3 INDUSTRIAL SAFETY

3.1 Introduction, 3.2 Objectives of industrial safety, 3.3 Accident, 3.4 Causes of accidents, 3.5 Types of accidents, 3.6 Effects of accidents, 3.7 Safety measures in construction work, 3.8 Safety measures in material handling, 3.9 Safety measures against electric shocks, 3.10 Fire prevention and protection, 3.11 Factories Act 1948, regarding safety, 3.12 Methods of safety, 3.13 First Aid.

3.1 INTRODUCTION

The danger of life of human being is increased with the advancement of scientific development in different fields. The importance of industrial safety was realised because every year millions of industrial accidents occur which result in either death or in temporary disablement or permanent disablement of the employees. This results in large amount of loss in terms of damage to property, wasted man-hours, machine hours. In order to avoid these accidents, workers should be aware of the basic safety principles and dangers which may exist in an industry.

3.2 OBJECTIVES OF INDUSTRIAL SAFETY

The objectives of industrial safety are as follows :

- To prevent accident in the plant by reducing the hazard to minimum.
- To prevent loss of life, permanent disability and the loss of income of worker by eliminating causes of accident.
- To eliminate accidents causing work stoppage and production loss.
- To achieve lower workman's compensation, insurance rate and reduce all the cost of accident.
- To educate all members regarding the safety principles.
- To have better morale of employees.
- To have better human relations in the industry.
- To increase production means to a higher standard of living.

3.3 ACCIDENT

An accident is a mishap, which causes injury to men, machines or tools and equipment. Injury may result either death or temporary disablement or permanent disablement of the employees.

3.4 CAUSES OF ACCIDENTS

The causes of accidents may be classified in three categories :

- Mechanical causes
- Working environment causes
- Human causes

Mechanical Causes

- Continued use of old, poor maintained or unsafe equipment.
- Use of unguarded or improper guarded machines or equipments.
- Unsafe processes.
- Unsafe design and construction of building structure.
- Improper material handling system.
- Improper plant layout.
- No use of safety devices (Halmets, Goggles, Gloves, Masks etc.)

Working Environment Causes

- Improper temperature and humidity causes fatigue to the workers so chances of accident increases with workers having fatigue.
- Defective and inadequate illumination.
- Presence of dust, fumes and smoke.
- Poor housekeeping, congestion, blocked exits, bad plant layout etc.
- Improper ventilation.
- Improper noise level.
- Improper floor (lid type floor).
- Improper height of working rooms.

Human Causes

- Operating without knowledge, without authority, without safety devices.
- Operating or working at unsafe speed.
- Working for long duration of work, shift duty etc.
- Working on unsafe equipments, moving equipments or dangerous equipments.
- Failure to use personal protective devices.
- Improper use of tools.
- Working with mental worries, ignorance, carelessness, nervousness, excitability, day dreaming etc.

3.5 TYPES OF ACCIDENTS

Various types of accidents are as follows :

1. **Near Accident.** An accident with no damage or injury is called near accident.
2. **Trivial.** An accident with very less damage is called trivial.
3. **Minor Accident.** It is an accident with damage and injury more than trivial.
4. **Serious Accident.** An accident with heavy damage and lot of injury is called serious accident.
5. **Fatal.** It is an accident with very heavy damage. There may be loss of lives also.

3.6 EFFECTS OF ACCIDENTS

The adverse effects of the accident can be summarized as under :

(*a*) Effect on the Industry or Owner

1. Direct cost of an accident :
   - ❖ Compensation paid to the workers.
   - ❖ Money paid for treatment.
   - ❖ Money value of damaged equipments, tools and materials.
2. Indirect cost of an accident :
   - ❖ Cost of lost time of injured worker.
   - ❖ Cost of time lost by other employees.
   - ❖ Cost of time lost by supervisors, safety engineers etc.
   - ❖ Cost of delays in production.
   - ❖ Cost of lowered production due to substitute worker.

(*b*) Effect on Worker

1. If the worker dies, the family loses the earner and the compensation never equals his earnings.
2. Accident also effects the morale of the employees.
3. The workers get temporary or permanent disability.

