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

Participant Handbook

Sector
Hydrocarbon

Sub-Sector
Midstream

Occupation
Pipeline Maintenance

Reference ID: **HYC/Q6401, Version 2.0, NSQF Level 3**

Line Patrolling Man (Oil & Gas)

This book is sponsored by

Hydrocarbon Sector Skill Council

OIDB Bhawan Tower C, 2nd Floor, Plot No. 2, Vikas Marg, Sector 73, Noida 201301 (UP)

Printed in India at

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

Skill India
कौशल भारत-कुशल भारत

HYDROCARBON SECTOR SKILL COUNCIL

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

Certificate

COMPLIANCE TO QUALIFICATION PACK – NATIONAL OCCUPATIONAL STANDARDS

is hereby issued by the

HYDROCARBON SECTOR SKILL COUNCIL

for

SKILLING CONTENT : PARTICIPANT HANDBOOK

Complying to National Occupational Standards of

Job Role/ Qualification Pack: **"Line Patrolling Man (Oil & Gas)"** QP No. **'HYC/Q6401 NSQF Level 3'**

Date of Issuance: March 4th, 2020

Valid up to*: March 3rd, 2024

*Valid up to the next review date of the Qualification Pack or the 'Valid up to' date mentioned above (whichever is earlier)

Authorised Signatory
Hydrocarbon Sector Skill Council

Acknowledgements

Hydrocarbon Sector Skill Council (HSSC) would like to express its gratitude to all the individuals and institutions who contributed in different ways towards the preparation of this **"Participant Handbook"**. Without their contribution it could not have been completed. Special thanks are extended to those who collaborated in the preparation of its different modules. Sincere appreciation is also extended to all who provided peer review for these modules.

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 Book

Welcome to the **"Line Patrolling Man (Oil & Gas)"** training programme. This Participant Hand Book (PHB) will facilitate and train the trainees/participants in the skills necessary to be a **"Line Patrolling Man (Oil & Gas)"**, in the Hydrocarbon Sector.

"Line Patrolling Man (Oil & Gas)" is someone who is competent to perform the job of patrolling and inspection of hydrocarbon Pipelines. The purpose of the Qualification is to provide skill training to the people to make them capable to work in Hydrocarbon Sector and upskilling of the people, who are already working in this trade in the sector Accordingly, the Participant Handbook (PHB) includes technical as well as behavioural skills required for this job role, and is based on National Skill Qualifications Framework (NSQF) aligned qualification pack and covers the following national occupational standards.

1. Carryout patrolling of hydrocarbon pipeline (HYC/N6401)
2. Working effectively in a team (HYC/N9301)
3. Maintain health, safety and security procedures (HYC/N9302)

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. Participants 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 programme shall certify the trainee as a Line Patrolling Man (Oil & Gas), thereby adding value for their employment opportunities as also the entrepreneurship capabilities.

Symbols Used


Key Learning Outcomes


Steps


Exercise


Tips


Notes


Unit Objectives


Summary

Table of Contents

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

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

1. Introduction to hydrocarbon sector

Unit 1.1 - Introduction to hydrocarbon sector

Unit 1.2 - Roles and responsibilities of a Line Patrolling Man (Oil & Gas)

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. List the roles and responsibilities of a **"Line Patrolling Man (Oil & Gas)"**

Unit 1.1 - Introduction to hydrocarbon sector

Unit Objectives

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

1. Identify about the hydrocarbon sector in India.
2. Define the market size of hydrocarbon sector.
3. List the three major segments in the hydrocarbon sector.
4. Identify about the investments in hydrocarbon sector.
5. Illustrate the initiatives taken by the government for hydrocarbon sector.
6. Identify about the achievements of hydrocarbon sector.

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.

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 as attested by the presence of Reliance Industries Ltd (RIL) and Cairn India.

India has been the fourth-largest Liquefied Natural Gas (LNG) importer since 2011 after Japan, south Korea, and china.

Market size

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 fy19. 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 fy19. 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.

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.

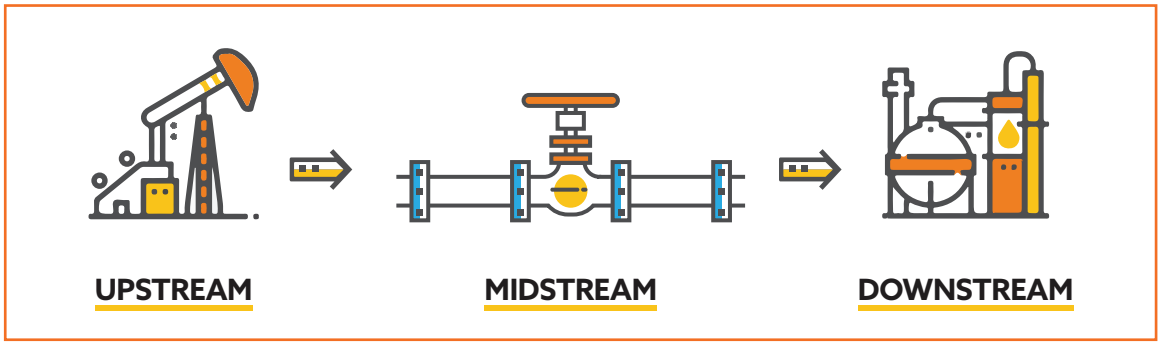


Fig: 1.1.1 Hydrocarbon Segments

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.

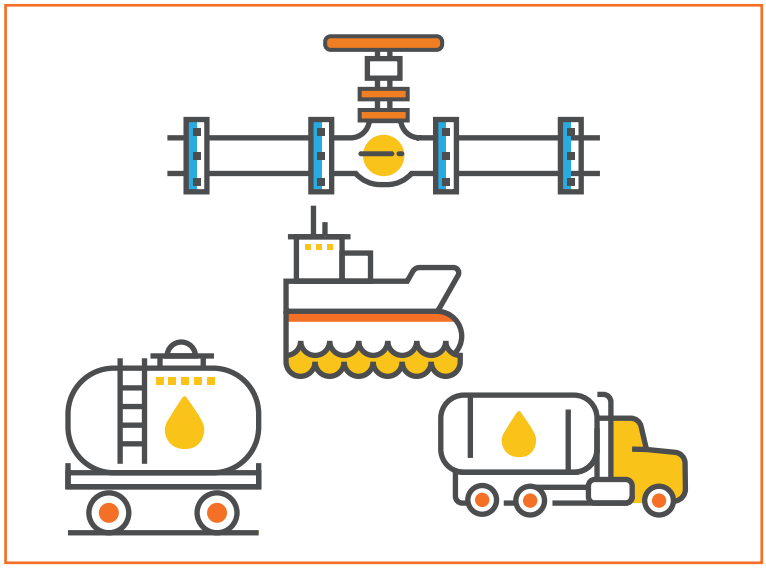


Fig: 1.1.3 midstream

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 Investment

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 upskilling.

1.1.4 Government initiatives

Some of the major initiatives taken by the government of India to promote oil and gas sector are:

- In November 2020, oil regulator petroleum and natural gas regulatory board (PNGRB) simplified the country's gas pipeline tariff structure to make fuel more affordable for distant users and attract investment for building gas infrastructure.
- In November 2020, the Indian government urged OPEC to remove pricing anomalies for different regions with a view to aid the corona-battered global oil industry get back to normalcy.
- As per union budget 2019-20, Indian scheme 'Kayakave Kailasa', the ministry of petroleum & natural gas has enabled SC/ST entrepreneurs in providing bulk LPG transportation. State run energy firms, Bharat Petroleum, Hindustan Petroleum and Indian Oil Corporation, plan to spend US $ 20 billion on refinery expansions to add units by 2022.
- The government is planning to set up around 5,000 compressed biogas (CBG) plants by 2023.
- The government is planning to invest US $ 2.86 Billion in the upstream oil and gas production to double natural gas production to 60 BCM and drill more than 120 exploration wells by 2022.
- Government of India is planning to invest RS. 70,000 Crore (US $ 9.97 Billion) to expand the gas pipeline network across the country.
- In September 2018, Government of India approved fiscal incentives to attract investment and technology to improve recovery from oil fields, which is expected to lead to hydrocarbon production worth RS. 50 Lakh crore (US $ 745.82 Billion) in the next 20 years.

- State-run oil firms are planning investment worth RS. 723 Crore (US $ 111.30 Million) in Utter Pradesh to improve the LPG infrastructure in a bid to promote clean energy and generate employment according to Mr. Dharmendra Pradhan, Minister of Petroleum and Natural Gas, Government of India.
- A gas exchange is planned in order to bring market-driven pricing in the energy market of India and the proposal for the same is ready to be taken to the union cabinet according to Mr. Dharmendra Pradhan, Minister of Petroleum and Natural Gas, Government of India.
- The oil ministry plans to set up BIO-CNG (compressed natural gas) plants and allied infrastructure at a cost of RS. 7,000 Crore (US $ 1.10 Billion) to promote the use of clean fuel.

1.1.5 Achievements

Following are the achievements of the Government during 2019-20:

- LPG penetration rate of households reached ~97% at the beginning of 2020 compared with 56% in 2016.
- The energy trade between India and us is likely to touch US $ 10 billion in FY 20.
- As on march 01, 2020, Gas Authority of India Ltd. (GAIL) had the largest share (71.61% Or 11,411 kms) of the country's natural gas pipeline network (16,324 kms).
- With 8,748 kms of refined products pipeline in India, IOC was leading the segment with 51.25% Of the total length of product pipeline network as on march 01, 2020.
- As on April 01, 2020(p), there were 24,670 LPG distributors (of PSUs) in India.
- The total number of OMC (oil marketing companies) retail outlets increased to 66,817 at the beginning of April 2020(p) from 59,595 at end of FY 17.
- Under city gas distribution (CGD) network, 86 geographical areas constituting 174 districts in 22 states/ union territories are covered.
- OMCs delivered 6.8 Crore LPG cylinders to Pradhan Mantri Garib Kalyan Package (PMGKP) beneficiaries by may 20, 2020.

1.1.6 Road Ahead

Energy demand of India is anticipated to grow faster than energy demand of all major economies on the back of continuous robust economic growth. India's energy demand is expected to double to 1,516 mtoe by 2035 from 753.7 Mtoe in 2017. Moreover, the country's share in global primary energy consumption is projected to increase by two-fold by 2035.

Crude oil consumption is expected to grow at a CAGR of 3.60% To 500 million tonnes by 2040 from 221.56 Million tonnes in 2017.

Natural gas consumption is forecast to increase at a CAGR of 4.18% To 143.08 Million tonnes by 2040

from 58.10 Million tonnes in 2018.

Diesel demand in India is expected to double to 163 million tonnes (MT) by 2029-30.

Notes

Unit 1.2 - Roles and responsibilities of a Line Patrolling Man (Oil & Gas)

Unit Objectives

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

1. Identify roles and responsibilities of Line Patrolling Man (Oil & Gas).
2. Identify essential skills of Line Patrolling Man (Oil & Gas).
3. Identify career aspects of Line Patrolling Man (Oil & Gas).

1.2.1 What does a Line Patrolling Man (Oil & Gas) do?

Line Patrolling Man is responsible for patrolling the oil and natural gas pipeline and right of usage (ROU) area to inspect or detect any evidence of leaks, such as oil stains, odors, and dead vegetation in and around the pipeline area. The responsibility includes inspection of oil and natural gas pipelines to identify irregularities that are or can become, a hazard and report to control room/authorities so that the irregularities can be repaired.

Roles and Responsibilities of Line Patrolling Man

- Carry out ground patrolling & surveillance of oil and natural gas pipeline within the assigned spread.
- Inspect the pipeline and Right of Usage (ROU) area to detect leakage or any other defect.
- Report to control room/authorities about the inspection of ROU covering the surface conditions on and adjacent to the pipeline right of way, indication of leaks, encroachment, exposure, construction activity other than that performed by the company. This report is supported by Photograph or sketch showing details of inspection.
- Carry out health, safety and security procedures.
- Improve work effectiveness with people within or outside the organization.

1.2.2 Line Patrolling Man (Oil & Gas) technical skills

- **Operation monitoring:** Detailed observation for indication of leaks, encroachment, exposure, construction activity
- **Operation and control:** Controlling operations of patrolling & surveillance of oil and natural gas pipeline

- **Critical thinking:** Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- **Active listening:** Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- **Equipment maintenance:** Performing routine maintenance on equipment used for inspection and determining when and what kind of equipment is needed.
- **Reading comprehension:** Understanding written sentences and paragraphs in work related documents.
- **Troubleshooting:** Determining causes of any defect identified and to report it. If the issue id resolvable, deciding what to do about it.
- **Writing:** Communicating effectively in writing as appropriate for the needs of the audience.
- **Speaking:** Talking to others to convey information effectively.
- **Complex problem solving:** Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- **Judgment and decision making:** Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- **Coordination:** Adjusting actions in relation to others' actions.
- **Time management:** Managing one's own time and the time of others.
- **Social perceptiveness:** Being aware of others' reactions and understanding why they react as they do.
- **Systems analysis:** Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.
- **Instructing:** Teaching others how to do something.
- **Active learning:** Understanding the implications of new information for both current and future problem-solving and decision-making

1.2.3 Knowledge

- **Mechanical:** Knowledge of basic instruments and tools for marking and measuring
- **English language:** Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- **Public safety and security:** Knowledge of relevant equipment, policies, procedures, and strategies to promote effective local, state, or national security operations for the protection of people, data, property, and institutions.
- **Communication Skills:** standard operating procedure for clear and effective communication at different levels

1.2.4 Working conditions

- Field environment with regularly scheduled travel and overnight stays.
- Regular travel to Oil & Gas pipeline sites.
- Frequent over time and flexibility required to manage covering Right of Usage (ROU) area for inspection, emergency response operations, adverse weather conditions, work priorities, fieldwork schedules, and out of town travel.
- Shifting priorities to meet changing directions.
- Works independently with little day to day direction.
- Time commitments often extend beyond normal working hours.

