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Participant Handbook

FIRE SAFETY

Sector
Hydrocarbon

Sub-Sector
Midstream, Downstream

Occupation
Management of Health, Safety and Environment (HSE)

Reference ID: **HYC/Q3601, Version 2.0**
NSQF Level 4

Fire Safety Technician (Oil & Gas)

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Disclaimer

"Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission."

Shri Narendra Modi
Prime Minister of India

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HYDROCARBON SECTOR SKILL COUNCIL

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **'Fire Safety Technician'** QP No. **'HYC/Q3601 NSQF Level 4'**

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Authorised Signatory
Hydrocarbon Sector Skill Council

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The preparation of this manual would not have been possible without the Hydrocarbon Industry's support. Industry feedback has been extremely encouraging from inception to conclusion and it is with their input that we have tried to bridge the skill gaps existing today in the industry.

This participant manual is dedicated to the aspiring youth who desire to achieve special skills which will be a lifelong asset for their future endeavours.

About this Guide

Welcome to the **"Fire Safety Technician (Oil & Gas)"** training program. This Participant Hand Book (PHB) will facilitate and train the trainees/participants in the skills necessary to be a **"Fire Safety Technician (Oil & Gas)"**, in the Hydrocarbon Sector. Besides, it will also enable the trainers to identify the scope within which the training is to be conducted for Fire Safety Technician (Oil & Gas) at Level 4, The PHB will provide the knowledge and skills necessary for the job role.

Fire Safety Technician (Oil & Gas) is someone who adherence to fire safety procedures and conducts fire fighting operations. Accordingly, the Participant Handbook (PHB) includes technical as well as behavioural skills required for this job role, and is based on National Skill Qualification Framework NSQF aligned Qualification Pack (QP) as follows:

1. Prepare workplace in line with fire safety rules (HYC/N3601)
2. Perform fire safety operations at workplace (HYC/N3602)
3. Working effectively in a team (HYC/N9301)

There are various practical and theoretical exercises given at the end of each unit, which may be used to test the understanding of the trainee on a topic. Trainers can use them for formative and summative assessment. This book is just a beginning, and much of the most exciting learning processes will take place in the classroom and thereafter.

Successful completion of the program shall certify the trainee as a Fire Safety Technician (Oil & Gas), thereby adding value for their employment opportunities as also the entrepreneurship capabilities.

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It is recommended that all trainings include the appropriate Employability Skills Module Content for the same is available here:

https://www.skillindiadigital.gov.in/content/list

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1. Introduction

Unit 1.1 - Hydrocarbon sector in India

Unit 1.2 - Roles and responsibilities of a fire safety technician

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Describe oil and gas sector and its sub-sectors.
2. List the three major segments in the hydrocarbon sector.
3. State the functions of upstream, midstream and downstream segments.
4. Describe the role of Hydrocarbon Sector Skill Council.
5. List OISD standards.
6. List the roles and responsibilities of a fire safety technician.

Unit 1.1 - Hydrocarbon sector in India

Unit Objectives

At the end of this unit, the participant will be able to:

1. Describe about the hydrocarbon sector in India.
2. List the three major segments in the hydrocarbon sector.
3. Identify about the achievements of hydrocarbon sector.
4. Identify and perform about the roles and responsibilities of fire safety technician.
5. Define and conduct OISD standards for fire fighting equipment and appliances in oil and gas industry.
6. State about the essential skills of fire safety technician.
7. Demonstrate the career aspects of fire safety.

1.1.1 Hydrocarbon sector in India – overview

The oil and natural gas sector is amongst the 8 core industries driving economic growth in India and plays a crucial role in country's economic growth. The industry is broadly divided into following different segments which refers to different points in the process of exploring and extracting, collecting and processing and ultimately distributing the oil and natural gas for use.

India is expected to be one of the largest contributors to NON-OECD petroleum consumption growth globally. Crude oil import rose sharply to US $ 101.4 Billion in 2019-20 from us$ 70.72 Billion in 2016-17. India retained its spot as the third largest consumer of oil in the world in 2019 with consumption of 5.16 Million barrels per day (MBPD) of oil in 2019 compared to 4.56 MBPD in 2016.

As of October 01, 2020, India's oil refining capacity stood at 249.9 Million metric tonnes (MMT), making it the second-largest refiner in Asia. Private companies own about 35.29% Of the total refining capacity in FY 20.

In FY 20, crude oil production in India stood at 30.5 MMT. In FY 20, crude oil import increased to 4.54 MBPD from 4.53 MBPD in FY 19. Natural gas consumption is forecast to reach 143.08 Million tonnes (MT) by 2040. India's LNG import stood at 33.68 BCM during FY 20.

India's consumption of petroleum products grew 4.5% To 213.69 MMT during FY 20 from 213.22 MMT in FY 19. The total value of petroleum products exported from the country increased to US $ 35.8 Billion in FY 20 from US $ 34.9 Billion in FY 19. Export of petroleum products from India increased from 60.54 MMT in FY 16 to 65.7 MMT in FY 20.

Gas pipeline infrastructure in the country stood at 17,016 Kms as of June 30, 2020.

India has been the fourth-largest liquefied natural gas (LNG) importer since 2011 after Japan, South Korea, and china.

The government has adopted several policies to fulfil the increasing demand. It has allowed 100% foreign direct investment (FDI) in many segments of the sector, including natural gas, petroleum products and refineries among others. Today, it attracts both domestic and foreign investment.

1.1.2 Major segments in the hydrocarbon sector

The industry is broadly divided into following different segments which refers to various points in the process of exploring and extracting, collecting and processing and ultimately distributing the oil and natural gas for use.

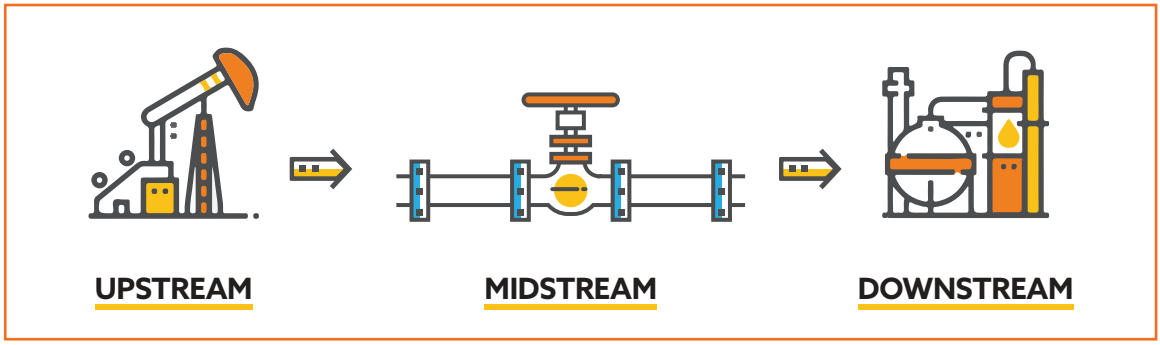

Fig: 1.1.1 Hydrocarbon Segments

The energy sector has three key areas: Upstream, midstream and downstream.

1. **Upstream:** Upstream is E&P (exploration and production). This involves the search for underwater and underground natural gas fields or crude oil fields and the drilling of exploration wells and drilling into established wells to recover oil and gas.

   The term 'upstream' also includes the steps involved in the actual drilling and bringing oil and natural gas resources to the surface, referred to as 'production'.

Fig: 1.1.2 Upstream

2. **Midstream:** Midstream entails the transportation, storage, and processing of oil and gas. Once resources are recovered, it has to be transported to a refinery, which is often in a completely different geographic region compared to the oil and gas reserves. Transportation can include anything from tanker ships to pipelines and trucking fleets.

   Midstream includes pipelines and all the infrastructure needed to move these resources long distances, such as pumping stations, tank trucks, rail tank cars and transcontinental tankers.

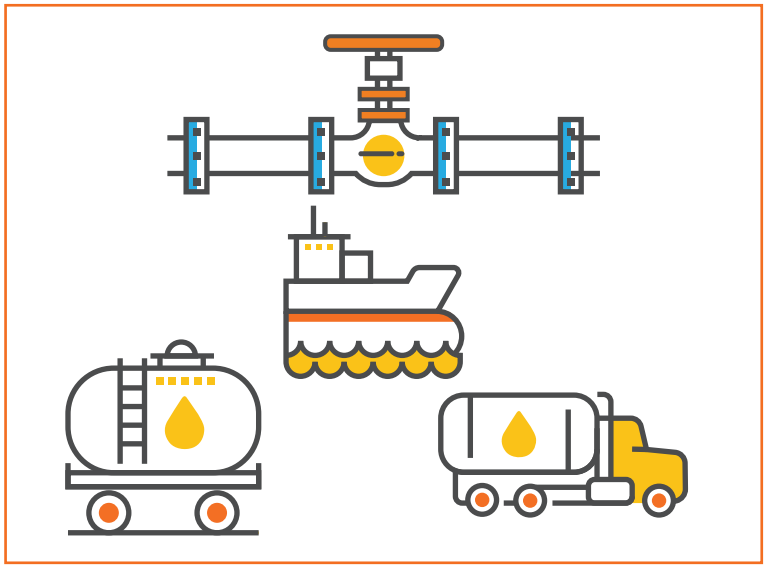

Fig: 1.1.3 midstream

3. **Downstream:** Downstream refers to the filtering of the raw materials obtained during the upstream phase. This means refining crude oil and purifying natural gas. The marketing and commercial distribution of these products to consumers and end users in a number of forms including natural gas, diesel oil, petrol, gasoline, lubricants, kerosene, jet fuel, asphalt, heating oil, LPG (liquefied petroleum gas) as well as a number of other types of petrochemicals.

   Oil and natural gas products are even used to make artificial limbs, hearing aids and flame-retardant clothing to protect fire fighters. In fact, paints, dyes, Fibres and just about anything that is manufactured has some connection to oil and natural gas.

   So now you know. 'Upstream' is about extracting oil and natural gas from the ground; 'midstream' is about safely moving them thousands of miles; and 'downstream' is converting these resources into the fuels and finished products we all depend on.

Fig: 1.1.4 Downstream

   Together, these three sectors of the oil and natural gas industry sustain the steady flow of fuels and materials that make life better and safer for us all.

1.1.3 Hydrocarbon sector skill council (HSSC)

In line with the National Skill Mission of India, Hydrocarbon Sector Skill Council (HSSC) for the Oil & Gas sector has been set up under the aegis of Ministry of Petroleum & Natural Gas (MoPNG) with its primary objective to execute skill development activities in Indian Hydrocarbon Sector and meeting the entire value chain's requirement of appropriately trained manpower in quantity and quality on a sustained and evolving basis.

Key objectives:

- To initiate, carry out, execute, implement, aid and assist activities towards skill development in the Indian Hydrocarbon Sector and meeting the entire value chain's requirement of appropriately trained manpower in quantity and quality on a sustained and evolving basis.
- Develop a skill development plan for the sector.
- Identify skill development need of the sector, review international trends and identify sector skill gap and technology.
- Develop National Occupational Standard (NOS's) for the job roles of covering the entire sector/ sub-sector.
- Identification and enlistment of Training Providers as outlined by NSDC.
- Create a pool of skill manpower and creating a benchmark for new skills and ups killing.

1.1.4 Oil industry safety directorate (OISD) standards

Oil Industry Safety Directorate (OISD) is an administrative body under the Ministry of Petroleum and Natural Gas of Government of India, who formulates and coordinates the implementation of a series of self-regulatory measures aimed at enhancing the safety in the oil & gas industry in India.

The refineries, gas processing, LNG and petrochemical plants are prone to hazards from fire and explosion due to handling, processing & storage of highly flammable liquid, gas and vapour as well as operation of the facilities at elevated temperature & pressure or cryogenic condition. These potential hazards get aggravated on accounts of process upsets, extreme physical conditions and accidental release of flammable hydrocarbon.

In recent past, the oil industry throughout its value chain has seen major up gradations and capacity built up in petroleum refining, coupled with induction of newer technologies like Catalytic Hydro-treating, Isomerisation, Hydrocracking, Fluidized Catalytic Cracking, and Delayed Coking etc. to extract maximum value addition from the product slate. With these upgradations in technologies along with diversification towards petrochemicals, the complexity of operation has increased manifold and so has the responsibility of oil and gas companies in a safe and efficient way without causing any accidents or harm to their surroundings.

The safety management in hydrocarbon industry is a multi-disciplinary function and every person needs to keep vigil against potential cause of fire & accidents and strive to eliminate them. A workplace incident is an indication that prevention was ineffective and that prompt changes need to be made. Everyone manning our work-stations should draw lessons from past industry incidents to prevent recurrence.

Six OISD standards have been included in the petroleum rules:

S. No.	OISD Standard	Description
1	OISD STD 105	Work permit system
2	OISD STD 116	Fire protection facilities for petroleum refineries and oil/gas processing plants
3	OISD STD 117	Fire protection facilities for petroleum depots, terminals, pipeline installations & lube oil installations
4	OISD STD 118	Layouts for oil and gas installations
5	OISD STD 141	Design and construction requirements for cross country hydrocarbon pipelines
6	OISD STD 156	Fire protection facilities for ports handling hydrocarbons

Table: 1.1.1 Six OISD standards have been included in The Petroleum Rules

Two OISD standards have been included in the gas cylinder rules:

S. No.	OISD Standard	Description
1	OISD STD 105	Work permit system
2	OISD STD 116	Fire protection facilities for petroleum refineries and oil/gas processing plants

Table: 1.1.2 Two OISD standards have been included in the Gas Cylinder Rules

Sixteen OISD standard have been included in the oil mines regulations 2017:

S. No.	OISD Standard	Description
1	OISD STD 108	Recommended practices on oil storage and handling
2	OISD STD 114	Safe handling of hazardous chemicals
3	OISD STD 116	Fire protection facilities for petroleum refineries and oil/gas processing plants
4	OISD STD 117	Fire protection facilities for petroleum depots, terminals, pipeline installations and lube oil installations
5	OISD STD 118	Layouts for oil and gas installations
6	OISD STD 128	Inspection of unfired pressure vessels

Table: 1.1.3 Sixteen OISD standard have been included in the Oil Mines Regulations 2017

Unit 1.2 - Roles and responsibilities of a fire safety technician

Unit Objectives

At the end of this unit, the participant will be able to:

1. Identify roles and responsibilities of fire safety technician.
2. Identify essential skills and knowledge required by fire safety technician.

1.2.1 Introduction to fire safety technician

A fire safety technician is responsible for ensuring and maintaining fire safety for a company or facility. With solid knowledge of fire safety codes and regulations, they implement preventive measures, maintain buildings safety standards, create and implement safety policies and are trained in appropriate fire safety procedures.

Roles and responsibilities of fire safety technician

- Performance of daily, weekly, monthly and annual inspections and preventative maintenance services on various fire extinguishers and fire-fighting hose. Also assist with automatic sprinkler and fire alarm systems, risers, sectional valves, pumps and fire doors.
- Replace, repair, fill and tag all fire extinguishers and fire hose in the facility.
- Complete electronic and/or hand-written inspection reports in a timely manner.
- Be proficient in the use of electric carts, high lifts and scissors lifts.
- Be able to work independently and use provided personal protective equipment such as fall protection, hearing protection, eye protection and head protection etc.
- Understand and use two-way radio communicators.

1.2.2 Fire safety technician skills

Knowledge of:

- Principles and practices of fire safety and suppression.
- Standard office practices and procedures, including filing and the operation of standard office equipment.
- Electrical principles and their application to the maintenance, repair and installation of fire/life safety systems.
- Design requirement, technical operating details of fire/life safety alarm and suppression systems.
- Methods, materials, tools, safety practices and equipment used in the fire/life safety systems trade.

- Safety factors in the operation of equipment and materials.
- Applicable safety codes, ordinances and regulations.

Ability to:

- Work well under pressure.
- Practice strong analytical and communication skills.
- Be pro-active, self-motivated, result oriented and resilient with a professional manner of conduct
- Display knowledge of basic practices of reviewing official documents for completeness and accuracy.
- Act in a lead capacity.
- Perform routine to moderately complex inspections, service, and repair of fire extinguishing equipment.
- Recognize and report deviations through inspection programs.
- Interpret, apply, and explain applicable laws, codes, and regulations.
- Read and work from blueprints, technical manuals, charts and schematics.
- Utilize and repair fire/life safety alarm and suppression systems.
- Understand and interpret complex fire/life safety regulations, code and standards.
- Maintain accurate records and reports on completed assignments.
- Operate and maintain a variety of equipment and tools.
- Understand and carry out oral and written instructions.
- Observe safety requirements and safe work practices and methods as required.
- Establish and maintain cooperative work relationships.

1.2.3 Working conditions

Environment:

- Indoor, office environment and outdoor environment, with climate changes.
- Hazardous conditions.
- Includes travel to conduct work.

Physical demands:

While performing the essential functions of this job the employee is regularly required to stand, walk, use hands to finger, handle, or feel, reach with hands or arms, stoop, kneel, crouch, or crawl, and is occasionally required to lift and/or move moderate to heavy objects up to 60 lbs. The work also requires the following physical abilities in order to perform the essential job functions.

- Hearing and speaking to exchange information.
- Dexterity of hands to perform the tasks required of the position.

- Sight in order to be aware of hazards and dangers found in the nature of the work.
- Regularly stand, walk, and sit for extended periods of time.
- Ability to climb, stoop, kneel, reach, push, pull, grasp, and perform repetitive motions.
- Climb ladders of varying heights.
- Ability to manoeuvre in crawl spaces, attics, and utility tunnels.
- Ability to work at extreme heights.

Summary

- The oil and gas industry is includes different processes of exploring and extracting, collecting and processing and ultimately distributing the oil and natural gas for use.
- The energy sector has three key areas, upstream, midstream and downstream.
- Upstream involves the search for underwater and underground natural gas fields or crude oil fields.
- Midstream entails the transportation, storage, and processing of oil and gas.
- Downstream means refining crude oil and purifying natural gas.
- The government is planning to set up around 5,000 compressed bio-gas (CBG) plants by 2023.
- Crude oil consumption is expected to grow at a CAGR of 3.60% To 500 million tonnes by 2040.
- Natural gas consumption is forecast to increase at a CAGR of 4.18% To 143.08 Million tonnes by 2040.
- Diesel demand in India is expected to double to 163 million tonnes (MT) by 2029-30.
- Pipeline technician is responsible for the maintenance and correct operation of an oil or gas pipeline system.
- Operation and control, critical thinking, equipment maintenance, quality control analysis are few skills of pipeline technician.

Exercise

1. **India's oil refining capacity was 249.9 million metric tons (MMT) as of October 1, 2020, making it the second largest refiner in Asia.** (True/False)
2. **In 2011, India became the fourth largest importer of Liquefied Natural Gas (LNG), after Japan, South Korea, and China.** (True/False)
3. Production is another term used to describe the actual drilling and bringing of oil and natural gas to the surface, occasionally referred to as **"upstream"**.

   .....

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4. Oil and natural gas products are even used to make artificial limbs, hearing aids and flame-retardant clothing to protect fire-fighters.

   a) Oil and natural gas
   b) Crude oil and natural gas
   c) LPG and natural gas
   d) Kerosene and heating oil

5. The full of OISD is

   .....

6. Write any two roles and responsibilities of fire safety technician.

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Notes

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=FsyAlv5Azws

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=nwpc-Mmfq1Y

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=oCqK7kHBpzg

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2. Prepare workplace in line with fire safety rules

Unit 2.1 - Carry out fire safety procedures

Unit 2.2 - Safety demonstration

HYC/N3601

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Perform safety procedures as per safety rules.
2. Manage safety demonstration for fire safety awareness program.

Unit 2.1 - Carry out fire safety procedures

Unit Objectives

At the end of this unit, the participant will be able to:

1. Identify the types and features of cooking gases.
2. List the points of PNG composition.
3. Explain the city gas distribution in India and its benefits.
4. State the different uses of domestic PNG.
5. Explain the basic properties of flammable gas.
6. Describe how to store the flammable gas.

2.1.1 Fire awareness

Fire is a chemical reaction that requires three elements to be present for the reaction to take place and continue.

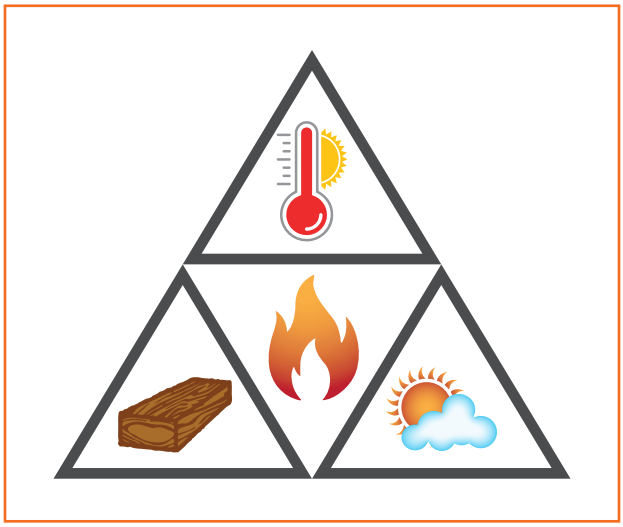


Fig: 2.1.1 Three elements that together cause fire

1. **Heat:** A heat source is responsible for the initial ignition of fire, and is also needed to maintain the fire and enable it to spread. Heat allows fire to spread by drying out and preheating nearby fuel and warming surrounding air.
2. **Fuel:** Fuel is any kind of combustible material. It is characterized by its moisture content, size, shape, quantity and the arrangement in which it is spread over the landscape. The moisture content determines how easily it will burn.
3. **Oxygen:** Air contains about 21 percent oxygen, and most fires require at least 16 percent oxygen content to burn. Oxygen supports the chemical processes that occur during fire. When fuel burns, it reacts with oxygen from the surrounding air, releasing heat and generating combustion products (gases, smoke, embers, etc.). This process is known as oxidation.

