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### CHAPTER-III

#### THEORETICAL BACKGROUND OF THE STUDY

##### A] INDUSTRIAL ACCIDENTS:

##### 1) Basic Concepts and Operational definitions:

- 1) Accident : H.W.Memrich defined, the term Accident as ' An accident is an unplanned and uncontrolled event in which the action or reaction of any object substance, person or radiation results in personal injury.'

Another definition given by M.N.Hasley 'An accident is an reaction of events each of which is planned and controlled, there occurs an unplanned event which being the result of some non-adjusting act on the part of individual (variously caused ) may or may not result in the injury. Accidents are reflections of human error in one guide or the other.'

C.B.Mamoria has defined it as ' An industrial accident is any occurrence that interrupts or interferes with the orderly progress of the activity in question.'

#### ii) Accident Prevention :

It may be defined as an integrated process, a series of co-ordinated activities directed to the control of unsafe personal performance and unsafe mechanical condition based on certain knowledge, attitude and abilities.

As explained by H.W.Heinrich - ' accident prevention in both science and arts, represents above all other things, control-viz. control of man performance, machine performance and physical environment'.

#### iii) Unsafe Acts:

A departure from an accepted normal or correct procedure or practice which has in the past actually produced injury or property damage or has the potential for producing such loss in the future, an unnecessary exposure to a hazard or conduct reducing the degree of safety normally present. An unsafe act be an act of commission or an act of omission.

#### iv) Accident Prone :

Certain individuals are always more likely than others to sustain accidents, even though exposed to equal risk or some individuals inherently are more likely to incur accidents than others under some conditions or an

individual who is more susceptible to accidents than normal individuals.

v) Compensation :

It is the consideration either in the form of money or any other form extending the benefits to employee for any injury or accident arising out of and in course of employment and resulting either in death or total or partial disablement.

vi) Unsafe Conditions or Faulty Physical environment :

Any physical state which deviates from that which is acceptable, normal, correct in terms of its past production or potential future production of personal injury and or damage to property or thing, any physical state which results in a reduction in the degree of safety normally present.

vii) Frequency Rate:

It is the number of lost time accidents per million man hours worked. A formula for the computation of Frequency Rate is given below -

$$FR = \frac{\text{No of lost time accidents} \times 10,00,000}{\text{Number of man hours worked during period.}}$$

That is, the number of accidents occurring in a given time for a certain number of workers, is used as a measure of the seriousness of the causes.

viii) Severity Rate:

It is the number of days lost because of accidents per million man hours worked. It can be computed with the formula given below.

$$SR = \frac{\text{Number of mandays lost} \times 10,00,000}{\text{Number of man hours worked during period}}$$

To estimate the effects of accidents the measure known as Accident Severity is used. It is the relation of time loss on account of accidents to the time worked.

for e.g. - During a year, a thousand men in a factory may work 300 days of 10 hours each, so that the total working time is 3,000,000/- hours. If, during this period, 30,000 working days are lost on account of accidents, the Severity Rate would be given as 10 days per thousand hours worked.

Although severity rates give a measure of the relative seriousness and economic effects which mere enumeration by frequency rates does not, it must not be overlooked that severity rates do not measure all the effects of accidents. Neither accident frequency nor severity rate is a cause or cure, they are simply methods of recording. Nevertheless, analysis of frequency rates is a fruitful field of research in arriving

at possible causes.<sup>1</sup>

Therefore, the only certain method of prevention of the effects is removal of the causes. To accomplish this, in the first place their nature must be known and secondly suitable antidotes must be discovered.

## 2) Causes of Accidents:

Industries in India do not have a long history. It was only during the fifties of the last century that the first cotton textile and jute mills were setup, coal mines were opened and a net work of railways started. As a matter of fact, when we became independent India had a slender industrial base. However, during the past two decades, as a result of planning, we are now witnessing the beginning of an industrial revolution. During this period the growth and diversification of industries have been concomitant with spectacular progress.

In this fast industrilisation process employing millions of workers with agrarian background into industrial environment under conditions of tension, high speed, intricate and revolving machines, full of hazards,

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1. Charles S. Myers - 'Industrial Psychology',  
Oxford University Press,  
London.

the moral and humanitarian responsibilities for ensuring safe and sound working conditions and recognition of the human element not only as a factor of production but also as a citizen exercising his fundamental rights to live safely, surely and adequately have increased considerably.

#### Accident Causation :

Accidents constitute a behavioural problem signifying a disintegration in the equilibrium of the individual in relation to the work situation. The forces that make for the disequilibrium are mainly drawn from the stress of the work situation and the psycho-social character of the individuals involved. As soon as this field is disturbed due to the displacement of a relatively specific situation or the appearance of a new one, the equilibrium is upset, accidents are defined as 'unforeseen, sudden, unintended or - unconscious deviations in work actively leading to an injury.'

#### Human Vs. Mechanical Causes :

Accidents may be caused due to -

- (a) Unsafe conditions.
- (b) Unsafe acts.

An 'unsafe condition' may refer to the condition of the floors, of a ladder or a scaffold, of a machine

of a stair way, of a tool, of a conveyor belt, or any thing else of a physical environment or mechanical character which could lead to an accident.

An ' Unsafe act ' is something somebody does which may culminate in an accident. The word ' May ' is used because it is not necessary that it should always lead to an accident, but we can be sure that if such acts are persisted, they will result in avoidable injuries.

Which is more important ?

It is a matter of considerable debate whether out of 'Unsafe Condition ' or ' Unsafe act', which is more important. The question is a difficult one. Both are important. The significance of separating causes into two kinds is that it draws attention to the fact that the attack strategy should be two-pronged. We must prevent both unsafe conditions and unsafe acts, not one or the other, what then is the relationship between the two ?

- a) The cause of nearly all accidents has its relation to an unsafe condition. This unsafe condition contains the potential to injure some one ( e.g. an unguarded press, an unfenced floor opening ; a piece of wood with a nail in it and the floor and so on ).
- b) It is the unsafe act that leads to an accident, we may call it the 'triggering' cause because it releases



The danger potential of the unsafe condition somewhat as the pressing of the trigger of the gun releases the unsafe potential of the loaded bullet.

How do we tackle the problem ?

- 1) The first attack has to be on the unsafe condition, because it alone is completely controllable.
- 2) The next important attack has to be on unsafe acts of the people. The place this line of attack second does not mean that it is relatively unimportant, but only that it is harder to control and less immediate in effect. Even though in the short run, more certain and quicker results can be obtained by rectifying unsafe conditions, in the long run the only way to make work places accident-free is to teach people to work safely and to see that they practise it.

ACCIDENT ANALYSIS:

In the analysis of accidents, the man-factor which performs an unsafe act and suffers the consequences in the form of agony, suffering ( mental, physical and financial ) has to be given predominance. This has been advisably done because in the race of technological innovation a great deal

of imbalance has been created. Man factor has been subjected to technology. Unless we shake off this illusion and ascribe to man his deserved place, the elimination of accidents carried out by H.W.Heinrich in 1920 propounded the following basis.<sup>2</sup>

Human Causes : 88% (Unsafe practice,lack of  
foresight,wrong attitude etc.)