Summary

- As defined by WHO, health is a "state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity''.
- Safety is the state of being 'safe', the condition of being protected from harm or other nondesirable outcomes.
- Workers in oil and gas industry are generally susceptible to certain safety and injury hazards such as, motor vehicle accident, contact injuries, fire and explosions, slip, trips and falls etc.
- Workers in oil and gas industry are generally susceptible to chemical hazards, physical hazards, biological hazards, ergonomic hazards, psychosocial hazards.
- It is important that driver, drive shaft,are secured from inadvertent movement before anyone works on the pump.
- It is important to ensure that the steam-and the associated steam condensate system-are properly isolated.
- A systematized approach PDCA should be used for managing occupational safety and health hazards.
- Risk management includes, identifying the risks, evaluating and prioritizing the risks, implementing preventive/protective measures to control the risk.
- Job safety analysis is a process of systematically evaluating certain jobs, tasks, processes or procedures and eliminating or reducing the risks or hazards in order to protect workers from injury or illness.
- 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.
- There are five different classes of fire, class A, B, C, D, E, K.
- There are 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.
- 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.
- 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. **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 .....

   .....

   .....

   .....

   .....
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

   .....

   .....

Notes

Notes

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

https://youtu.be/W-PooTpdcyw

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

https://www.linkedin.com/posts/bpcl_bi-na-panki-pipeline-walker-mr-brijen-singh-activi-ty-6899250261156859906-CrEf?utm_source=share&utm_medium=member_desktop

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

https://www.youtube.com/watch?v=ueA_dTAFXg4

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

2. Carryout patrolling of hydrocarbon pipeline

Unit 2.1 - Introduction to crude oil

Unit 2.1 - Patrolling of Hydrocarbon Pipeline

HYC/N6401

Key Learning Outcomes

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

1. Describe the name, types and properties of hydrocarbon products and their flow in the pipeline
2. Describe the procedure for obtaining work permit from concerned operating department/ control room
3. Explain the procedure to inform concerned authorities/control room while planning for line walk
4. List the tools required for pipeline patrolling
5. Describe the activities to be undertaken while patrolling oil and natural gas pipelines
6. List things to be inspected/observed while patrolling i.e. surface conditions, leakage, construction activity, encroachments, washouts and any other factor affecting the safety and operation of pipeline
7. List signs of pipeline leakage such as odours, stains on the ground and visible damage to the pipeline
8. Describe the various types of markers
9. Explain the various conditions of the markers which require attention
10. Explain the effect of vegetation on the pipeline which can cause possible leakage
11. Describe GPS device and its uses
12. Describe the action to be taken in case of large leakage, washouts, theft, criminal activity etc.
13. Explain how to prepare record of ROU inspection (encroachment and washout) and condition of markers, TLP and signboards
14. Describe how to prepare daily inspection report and its submission to the authorities
15. Maintain the record of line walk inspection report

Unit 2.1 - Introduction to crude oil

Unit Objectives

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

1. Identify the origin and processes of crude oil.
2. Identify the natural gas processes.
3. Describe the pipelines and its various types.

2.1.1 What is Crude Oil?

Crude oil is a naturally occurring, unrefined petroleum product composed of hydrocarbon deposits and other organic materials. A type of fossil fuel, crude oil can be refined to produce usable products such as gasoline, diesel, and various other forms of petrochemicals. It is a non-renewable resource, which means that it can't be replaced naturally at the rate we consume it and is, therefore, a limited resource.

Where does crude oil come from?

Crude oil is formed from the remains of dead organisms (diatoms) such as algae and zoo plankton that existed millions of years ago in a marine environment.

These organisms were the dominant forms of life on earth at the time.

As they lived these organisms absorbed energy from the sun and stored it as carbon molecules within their bodies. Once they died their remains sank to the bottom of the oceans or riverbeds and were buried in layers of sand, mud and rock.

Over millions of years, the remains were buried deeper and deeper under more sediment and organic materials.

The enormous pressure, high temperatures, and lack of oxygen transformed the organic matter into a waxy substance called kerogen.

With even more heat, pressure, and time the kerogen undergoes a process called catagenesis which transforms the kerogen into hydrocarbons.

Different combinations of pressure, heat, and the original composition of organic material will determine the type of hydrocarbon formed. In this case, the hydrocarbons form crude oil.

Other examples are asphalt if the temperature is lower, and natural gas if the temperature is higher.

After the oil is formed it moves through tiny pores in the surrounding rock from an area of high pressure to low pressure, this is often upwards.

Some oil might make it all the way to the surface where it pools, in other cases the oil will get trapped under impermeable layers of rock or clay where it will form underground reservoirs.

The process of crude oil refining

Once crude oil is extracted from the ground, it must be transported and refined into petroleum products that have any value. Those products must then be transported to end-use consumers or retailers (like gasoline stations or the company that delivers heating oil to your house, if you have an oil furnace). The overall well-to-consumer supply chain for petroleum products is often described as being segmented into three components.

- Upstream activities involve exploring for crude oil deposits and the production of crude oil. Examples of firms that would belong in the upstream segment of the industry include companies that own rights to drill for oil (e.g., Exxonmobil) and companies that provide support services to the drilling segment of the industry (e.g. Halliburton).
- Midstream activities involve the distribution of crude oil to refiners; the refining of crude oil into saleable products; and the distribution of products to wholesalers and retailers. Examples of firms that would belong in the midstream segment of the industry include companies that transport oil by pipeline, truck or barge (e.g., Magellan pipeline); and companies that refine crude oil (e.g., Tesoro).
- Downstream activities involve the retail sale of petroleum products. Gasoline stations are perhaps the most visible downstream companies, but companies that deliver heating oil or propane would also fall into this category.

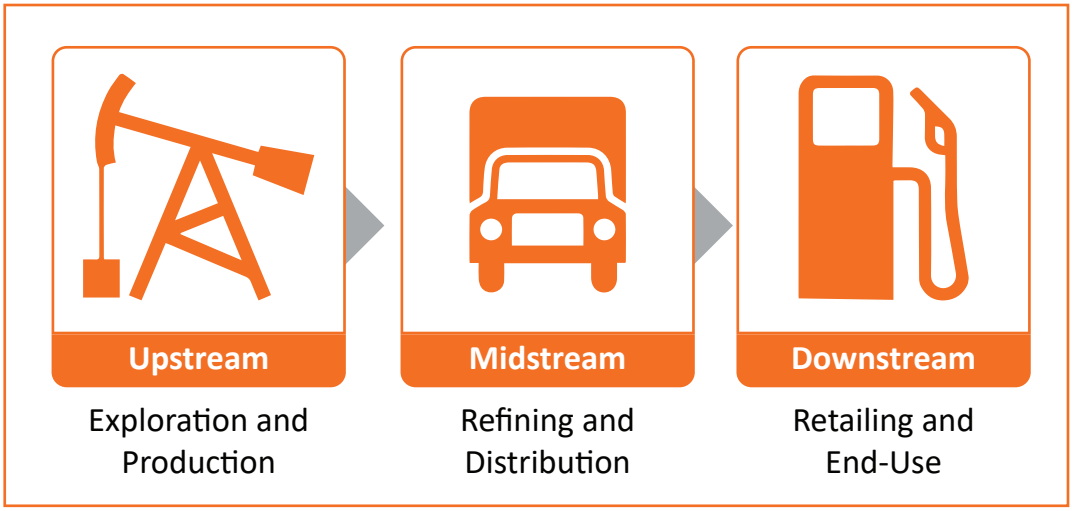


Fig: 2.1.1 Well-to-consumer supply chain for petroleum products. Upstream Midstream and Downstream

Petroleum refineries are large-scale industrial complexes that produce saleable petroleum products from crude oil (and sometimes other feed stocks like biomass). The details of refinery operations differ from location to location, but virtually all refineries share two basic processes for separating crude oil into the various product components. Actual refinery operations are very complicated, but the basic functions of the refinery can be broken down into three categories of chemical processes.

- Distillation involves the separation of materials based on differences in their volatility. This is the first and most basic step in the refining process, and is the precursor to cracking and reforming.
- Cracking involves breaking up heavy molecules into lighter (and more valuable) hydrocarbons.
- Reforming involves changing the chemical nature of hydrocarbons to achieve desired physical

properties (and also to increase the market value of those chemicals).

The first process is known as distillation. In this process, crude oil is heated and fed into a distillation column. A schematic of the distillation column is shown in below given figure.

As the temperature of the crude oil in the distillation column rises, the crude oil separates itself into different components, called **"fractions."** The fractions are then captured separately. Each fraction corresponds to a different type of petroleum product, depending on the temperature at which that fraction boils off the crude oil mixture.

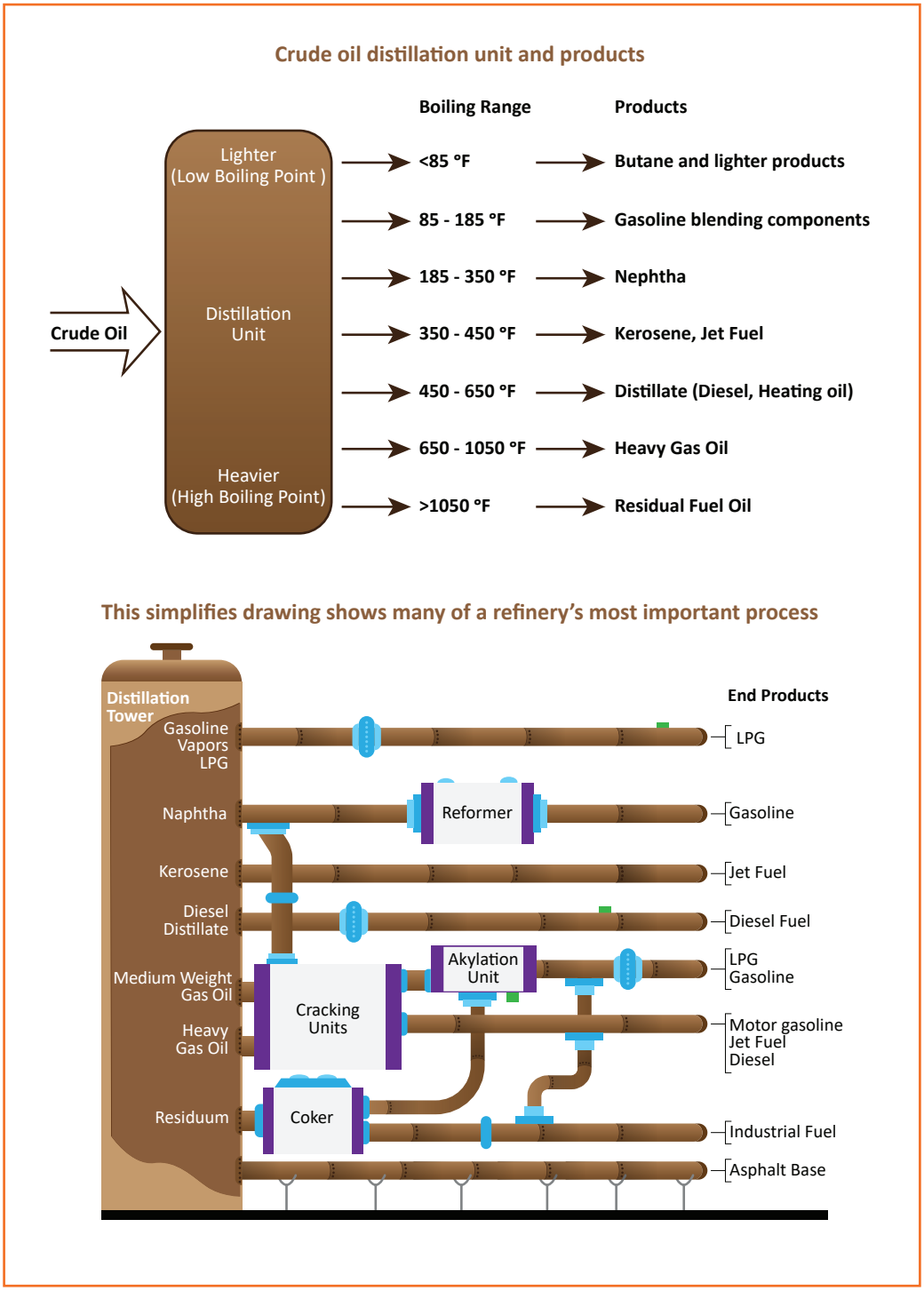


Fig: 2.1.2 Important processes of a refinery

The second and third processes are known as cracking and reforming. The figure shown above provides a simplified view of how these processes are used on the various fractions produced through distillation. The heaviest fractions, including the gas oils and residual oils, are lower in value than some of the lighter fractions, so refiners go through a process called **"cracking"** to break apart the molecules in these fractions. This process can produce some higher-value products from heavier fractions. Cracking is most often utilized to produce gasoline and jet fuel from heavy gas oils. Reforming is typically utilized on lower-value light fractions, again to produce more gasoline. The reforming process involves inducing chemical reactions under pressure to change the composition of the hydrocarbon chain.