These three elements typically are referred to as the **"fire triangle."** Fire is the result of the reaction between the fuel and oxygen in the air.

Causes of fire

- **Electrical:** For example, overloading of circuits, faulty old or bad connections causing sparks or generating a heat source, poor maintenance of electrical appliances, lack of ventilation and cooling, static electricity etc.
- **Heating appliances:** For example, clothing left on boilers to dry, no sparks guards on open fires or stoves, left unattended while cooling, sited close to combustible materials, faulty temperature control etc.
- **Process dangers:** For example, overheating of machinery, heat generated by friction, uncontrolled sparking, breakdown in cooling process, chemical reaction, poor quality ventilation and temperature control etc.
- **Flammable dusts:** For example, poor extraction, process proximity to heat or spark source, no containment system, no monitoring or measuring system etc.
- **Carelessness:** For example smoking, inadequate precautions while welding, drilling or cutting, horseplay or interference with safety equipment, removal of guards etc.
- **Bad housekeeping:** For example lack of maintenance of work area and equipment, oil/fuel leaks and spillages ignored, overflowing bins and waste baskets, no safe procedures for disposing of combustible waste etc.
- **Spontaneous combustion:** For example chemicals not stored at correct temperature, chemicals mixed incorrectly, combustible materials or waste left unattended etc.
- Poor judgment and human error.
- Failure to follow fire safety instructions.
- Misuse of faulty electrical equipment.

Classification of fire

Before we move forward and study about fire prevention and the safety equipment required for the same, we need to understand the different types of fire. This information is extremely important as it can help you choose the appropriate means to extinguish the fire.

Classes of Fire	
Class A Fires are related to solid materials (wood, paper, cloth, trash, rubber and plastics, charcoal, etc.)	
Class B Fires are related to flammable liquids (paint, diesel, gasoline, petroleum oil, and pain)	
Class C Fires are related to flammable gases (energized electrical equipment like motors, appliances, transformers, propane, and methane). Electrical equipment such as appliances, wiring, and breaker panels, etc. These categories of fires become Class A, B, and D fires when the electrical equipment that initiated the fire is no longer receiving electricity).	
Class D Fires are related to flammable metals (combustible material like aluminium, sodium, potassium, magnesium). These fires burn at extremely high temperatures and require special suppression agents.	
Class E Fires are related to electrically energized objects, wiring, and electrical appliances. These fires are caused because of faulty heaters or electrical appliances overheating.	
Class K Fires related to cooking oil and greases like vegetable fat and animal fat.	

Table: 2.1.1 Fire classification

2.1.2 Introduction to fire safety procedures

It's no secret that drilling,transportation and handling of oil is a dangerous job. One of the more serious risks for this industry is the potential for fires and explosions.

Preventing fires at oil and gas facilities

Most workplaces have procedures and controls to prevent fires, but fire safety needs special attention on an oil and gas site. There is a wide variety of fire hazards on an average oil and gas site, including.

- Flammable vapours from oil, gas and their by-products.
- Naturally occurring gases (benzene, methane, hydrogen sulphide, etc.).
- Triethylene glycol.
- Mineral spirits and other cleaning chemicals.
- Compressors, heater treaters and other oil and gas-producing equipment.
- Electrical equipment.
- Hot work.
- Dry grass, brush or vegetation.

Because a fire can start whenever a heat source, a fuel source and oxygen are present, it is important for workers to be able to prevent fires from even starting and to know what to do if a fire does start on their site.

1. **Handling of flammable materials:** Flammable materials should be stored and used in a way that prevents exposure to ignition sources. Small containers of flammable materials should only be stored in fire-proof cabinets. Approved storage cabinets for flammable liquids and other materials should be labelled **"flammable, keep fire away."** Larger quantities of flammable materials should be stored in separate tanks or in a separate building on the site, away from ignition sources.

   Any material that could fuel a fire, such as wood, paper or cloth, must be kept away from ignition sources and flammable materials. Workers should transport all flammable materials in approved containers, use the least flammable material for the job and only use as much as is needed to complete the job.

   When dispensing flammable liquids into portable metal containers, workers should make sure the original container is grounded and the portable container is bonded to the source container. If a tank or source container has a bonding cable for portable containers, workers need to use it every time they need to fill a portable container.

   Finally, any rags used to clean equipment on a rig site may be coated in flammable materials and should be disposed of in an approved, fire-proof disposal container until they can be cleaned or removed from the site.

Fig: 2.1.2 Warning Label

2. **Housekeeping:** Keeping the rig site clean and organized will not only reduce the risk of fire on

site, but it will also make it easier to evacuate if a fire does occur. All walkways, exits, foot paths and vehicle paths should be kept clear of equipment and debris. Workers should remove anything that blocks exit, alarms or other emergency equipment.

All lighting and emergency equipment must be in good working order. Damaged equipment or burnt-out light bulbs should be repaired or replaced immediately.

3. **Flame-resistant clothing:** Because oil and gas workers are exposed to so many fire hazards, the occupational safety and health administration (OSHA) often requires oil and gas employers to provide employees with flame-resistant clothing (FRC).

Fig: 2.1.3 Flame-Resistant Clothing

FRC is made of materials that stop burning once the ignition source is removed and that provide temporary insulation against active flames. FRC is required during operations with a flash-fire risk, such as servicing operations, production operations or drilling in active hydrocarbon zones.

Keep in mind that **"flame-resistant"** is not the same as **"fire-proof."** FRC will burn while an ignition source, such as an open flame, is still present. FRC comes in a variety of types and protection ratings. FRC worn to protect against flash fires is often not rated to protect against sustained hazard conditions, such as when fighting active petroleum fires. Some FRC also provides protection against electrical hazards or arc flashes.

Workers' FRC should include a long-sleeved outer layer and long pants and should be the outermost layer of clothing a worker has, unless they are also wearing a chemical apron or other protective covering. Any hard hats or other headgear should also be FRC-rated. Workers should only wear natural materials such as cotton or wool under their FRC, since non-treated polyester and other synthetic materials can melt to worker's skin in a fire.

FRC often has special requirements for maintenance, cleaning and repair, and failing to follow procedures can cause the material to lose its fire protection rating. Damaged FRC must be replaced immediately.

4. **Emergency action plan:** Sites should have a written emergency action plan that lists what on-site personnel should do during fires, severe weather, chemical releases and other emergencies. The plan will be unique to your work site and will include the alarms on your work site, what each

alarm means, and what you and your co-workers should do when you hear each alarm. The plan should also cover evacuation procedures from all areas of the site, how to report fires or other emergencies, and which employees will have special responsibilities during an emergency.

Fig: 2.1.4 Emergency action plan

Many sites and facilities use different audible and visual alarms to communicate different emergencies. A distinctive, three-pulse pattern, known as the standard audible emergency evacuation signal, is commonly used during a fire or other emergency that requires evacuation. Some sites may use horns, sirens or bells. Visual alarms may also be available on the site and include flashing or steady lights.

5. **Fire extinguisher use:** Fire extinguishers are rated to fight different classes of fire. Most portable fire extinguishers are dry chemical extinguishers that can fight class a solid-fuel fires, class b flammable-liquid fires and class c electrical fires. Some large oil and gas equipment feature built-in fire extinguishing or fire-suppressing materials, while others have portable extinguishers stored on or in the equipment.

   Only specially trained employees should attempt to fight fires, but any employee may need to be trained to use an extinguisher to clear an escape route. The steps for using a fire extinguisher can be remembered by the acronym **"pass"**.

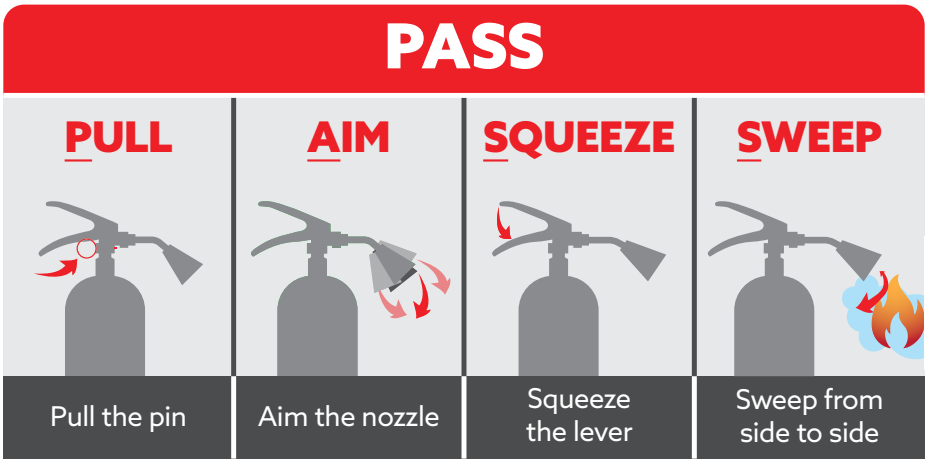


Fig: 2.1.5 Fire extinguisher use

2.1.3 Permit to work

A permit to work (PTW) system is a document which sets out the work to be done, precautions to be taken for all foreseeable hazards involved & records the state of equipment when handed over while it does not itself make the job safe. It makes the work method fool-proof.

Examples of jobs requiring work permits are those who are requiring employee to enter and work in confined spaces, to repair, maintain or inspect electrical installations or to use large or complex equipment.

Role and purpose of a permit- to- work system

When a job has the potential of causing serious injuries or death, it is necessary to formalize agreed upon work procedures. This prevents instructions from being missed, forgotten or misinterpreted. It also serves as a checklist to ensure that all hazards have been identified and evaluated. Work permit is issued for non-routine work and not for routine work like cleaning, housekeeping etc.

In addition, the occupier or supervisor and the assigned worker(s) will be able to verify that all requirements and conditions are complied with and before the job is started.

Types of permit

Permit- to- work (PTW) covers many different types of operations and tasks, and the following are examples of types of job where permits should be considered.

- Work where heat is used or is generated, for example welding, grinding, etc.
- Work which involves breaking containment of a flammable or dangerous substance.
- Work which involves breaking containment of a pressure system.
- Work on electrical equipment.
- Work within tanks and other confined spaces.
- Working at height.
- Work involving hazardous substances.
- Well intervention.
- Diving operations.
- Work involving pressure testing.

1. **Hot work permit:** This is issued for work which involves the application of heat or sources of ignition to vessels or equipment which may contain or have contained flammable vapour. Also for areas in which there may be a flammable atmosphere. Hot work permits are typically coloured red or are red- edged.
2. **Cold work permit:** This is issued for work involving hazardous activities which are not covered by a hot work permit.
3. **Electrical work permit:** As it suggests, this permit is used when working on a piece of equipment or a circuit that is safe. A permit should never be issued for work on live equipment.
4. **Confined spaces entry certificate:** These certificates are used when entry to a confined space is essential for work to be done. They should specify all of the precautions necessary to ensure

that exposure to hazardous fumes or an oxygen- depleted atmosphere is eliminated before entry to the confined space is permitted.

Although the certificate should confirm that the enclosed space is free from asphyxiating gases or hazardous fumes, it should also specify any precautions necessary to protect the worker(s) from exposure to the risk of harm from other sources, e.g.

- The ingress of airborne contaminants from other sources.
- Hazardous fumes being released from residues within the confined space.
- Oxygen depletion caused by oxidation.

These precautions can include:

- Use of forced ventilation.
- Provision of personal protective equipment including breathing apparatus.

2.1.4 Fire safety signs

Most people take the presence of fire safety signs for granted. But whilst one may not pay attention to them on a typical day, in a real emergency they can be the difference between life and death. That's exactly why they are a crucial element of any site's fire safety strategy. Discover the various categories of fire signage below.

Why are fire safety signs so important?

It's vital that everyone in a building/site is aware of their nearest fire exit, escape routes and where to find fire-fighting equipment. Fire signage is essential in guiding the occupants of any work premises when a fire breaks out.

Categories of fire signage

The different types of fire safety signs that site/businesses must have include the following:

To help prevent fires:

- **Prohibition signs:** Signs that fall into this category include **"no smoking"** notices. These messages outline a prohibited action that could increase the risk of a fire.
- **Mandatory signs:** These signs indicate steps people must take to comply with fire regulations, which are designed to safeguard occupants. An example of a mandatory sign is a **"fire door keep shut"** notice.
- **Warning signs:** These signs are required to make people aware of the presence of flammable materials. For example, a store cupboard that contains potentially dangerous liquids.

Fig: 2.1.6 Prohibition Sign

To aid the escaping and fighting of fires

- **Safe condition signs:** These signs indicate fire escape routes, fire assembly points and first aid equipment to guide occupants dealing with an emergency and escaping the building.
- **Fire exit signs:** These signs are required in order to highlight the location of fire exits so those escaping the building quickly know which door to head for.
- **Fire equipment signs:** These notices direct people to the location of fire-fighting equipment such as extinguishers or fire hoses and also fire alarm activation areas. Depending on the layout of building, this may not be required if the equipment itself is highly visible.
- **Supplementary information signs:** To provide further instruction, these signs include information such as a directional arrows or text to expand on neighbouring notices.

Fig: 2.1.7 Exit Sign

How is fire safety signage colour-coded?

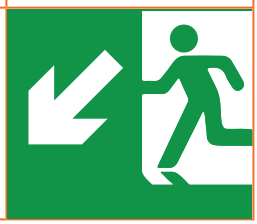
The fire signage categories listed above have been standardised with different colours and shapes. As a result, they can be recognised immediately and interpreted quickly in an emergency situation.

1. **Colour of fire exit signs:** Fire safety signs associated with escaping a fire are green, which has become the universal colour for **"go"**. These types of notices are square or rectangle in shape and have contrasting white writing on them. Exit notices may need to be illuminated so that they adhere to fire door signs regulations. Emergency lighting is used to make them visible in varying light conditions	
2. **Colour of fire equipment signs:** Any fire safety signs that are associated with fire fighting equipment is red. This is in line with the equipment itself, which is also required to be red in colour. The writing and pictograms on these signs are white. One example of this kind of sign is a fire hose notice, which highlights the location of fire fighting equipment	

3. **Meaning of blue and white health and safety signs:** Blue fire safety signs with white writing on them state mandatory precautions that one must abide by in a building. Mandatory signs are circular in shape. An example of this type of sign includes the familiar **"fire door keep shut"** notice, designed to offer protection in the event of a fire	
4. **What message do yellow safety signs carry?** Yellow fire safety signs carry warning messages and are triangular in shape. They feature a black symbol that indicates the type of hazard in a specific area. An example of a yellow warning message is a fire risk sign	

Table: 2.1.2 Fire safety signage and colours

Examples of fire safety sign categories

Type of fire safety sign	Colour of sign	Shape of sign	Message	Example signage
Mandatory signs that indicate things that SHOULD be done	Blue with white writing or symbols	Circular	Fire door keep shut	
Prohibition signs that warn outline things that SHOULD NOT be done	Red outline with a white background and a red strike through	Circular	No naked flames	
Warning signs that highlight specific fire risks in a building	Yellow with black detail	Triangular	Fire risk	
Safe condition and fire exit signs that highlight escape routes	Green with white writing and symbols	Rectangular	Fire exit this way	

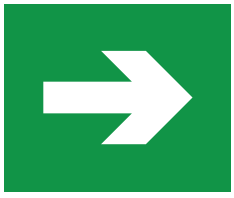
Type of fire safety sign	Colour of sign	Shape of sign	Message	Example signage
Fire equipment signs that direct people to extinguishers and hoses	Red with white writing and symbols	Circular or rectangular	Fire extinguisher is located here	
Supplementary information signs to provide additional direction	Multiple colours, including green, red or yellow	Rectangular	Escape route	

Table: 2.1.3 Fire safety signs categories

2.1.5 Fire safety equipment

There are many different types of fire safety equipment. Each device is designed specifically to deal with the different classes of fire in a range of environments.

1. **Fire extinguishers:** Most buildings contain a variety of hand-held fire fighting equipment. This range of equipment is designed to help contain small fires before they spread and become too large to control. Portable fire extinguishers are available with a number of different extinguishing agents to help you combat a flame. A portable extinguisher may contain the following substance.
    - Water
    - Foam
    - Dry powder
    - CO2
    - Wet chemical
2. **Fire blankets:** Fire blankets are designed to smother class f fires. That means flame that is fuelled by cooking oils and fats. Naturally, fire blankets are installed in kitchen environments, where the chance of a class f fire is the highest.
3. **Fire hose reels:** Fire hose reels are ideal for extinguishing class a fires. That is fires that are fuelled by paper, rubber, wood, and other non-conductive materials. As fire hose reels discharge water, they cannot be used to combat electrical fires. There are other types of fire safety equipment designed to deal with electrical fires – namely CO2 fire extinguishers.
4. **Signage:** All fire equipment should be accompanied by standard signage. This helps users identify the location and type of equipment they can access in an emergency. There is a range of different regulations when it comes to fire safety signage.
5. **Sprinklers:** Sprinklers are the most efficient and effective fire safety device because they react so

quickly. They reduce the risk of death or injury from a fire because they dramatically reduce heat, flames, and smoke, allowing people the time to evacuate from the facility.

6. **First aid kits:** They might not be the first thing to spring to mind when you think of the different types of fire safety equipment, but first aid kits are essential in the aftermath of a fire. Having adequate first aid measures on hand will help with minor injuries sustained during a fire.
7. **Emergency & exit signs:** Whilst fire fighting equipment is important during an emergency when a flame is out of control, you need to evacuate a building. Emergency and exit signs will help to provide a clear path to an exit during a fire. Having clear signage and lighting will help contain panic and guide your team members to an appropriate exit in time.
8. **Smoke alarms:** Some types of fire safety equipment are designed for detection. Smoke alarms should be installed in all commercial and domestic buildings.

2.1.6 Oil spills and gas leaks

Oilfield spills can harm wildlife and pose a risk to human health if they reach fresh water sources or contaminate soil or air. The enormous size of the oil and gas industry and the huge volumes of oil and produced water that are handled, stored, and transported result in thousands of spills every year.

But not all spills are created equal: The size, location, and type of spill, and how quickly the spill can be cleaned up, all influence the overall environmental impact.

Spills occur in two main settings: At or near the well site, or in transit between the oilfield, refineries, and consumers. Spills in the oilfield are usually smaller and easier to clean up than those related to bulk transportation: drill sites are purpose-built “pads” made of gravel and other materials designed to deter spills from reaching soil or groundwater; additional containment measures are used around liquid storage tanks or pits to help contain spills; and equipment and personnel are commonly on hand to address spills quickly.

Environmental impact of fire caused by oil spills and gas leaks

Fire not only poses a risk to life and property it also has a significant impact on the environment. Environmental damage from fires can be both short and long term and, in the case of pollutants from fires affecting groundwater supplies, may persist for decades or even longer. Rivers, sewers, culverts, drains, water distribution systems and other services all present routes for the conveyance of pollutants off-site and the effects of a discharge may be evident some distance away.

In many cases, major pollution incidents can be prevented if appropriate pollution prevention measures are in place or immediately available. Contingency planning is the key to success, therefore preventive and protective measures and incident response strategies should be carefully considered and implemented.

2.1.7 Environmental impact of fire

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Sources of pollution in the event of fire

Every combustion process has the ability to cause environmental pollution. In some cases fires will pollute flora and fauna directly and in others the pollution will occur via the air, the earth and/or the ground water. The degree of contamination from fire effluent depends upon how large the fire is, what is burning and the temperature and burning conditions. When considering how a fire from a particular location may pollute the environment, it should be borne in mind that pollution can occur through a number of routes, including:

- Via site's surface water drainage system, either directly or via off-site surface water sewers.
- By direct run-off into nearby watercourses or onto ground, with potential risk to ground waters.
- Via the foul drainage system, with pollutants either passing unaltered through a sewage treatment works or affecting the performance of the works, resulting in further environmental damage.
- Through atmospheric deposition, such as vapour plumes.

There are an infinite number of compounds that are produced during a combustion process. Some common building materials and contents are known to give off toxic, corrosive and/or carcinogenic fumes when involved in fire. In addition to fumes, harmful particulates in the form of soot or other fallout present significant risks to the environment.

The most common pollutants that are likely to cause environmental pollution as a result of fires include

- Sulphur dioxide
- Carbon monoxide
- Benzene
- Acetone
- Polychlorinated biphenyls
- Fire-fighting water/foam run-off
- Asbestos
- Isocyanates – cyanide.

Pre-planning to minimise the environmental impact of fire

Most industrial and commercial sites have the potential to cause significant environmental harm and to threaten both water resources and public health.

Fig: 2.1.8 Fire accident in Industry

Regardless of the measures that may be taken to prevent environmental pollution, under normal circumstances there is always a residual risk of a spillage or a fire that could cause serious environmental damage. In addition to the obvious threat posed by chemicals and oils, even materials that are non-hazardous to humans, such as foods and beverages, can cause serious environmental harm. The run-off generated in the event of a fire can be very damaging and the discharge of toxic effluent into the atmosphere can have long effects over a wide area.

The environmental impact of a fire may be long term and, in the case of effluent contaminating ground water, may persist for decades. As a result, the legal consequences and clean-up operation can be costly. Rivers, sewers, culverts, drains, surface water soak aways, porous or unmade ground water distribution systems and service ducts all present routes for pollutants to quickly enter the surrounding environment (including surface water and ground water). Thus, the effects of a discharge may not be evident on site, but may become apparent some distance away. Any incident response plan should take into account the vulnerability of ground water both beneath and down-gradient of the site.

In the majority of cases it will be possible to reduce the risk of a fire having a serious impact upon the environment by ensuring that appropriate pollution prevention measures are in place.

1. **Incident response plan (IRP):** an incident response plan (IAP) weighs the risk and benefits of emergency response and fire ground tactics to provide clear direction for effective operations while maximizing the safety of both first responders and people on the scene. Planning saves lives, property, and resources. The plan need not be expensive to prepare but could minimize the consequences of an incident.

