BASIC PRINCIPLES OF ACCIDENT PREVENTION

- How do we progress?
  Increased industrialization in planned manner is necessary for the progress and prosperity of a society.

- What is the effect of industrialization?
  Every work that we do involves some degree of hazard. Exposure to an uncontrolled hazard over a sufficiently long period of time can give rise to adverse conditions such as ill-health and industrial accidents.

- What shall we do then?
  In order to ensure the total protection of the workers, preventive measures have to be adopted in controlling the hazards and to prevent accidents. Industrial Accident prevention work in India did not begin with the early stage of industrialization.

- What was done for reducing the hazards?
  Labor laws were enacted from time to time to remedy certain ills noticed in the working conditions. In common with much other social legislation, there was a time lag between the appearance of unsafe and unhealthy working conditions and the legislation which was designed to eliminate them. Enforcement of the provisions of the labor legislation has brought about reduction in hazards in the industry.

What is the main cause of accidents?

- ACCIDENTS ARE CAUSED BY THE ABSENCE OF ADEQUATE MANAGEMENT CONTROL
  Accidents, ill health and incidents are seldom inevitable random events. They generally arise from failures in control and often have multiple causes. Although the immediate cause of an event may be a human or technical failure, such events usually arise from organizational failings which are the responsibility of management. Successful safety policies place heavy emphasis on achieving effective control over both people and technology. They aim to exploit the strengths of employees while minimizing the influence of human limitations.

- What are the techniques of accident prevention?

  - TECHNIQUES OF ACCIDENT PREVENTION

  Accident prevention is relatively simple because accidents are caused by the presence of hazards. Accidents are preventable. Simple techniques have been evolved for accident prevention through experience. An effective safety program requires the removing of the hazards. To remove the hazard; first step is...
1) Identify the hazard.

Then further steps are use of Es. Those Es are –

2) Estimate the hazard - estimate the hazard in terms of its probability and severity

3) Eliminate the hazard completely, - means removal of hazard. If it is possible to eliminate the hazard completely eliminate the same -eg In one company because of buffing operation on Aluminum castings, Al dust produced was collected in bags. One day a spark went into the dust and the dust got exploded. Five persons died. As per MD’s direction the company stopped the entire buffing operation. This is an example of complete elimination of the hazard

4) Eliminate the hazard – by replacing it with less hazardous alternative,

5) Engineering Control – installing the guards, Guarding of machine is an accepted engineering control measure all over the world. Here its not only the guarding of moving parts of the machinery but also what a particular machine is emitting? eg Noise etc, is to be guarded.

6) Enclosing the man – by using Personal Protective Equipment (PPE). When you are not able to take any of the above measures surrender to the hazzard and then you have to go to personal protective equipment.

7) Education, - Education is required at every stage of implementation of these Es.

8) Enforcement - 75% of work force changes with training but the remaining work force needs enforcement of every safety arrangement made.

9) Enthusiasm- Enthusiasm is required for every stage of these Es.

At the beginning itself, the plant or the works must be engineered for safety. This implies that all new plants and processes should be provided with engineered safeguards. During operation of the plants specific attention should be given to their proper upkeep. This should be supplemented by education of workers and emphasizing on the role of the supervisors in enforcing the safety rules.

Systematic analysis of a large number of accidents of the same kind involving the same person has shown that for every major injury there are a large number of minor injuries. On an average, for each of these injuries, there are about 10 times more minor injuries as any other similar accidents have caused. Underlying these there are many instances of unsafe practices and the presence of unsafe mechanical or physical conditions causing it.

The core of accident prevention principle consists of foreseeing the unsafe conditions and of rectifying them before accident occurs. Investigation of an accident, even if it has not resulted in injury, aids in pinpointing the deficiencies in the set-up and helps in preventing recurrence of accidents. No-injury accidents are so because of a factor of luck that nothing has happened to the person.
Some of the terms, used in the practice of industrial safety are;

i) **Accident**: any unplanned event that interrupts or interferes with the orderly progress of activity. All accidents do not necessarily cause personal injury.

- Do we plan any accident? e.g. This year 10 accidents, next year 7 accident likewise. No.
- Hence it is unplanned event
- When any accident takes place employees stop their work. Every one rushes at the scene of accident and production activity stops.
- Hence this event interrupts or interferes with the orderly progress of activity.
- Suppose something falls from the top. If someone is below that falling body he gets injured but if he is not below that falling body he will not get injured. However this event has the potential to cause personal injury. Hence –

**Accident**: any unplanned event that interrupts or interferes with the orderly progress of activity. All accidents do not necessarily cause personal injury.

ii) **Hazard**: any condition that may result in the occurrence of or contribute to the severity of an accident.