Mechanical } : 10% (Plant condition,tool or  
Failure. } equipment failure )

Acts of God : 2% (Weather,Floods,Cyclones etc.)

### 3) Factors Contributing to Accidents:

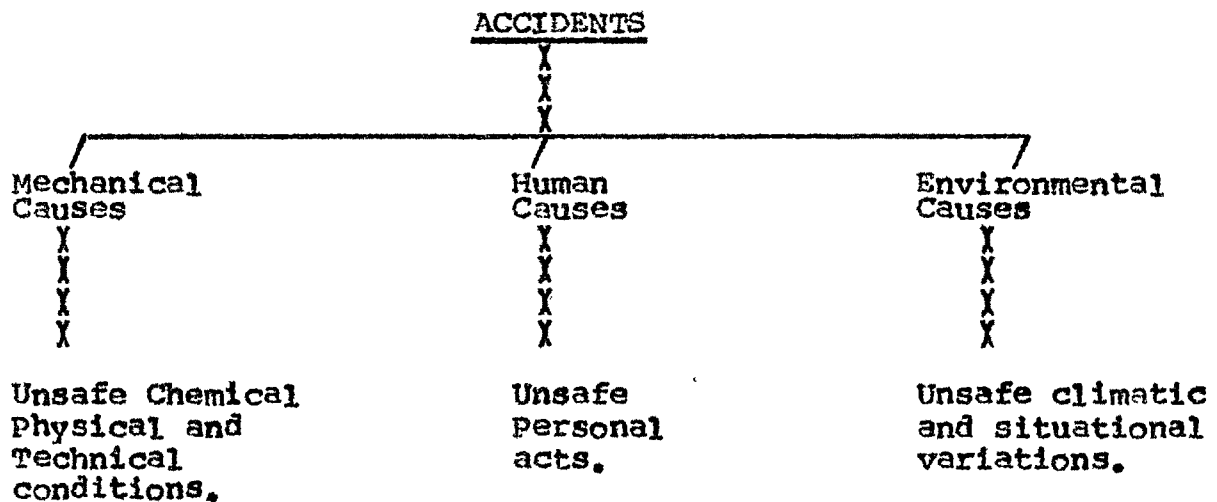
Factors which are caused to the happenings of the accidents are classified on the basis of the area of their origin, the person or the environment and according to the basis of proximity to accident events. Accidents are usually the result of a combination of factors, each one of which may vary from situation to situation. This combination may be of unsafe acts and equipment of people, factors of conditions. It has been rightly said that an accident does not have a single cause but a multiplicity of causes, which are often closely related.

The cause of accidents may be broadly classified into three categories as shown below.

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2. H.W.Heinrich - ' Industrial Accidents Prevention',  
Mc Graw-Hill 1959.

1) Mechanical, (2) Human and (3) Environmental.



1) Mechanical Causes : These causes are associated with defective plant, equipment, tools, materials, buildings, etc. They arise when there are improper or inadequate safety guards on machines, when mechanical designs are defective and are attributable to unsafe conditions of equipment :

- i) Inadequately guarded.
- ii) Unguarded.
- iii) Unsafe design or construction.
- iv) Hazardous arrangement (Piling, overloading, etc.)

An analysis of reported accidents shows that machine accidents are perhaps one-fourth in number of the non-machine accidents, but the usually greater severity of the machine accidents and the dramatic stoppage of work, the loss of limb or life gives it prominence and attracts attention. But the machine is usually blamed and fault is found with the guarding of the machine or with the

dangerous part of the machine. The machine, in fact, is only as dangerous as man makes it.

2) Environmental Causes : The environmental causes of accidents refer to inadequate situational and atmospheric conditions of work. They are distinguished from mechanical causes by the fact that they do not directly cause the accident but only indirectly contribute to its occurrence by virtue of their adverse effects upon the individual. The environmental causes are also, sometimes, designated as external to the individual and general where all the workers are affected by them. Some of the important environmental factors which contribute to accident causation are :

- i) Bad working conditions,
- ii) Poor lighting and ventilation,
- iii) Congestion and overcrowding,
- iv) Excessive glare, heat and humidity,
- v) Long hours of work and high speed of work,
- vi) Unnecessary job-related strain or tension, etc.

Some times prolonged exposure to such environmental conditions may end in a fatality. Environmental conditions are contributory causes for accidents. ' Man is a totality of integrated physiological and psychological functions and the environment has a great effect on his body and mind.' Too high or too low temperature of the atmosphere, defective ventilation, improper lighting, irritating noises and

vibrations and unduly long hours of work create conditions of discomfort and disability.<sup>3</sup> They cause fatigue of body and lethargy of mind. They bring down morale, reduce quickness in perception of danger, making a worker easily vulnerable to accidents.

3) Human Causes : Research evidence indicates that about 80 percent of industrial accidents are caused by such human factors as fatigue and anxiety. Human causes contribute by far the most important class of accident causes and accidents due to human failures preponderate over other type of accidents.

The various factors that contribute the human causes may be grouped as :-

A) Individual Factors:

- |                |                      |
|----------------|----------------------|
| i) Age         | iv) Health           |
| ii) Marriage   | v) Length of Service |
| iii) Schooling | vi) Work performance |

B) Psychological Factors:

- i) Attitude towards job.
- ii) Interest and difficulties.
- iii) Machine-habits.
- iv) Attention
- v) Fatigue

C) Personality Factors:

- |                        |                   |
|------------------------|-------------------|
| i) Intellectual level  | iii) Adjustment   |
| ii) Emotional maturity | iv) Anxiety level |

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3 V.V.Giri, 'Labour Problems in Indian Industry ',  
Asia Publishing House, Bombay, p.313.

D) Sociological Factors:

- |                               |                     |
|-------------------------------|---------------------|
| i) Size of the family         | v) Home-environment |
| ii) Number of dependents      | vi) Social status   |
| iii) Financial position       |                     |
| iv) Inter-personal relations. |                     |

Above all factors proves that Man-failure is the more direct cause of most accidents. But usually it is forgotten that it is the use-rather the abuse-of the machinery by the man that causes the accident. Belts, Pulleys, gears, flywheels and ladders are there, but they are less harmful than the unsafe acts of the man who work with them.<sup>4</sup> Therefore, workers should be trained to examine their tools and should be taught to operate them safely. 'There is no greater insurance against accidents than the safety education of the workers.'

Accidents have many ways of attaining consummation. An accident may injure the workman or damage the machine or tools or injure the person other than the one involved in the accident or may not attain consummation at all. Suppose a weaver is performing the operation of shuttling on his loom and the shuttle frequently slip from his hand. Here the fact of the shuttle slipping from the hand constitutes the accident and the events that occur after

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4. V.V.Giri, 'Labour Problems in Indian Industry '  
pp.309-312.

that represent the effects of the accident.

Finally we can say that causes of accidents can be mechanical, environmental, situational, physical, psychological and physiological or a combination of two or more of all these.

#### 4) Model of Accident Occurrence:

Various models have been worked out in the past in understanding the phenomenon of accidents and exploring the means of controlling them. Chain of multiple events, behaviour models, epidemiological model, energy exchange model and system model are some of them. The appropriateness of a model would depend on the context and the use of it is to be put to. A simple model on accident occurrence, which is at the same time global in its coverage, which has proved useful at the practical level of organising and controlling of accidents in industrial establishments is the one proposed Heinrich.<sup>5</sup> With slight modifications the same is presented in Figure I.

