

6.1 Accident-definition, Causes of accident, Prevention of accident, effect of accident to industry, worker and society, Preparation of accident report and investigation.

6.2 Occupational diseases, hazards, safety awareness.

6.3 Role of OSHA. (Occupational safety & health administration), industrial health.

Introduction:

Safety is very important aspect for any industry. An accident free environment boosts the morale of the team members working in any hazardous situations. Safety means continuing and healthful living without injury. Safety is free from harm or danger of harm.

The word safety also refers to the precautions people take to prevent accident, harm, danger, damage loss and pollution. Safety also deals with improvement in working conditions for better health.

Need for Safety

Safety in industry helps in

1. Increasing rate of production.
2. Reducing production cost.
3. Reducing damage to equipment and machinery.
4. Preventing premature death of talented workers who are an asset to the society.
5. Preventing needless pain and suffering to its employees.

Safety results

1. from safe plant, processes, and operations, and
2. by educating and training workers and supervisors regarding safe practices on the shop floor.

Accidents

An industrial accident may be defined as an event, detrimental to the health of man, suddenly occurring and originating from external sources, and which is associated with the performance of a paid job, accompanied by an injury, followed by disability or even death. An accident may, happen to any employee under certain circumstances.

Causes of Accidents:

An accident is an unplanned incident and for each such incident there is usually a specific cause or causes if one could discover them.

The causes of accidents may be classified in two categories:

1. Technical Causes or Unsafe conditions:

- Mechanical factors.
- Environmental factors.

2. Human causes:

- Unsafe act.
- Unsafe personal factors

1. Technical causes are unsafe conditions which involve mechanical factors and environmental factors. These involve deficiencies in plant, equipment, tools, materials handling system, general work environment, etc.

2 Human causes are the unsafe acts which involves personal factors by person concerned and are due to his ignorance or forgetfulness, carelessness, day-dreaming, etc.

Mechanical Causes or Mechanical Factors

1. Unsafe mechanical design or construction.
2. Hazardous arrangement (piling, over-loading etc.)
3. Improper machine guarding
4. Unsafe apparel (apparel- clothing).
5. Defective agencies or devices.
6. Improper material handling.
7. Broken safety guards.
8. Protruding nails.
9. Leaking acid valve.
10. Untested boilers or pressure vessels.

Environmental factors

Environmental factors indicate proper physical and atmospheric surrounding conditions of work which indirectly promote the occurrence of accidents. Environmental factors include

1. Too low temperature to cause shivering.
2. Too high a temperature to cause headache and sweating.

3. Too high a humidity (in textile industry) to cause discomfort, fatigue and drowsiness (especially when the atmosphere is also hot).
4. Defective and inadequate illumination causing eyestrain, glares, shadows, etc.
5. Presence of dust, fumes and smokes (e.g., in foundry or welding shop) and lack of proper ventilation.
6. High speed of work because of huge work load.
7. More number of working hours and over and above them the tendency of the employer to insist for over-time work.
8. Inadequate rest pauses or breaks between the working hours.
9. Noise, bad odour and flash coming from the nearby machinery, equipment or process.
10. Poor housekeeping

Personal Factors

1. Age.
- 2 Health
3. Number of dependents.
4. Financial position.
5. Home environment.
6. Lack of knowledge and skill.
7. Improper attitude towards work.
8. Incorrect machine habits.
9. Carelessness and recklessness.
10. Day-dreaming and inattentiveness.
11. Fatigue.
- 12 Emotional instability, e.g., jealousy, revengefulness, etc.
13. High anxiety level.
14. Mental worries.
15. Unnecessary exposures to risk.
16. Non-use of safety devices.
17. Working at unsafe speeds.
18. Improper use of tools.

Types of Accidents

1. Near accident
2. Minor.
3. Serious.
4. Fatal.

1. Near accident – i.e., An accident with no damage or injury.

2. Minor accidents

- Less harmful in nature
- Preventing employees for the period less than 48 hours from working
- Not necessary to report to higher management.

3. Serious accident

- Supervisor should report to the higher management
- Accident is little complicated than the minor accident
- Prevent worker for the period of 48 hours or more from working after injury

4. Fatal accident

- It result in to death of employee
- Reporting to top management, legal bodies and police is must

Effects of Accident:

Economic Aspects (Cost) of Accidents

An accident can be very costly to the injured employee as well as to the employer of the concern.

There are definite costs associated with the accident,

- Direct and measurable costs
- Indirect costs i.e., somewhat intangible (vague) but nevertheless real costs.

