

MCN401- INDUSTRIAL SAFETY ENGINEERING

MODULE-1



TEXTBOOKS

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7. Vaid, K.N., (1988). Construction safety management. National Institute of Construction Management and Research, Mumbai.
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MODULE-1 SYLLABUS

- **Module I (safety introduction):**
- Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government and voluntary agencies in safety. Safety policy. Safety Officer-responsibilities, authority. Safety committee-need, types, advantages.



SAFETY MANAGEMENT

- A Safety Management System (SMS) is a systematic positive approach to managing safety including the necessary organizational structures, accountabilities, policies and procedures.
- Safety Management system help to create safe healthy work environment to prevent accident & protect environment. It help to improve safety performance in industries.
- Yearly several Lakh people are killed or injured in industries due to mechanical, electrical, chemical, Physical, Environmental and radiation hazard or occupational diseases. Occupational diseases are notified in Schedule III of The Factories Act 1948



NEED OF SAFETY

1. Social Need :

- The accident causes social loss in great magnitude in form of suffering, loss of earning capacity and cost due to disturbance to economic efficiency. The economic costs are more tangible

2. Management Need:

- Management bear huge loss due to accident. Cost of accident is two Types Direct & Indirect cost. Indirect cost is several times more than Direct Cost. Direct cost include medical expenses, compensation to the injured or their families



NEED OF SAFETY (CONT..)

3. Legal Need:

- As per The Building & other construction Act 1996, Factories Act 1948 and several other related Acts & rules the general duty of the employer is to ensure Health & Safety of his employee & protect the Environment.

4. Humatarian Need:

The Humanitarian reason for prevention of accidents is based on notion that it is duty of every person to ensure safety of his fellow men



DEFINITIONS

- **Safety:** Control over hazards or Freedom from unacceptable risk of harm.
- **Accident** :Undesirable Event that arises to injury, fatality, ill health, property damage or combination of these.
- **Hazard:** Source, Situation, or Act with a potential for harm in terms of human injury or ill health or property damage or a combination of these all. Reportable injury:If a person sustained injury & unable to resume his duty within 48 hours.
- **Risk:** Combination of Probability & severity of specific hazardous event occurring.ie, Probability of event X Severity of harm
- **Non Conformance:** Any Deviation from work standards, practices, procedure, Regulations, Management System requirements etc, that could be either directly or indirectly lead to injury or illness, damage or loss to property or combination of these.



DEFINITIONS

- **Dangerous occurrence:** Any occurrence of serious nature which could have caused injury/ death to person but did not, is called Dangerous occurrence.
- **Near Miss:** A narrow escape of injury or any harm



METHOD TO CALCULATION ACCIDENT RATE, FREQUENCY RATE & SEVERITY RATE (AS PER IS3786)

$$\text{Accident Rate: } \frac{\text{Total Numbers of Lost Time injury}}{\text{Average Numbers of employees}} \times 1000$$

$$\text{Frequency Rate: } \frac{\text{Total Numbers of Lost Time injury}}{\text{Man-hours worked}} \times 1000000$$

$$\text{Severity rate: } \frac{\text{Total Man Days Lost}}{\text{Man-hours worked}} \times 1000000$$



METHOD TO CALCULATION ACCIDENT RATE, FREQUENCY RATE & SEVERITY RATE (AS PER IS3786)

Example

Employees: 200 (Average)

Working hours (W.H): 8 hours Per Day

Numbers of Days in a Month: 26

Lost Time Injury (L.T.I): 02

Total Man-hours: Average No. of Employees per day X No. of Day in Month X W.H

Total Man-hours: $200 \times 8 \times 26 = 41600$ hours

Accident rate: $\frac{02}{200} \times 1000 = 10$ Per Thousand

Note: Here accident Rate is calculated on lost time injury.



CAUSES OF ACCIDENT

- **Unsafe Act & unsafe Condition** are basic cause of any Accident. When both conjugate at one point then accident happened.
- In other words, **Human and mechanical failure** are causes of accident



UNSAFE ACT

- Committing mistake by person or Any act that may lead to accident is known as unsafe act. Following are example of unsafe act:
- Working without wearing safety helmet & safety Shoes
- Working at height without wearing full body harness.
- Taking Rest in working Areas
- working or Taking rest below Hanging Load
- Over speeding
- Operating equipment without qualification or authorization.
- Lack of/or improper use of PPE
- Operating equipment at unsafe speeds
- Failure to warn
- Bypass or removal of safety devices
- Using defective equipment



UNSAFE CONDITION

- Any sources or situation or condition that have potential to create accident is known as unsafe condition. Following are example of unsafe Condition:
- Damage welding Cable
- Mechanical guard not Provided on rotating parts
- Defective sling or lifting equipment.
- Defective work platform
- Floor or platform Opening, Pits
- Poor housekeeping
- Defective tools, equipment or supplies
- Inadequate supports or guards
- Congestion in the workplace
- Inadequate warning systems
- Hazardous atmospheric conditions etc.