If reasons for the existence of unsafe conditions could be committed from this model, it could be converted into a simplified one representing 'man-machine' interaction. This model shown in FIGURE 2, would cover all accidents involving personal injuries as well as material damage. The

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5. H.W. Heinrich, 'Industrial Accidents Prevention'  
Mc Graw - Hill Company.

model hypothesises that all accidents are caused due to unsafe condition/s or circumstance/s at the interface between man and his artifacts either in combination with unsafe action/s arising out of faults or errors made by him or by themselves alone. His commission of errors or faults are on account of his human limitations which may be anatomical, physiological or psychological in nature or the effect of the social or physical environment.

FIGURE NO.1: Model of Accident Occurrence(After Heinrich)

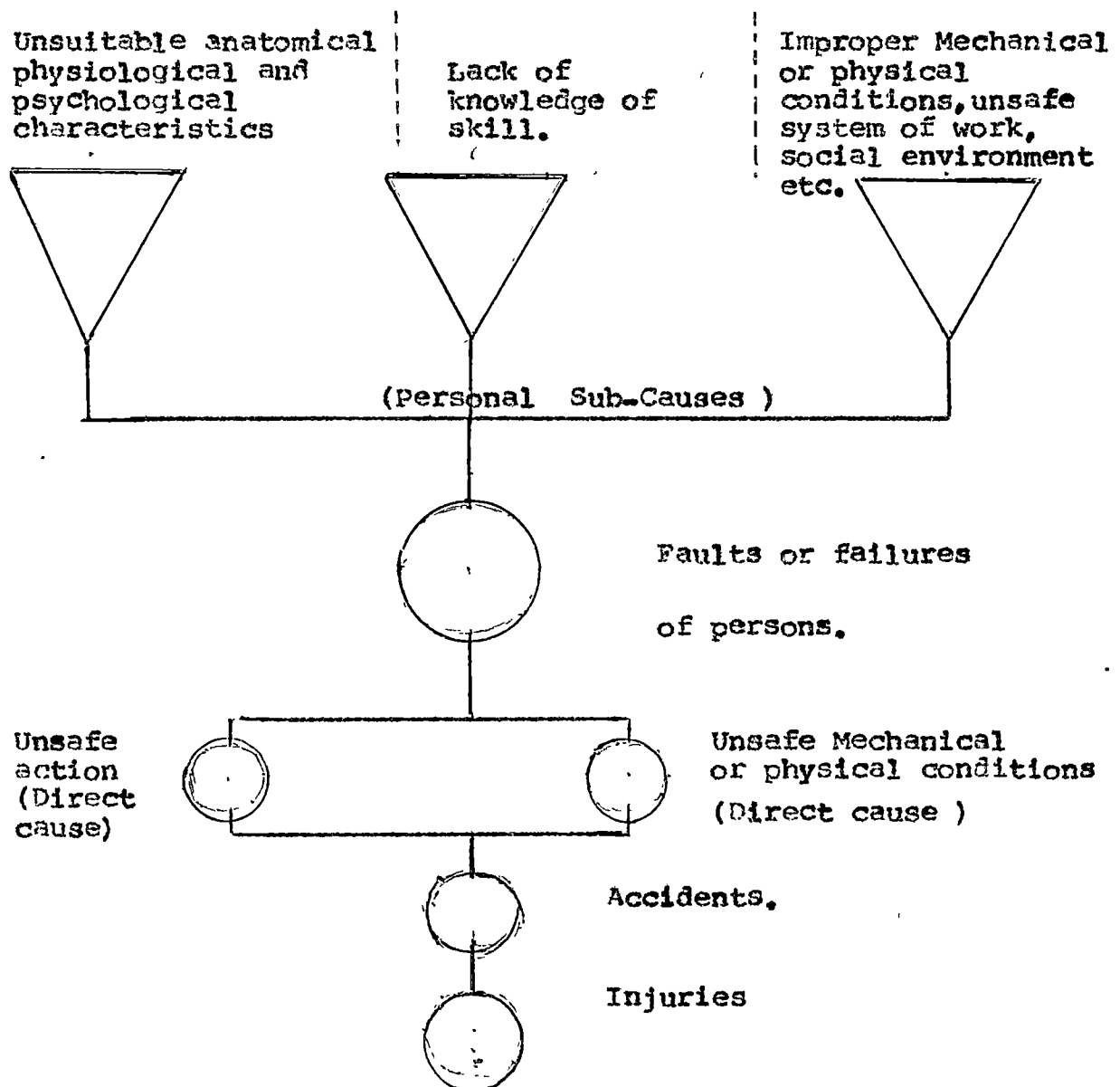
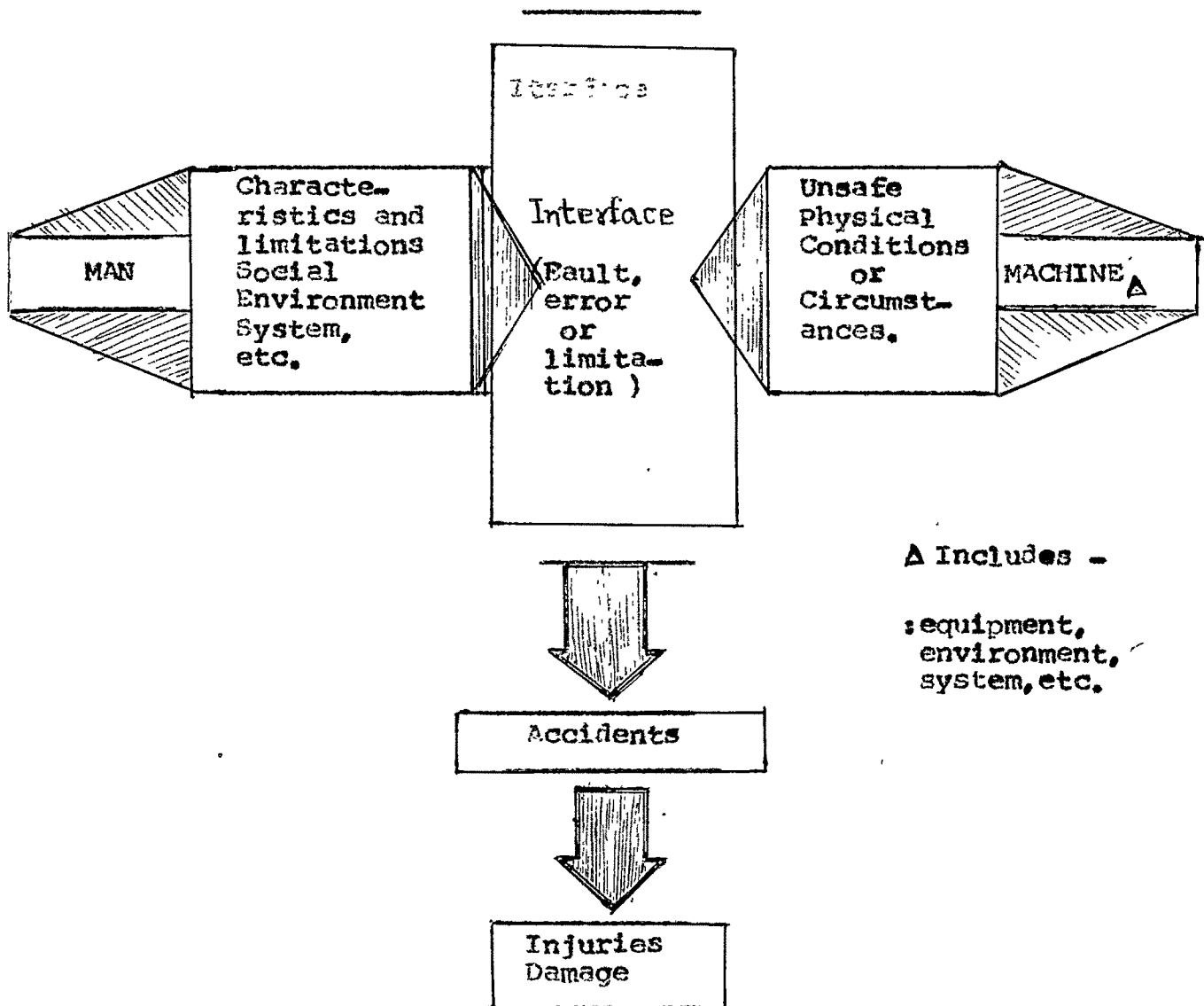