Direct Costs of an Accident:

These types of losses are measured in terms of money. Employer has to pay to the worker for compensation; medical expenses are coming under direct losses. They associate:

- (i) Compensation insurance, including Payment, and Overhead costs.
- (ii) Uncompensated wage losses of the injured employee.
- (iii) Cost of medical care and hospitalization.

Indirect Costs of an Accident:

The indirect costs of an accident are associated with

1. Costs of damage to equipment, materials and plant.
2. Costs of wages paid for time lost by workers not injured.
3. Costs of wages paid to the injured worker.
4. Costs of safety engineers, supervisors and staff in investigating, recording and reporting of accidents and its causes.

5. Costs of replacing the injured employee.
6. Cost of lowered production by the substitute worker.
7. Cost of delays in production due to accident.
8. Cost of reduction in efficiency of the injured worker when he joins the concern after getting recovered.

And lastly the influence of accident on the morale of employees.

Accident Prevention

Accident prevention is highly essential in an industry, in order to

- (i) Prevent injury to and premature death of employees.
- (ii) Reduce operating and production costs.
- (iii) Have good employer-employee relations.
- (iv) High up the morale of employees.

Above all, prevention of accidents is a true humanitarian concern.

Accident prevention does not occur by itself; there should be consistent implementation of safety measures and safety programmes emphasizing the need for

1. Safe workplace layout and working conditions.
2. Safe material handling.
3. Personal protective devices.
4. Safety activities in the organization.

1. Safe Workplace Layout and Working Conditions

Layout

- Although most accidents take place because of unsafe act of the employees, the role of the environments and surroundings cannot be ignored in determining the cause of accident.
- A good layout and working conditions play a major role in preventing many accidents which would have otherwise occurred.
- For preventing accident, the layout should be such that:
 - (i) Every employee has enough space to move and operate.
 - (ii) Passageways between working places, roads, tracks and alleys, etc. must never be obstructed.
 - (iii) It prevents the inrush of cold/hot air and draughts to the working place.

- For adequate lighting, ventilation etc, the heights of the working rooms should be of 3 meters.
- Floors must be of nonskid type, satisfactorily plane and must possess such properties that they can be easily cleaned and absorb sounds.
- Windows should be of adequate dimensions in order to make full use of natural day light.
- Doors and gates leading to open should be provided with guards, etc., to prevent draughts at the neighboring workplaces.
- Fire hazards can be reduced by utilizing fire walls to separate manufacturing area into several compartments.
- A worker operating on the machine should have easy access to the safety switches provided on the machine or near workplace.

Working Conditions

- In enclosed rooms, in order to have comfortable conditions, the following should be controlled.
- Air temperature, air purity, velocity of air, humidity of air, and heat radiations between bodies of different temperatures.
- Not only in enclosed rooms, even otherwise proper ventilation is a must if the manufacturing processes give rise to dust, smoke, fumes etc.
- whether natural or artificial, there should be sufficient illumination of adequate colour of light which is continuous and uniform and free from glare.
- A high noise level at the workplace impairs men at work and may even endanger them. Noise develops from riveting, grinding, forging, engines, compressors etc. To reduce noise level and to minimize detrimental effects (e.g., deafness) arising out of it following should be done:
 - (i) Select, purchase and make use of machines and processes which produce little noise.
 - (ii) Isolate and keep noise producing machines in separate closed cabins.
 - (iii) Use silencers to minimize the hissing sound of compressed air escaping from blow-off valves in pneumatic tools and machines.
 - (iv) Use suitable machine mounts to damp down the vibrations.

2. Safe Material Handling

- Careless handling of heavy materials and components is a major source of back and foot injuries.

- To avoid premature fatigue of transport workers, full use should be made of mechanized materials handling equipment.
- Use mechanical means of conveyance to ensure the safety of men engaged in material handling.
- The transport workers should not be asked to lift more than the permissible load.
- During transport, sharp materials, sharp edged goods, poles etc., should be covered, placed in stable holders and retained by means of wire.
- Goods should be piled up such that they do not collapse due to impact or vibrations.
- Containers or vessels employed to transport liquids or small parts:
 - (i) should not be too large to limit the range of vision and impede lifting and carrying,
 - (ii) should be light, and
 - (iii) should not be defective leaking.
- Depending upon the condition of material, use a proper material handling equipment
- All material handling equipment should be promptly repaired and adequately maintained on priority basis.

3. Personal Protective Devices for

(a) Protection of head

- Safety hard hats.
- Rubberized hats for protection against liquids (chemicals).
- Ear protectors.

(b) Protection of face

- Facemask.
- Face shields.
- Welding helmets.