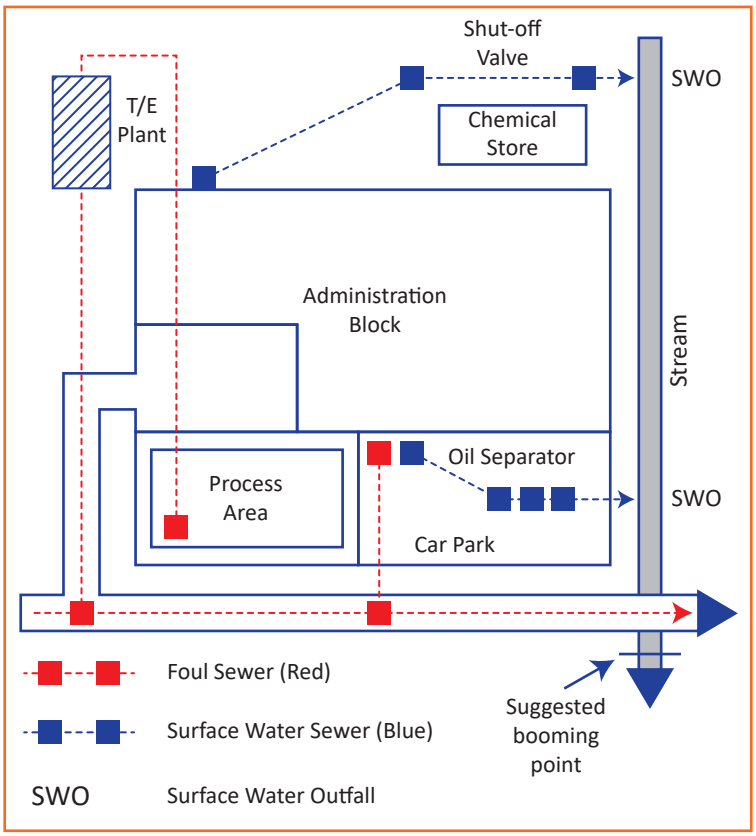


Fig: 2.1.9 Incident response plan

The plan should be drawn up by people with the relevant competencies and may in many cases be developed in consultation with external agencies or specialists in the field. The plan should include:

- Company name and full postal address of the site.
- A brief description of the main business activities on site (specifying those with a high potential for environmental harm).
- The date the plan was completed and the date it is due to be reviewed.
- The signature of the plan by a senior company manager.
- A list of recipients of the completed plan.
- **A contact list including contact details for:**
  - □ Emergency services.
  - □ Relevant environmental regulators.
  - □ Local water supplier and sewer provider.
  - □ Health and safety executive (HSE).
  - □ Specialist clean-up contractors.
  - □ Site key holders.
- A site drainage plan showing.
  - □ Foul drainage surface water including the direction of flow and any drain covers.

- □ Discharge points/soak aways for surface water and trade effluent.
- □ The sewage treatment works to which sewage and trade effluent discharges.
- □ Any watercourse, spring, borehole are well located within or near the site.

- **General layout of buildings including:**
- Site access routes for emergency services.
  - □ Any on-site treatment facilities for trade effluent or domestic sewage.
  - □ Areas or facilities used for storage of raw materials, products and wastes.
  - □ Any bounded areas together with details of products stored and estimated.
  - □ Retention capacity.
  - □ Location of hydrants, 'fire boxes' and spill kits.
  - □ Inspection points for the detection of pollution.
  - □ Oil separators.
  - □ Retention or balancing tanks.
  - □ Firewater retention ponds.

Emergency procedures

Detailed emergency procedures should be put in place which must include details of staff responsibilities and the processes for dealing with events such as fires, spillages and leaking containers, etc. The level of response will obviously depend on health and safety issues, staff training, and the level of personal protective equipment (PPE) available and the nature of any incident. The resultant procedures for dealing with emergencies will therefore need to be site specific. It is important to consider what could happen in the worst case and to take this into account when developing such emergency procedures.

Following are the checklist of actions that may be useful when considering the issues that should influence the development of comprehensive emergency procedures. Any such checklist should include such items as:

- The site fire fighting strategy as agreed with the fire and rescue service. If 'controlled burn' is an agreed option, this should be clearly stated.
- The method of alerting nearby properties, downstream abstractors or environmentally sensitive sites that could be affected by an incident.
- A quantification of the consequences of an incident at nearby properties.
- The methods whereby staff on site and, where appropriate, adjacent sites are alerted to an incident.
- The detailed arrangements for contacting the relevant emergency services, relevant agency, local authority and other organisations, and dealing with the media.
- Any substances that may present risks should be recorded in the incident response plan.
- The provision and management of any relevant PPE.
- Arrangements in place for making leaking containers safe.

- Procedures for containing leaks, spills and fire fighting run-off and for the protection of any on-site effluent treatment plant.
- The requirement for spill kits, drain blockers and other pollution control equipment and the operation of pollution control devices should be clearly documented.
- Stocks of pollution control equipment and materials held locally by other organisations should be identified and contact details for clean-up companies should be kept up to date.
- Procedures for the recovery of spilled product and the safe handling and legal disposal of any wastes arising from an incident.

Containing water run-off

The environmental impact of contaminated water running off from the location of a fire into the surrounding land and water courses can be significant. Water used for fire fighting is always contaminated with the effluent from fire and often contains other contamination as a direct result of a fire. For example, a fire in a cold storage depot may result in quantities of food stuffs degrading and presenting significant biological hazards.

In order to minimise the risks of environmental damage as a result of fire it is necessary to ensure that the site of any potential incident has sufficient emergency containment systems, emergency materials and equipment, arrangements for waste management and consideration has been given to the pre-planning of fire fighting strategies and run-off management.

1. **Emergency containment systems:** A bund is a purpose-built dam around an area where a spillage is likely to occur. Typically bunds can be seen around oil storage tanks. In the event of a spill, for whatever reason, the hazardous substance is contained within the bunded area.

   In some cases, particularly at smaller sites, containing contaminated fire-water run-off will be considered to be impracticable because of cost and space considerations. In such cases, temporary containment systems or pollution control materials are available and should be used to minimise the environmental impact of fire-water run-off.

   However, if reliance is placed on these secondary measures, consideration of some other form of local containment may be necessary to provide sufficient time to prepare them. Their use and location must be clearly marked in the pollution incident response plan and indicated on site with durable signs explaining their use.

   There are a variety of emergency containment measures that may be used including:

   - Sacrificial areas.
   - Bunding of vehicle parking and other hard standings.
   - Pits and trenches.
   - Portable tanks, over drums and tankers.

2. **Emergency materials and equipment:** A wide variety of 'off-the-shelf' products are available to deal with spillages or to contain spills in emergency containment areas. Any materials or equipment used must be located at accessible positions which are clearly marked with durable

notices explaining their use. In addition, any equipment must be fit for the purpose and effectively well maintained ready for use. The pollution incident response plan will identify the pollution prevention equipment and materials and their location. The type of materials and equipment that may be provided to mitigate the effects of a fire on the environment include.

- **Sand and earth:** These basic containment materials can be used to soak up spillages of oil and chemicals and used in sandbags to block off drains or to direct flows to a predetermined collection point. Sand should be kept dry and sufficient shovels or other means of application must also be readily available. The contaminated sand or earth must be properly disposed of (see below) and, obviously, must not be washed into the drainage system.
- **Proprietary absorbents:** These serve a similar use to sand and earth. They are available commercially in the form of granules, sheets, pillows or a loose powder. Although most absorbents are designed for oil spills, specialized products are available for chemical spills.
- **Sealing substances and devices for containers:** These devices and materials are designed for use when a tank, storage drum, valve or pipe has been punctured or damaged by fire. Leak sealing devices may take the form of a pad or clamp which is put over the damaged area like a plaster, or they may be pre-shaped, inserted into the damaged area and then inflated. Leak sealing putties are also available, ready made or supplied in a dry powder form for mixing with water. These are applied over the damaged area to form a temporary seal.
- **Drain seals:** Drain seals can be used to seal a drainage grid by covering or blocking the drain and those which fit in a pipe. Again there are several types of drain seal; care should be taken in their installation to avoid exposure to hazardous conditions and to ensure the contained liquid does not overflow from gullies or elsewhere on the drainage system.
- **Booms:** Booms designed for use on watercourses may also be used to isolate drains or divert or contain spillages on site. They may be permanently fixed in position or deployed at the time of an incident. There are two distinct types of boom; those that are filled with absorbent material which can be suitable for hydrocarbons, aqueous chemicals or both; and those that are typically plastic and form a physical barrier to limit the spread of the contaminant.

Exercise

1. **Class A fires involve flammable liquids.** (True/False)
2. **If possible, hot work should be moved or performed in areas with less hazard potential.** (True/False)
3. **Air pressurized water extinguishers (APW) are suitable for electrical fires.** (T/F)
4. **Each exit route door must be free of decorations or signs that obscure the ..... of the door.**
5. **The three elements needed for a fire include:**
   a) Fuel
   b) Oxygen
   c) Heat
   d) All of the Above

6. **The acronym for proper use of a fire extinguisher is:**
   a) PAST
   b) PASS
   c) PALS
   d) None of the Above

7. **Which of the following activities are considered "hot work"?**
   a) Welding
   b) Cutting
   c) Grinding Ferrous Metals
   d) All of the Above

8. **As a part of an Emergency Action Plan, which of the following is required in every organization to alert occupants of an evacuation?**
   a) Employee alarm system
   b) Floor plan of the building
   c) Draft of evacuation procedures
   d) Training document

9. **What are two important reasons for using work permit?**
   a) To communicate and control work
   b) To track contractors and emergencies
   c) To designate representatives and communicate
   d) To track work Hours and contractor names

10. **Why do we use work permits in hazardous areas?**
    a) To identify a designated representative
    b) To identify receivers
    c) To identify hazards and precautions
    d) To check expired certification

11. **What does the following health and safety sign indicate?**
    a) The location of the fire alarm
    b) The location of the fire extinguisher
    c) Which way to exit
    d) Do not press the button

12. **The following image shows which type of fire extinguisher?**
    a) Foam Fire Extinguisher
    b) Carbon Dioxide Fire Extinguisher
    c) Dry Powder Fire Extinguisher
    d) Wet Chemical Fire Extinguisher

13. **What type of permit is needed in order to carry out work that could potentially result in a fire breaking out on the work site?**
    a) A fire permit
    b) A hot permit
    c) A work permit
    d) No permit is needed

14. **After using a carbon dioxide fire extinguisher, the nozzle gets extremely cold. This is a sign that:**
    a) You should not use it
    b) It is safe to continue
    c) The materials inside are running low
    d) None of the above

15. **Smoke alarms:**
    a) Are your best protection against death from fire
    b) Can only work if you keep a good battery in them
    c) Must be tested every month to ensure they are working
    d) All of the above

Unit 2.2 - Safety demonstration

Unit Objectives

At the end of this unit, the participant will be able to:

1. Identify and conduct ways to keep people safe.
2. Identify and develop safe fire evacuation procedure.
3. Identify the ways to perform first aid related to fire injury.
4. Perform CPR.

2.2.1 Safety of people in the event of a fire

The safety of people in the event of a fire in buildings is dependent on having emergency procedures that make full use of the fire safety design features of the building and take account of the behaviour of the occupants when faced with an emergency situation.

The aim of devising effective emergency procedures is to ensure that the occupants of a building are never exposed to fire effluent or heat or that, if they are, any such exposure does not significantly impede or prevent their escape and does not result in people experiencing or developing serious ill-health effects.

Perception and behaviour of people in the event of a fire

Fire safety in building design is aimed at providing a safe environment for occupants while inside the building. Provision is also made for a safe means of escape for all occupants since a fire emergency usually involves evacuation to a place of safety. Obviously the effectiveness of the means of escape that is provided in any building is reliant upon how they are used at the time of an emergency by individual occupants.

The way an individual occupant of a building will behave to a fire danger is complex. The psychological response of each person is based on their perception of the situation they find themselves in. In order to understand how people perceive the danger of fire it is necessary to consider the principles of sensory perception.

When a person has become aware of an emergency they may react, for example, by spending time thinking about what they should do or by starting to move. This decision will be based upon how seriously they see the risk and how much time they think they may have to evacuate. It can be seen that individual perception is therefore critical to overall escape time.

1. **Principles of sensory perception:** The way in which people perceive risk is dictated by individual attitudes, skills, training, experience, personality, memory and their ability to process sensory information; it is the process by which we detect and interpret, i.e. Recognise information from our environment.
    - **Detection: Is the process of receiving information from the outside world. The detection process involves all the sense organs:**

- Eyes for gathering visual information.
- Ears for sensing vibrations in the air, including sound.
- The nose and tongue are sensitive to certain chemical stimuli.
- Skin responds to pressure, temperature changes and various stimuli related to pain.
- The skeletal structure receptors in our joints, tendons and muscles are sensitive to body movement and position.

- **Interpretation:** Takes place in the brain. The sense organs send messages to the brain by converting stimuli from the outside world into nervous impulses. In order to be able to 'recognise' a situation or object from data received from the senses, the brain will attempt to match a set of data to a previous pattern. For example, a child will learn the look, behaviour, smell and feel of a dog and subsequently interpret anything that looks, behaves, smells or feels like a dog as a dog.

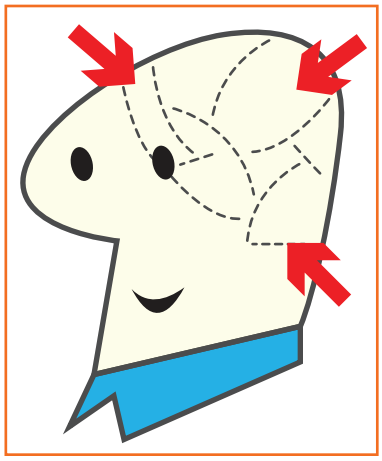


Fig: 2.2.1 Interpreting information

- **Perception vs reality:** Perception varies with individuals, who can interpret sensory data in a number of ways. The illusion shown in figure below is not an inaccurate perception; it is a demonstration of how one perception can be inconsistent with another perception. Recognition of the saxophone player is just as valid as recognition of the young woman. Both are as real and accurate as one another. This example also demonstrates that perception is an active process; humans constantly interpret sensory data to produce recognisable objects and events.

  The problems associated with individual perception of reality can be further understood by considering the following key principles in recognition:

  - There is a tendency to perceive things as complete, filling in the gaps in order to get an overall impression.
  - There is a tendency to perceive objects as constant in size, shape, colour, and other qualities.
  - Sometimes an object that is constant is perceived as variable, for example one moment there appears to be a single object, and the next there appears to be more than one.

2. **The time required for escape: evacuation can be seen as having four distinct phases:**
   - **Phase 1:** Alert time from fire initiation to detection/ recognition.
   - **Phase 2:** Pre-movement time taken by behaviour that diverts an individual from the escape route/s.
   - **Phase 3:** Travel time to physically get to an exit.
   - **Phase 4:** Flow time, i.e. how long it takes for the occupants to move through the various stages of the escape route. Doorways are invariably the least efficient element with the longest flow time and restriction on the route.

Phase 1	Phase 2	Phase 3	Phase 4
Alert	**Pre-movement**	**Travel time**	**Flow Time**
Time from fire initiation to detection/ recognition	Time taken by behaviour that diverts an individual from the escape route(s)	To physically get to an exit	Time taken to move through the various stages of the escape plan

3. **Characteristics of people influencing safe evacuation:** How the occupants of a building may react during both the pre-movement and travel time phases of evacuation are influenced by the characteristics of the people involved. When designing the means of escape from a building it is vital to take into account the number of occupants in a building, together with their density and distribution throughout the building.

   However, in addition to these 'occupancy factors' there are a number of other important aspects that influence people's behaviour at the time of a fire emergency in a building, which must be considered when developing and managing an emergency evacuation procedure, including:

   - Sensory condition
   - Physical condition
   - State of conciseness
   - Initial reactions
   - Stake holding
     - □ Financial stake
     - □ Moral stake
     - □ Legal stake
   - Fire and/or heat in the building.
   - Building design features.

4. **Crowd movement:** The problems associated with the behaviour of individuals of people are gathered together. Research has highlighted several crucial factors which influence the way a crowd may behave. The behaviour of individuals in a crowd often differs from when those same

people are by themselves or in smaller groups. For example;

- Individuals in a crowd can be greatly influenced by the actions of others in a crowd, e.g. If one or two people in a crowd take a short cut, then others will tend to follow.
- Individuals in a crowd are more likely to voice collective frustration at delays caused by excessive queuing.
- Individuals in a crowd are more likely to be susceptible to panic and once panic starts in a crowd it can quickly spread.
- In emergencies individuals will become more aggressive in order to escape.
- Individuals' emotions are often heightened in a crowd, sometimes as a consequence of public entertainment, sometimes by the experience of just being in a large group of people.

The measures needed to overcome behavioural problems and ensure safe evacuation of people in the event of a fire

There are many factors that affect people's behaviour in a fire emergency. Different and complex combinations of these factors influence the time and direction of movement for a particular incident. In contrast, there are only a few simple measures that need to be taken to overcome the majority of these behavioural problems. Each of the following plays a key role in overcoming behavioural problems with securing the safe evacuation in the event of a fire:

1. **The emergency plan:** The key to ensuring that the behavioural problems of people in an emergency situation are minimised is to develop a comprehensive emergency plan. If there is a plan that is well thought out and clearly communicated people will tend to trust it and be willing to play their part. The plan should include, not only the actions that individuals are expected to take in an emergency, but also some arrangements for business continuity.

   The emergency plan for the evacuation of a building will be based on the findings of the fire risk assessment. In many small buildings the emergency plan may merely be a set of simple instructions to staff as to the actions they are required to take in the event of a fire.

   A clear plan of the building that is available to employees, visitors, contractors and the fire service has a number of important benefits including:

   - Assisting employers to better understand the emergency plan.
   - Facilitating easy management of the means of escape.
   - Assisting the safety briefing of employees, visitors, contractors, etc.
   - Assisting fire service operations at the time of an emergency.

2. **Detection:** In order to maximise the amount of time that people in buildings have to escape a fire it is important to ensure that there are adequate arrangements for detecting a fire as soon as one breaks out.

   All fires give off heat, light and smoke, each of which can be detected by a variety of means. In some small premises that are occupied around the clock, it may be sufficient to rely on human detection, i.e. People smelling the smoke or seeing the flames. In most cases, however, some

form of automatic system is the only means of achieving adequate detection of a fire.

Providing automatic fire detection in zones often results in a quicker identification of the location of the fire and can provide an overview of the extent of fire and smoke spread throughout the building which will aid evacuation and response.

In the case of a multiple story building the fire detection system is often zoned in floors which allows for appropriate sequential evacuation of the occupants if necessary.

3. **Warning signals:** Confirmation that there is a requirement for an emergency evacuation is totally reliant on the perception of the person reporting the incident and his or her ability to comprehend the situation and possible impact.

   There should be a simple system in place to enable confirmation and activation of the emergency action procedure. This in turn will depend on the communication of reliable information about the risk and/or the level of exposure to hazards.

   If the warning is perceived as a precautionary measure the decision to move may be delayed or in some circumstances even ignored. This will be influenced by the experience of any previous unnecessary evacuations.

Fig: 2.2.2 Smoke/Fire alarm

4. **Layout of escape routes:** The elements of the means of escape, which are provided within a building. However, in addition to the size, number, width and length of escape routes it is vital that the routes are laid out and indicated in such a way that people who need to use them in an emergency are able to readily identify the direction of travel. In order to ensure that people do not hesitate to use the means of escape with which the building is provided, it is necessary to ensure that there is :

   - Adequate signage, which complies with the health and safety (safety signs and signals) regulations 1996.
   - Adequate lighting of the escape routes and any signage.
   - Clear information relating to the operation of any security devices throughout the route, for example 'push bar to open' or 'twist knob to open'.
   - Escape routes should be intuitive.

5. **Emergency instructions:** It is vital to ensure that the emergency instructions for occupants in a building are clear, consistent, simple and understandable. Emergency instructions should be given on various occasions, for example when staff join an organisation or are relocated within it.

For contractors and others the emergency instructions should be provided at the time they enter the relevant building. For members of the public and for others it is normal that the emergency instructions are only given by the provision of notices located at various points throughout the building.

Emergency instructions provided on notices should contain information relating to such issues as the action to be taken when a fire is detected, the action to be taken when the alarm is heard and any special additional instructions that may be required.

6. **Rehearsal:** Irrespective of the quality of the means of escape within a building and the associated systems, it is always necessary to rehearse the emergency procedure.

   The advantages of conducting fire drills include:

   - The testing of the systems to ensure they operate as expected
   - Increasing the familiarisation of the procedure with the occupants of a building
   - To allow those who hold key roles, e.g. Fire wardens and fire incident controllers, to practice their roles
   - To demonstrate to staff and enforcement bodies that reasonable arrangements have been made to ensure effective evacuation in case of fire.

2.2.2 First aid

First aid is the first assistance or treatment given to a casualty or a sick person for any injury or sudden illness before the arrival of an ambulance, the arrival of a qualified paramedical or medical person or before arriving at a facility that can provide professional medical care.

Aims of first aid

The aims of first aid are:

- To preserve life,
- To prevent the worsening of one's medical condition,
- To promote recovery, and
- To help to ensure safe transportation to the nearest healthcare facility.