FIGURE NO.2 : Model of Men-Machine Interaction.



5. The Psychology of Accidents:

It is generally accepted that all human behaviour is motivated, that all human activities have specific goals, both conscious and unconscious, 'Accident' behaviour is no mishap can be considered as an 'accident', unless it can be ascribed to the purely mechanical causes, such as the malfunctioning of

a machine. Each so-called human error injury is the result of motivated performance on the part of the injured person. Thus we may say that the injured person 'hunts' himself 'deliberately'. His injury stems from frustration or rather, from his way of adjusting to it through self-punishment, attention seeking or resentment of authority. The particular drive being frustrated is that towards mastery or achievement a drive once categorised as only secondary in strength but now thought to be nearly as strong as hunger and thirst and like these physical needs, constantly recurring. Satisfying this particular need requires not only mastery or achievement itself but the status and recognition it brings in the form of praise or reward or even negative recognition such as punishment.

Repeated frustrations of the first order drive produces, chronic emotional insecurity and the constant manifestation of the following symptoms :-

i) An insatiable craving for affection along with an inability to accept affection. No one cares about me. Suicide or grave self-injury is usually caused by the victims of conviction that he is unworthy of affection of others which ultimately leads him to punish ( hurt ) himself.

ii) A disregard of the personalities and needs of others. The preoccupation with self leads the insecure person to overemphasise normal environmental problems and

to exaggerate his physical symptoms and minor difficulties in a constant demand for the attention of others.

iii) Resentment - the emotionally insecure person will strike at those who try to help him, particularly those who are stronger or more successful such as supervisors or managers. He will seek to hurt them directly or indirectly.

Self-injury is a way of gaining temporary satisfaction of an over-emphasised need. The urge to satisfy it is often strong enough to overcome any temporary discomfort or deterrent.<sup>6</sup> This holds true for 'normal' people as well as 'mentally ill'. The difference between these two categories is to be found only in the duration and internity of socially acceptable adjustments to frustration. Every body at one time or another demonstrates one or more of the symptoms of mental illness and almost all adjustment mechanisms and categories of mental illness manifest the drive to self injury, anxiety, depression, compensation, rationalisation, negativism, day-dreaming, all incorporate this drive.

Let us consider just one example, hysteria :-

This is a common psychoneurotic reaction characterised by adjusting to frustration through aggression against ones self-in terms of work.

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6. Thomas W. Harrell, 'Industrial Psychology', 3rd Reprint  
Oxford and IBH Publishing Co.,  
New Delhi.

The steps in this pattern of maladjustment are as follows:

i) Desire to escape an unpleasant situation(job) that does not bring achievement and recognition.

ii) Realisation that self-injury is a way to escape this comes from day-dreaming, seeing ( or hearing of ) injury to fellow employee or any device in the work environment that calls attention to the possibility of injury.

iii) 'Accidental' escape through the suggested channel.

iv) Fear of having to return to the unpleasant situation upon recovery.

iv) Fear of having to return to the unpleasant situation upon recovery.

v) Exaggeration of symptoms of the seemingly minor injury.

vi) Ultimately symptoms with no physical cause.

Any reward given to the hysterical employee after his injury will support his fantasy of being unable to return to work. Sympathy, condoling, prolonging medical care are extremely detrimental to his recovery and to the mental health also.

A leading mental hygienist once remarked 'The hysterical individual actually desires to be injured in order that he may have an excuse to retreat from the reality of his frustrated needs. Many accidents are actually ' wish fulfilment' and a noted management consultant said ' most

people who induce accidents are normal but emotionally disturbed and unhappy.<sup>7</sup>

By having an accident they achieve their needed feeling of importance through the attention and sympathy of others. This is not constantly done. The individual courts dangers until the accident finally occurs and then he crasis it from his memory and will swear he was being safe and that he could not control caused accident. In other words a man exposes himself to dangers not because he can not read the warning sign but because there is something within him so powerful that, he refuses to accept the warning and to protect his own personality.

Now-a-days, according to most experts 90% or more of injures are attributable to 'human-error' which means in reality, to personality factors and so it might at first glance seem impossible to effect any further improvement in industry's safety record. But it is clear that the desire for self-injury is not itself enough to cause an accident. There must of course, be a means of injury, sharp tools, flying particles, pinch points or some such hazards. In addition, there must be random, rather than intellegent guidance from the environment that is from fellow employees, supervisors, machinery and tools and what is the most

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7 A.N.Saxena, ' Safety and Good House-Keeping '

National Productivity Council, New Delhi.

important for self-injury there must be something in the environment, even seemingly minor element, that acts as a trigger to the desire of self-injury. Warning signs, safety talks, inspections, injury investigation, safety regulations, and similar devices of conventional safety programming actually trigger many unconsciously deliberate injuries. If the employee's predisposition towards self-injury derives from factors unrelated to the job such as unrest at home or national or international upheavals, 'efforts by' supervisors or managers to help him 'solve' his problems are inadvertently rewarding and therefore set as a necessary trigger.

#### 6) Accident : Proneness in the Industry :

In connection with reducing the accidents, this term is very often and widely used. Many persons believe that some workers have an innate tendency of getting involved in accidents. And they think that if we are able to detect such persons and remove them from the jobs, our problem of reducing the number of accidents, can be easily solved.

These have been many misunderstandings about the use of this term. At times this term itself is used as an explanation for persons getting involved in more accidents. Really the term is a descriptive one which means that a person is more likely to get involved in accidents rather than other individuals, if it is used as an explanation we are really not adding anything to our knowledge. We are

simply labelling the persons who have already got involved in a number of accidents.