(c) Protection of eyes

- Goggles of case-hardened and clear glass for protection against impact.
- Eye cup goggles for protection against flying objects and dust.
- Eye cup goggles impervious (resistant) to chemicals for protection against acids/alkaline splashes.

(d) Protection of lungs

- Air line respirators
- Cartridge respirators
- Oxygen or air breathing apparatus.
- Gas mask.

(e) Protection of other body parts, e.g., hands, foot, leg, etc.

- Protective asbestos clothing.
- Gloves.
- Safety shoes.
- Foot guards.
- Safety body belt.
- Aprons.
- Safety (moulder's) shoes.

4. Safety measures Essential in Industry

- Formation of Safety committee
- Execution of Safety programs.
- Following safety instruction and displaying them to emphasize need to act safely.
- Educating the employees to develop safety consciousness.
- Provide wire mesh safety guards to all rotating parts, ag., pulleys etc.
- High voltage equipment and other machines which cannot be properly guarded should be fenced.
- Pressure vessels and their component parts (e.g, valves, gauges, etc) should be periodically tested as per their specifications, the defective parts should be replaced.
- Material handling equipment should have unobstructed paths to move on.
- Defective tools, e.g., hammers, spanners, etc. should be immediately replaced.
- Power should be switched off before repairing the equipment.
- Inflammable material should be stored separately and away from the general store.
- Electrical connections and insulation should be checked at regular intervals.
 - To avoid electrical accidents
 - (i) None except the electrician should be permitted to touch electrical connections.
 - (ii) All live wires should be isolated and insulated from each other.
 - (iii) Electrical connections and ground connections of all portable and unportable machinery should be checked periodically.
 - (iv) Damp environmental conditions (floor etc.) should preferably be avoided.
- Fire extinguishers should be kept in proper condition and at key places.

Accident Reporting and Investigation:

- The management keeps a neat and systematic record of each and every accident occurring plant. The aim of this record is to create a system to avoid the occurrence of an unfortunate incident in future.
- The accident investigation report is prepared by the supervisor. The accident report form may vary with specific cases
- As a basic norm the report form should include:
 - The facts of identification.
 - A narrative description of the accident.
 - The major cause of accident, namely, the unguarded machine or other mechanical and physical hazard, the unsafe act of person and a probable reason for its commission.
 - Facts of prevention namely; what was done and what should be done to prevent the occurrence of other similar accidents.

A typical sample form is as follows:

Investigation Report of Accident by Supervisor:

- Identification
- Company Department,
- Location
- Time of accident
- Date of Investigation
- Name of injured person
- Age
- Severity of injury
- Treatment
- Doctor.
- Witness of accident.

How did it happen?

1. Describe the accident fully, stating whether injured person fell or was struck etc. and all the factors contributing to accident. Use other side of report for additional space.
2. What machine tool, substance, object was most closely connected with accident?
3. For a machine or vehicle, what part of it? (if gear, pulley, motor etc.) ,
4. What way was the machine tool, object or substance unsafe?
5. Were mechanical guards or other necessary safe guards such as goggles provided?

6. Was the injured person using them when accident occurred?
7. Name the unsafe practices of the injured person or other person that resulted in this accident.
(Describe as lifted with bent back, refused to wear goggles. removed guard, ran down the stairs etc.)
8. Why did the person act unsafely?
9. How can you prevent accidents of this type?
(Specify the remedial measures such as better illumination, better ventilation, providing goggles, providing a better guard. enforcing instructions. training employees etc.)
10. What have you already done to prevent a similar accident?

Signature of Safety Director

Signature of Supervisor

Investigation of causes:

It is the study of accident details by close observation and systematic enquiry. Generally a committee is appointed for investigation to identify the causes and to fix up the responsibility. Based from the facts observed during investigation, the committee gives suggestions regarding the remedial actions to be taken to prevent the accident in future and submits the report to the management.

The management studies the report submitted by the committee and take corrective action. The action may be in terms of punishment to the responsible persons or constructive changes to remove the shortcomings in the plant.

Promoting Safety Awareness in Employees:

The plant cannot operate safely, unless safety consciousness is developed among the workers. The safety awareness can be created by safety education and training.

For promoting the safety awareness in employees, following activities are essential:

1. Safety education of employees highlighting importance of safety.
2. Training of workers for imparting knowledge of safety rules and measures.
3. Creation of alertness and development of safe working habits by displaying posters.
4. Showing films and demonstration for safe working.
5. Enforcing strictly the safety rules and regulations on employees.
6. Arranging safety competitions, the department and the employees with accident free record should be rewarded.
7. Providing safety devices like goggles, pads, shoes, gloves etc.
8. Collection and display of all important information regarding accident and corrective actions to prevent it in future.

