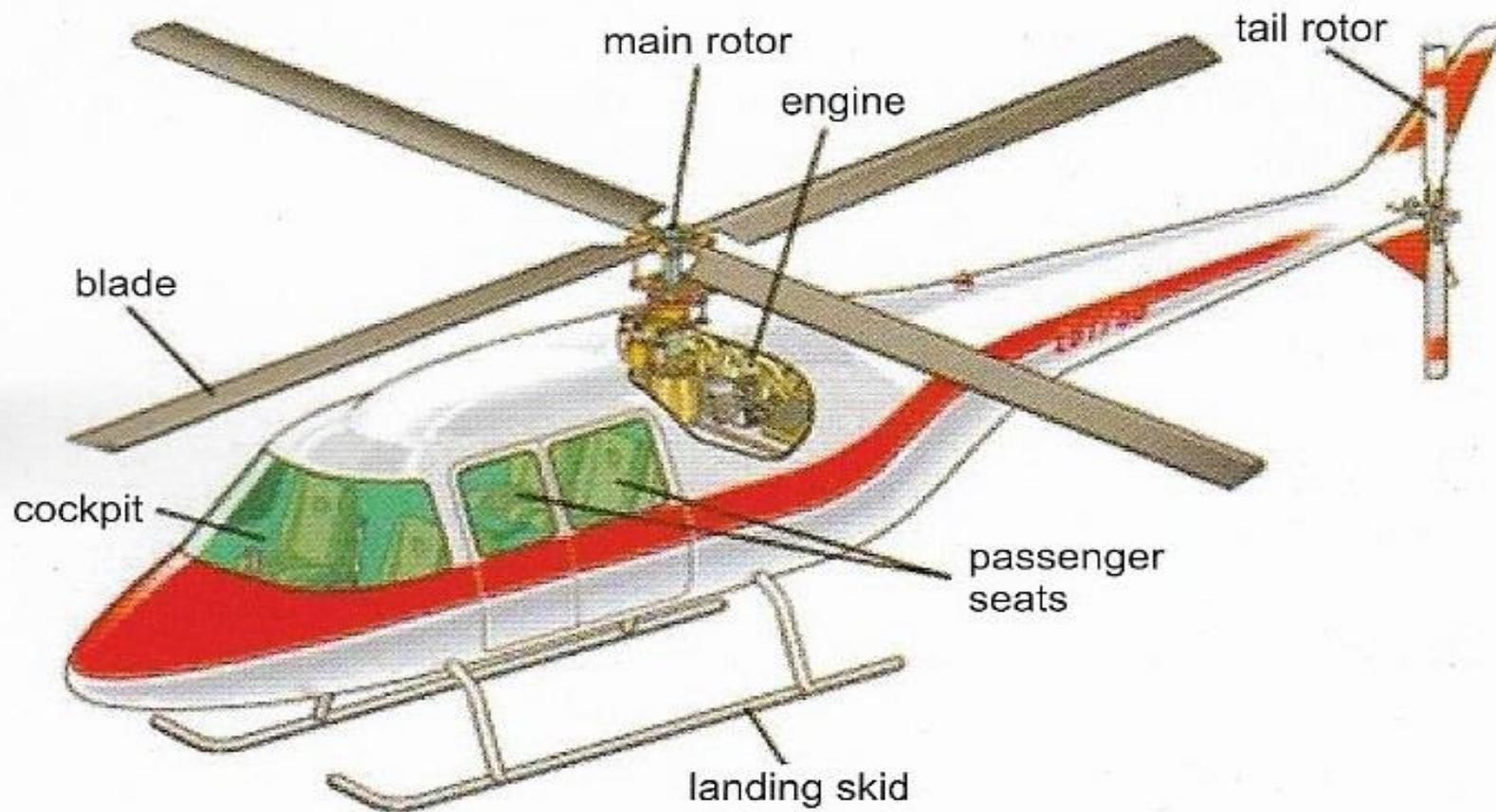
SAFETY PROMOTIONAL ACTIVITIES

SAFETY SLOGANS



HELICOPTER ANATOMY

HELICOPTER OPERATIONS



ABBREVIATIONS

- SAFETY- STAY ALERT FOR EACH TASK YOU DO
- FIRE - FIND INFORM, RESTRICT, EXTINGUISH
- HSE - HEALTH SAFETY ENVIRONMENT
- OSHA - OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
- IOSH -INSTITUTION OF OCCUPATIONAL SAFETY AND HEALTH
- NEBOSH- NATIONAL EXAMINATION BOARD IN OCCUPATIONAL SAFETY AND HEALTH
- NFPA - NATIONAL FIRE PROTECTION ASSOCIATION
- NSC - NATIONAL SAFETY COUNCIL
- NBC -NATIONAL BUILDING CODE
- PTW - PERMIT TO WORK

ABBREVIATIONS

- TBT - TOOL BOX TALK
- RA - RISK ASSESSMENT
- TRA - TASK RISK ASSESSMENT
- HIRA - HAZARD IDENTIFICATION RISK ASSESSMENT
- JSA - JOB SAFETY ANALYSIS
- JHA - JOB HAZARD ANALYSIS
- NM - NEAR MISS
- FAK - FIRST AID KIT
- FAC - FIRST AID CASE
- LTI - LOST TIME INJURY
- PPM - PARTS PER MILLION
- HID - HAZARD IDENTIFICATION

ABBREVIATIONS

- DCP - DRY CHEMICAL POWDER
- FMB - FOAM MAKING BRANCH
- AFFF - AQUEOUS FILM FORMING FOAM
- LOTO - LOCKOUT AND TAGOUT
- CPR - CARDIO PURLMINORY RESUSCITATION
- PASS - PULL AIM SQUEEZE SWEEP
- STOP - SAFETY TRAINING OBSERVATION
PROGRAMME
- HAZOP- HAZARD AND OPERABILITY ANALYSIS
- NRV - NON RETURN VALVE
- MSDS - MATERIAL SAFETY DATA SHEET

ABBREVIATIONS

- SCBA - SELF CONTAINED BREATHING APPARATUS
- CABA - COMPRESSED AIR BREATHING APPARATUS
- LEL - LOWER EXPLOSIVE LIMIT
- UEL - UPPER EXPLOSIVE LIMIT
- PEL - PERMISSIBLE EXPOSURE LIMIT
- STEL - SHORT TERM EXPOSURE LIMIT
- ILDH - IMMEDIATE DANGER TO LIFE OR HEALTH
- SWL - SAFE WORKING LOAD
- PFAS - PERSONNEL FALL ARREST SYSTEM
- ELCB - EARTH LEAKAGE CIRCUIT BREAKER
- GFCI - GROUND FAULT CIRCUIT INTERRUPTER
- MCB - MINIATURE CIRCUIT BREAKER