Secondly, some how we seem to believe that accidents proneness is a general concept. In other words, we seem to believe that if an individual is labelled as ' accident prone ' he is more prone or liable to get involved in all types of accidents. This is again quite erroneous. The term is very specific one, in the sense that for getting involved into accidents of a typical kind there are some personality characteristics, these will make him more liable to get involved into that particular type of accident only. For example, two individuals are operating the same piece of machinery under identical circumstances have the same situational probability of having an accident. However one may be inherently a poor operator in the area of co-ordination, Because of this lack of proficiency, he will have a greater probability of having an accident in circumstances requiring co-ordination. He is called a accident prone operator.

Many studies in the field of industrial accident prone-ness have attempted to identify accident prone individuals.

Finally we can say that, ' Accident Proneness is the continuing tendency of a person to have accidents as a result of his stable and persisting characteristics.'

This term if used in this specific way has certainly some uses. For certain types of accidents certain characteristics of the personality seem to be associated. If we can locate some of these qualities, we can think in terms of eliminating the individuals with those personality characteristics. These qualities have to be discovered by systematic research and later we may be able to devise some screening tests for the occupations in which more accidents take place. There is plenty of scope for research in this fascinating area.

Already some companies attempt to train and educate such accident-prone employees in safety matter; some go to the extent of providing psychiatric help also and in extreme cases some companies discharge them. Many others believe in eliminating this problem at the selection process by careful job analysis, by testing general abilities, and by studying the workers physical characteristics, particularly in relation to physical defects and limitations. This is an ideal approach of reduction of accidents by the elimination of accident-prone applicants in the selection process.<sup>8</sup>

#### 7) Consequences of Accidents:

An accident is both an economic and a human relations tragedy. The lost wages to the employee present an

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8. M.N. Rudrabasavaraj, 'Dynamic Personnel Administration, Himalaya Publishing House, Bombay, p.348.



economic problem to the workers and his family. The lost production and broken equipment are tangible economic costs to the employer. The family's loss in wages , Creates social and human-relations stresses. The group reactions to the injury of a fellow worker result in depressed morale and tensions that tend to lower production.

Both the employer and his workers have a morale and economic responsibility to work all the time to eliminate the causes of accidents. Of course the reduction of accidents would be a worth while objective even if there were no economic factors involved. However, there is no escaping the economic consequences of accidents; hence the additional pressure to exert every effort to make the workplace a safe place. Accident reduction really contributes to cost reduction. One of the writers in industrial accidents and their cost has rightly mentioned that, ' one of the outstanding records of accident reduction is that of the steel industry, which intensively undertook an organised safety program before 1920 under the active support of the late Judge Gary.'

a) Losses of Accidents:

Inspite of the larger number of casualties caused by accidents in industry, sustained efforts have not been made to minimise accidents. The industry as a whole suffering from the loss of, productive time of the injured person and other employees in workshop, damages to the machines, tools, etc. due to the increasing rate of accidents.

Such losses can be studied under two headings.

- 1) Direct Losses.
- 2) Indirect Losses.

1) Direct Losses : These arise out of the legal obligation of the management to pay compensation for injuries caused and to meet the medical expenses incurred by the victims of accidents. These losses can be measured in terms of money and are quite substantial for every industrial country.

2) Indirect Losses : These arise from the following sources :-

- i) Loss of productive time of the injured employee.
- ii) Loss of productive time of other employees who stop work.
  - a) Out of idle time.
  - b) Out of sympathy
  - and
  - c) For assisting the injured employee
- iii) Loss of productive time of the foreman, supervisor and other executive as follows.
  - a) assisting the injured employee.
  - b) investigating causes of accidents.
  - c) arranging for a substitute for the injured employee.

- d) Selecting, training or breaking in a new worker to replace the injured employee.
  - e) Preparing the accident report for the Government agency.
- 
- iv) Loss due to damage caused to machines, tools and other property or to the spoilage material.
  - v) Incidental loss due to interference with production and failure to fill orders in time, payment of forfeits and other similar causes.
  - vi) Loss due to continuing the payment of wages in full to the injured employee after his return, even though his productivity is less than before.
  - vii) Loss of profit on the injured workers production and on idle machines.
  - viii) Loss due to lower productivity of other workers due to a fall in their morale.
  - ix) Losses arising out of overhead expenses of lighting, heating etc, which continue to be incurred while the injured employee is a non-producer.
  - x) Losses to the injured worker like -
    - (a) Loss of income plus medical expenses.
    - (b) Physical pain and suffering which no monetary payment can compensate.

- xi) Cost of society, the families of injured in many cases, have to be given financial assistance which falls partly on the tax-payers and partly on the society.

b) Cost of an Accident:

Industries in India have developed over a period of time against background of varying economic demands, and social criteria and their benefits to or contribution to the national economy. With the advent of industrial advancement since our independence the number of accidents in industries have also increased every year.

An accident interrupts orderly development of work, disrupts the smooth system of production and constitutes eventually a loss of productivity. The cost of accidents is an important element in accident analysis, but it is very difficult to measure it in terms of money. However we can measure the cost of an accident in two ways -

- 1) Direct Cost.
- 2) Indirect Cost.

1) Direct Cost:

The information regarding direct cost can be easily maintained and made readily available in almost all plants. We can also get the direct cost on the basis of the following expenses -

- a) The wages of employee,
- b) First-aid and medical expenses,
- c) Cost of training for new worker,
- d) Loss due to waste of new material,
- e) Loss of production due to the inferior,  
skills of new worker.,
- f) Compensation.

Compensation :

Compensation is the consideration either in the form of money or in any other form extending the benefit to employee for any injury or accident arising out of and in course of employment and resulting either in health or total or partial disablement. Law assumes certain liability on the part of employees that they must accept the normal hazards arising out of their work, assignment. Law also considers that employees partially ( but unconsciously ) are responsible to causing injuries. As their co-workers and that they frequently contribute, invariably to the causes of accidents in which they themselves are likely to be involved. Consideration has to be provided to the dependents of the employee for such accidents causing death or total or partial disablement for a period exceeding three days. The Workmen's Compensation Act provides for such compensation assuming that workers do not seek to injure themselves nor do others intends to injure them. It is provided through Employee's State Insurance Act. Money worth or benefits are

fixed by the Acts and accordingly employees or their dependents are liable to get compensation.

## 2) Indirect Costs:

It is difficult to realise and to calculate the indirect cost of accidents. But indirect costs of accidents are estimated to be all the way from two to four times the direct costs.<sup>9</sup> It has been established and realised by the top management authorities that such indirect cost average three times amount of direct costs. Every management has to become conscious of these unnecessary costs of production and has to find out measures as how to reduce them.

Indirect costs of an accidents are as follows :-

1) Cost of Damage to equipment, materials and plant :- Many accidents entail considerable damage to physical property. Such costs are more evident to the employer than many of those that follow.

1i) Cost of Wages paid for time lost by workers not injured : - No accident has yet occurred after which other people did not stand around, watch and discuss the details. When this happens during working hours, the employer is absorbing wages paid for which there is no production. Besides if the accident results in the death of a fellow employee, there is usually a considerable loss in production because of the lowering of employee morale.