2.1.2. Natural gas processing

Natural gas transported on the mainline natural gas transportation (pipeline) system must meet specific quality measures so that the pipeline network (or grid) can provide uniform quality natural gas. Wellhead natural gas may contain contaminants and hydrocarbon gas liquids (HGL) that must be removed before the natural gas can be safely delivered to the high-pressure, long-distance pipelines that transport natural gas to consumers. Natural gas typically moves from natural gas and oil wells through a gathering system of pipelines to natural gas processing plants for treatment.

Natural gas processing can be complex and usually involves several processes, or stages, to remove oil, water, HGL, and other impurities such as sulphur, helium, nitrogen, hydrogen sulphide, and carbon dioxide. The composition of the wellhead natural gas determines the number of stages and the processes required to produce pipeline-quality dry natural gas. These stages and processes may be integrated into one unit or operation, be performed in a different order or at alternative locations (lease/plant), or not be required at all.

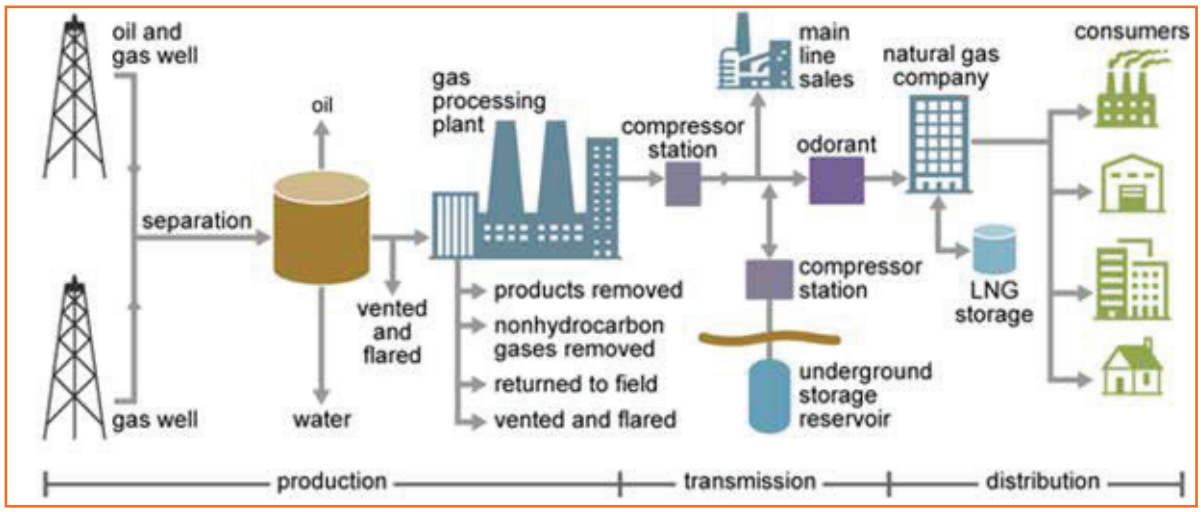


Fig: 2.1.3 Typical Gas Plant

The basic stages of natural gas processing/treatment are:

- **Gas-oil-water separators:** pressure relief in a single-stage separator causes a natural separation of the liquids from the gases in the natural gas. In some cases, a multi-stage separation process is required to separate the different fluid streams.

- **Condensate separator:** Condensates are most often removed from the natural gas stream at the wellhead with separators much like gas-oil-water separators. The natural gas flow into the separator comes directly from the wellhead. Extracted condensate is sent to storage tanks.
- **Dehydration:** A dehydration process removes water that may cause the formation of undesirable hydrates and water condensation in pipelines.
- **Contaminant removal:** Non-hydrocarbon gases - such as hydrogen sulphide, carbon dioxide, water vapour, helium, nitrogen, and oxygen - must also be removed from the natural gas stream. The most common removal technique is to direct the natural gas though a vessel containing an amine solution. Amines absorb hydrogen sulphide and carbon dioxide from natural gas and can be recycled and regenerated for repeated use.
- **Nitrogen extraction:** Once the hydrogen sulphide and carbon dioxide are reduced to acceptable levels, the natural gas stream is routed to a nitrogen rejection unit (NRU), where it is further dehydrated using molecular sieve beds.
- **Methane separation:** The process of demethaniser the natural gas stream can occur as a separate operation in a natural gas processing plant or as part of the NRU operation. Cryogenic processing and absorption methods are some of the ways used to separate methane from HGL.
- **Fractionation:** fractionation separates the HGL into component liquids using the varying boiling points of the individual HGL. HGL from the processing plant may be sent to petrochemical plants, oil refineries, and other HGL consumers.

Natural gas transport

Once natural gas is extracted, it must be transported to different places to be processed, stored, and then finally delivered to the end consumer.

Natural gas can be transported on land via pipeline or on water via ship.

Most of the world's natural gas is delivered by pipeline. Large networks of pipelines quickly deliver natural gas on land to major processing facilities and end consumers. This complex network includes three types of pipelines along the transportation route.

1. **Gathering pipeline system:** The gathering system includes low pressure small pipelines that transport raw natural gas from the wellhead to the processing plant.
2. **Intrastate/interstate pipeline system:** Pipelines can be classified as intrastate or interstate. Their technical and operational characteristics are substantially similar, and they both have the same goal - to transport natural gas from the processing plant to the centres of its consumption.
3. **Distribution pipeline system:** The distribution pipeline system has the purpose of delivering gas to the end-consumers.

Natural gas must be highly pressurized to move it along the pipeline. To ensure that the natural gas remains pressurized, compressor stations are placed in intervals along the pipeline. The natural gas enters the compressor station, where it is compressed by either a turbine, motor, or engine. Metering stations are also installed throughout the pipeline network to monitor for pressure, flow and leaks.

Where natural gas cannot be delivered on land, it can be liquefied and delivered by ship. Compared to gas

pipelines, liquefied natural gas (LNG) shipping is preferred for international transport because, in a liquid form, natural gas takes up less volume, making it easier for shipment and storage. LNG infrastructure includes a gas pipeline leading to the seaside, gas liquefaction plant, storage facilities and an LNG terminal for shipment. After being liquefied and transported to the area of demand, LNG is returned to gas form at re gasification plants at the terminal.

Natural gas can also be stored for later use.

What is natural gas storage?

Natural gas is stored during periods of lower demand and withdrawn during periods of higher demand. Natural gas storage is most often used to meet seasonal demand.

Natural gas is stored underground and under pressure in three types of facilities.

- **Depleted natural gas or oil field:** The most common storage method is in depleted natural gas or oil fields, typically close to consumption centres. By converting a field into a storage facility, companies can take advantage of existing wells, gathering systems, and pipeline connections. They are the most common sites because of their wide availability.
- **Aquifer reservoir:** An aquifer is suitable for gas storage if the water-bearing sedimentary rock formation is overlaid with an impermeable cap rock. While the geology of aquifers is similar to depleted production fields, their use in gas storage usually requires more base (cushion) gas and greater monitoring of withdrawal and injection performance. Deliver ability rates may be enhanced by the presence of an active water drive.
- **Salt caverns:** These storage facilities provide very high withdrawal and injection rates relative to their working gas capacity. Base gas requirements are relatively low. The large majority of salt cavern storage facilities have been developed in salt dome formations located in the gulf coast states. Cavern construction is more costly than depleted field conversions when measured on the basis of dollars per thousand cubic feet of working gas capacity, but the ability to perform several withdrawal and injection cycles each year reduces the per-unit cost of each thousand cubic feet of gas injected and withdrawn.

Liquefied natural gas (LNG) is stored above grounds in storage tanks that are specially designed to maintain the low temperatures required to keep the gas in liquid form.

2.1.3 Pipelines

It is generally the case that all crude oils, natural gas, liquefied natural gas, liquefied petroleum gas (LPG) and petroleum products flow through pipelines at some time in their migration from the well to a refinery or gas plant, then to a terminal and eventually to the consumer. Aboveground, underwater and underground pipelines, varying in size from several centimetres to a metre or more in diameter, move vast amounts of crude oil, natural gas, LHGs and liquid petroleum products. Pipelines run throughout the world, from the frozen tundra of Alaska and Siberia to the hot deserts of the middle east, across rivers, lakes, seas, swamps and forests, over and through mountains and under cities and towns. Although the initial construction of pipelines is difficult and expensive, once they are built, properly maintained and operated, they provide one of the safest and most economical means of transporting these products.

The first successful crude-oil pipeline, a 5-cm-diameter wrought iron pipe 9 km long with a capacity of about 800 barrels a day, was opened in Pennsylvania (US) in 1865. Today, crude oil, compressed natural gas and liquid petroleum products are moved long distances through pipelines at speeds from 5.5 To 9 km per hour by large pumps or compressors located along the route of the pipeline at intervals ranging from 90 km to over 270 km. The distance between pumping or compressor stations is determined by the pump capacity, viscosity of the product, size of the pipeline and the type of terrain crossed. Regardless of these factors, pipeline pumping pressures and flow rates are controlled throughout the system to maintain a constant movement of product within the pipeline.

Types of pipelines

The four basic types of pipelines in the oil and gas industry are flow lines, gathering lines, crude trunk pipelines and petroleum product trunk pipelines.

- **Flow lines:** Flow lines move crude oil or natural gas from producing wells to producing field storage tanks and reservoirs. Flow lines may vary in size from 5 cm in diameter in older, lower-pressure fields with only a few wells, to much larger lines in multi-well, high-pressure fields. Offshore platforms use flow lines to move crude and gas from wells to the platform storage and loading facility. A lease line is a type of flow line which carries all of the oil produced on a single lease to a storage tank.
- **Gathering and feeder lines:** Gathering lines collect oil and gas from several locations for delivery to central accumulating points, such as from field crude oil tanks and gas plants to marine docks. Feeder lines collect oil and gas from several locations for delivery direct into trunk lines, such as moving crude oil from offshore platforms to onshore crude trunk pipelines. Gathering lines and feeder lines are typically larger in diameter than flow lines.
- **Crude trunk pipelines:** Natural gas and crude oil are moved long distances from producing areas or marine docks to refineries and from refineries to storage and distribution facilities by 1 to 3 m - or larger diameter trunk pipelines.
- **Petroleum product trunk pipelines:** These pipelines move liquid petroleum products such as gasoline and fuel oil from refineries to terminals, and from marine and pipeline terminals to distribution terminals. Product pipelines may also distribute products from terminals to bulk plants and consumer storage facilities, and occasionally from refineries direct to consumers. Product pipelines are used to move LPG from refineries to distributor storage facilities or large industrial users.

Exercise

1. **..... formed from the remains of dead organisms that existed millions of years ago in a marine environment.**
   a) Natural Gas
   b) Crude Oil
   c) Gasoline
   d) Hydrocarbon

2. **..... activities involve exploring for crude oil deposits and the production of crude oil.**
   a) Lowstream
   b) Upstream
   c) Downstream
   d) Midstream

3. **Which one of the following is not a type of pipeline system in oil and gas industry?**
   a) Flow lines
   b) Gathering and feeder lines
   c) Crude trunk pipelines
   d) Gathering product pipelines

4. **These types of lines collect oil and gas from several locations for delivery to central accumulating points, such as from field crude oil tanks and gas plants to marine docks.**
   a) Flow lines
   b) Gathering and feeder lines
   c) Crude trunk pipelines
   d) Gathering product pipelines

Notes

Unit 2.2 - Patrolling of hydrocarbon pipeline

Unit Objectives

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

1. Carry out patrolling of oil and natural gas pipeline within the assigned spread
2. Inspect the pipeline and Right of Usage (ROU) area to detect leakage or any other defect
3. Report to control room/authorities about the identified risk/damage

2.2.1 Tools and Equipment required for pipeline patrolling

Tools and Equipment required for pipeline patrolling are listed below:

- Gas detector
- Clamps
- Mobile phone (to communicate with control room)
- Safety helmet
- Hand gloves
- Wrenches
- GPS devise
- Safety shoes
- Safety glasses
- Reflective jacket

Gas detector

Wrenches

Clamps

GPS devise

Mobile phone (to communicate with control room)

Safety shoes

Safety helmet

Safety glasses

Hand gloves

Reflective jacket

2.2.2 Activities to be undertaken while patrolling oil and natural gas pipelines

Identifying abnormalities on the pipeline and its right-of-way is essential during a patrol because they can lead to exposure of the pipe to the atmosphere from regular settlement and weather.

The right-of-way is a strip of land on both sides of the pipeline that serves as an easement for the pipeline owner to operate and maintain the gas line.

Irregularities the patrol technician should check for on the pipeline and right-of-way include:

The following can be inspected during the patrol:

- Loose buts or bolts
- Tree clearance
- Woodpecker holes
- Phase or shield line lightning strikes
- Phase or static line saddle pins

The pipeline patrol services look for:

- Broken terraces
- Exposed pipes
- Pipeline leaks
- Land erosion
- Sunken back-fill
- Evidences of the heavy traffic
- Encroachments on right-of-way

2.2.3 Signs of leakages

Any one of these is a sign of a suspected natural gas pipeline leak:

- Whistling or hissing sound.
- Distinctive, strong odor, often compared to rotten eggs.
- Dense fog, mist or white cloud.
- Bubbling in water, ponds or creeks.
- Dust or dirt blowing up from the ground.
- Discolored or dead vegetation above the pipeline right of way.