Role of first aider: remember pact

P - Protect
A - Assess
C - Care
T - Transport-Triage

(A) Vital signs

Vital signs are measurements of the body's basic functions. Normal vital signs change with age, sex, weight, exercise tolerance, and overall health. The four main vital signs that are usually monitored are given as follows:

Vital signs	Good	Poor
Heart rate	60-100 Beats per minute	Less than 60 or greater than 100 beats per minute
Respirations	14-16 Breaths per minute	Less than 14 breaths per minute
Skin	Warm, pink and dry	Cool, pale and moist
Consciousness	Alert and orientated	Drowsy or unconscious

Table: 2.1.1 Vital signs

(B) Four a's

Awareness	Assessment	Action	After care
• Observe • Stop to help	• Assess what is required to be done • Ask yourself, 'can I do it?'	• Do what you can • Call for expert medical help • Take care of your and the bystander's safety	• Once you have assisted the victim, stay with him/her till expert care arrives

Table: 2.1.2 Four a's

(C) Degrees of burns

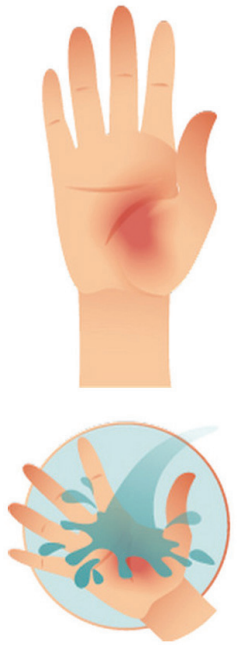
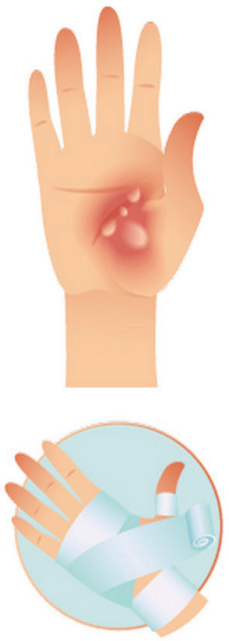
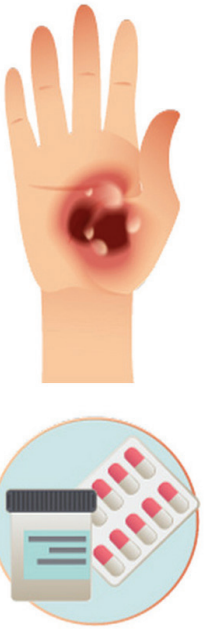
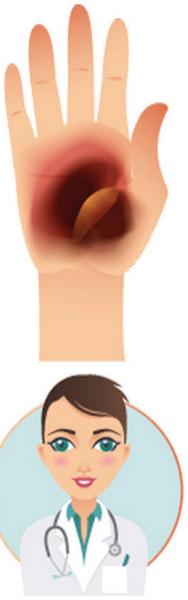
1st degree burn	2nd degree burn	3rd degree burn	4th degree burn
Will recover by it-self in a few days **Action required:** place under running water 	Serious but recovers in a few weeks **Action required:** place clean wet cloth over the burnt area 	Very serious and will require skin grafting **Action required:** place a clean dry cloth over the burnt area 	Extremely serious and requires many years with repeated plastic surgery and skin grafting, is life threatening **Action required:** leave open and prevent infection 

Table: 2.1.3 Degree of burn

(D) First aid techniques for common injuries

Some common techniques to first aid common injuries:

Injury	Symptom	Do's	Don'ts
Fracture	• Pain • Swelling • Visible bone	• Immobilise the affected part • Stabilise the affected part • Use a cloth as a sling • Use board as a sling • Carefully transfer the victim on a stretcher	• Do not move the affected part • Do not wash or probe the injured area

Injury	Symptom	Do's	Don'ts
Burns (see degrees of burn table)	• Redness of skin • Blistered skin • Injury marks • Headache/seizures	• In case of electrical burn, cut-off the power supply • In case of fire, put out fire with blanket/coat • Use water to douse the flames • Remove any jewellery from the affected area • Wash the burn with water 	• Do not pull off any clothing stuck to the burnt skin • Do not place ice on the burn • Do not use cotton to cover the burn
Bleeding	• Bruises • Visible blood loss from body • Coughing blood • Wound/injury marks • Unconsciousness due to blood loss • Dizziness • Pale skin	• Check victim's breathing • Elevate the wound above heart level • Apply direct pressure to the wound with a clean cloth or hands • Remove any visible objects from the wounds • Apply bandage once the bleeding stops	• Do not clean the wound from out to in direction • Do not apply too much pressure (not more than 15 mins) • Do not give water to the victim

Table: 2.1.4 First aid techniques for common injuries

First aid techniques for fire injury

For all burns

Stop burning immediately.

- Put out fire or stop the person's contact with hot liquid, steam, or other material.
- Help the person **"stop, drop, and roll"** to smother flames.

- Remove smouldering material from the person.
- Remove hot or burned clothing. If clothing sticks to skin, cut or tear around it.

Remove constrictive clothing immediately

- Take off jewellery, belts, and tight clothing. Burns can swell quickly.

Then take the following steps:

1. For first-degree burns (affecting top layer of skin).

   Cool burn:

   - Hold burned skin under cool (not cold) running water or immerse in cool water until the pain subsides.
   - Use compresses if running water isn't available.
   - Protect burn.
   - Cover with sterile, non-adhesive bandage or clean cloth.
   - Do not apply butter, oil, lotions, or creams (especially if they contain fragrance). Apply a petroleum-based ointment two to three times per day.

   Treat pain:

   - Give over-the-counter pain reliever such as acetaminophen (panadol, tylenol), ibuprofen (advil, motrin, nuprin), or naproxen (aleve, naprosyn).

   ### When to see a doctor

   Seek medical help if:

   - You see signs of infection, like increased pain, redness, swelling, fever, or oozing.
   - The person needs tetanus or booster shot, depending on date of last injection. Tetanus booster should be given every 10 years.
   - The burn blister is larger than two inches or oozes.
   - Redness and pain last more than a few hours.
   - The pain gets worse.
   - The hands, feet, face, or genitals are burned.

2. For second-degree burns (affecting top 2 layers of skin).

   Cool burn:

   - Immerse in cool water for 10 or 15 minutes.
   - Use compresses if running water isn't available.
   - Don't apply ice. It can lower body temperature and cause further pain and damage.
   - Don't break blisters or apply butter or ointments, which can cause infection.

Protect burn:

- Cover loosely with sterile, non-stick bandage and secure in place with gauze or tape.

Prevent hock

Unless the person has a head, neck, or leg injury, or it would cause discomfort:

- Lay the person flat.
- Elevate feet about 12 inches.
- Elevate burn area above heart level, if possible.
- Cover the person with coat or blanket.

See a doctor:

- The doctor can test burn severity, prescribe antibiotics and pain medications, and administer a tetanus shot, if needed.

3. For third-degree burns

Call ambulance

Protect burn area:

- Cover loosely with sterile, non-stick bandage or, for large areas, a sheet or other material that won't leave lint in wound.
- Separate burned toes and fingers with dry, sterile dressings.
- Do not soak burn in water or apply ointments or butter, which can cause infection.

Prevent shock

Unless the person has a head, neck, or leg injury or it would cause discomfort:

- Lay the person flat.
- Elevate feet about 12 inches.
- Elevate burn area above heart level, if possible.
- Cover the person with coat or blanket.
- For an airway burn, do not place pillow under the person's head when the person is lying down. This can close the airway.
- Have a person with a facial burn sit up.
- Check pulse and breathing to monitor for shock until emergency help arrives.

See a doctor:

- Doctors will give oxygen and fluid, if needed, and treat the burn.

2.2.3 Cardiopulmonary resuscitation (CPR)

Cardiopulmonary resuscitation (CPR) is a lifesaving technique. It aims to keep blood and oxygen flowing through the body when a person's heart and breathing have stopped. CPR can be performed by any trained person. It involves external chest compressions and rescue breathing. CPR performed within the first six minutes of the heart stopping can keep someone alive until medical help arrives.

Fundamentally these are referred to as abc of life. The process is always referred to perform in an emergency:

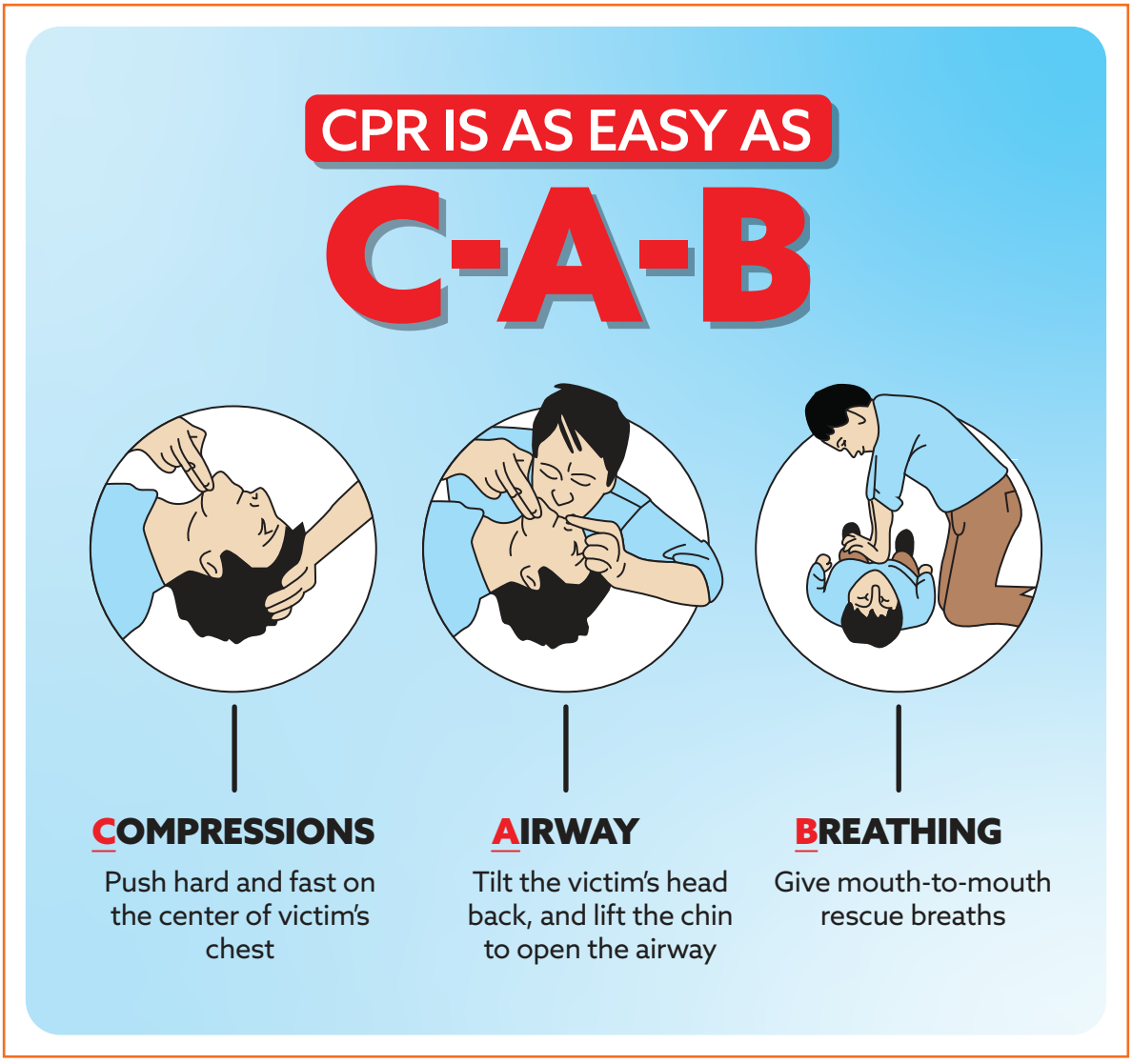


Fig: 2.2.3 CPR Process

Performing hands-only CPR

If a person is not breathing, his or her heartbeat will stop. These CPR steps (chest compressions and rescue breaths) will help circulation and get oxygen into the body.

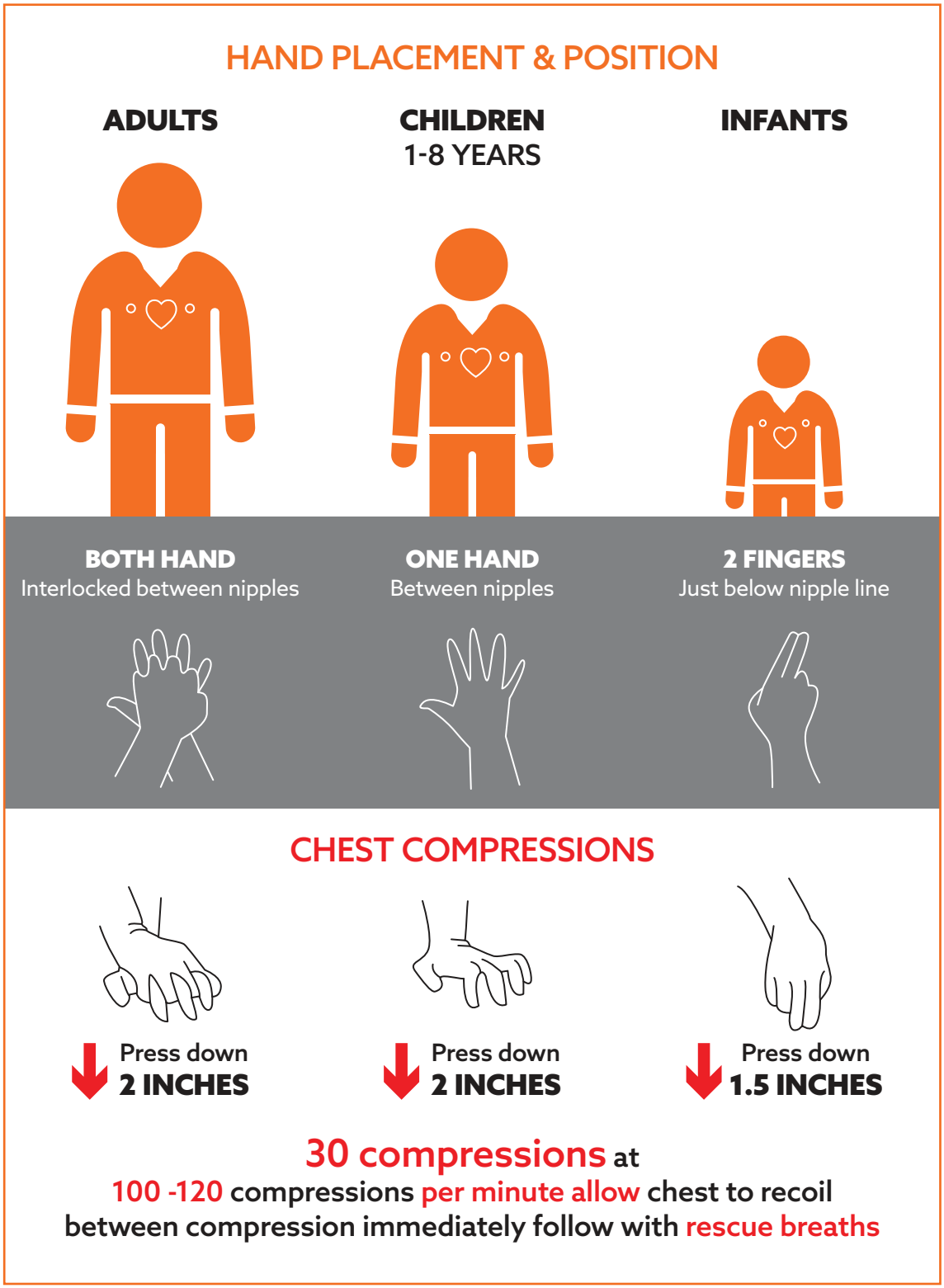


Fig: 2.2.4 Performing CPR Steps

Step 1: Position your hand Make sure the victim is lying on his back on a firm surface. Kneel beside him and place the heel of your hand on the centre of the chest	
Step 2: Interlock fingers Keeping your arms straight, cover the first hand with the heel of your other hand and interlock the fingers of both hands together. Keep your fingers raised so they do not touch the Victim's chest or rib cage	
Step 3: Give chest compressions Lean forward so that your shoulders are directly over the victim's chest and press down on the chest about two inches. Release the pressure, but not your hands, and let the chest come back up. Repeat to give 30 compressions at a rate of 100 compressions per minute	
Step 4: Open the airway Move to the victim's head. Tilt his head and lift his chin to open the airway again. Let his mouth fall open slightly	
Step 5: Give rescue breaths Pinch the nostrils closed with the hand that was on the forehead and support the victim's chin with your other hand. Take a normal breath, put your mouth over the victim's, and blow until you can see his chest rise	
Step 6: Watch chest fall Remove your mouth from the victim's and look along the chest, watching the chest fall. Repeat steps five and six once	
Step 7: Repeat chest compressions and rescue breaths Place your hands on the chest again and repeat the cycle of 30 chest compressions, followed by two rescue breaths. Continue the cycle	

Table: 2.2.1 Performing CPR steps

2.2.4 Fire safety inspection

The occurrence of any fire has the potential to cause severe damage to both life and property. A fire safety audit is the most effective tool for assessing the fire safety standards of the facility. It helps the owners to identify areas where improvement can be made and develop an action plan, in addition to emergency preparedness and mock drills.

Fire safety equipment inspection checklist

Fire prevention and safety equipment are a vital factor in fire inspections. Fire extinguishers, fire alarms, smoke detectors, fire sprinkler systems all play a vital role in fire prevention. It is important therefore to ensure that all equipment is in working order and in compliance with fire safety codes.

- The stipulated number of extinguishers should be present (within 75 feet distance from any place in the facility).
- The size, rating, and type of fire extinguishers match the requirement for the kind of business.
- The extinguishers, fire alarm panels, and fire sprinklers must be serviced and inspected within the previous 12 months.
- All extinguishers should be mounted on the wall in keeping with the specified fire safety recommendations (the top of the unit must be no higher than 3.5 Feet if extinguishers are greater than 18 kg and 5 feet if lighter)
- There should be no warning lights on the fire alarm panel.
- There should be adequate clearance around fire sprinkler deflectors (at least 18 inches recommended).
- There should be no signs of leakage, physical damage or corrosion on any of the equipment.
- The valves, hose connections, and water pressure must be adequate to the requirements of the fire code.

Fire, exit routes inspection checklist

This section ensures that there are no obstructions to people exiting the building in case of a fire emergency. This includes pathways, exits, aisles, and walkways.

- At least two stipulated fire exits should be present.
- All exit doors must unlocked at all times of occupancy.
- Aisles that lead to and away from fire exits should be unobstructed.
- The pathway that leads to exit doors has to be wide enough (at least 36 inches wide.)
- Fire exits must provided with panic hardware.
- All doors to fire exits can be easily opened in case of emergency.
- Easy access to fire protection equipment like fire extinguishers and fire alarm control panel.
- The paths to the exits should be well lit and clearly marked.
- The exit signs should have backup batteries (to allow for a minimum of 90 minutes power backup) in case the lights go off during a fire emergency.

Summary

- Electrical, heating appliances, process dangers, flammable dusts are some cause of fire.
- The aim of devising effective emergency procedures is to ensure that the occupants of a building are never exposed to fire effluent or heat.
- Sensory perception is the process by which we detect and interpret, i.e. recognise information from our environment.
- Different classes of fire are, class A, B, C, D, E, K.
- Different types of fire extinguishers, water extinguisher, dry chemical powder, foam type extinguisher, carbon dioxide extinguisher, special dry powder.
- The fire extinguishers are used by following pass technique.
- Flammable materials should be stored and used in a way that prevents exposure to ignition sources.
- Personal protective equipment (PPE) is a clothing or equipment worn by workers to protect them from various hazards.
- Fire extinguishers are designed to tackle specific types of fire.
- A permit to work (PTW) system is a document which sets out the work to be done, precautions to be taken for all foreseeable hazards involved & records the state of equipment when handed over while it does not itself make the job safe.
- Evacuation can be seen as having four distinct phases, alert time, pre-movement time, travel time, flow time.
- The key to ensuring that the behavioural problems of people in an emergency situation are minimised is to develop a comprehensive emergency plan, which involves detection, warning signals, layout of escape routes, emergency instructions.
- Mandatory signs indicate steps people must take to comply with fire regulations, which are designed to safeguard occupants.
- Warning signs are required to make people aware of the presence of flammable materials.
- An incident response plan (IAP) weighs the risk and benefits of emergency response and fire ground tactics to provide clear direction for effective operations while maximizing the safety of both first responders and people on the scene.
- First aid is the first assistance or treatment given to a casualty or a sick person for any injury or sudden illness before the arrival of an ambulance.
- The first aider should always remember pact, which is protect, assess, care, transport triage.
- First degree burns recovers by it-self in a few days,second degree burns are serious but recovers in a few weeks. Third degree burns are very serious and requires skin grafting, fourth degree burns are extremely serious and requires years with repeated plastic surgery and grafting to recover.
- Cardiopulmonary resuscitation (CPR) is a lifesaving technique. It aims to keep blood and oxygen flowing through the body when a person's heart and breathing have stopped.