- Suppose a belt and pulley drive is not guarded and it is running. If someone’s finger gets caught in that belt then his finger may not only get injured but it may get amputated thereby increase the severity of the accident. This is Hazard. Hence –

**Hazard**: any condition that may result in the occurrence of or contribute to the severity of an accident.

iii) **Accident Prevention Program**: A formal organized effort to prevent accidents from occurring/recurring.

- Accident prevention program changes from company to company one process to another process depending upon the hazards associated with it.

iv) **Injury on Duty**: Any injury that arises out of or in the course of a person’s employment.

- Arises out of person’s employment means injury due to hazards faced because of his occupation
- Arises in the course of person’s employment means while he was doing his work during his employment

v) **First-aid Injury**: Any injury on duty that needs only first aid as treatment.

- If a person meets an injury during his work, say an abrasion to his finger, he will go to first aider, take the first aid and starts his work again. Such injury is called first aid injury.

vi) **Disabling Injury**: Any injury that causes disablement beyond the day of shift. It is called as Lost Time Injury also. Types of disabling injuries are –

1) Permanent Total Disability (PTD)
2) Permanent Partial Disability (PPD)
3) Temporary Total Disability (TTD)
4) Temporary Partial Disability (TPD)

- If a worker is injured during his working hours and he is made unfit to work by the doctor or first aider, and he is not able to attend his duty till the end of his shift such injury is disabling injury
- Example of PTD is - Death
- Example of PPD is – losing a body part, say a finger
- Example of TTD is - a person is injured during his work and is unfit to work for certain days. He resumes his duties after certain days, those days are TTD for him.
- Example of TPD is – Suppose a worker resumes his duty after certain days. Suppose he had fracture and he is OK now. Initially for one or two days he requests his supervisor to give him light work. Those two days are TPD for him.

vii) **Frequency rate**: The number of disabling injuries per million man-hours of employees exposure.

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\text{Frequency rate} = \frac{\text{No. of disabling injuries} \times 10^6}{\text{Total no. of man hours worked in that period}}
\]

viii) **Severity Rate (SR)**: The number of days lost per million man-hours of employee exposure.

\[
\text{Severity rate} = \frac{\text{Man days lost due to all Disabling Injuries} \times 10^6}{\text{Total no. of man hours worked in that period}}
\]

ix) **Agency**: the object, substance, or exposure which is most closely associated with the injury and which could have been made safer

* e.g. Machine, pump, Hoisting apparatus, Vehicles, Hand tools, Chemicals
x) **Accident Type**: The manner of contact of the injured person with an object, substance or exposure, or the movement of the injured person that resulted in the injury.

* e.g. Fall of person
  - Caught in or between machines
  - Stumbling or striking against an object
  - Electric shock
  - Poisoning

xi) **Unsafe act**: The violation of a commonly accepted safe procedure or practice which resulted in the accident

* e.g. Operating without authority
  - Working at unsafe speed
  - Making safety devices inoperative
  - Unsafe position or posture
  - Failure to use personal protective equipment.

xii) **Unsafe condition**: The condition of the selected agency which could and should have been guarded or corrected.

* e.g. Improper guarding
  - Defective agency
  - Hazardous arrangement or Process
  - Improper ventilation
  - Improper dress or apparel.

**ACCIDENT SEQUENCE**
The basic theory of accident occurrence may briefly be stated as follow:

- An injury occurs only as the results of an accident.
- An accident occurs only due to an unsafe act or unsafe condition or both.
- Unsafe acts or unsafe conditions exist because of human faults.
- Faults of a person occurs because of no management control.

**ACCIDENT RATIO STUDIES**
Several studies have been undertaken to establish the relationship between serious and minor accidents and other dangerous events. The results of such studies are summarized here. The most significant conclusion which can be drawn from this study are that:

* Although the detailed findings of the studies were different because of the definitions and accident data used, each study demonstrates a consistent relationship between the different kinds of event. There are consistently
greater numbers of less serious events taking place than the more serious events;

* As it was often a matter of chance whether dangerous events caused ill health, injury or damage, the “No Injury incidents” or “Near Misses” in each case had the potential to become events with more serious consequences. However, not all near misses involves risks which might have caused fatal or serious injury;

* All the events representing failures in control were therefore potential learning experience through which improved control could have been established;

* Effective health and safety policies will therefore have to examine all unsafe events and the behaviors which give rise to them, both as a means of establishing control and as a means of measuring performance.

HEINRICH (1950)
From data available to him on the frequency of potential injury accidents Heinrich estimated that in a unit group of 330 accidents of the same kind there would be:

1 major or lost time injury

29 minor injuries

300 no injury accidents

-What is the meaning of this triangle?
Suppose in a corridor a big wire rope is lying. People will pass on that wire rope. 300 persons will stumble on it but escape with no injury. 29 persons will stumble on it and will have a minor scratch here and there. But definitely one person will stumble on it, fall down, break his head or he may die.