2.2.4 Action plan for pipeline leakages

While you notice leakages in the pipelines, remember these two important points:

- Do not attempt to extinguish a natural gas fire.
- Do not attempt to operate any pipeline valves or equipment.

Action plans for 2 kind of leakages is explained below:

a. Leakage with no flame

- Immediately evacuate the area.
- Do not start or turn off motor vehicles or electrical equipment (such as cell phones, pagers, two-way radios, or lights) as this could cause the gas to ignite.
- Abandon any equipment being used in or near the area.
- Move far enough away from the noise until you can have a normal conversation.
- Discourage others from entering the area.
- From this safe location, call or contact the local fire department or law enforcement.
- Notify the operator of the pipeline.

b. Leakage with flame

- Move behind a structure that provides protection until there is a reduction in noise.
- Plan a route away from the fi re that offers shelter.
- Driving away from the area is acceptable.
- Move far enough away from the flames until you feel comfortable.
- Discourage others from entering the area.
- From this safe location, call or contact the local fi re department or law enforcement.
- Notify the operator of the pipeline.
- Odors.
- Stains on the ground.
- Visible damage to the pipeline.

2.2.5 Detection of leakage using Lower Explosive Limit (LEL) gas detector

Lower Explosive Limit (LEL)

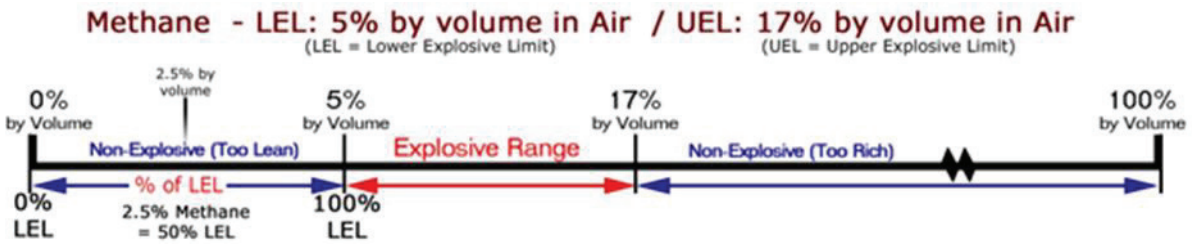
- Lowest concentration (percentage) of a gas or vapour in air capable of producing a flash of fire in presence of an ignition source (arc, flame, heat).
- An LEL Monitor is an instrument used to detect hazardous levels of a combustible gas or solvent vapour in air, expressed in % LEL, or Lower Explosive Limit.
- An LEL Detector simply detects, indicates and alarms for levels between 0-100% LEL of materials it

is calibrated to monitor and detect.

- Zero percent Lower Explosive Limit (0% LEL) denotes a combustible gas-free atmosphere.
- One hundred percent lower explosive limit (100% LEL) denotes an atmosphere in which gas is at its lower flammable limit.

The relationship between percent LEL and percent by volume differs from gas to gas. The example below demonstrates the flammability of Methane (Natural Gas) in Air.

- In concentrations of 0-5% Methane in air, the mixture is too lean to ignite or burn.
- Methane concentrations between 5% and 17% will support ignition and are considered highly flammable.
- At levels above 17%, the atmosphere is too rich for the methane to ignite.



2.2.6 Markings and Sign boards

Pipeline markers and indicators are important damage prevention tools used to indicate the approximate location of the respective pipeline along its route, to prevent **"dig-ins"** from occurring.

- Installing markers is required by pipeline safety regulations because markers contribute to public awareness and damage prevention, which in-turn reduces the risk of loss of containment.

Various types of signage and markers in Pipeline area are:

Signage

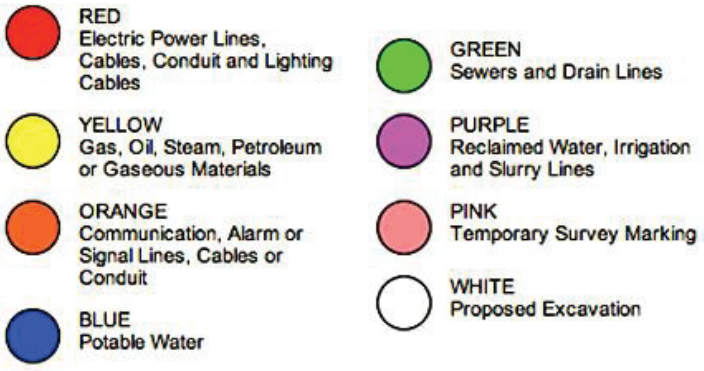
Boundary marking

Warning markers

Kilo Meter (KM) markers

Aerial markers

Direction markers



External painting

Exercise

1. Which one of the following is not a tool used for pipeline patrolling?
   a) Clamps
   b) Mobile Phone
   c) GPS devise
   d) Bolts
2. What would be the action plan for pipeline leakage with no flame?
   a) Do not start or turn off motor vehicles or electrical equipment
   b) Move behind a structure that provides protection
   c) Driving away from the area is acceptable
   d) None of the above
3. What information cannot be found on pipeline marker signs?
   a) Pipeline ROW
   b) Warnings
   c) Emergency Response
   d) Length of pipe
4. **LEL stands for ..... and what is its use?**

   .....
   .....

Notes

Notes

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

https://youtu.be/6ozmKhahk8M

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

https://youtu.be/cXnHOOTCrKY

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

https://youtu.be/QgtSoEJD9HE

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

https://youtu.be/PenuYdMm3Wg

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

https://youtu.be/Gap_IhBIrGI

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

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

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

3. Working effectively in a team

Unit 3.1 - 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 and handling the work patiently with team and customers.

Unit 3.1 - 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.

3.1.1 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;

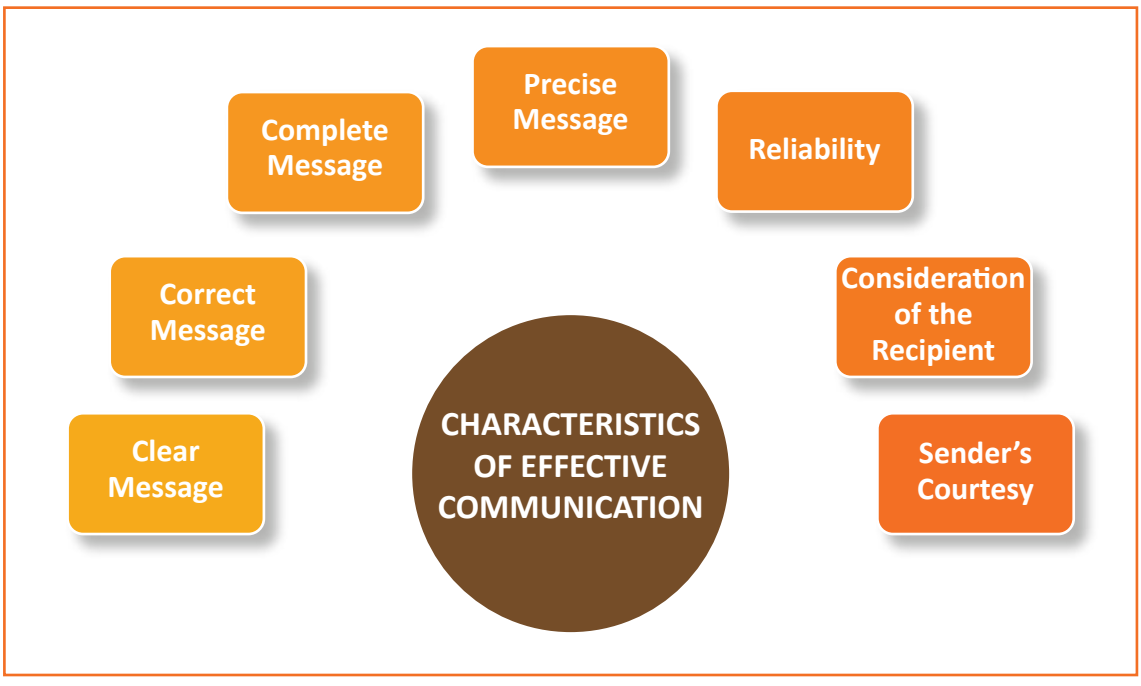


Fig: 3.1.1 Characteristics of effective communication

- **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;

Fig: 3.1.2 Effective communication skills

- **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.

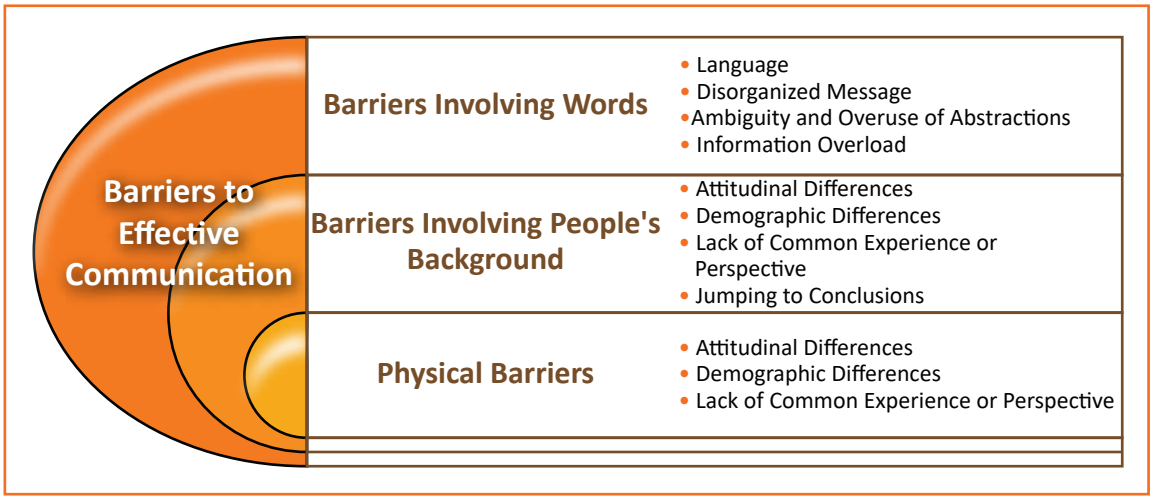


Fig: 3.1.3 Barriers to effective communication

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.

3.1.2 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.

3.1.3 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.

3.1.4 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

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

https://youtu.be/EDMY39JE1sY

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

https://youtu.be/6fbE52YDEjU

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

https://youtu.be/H_vOfqIpD60

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

https://youtu.be/WTa4wvFVX_Y

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

https://youtu.be/fUXdrl9ch_Q

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. Maintain health, safety and security procedures

Unit 4.1 - Maintain health, safety and security procedures

HYC/N9302

Key Learning Outcomes

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

1. Identify the importance of promoting a safe working environment.
2. Identify how to reduce risk.
3. Define hospital electrical safety measures.
4. Define hospital fire safety measures.
5. Define hospital environment safety measures.
6. Explain medical emergencies.
7. Explain the procedure of dealing with medical emergency.
8. Identify the basic fire awareness.
9. Explain the first aid process.
10. Explain the cardiopulmonary resuscitation (CPR) process.

Unit 4.1 - Maintain a Safe Working Environment

Unit Objectives

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

1. Identify the importance of promoting a safe working environment.
2. Identify how to reduce risk.
3. Define hospital electrical safety measures.
4. Define hospital fire safety measures.
5. Define hospital environment safety measures.
6. Explain medical emergencies.
7. Explain the procedure of dealing with medical emergency.
8. Identify the basic fire awareness.
9. Explain the first aid process.
10. Explain the cardiopulmonary resuscitation (CPR) process.

4.1.1 Introduction

Commitment to health and safety should be at the top. Everyone at a workplace, including employer, supervisor, workers, employees and customers must take the responsibility to promote health, hygiene and safety.

Definition of health

As defined by the World Health Organization (WHO), health is a "state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity''.

Definition of safety

Safety is the state of being 'safe', the condition of being protected from harm or other non-desirable outcomes. Regular risk assessments should be conducted at retail stores to identify health and safety problems, and initiate necessary measures to eliminate or mitigate them as far as possible.

4.1.2. Health and safety requirements

It is imperative to ensure that the retail space is safe for everyone in the area especially for employees and the customers. It is always expected from every sales associate to identify and follow health and safety needs laid down by the retailer and the law, which are in place to act as a monitor to avoid all kinds of health or safety hazards.

Following are the factors to keep in mind while undertaking health and safety measures at a retail store:

1. **Abiding by the law:** A retailer has to show that he or she is following all safety practices in his retail store.
2. **Risk assessment:** A risk assessment examines the hazardous conditions at a workplace to identify risks and implement measures to prevent or reduce the risks.
3. **Safety readiness from expected perils:** As per the health and safety legislation, it is required to follow health and safety rules.
4. **Ergonomics:** It is the science of matching a retail store's requirements to the retailer's capabilities. For example, if a retailer hires a weak person to lift heavy boxes for hours on end, there are more chances of risk injury to the employee due to poor ergonomics.
5. **Air quality:** Without inadequate ventilation, air starts to collect mold, fungus, bacteria or odours in a retail store. Law recommends installing machines that cycle fresh outdoor air and circulates it throughout the store.
6. **Visual inspection of premise:** As per the law, it is important to visually inspect the store premises to ensure no hazards are visible, which include uneven flooring, spills and misplaced boxes.
7. **Crime:** The retailer should install a surveillance camera in different parts of the store for safety purposes. Hiring a guard may also help monitor the store.
8. **Training:** Employees of the retail store should be trained to tackle any situation inviting danger.
9. **Insurance:** The retailer must get the retail store insured.