DANGEROUS OCCURRENCE

- A **Near Miss** is defined as an incident in which there was no injury or property damage but where the potential for serious consequences existed.
- A Dangerous Occurrence is one of a number of specific, reportable adverse events, which are defined within the Safety, Health and Welfare at Work (Reporting of Accidents and Dangerous Occurrences) Regulations 2016 (S.I.No.370 of 2016).
- Dangerous Occurrences are reportable to the Health & Safety Authority (HSA) via the HSA online notification process. Any Dangerous Occurrences which are notifiable to the HSA will be forwarded by the Health & Safety Co-ordinator.
- These are incidents with a high potential to cause death or serious injury, but which happen relatively infrequently



DANGEROUS OCCURRENCE (CONT..)

■ Dangerous occurrences usually include incidents involving:

- ☐ Lifting equipment
- ☐ Pressure systems
- ☐ Overhead electric lines
- ☐ Electrical incidents causing explosion or fire
- ☐ Explosions, biological agents
- ☐ Radiation generators and radiography
- ☐ Breathing apparatus
- ☐ Diving operations
- ☐ Collapse of scaffolding
- ☐ Train collisions
- ☐ Wells
- ☐ Pipelines or pipeline works



What is Dangerous Occurrence?

"Dangerous Occurrence" means an occurrence of a kind specified below –

1. The disintegration of a revolving vessel, wheel, grindstone or grinding wheel that is operated by mechanical power.
2. The collapse or failure of a lifting appliance (except the breakage of chain or rope slings).
(Note: "Lifting appliance" includes crane, derrick, winch and hoist.)
3. An explosion or fire that –
 - (a) causes damage to the structure of any workplace, or to any plant or substance at a workplace; and
 - (b) prevents the continuation of ordinary work at the workplace.
4. An electrical short circuit or electrical failure of electrical plant that –
 - (a) is followed by, or associated with, an explosion or fire; or
 - (b) causes structural damage to the plant,
being a short circuit, failure, explosion, fire or damage that stops the operation of the plant or prevents it from being used.
5. An explosion of a receiver or container used for the storage at a pressure greater than atmospheric pressure or of any gas or gases (including air) or any liquid or solid resulting from the compression of gases.
6. A total or partial collapse of a roof, wall, floor, structure or foundation of premises where a workplace is located.
7. A total or partial collapse of any overburden, face, tip or embankment within a quarry.
8. The overturning of, or a collision with any object, by –
 - (a) a bulldozer, dumper, excavator, grader, lorry or shovel loader; or
 - (b) a mobile machine used for the handling of any substance in a quarry.



DANGEROUS OCCURRENCE (CONT..)

Who should Report Accident?

An accident must be reported by the person responsible for a workplace. The person responsible for a workplace is the employer of the employees who are employed to carry out work there, or if the employer does not exercise any degree of control over the relevant part or aspect of the workplace, means the **OCCUPIER** of the workplace.

"**OCCUPIER**", in relation to any premises or workplace, includes a person who has any degree of control over the premises or workplace and, in particular, includes a person who, under a lease or contract, has an obligation –

- (a) for the maintenance or repair of the premises; or
- (b) for the safety of, or the absence of risks to health arising from the condition or use of, any plant or substance located on the premises; or
- (c) to provide, maintain or repair a means of access to, or egress from, the premises.



REPORTABLE ACCIDENTS

How to Report Accident?

1. Where an accident causes the death of, or **SERIOUS BODILY INJURY** to, an employee –
 - ⇒ Notify it to an occupational safety officer of the Labour Department (LD) within 24 hours after the time when the accident occurred.
 - ⇒ Report it in writing to an occupational safety officer of the LD within 7 days after the date of the accident if notification of the accident is not contained in a written report that contains the particulars required below.

"SERIOUS BODILY INJURY", in relation to a person, includes any bodily injury that results in the person's admission at a hospital or clinic for treatment or observation.



REPORTABLE ACCIDENTS(CONT..)

2. Where an accident (other than an accident causing the death of, or serious bodily injury to, an employee) causing an employee **INCAPACITATED** from working for at least 3 days –
 - ⇒ Report it in writing, with the particulars required below, to an occupational safety officer of the LD within 7 days after the date of the accident.

"INCAPACITATED", in relation to a victim of an accident, means that the victim is permanently or temporarily incapacitated from working in any capacity in which, but for the accident, the victim would have been capable of working.



REPORTABLE ACCIDENTS(CONT..)



Subsequent Death of Accident Victim

Where the victim of an accident dies after the accident has been notified or reported -

⇒ Report, within 24 hours after becoming aware of the death, either orally or in writing the death to an occupational safety officer of the LD AND to the police officer in charge of the police station nearest to the workplace.



REPORTABLE ACCIDENTS (CONT.)

Who should Report Dangerous Occurrence?

The occupier of premises where a workplace is located must report any dangerous occurrence that occurs at the workplace.

How to Report a Dangerous Occurrence?

⇒ Report it in writing to an occupational safety officer of the LD within 24 hours after the dangerous occurrence.

What are to be Reported in Writing?

The report in writing must contain the following particulars –

- (a) the time of the dangerous occurrence;
- (b) particulars of damage to, or the destruction of, property; and
- (c) the circumstances of the dangerous occurrence.