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9. H.W.Heinrich, ' Industrial Accident Prevention,  
Mc Graw Hill Company, New York, 1959.  
PP. 50-52

iii) Cost of wages paid to the injured -

employee :- Technically the employer owes no wages to the employee who is injured, since she or he is no longer working and future compensation comes from the insurance company under workers compensation laws. Most states require a waiting period of one week before compensation can be paid, and some employers continue the injured employee's wage during this time. A survey revealed that 14 percent provided some type of supplementary pay to legally authorised Worker's Compensation payments. At the very least, the employee is paid for the remainder of the workday during which he or she was injured.

iv) Costs of Supervisors and Staff in Investigating, Recording and Reporting :- One part of a constructive safety program is concerned with the effort to make people learn from mistakes. Each accident is an opportunity to learn, in order that similar ones may be prevented in the future. Obviously a large amount of paper work must be undertaken to provide records for management.

v) Costs of Replacing the injured employee :-

If the employee is severely injured and must be permanently replaced on the job, the company will incur all of the money costs of labour turnover. If she or he does return to the job, the company has the costs of,

(a) adjusting during the absence

and

- b) decreased production from the employee immediately after returning.

Most people are 'gun-shy' after suffering an accident and a certain adjustment period usually follows a return to work.

vi) Miscellaneous Costs :- Other costs are even less apparent than those listed above among them are :-

- a) Any overtime caused by an accident,
- b) Any loss of profits due to cancelled orders resulting from the delay in normal work procedures  
and
- c) The costs of maintaining a first-aid dispensary for accidents that do not technically result in lost work time.

The National Safety Council ( U.S.A.)<sup>10</sup>:-

Calculations embrace the following cost items :-

- 1) The premium on compensation insurance or payments on compensation by self-insured cost items.
- 2) Cost of wages paid for time lost by workers who were not injured.
- 3) Cost of damage to equipment.





- 4) Cost of wages paid for time lost by injured worker other than workmen's compensation.
- 5) Extra cost due to overtime work - necessitated by the accident.
- 6) Cost of wages paid to supervisors while their time is required for activities resulting from the accident.
- 7) Wage cost due to decreased output of injured worker after return to work.
- 8) Cost of learning period of new worker.
- 9) Uninsured medical cost borne by the Company.
- 10) Cost of time spent by higher supervision and clerical workers on accident investigations or processing compensation applications.
- 11) Miscellaneous unusual costs.

Causes of Indirect Costs :

We can certainly enumerate few causes of the above few wasted indirect costs.

- 1) Idle time of injured employee,
- 2) Idle time of fellow-workers who helps injured,

- 3) Idle time of foreman to assisted injured investigate and report and train substitute.
- 4) Idle machines, equipment and tools,
- 5) Upset production schedules,
- 6) Fall in wage for low production of worker who was injured and rehabilitated.

Thus we can calculate the cost of accidents only in a limited sense.

Out of the causes that are listed above, some need to be explained and one of them is ' Industrial Fatigue.' Industrial fatigue develops the disinterest and feeling of boredom in the work. Even with such fatigue if the activity is further continued, individual may experience that it leads to increase annoyance and finally he finds it extremely difficult and even sometimes impossible to carry on work with greatest efforts of security. Ultimately not only the production which may be adversely affected, reducing the output, but it further desposes the individual into illness and accidents and neurosis. Dissatisfaction and resentments are the results of frustration, worker may ultimately get involved in accidents.

B) PREVENTION OF ACCIDENTS:

1) Importance and Need :

Whatever may be the attention paid to the elimination of hazards and the provision of suitable conditions

of work, it is an unassailable fact that accidents do happen in industry. This has attracted attention and methods of prevention have been evolved out of the experience gained. It is, therefore, a natural corollary that prevention of accidents in any factory has also to be based on proper investigation and analysis. Most careful and searching investigation is essential. Right conclusions should be drawn and proper methods put into practice. So the essential feature of prevention is the removal of the cause of the accident.

Industrial accidents result in terrible suffering to the victim and his dependents. In our country, on an average, 400 people lose their lives every year due to accidents. Subject to Indian Factories Act, more than 1.5 lakhs of people meet with lost time injuries. The total loss to industry is more than 1.5 million mandays every year an effort which could produce nearly 300 broad gauge locomotives. In addition, there is also the cost due to medical attention and compensation to be paid. The indirect losses on account of accidents are as much as 4 times the cost of direct losses which can be easily traced and accounted for.

Accident prevention can be a sound financial investment for both employees and employers, though there are no available figures on the cost of accident prevention. Accidents are not only expensive, but they also lower the morale of the workers and in addition result in lower

production rates . As a group, companies with excellent safety records, probably have more satisfied workers than the companies with high accident severity and frequency. There is an interaction here, just as accidents lower morale, poor morale appears to be a cause of accidents.<sup>1</sup>

Simply stating the size and importance of the problem of the accident in industry, does not give all the reasons for taking action to reduce it. There would be little basis for action if accidents happened purely by chance; there is a very real cause behind each entry into the fatality column and each injury. Experts believe that 98 percent of these causes may be controlled and eliminated.' The work of accident prevention has also been undertaken by Safety First Association of India which was established in 1931. In the association's opinion, the problem of reducing the waste of manpower due to accidents has first place among those which must be tackled.

## 2) PRINCIPLES OF ACCIDENT PREVENTION;

Various definitions of ' Accident' have been made and found in literature. A broad at the same time generally accepted definition for all purposes relating to safety of personnel is that ' an accident is an unplanned and unexpected event which causes or is likely to cause an injury.

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1. Thomas W. Harrell, 'Industrial Psychology'  
Oxford IBH Publishing Co., New Delhi.

### I) Cause of Accidents:

Heinrich<sup>2</sup> after careful study of 75,000 lost time accident cases from insurance files, found that 98% of the accidents were caused by either unsafe actions or unsafe mechanical or physical conditions, or both and that they could be prevented by correction of the unsafe acts and conditions.

### II) Foundation of Lost Time Injury :

Analysis by the same author of 5000 lost time accidents has shown that for every accident resulting in an injury there are many other similar accidents that cause no injuries, whatever. It was estimated by him that in a unit group of 330 accidents of the same kind involving the same person and similar circumstances, 300 result in no injuries, 29 in minor injuries and 1, in a lost time injury. This is illustrated in FIGURE - 1

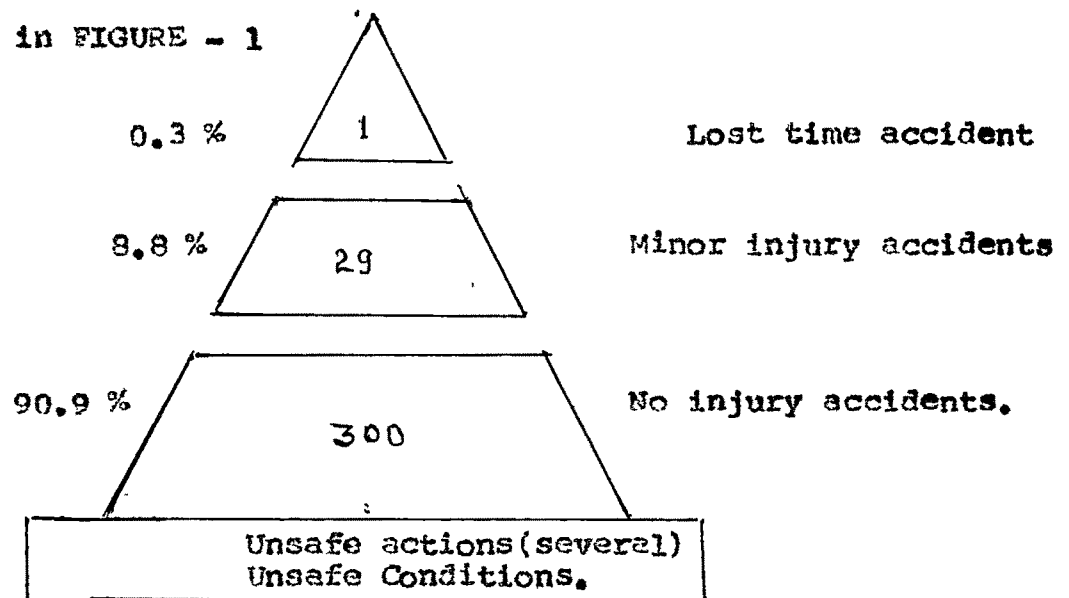


FIGURE-1: Foundation of a lost time Injury.