Exercise

1. **The way an individual occupant of a building will behave to a fire danger is .....**
2. **How should you open the airway of an unconscious casualty?**
   a) Head tilt and chin lift
   b) Jaw thrust
   c) Head tilt and jaw thrust
   d) Lift the chin
3. **How long would you check to see if an unconscious casualty is breathing normally?**
   a) No more than 10 seconds
   b) Approximately 10 seconds
   c) Exactly 10 seconds
   d) At least 10 seconds
4. **You are a lone first aider and have an unconscious non-breathing adult, what should you do first?**
   a) Start CPR with 30 chest compressions
   b) Give five initial rescue breaths
   c) Call 911/112 requesting AED (defibrillator) and ambulance
   d) Give two initial rescue breaths
5. **Which is the correct ratio of chest compressions to rescue breaths for use in CPR of an adult casualty?**
   a) 2 compressions: 30 rescue breaths
   b) 5 compressions: 1 rescue breath
   c) 15 compressions: 2 rescue breaths
   d) 30 compressions: 2 rescue breaths
6. **Which test should you use if you suspect that a casualty has had a stroke?**
   a) Face, Arms, Speech, Test
   b) Alert, Voice, Pain, Unresponsive
   c) Response, Airway, Breathing, Circulation)
   d) Pulse, Respiratory Rate, Temperature
7. **What is best treatment of second degree burn?**
   a) Put Aloevera lotion on it
   b) Water
   c) Put ice on the burn
   d) wrap with cloth
8. **A nosebleed can be stopped by:**
   a) Waiting
   b) Pinching briefly the nostrils
   c) Give something cold to drink
   d) put some cotton wool into the nose
9. **How do you check for breathing?**
   a) Listen
   b) Look for rising chest
   c) Feel with cheek
   d) Look, Listen and Feel
10. **Most poisoning take place in the home)** (True/False)
11. ..... are more serious burns that affect the outer layer of skin and the next layer, the dermis. They take longer to heal.
12. **Full form of CPR is .....**
13. **What is the normal heart rate?**
    a) 12-20
    b) 15-20
    c) 60-100
    d) 50-80

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=lQ3V8JHJp-c

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SKILL COUNCIL

3. Perform fire safety operations at workplace

Unit 3.1 - Usage of fire fighting equipment

Unit 3.2 - Fire safety measures

HYC/N3602

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Identify the usage of fire fighting equipment.
2. Demonstrate fire safety measures.
3. Perform record keeping system with respect to safety.

Unit 3.1 - Usage of Fire fighting Equipment

Unit Objectives

At the end of this unit, the participant will be able to:

1. Identify sources of fire and fire fighting equipment.
2. Identify fire fighting procedures.
3. Identify various PPE used in fire emergencies.
4. Demonstrate appropriate method to extinguish fire.

3.1.1 Fire fighting equipment

Fire extinguishers are designed to tackle specific types of fire. There are five different classes of fire and several different types of fire extinguishers.

Types of Fire Extinguisher	Identification		
	Use	Fire Class	Colour Code
Water Extinguisher 	• Water removes heat and extinguishes the fire • Water must not be used on fires involving live electrical equipment as it can cause electrocution • Water must not be used on metal fires	Class A fire	Signal red 
Dry Chemical Powder (DCP) Extinguisher 	• DCP extinguishers put out fire by coating the fuel surface with chemical powder • This separates the fuel from the oxygen in the air and prevents vapour formation	Class B & C fire	Red with a blue panel above the operating instructions 

Types of Fire Extinguisher	Identification		
	Use	**Fire Class**	**Colour Code**
Foam Type Extinguisher 	• The extinguishing agent is aqueous film forming concentrate in water which forms air foams when discharged through an aspirating nozzle. • It has a blanketing effect excluding oxygen from the surface of the fuel as it spreads on the fuel. • Prevents vapour formation from the surface of the burning liquid.	Class A & B fire	Red with a cream panel above the operating instructions 
Carbon Dioxide Extinguisher 	• CO2 extinguish the fire by displacing oxygen in the surrounding air. • Its principal advantage is that it does not leave any residue. • Can be used on electrical/ electronic equipment. • CO2 is not suitable for fires involving metals.	Class B & C fire	Red with a black panel above the operating instructions 
Special Dry Powder	• Special extinguishing agents are used for extinguishing metallic fires. • Dry powders extinguish the fire by forming a crust on metal surface excluding air and also absorb heat from the metal surface.	Class D fire	Red with a blue panel above the operating instructions 

Table: 3.1.1 Fire extinguisher types

Correct use of a fire extinguisher

The method of using a fire extinguisher is to follow P.A.S.S. Pass is the acronym for, pull the pin (P), aim (A), squeeze (S) and sweep (S).

1. **Pull the pin:** To use an extinguisher in a proper way, the first step is to pull the handle's pin.
2. **Aim:** The next step is to aim the extinguisher's nozzle. The direction should be towards the fire's base. This is because the sprayed foam at the top will diminish or extinguish only the fire at the top. This will not serve the purpose for which the extinguisher is used. The burned down flame may spring up to life if it gets enough oxygen or any combustible material.

3. **Squeeze:** Then, in an extremely controlled manner, you need to release the agent. This can be done by squeezing the trigger.
4. **Sweep:** If you see in the second step, you already read that you should direct the nozzle at the fire's base. You will sweep the extinguisher's nozzle from left to right. Continue with this process until you put out the fire. You need to act fast as most extinguishers' discharge time is nearly 10-20 seconds.

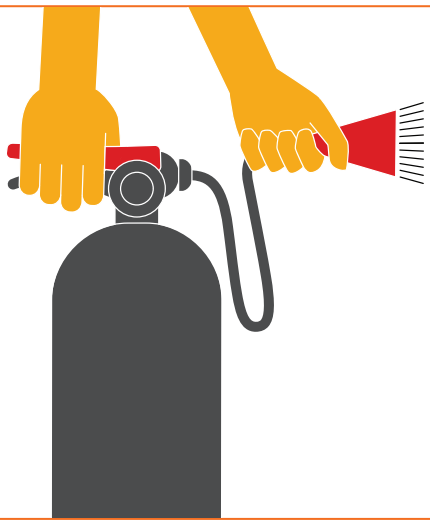
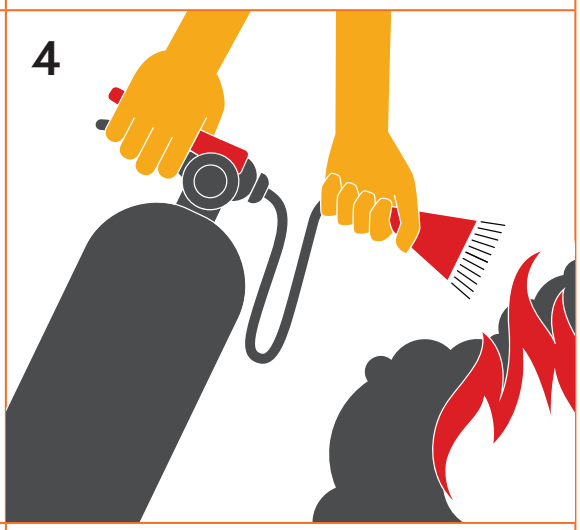
PASS Technique	
1 	2 
Pull out the safety pin as instructed on the label	**Aim the nozzle at the base of the fire**
3 	4 
Squeeze the lever	**Sweep the fire using the extinguisher's discharge**

Table: 3.1.2 Correct method for using fire extinguisher

How to deal with fire

If the house has got fire, you need to take following steps:

- If the fire is very small and can be handled, you should deal with it yourself. Otherwise, you should

come out of the house with other family members.

- Call the fire brigade and also the neighbours for help.
- If your clothes got fire, lie down on the floor and roll around so that the flames may smooth.
- If you are trapped in a fire in a room, bent down on your knees and try not to inhale the smoke as much as possible.
- You should crawl toward the exit as soon as you can.
- You can use the fire extinguisher on the small fire, but you should get yourself trained on it.

Methods of starving fire

On discovery of a fire, everything possible should be done to starve the fire by removing the oxygen and combustible material. The prevention procedure is as follows;

- Close all the doors and windows;
- Cover small fires with a blanket or other suitable objects;
- Cool the fire down;
- Remove combustibles;
- Switch off all electricity main switch; and
- If available, use the appropriate extinguishers.

Remove bystanders from the danger area to a safe place. Keep an access route open for the fire brigade or emergency services and look out for looters as people may take advantage of the confusion caused by the fire to steal valuables.

Fire emergency procedures (dos & don'ts)

The general principles (dos and don'ts) when conducting basic fire-fighting is as follows:

Dos

- Ensure the back-up assistance is available before tackling a fire;
- Ensure that an escape route is available before tackling the fire;
- Follow instructions on the extinguisher's label;
- Apply the extinguisher medium to the base of the flames and move the nozzle in a rapid side-to-side action;
- Drive the flames away from you;
- For vertical fires, start at the base of the flames and move upwards;
- If the fire is outdoors, approach the fire from the windward side;
- When approaching the fire, adopt a crouching position that provides protection against heat and smoke;
- Keep alert for any changes in the fire pattern;
- When tackling a fire involving electrical equipment, isolate the power as soon as possible to prevent re-ignition; and

- Ensure that the fire has been completely extinguished and no spark remains.

Don'ts

- Do not place yourself at risk;
- If the fire is too big, evacuate the area immediately;
- Never tilt or invert any extinguisher during operation unless it is the turnover type;
- When extinguishing the fire of a flammable spillage, never walk on the liquid spillage. This can prevent injuries in the event of the names flashing back;
- When tackling flammable liquid fires using a controllable discharge type extinguisher, spray the medium until the fire is completely extinguished; and
- After the fire has been extinguished, back off slowly and never turn your back on it.

Fire evacuation steps

The sequence of an evacuation situation is

- Detection
- Decision
- Alarm
- Reaction
- The movement to an area of refuge or an assembly station/ area
- Transportation

Rescue techniques during fire hazard

(A) Responding to fire

- The fire alarm system must be initiated, and an alert must be raised.
- A safe evacuation path must be identified before dealing with the fire.
- The appropriate class of fire extinguisher must be chosen.
- The P.A.S.S. Technique must be adopted for extinguishing the fire.
- Immediate evacuation must be initiated if the extinguisher is exhausted and the fire still exists.
- Call security or local emergency services.
- Summon the fire fighting services at the earliest.
- Stay as far as possible from smoke, because the smoke may comprise toxic gases.
- Cover your mouth and nose with a damp cloth. Place a damp cloth above the person too and ensure that the person does not inhale toxic gases.
- Look out for the nearest emergency exit routes and call out for people, who you can take along with you.
- While opening a door, first touch the door with the back of your palm.
- Wrap the person with a blanket to protect him/ her from fire.

- Start moving out of the building carefully as you have to carry along a person with you.
- Always use a staircase and not the elevator.
- Do not rush.
- As you move out of the building, gather people, whoever you come across.
- Always move downstairs and avoid returning to the burning premises, until the fire-fighters arrive.

(B) Initiate evacuation

- Stop your work immediately but do not panic.
- Gather and carry only the most important items like a cell phone before leaving.
- Leave the house via the nearest door bearing an **"exit"** sign.
- Report to the person's family or friend over the telephone if they are not present.
- Call 101 for fire emergency or 108 for other natural disaster help.
- Incorporate first aid treatment to the person.

(C) Emergency evacuation process

- On hearing an evacuation alarm or instruction of any people inside or outside the house regarding fire, immediately cease all activity and secure personal valuables.
- Assist any person in immediate danger, but only if safe to do so.
- If practical, and only if safe to do so, secure any activity or process that may become hazardous or suffer damage if left unattended as a consequence of evacuation.
- Act in accordance with directions given by emergency control personnel and evacuate the building immediately.
- Assist with the general evacuation if directed to do so by emergency control personnel.
- Assist with the evacuation of disabled occupants.
- In a fire, do not use a lift to evacuate a building.
- Move calmly to the nominated evacuation assembly area and do not leave the evacuation assembly area until the all clear has been given.
- Follow the instructions of relevant emergency services personnel and campus emergency control personnel.

3.1.2 Fire hazards, risks and controls relating to hydrocarbons

Lightning

A lightning strike is a massive discharge of electricity from the atmosphere, where the electrical charge has built up, to the earth.

The threat from lightning cannot be entirely eliminated, particularly with floating roof tanks where vapour is usually present around the rim seal. In these circumstances, measures to mitigate the consequences of a fire should be provided, including automatic rim seal fire extinguisher systems.

Threats from a lightning strike include:

- Sparks which can cause a fire or explosion.
- Power surges to electrical equipment, particularly monitoring and safety devices which can render them inoperable.

  Protection from lightning strikes is a specialist area requiring expert knowledge as to what systems are suitable for each facility. However, in general they include the following:

- A 'dissipation array system' which reduces the potential between the site and any storm cloud cell that might be in the vicinity.
- A grounding system called a 'current collector'. This provides an electrically isolated area within which the facility will be located. This is normally made up of wire buried to a depth of about 25 centimetres and which surrounds the protected area. This wire is also connected to rods which are driven into the earth at about 10 metre intervals. Finally, the enclosed area is integrated by a net of cross- conductors which are also connected to any structures within the area, as well as the grounding system itself. This allows any current to discharge to earth safely.
- Electrical surge suppression devices. These devices have two distinct functions to perform. First, to stop direct strikes within the facility, and second, to prevent fast- rising, high current surges.

In general, the necessary precautions are:

- To keep the lightning channelled far away from the immediate neighbourhood of flammable and explosive materials.
- To avoid sparking or flash over in joints and clamps, and at nearby components.
- To prevent the overheating of conductors.
- To prevent flash over or sparking due to induced voltages.
- To prevent raising the potential of the earth termination system.
- All metal containers to be of sufficient thickness (usually 5 mm minimum).
- Down- conductors fitted to all other metal structures and in sufficient numbers as to subdivide any current surge adequately.
- All earthing systems to be interconnected to a single earth termination system. This usually takes the form of a mesh or grid pattern around the site.

Potential consequences of explosions and thermal radiation

Fire can be defined as "the rapid oxidization of a material or substance". This is known as combustion, which releases light, heat and various reaction products such as smoke and gas. Fire is made up of three interdependent elements known as the fire triangle. These are:

- Heat or a source of ignition
- Fuel
- Oxygen

This is known as the fire triangle.

1. **Explosions:** an explosion is a type of fire but one which combusts with such a rapid force that it causes an effect known as over- pressure (explosion). Under certain conditions, the speed of the front of the flame may move to a supersonic level, resulting in a significantly more powerful explosion.

   There are three types of explosion that are associated with the oil and gas industry. These are:

   - Boiling Liquid Expanding Vapour Explosion (BLEVE).
   - Confined Vapour Cloud Explosion (CVCE).
   - Unconfined Vapour Cloud Explosion (UVCE).

2. **Thermal radiation:** thermal radiation is the transfer of heat from one source to another. This can be a structure or a person. Where the recipient source is a person, the consequences can be severe.

   The initial effect of exposure to a source of heat (fire) is to warm the skin. This then becomes painful as the amount of energy absorbed increases. Thereafter, second- degree burns begin to take effect, with the depth of burn increasing with time for a steady level of radiation. Ultimately, the full thickness of the skin will burn and the underlying flesh will start to be damaged, resulting in third- degree burns.

   When plant, including pipework and vessels, is exposed to thermal radiation the effect is the transfer of heat to the product inside the plant. This can change the characteristic of the product and make it less stable. These characteristics include the potential to make the product expand and/or increase the amount of vapour given off, amongst other things. This can result in loss of containment, with an ensuing vapour cloud explosion, jet fire, pool fire or running liquid fire.

Electrostatic charges

Whenever a liquid moves against a solid object, such as the inside of a pipe, it generates a static electrical charge. This is caused by ions (charged atoms) being transferred from the liquid to the surface of the pipe or vessel.

The most common cause of static electricity build- up is where there is a flow (transfer) or movement (mixing process) of liquid within a process.

The amount and rate of static generation can be dictated by a number of factors. These factors, or their elimination or reduction, can also be used to control the risks associated with static electrical generation. These include:

- The conductivity of the liquid.
- The amount of turbulence in the liquid.
- The amount of surface area contact between the liquid and other surfaces.
- The velocity of the liquid.
- The presence of impurities in the liquid.

- The atmospheric conditions. Static build-up is enhanced when the air is dry.

Let's look at some typical areas within a process where static electricity is most likely to occur, as well as some simple control measures.

1. **Electrostatic charges – piping systems:** As we've mentioned, the flow of liquid through piping systems can generate a static charge. However, there are factors which can influence the amount of charge generated. These include the rate of flow and the velocity of the liquid.

   Control measures include keeping the rate and velocity of the liquid low. This can be achieved by ensuring pipe dimensions are appropriate for the volume of liquid flowing through them; and also ensuring the length of pipe is as short as possible.

2. **Electrostatic charges – filling operations:** Filling operations, which involve large flows of liquid and splashing, generate turbulence. This turbulence allows the large amounts of liquid to pass against the vessel surfaces which in turn generates a static charge. If the liquid has already passed through piping to get to the filling operation, this will only serve to increase the accumulated charge already generated.

   Control measures include:

   - Ensuring filling operations do not involve the free-fall of liquids. This will reduce the amount of splashing taking place.
   - Lowering the velocity of the liquid being filled.
   - Ensure fill pipes touch the bottom of the container being filled.
   - Tanks which have been filled with products that have a low conductivity, i.e. Jet fuels and diesels, should be given time to relax before the process continues.
   - Tanks which have been filled with product should not have any ullage (vapour space) for a set period of time. Nor should any dipping of the product take place, again for a set period of time.

3. **Electrostatic charges – filtration:** By their very nature, filters have large surface areas, and this can generate as much as 200 times the amount of electrostatic charge in a piping system that has a filtration system within it, as compared with the same piping system without filtration. Control measures include ensuring good bonding and grounding is in place.
4. **Electrostatic charges – other issues:**

   - Liquids which have particles within them are more susceptible to the generation of static charge than those without.
   - Static can be generated when liquids are mixed together.
   - Piping or vessels which allow a space for vapour to accumulate are a particular concern as any spark generated from a discharge of static electricity may cause an explosion inside the pipe.

Methods of controlling static charges

Although the generation of static electricity cannot be totally eliminated, the rate of generation and its accumulation can be reduced by the following control measures:

1. **Methods of controlling static charges – additives:** In some instances, anti- static additives can be introduced to reduce static charge build up.
2. **Methods of controlling static charges – bonding and grounding:** Bonding and grounding techniques are a very effective means of minimizing the risk of spark generation from a build- up of static electricity.

A bonding system is where all the various pieces of equipment within a process system are connected together. This ensures that they all have the same electrical potential, which means there is no possibility of a discharge of electricity, by way of a spark, from one piece of equipment to another.

Grounding is where pieces of equipment (which may be bonded together or not) are connected to an earthing point. This ensures any electrical charge in the equipment is given the means to constantly flow to earth, thus ensuring there is no potentially dangerous build- up of charge which could lead to a sudden discharge of electricity, by way of a spark.

All equipment which is involved in processing or storing flammable liquid, gas or vapour should be bonded and grounded.

Some other considerations are:

- Incidental objects and equipment, such as probes, thermometers and spray nozzles, which are isolated, but which can become sufficiently charged to cause a static spark, may need special consideration.
- The cables used for bonding and grounding cables should be heavy duty cables. This is to ensure that they can cope with physical wear and tear without compromising their grounding ability. It is also to ensure that their electrical resistance is as low as possible.
- The bonding of process equipment to conductors must be direct and positive.
- Using an inert gas, such as nitrogen, within the ullage space of a storage vessel will prevent an explosion or flash fire occurring if an electrostatic spark does occur. The inert gas lowers the oxygen content of the gas in the ullage space, thus ensuring there is insufficient oxygen to support a burning process (oxygen being part of the fire triangle).
- Operators should wear anti-static clothing.

The identification of ignition sources

1. **Fire hazards, risks and controls:** In the oil and gas industry, the severity of any incident involving fire and/or explosion is likely to be very grave, possibly involving loss of life, severe damage or destruction of plant, as well as having a potential impact on local communities. Consequently, any type of fire or explosion is unacceptable and controls must be put in place to prevent such an occurrence. These controls fall into two main categories.

   First, any product should remain contained or under control throughout the process it is undergoing. In simple terms this means that any leak of product is regarded as highly undesirable. However, if a leak does occur there should be systems in place to detect it immediately and for appropriate action to be taken to control it and/or mitigate any consequences.

Second, all sources of ignition should be eradicated as far as possible in areas where product is processed and has the potential to escape.

Where it is necessary to introduce an ignition source into such an area, such as maintenance involving hot work, then an appropriate risk assessment should be undertaken to identify and evaluate the risks, as well as introducing a permit- to- work regime. These measures may well be accompanied by other appropriate controls, such as temporarily shutting down the process and having fire- fighting equipment to hand.

2. **Identifying sources of ignition:** We will now look at potential ignition sources which need to be considered when conducting a risk assessment. Some of the sources of ignition have had basic control measures added.

   - **Smoking and smoking material:** A total ban on smoking and the taking of smoking materials into controlled areas should be enforced.
   - **Vehicles:** Vehicles may be totally prohibited or restricted to only specially adapted vehicles
   - **Hot work such as welding, grinding, burning, etc.:** Implement a permit-to-work regime.
   - **Electrical equipment:** The equipment should be suitable for the zone it is intended to be used in. It should also be properly and regularly inspected and maintained.
   - Machinery such as generators, compressors, etc.
   - Hot surfaces such as those heated by process or by local weather (hot deserts).
   - Heated process equipment such as dryers and furnaces.
   - Flames such as pilot lights.
   - Space heating equipment.
   - **Sparks from lights and switches:** use only electrical equipment and instrumentation classified for the zone in which it is located.
   - Impact sparks.
   - **Stray current from electrical equipment:** Ensure all equipment is bonded and earthed.
   - **Electrostatic discharge sparks:** Bond and ground all plant and equipment
   - **Electromagnetic radiation:** Make the correct selection of equipment to avoid high intensity electromagnetic radiation sources, e.g. Limitation on the power input to fibre optic systems, avoidance of high intensity lasers or sources of infrared radiation.
   - **Lightning:** We have covered the control measures for lightning earlier in this section. There should be measures in place which reduce the potential of a lightning strike, as well as a grounding system to disperse any charge that may affect the installation. A further consideration is to look at weather windows (i.e. To not work during electrical storms).

Other control measures include:

- Controls over activities that create intermittent hazardous areas, e.g. Tanker loading/unloading.
- Control of maintenance activities that may cause sparks or flames through a permit- to- work system.

- Precautions to control the risk from pyrophoric scale. This is where a substance can ignite spontaneously in air, particularly humid air, and is usually associated with formation of ferrous sulphide.
- Where control and/or detection equipment is regarded as critical, such as smoke and flame detectors, then a back- up or secondary system may be considered appropriate.