4.1.3 Promoting a safe working environment

The fundamental goal of any safety program is to ensure that workers are not exposed to sources of energy such as high-voltage electricity, high-temperature fluids, toxic chemicals, moving parts, or falls from heights. Therefore, before working on a piece of equipment, the associated sources of high energy must be identified and secured. In the case of a pump, e.g., The following energy sources are probably present.

- **Rotating energy:** The driver, drive shaft, and impeller all turn. It is important that they be secured from inadvertent movement (even if the motor has been de-energized) before anyone works on the pump.
- **Electrical energy:** If the pump has an electrically driven motor, the electricity supply to it must be properly isolated.
- **Heat energy:** If the pump is driven by a steam turbine, or if there is steam tracing around it, it is important to ensure that the steam, and the associated steam condensate system are properly isolated.
- **Chemical energy:** If the pump normally handles hazardous chemicals that are toxic or a health hazard, it has to be properly cleared of them.

- **Flammable/explosive energy:** If the pump handles hydrocarbons, or other materials that could ignite, they have to be cleared, often using an inert gas such as nitrogen.
- **Potential energy:** If the pump is not located at grade, it may be possible for a person to fall off it (and if it is at grade there may be a pit below it).

Energy control procedures can be placed into one of the four categories shown - below (in the preferred order).

- Removal of the hazard.
- Positive isolation of the hazard.
- Lockout/tagout of the hazard.
- Administrative controls.

Venting and draining requirements

- Equipment and systems, provided with isolation for servicing, should be equipped with vent and drain valves as required to relieve pressure and remove fluids from the isolated equipment.
- Isolated components containing high pressure or a significant volume of vapour should be equipped with a vent valve. If the potential exists for venting of a significant volume of vapour the vent should be tied into the appropriate flare or vent system. For high-pressure services, the vent should include a throttling valve in addition to the isolation valve to control the rate of venting.
- Isolated components containing a significant volume of liquid should be equipped with a drain valve. If the volume of liquid is large, the drain should include a throttling valve in addition to the isolation valve to control the rate of draining and to prevent large volume gas blow by to the drain system.

Manways

When removing the first manway, the following guidelines can be used:

- Loosen bolting on the manway and remove all but four bolts. These are at the 12, 3, 6, and 9 o'clock positions.
- The last bolts on the manway should be loosened and carefully spread open to ensure that there is no pressure trapped in the vessel.
- When it is confirmed that there is no residual pressure in the vessel, the four bolts can be removed, and the manway taken off.

Electrical equipment

Electrical equipment can be isolated as follows:

- Shut down the equipment using the selector switch followed by the master disconnect.
- Ensure that all power sources are locked and tagged out.
- Stored electrical energy must be discharged to obtain zero energy state.
- When working on or near exposed de-energized electrical equipment, a qualified person should use test equipment to ensure that all circuits are dead.

Mechanical equipment

- Release or block all stored mechanical energy including that contained in springs and items under tension.
- Use blocks, pins, or chains to restrain energy when equipment cannot be brought to a zero potential energy state.
- Padlocks, lockouts, blinds, and tags should be used to lockout and tagout mechanical energy.
- If additional energy sources are present, follow the applicable methods of energy isolation listed in this section.

Pipe plugs

Plugs are sometimes used in pipeline repair; they create a vapour barrier when a line has been isolated and de-pressured, but has not been completely cleared of flammable, combustible, or toxic materials. Expandable plugs are also used to isolate sections of gravity drain systems such as sewers. Examples include plumbers plugs - which consist of two parallel disks that compress an elastic material together to form a seal on the inside diameter of the pipe - and inflatable bladders - which are inflated either pneumatically or hydraulically

4.1.4 How to Reduce Risk

To reduce risk, you must:

- Make sure that your own health and hygiene does not pose a risk to others.
- Make sure that your seniors know where you are.
- Check for health, safety and security risks when working and report if you see any hazards.
- **Use approved procedures when carrying out work that could be dangerous including:**

  1. Correct moving and handling techniques.
  2. Appropriate hygiene procedures.
  3. Correct protective clothing for the situation, environment and activities.
  4. Storing equipment and materials and dealing with spillages and getting rid of waste.

- **Take immediate and appropriate action to deal with emergencies, including:**

  1. Security problems.
  2. Accidents.
  3. Fire.

- **Use your skills and experience until appropriate help arrives: You must:**

  1. Call for the appropriate help.
  2. Continue to provide help until someone who is qualified to deal with the emergency is available.
  3. Support patients and others including family carers who may be affected by the emergency.
  4. Record and report incidents and emergencies accurately and fully in line with your organisation's policies.

4.1.5 Near misses and dangerous occurrences

Not only is the investigation of accidents and incidents important, it is also useful to investigate near misses and dangerous occurrences which did not result in injury. Just because no- one has been injured on one occasion does not mean that if the event happened again the result would be the same.

Whether the incident is classed as an accident, a near miss or a dangerous occurrence, the investigation should carry the same degree of importance, and the findings will be as useful in any event in preventing a recurrence. Specific lessons should be noted to identify why control measures already in place failed to prevent the incident and what further measures should be introduced to rectify the situation. General lessons learned from one incident will also be useful throughout an organization to increase awareness about health and safety issues.

4.1.6 Categorizing incidents

Hazards related to oil and gas industry

Hazards in oil and gas industry can be divided into two broad categories:

1. **Safety and injury hazards:** Workers in oil and gas industry are generally susceptible to the following safety and injury hazards.

Safety and Injured Hazard	Possible Causes
Motor Vehicle Accident	• Often the roads leading to well sites lack firm shoulders and other safety features. • Fatigue due to long driving distance and long working shifts.
Contact Injuries	• Workers being stuck by, entangled, or crushed by tools, machinery or other objects.
Fire and explosions	• Presence of highly combustible hydrocarbons. • Presence of oxygen/ignition source.
Slip, Trips and Falls	• Frequent need to work at elevations. • Uneven Surface. • Improper use or non-availability of fall protection systems.
Confined Space	**According to NIOHS, confined space refers to space, which by design has:** • Limited openings for entry and exit. • Unfavourable natural ventilation. • Not designed for continuous employee occupancy. Example of confined space in Oil and Gas Industry are storage tanks, pipelines, Silos, etc.

Table: 4.1.1 Possible cause of injure/hazard

2. Workers in oil and gas industry are generally susceptible to following agents which lead to various health and illnesses hazard, chemical hazards (toxic, corrosive, carcinogens, asphyxiates, irritant and sensitizing substances); physical hazards (noise, vibration, radiations, extreme temperature); biological hazards (virus, parasites, bacteria); ergonomic hazards (manual handling activities, repetitive motions, awkward postures); and psychosocial hazards (overwork, odd working hours, isolated sites, violence).

   The following table identifies the potential health effects from key processes in oil and gas industry:

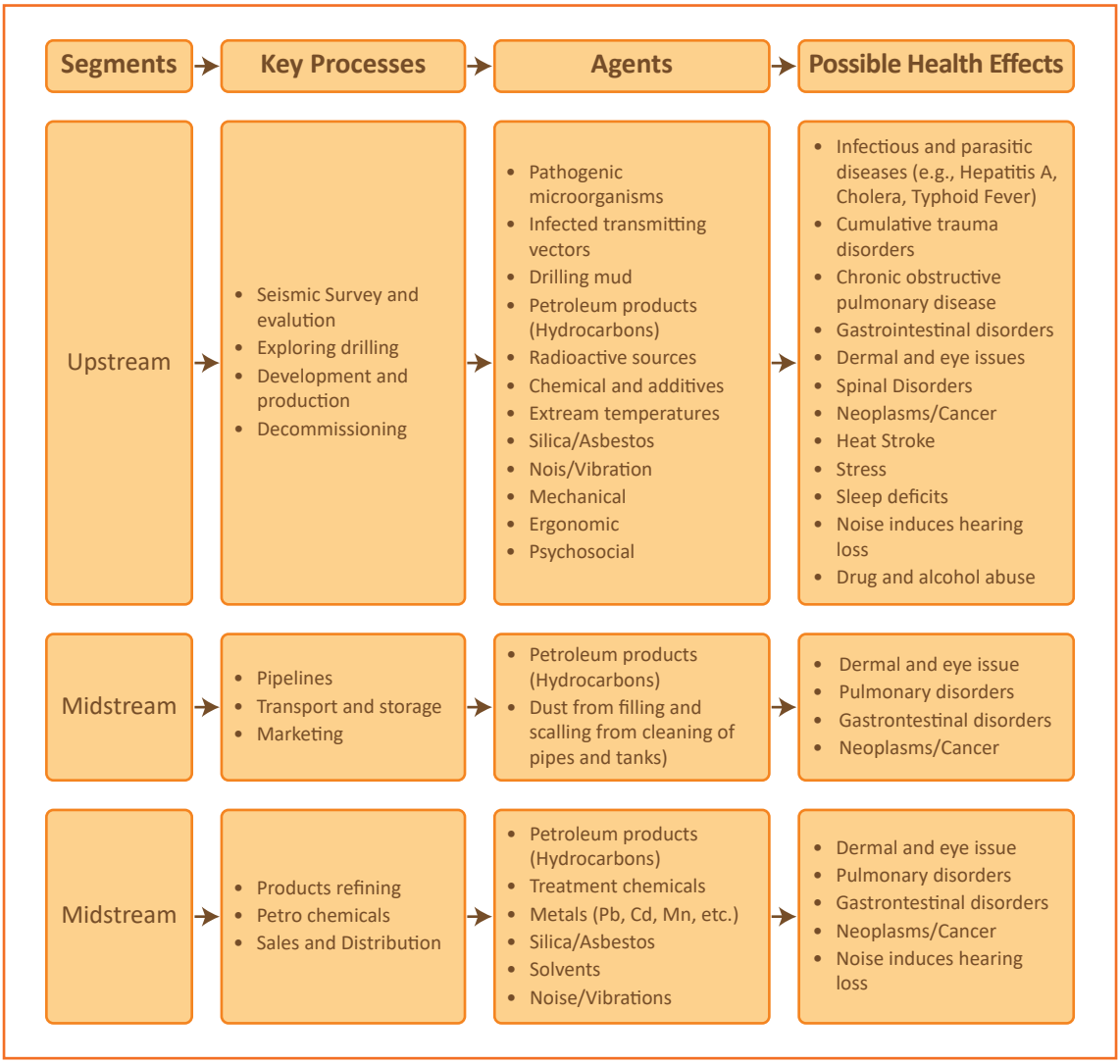


Fig: 4.1.1 Potential health effects from key processes

4.1.7 Managing occupational safety and health risks

The aim of occupational safety and health risk management is to identify and assess safety and health hazards existing at the workplace and to define appropriate control and retrieval steps.

Business processes in oil and gas industry are very complex. Hence it is essential that a systematized approach should be used for managing occupational safety and health hazards. Its solution model can be based on the PDCA cycle.

Fig: 4.1.2 PDCA Cycle

4.1.8 Risk management process

Risk management is crucial for preventing work related injury and illness. It includes:

- Identifying the risks.
- Evaluating and prioritizing the risks.
- Implementing preventive/protective measures to control the risk.

There are a number of circumstances in the oil and gas industry where a proper risk management process is essential. For example:

- **Job safety analysis:** It is a process of systematically evaluating certain jobs, tasks, processes or procedures and eliminating or reducing the risks or hazards to as low as reasonably practical (ALARP) in order to protect workers from injury or illness.
- Workplace inspections and audits.

- **Change management:** Identification of new hazards, introduction of new equipment/process, or regulatory needs.