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2. H.W.Heinrich, 'Industrial Accidents Prevention'  
Mc Graw - Hill Company, 1959.

The important point which emerges from this study is that the pattern indicated by the ratio of injury causing lost time accidents to other accidents causing no injuries or minor injuries provides ample opportunity for preventive work. More so, as it is only after several repeated unsafe actions or repeated exposure to an unsafe mechanical or physical condition that even the no injury accidents happen. However, the figures mentioned represent an average only and it is very likely that a minor or a serious injury may occur the very first time a person acts unsafely or is exposed to a mechanical hazard in other cases, he may be so endangered hundreds or thousands of times before he receives an injury.

### III) Accident Sequence:

The basic theory of accident occurrence may be briefly stated as :-

- i) A personal injury occurs only as the result of an accident ;
- ii) An accident occurs only as a result of an unsafe action or exposure to an unsafe mechanical or physical condition or both ;
- iii) Unsafe actions or Unsafe mechanical or physical conditions exist only because of faults on the part of persons  
and
- iv) Faults of persons are inherited or acquired from the environment and the reasons or causes

for the faults are :-

- a) Anatomical or physiological unsuitability,
- b) Improper psychological characteristics,
- c) Lack of knowledge or skill
- and
- d) Improper mechanical or physical environment.

The basic theory of accident occurrence with the various factors in their sequence is illustrated in Figure - 2.

#### IV) Remedy:

It will be seen that the occurrence of an injury is the natural culmination of a series of events or circumstances which invariably occur in a fixed and logical order. One is dependent on another and one follows because of another, thus constituting a sequence. If the series is interrupted by elimination of even one of the several factors that comprise it, the injury can not possibly occur.

Knowledge of the factors in the accident sequence guides and assists in selecting the point of attack in prevention work. It permits simplification without sacrifice of effectiveness. It also permits expansion of safety work into the underlying field of human behaviour or limitations and helps in organising and introducing most suitable control measures.

It would be appreciated that many things may occur to break the accident sequence. A person having inherited or acquired faults may not act unsafely or permit a mechanical hazard to exist. If he does not in an unsafe manner, it is possible that accident may not occur. Even if a person is involved in an accident an injury may not be caused. The most important point is that unsafe actions and unsafe mechanical or physical conditions are the immediate causes of accidents and meet practicable of determination and elimination and that supervision and management can control the actions of employed persons and so prevent unsafe acts and so also guard or remove unsafe conditions even though previous events or circumstances in the sequence are unfavourable. Thus in accident prevention, the bull's eye of the target is the middle of the sequence, unsafe acts of persons and unsafe conditions.

#### UNSAFE ACTIONS:

##### (a) Classification, causes and prevention.

These are generally classified under the following heads:-

- i) Operating without authority, failure to secure or warn.
- ii) Operating or working at unsafe speed,
- iii) Making safety devices inoperative,
- iv) Using unsafe equipment, hands instead of equipment or equipment unsafely.



- v) Unsafe loading, placing, mixing, combining etc.
- vi) Taking unsafe position or posture;
- vii) Working on moving or dangerous equipment;
- viii) Distracting, teasing, abusing, startling, etc. and
- ix) Failure to use safe attire or personal, protective devices.

Very often one does not have to study the subcauses for the unsafe actions or persons before remedial measures can be suggested for prevention of such actions. All that would be needed is proper instruction and follow-up. However, in many instances there is a need for finding the underlying reasons for unsafe acts and when these are discovered, they lead to the proper selection and application of effective measures in accident prevention. The reasons or subcauses that give rise to unsafe actions have been classified by Heinrich,<sup>2</sup> as stated earlier under the FOUR broad headings of anatomical or physiological unsuitability, improper physiological unsuitability, improper psychological characteristics, lack of knowledge or skill and improper mechanical or physical environment. To put it differently in the language in the ergonomist, faults on the part of persons which leads to unsafe actions of persons in a working environment are caused due to human limitations in respect of anatomical, physiological perceptual and psychological

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2. H.W.Heinrich, ' Industrial Accidents Prevention '  
Mc.Graw - Hill Company 1959.

characteristics, skills, knowledge and capabilities as well as due to imperfections in the mechanical, physical or social environment.

Clearly, human limitations in the context of interface between man and machine or man and his work environment are the ultimate causes of all accidents.

Personal characteristics such as age, job experience, visual functions, perception, motor ability, dexterity, reaction time, cardiovascular disorders, neuropsychiatric disorders and physio-pathological conditions have bearing on incidence of accidents. Therefore, it is essential that adequate attention is paid to proper selection, training, placement, education and supervision of workers on the basis of the hazards in the job concerned. Further, engineering revision to make the work environment safer to the employees, the most effective way of controlling unsafe actions of persons should be taken advantage of wherever possible.

(b) Accident Proneness' can be defined in simple terms as a personal idiosyncrasy predisposing the individual who possesses it in a marked degree to a relatively high accident rate. This presupposes that there are only a few people who have many more accidents than the others. There has been lot of confusion in the use as well as interpretation of the word 'Accident Proneness.' Great injustice has also been caused

to be done to employees due to adoption of a negative approach arising out of wrong convictions regarding accident proneness of individuals. Numerous studies carried out by research workers have failed to prove conclusively that any group of persons in a given sample can be separated as accident prone.

Dr. Schulzinger after careful study of 35,000 injury cases points out, most people move in and out of the so called accident-prone group depending upon age, mental and physical state, environmental factors and other conditions that vary with the passage of time rather than remaining fixed with the individual. Several tests have been advocated in the past to segregate the so-called accident prone group. To name a few, sensory motor, manual dexterity, mechanical attitudes, emotional stability, cultural interests, intelligence, personality, eye, blood and combination of these tests have been recommended by various investigation as a means of predicting accident proneness. However, the reliability of these tests for predicting performance in terms of causation of accidents, it must be admitted, has been not found to be significant enough to be useful.

#### Unsafe Mechanical/Physical Conditions:

Unsafe Mechanical or Physical Conditions are generally classified under the following heads :-

- a) Inadequately guarded,
- b) Unguarded,
- c) Defective condition, rough, sharp, slippery, decayed, corroded, frayed, cracked etc.
- d) Unsafe design or construction,
- e) Hazardous arrangement, process etc. (Filing, Storage, aisle space, exists, layout, overload, misalignment).
- f) Unsafe illumination ( inadequate or unsuitable )
- g) Unsafe ventilation ( inadequate or improperly distributed )
- h) Unsafe dress or apparel
- and
- i) Unsafe methods, processes, planning etc.