(*c*) Cost to Society

Work connected with injuries also put a considerable burden on society as a whole as under :

1. The cost of accidents is included in the products, so the society has to pay more prices for the products.
2. If some workers do not come under compensation act, the need for help from society is much greater.
3. Loss of production hours causes fewer products in market. So more prices if demand is more than production.

3.12 METHODS OF SAFETY

The common methods of safety are as follows :

1. Safety by workplace layout and proper working conditions.
2. Safety by proper material handling.
3. Safety by construction or design.
4. Safety by position.
5. Safety by using fixed guards.
6. Safety by using interlock guards.
7. Safety by using automatic guards.
8. Safety by using trip guards.
9. Safety by using distance guards.
10. Safety by using personal protective devices.

1. Safety by Workplace Layout and Proper Working Conditions :

- A proper layout and working conditions play a major role in preventing many accidents which would have otherwise occurred.
- Every employee should have enough space to move and operate.
- Passageways should be clearly marked and never be obstructed.
- Floor must be non-skid type, satisfactorily plane. It should be easily cleaned.
- Height of working rooms should be adequate for proper ventilation and lighting.
- Fire walls should be used to separate various compartments.
- Windows should have adequate size and should be in adequate numbers.
- Proper ventilation should be there in workplace.
- Illumination should be sufficient, continuous, uniform and free from glare.
- Noise level should be proper. If it is high, use silencers to minimise the noise level.

2. Safety by Proper Material Handling :

- ❖ Use mechanised material handling equipment.
- ❖ Use mechanical means of conveyance to ensure safety of men engaged in material handling.
- ❖ Proper safety guards should be provided in all material handling equipments.
- ❖ Use proper containers or vessels employed to transport liquid. It should be light, defect free and of proper size.
- ❖ All material handling equipments should be promptly repaired and adequately maintained on priority basis.

3. Safety by Construction or Design :

- ❖ When a new machine is designed, all dangerous parts should be properly enclosed in proper housings.
- ❖ Proper safety guards for moving parts should be designed to eliminate any chances of danger because of the exposure of these parts.
- ❖ Various controls should be provided within the reach of the operator. Height and size of various controls should be designed according to the work study principles (ergonomics).
- ❖ Generally all lubricating points are provided on the outer surface.
- ❖ Common examples of safeguarding are :

  Belt drive and motor in a lathe or milling machine, back gears in a lathe machine etc.

4. Safety by Position :

- ❖ The principle of this safety method is that every dangerous part should be located beyond the reach of the operator.
- ❖ In all the cases, this safety method is not applicable. Therefore in such cases where above said method is not applicable, it is advisable that the dangerous parts of all the machines should invariably be guarded and should be enclosed in the body or housing of the machines as far as the design conditions permit.
- ❖ All the safety controls should be properly positioned *i.e.* these should be easily located.

5. Safety by Using Fixed Guards :

- ❖ Safety guards should be fixed.
- ❖ Safety guards should be rigid and robust. मजबूत
- ❖ Safety guards should be placed in such a way that any access to the dangerous parts of the machine is totally prevented from all directions, particularly in the running condition of the machine.
- ❖ If fixed guards are made adjustable to accommodate different kinds of works or set of tools, once adjusted should be fixed in its position.
- ❖ If fixed guards are provided at a distance from the danger point, then the operator should not go near the danger point beause this provision will carry a remote feeding arrangement.
- ❖ Where the parts are likely to be subjected to shocks, the use of cast iron guards should be avoided.
- ❖ Steel sheets can be used as an alternative to cast iron guards as steel sheets are easy to fabricate and are lighter in weight.

6. Safety by Using Interlock Guards :

- It is a very efficient and sound method of guards.
- According to this safety method, guards cannot be removed or dangerous parts cannot be exposed until and unless the machine is totally stopped.
- Similarly, the machine cannot be started to work unless the guard returns in its proper position and protects the dangerous parts.