Occupational Safety and Health Administration (OSHA):

Occupation is the activity in which a person engages. In his occupation a person may be working with poisonous or toxic chemicals, radio-active emission or contaminated air, in an environment of high temperature. These situations are treated as unsafe working conditions and may lead to some diseases. The diseases caused due the occupation are called occupational diseases. The purpose of occupational safety is to create safe working conditions so as to avoid the occupational diseases.

The major areas (hazards) causing occupational diseases are as follows:

1. Environment with high temperature which may cause heat exhaustion or heat strokes.
2. Atmospheric pressure variation (high and low) experienced by tunnel workers and drivers.
3. Mechanical vibration due to air hammer.
4. Electro-magnetic and ionizing radiation.

5. Inhalation of contaminated air (e.g. workers working in fumes. gases in ceramic industry) and poisonous vapors like mercury.
6. Inhalation of dust (e.g. workers in silk and cotton weaving industry)
7. Environmental hazards like noise, shock.
8. Skin diseases caused by acids, alkalis, solvents etc.

Health and Industrial Health:

World Health Organization (W.H.O.) has defined health as '**a state of complete physical, mental and social well being and not merely absence of disease**'.

OSHA and Role of OSHA

With the Occupational Safety and Health Act of 1970, American Congress created the Occupational Safety and Health Administration (OSHA) to ensure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance.

OSHA's role is

- to assure the safety and health of workers by setting and enforcing standards;
- of providing training, outreach, and education; establishing partnerships;
- Of encouraging continual process improvement in workplace safety and health
- OSHA works to assure the safety and health of all of working men and women.
- Most employees in the nation come under OSHA's jurisdiction.
- Part of OSHA's mission is to provide assistance to employers to reduce or eliminate workplace hazards.
- OSHA provides a vast array of informational and training materials focusing on numerous safety and health hazards in the workplace.

Industrial Health is:

1. Maintenance of physical, mental and social fitness of workers.
2. Prevention of illness caused by working conditions.
3. Protection of workers from risks resulting from factors adverse to health.
4. Placement of worker in an environment suitable to his physical habits.

Health Administration and its Importance:

Health Administration is the setting up and implementation of a system for administering industrial health.

Proper health administration has the following results:

1. Rate of absenteeism is lowered.
2. Rate of labour turnover is reduced.
3. Job satisfaction and discipline among workers

4. Good performance and high productivity
5. Decreased accidents
6. Decreased occupational diseases.
7. Improved morale of workers.

Precautionary measures for maintaining industrial health:

For maintaining the industrial health, the following measures are necessary:

1. Cleanliness: Every section of factory should be kept clean and free from dust. Floors should be swept and cleaned with some disinfecting fluid, whitewashed and painted regularly.
2. Disposal of wastes and effluents (liquid waste, especially chemicals produced by factories): Effective arrangements should be made for the disposal or treatment of waste and effluents.
3. Proper ventilation: Provision should be made for the circulation of fresh air. It also controls the temperature.
4. Control of temperature: Higher temperatures cause more perspiration and workers get tired early. Therefore, temperature should be controlled by providing fans and air coolers wherever possible.
5. Dust and fumes: Exhaust fans should be provided to prevent or reduce the inhalation and accumulation of dust and fumes.
6. Proper illumination: The design of the factory building should be such that it provides sufficient natural illumination in the plant. If natural illumination is insufficient, artificial lighting should be provided.
7. Overcrowding: Overcrowding should be avoided. Every worker should have minimum 500 sq.ft. space.
8. Control of noise: High noise troubles the worker. Certain activities create more noise. These activities should be placed separately inside closed sound proof rooms.
9. Drinking water: Cold potable drinking water should be made available to the employees throughout the year.
10. Sanitation facility: Adequate and clean sanitation facilities (urinals and latrines) should be separately provided for men and women employees.
11. Rest pause: Provision of rest pauses must be made at suitable intervals and reasonable hours of work.
12. Recreational facilities: Proper recreation relieves the strain of work.
13. Industrial Hygiene Department: This department is a part of medical department which deals with those areas causing occupational diseases.

Health Administration Programme:

In the medium and big sized industries the Industrial Hygiene Department is established to deal with areas causing occupational diseases.

The industrial health programme includes:

1. A professional staff of physicians and nurses.
2. Facilities for routine medical checkup.

3. First aid treatment for workers.
4. Facilities for emergency cases.
5. Information and educational services to achieve health promotion.
6. Implementation of mass inoculation(vaccination) programme.
7. Maintenance of adequate health records.