

Cost of Accidents

- global losses on account of accidents every year are almost more than the total loss due to World Wars I and II combined.
- According to NSC-US estimates of 1996, occupational death and injuries cost the nation about US\$121 billion.
- some examples of direct cost and indirect cost are shown in Table purely for illustration purpose

| Direct cost for workers | Indirect cost to workers. |
|-------------------------|--|
| loss of income . | The pain and suffering of the injury or illness. |
| Healthcare cost | Family sufferings. |
| | The possible loss of job . |
| | Negative impact on morale of other family members |

Direct cost for employer

Cost of **ambulance, hospitalization, medical and ancillary treatment**

Cost of disability benefits

Compensation payments

Payment of **work not performed**

Repair or replacement of **damaged m/c and equipment**

Legal proceedings

investigation cost

Indirect cost for employer

lost time of injured worker. crewmember, foreman, supervisor. first-aid attendant, safety officer and other executives

Cost due to **damage to equipment, tools, property and materials**

Cost due to **loss of productivity** of crew members and cost of **idling of equipment**

Cost of **replacement for the injured/ill** worker

Cost to **train replacement** worker and cost of low productivity of new worker in the initial periods

Cost of **loss of reputation** and public relations

Overheads such as utilities and telephone

- study conducted by Japan Industrial Safety and Health Association (JISHA):- ***investment in safety pays, yielding 2.7 times as much returns as the expenses incurred on safety***
- Empirical research: ***Higher safety investment in a project, the lower the injury rates and the higher the profit.***
- ***indirect costs are quite high when compared to direct costs associated with an injury.***

Emergency Response

- emergency action plan which should list the types of evacuation
- designate and train a sufficient number of persons.
- prompt medical attention in case of serious injury.
 - proper equipment for prompt transportation of the injured
 - communication system for contacting necessary ambulance service.
- first-aid kit shall be placed in a weatherproof container
 - Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work.

Accident Statistics and Indices

- are maintained primarily for—
 - (1) designing preventive measures and making people safety-conscious;
 - (2) enabling inter- and intra company comparisons in different time periods; and
 - (3) understanding whether a particular preventive measure adopted by management has resulted in improvement.
 - Based on the principle of ‘what gets measured, gets improved
 - .

indicators taken from IS:3786

- ***Frequency Rate***

number of deaths and injuries in occupational accidents per one million work-hours in the aggregate.

$$F_A = \frac{\text{Number of lost-time injury}}{\text{Man-hours worked}} \times 1,000,000$$

$$F_B = \frac{\text{Number of reportable lost-time injury}}{\text{Man-hours worked}} \times 1,000,000$$

- Lost time injury: worker returns to his work quickly.
- A reportable lost-time injury is one that may result in worker absenteeism for more than 48 hours (a clear two days after accident has occurred, leaving the day of accident) and is supposed to be reported by statute to the appropriate authority)
 - may be fatal or non-fatal,
 - Fatality rate:

$$F_c = \frac{\text{Number of fatal injuries}}{\text{Man-hours worked}} \times 1,000,000$$

Severity Rate

The severity rate of new cases of occupational injury is defined in the following manner:

$$S_A = \frac{\text{Man-days lost due to lost-time injury}}{\text{Man-hours worked}} \times 1,000,000$$

$$S_B = \frac{\text{Man-days lost due to reportable lost-time injury}}{\text{Man-hours worked}} \times 1,000,000$$

measure its safety performance

- using experience modification rate (EMR), OSHA safety statistics, etc., and communicate these results to its employees.
- The EMR indicates whether the company is at, below, or above average (EMR <1.0 better than average, EMR >1.0 worse than average) for number of injuries for its particular industry

The incident rate is an OSHA term for the number of recordable injuries and illnesses for a facility in a year, normalized to 100 employees working 2000 h/year. Thus, the incident rate is calculated as

$$\text{Incident rate} = \frac{\text{number of recordable injuries (annual)}}{\text{total annual hours worked by all employees}} \times 200,000$$

Table 509.1. Number of Toilet Facilities at Construction Sites

| Number of employees | Facilities |
|----------------------------|---|
| 20 or less | 1 |
| More than 20 | 1 toilet seat and 1 urinal per 40 workers |
| 200 or more | 1 toilet seat and 1 urinal per 50 workers |

Table 509.2. Permissible Noise Exposure at Construction Sites

| (Permissible noise exposure) Duration per day (hours) | (Permissible noise exposure) Sound level (dB) |
|--|--|
| 8 | 90 |
| 6 | 92 |
| 4 | 95 |
| 3 | 97 |
| 2 | 100 |
| 1 1/2 | 102 |
| 1 | 105 |
| 1/2 | 110 |
| 1/4 or less | 115 |

Exposure to impulsive or impact noise should not exceed 140dB peak sound pressure level.

Light Exposure

- Employees shall not be exposed to light intensities above the following limits:
 - Direct staring: $1 \mu\text{W}/\text{cm}^2$
 - Incidental observing: $1 \text{ mW}/\text{cm}^2$
 - Diffused reflected light: $2.5 \text{ W}/\text{cm}^2$
 - Employees shall not be exposed to microwave power densities greater than $10 \text{ mW}/\text{cm}^2$.

Table 509.3. Minimum Illumination Intensities (Foot-Candles)

| Foot-candles | Area of operation |
|---------------------|--|
| 5 | General construction area lighting |
| 3 | General construction areas, concrete placement, excavation and waste areas, access ways, active storage areas, loading platforms, refueling, and field maintenance areas |
| 5 | Indoors: warehouses, corridors, hallways, and exitways. |
| 5 | Tunnels, shafts, and general underground work areas (Exception: minimum of 10 foot-candles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines approved cap lights shall be acceptable for use in the tunnel heading.) |
| 10 | General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenter shops, rigging lofts and active store rooms, mess halls, and indoor toilets and workrooms) |
| 30 | First aid stations, infirmaries, and offices |

Signs, Signals, and Barricades

- **Danger Signs:** red as the predominating color
- **Caution Signs:** yellow as the predominating color
- Exit Signs
- Safety Instruction Signs
- Directional Signs
- Traffic Signs
- Accident Prevention Tags
 - Accident prevention tags shall be used as a temporary means of warning employees of an existing hazard, such as defective tools, equipment, etc.
 - They shall not be used in place of, or as a substitute for, accident prevention signs.

Guardrails & Midrails

- Top edge height of toprails, or equivalent guardrail system members, shall be 42 in (1.1 m) plus or minus 3 in (8 cm) above the walking/working level.
- Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members shall be installed between the top edge of the guardrail system and the walking/working surface when there is no wall or parapet wall at least 21 in (53 cm) high

Safety Nets

- Safety nets shall be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 ft (9.1 m) below such level.

Table 509.4. Safety Net Provisions in OSHA

| Vertical distance from working level to horizontal plane of net | Minimum required horizontal distance of outer edge of net from the edge of the working surface |
|--|---|
| ≤5 ft | 8 ft |
| >5-10 ft | 10 ft |
| >10 ft | 13 ft |