Following two designs are commonly used for above said purpose :

(*i*) **Scotch Interlocking.** It consists of a solid metal piece called scotch which remains between two moving parts of the machine. This prevents the machine from starting unless the same is not removed and the guard brought in proper position for protection.

(*ii*) **Control Interlocking.** In this design, movable portion of the guard is connected to some mechanism in such a way so that it will not allow the operation until and unless the guard is brought in protecting position.

7. Safety by Using Automatic Guards :

- The design of this guard is such that it automatically forces the operative away from the dangerous area of work before the operation starts and does not permit his access to this area again until and unless the machine stops.
- Time required for the operation of these guards are high so these guards are not suitable for quick acting and fast running machines.

8. Safety by Using Trip Guards :

- The principle of this guard is that a tripping device is provided for quick stopping of the machine as soon as the operative approaches within the reach of dangerous parts.
- The tripping device and the guard work in close conjunction with each other.

9. Safety by Using Distance Guards :

- The principle of this safety method is that a fencing, enough high, is made of bars or rails etc. at a suitable distance from the machine such that even if the operator, by chance, extends his hands over it, his fingers, clothes or any part of the body does not reach within the area of dangerous parts.

10. Safety by Using Personal Protective Devices :

- Safety halmets, goggles, face mask, face shields, ear protectors, gas mask, gloves, safety shoes, protective asbestos clothing, aprons, foot guards etc. should be used for personal protection.

3.13 FIRST AID

The accident may occur at any time in the factory. The doctor is also not available at that time and at that place for the treatment. Therefore it is necessary to have first aid facilities in the factory, so that preliminary treatment may be given to the person immediately after the accident before reaching the doctor to the patient or taking patient to the doctor. First aid boxes should be

easily available (marked with '+' red symbol), properly equipped and in adequate numbers. Training of first aid should be given to the adequate persons.

Duties of First Aider :

The main duties of the first aider are as follows :

1. To know the first aid techniques.
2. To maintain the first aid box properly. Replace the expire medicine.
3. To reach as soon as possible with the first aid box at the place where accident occurs.
4. To give necessary treatment to the patient.
5. To bring the patient to the first aid room for further treatment.
6. To call the doctor as soon as possible or to arrange the ambulance for taking the patient to the hospital.
7. To have full sympathy with the patient.
8. To make a call to the family of the patient or to a responsible person so that adequate arrangements can be made in the hospital.

First Aid Materials :

1. Rolled bandages 10 cm wide
2. Rolled bandages 5 cm wide
3. Knife, scissors
4. Dettol
5. Burnol
6. Sterlized dressings (small, medium and large size)
7. Large size burn dressings
8. Safety pins
9. Packets of sterlized cotton wool
10. Eye drops
11. Adhesive plaster
12. Glass for taking medicine
13. Eye washing glass
14. 4 oz. bottle containing $KMnO_4$
15. Spirit Ammonia
16. Necessary capsules and tablets.

First Aid to Save Life :

If breathing has stopped, apply immediate artificial respiration. This can be done by following two methods :

(*a*) Mouth to Mouth Artificial Respiration

1. Remove any obstructions from the mouth of the patient using your finger.
2. Lay the victim on his back.
3. Turn his head backward by holding the face near the lower jaw and raising his chin. This will clear the air passage for breathing of the victim.

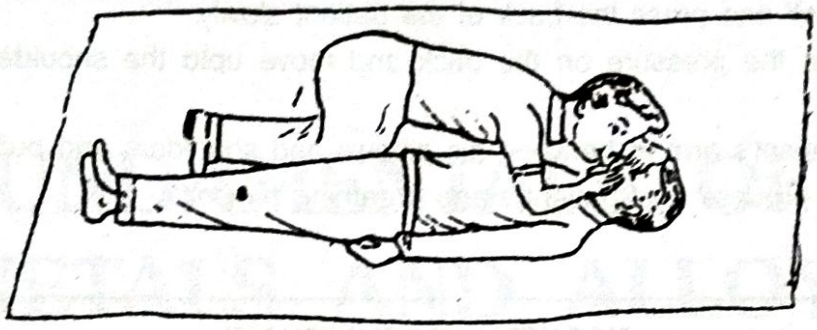

Fig. 3.1. *Mouth to Mouth Artificial Respiration.*

4. Open your mouth wide and take a deep breath to suck as much air as you can.
5. Supply this air to the victim's mouth by sealing your lips around victim's mouth. The nose of the victim should be closed when you supply air to victim's mouth.
6. Blow gently onto his lungs until they are filled.
7. Remove your mouth and watch the patient's chest movement. When exhalation is complete, repeat procedure until patient breathes by himself.