-What is required to be done?
-Remove the wire rope lying in the corridor.
-Nobody will do that in spite of the fact that they got hint 329 times.
-The effect is fatal accident.

-What is required is removal of that wire rope from the corridor.

BIRD (1969)
From an analysis of 1753 498 accidents reported by 297 co-operating organizations in the USA, representing 21 different types of occupational establishment and
employing 17,50,000 people who worked more than 3 billion man hours during the exposure period were analyzed by FE Bird and he drew the following ratio:

1 serious or disabling injury
10 minor injuries
30 property damages accident
600 incidents which has no visible injury or damage.

TYE/PEARSON (1974/75)
Based on a study of almost 1,00,000 accidents in British industry Tye and Pearson drew up the following ratio:

1 fatal or serious injury
3 minor injuries—when the victim would be absent for up to 3 days
50 injuries requiring first-aid treatment
80 property damage accidents
400 non-injury/damage incidents or “Near Misses”

THE TOTAL LOSS CONTROL
The cost of injuries and ill health are only one component of unwanted happenings which results in unnecessary financial losses. Accidental damage to property, plant or products also imposes cost to the company. Under the total loss control approach, accidents are taken to include not only those circumstances which actually cause ill health or injury, but also every event involving damage to property, plant, products or the environment, production losses, or increased liabilities. The total loss control approach is based on research into accident causation. This indicates that there are many more “Incidents” or near-miss events than those which cause injury or property damage. The examination of the causes of all such loss events can provide valuable insights into inadequacies in risk control and action which could prevent future injuries or losses.

SAFETY AND QUALITY
There are considerable similarities between the approaches to health and safety described here and those advocated for effective quality management. The adoption of quality management system will not automatically lead to high standards of health and safety in all areas. The principles of good health and safety management and good quality management are, however the same. There is increasing recognition that a developed approach to quality is an essential feature of a successful organization. The emphasis is on “Managing Quality In” rather than “Inspecting Defects Out”. Those organizations which have adopted this approach and applied it to their health and safety management systems, often as part of a total quality management (TQM) philosophy, achieve particularly high standards of health and safety performance. The TQM approach seeks to promote continuous improvement in all aspects of an organization’s activities. As the term “Total Quality” would imply, the ultimate goal for health and safety is an Injury-Free working environment, and this is the target which a number of organization have set for themselves. Success in quality management requires the development of supportive organizational culture. The TQM Philosophy stresses the importance of the active involvement of all employees in the quality process. Organizations which are successful in the management of health and safety go to great lengths to develop a positive safety culture on the same basis.

Loss Control Block Diagram

- Identification and Appraisal of the Accident Problem
- Development of Accident Prevention and Loss Control Procedure
- Communication of Accident Prevention Information
- Measurement of Effectiveness of Controls

Repeat all earlier steps again and again
THEORY OF ACCIDENT OCCURRENCE

Unsuitable anatomical physiological and psychological characteristics

Lack of Knowledge or skill

Improper Mechanical or physical conditions unsafe system of work, Social environment, etc.

Personal Sub-Cause

Faults or failure of persons

Unsafe action (Direct Causes)

Unsafe mechanical or Physical conditions (Direct Causes)

Accident

Injuries

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Safety duties at different levels

- **SUPERVISOR**
  - Instruction, Training & Leadership

- **MANAGEMENT**
  - Policy

- **EMPLOYEES**
  - Learn & Use Safe Work Methods
  - Observe Rules

- **SAFETY DIRECTOR**
  - Programme Direction & Planning

- **UNIONS**
  - Promote Employee Intersect & Cooperation

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National Safety Council, India
TYPES OF SAFETY ORGANIZATION

LINE
PRESIDENT
GENERAL MANAGER
SUPERINTENDENT
GENERAL FOREMAN
FOREMAN
WORKER

STAFF
TOP EXECUTIVE
PRODUCTION ENGINEER
SAFETY DIRECTOR
SUPERINTENDENT
GENERAL FOREMAN
FOREMAN
WORKER

SAFETY COMMITTEE
CENTRAL SAFETY COMMITTEE
EXECUTIVE
COMP TROLLER
MAINTENANCE SUPERINTENDENT

DEPARTMENTAL SAFETY COMMITTEE
2 FOREMEN
2 WORKERS

DEPARTMENTAL SAFETY COMMITTEE
3 FOREMEN
3 WORKERS

DEPARTMENTAL SAFETY COMMITTEE
2 FOREMEN
2 WORKERS