  All of these control measures are supplementary to the main control and fire- fighting systems such as emergency shut down systems, fire deluge systems, sprinkler systems, etc.

Zoning/hazardous area classification and selection of suitable ignition- protected electrical and mechanical equipment and critical control equipment

Gases and vapours can create explosive atmospheres. Consequently, areas where these potentially hazardous airborne substances present themselves are classed as hazardous areas so that appropriate controls can be implemented.

However, how often these substances present themselves is also a factor in determining the appropriate level of control. For example, if the presence of a flammable vapour only happens once every three months, it would not be sensible to apply the same level of control to an area where a flammable vapour is present all day, every day.

The answer is to apply a classification to areas – called zoning – which places appropriate controls on the type of equipment that can be used in that area and which potentially can create a source of ignition, particularly electrical equipment, which reflect the risk involved.

This zoning is determined by the frequency and extent of explosive atmospheres being present over a fixed period of time and the likelihood of an explosive atmosphere occurring at the same time as an ignition source becomes active. All of these parameters are established through a rigorous risk assessment.

1. **Zoning:** A place where an explosive atmosphere may occur on a basis frequent enough to be regarded as requiring special precautions to reduce the risk of a fire or explosion to an acceptable level is called a 'hazardous place'.

   A place where an explosive atmosphere is not expected to occur on a basis frequent enough to be regarded as requiring special precautions is called a 'non- hazardous place'.

   Under these circumstances, 'special precautions' means applying measures to control sources of ignition within an area designated as a hazardous place.

   Determining which areas are hazardous places, and to what extent, is called a 'hazardous area classification study'. A hazardous area classification study is a method of analysing the extent and frequency to which an area is subject to having an explosive atmosphere. The main purpose of this is to facilitate the appropriate selection and installation of apparatus, tools and equipment which can be used safely within the environment, even if an explosive atmosphere is present.

   A hazardous area classification study involves giving due consideration to the following:

   - The flammable materials that may be present.
   - The physical properties and characteristics of each of the flammable materials.

- The source of potential releases and how they can form explosive atmospheres.
- Prevailing operating temperatures and pressures.
- Presence, degree and availability of ventilation (forced and natural).
- Dispersion of released vapours to below flammable limits.
- The probability of each release scenario.

Consideration of these factors will enable the appropriate selection of zone classification for each area regarded as hazardous, as well as the geographical extent of each zone. The results of this work should be documented in hazardous area classification data sheets. These sheets should be supported by appropriate reference drawings which will show the extent of the zones around various plant items.

Hazardous areas are classified into zones based on an assessment of two factors:

A) The frequency of the occurrence of an explosive gas atmosphere.

B) The duration of an explosive gas atmosphere.

These two factors in combination will then facilitate the decision- making process which will determine which zone will apply to the area under consideration.

- **Zone 0:** An area in which an explosive gas atmosphere is present continuously or for long periods of time.
- **Zone 1:** An area in which an explosive gas atmosphere is likely to occur in normal operation.
- **Zone 2:** An area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, will only exist for a short period of time.

As the zone definitions only take into account the frequency and duration of explosive atmospheres being present, and not the consequences of an explosion, it may be deemed necessary, because of the severe consequences of any explosion, to upgrade any equipment specified for use within that area to a higher level. This will be a discretionary option open to the analysis team.

2. **Selection of equipment:** The whole idea of zoning is to determine what apparatus, tools and equipment may be installed or used in a particular zone. The issue with electrical equipment is that it normally creates sparks, either as a result of the brushes coming in contact within the rotating armature, or when a switch is activated. Either event can ignite any flammable gas present in the atmosphere in the vicinity of the equipment.

   Consequently, manufacturers have designed specialized equipment which overcomes, in various ways, the issue of having sparks which are exposed to the local atmosphere. The particular solution which is incorporated into each piece of equipment is signified by a code which is marked on the equipment's product identification label. For example, 'd' signifies equipment which has the motor and switch enclosed in a flame-proof enclosure, or 'q' powder filled. Both pieces of equipment are safe to use in zones 1 and 2.

Tools and equipment categorization in zoned areas

Zone 0	Zone 1	Zone 3
An area in which an explosive gas atmosphere is present continuously or for long periods of time.	An area in which an explosive gas atmosphere is likely to occur in normal operation.	An area in which explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, will only exist for a short period of time.
Category 1 equipment **Note:** Although this equipment is categorized for use in Zone 0, it can also be used in Zone 1 and Zone 2.	Category 2 equipment **Note:** Although this equipment is categorized for use in Zone 1, it can also be used in and Zone 2.	Category 3 equipment **Note:** This equipment is also used in zone 3.
1a - Intrinsically safe Ez s - Special protection if specifically certified for Zone 0	'd' Flame-proof enclosure 'p' Pressurized 'q' Power filled 'o' - Oil Immersion 'e' - Intrinsically safe 'm' - Encapsulated 's' - Special protection	Electrical type 'n'

Table: 3.1.1 Tools and equipments categories

Temperature classification for tools and equipment in zoned areas

Temperature	Maximum surface temperature	Substances can be used which will not auto ignite at temperatures below
T1	450 °C	450 °C
T2	300 °C	300 °C
T3	200 °C	200 °C
T4	100 °C	100 °C
T5	85 °C	85 °C

Table: 3.1.2 Temperature classification for tools in zonal areas

3.1.3 Emergency evacuation procedures

Decisions relating to the method of emergency evacuation are made at the time a building is designed and based on such factors as the proposed purpose group and the size of the building. Once a building is

occupied, it will be necessary to devise detailed emergency evacuation procedures that take into account the design features and fixed installation of a building.

When devising emergency procedures the responsible person will need to consider:

- The characteristics of the occupants, their disposition within the building, their physical and mental state.
- The characteristics of the building in terms of its size, use and construction.
- The physical provisions for means of escape in the building.
- The circumstances under which it will be necessary to evacuate.
- What the arrangements are for fighting the fire.
- What type of evacuation will be appropriate, e.g. Phased or full.
- How the evacuation is to be initiated.
- What arrangements are needed to call the fire service.
- What special roles are required to support the procedure, e.g. Fire warden and fire incident controllers.
- What information, instruction and training is necessary to support the procedure.

The fire risk assessment will provide much of this information and it will also give an indication of the time available for the occupants of a building to reach a place of safety. In most cases, the full evacuation of a building should be achieved in the region of 2.5–3 Minutes. This time will be extended where a phased/sequential procedure is adopted.

The procedure

The procedure should cover:

- What to do on discovering a fire or smell smoke.
- What to do on hearing the alarm.
- Roles and responsibilities of staff, e.g. Conducting in assisting disabled occupants.
- Arrangements for calling the fire service.
- How to save time, e.g. Leaving personal belongings behind.
- Where to evacuate to.
- Any special precautions that may need to be taken.

Clear concise arrangements should be displayed; they may also be supplemented by additional information such as escape route plans in hotels and licensed premises.

Competent staff

In order to ensure the safe evacuation of people in the event of fire it is not possible merely to rely on building design, adequate means of escape, fire alarms, emergency lighting, etc. In all but the smallest workplaces it will be necessary to have staff that have been trained to assist with emergency evacuation. Specifically those people responsible for fire safety within buildings and outside venues will need to

consider the provision of fire wardens/marshals, crowd safety stewards, fire alarm verifiers and fire incident controllers.

Fire safety technician's role in emergency evacuation procedures

It is important to realise that fire safety technicians contribute to the safety of people in fire. First, they have a proactive role that requires them to support the ongoing management of fire safety by carrying out such duties as

- Carrying out an ongoing fire risk assessment while at work.
- **Identifying fire hazards and removing them or reporting them to management, for example:**
  - Taking action to reduce the risk of arson.
  - Ensuring flammable liquids are stored and used correctly.
  - Ensuring sources of ignition are limited or controlled (for example, checking permits to work for any hot work).
  - Monitoring smoking in the workplace.
  - Monitoring the build-up of combustible storage and waste.
- **Monitoring fire protection measures, for example:**
  - Ensuring fire doors are in good condition and kept locked or closed shut as necessary.
  - Ensuring fire fighting equipment is in position, tested and in good condition.
  - Ensuring means of escape including corridors and final exit doors are not obstructed particularly with combustible material.
  - Ensuring all doors required to provide emergency egress are clearly marked and operate as they should.
- Knowing what action to take in the event of a fire.
- Being trained to tackle fire should the need arise.
- Being competent to assist in the full and safe evacuation of people in the event of a fire.

However, the emergency role of a fire safety technician must include the following:

- Knowing how to raise the alarm.
- Knowing how to call the fire service.
- Knowing where the means of escape for the part of the workplace that they are responsible for is.
- Being prepared and trained to use fire fighting equipment if it is safe to do so.
- **Assisting the evacuation of people by:**
  - Donning a high visibility jacket or waistcoat in order to be easily recognised.
  - Assisting disabled staff members in accordance with individual peeps.
  - Conducting a quick but thorough check or sweep of all rooms including walk-in cupboards, plant rooms and toilets.
  - Ensuring heat generating equipment is turned off.

- Closing doors and windows if possible.
- Reporting to the fire incident controller the situation within their area of responsibility).
- Take a roll call.
- Assist the return to the workplace when the fire service confirm it is safe to do so.

The purpose of drills, evacuation and roll-calls

There is no evidence from research to suggest that a fire exit sign will necessarily encourage people to head towards it in the event of a fire, unless the route is already familiar. Occupants may choose to ignore specific fire exit routes and choose familiar routes. It is quite likely that people would often be more inclined to move to a familiar exit which is further away than an unfamiliar exit nearby. Therefore it is vital that where possible people who may need to use an exit in the event of an emergency are familiar with it.

The purpose of practising an evacuation procedure is to ensure it functions adequately, to ensure all those with a specific role in the procedure are aware of and competent in their role and are able to demonstrate to all parties that arrangements have been put in place to achieve a reasonable level of safety in the event of fire.

The object of a fire evacuation procedure is to practise good evacuation behaviour, so that people do not experience or develop serious health effects associated with being exposed to the effects of fire.

Confirming the building is clear

In the event of a fire in a building the fire service will need to know, among other things, whether or not there are still people left in the building. It is important to provide the fire service with clear information regarding the situation relating to people in the building. If the fire service officer on the scene has any doubt as to whether there are persons in a building their first priority becomes the rescue of those people. This will involve committing fire fighters into the building to conduct search and rescue operations and is very likely to delay an attack on the main seat of the fire.

In order to be confident when reporting to the fire service, the fire incident controller will need to know that everyone has either left the building or, if people are still in the building, where they are likely to be found. The two methods used by a fire incident controller are the ‘sweep’ and ‘roll-call’.

1. **Sweep:** The sweep technique is simply the application of a systematic and progressive checking of all the areas within a building or within the area of responsibility of a fire warden/marshal. When conducting a sweep of an area it is important to ensure that all areas that may be occupied are swept. This includes any plant rooms where contractors may be working, any walk-in cupboards or storerooms and any toilets or rest facilities. During a sweep of an area the fire warden/marshal should also ensure that where possible and without causing undue delay any doors or windows are closed, any heat generating equipment is turned off and any signs of fire are noted and, if appropriate, dealt with.

   In order to ensure that an effective sweep is made of a building at the time of an emergency evacuation it is necessary for the fire safety manager or fire incident controller to allocate specific areas of the building to specific fire wardens/marshals. In the case of multi-story offices this is

often achieved by nominating two to three fire wardens per floor, whereas, in the case of an open plan factory, fire wardens may be allocated to production areas.

When planning the division of a large building to be swept by fire wardens it is important to bear in mind that the area to be swept by one individual must be of a size and nature that will allow the sweep to be conducted and the warden to evacuate within 2½ and 3 minutes of the alarm sounding.

2. **Roll-call:** In addition to a sweep of the premises it is often the case that some form of roll-call will be taken at the fire assembly point. The level and nature of the roll-call will be determined by the fire risk assessment and be dependent upon factors such as
   - The size and nature of the workforce.
   - The number and nature of any visitors that may be present in the building.
   - The resources required to maintain an accurate roll-call of persons in the building.

3.1.4 Fire fighting PPEs

Fire safety technicians should be provided with structural fire fighting protective garments for use during interior structural fire suppression duties. They are exposed to hazards during the course of their work and require appropriate personal protective equipment (PPE).

Actions for employers

Employers should:

- Evaluate the appropriateness of using bunker gear as PPE for certain activities, particularly during the summer months.
- Consult with their joint health and safety committees or health and safety representatives on alternative protection and guidelines for use.
- Ensure that PPE is appropriately sized to provide effective protection.

Fig: 3.1.4 Fire Fighter Personal Protective Equipments (PPE) kits

1. **Bunker gear:** The common term 'bunker gear' refers to the coat, trousers and coverall elements of the protective ensemble. Other parts of the ensemble include the helmet, hood, boots and gloves.

   Bunker gear may not be appropriate PPE for all incidents, considering the potential for heat stress, reduced mobility and added weight.

Fig: 3.1.5 Fire Helmet

2. **Protective head wear:** Fire safety technicians exposed to the hazards of head injury must wear appropriate PPE, which may include helmets and protective hoods.

   a. **Fire helmets:** A fire helmet is not designed to protect personnel from all conditions or hazards. It provides limited protection to the head when worn during structural fire fighting activities. Other types of emergency calls, such as water rescue, may require head protection designed for that activity.

      Fire helmets are not designed for crash protection and should not be worn when riding in the enclosed cab and crew area of fire service vehicles. The helmet may interfere with head clearance and put personnel at a greater risk of neck or back injury should there be a vehicle roll-over or other motor vehicle incident.

   b. **Protective hoods:** Protective hoods should be worn whenever there is a risk of injury from heat and/or flame to exposed skin. Helmet liners should be used in addition to protective hoods.

Fig: 3.1.6 Protective hoods

3. **Boots and gloves:** Fire safety technicians exposed to the hazard of foot or hand injury must wear protective boots or gloves appropriate in the circumstances.

Fig: 3.1.7 Boots

Fig: 3.1.8 Gloves

Exercise

1. **An example of two "Class B" fuels would be:**
   a) Cardboard, newspapers
   b) Lamp, hot plate
   c) Grease, paint thinner
2. **An APW (water extinguisher) is safe to use on an electrical fire.** (True/False)
3. **Carbon Dioxide extinguishers are designed for which types of fuels?**
   a) Class B and C
   b) Class A, B and C
   c) Class A and C
   d) Class A and B
4. **Which type of extinguisher has a hard horn on the end of a flexible hose or metal arm?**
   a) APW (air-pressurized water)
   b) CO2 (carbon dioxide)
   c) ABC (dry chemical)
5. **As a general rule, you should not attempt to fight a fire if it is spreading rapidly.** (True/False)
6. **ABC fire extinguishers extinguish fire by cooling it down.** (True/False)
7. **Water will not extinguish most flammable liquid fires.** (True/False)
8. You should always keep an exit or means of escape at your back when trying to fight a fire.
   (True/False)
9. **The three elements of the fire triangle are:**
   a) Water, a heat source, and fuel
   b) Oxygen, water, and fuel
   c) Oxygen, fuel, and a heat source
   d) Fuel, oxygen, and earth
10. **Do you know where the nearest fire extinguisher is in your work area?** (True/false)
11. **What is starving in extinguishing the fire?**
    a) Adding fuel
    b) Removal of fuel
    c) Clearing the hazards
    d) Stop the supply of oxygen
12. **Which of the following is a chemical hazard?**
    a) Noise
    b) Vibration
    c) Explosion
    d) Radiation
13. **The P.A.S.S. Technique must be adopted for extinguishing the fire.**

    .....
    .....
14. **Call 112 for fire emergency or 1078 for other natural disaster help.**

    .....
15. **A lightning strike is a massive discharge of electricity from the atmosphere, where the electrical charge has built up, to the earth.**

    .....
    .....
    .....

16. **Any time a liquid is forced against a solid, such as the inside of a pipe, it generates a static charge.**

.....

.....

.....

.....

17. **Mention the types of explosion that are associated with the oil and gas industry.**

.....

.....

.....

.....

18. **What are the 4 types of fire?**

.....

.....

.....

.....

19. **What is the main purpose of hazard identification?**

.....

.....

.....

.....

Notes

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=L4sUQZta8Rw

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=loQ9Dbsy2ag

Unit 3.2 - Fire safety measures

Unit Objectives

At the end of this unit, the participant will be able to:

1. Identify appropriate ways to manage fire caused due to oil spills or gas leakage.
2. Perform checks for open or damage valves in case of fire due to oil spills or gas leakage.
3. Identify fire and explosion strategy.
4. Demonstrate usage of alarms.
5. Demonstrate first aid techniques in case of inhalation of toxic gas.

3.2.1 Emergency plan

On-site emergency plan

Technician of both onshore and offshore installations should undertake the following actions as part of the procedure of writing a comprehensive emergency plan:

- Identify all the major hazards associated with the operations together with their source, type, scale and consequences. This should include malicious acts.
- From these hazards, identify all the conceivable scenarios that could arise which will need an emergency response, including those which involve evacuation, escape and rescue.
- From these scenarios, produce a well-defined plan of action which establishes the appropriate response for an emergency situation and which takes into account the varying demands of different scenarios.
- Establish the procedures and frequencies required to test and practise the emergency response to be followed in each of the different scenarios identified.
- Establish the formal command structure. The person in overall charge in an emergency will be, in the case of an offshore installation, the offshore installation manager (OIM). Onshore it will be a nominated and named competent person until such time as the emergency services take command of the situation.
- Establish that those people who will be expected to take an active part in any emergency response, including those in overall command, are competent to do so (competent being defined as having sufficient training and experience and any other relevant qualities).
- Establish that there are enough people to respond to any emergency.
- Establish the roles and responsibilities of all individuals on the installation.
- Establish that there are enough resources to respond to any emergency.
- For onshore sites, establish that there are plans for both on site and off site should the emergency not be contained within the site.
- For onshore sites, establish that a major accident prevention policy (MAPP) has been prepared

and is current.

- Establish what measures will be necessary to facilitate a site clean- up and re-mediation following an incident.

Once all the information listed above has been gathered, the plan itself can be composed.

Contents of an emergency plan

An emergency plan should contain the following information.

1. Responsibilities and authority of those overseeing an emergency.

   The command structure for managing the on-site response to an emergency situation in accordance with the planned scheme. This will include:

   - The names and positions of persons authorized to set emergency procedures in motion.
   - The name and position of the person in charge of, and coordinating, the on-site mitigatory action.
   - The name and position of the person responsible for liaising with external agencies and/or local authorities.
   - Details of what arrangements have been made for occasions when senior managers are not available.
   - The contact details of all authorized personnel.

2. Types of events planned for and extent of responses planned.

   This is the principle aspect of an emergency plan. It should include details of the following issues:

   - The types of emergency situations which have been regarded as reasonably conceivable.
   - The response strategy for each of these situations.
   - The details of personnel who have been allocated roles to play in an emergency situation, and their responsibilities.
   - The details and location of any special equipment, such as fire fighting equipment and damage control facilities.

3. Alarm systems and responses to alarms.

   This should include what alarm systems and arrangements have been made for early detection of a potential emergency situation. This will include what arrangements have been made and responsibilities for ensuring an appropriate response is made by personnel, such as evacuating the area or facility, taking shelter, using protective equipment, etc.

4. Arrangements for triggering any off site emergency plan.

   Where an off site plan is applicable, details of what arrangements have been made for alerting off site emergency services and other agencies such as water companies, environmental agency, etc. Also, under what circumstances these alerts should be made, what information will be required by each service or agency, and their contact details.

Fire and explosion strategy

A 'fire and explosion strategy' is a combination of measures taken to reduce the risk to personnel in the case of fire or explosion, or that reduces the risk of fire and explosion happening in the first place. Some of those measures listed here will apply specifically to offshore installations, others will apply to onshore installations and the rest to either type of installation:

Measures to be considered in formulating a fire and explosion strategy for a specific installation include:

- Buildings which are occupied should have an assessment made of the risks and hazards they might be vulnerable to if a major incident occurred. From that assessment, appropriate measures should be taken to address those issues. The buildings included in the assessment process should also include temporary and secondary refuges.
- Escape routes should be clearly marked using high visibility signage along their entire route.
- Escape routes should be well lit and include a contingency for emergency lighting in case of power loss.
- All escape routes, where appropriate, should be protected by firewalls or by deluge fire protection systems.
- Escape routes should be of a size that is adequate to accommodate all personnel.
- Where appropriate, the installation should be compartmentalized (have firewalls between compartments).
- Where appropriate, blow out, or explosion panels, should be strategically positioned within the installation to alleviate any overpressure.
- Where appropriate, escape routes should have heat activated deluge/sprinklers within them.
- Each area of the installation should have more than one escape route.
- Escape routes should be protected against the effects of fire and explosion.
- There should be internal access to the helideck from any temporary refuge facility.
- There should be a policy of ensuring the number of overrides and inhibits applied to the emergency shut down (ESD) system and the fire and gas (F&G) system is kept to a minimum.
- At the design stage of an emergency shut down system, fail-safe and fireproof ball valves should be incorporated so their integrity will not be compromised in the case of a fire.
- At the design stage of a process system, the amount of flanged pipework should be minimized in order to reduce the potential for leaks.
- At the design stage the inventory of hazardous substances should be reduced to a minimum.
- Emergency shut down valves (ESDVs) should be enclosed with fireproof casing.
- Water deluge operating skids should be situated away from the area they are protecting.
- Access doors to accommodation areas should have automatic door closers fitted to prevent ingress of smoke and flames.
- All enclosures which house rotating equipment and electric drives should have very early smoke detection apparatus (VESDA) fitted.