Generally risk management process in the oil and gas industry involves the following key steps:

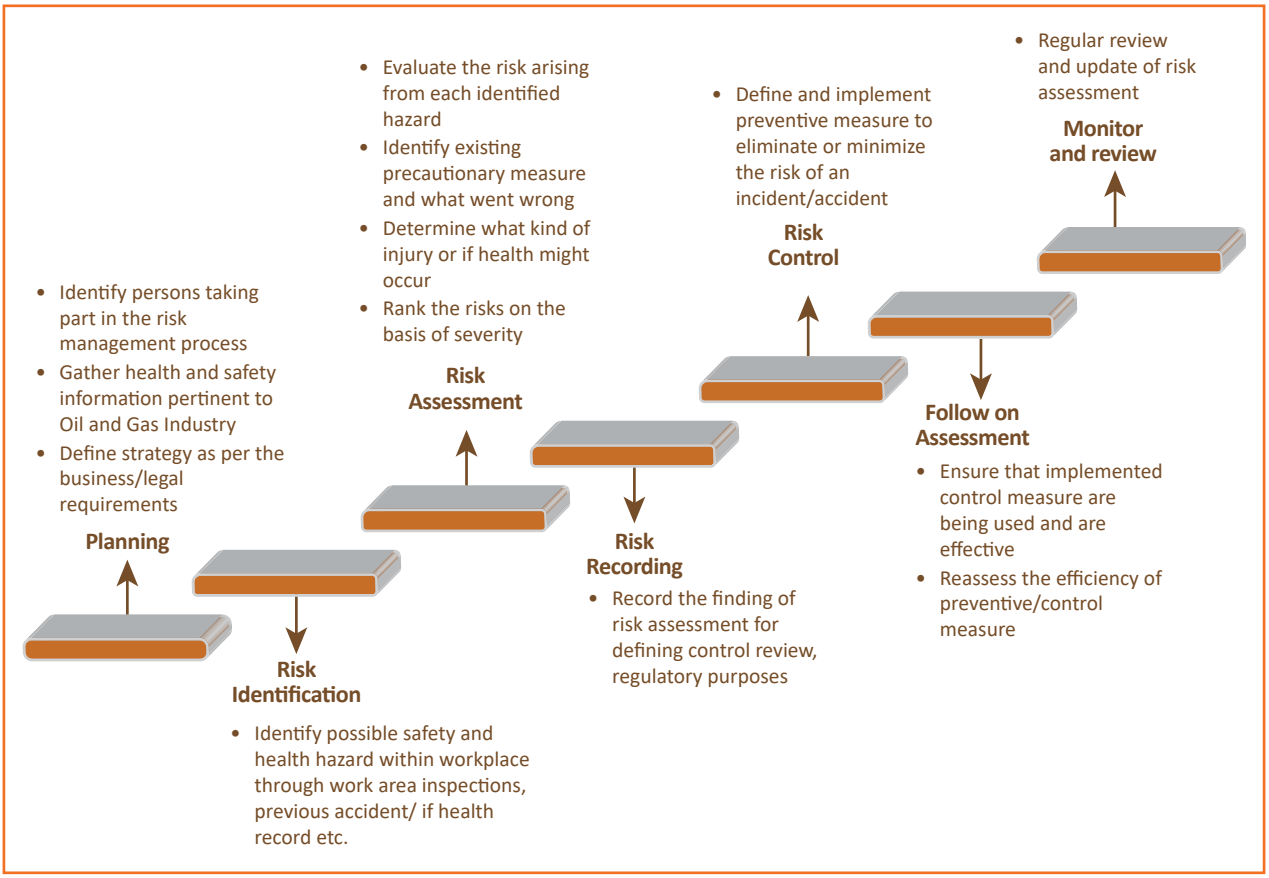


Fig: 4.1.3 Risk Management process

4.1.9 Personal protective equipment (PPE)

Personal protective equipment (PPE) is a clothing or equipment worn by workers to protect them from fire, exposure to toxic chemicals and direct impact. PPE should only be used when engineering designs and operating or maintenance practices do not provide a sufficiently safe work environment.

The need for PPE can be determined with a risk analysis, which will be structured along the following lines:

- Can the hazard be removed? If so, there will be no need for PPE.
- Can the consequences of the hazard be reduced? If so, it may be possible to work with a lower level of PPE.
- Can the likelihood of occurrence be reduced? This may not change PPE requirements, but it will reduce the chance of someone being injured.

Only when the above analysis has been completed, should consideration be given to the types of PPE to be used. A job hazards analysis (JHA) will help determine what type of PPE is needed and when and where it should be worn.

Clothing

Proper clothing will help keep acidic, corrosive, oily, dirty, or dusty materials off the body. Even if clothing with special PPE capabilities is not required, the following rules should be observed at all times and in all work site locations.

- Shorts are never permitted. Workers should always wear full-length pants (trousers) that cover the entire leg.
- Full cover shoes should always be worn. They should have non slip soles. Many companies require that shoes always have toe protection - often in the form of a steel toe cap.
- Hard hats should always be worn.

The effectiveness of clothing with regard to safety and health is affected by the following three factors:

- **Insulation:** High insulation is generally desired in cold weather and not wanted when temperatures are high.
- **Permeability:** This is the measure of the resistance to water vapour movement throughout the clothing.
- **Ventilation:** The ability of ambient air to move throughout the fabric itself or through garment openings.

Flame-resistant clothing

If normal clothing catches fire, it will continue to burn even if the ignition source is removed or if the affected worker moves away from the fire. Flame-resistant material self-extinguishes on removal of the ignition source. Clothing made of flame-resistant material is known as flame-resistant clothing (FRC), which will not continue to burn in such situations, nor will it melt like some synthetic fabrics.

It is used to make coveralls, lab coats, and fire hoods, and is now routinely worn by workers on process facilities at all times. It is also worn by workers who come in contact with energized electrical equipment.

- **Impervious clothing:** Impervious clothing provides protection from splash and should be worn during jobs where it is possible to come in contact with highly acidic or corrosive materials.

  Such jobs may include the following:

  1. Breaking lines.
  2. Opening equipment.
  3. Jobs where liquid materials could splash or spray.

  Workers wearing impervious clothing are more likely to suffer from heat stress.

- **Laboratory clothing:** The clothing requirements for laboratory work will depend on the materials being handled.

  Laboratory workers often handle hazardous chemicals directly; therefore, they will often be required to wear coats, goggles, and chemical-resistant gloves.

Emergency PPE

Emergency responders need specialized PPE in order to fight fires and to enter areas that may be contaminated with toxic chemicals.

- **Fire fighter protective clothing:** Fire fighter protective clothing, sometimes referred to as bunker gear, is worn by all members of fire teams and helideck fire guards. (Only those who are properly trained should wear this type of clothing.) Its use is required for those fighting fires beyond the incipient stage.

  The type of clothing will vary according to the local environment. However, the following should be the minimum requirements:

  1. Fire coat and/or leggings. The coat should be of knee length.
  2. Insulated fire boots - at least calf height with non slip sole tread and reinforced safety toe cap.
  3. Safety gloves.
  4. Self-contained breathing apparatus (SCBAS) for entering smoky areas.

  Fire fighter clothing should not restrict the person's movements. It should also be stored such that it cannot be contaminated or affected by heat, sunlight, or dampness.

- **Proximity suits:** heat-reflecting proximity suits are used by properly trained persons for taking actions such as closing a critical valve that is located close to a fire that has not yet been extinguished. On many offshore platforms, at least one person wearing a proximity suit will be on the helideck when helicopters are landing and taking off.

  Fire entry suits are used for entering flame areas but only for precise snatch rescue work where the casualty location is known and not for fire fighting under any circumstance.

Respiratory protection

Although every attempt should be made to make sure that workers are never exposed to toxic or harmful vapours, there will be times when some form of respiratory protection is needed, if only as a precaution.

- **Fixed breathing air systems:** Respiratory protective equipment should be used in areas that do not have a safe breathing environment, or where there is the possibility of an unexpected release of toxic gas or particulates.

  When respirators are used in atmospheres where the concentration of toxic gases could approach the immediately damaging to life and health (IDLH) level, standby personnel carrying SCBA should be present, along with suitable rescue equipment such as harnesses and hoists.

- **Respirators: the five most widely used types of respirator are as follows:**

  1. **Air-purifying respirators:** Air-purifying respirators contain material that traps and purifies the air that the worker is breathing. They can trap either solid materials (particulates or dust) or toxic gases depending on the material used in the filter. Respirators of this type can be single or multiple use (replacement cartridges are put into the respirator for multiple use). In general, respirators in this category do not provide a high level of protection and should not be used when the concentration of toxic gas is close to IDLH (immediately dangerous to life or health).

2. **Supplied air respirators:** Supplied air respirators are connected via a hose to a supply of air. The air can come from a compressor or from cylinders. (If a compressor is used, it is essential that the air supply cannot become contaminated by fumes in the area.) Respirators of this type are safer than any type of system that purifies air because they do not rely on trapping or containing hazardous chemicals.
3. **Self-contained breathing apparatus (SCBA):** SCBAS are similar to supplied air respirators except that the air is supplied from a cylinder, usually carried by the worker. They are used for short-duration tasks, emergency rescue, escape, and process control procedures. The air supply is generally rated for 30 minutes, but this time is reduced if the work being performed is strenuous.
4. SCBAS should be inspected before each use; emergency units should be inspected at least monthly.
5. **Chemical canister re breathers:** Chemical canister re breathers are used only for emergency egress. The canister contains a special chemical that evolves as oxygen when contacted by the moisture and carbon dioxide in exhaled breath (the co2 and moisture are retained).
6. They are suitable for high concentrations of contaminants and oxygen deficient atmospheres, but they are negative-pressure respirators that rely upon a perfect face-to-mask seal, which limits their use to emergency situations only.
7. **Disposable respirators:** These are intended for single use. They are primarily used for protection against nuisance dusts and non-toxic particles.

Use of respirators

Before using a respirator, the following checks should be carried out:

- The respirator should be checked for correct fitness before every use.
- Employees should not wear items such as facial hair or eyeglasses that could prevent a good seal. Employees who wear prescription glasses while working should be provided with specially designed units.
- All respirators should be inspected before each use to assure all parts are present and in good working order. There should be no cracks in the rubber or lenses and head straps should be properly elastic. Hoses should be checked by being stretched and then looking for cracks.
- A check for leaks should be carried out by covering the mask with the palms of the hands and then inhaling gently. If the mask is pulled toward the face then the fit is good. The leak check is particularly important for negative pressure respirators.
- The pressure in SCBA tanks should be as specified. The regulator pressure should be about the same as that of the cylinder. The low-pressure alarm should be checked.

Head protection

Hard hats/helmets protect the head from impact and penetration from falling or flying objects, overhead spills of hot or hazardous liquids, and electric shock.

They should be worn at:

- Construction sites.
- When near lifting operations or overhead work.
- All process plant areas.

Hard hats are made of rigid plastic, sometimes with a mid line reinforcement ridge. Different styles are available (those made in the form of a traditional cowboy hat are often not permitted on process facilities).

Inside the helmet is a suspension that spreads the helmet's weight over the top of the head and that also provides a space of approximately 30 millimetre between the helmet's shell and the wearer's head so that if an object strikes the shell, the impact is less likely to be transmitted directly to the skull. The suspension generally has an adjustment knob or strap so that the hat can be used for different head sizes.

Hand protection

Gloves should be worn when hands are exposed to hazardous substances or to sharp, rough, or hot objects. The following types of glove are used.

- Leather palm gloves are often worn when carrying out heavy duty work. They resist heat, sparks, sharp, and rough objects, and provide some cushioning against blows, but they provide minimal protection from hydrocarbons and liquids.
- Impervious gloves are made of materials such as neoprene, PVC, or nitrile. They are used when handling hydrocarbons or corrosive chemicals such as acids and caustic.
- Gauntlet-type gloves, which extend above the cuff and protect the wrist and forearm, should be worn when there is a possibility of splashing.
- Cotton gloves protect against dirt and abrasion but are not heavy enough for use with rough or sharp materials.
- Latex gloves provide for maximum dexterity but provide limited protection.
- They are used in light service, such as laboratory work and to keep oil, grease, and liquids off the skin.
- Welders gloves are made from treated leather that provides protection against heat, welding sparks, splatter, and hot slag.
- Insulated gloves are used in laboratories for handling distillation pots and other hot objects.
- Electrician gloves protect against electrical shock.

Foot protection

Shoes used in process facilities should be notched or grooved to prevent slipping on oily or wet surfaces. They should also have a heel to assist with climbing ladders. Boots or shoes with steel toe caps should be used when a dropped object could crush a person's foot.

The following guidelines should be considered:

- Soles should be notched or grooved to prevent slipping on oily or wet surfaces.
- Boots or shoes should have oil-resistant soles and a heel.

- Rubber boots or overshoes can be worn to protect the feet and shoes from excessive water, oil, muck, or corrosive material.
- **Footwear of the following types should not be worn:**
- Tennis and deck styles.
- Deep lug and hiking style soles.
- Crepe soles.
- Smooth leather soles.
- Western style or narrow throat boots.
- Lace-up and zipper style boot higher than 8 inches.
- Slip-on boot higher than 12 inches.

Eye protection

- Eye protection should be used when there is a reasonable probability of eye injury.
- Employers must ensure that each affected employee uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapours, or potentially injurious light radiation.
- Employers must ensure that each affected employee uses eye protection that provides side protection when there is a hazard from flying objects.
- Detachable side protectors (e.g., Clip-on or slide-on side shields) meeting the pertinent requirements of this section are acceptable.
- Employers must ensure that each affected employee who wears prescription lenses while engaged in operations that involve eye hazards wears eye protection that incorporates the prescription in its design or wears eye protection that can be worn over the prescription lenses without disturbing the proper position of the prescription lenses or the protective lenses.
- Employers must ensure that each affected employee uses equipment with filter lenses that have a shade number appropriate for the work being performed for protection from injurious light radiation.

Safety glasses

In general, safety glasses should be worn whenever a person is working outside at a process facility, working indoors with hazardous chemicals, and in most non office work areas. Prescriptive lenses must comply with the overall safety glass policy.

Chemical goggles

Chemical goggles protect against splashing liquids, flying solids, and other harmful materials. Examples of work that may require chemical goggles are the following.

- Light chipping.
- Dusty work.
- Cutting wire.

- Using grinders.
- Handling mineral wool or fibreglass.
- Handling hazardous liquids.

4.1.10 Signs

Signs are widely used throughout the process industries to advise people of hazardous conditions and to provide directions as to what actions to take in various situations. It should, however, be remembered that **"red lights don't stop cars - brakes stop cars"**; it is always best to engineer a solution to a hazard than to warn people about that hazard.

Training programs should include an explanation of the signs that are used by the company.

Where possible signs should be symbolic only, i.e., They should not contain wording. This policy reduces problems communicating with an international workforce. However, some signs that use symbols only can be confusing. For example, the **"falling rock"** sign would appear to warn against rocks falling on vehicles. In fact, it is more to do with the fact that fallen rocks may be on the roadway. If supplemental wording is necessary, then all the languages that are typically used at the site should be included.

Types of sign

Guidance as to the types of signs and their meanings is provided in the following sections.