(*b*) By Laying the Victim With His Face and Chest Downwards

1. Lay the victim on ground on his chest and stomach with his chin pointing outwards.
2. Remove any obstructions from the mouth of the victim.
3. Sit on your knees near the head of the victim and keep your both hands on his back, near the collar bone, in such a way that the thumbs of both hands touch each other and the fingers remain open.

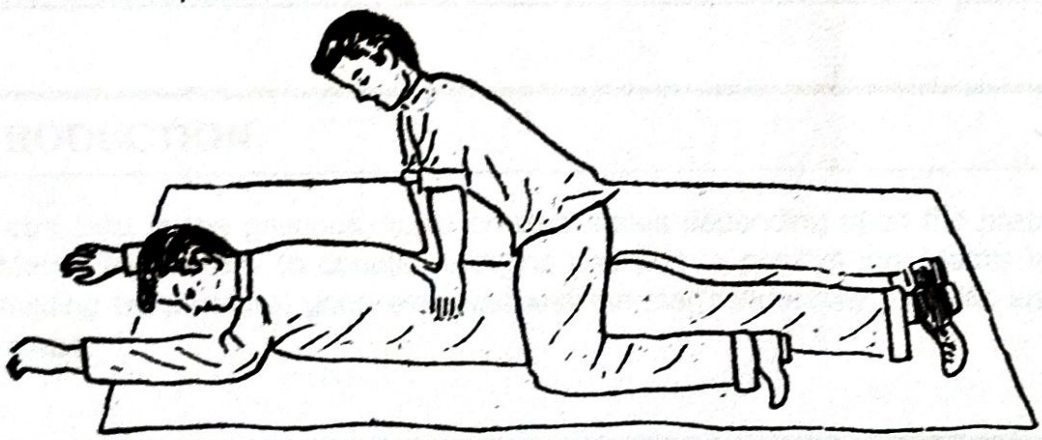

Fig. 3.2. *Lay the Victim.*

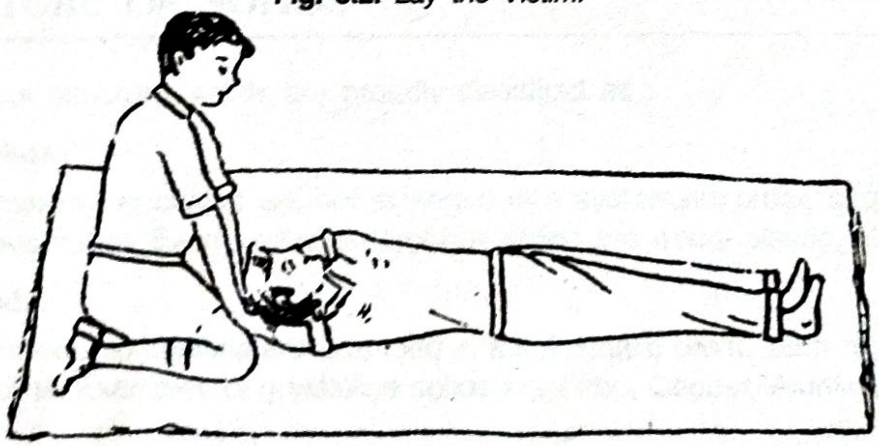

Fig. 3.3. *Hold the Patient's (Victim's) Arms.*

4. Bend yourself and press the back of the patient slowly.
5. Now release the pressure on the back and move upto the shoulders by sliding your palms.
6. Hold the patient's arm in between his elbows and shoulders and pull him upwards.
7. Repeat the process until patient starts breathing himself.