- Measures should be taken to ensure the mechanical and natural ventilation to production areas is sufficient to assist in dispersing any gas leak.
- The accommodation and control rooms should be segregated and distanced away from production processes wherever possible.
- The control rooms and emergency command and control centers should be segregated using blast and fire walls.
- Subsea isolation valves (SSIVS) should be fitted in sea lines and wells.
- High integrity pipeline protection systems (HIPPS) should be fitted where appropriate.
- External fire protection should be fitted to the accommodation rooms and temporary refuge (TR).
- The temporary refuge should be airtight and always under positive atmospheric pressure.
- There should be a separate emergency command and control (ECC) center in the temporary refuge when the control room is not situated within the TR.

3.2.2 Alarms – importance of response

Onshore alarms

When an emergency situation arises within an onshore facility, it is imperative that everybody on the site, as well as the general public in the vicinity, is made aware of the situation. This alarm signal is conveyed by means of a warning siren which is loud enough for everybody on the site, and in the surrounding area, to hear.

It is the responsibility of the site management to ensure siren when it is sounded and what it signifies. This includes the general public who may live or work in the surrounding area. Consequently, well-publicized tests of the siren should be conducted periodically to raise awareness. Finally, so there can be no misunderstanding of why the siren is being sounded, the siren will be of one type only and for all incidents.

There will be areas within the facility that are particularly noisy, such as machinery spaces and enclosed rooms. In these instances, the alarm should be backed up with flashing beacons.

The alarm is also likely to be linked to the control center of the emergency services so that they are automatically made aware of any emergency.

Offshore alarms

Offshore, the alarm situation is somewhat different as there are two types of alarm used. The first type of alarm is the general platform alarm (GPA), which is a general alarm calling all personnel on board (POB) to go to their allocated muster station. The general platform alarm (GPA) is an intermittent signal of a constant frequency.

Both types of alarm are generally backed up with a public address announcement and by a visual alarm system where necessary.

3.2.3 Principles of escape, evacuation and rescue from onshore facilities and offshore platforms

The process of evacuating an oil and gas installation varies greatly between those situated onshore and those situated offshore. Consequently, we need to look at the evacuation process of both types of installations separately.

Escape and evacuation – onshore

When personnel need to escape or evacuate an onshore installation there are a number of factors which can enhance their ability to escape without undue difficulty. These include:

- Escape routes should be clearly marked using high visibility signage along their entire route.
- Escape routes should be well lit and include emergency lighting in case power is lost.
- All escape routes should be protected, where possible, by firewalls or by deluge fire protection systems.
- Escape routes should be congestion free (have clear access and egress) and be adequate in size to accommodate all personnel.
- Escape routes should have heat activated deluge/sprinklers within them.
- Each area of the installation should have more than one escape route.
- Where appropriate, the installation should be compartmentalized (have firewalls between compartments).
- Where appropriate, blow out, or explosion panels, should be strategically positioned within the installation to alleviate any overpressure.

When an incident occurs within an onshore installation, the normal means for personnel to evacuate the site would be through the main exits. However, there may be instances where these exits have become blocked or are unavailable. Where this is the case, escape and evacuation will have to be by an alternative exit and this will have to have been foreseen and planned for as part of the planning process when the original emergency plan was drawn up and different scenarios were being considered.

The emergency plan will set out procedures for all conceivable eventualities, and the emergency command and control (ECC) center will follow these procedures in conjunction with the emergency services.

Evacuation of casualties will be by the most appropriate means available, usually by ambulance. In certain circumstances, an air ambulance may be deemed more appropriate, especially where time is of the essence with seriously injured persons. However, other factors such as risk of explosion or toxic fumes may influence the decision to use helicopters. Visibility (night- time or foggy conditions) or weather conditions (strong winds or thunderstorms) will also affect this decision.

The local authority should work with the operators of the installation in preparing an off-site emergency plan. This will set out how they will respond to an incident which affects the surrounding area, its population and the environment. It will include how the area will be evacuated if needs be, and their response to, and rescue from, damaged property.

Escape and evacuation – offshore

When personnel need to escape or evacuate an offshore installation, there are a number of factors which can enhance their ability to escape without undue difficulty. These include:

- Escape routes should be clearly marked using high visibility signage along their entire route.
- Escape routes should be well lit and include emergency lighting in case power is cut off.
- All escape routes should be protected, where possible, by firewalls or by deluge fire protection systems.
- Escape routes should be congestion free (have clear access and egress) and be adequate in size to accommodate all personnel.
- The installation should be compartmentalized (have firewalls between compartments).
- Blow out, or explosion panels, are strategically positioned within the installation to alleviate any overpressure.
- Escape routes should have heat activated deluge/ sprinklers within them.
- Each area of the installation should have more than one escape route.
- There should be more than one means of communicating to personnel specific instructions, such as what to do and where to go.
- The number of ways an alarm is conveyed to personnel should not be by siren alone; i.e. A flashing beacon should be used for areas where a siren might not be heard.
- Multiple means of manually descending to sea level are provided, i.e. Knotted rope, sea ladder attached to the platform leg, scramble net, skyscape, etc.
- Appropriate personnel escape equipment is available either in the accommodation area or on each escape route. This equipment should include emergency breathing systems (EBS), emergency life support apparatus (ELSA), smoke hoods, torches and flame retardant gloves.

Fig: 3.2.1 Personal escape equipment

When an incident occurs on an offshore installation, and escape and evacuation are required, there are a number of means of leaving the installation safely.

The primary method is by lifeboat. These can be launched by davit (a crane- type device which lowers the lifeboat to the sea) or by free- fall where the lifeboat is set at an angle on a launch ramp and allowed to fall into the sea when required.

Life rafts are another means of leaving the installation safely. However, they are not as efficient or as quick to escape in as lifeboats and should rank as second in choice as a means of escape.

Life rafts have to be launched into the sea by means of a davit before they are inflated and can be boarded, which means personnel have to get down from the platform to sea level in order to board the life raft. This can be by 'donut', which is a personnel- controlled descent device. This device is attached to a rope which is attached to the platform. The person controls his/her descent with the device and another rope, attached to the life raft, guides the person to the life raft.

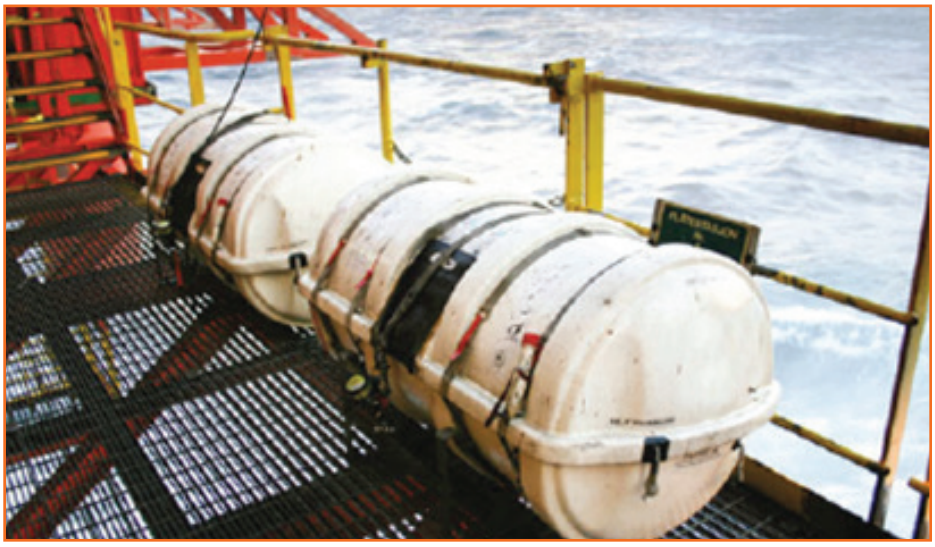


Fig: 3.2.2 Life raft

Other means of descending to sea level in an emergency include by knotted rope, by sea ladder attached to the platform leg, by scramble net, or by 'skyscape' (a ladder type escape device).

Escape can also be considered by helicopter. However, this is usually restricted to casualties who are not capable of leaving the installation unaided.

There is also the consideration of the extent of the incident, which might restrict helicopters landing on the platform.

Fig: 3.2.3 Skye scape

The platform's standby vessel will be available to respond to an escape and evacuation situation. As well

as assisting with the evacuation of the platform, it can offer sea rescue with its fast rescue craft (FRC) and receive launched survival craft (lifeboats and life rafts). If needed, it can also use its fire- fighting capabilities.

It is the duty holder's responsibility to ensure appropriate and comprehensive arrangements are in place for the effective recovery of persons involved in escape or evacuation from the installation. This includes persons falling into the sea from the installation (man overboard), or a helicopter ditching close to the installation.

On recovery, they must be taken to a place of safety. This can be a location onshore, or offshore, for example the platform's standby vessel, where medical treatment and other care facilities can be made available.

Fig: 3.2.4 Fast rescue craft

3.2.4 Fires and other adverse events

One of the most significant consequences of failure to adequately report and investigate a near miss safety incident may be that key learning opportunities are lost. It is often the case that a company will have little difficulty gathering data on significant incidents, particularly those that require it to notify the enforcing authority. However, near misses, false alarms and minor injury accidents and other losses often slip through the net of formal reporting and recording, serving to limit the opportunities to address safety systems failures before substantial losses accrue.

The consequences of failing to monitor events can lead to serious accidents.

Gathering information

It is important in the beginning of an investigation to gather the information immediately or soon after the adverse event occurs or is discovered because:

- The location of the event will be in the same condition, i.e. light levels, temperature, etc.
- People's memories will be fresh.
- There will be limited opportunity for a consensus view to emerge from witnesses.

The amount of time spent on gathering evidence will be proportionate to the outcome/potential outcome

of the event; however, consideration should be given early on to the sources of information available for the investigation.

Fig: 3.2.5 Gathering information at site after accident

Sources of information

Information relating to the immediate, underlining and root causes of any adverse event should be gathered from as wide a range as possible. Information from different sources will tend to confirm the existence of problems with management systems. For example, it is likely that an unsafe workplace practice has developed as a result of either a lack of policy or a policy that is not supported with adequate training or supervision.

Analysing information

Once information has been gathered it is necessary to order it in a logical sequence. The most logical approach is to arrange the information chronologically.

Therefore the first question to be asked is exactly what happened. In order to do this a suitable starting point must be identified. In many cases this will be at the point when the work actively started. In some cases the starting point of the investigation may be at a point in time when a significant failure of a management system initiated a sequence of events that led to an adverse event.

After establishing exactly what the sequence of events was the investigation must attempt to understand why these events occurred.

When exploring why a certain sequence of events occurred it will be necessary to consider a number of potential contributory factors. These factors will relate to the job, the people, the organisation, the equipment involved and the environment.

Job factors include:

- The nature of the work, e.g. is it routine, boring, or exceptional?
- Is there sufficient time available to complete the tasks safely?
- Are there any distractions, noise, other jobs, etc.?
- Are there adequate safe procedures/systems of work?

Human factors include:

- The physical and mental abilities of the individuals involved.
- The levels of competence.
- Personal or work-related stress.
- The effects of fatigue, drugs and alcohol.
- Human failure, e.g. errors and violations.

Organisational factors include:

- Work pressures and long hours worked.
- The availability of sufficient resources.
- The availability and quality of supervision.
- The health and safety culture in the organisation.

Equipment factors include:

- The ergonomic design of the controls.
- The ergonomic layout of the workplace.
- Built-in safety devices.
- The condition of the equipment.
- The history of maintenance and testing.

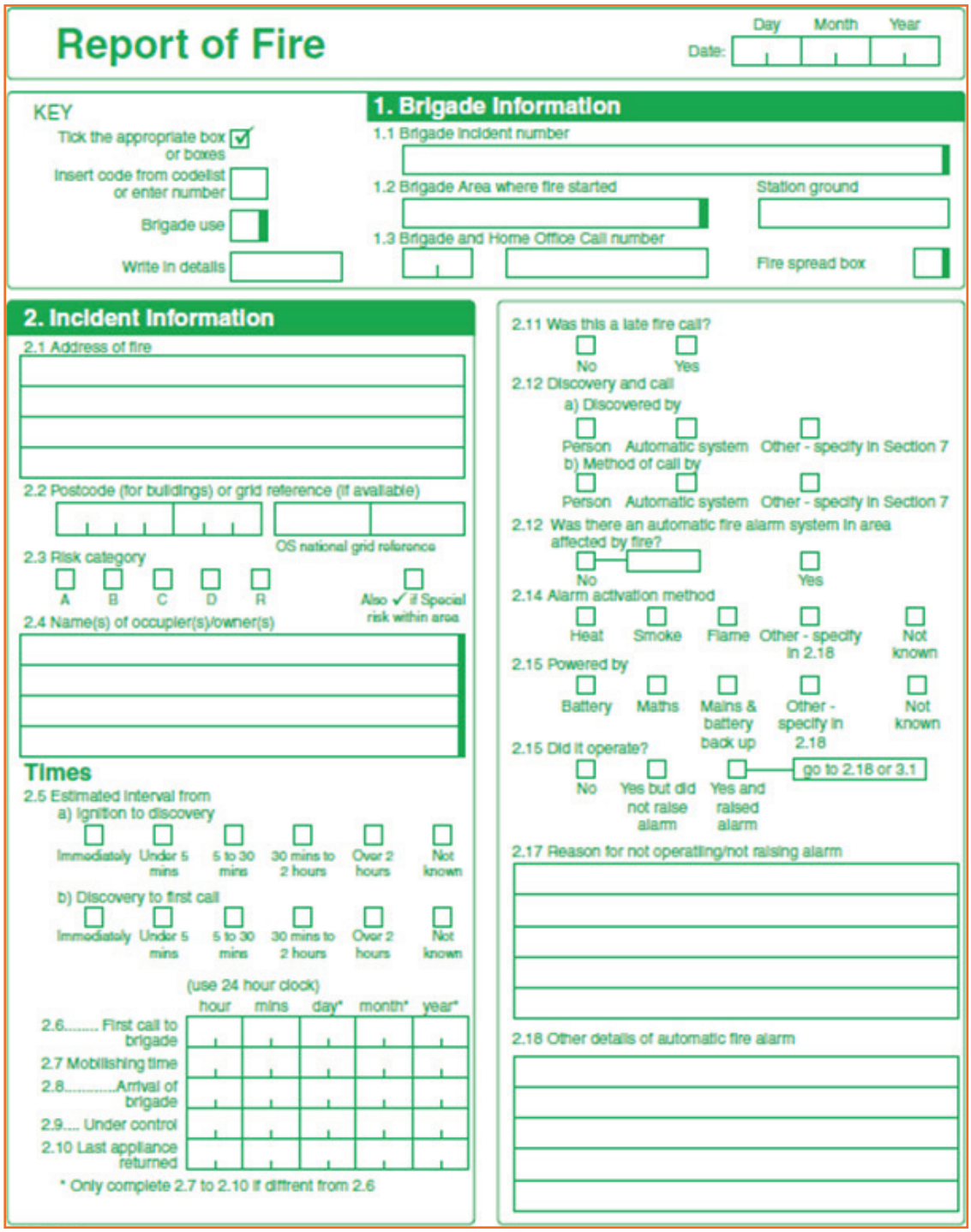
Environmental factors include:

- Temperature,
- Light levels,
- Noise levels,
- Cramped/open working conditions,
- The provision of adequate welfare arrangements,
- Cleanliness/housekeeping standards.

3.2.5 Reporting fire-related events

1. **Personal Injuries: Any personal injuries, i.e. fatal, major or three-day, that occur as a result of a fire must of course be reported to the authorities. Specified injuries that are likely to arise from a fire in a workplace are:**

   - Chemical or hot metal burns.
   - Any situation requiring resuscitation.
   - Loss of consciousness following smoke inhalation or oxygen deficiency.
   - Admittance to hospital for more than 24 hours.



Report of Fire

Date: Day Month Year

KEY
Tick the appropriate box or boxes
Insert code from codelist or enter number
Brigade use
Write in details

1. Brigade Information
1.1 Brigade incident number
1.2 Brigade Area where fire started
Station ground
1.3 Brigade and Home Office Call number
Fire spread box

2. Incident Information
2.1 Address of fire
2.2 Postcode (for buildings) or grid reference (if available)
OS national grid reference
2.3 Risk category
A B C D R
Also ✓ if Special risk within area
2.4 Name(s) of occupier(s)/owner(s)

Times
2.5 Estimated interval from
a) Ignition to discovery
Immediately Under 5 mins 5 to 30 mins 30 mins to 2 hours Over 2 hours Not known
b) Discovery to first call
Immediately Under 5 mins 5 to 30 mins 30 mins to 2 hours Over 2 hours Not known

(use 24 hour clock)
hour mins day* month* year*
2.6..... First call to brigade
2.7 Mobilising time
2.8.....Arrival of brigade
2.9.... Under control
2.10 Last appliance returned
* Only complete 2.7 to 2.10 if diffrent from 2.6

2.11 Was this a late fire call?
No Yes
2.12 Discovery and call
a) Discovered by
Person Automatic system Other - specify in Section 7
b) Method of call by
Person Automatic system Other - specify in Section 7
2.12 Was there an automatic fire alarm system in area affected by fire?
No Yes
2.14 Alarm activation method
Heat Smoke Flame Other - specify in 2.18 Not known
2.15 Powered by
Battery Mains Mains & battery back up Other - specify in 2.18 Not known
2.15 Did it operate?
No Yes but did not raise alarm Yes and raised alarm go to 2.18 or 3.1
2.17 Reason for not operating/not raising alarm
2.18 Other details of automatic fire alarm

Fig: 3.2.6 Fire report

2. **Dangerous occurrences:** Any dangerous occurrences that occur as a result of a fire must also be reported to the authorities. However, specified dangerous occurrences that are likely to arise from a fire in a workplace are the failure of any closed system under pressure that has the potential to cause death.

   An electrical short circuit or overload attended by fire which results in:

   - A stoppage for 24 hours or,
   - Has the potential to cause death,
   - Incidents involving explosives,
   - A failure of a breathing apparatus in use or during test immediately prior to use,
   - An explosion or fire which is due to the ignition of any material, which results in the stoppage or suspension of normal work for more than 24 hours.

Summary

- Different classes of fire are, class A, B,C, D, E, K
- Different types of fire extinguishers, water extinguisher, dry chemical powder, foam type extinguisher, carbon dioxide extinguisher, special dry powder.
- The method of using a fire extinguisher is to follow P.A.S.S. PASS is the acronym for, Pull the Pin (P), Aim (A), Squeeze (S) and Sweep (S).
- A lightning strike is a massive discharge of electricity from the atmosphere, where the electrical charge has built up, to the earth.
- Fire can be defined as **"the rapid oxidization of a material or substance"**. This is known as combustion
- An explosion is a type of fire but one which combusts with such a rapid force that it causes an effect known as over- pressure (explosion).
- Thermal radiation is the transfer of heat from one source to another.
- Whenever a liquid moves against a solid object, such as the inside of a pipe, it generates a static electrical charge.
- Methods of controlling static charges are , anti- static additives, bonding and grounding techniques are a very effective means of minimizing the risk of spark generation from a build- up of static electricity.
- Any leak of product is regarded as highly undesirable. However, if a leak does occur there should be systems in place to detect it immediately and for appropriate action to be taken to control
- Smoking materials, vehicles, welding, grinding, electrostatic discharge sparks are some sources of ignition
- Hazardous areas are classified into zones
- Zone 0 is an area in which an explosive gas atmosphere is present continuously or for long periods of time.

- Zone 1 is an area in which an explosive gas atmosphere is likely to occur in normal operation.
- Zone 2 is an area in which an explosive gas atmosphere is not likely to occur in normal operation but, if it does occur, will only exist for a short period of time.
- Fire Safety Technicians should be provided with structural fire fighting PPE for use during interior structural fire suppression duties.
- On site emergency plan includes both onshore and offshore installations.
- Content of emergency plans include, responsibilities and authority of those overseeing an emergency, types of events, alarm systems
- A 'fire and explosion strategy' is a combination of measures taken to reduce the risk to personnel in the case of fire or explosion
- Emergency Shut down Valves (ESDVs) should be enclosed with fireproof casing.
- All enclosures which house rotating equipment and electric drives should have Very Early Smoke
- Detection Apparatus (VESDA) fitted.
- Subsea Isolation Valves (SSIVs) should be fitted in sea lines and wells.
- High Integrity Pipeline Protection Systems (HIPPS) should be fitted where appropriate.
- Onshore alarm signal is conveyed by means of a warning siren which is loud enough for everybody on the site, and in the surrounding area, to hear.
- When exploring why a certain sequence of events occurred it will be necessary to consider a number of potential contributory factors. These factors will relate to the job, the people, the organisation, the equipment involved and the environment.
- Information relating to the immediate, underlining and root causes of any adverse event should be gathered from as wide a range as possible.
- Any personal injuries, dangerous occurrences that occur as a result of a fire must of course be reported to the authorities.

Exercise

1. **Who has the responsibility to ensure siren is heard and what it means?**
   a) Human resources
   b) Site management
   c) Personnel management
   d) General public

2. There are two types of alarms in offshores alarm system, they are –
   a) General onboard alarm, Personnel platform alarm
   b) General platform alarm, Personnel onboard alarm
   c) Platform alarm, Personnel onboard alarm
   d) Onboard alarm, Personnel alarm

3. Escape routes should be clearly marked with ..... along the entire route.
   a) Signage
   b) Lights
   c) Paintings
   d) All the above

Notes

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https://www.youtube.com/watch?v=YWDH5q9u04U

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Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

N·S·D·C
National
Skill Development
Corporation
Transforming the skill landscape

HSSC
HYDROCARBON SECTOR
SKILL COUNCIL

4. Working effectively in a team

Unit 4.1 - Working effectively in a team

HYC/N9301

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Discuss the communication skills.
2. Define the teamwork and communication in handling patient.

Unit 4.1 - Working effectively in a team

Unit Objectives

At the end of this unit, the participant will be able to:

1. Identify importance of effective communication.
2. List out essential skills required for effective communication.
3. Identify barriers to effective communication.
4. Define how to work effectively in team.