Fig: 5.1.4 Prohibition Sign

Prohibition

Prohibition signs mean **"you must not"** or **"do not do. . .,"** Or **"stop."** Signs of this type have a red circle, a white interior, and a red bar, the sign can be supplemented with more specific information.

Other examples of prohibition signs include the following:

Other examples of prohibition signs include the following:

- No smoking.
- No open flames.
- Non-potable water.
- Prohibition sign.
- Prohibition sign with information.
- Do not enter.
- Do not fish.
- Do not use crane for personnel transfer.

Fig: 5.1.5 Example of prohibition sign

Mandatory action

Mandatory signs mean **"you must do. . ."** Or **"carry out this action,"** or simply

Fig: 5.1.6 Mandatory Sign

"obey." They are often used when special PPE (personal protective equipment) is required.

Other examples of mandatory signs include the following:

- Hearing protection required.
- Wash hands.
- Chock wheels.
- Ground fuel truck.
- Hard hat area.
- Doors must be kept closed.
- Goggles required.
- Face shield required.

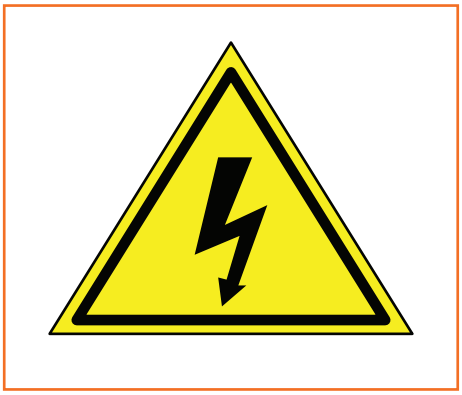


Fig: 5.1.7 Warning Sign

Warning

Warning signs are yellow triangles using black lettering.

Other examples of warning signs include:

- H2s gas.
- Corrosive liquids.
- Radiation.
- Equipment automatic start.
- Open trenches.
- High temperature.
- Flammables.

Safe condition

A green square or rectangle indicates a safe condition, a means of escape or the location of safety equipment.

Other examples of safe condition signs include:

- Emergency shower station.
- Emergency eyewash station.
- Potable water.
- Emergency shut down.
- First aid.
- Trash.

Fig: 5.1.8 Fire Safety Sign

Fire safety

Red square or rectangle is to do with fire safety.

Fig: 5.1.9 Fire exit sign

4.1.11 Medical emergencies

Everyone plans for emergencies. That is the reason why we keep a first aid kit with ourselves. At work, however one is exposed to a lot of stress and physical activity. This could lead to certain medical emergencies. It's better to be prepared with the first aid measures and knowledge of implementing them on ourselves and on others. This module equips you with that information. Pay attention to these medical emergency procedures to understand how to conduct you in theses crucial movements. Pay attention during these sessions.

Dealing with medical emergency

A medical emergency is an accidental injury or a medical crisis that is severe. These could be situation where.

- The person is not breathing.
- Stroke or heart attack.
- Severe bleeding.
- Shock.
- Poisoning.
- Burns.

A medical emergency requires your immediate attention, sometimes even before you call emergency services for help.

It is crucial that you know the emergency medical service (ems) number, for your own safety and the safety of others.

Do not

- Give the victim anything to eat or drink.
- Hold the victim.
- Splash or pour any liquid on the victim's face.
- Shift the victim to another place (unless it is the only option to safeguard the victim from the injury).

Bleeding

- Put pressure to the wound with a pressure bandage. Raise the wounded portion to slow the bleeding.
- Pressure the associated points if necessary then apply an additional pressure to reduce the bleeding.

Fainting

- Fainting is a small loss of consciousness which is caused by a momentary reduction of the blood flow to the brain.
- A small loss of consciousness can cause the person to fall.
- A very slow pulse.
- Cold skin with sweat and pale appearance.

Causes of fainting:

1. Taking in too little quantity of foodstuff and liquids (dehydration).
2. Low BP.
3. Deprivation of sleep.
4. Fatigue.

First aid for fainting:

1. Place the victim lying on his/her back and raise his/her legs above the heart level.
2. Check the victim's airway to ensure it is clear.
3. Check for the indications of breathing, coughing, or movement.
4. Loosen clothing (neck ties, collars, belts etc.).
5. If consciousness is not regained within one minute call ems.

Shock

Shock occurs with the failure of the circulatory system due to which insufficient oxygen reaches the tissues. If this condition is not treated immediately, important organs can fail, which can ultimately lead to death. Fear and pain makes effect of shock worse.

First aid for shock:

1. Place the victims resting down (if feasible).
2. Raise the legs 10-12 inches, unless you doubt for a back injury or broken bones.
3. Cover the victim to preserve the body temperature.
4. Give the victim room for fresh air.
5. If victim wants to vomit then- position him/her on his/her left side.
6. Loosen restrictive clothing.

Muscle cramps

- Stretch out the cramped muscle to neutralize the cramp.
- Give massage to the cramped muscle rigidly.
- Apply hot water bottle to the affected area.
- Seek medical help if the cramp continues.
- Avoid unnecessary movements and activities which can cause pain.
- Apply some ice which will help in reducing pain and swelling.
- Apply light pressure with an elastic wrap or a bandage which can also help in reducing the swelling.
- Raise the cramped limb at the level of the heart which further reduces pain and swelling.

Fractures

A fracture is a break or crack in the continuity of the bone.

Dislocation

A dislocation is the displacement of one or a lot of bones at a joint. It usually happens in the shoulders, elbow, thumb, fingers and also the lower jaw.

First aid for dislocations & fractures:

1. Immobilize the effected part.
2. Stabilise the effected part.
3. Use a cloth as a sling.
4. Use board as a sling.
5. Carefully transfer the victim on a stretcher.
6. Call a doctor.

4.1.12 Basic fire awareness

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

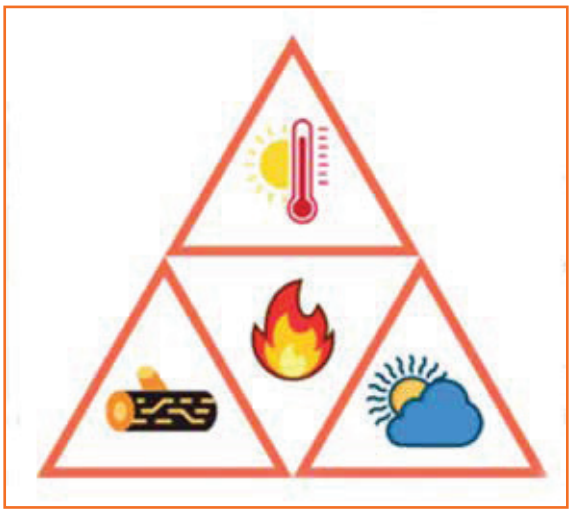


Fig: 5.1.10 Basic cause for fire

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's 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 per cent 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:** e.g. overloading of circuits, faulty old or bad connections causing sparks or generating a heat source, poor maintenance, 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:** e.g. overheating of machinery, heat generated by friction, uncontrolled sparking, breakdown in cooling process, chemical reaction, poor quality ventilation and temperature control etc.
- **Flammable dusts:** e.g. 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 spillage's 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 instructions.
- Misuse of faulty electrical equipment.
- **Electrical appliances:** Many fire started by electrical appliances are associated with lamps and heat developed by filament. Portable lamps are a frequent source of trouble the common causes as follows.

  i. Lead wires damaged.

  ii. Lamp taken in to atmosphere which has explosive dust, gas or vapour.

  iii. Bulb loose in socket.

  iv. Bulb easily broken (take care properly).

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: 5.1.2 Classification of fire

Fire extinguisher

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. 
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. 

Types of fire extinguisher	Identification		
	Use	Fire class	Colour code
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: 4.1.3 Classes of fire extinguisher

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.

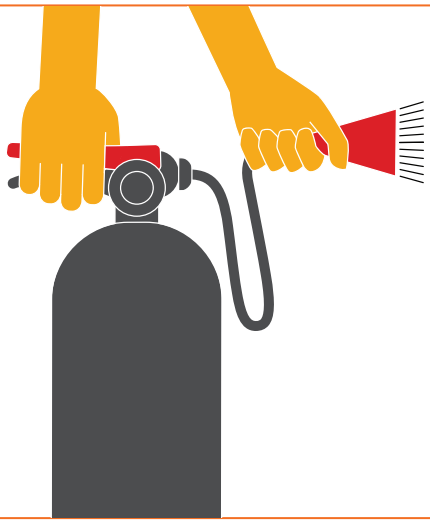
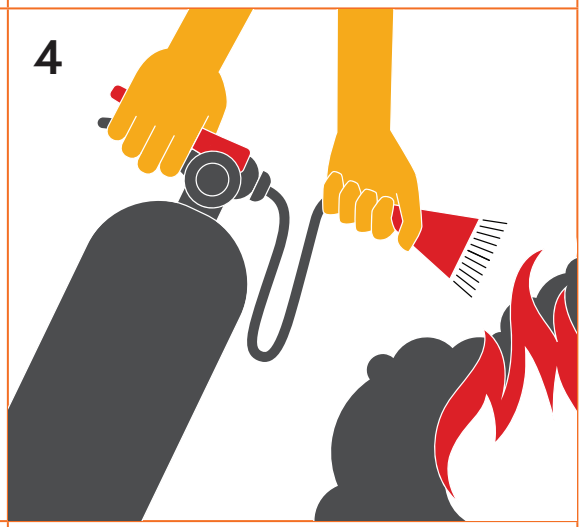
PASS Technique	
1 	2 
Pull out the safety pin as instructed on the label	**Aim the nozzle at the base of the fire**
3 	4 
Squeeze the lever	**Sweep the fire using the extinguisher's discharge**

Table: 4.1.4 Fire extinguisher PASS method

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 (do's & don'ts)

The general principles (do's and don'ts) when conducting basic fire-fighting is as follows.

Do's

- 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 a person with yourself.
- 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 with the person.
- Leave the house via the nearest door bearing an **"exit"** sign.
- Report to the person's parents 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, if needed.

(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.

4.1.13 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: 5.1.5 Vital sign

(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: 4.1.6 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: 4.1.7 Burn classification

(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.

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: 4.1.8 First aid techniques for common injuries

4.1.14 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:

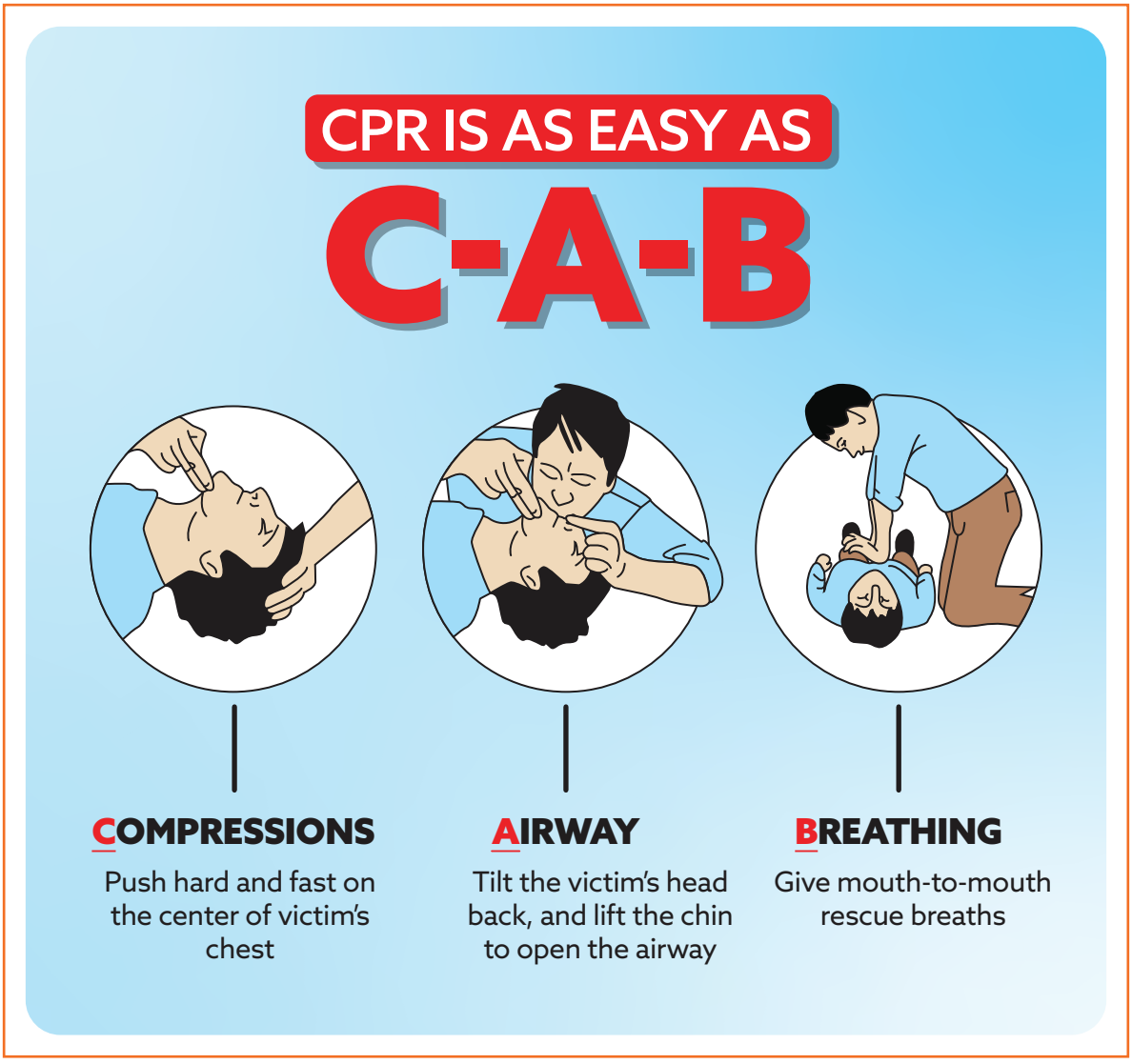


Fig: 4.1.11 CPR Process

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.