4.1.1 Effective communication

Effective communication is a process of exchanging ideas, thoughts, knowledge and information such that the purpose or intention is fulfilled in the best possible manner. In simple words, it is nothing but the presentation of views by the sender in a way best understood by the receiver.

We can say that it generally involves:

- **Sender:** The person who initiates the process of communication by sending a message.
- **Receiver:** The one to whom the message is to be delivered.

Characteristics of effective communication

Just delivering a message is not enough; it must meet the purpose of the sender. Keeping this in mind, let us discuss the elements which make communication effective:

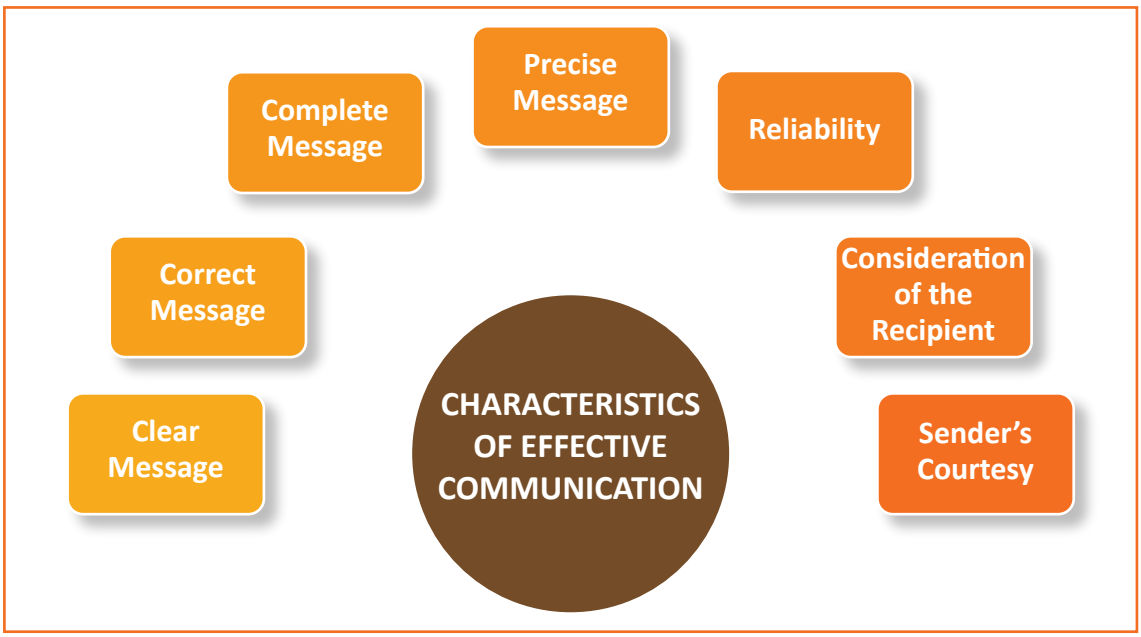

Fig: 4.1.1 Effective communication

- **Clear message:** The message which the sender wants to convey must be simple, easy to understand

and systematically framed to retain its meaningfulness.

- **Correct message:** The information communicated must not be vague or false in any sense; it must be free from errors and grammatical mistakes.
- **Complete message:** Communication is the base for decision making. If the information is incomplete, it may lead to wrong decisions.
- **Precise message:** The message sent must be short and concise to facilitate straightforward interpretation and take the desired steps.
- **Reliability:** The sender must be sure from his end that whatever he is conveying is right by his knowledge. Even the receiver must have trust on the sender and can rely on the message sent.
- **Consideration of the recipient:** The medium of communication and other physical settings must be planned, keeping in mind the attitude, language, knowledge, education level and position of the receiver.
- **Sender's courtesy:** The message so drafted must reflect the sender's courtesy, humbleness and respect towards the receiver.

Effective communication skills

Conveying a message effectively is an art as well as a skill developed after continuous practice and experience. The predetermined set of skills required for an influential communication process are as follows:

- **Observance:** A person must possess sharp observing skills to gain more and more knowledge and information.
- **Clarity and brevity:** The message must be drafted in simple words, and it should be clear and precise to create the desired impact over the receiver.
- **Listening and understanding:** The most crucial skill in a person is he must be a good, alert and patient listener. He must be able to understand and interpret the message well.
- **Emotional intelligence:** A person must be emotionally aware and the ability to influence others from within.
- **Self-efficacy:** Also, he/she must have faith in himself and his capabilities to achieve the objectives of communication.
- **Self-confidence:** Being one of the essential communication skills, confidence enhances the worthiness of the message being delivered.
- **Respectfulness:** Delivering a message with courtesy and respecting the values, believes, opinions and ideas of the receiver is the essence of effective communication.
- **Non-verbal communication:** To connect with the receiver in a better way, the sender must involve the non-verbal means communication too. These include gestures, facial expressions, eye contact, postures, etc.
- **Selection of the right medium:** Choice of the correct medium for communication is also a skill. It is necessary to select an appropriate medium according to the situation, priority of the message, the receiver's point of view, etc.

- **Providing feedback:** Effective communication is always a two-way process. A person must take as well as give feedback to bring forward the other person's perspective too.

Barriers to effective communication

There are certain obstacles which sometimes hinder the process of communication, making it less useful for the sender as well as the receiver. These barriers are categorized under three groups. Let us understand these in detail below:

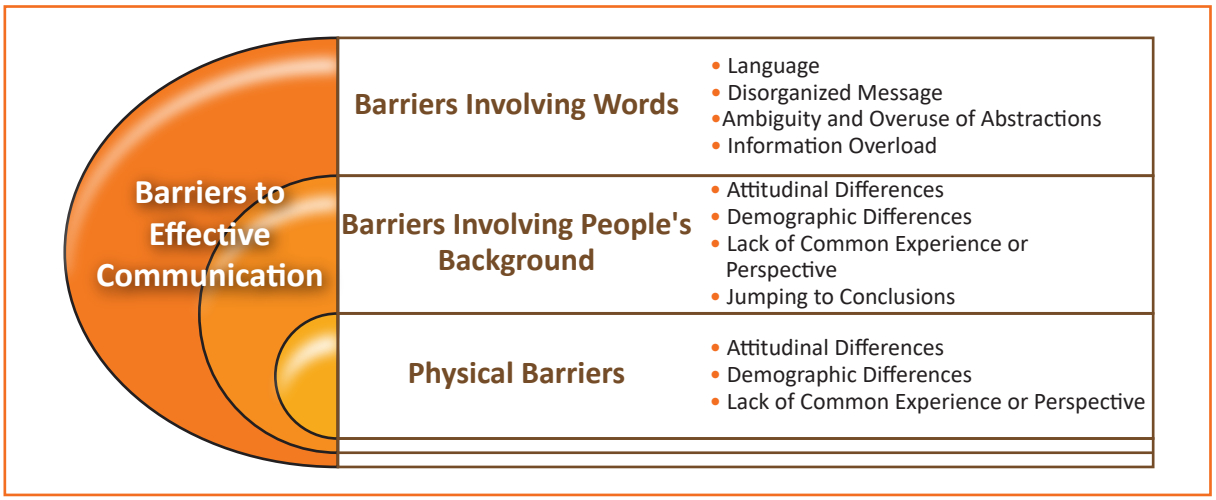

Fig: 4.1.2 Barriers to effective communication

Barriers involving words

Words play an essential role in the process of communication. Any disturbance or distraction in the way a message is presented may lead to miscommunication. Following are the different types of communication barriers related to words:

- **Language:** It is a medium of communication. If the sender is making excessive use of technical terms, it will become difficult for the receiver to understand the message clearly.
- **Ambiguity and overuse of abstractions:** Even if the message is presented in a non-realistic or vague context involving a lot of notions, the receiver won't be able to connect with the idea properly.
- **Disorganized message:** When the words are not organized systematically to form a powerful message, it loses its efficiency and meaning.
- **Information overload:** The effectiveness of communication reduces when a person keeps on speaking for an extended period. Thus, leading to the receiver's exhaustion, who won't be able to keep track of everything that is conveyed.

Barriers involving people's background

People belong to different backgrounds, i.e., Culture, education level, gender, etc. These attributes majorly affect the efficiency of the communication process. It involves the following related obstacles:

- **Attitudinal differences:** At times, people are resistant to understand or change their mind when they have set their views about a particular topic. Their attitude obstructs meeting the purpose

of the communication.

- **Demographic differences:** The difference in age, generation, gender, status, tradition, etc., Creates a lack of understanding among people and thus, hinders the process of communication.
- **Lack of common experience or perspective:** The experiences of a person develops their perspective of seeing things in a particular way. This perspective varies from person to person. Therefore, it becomes difficult for a receiver to relate with the sender's experience or views as he might have never gone through it himself.
- **Jumping to conclusions:** Some people lack the patience of listening to others and often jump to conclusions between the communications, thus neglecting the motive of the message.

Physical barriers

These barriers can be experienced directly but challenging to overcome. These include:

- **Physical distance:** When people communicate over long distances, they miss out the non-verbal aspect of communication, since the gestures and expressions of the receiver cannot be interpreted.
- **Noise:** The environment or the communication system sometimes involve unwanted noise which interrupts the process of communication making it inefficient.
- **Physiological barriers:** One of the most common barriers to effective communication is the physical disability of the people involved. Some of these are hearing impairment, poor eyesight, stammering, etc.

Thus, we can say that the significant purpose of communication is to pass on the information to the receiver in such a manner that it does not lose its significance. At the same time, the message must be received in its purest form.

4.1.2 Communicate with supervisor

Good communication with your supervisor is important to both of you. There are five important aspects to remember when communicating with your supervisor:

- You must be able to follow instructions.
- You need to know how to ask questions.
- You should report any problems and results of your work.
- You should accurately record and give messages to your supervisor.
- You need to discuss your job performance.

Following instructions is important at all times, but especially during your training period. Your supervisor will be watching to see how well you do this. Use your senses to follow instructions correctly.

- **Concentrate:** Focus your attention on the supervisor. Don't be distracted by noise and movement.
- **Listen:** Pay attention to the words being spoken. If you hear unfamiliar words or terms, ask for

clarification. Listening also means interpreting body language, voice inflections, and gestures. If this non-verbal communication is confusing, ask the supervisor to clarify what you don't understand.

- **Watch:** Sometimes a supervisor demonstrates how a task is performed. If necessary, ask the supervisor to repeat the process until you understand it completely. Sometimes a task may be too complex or time-consuming to demonstrate. In such cases, you probably will receive general instructions. If there are details you don't understand, ask for guidance to continue the task.
- **Question:** After you have listened and watched, ask questions. A good supervisor will encourage you to ask questions. It's better to ask a question than to make a mistake because you didn't understand.
- **Write:** Write down in a small notebook the important points to remember about the instructions you get. Don't write while your supervisor is talking or demonstrating something. Do it at a break in the instructions.
- **Practice:** With your supervisor's permission, perform the task. Make sure you have fully completed the job. This may include putting tools away or cleaning up your work area. Don't leave your work partially completed.

4.1.3 Achieve goals in the workplace

Creating goals in the workplace can help you achieve personal and professional success. Setting timeliness and taking steps to reach milestones can help you excel in your role and advance your career.

What is the importance of achieving goals in the workplace?

Setting goals is important because it helps you define how you should move toward achieving professional short- and long-term objectives both for your personal career and your company. They can give you motivation for improving skill sets, learning new skills or growing your responsibilities. Setting and achieving workplace goals can also show management that you are committed to the success of the organization. Some benefits of setting workplace goals are:

- **They give you direction:** A well-planned goal helps you move forward in the direction you need or want to go. For example, if you want to become a sales manager someday, writing down that goal with specifics on what steps you will take to achieve it can help you to begin working on your goal right away.
- **They help you stay on track:** A specific goal gives you a solid plan for accomplishing a task or project. You can look often at your goal to help you stay motivated. For example, if you need to write a training guide for new employees, you can look at the time line needed to reach that goal on a daily or weekly basis. This reminder can help you meet your deadline.
- **They make large projects easier:** You can divide your goals into smaller tasks so you do not become overwhelmed with a large project. For example, writing an entire training guide might seem daunting. However, if you set a goal to write one section of the guide each day or week, you

will see progress on the task and feel a sense of accomplishment.

- They help with time management. When you have a deadline for a task, setting specific goals for each phase of the project will help you finish the task on time and eliminate distractions.

How to accomplish goals

Use these steps to help you set and achieve workplace goals to advance your career or succeed in your role:

1. **Create goals that inspire you:** When setting workplace goals, choose ones that will inspire you. Think of tasks or accomplishments that will advance your career or relate to your core values. Your desire to accomplish these goals will help you remain motivated and work toward achieving them.

   You can also use rewards to help motivate you to complete your goals. Develop a system to celebrate your progress, such as taking a break or having a snack for achieving small goals during the day, or attending an event or taking a vacation after accomplishing larger goals.

2. **Write down your goals:** Writing out your goals on paper, a calendar or a computer can reinforce them and provide a visual reminder to work toward them. Written goals allow you to access and view them often. To begin achieving your goals, write down each one and create a plan and time line to reach them.

3. **Use smart goals:** Smart goals are a methodology for setting goals that makes them easier to track and accomplish. Using this method gives you clear directions on how to define and plan achieving your goals. Here are the components of a smart goal

   - **Specific:** This part of the goal-setting process is critical for the success of accomplishing goals. Write the goals in a well-defined and clear manner so that you or anyone else in the workplace can understand them. Always use precise action words. For example, **"increase sales"** or **"earn a promotion"** are unspecific goals, but **"increase sales by 10% this month"** or **"become assistant manager by the end of the year"** are specific goals, and their clarity makes them easier to work toward.
   - **Measurable:** Use numbers, dates and other objective criteria when setting your goals so you can measure and view your progress.
   - **Achievable:** When you set a goal, check that it is feasible. Look at how much time you have each day, week or month to accomplish a task and set a realistic plan for accomplishing it. Be sure you have the training, tools and resources to achieve the goal.
   - **Relevant:** When you are trying to reach goals, especially in the workplace, they should relate to your career and the direction you want to go. Understand your particular skill sets and expertise in the job, and make the goal relevant to them.
   - **Time-bound:** Similarly to the measurable aspect of smart goals, you should have a clear time frame for accomplishing every goal. Knowing when a project needs to be completed will help you focus on all the tasks that need to be accomplished to meet the deadline.

4. **Re-evaluate your goals periodically:** It is important to look at the progress of your goals regularly. Depending on the depth of the plan, you can re-evaluate daily, weekly, monthly or biannually.

Look at the actions you've taken to move forward with your goal, and if they are successful, continue to do those things. If you find that the goal is harder to achieve than you originally planned, make adjustments so you can increase your progress.

For example, if you have committed to writing five blog posts per week for the company website, and you are finding it difficult to accomplish those numbers, try writing only four posts per week or changing your schedule so you have more time to write. Speak with your team members or management and get approval for the new plan.

5. **Keep striving toward your goals:** As you move toward accomplishing your goals, you want to maintain the excitement of and commitment to achieving them. Here are a few things to keep in mind when you are accomplishing your goals

   - **Be excited about the process:** One of the reasons you created goals was because you wanted a change. Stay passionate about the **"why"** of your goal. Keep positive on the small steps you are making toward the plan, and reward yourself when a time-bound goal is met.
   - **Find support and encouragement:** Surround yourself with people who encourage you to accomplish your goals. Spend time with positive co-workers, friends, family members and others who believe in what you are trying to achieve. A kind and encouraging word can inspire you to keep moving toward the completion of your goal.
   - **Visualize your success:** One of the best aspects of goal setting is enjoying the results at the end. Always visualize yourself succeeding, and use your goals to help you be happy and successful in the workplace.

4.1.4 Work effectively in a team

When a mix of people with different skills and varying levels of experience are pulled together in a team, it can lead to more effective and innovative solutions, which is great news for businesses. Employees can often feel happier being part of something bigger too, which can lead to higher productivity and lower staff turnover. As a result, team working is an important skill that employers often look for in job candidates. It's therefore a skill you shouldn't overlook.

Tips to improve your teamwork

Working with other people may seem simple enough but working in a team can be a complicated dynamic to navigate effectively. Here are nine key tips you should follow to improve your team working skills:

1. **Get into the right mindset:** Working alone means that you can set your own schedule and tackle tasks in a way that suits you best. In a team, you need to share ideas, divide workloads and go with group consensuses for decisions. By understanding this shift and accepting the differences, you will be able to set the right mindset and get stuck into the new team dynamic.
2. **Understand what's required of you:** Before you begin, make sure you understand your role, responsibilities in the team, deadlines, how everyone plans to work together, why the team was created, the teamwork processes and practices as well as what the ultimate goal of the team is.

By doing this, you will be able to contribute much more effectively.

3. **Put in 100% effort:** Don't hide behind others or let other team members take on the bulk of the work. Be prepared to put in an equal amount of effort as others, so you complete the work assigned to you within the time frame that's been set. A good team player would also notice when others are struggling and help. The overall team will perform better as a result.
4. **Communicate, communicate and communicate:** The importance of communication in a team can't be underestimated. It's vital that everyone shares their progress and raises issues quickly so they can be dealt with. Don't forget that communication isn't just about talking but listening to others too. Without this level of open and honest conversation, problems may be missed, and projects can rapidly fall behind.
5. **Share your ideas:** When you've come up with an exciting new idea, you may want to rush to your boss to share it. But when working as a team, you must share your ideas and resources with your team members. Arguing afterwards over who gets the credit won't do any favours for you, as your boss will see that you're not a team player.
6. **Keep an open mind:** Brainstorming as a team is a great way to come up with a range of new and exciting ideas. While you may think your idea is the best, others might not always agree with you. You may also not agree with everyone else's ideas. Don't be difficult or overly negative about other people's ideas. Understand that everyone has the right to their own opinions and as a team, you will go with the consensus.
7. **Get to know each other:** Take time to get to know the rest of your team. This will make it much easier for you all to work together effectively going forward. There may be instances when you don't get on with a certain team member, but for the benefit of everyone, it's important that you always try and remain professional.
8. **Stay positive:** Don't complain all the time or place blame on single members of the team. You're all in it together. If you notice the morale is dropping, provide encouragement where needed. Take time to celebrate your team's achievements too. A happier, more positive team will work much better together and achieve even better results.
9. **Be adaptable:** When working on a project, deliverables may change, team members may come and go, or you may face unexpected obstacles. You need to be someone who can adapt quickly to new situations, which will ensure the team continues to work together effectively.

Summary

- Effective communication is a process of exchanging ideas, thoughts, knowledge and information such that the purpose or intention is fulfilled in the best possible manner.
- Listening and understanding is the most crucial skill in a person is he must be a good, alert and patient listener.
- The effective communication certain characteristics such as clear, correct, precise, complete, and reliable message.

- Non-verbal communication includes, gestures, facial expressions, eye-contact, postures, etc.
- Effective communication is always a two-way process and providing feedback is an essential part of it.
- Certain obstacles sometimes hinder the process of communication, language barriers, ambiguity, overuse of abstractions, information overload.
- Physiological Barriers are the physical disability of the people involved. Some of these are hearing impairment, poor eyesight, stammering, etc.
- Goal setting gives direction and help with time management.
- SMART goals are a methodology for setting goals that makes them easier to track and accomplish.
- Working effectively in a team can lead to more effective and innovative solutions at workplace

Exercise

1. **The clear exchange of ideas and information is .....**
   a) Listening
   b) Communication
   c) Sympathy
   d) Social isolation

2. **The characteristics of communication when the sender must be sure from his end that whatever he is conveying is right by his knowledge is called .....**
   a) Correct message
   b) Complete message
   c) Reliability
   d) Sender's Courtesy

3. **Which type of barriers to effective communication is the physical disability of the people to communicate effectively?**
   a) Noise
   b) Physiological Barriers
   c) Physical Barriers
   d) Emotional Barriers

4. **SMART goals are a methodology for setting goals that makes them easier to track and accomplish. What does S stand for in SMART?**
   a) Sales
   b) Specific
   c) Smart
   d) Seamless

5. **..... as a team is a great way to come up with a range of new and exciting ideas.**
   a) Reflection
   b) Staying positive
   c) Brainstorming
   d) Communication

Notes

Scan the QR codes or click on the link to watch the related videos

https://www.youtube.com/watch?v=6fbE52YDEjU

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5. Annexure

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1	Module 1	Unit 1.1 - Hydro-carbon sector in India	Unit 1.1 - Hydro-carbon sector in India	3	https://www.youtube.com/watch?v=FsyAl-v5Azws	
2	Module 1	Unit 1.2 - Roles and responsibili-ties of a fire safety technician	Unit 1.2 - Roles and responsibili-ties of a fire safe-ty technician	8	https://www.youtube.com/watch?v=n-wpc-Mmfq1Y	
3	Module 1	Unit 1.2 - Roles and responsibili-ties of a fire safety technician	Unit 1.2 - Roles and responsibili-ties of a fire safe-ty technician	8	https://www.youtube.com/watch?v=oCqK-7kHBpzg	
4	Module 2	Unit 2.1 - Carry out fire safety procedures	Unit 2.1 - Carry out fire safety procedures	15	https://www.youtube.com/watch?v=lQ3V-8JHJp-c	
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6	Module 2	Unit 2.2 - Safety demonstration	Unit 2.2 - Safety demonstration	34	youtube.com/watch?v=KX8LM-Lylf14	
7	Module 2	Unit 2.2 - Safety demonstration	2.2.3 Cardiopul-monary resusci-tation (CPR)	45	https://www.youtube.com/watch?v=nCUx_e458ow	

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8	Module 3	Unit 3.1 - Usage of fire fighting equipment	3.1.1 Fire fighting equipment	55	https://www.youtube.com/watch?v=L4sUQZ-ta8Rw	
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