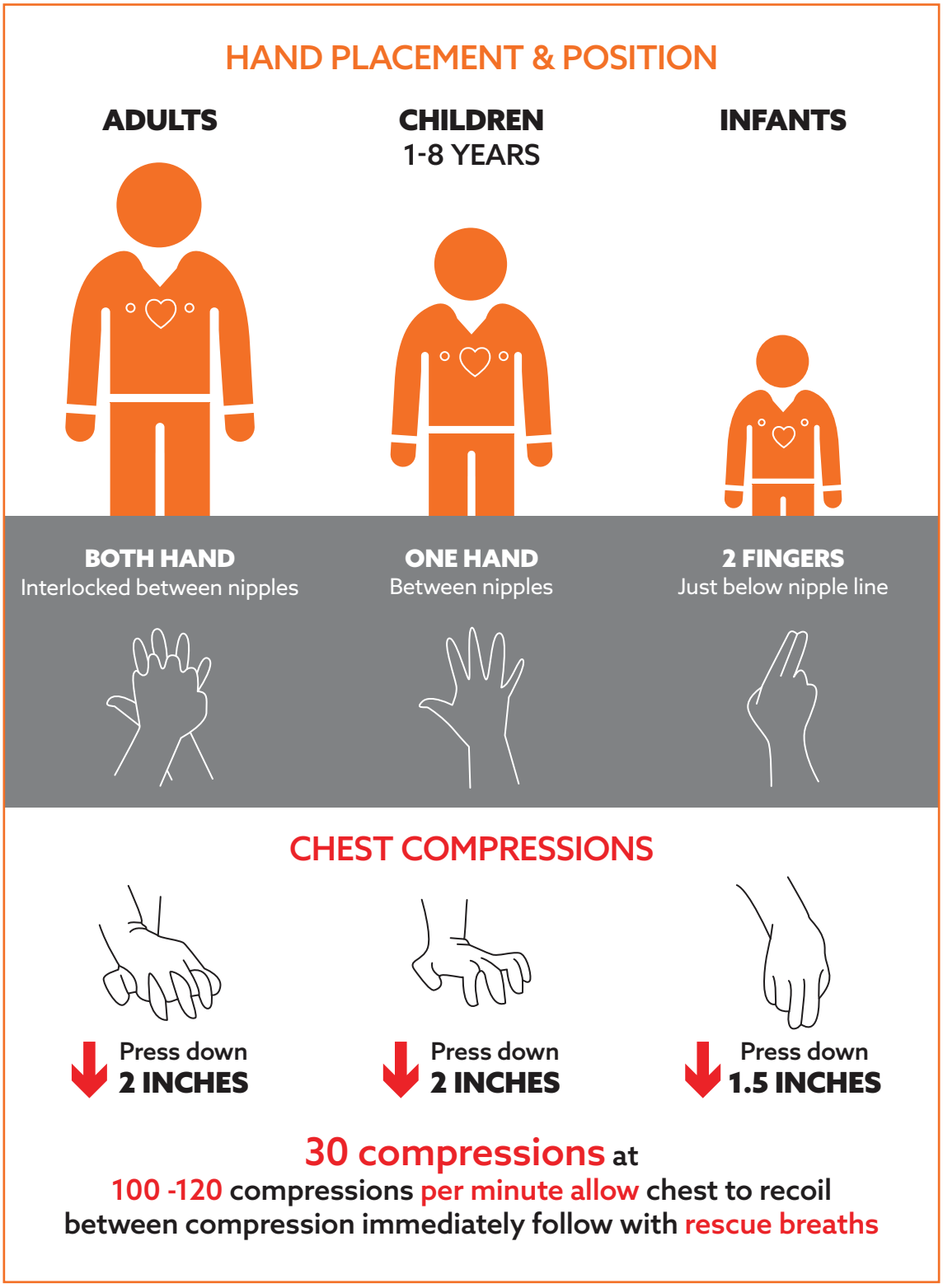


Fig: 4.1.12 Performing CPR Steps

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: 4.2.1 Performing CPR steps

4.1.15 Accident/incident report forms

There are many kinds of accident/incident report forms but all do the same job – they all include the findings of the investigation and determine the causes of the incident. They also provide recommendations to prevent further occurrences. There are also various computer programs which have been developed to record and analyse data. Whatever the format, they all state.

- **What happened:** The injuries/losses/costs.
- **How it happened:** The event itself.
- **Why it happened:** The causes, root, underlying and immediate.
- **Recommendations:** Any action to be taken to remedy the situation and prevent any recurrences.

The use of standardized report forms ensures that the investigation process is correctly adhered to and that information can be reported back to management. Follow- up actions can easily be taken following appropriate recommendations within the report. Standardized report forms can also act as a checklist.

An efficient recording system will:

- Ensure the information is correctly and accurately presented.
- Allow the data to be analysed easily in order to discover common causes or trends.
- Ensure data which may be required for future reference is included.
- Identify issues which may help prevent any recurrence of the accident.

Report forms should be reviewed on a regular basis to ensure that any recommendations have been implemented.

Summary

- As defined by who, health is a “state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity’’.
- Safety is the state of being ‘safe’, the condition of being protected from harm or other non-desirable outcomes.
- Workers in oil and gas industry are generally susceptible to certain safety and injury hazards such as, motor vehicle accident, contact injuries, fire and explosions, slip, trips and falls etc.
- Workers in oil and gas industry are generally susceptible to chemical hazards, physical hazards, biological hazards, ergonomic hazards, psychosocial hazards.
- It is important that driver, drive shaft, are secured from inadvertent movement before anyone works on the pump.
- It is important to ensure that the steam - and the associated steam condensate system - are properly isolated.
- A systematized approach PDCA should be used for managing occupational safety and health hazards.
- Risk management includes, identifying the risks, evaluating and prioritizing the risks, implementing

preventive/protective measures to control the risk.

- Job safety analysis is a process of systematically evaluating certain jobs, tasks, processes or procedures and eliminating or reducing the risks or hazards in order to protect workers from injury or illness.
- 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.
- There are five different classes of fire, class a, b, c, d, e, k.
- There are 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.
- 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.
- 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. **A ..... examines the hazardous conditions at a workplace to identify risks and implement measures to prevent or reduce the risks.**
   a) Risk assessment
   b) Ergonomics
   c) Air quality
   d) Visual Inspection

2. **These are the clothing or equipment worn by workers to protect them from fire, exposure to toxic chemicals and direct impact.**
   a) Risk Identification
   b) Personal Protective Equipment (PPE)
   c) Proximity suits
   d) Administrative controls

3. **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 .....**
   a) Swing
   b) Sweep
   c) Swipe
   d) Send

4. **These are the type of burns which are very serious and require skin grafting.**
   a) 1st degree burn
   b) 2nd degree burn
   c) 3rd degree burn
   d) 4th degree burn

5. **What does CPR stand for?**
   a) Cardiac personal resuscitation
   b) Caring personal rescue
   c) Cardiopulmonary rescue
   d) Cardiopulmonary resuscitation

6. **These are the signs which mean "You must not" or "Do not do. . .," or "Stop."**
   a) Prohibition signs
   b) Mandatory action signs
   c) Warning signs
   d) Fire safety signs

7. **This occurs with the failure of the circulatory system due to which insufficient oxygen reaches the tissues.**
   a) Fractures
   b) Shock
   c) Muscle cramps
   d) Dislocation

8. **These are the class of fire that are related to solid materials.**
   a) Class B
   b) Class C
   c) Class D
   d) Class A

9. **Which of the following is strictly prohibited in fire emergency procedures?**
   a) Apply the extinguisher medium to the base of the flames
   b) Do not drive the flames away from you
   c) Follow instructions on the extinguisher's label
   d) Ensure that the fire has been completely extinguished

10. **In order to be a first aider one must remember PACT, what does P stand for in PACT?**
    a) Prevent
    b) Protect
    c) Prioritize
    d) Process

Notes

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

https://youtu.be/QEB7wE-YFXg

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

https://youtu.be/2V2FFQUfxj0

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

https://youtu.be/xnZZruGjKBA

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

https://youtu.be/aU1P7-Cn72s

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

https://youtu.be/QEB7wE-YFXg

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

https://youtu.be/2V2FFQUfxj0

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

5. Annexure

S No.	Module No.	Unit No. and Name	Topic Name	Page No.	URL	QR Code (s)
1	Module 1	Unit 1.1 - Introduction to the Hydrocarbon Sector	Introduction to the Hydrocarbon Sector	3	https://youtu.be/W-PooTpdcyw	The People Behind The Pipeline
2	Module 1	Unit 1.2 - Roles and responsibilities of a Line Patrolling Man (Oil & Gas)	What does a Line Patrolling Man (Oil & Gas) do?	9	https://www.linkedin.com/posts/bpcl_bina-panki-pipeline-walker-mr-brijen-singh-activity-6899250261156859906-CrEf?utm_source=share&utm_medium=member_desktop	BPCL - Line Walker Video
3	Module 1	Unit 1.2 - Roles and responsibilities of a Line Patrolling Man (Oil & Gas)	Working conditions	9	https://www.youtube.com/watch?v=ueA_dTAFXg4	Awareness video - Gail Pipeline
4	Module 2	Unit 2.1 - Introduction to crude oil	What Is Crude Oil?	17	https://youtu.be/6oz-mKhahk8M	Fundamentals of upstream, midstream, and downstream
5	Module 2	Unit 2.1 - Introduction to crude oil	The process of crude oil refining	17	https://youtu.be/cXnHOOTCrKY	Crude-oil distillation in a refinery
6	Module 2	Unit 2.1 - Introduction to crude oil	Natural Gas Processing	17	https://youtu.be/QgtSoEJD9HE	Turning natrual gas into liquid
7	Module 2	Unit 2.1 -Introduction to crude oil	Natural Gas Processing	17	https://youtu.be/PenuYdMm3Wg	Natural Gas 101: Natural Gas Transportation

S No.	Module No.	Unit No. and Name	Topic Name	Page No.	URL	QR Code (s)
8	Module 2	Unit 2.1 -Introduction to crude oil	Pipelines	17	https://youtu.be/Gap_IhBIrGI	How are pipelines constructed?
9	Module 2	Unit 2.2 - Patrolling of hydrocarbon pipeline	Activities to be undertaken while patrolling oil and natural gas pipelines	25	https://www.youtube.com/watch?v=wUdhcRqEPUA	Leak Recognition
10	Module 3	Unit 3.1 - Working effectively in a team	**Effective Communication**	35	https://youtu.be/EDMY39JE1sY	5 steps to manage conflict between team members
11	Module 3	Unit 3.1 - Working effectively in a team	Achieve goals in the workplace	35	https://youtu.be/6fbE52YDEjU	Team work can make the dream work
12	Module 3	Unit 3.1 - Working effectively in a team	Achieve goals in the workplace	35	https://youtu.be/H_vOfqIpD60	Why team building is important
13	Module 3	Unit 3.1 - Working effectively in a team	Communicate with supervisor	35	https://youtu.be/WTa4wvFVX_Y	How to manage conflict in a team
14	Module 3	Unit 3.1 - Working effectively in a team	Work effectively in a tea	35	https://youtu.be/fUXdrl9ch_Q	Good Teamwork and Bad Teamwork

S No.	Module No.	Unit No. and Name	Topic Name	Page No.	URL	QR Code (s)
15	Module 4	Unit 4.1 - Maintain health, safety and security procedures	Use of personal protective equipments	47	https://youtu.be/QEB7wE-YFXg	Personal protective equipment
16	Module 4	Unit 4.1 - Maintain health, safety and security procedures	Various types of safety signs and what they mean	47	https://youtu.be/2V2FFQUfxj0	Types of safety signs and symbols
17	Module 4	Unit 4.1 - Maintain health, safety and security procedures	Types of fire	47	https://youtu.be/xnZZ-ruGjKBA	Classes of fire
18	Module 4	Unit 4.1 - Maintain health, safety and security procedures	Techniques of using the different fire extinguishers	47	https://youtu.be/aU1P7-Cn72s	Types of fire and fire extinguishers
19	Module 4	Unit 4.1 - Maintain health, safety and security procedures	Techniques of using the different fire extinguishers	47	https://youtu.be/3nakKzM66hk	Fire extinguishing agents
20	Module 4	Unit 4.1 - Maintain health, safety and security procedures	How to Reduce Risk	47	https://www.youtube.com/watch?v=ueA_dTAFXg4	Awareness video - Gail Pipeline

DGT/VSQ/N0102 Employability skill (60 hours)

https://eskillindia.org/NewEmployability

Scan this QR code given below to access the e-book

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

Address: OIDB Bhawan Tower C, 2nd Floor, Plot No. 2, Vikas Marg, Sector 73, Noida 201301 (UP)
E-mail: admin@hsscindia.in
Web: www.hsscindia.in

Price: ₹