Though in majority of the accidents, the direct cause is usually attributed by investigators to unsafe actions of persons, it should be emphasised that the most effective method of prevention of accidents by adopting engineering measures to remove the unsafe mechanical or physical conditions involved in the situations. Knowing that all accidents happen due to interface between man and machine or man and his environment on account of the limitations of the man in respect of his anatomical, physiological, psychological and perceptual characteristics, skills and abilities, the reduction in unsafe actions leading to accidents which can be achieved by removal of unsafe mechanical or physical conditions can well be appreciated.

It is a plain fact that the more a process or an environment is kept free from unsafe mechanical or physical conditions, the lesser would be the chances for persons to run into accidents. Therefore, the part that ' engineering revision ' ( removal of unsafe mechanical or physical conditions or amending unsafe processes or systems of work ) can play in accident prevention can not be over emphasised. Efforts to prevent accidents by methods giving emphasis on control of unsafe actions alone would not give encouraging results unless they are backed up with ' engineering revision ' to the extent practicable.

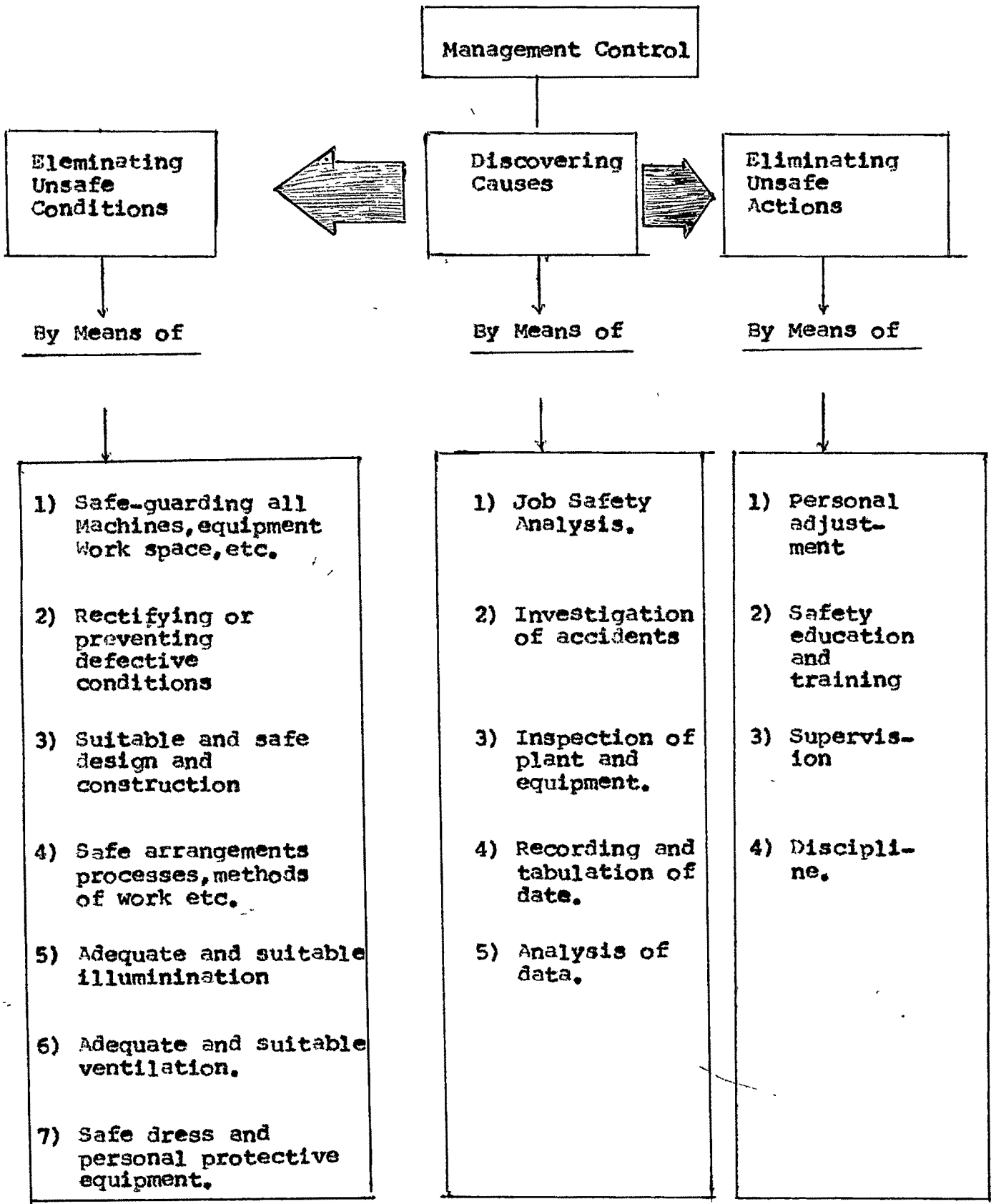
c) Prevention Methods :

The well known prevention methods mentioned earlier can be summarised as :-

- i) Engineering revision ,
- ii) Personal adjustment
- and
- iii) Instruction, persuasion and appeal ,
- iv) Discipline.

The important steps or procedures in application of these methods are detailed in the CHART given in the

### Application of Accident Prevention Methods



### 3) Present Position and Scope for Improvement:

The total figures of accidents as such do not provide a means of evaluation of our performance in prevention of industrial accidents. Evaluation can be made by comparison of ' the rate of accidents per 1000 workers employed ' in India with those of other industrially advanced countries. The number of accidents per 1000 workers employed in all manufacturing industries in India, UK & USA during 1974 are :-

India <sup>3</sup>	-	54.74	( Accidents causing disablement for 48 hours or over )
U.K. <sup>4</sup>	-	33.20	( Accidents causing disablement to earn full wages for 3 full days or more )
U.S.A. <sup>5</sup>	-	24.09	( Accidents causing disablement for one complete day beyond the day of accident, i.e.involving absence of 40-48 hours or more )

Thus, from the above figures, a question may arise that why are we doing so badly compared to UK and USA ?  
Reasons such as :-

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3. Labour Bureau, Simla, 'Indian Labour Statistics', 1975.
  4. U.K. Annual Report of H.M. Chief Inspector of Factories, 1974.
  5. National Safety Council, USA ' Accident Facts', 1975.

- i) in-sufficient voluntary efforts on the part of managements, trade unions and others,
- ii) more manual operations in our production processes,
- iii) the lower economic and educational status of our workers,
- iv) low wages and compensation rates,
- v) tendency to believe that accidents are inevitable and
- vi) managements being not sufficiently conscious of the high cost of accident, are often attributed to our poor performance.

However, experience indicates that remarkable success in accident prevention can be achieved even with the existing disadvantages, by planned and perseverant efforts in individual plants. This is borne out by the spectacular reduction in the incidence of accidents in many factories which have tackled this problem in a scientific manner.

#### 4) STEPS in Prevention of Accidents :

In most cases of industrial injuries, it is possible to establish a chain or sequence of events leading to injury:-

<u>Back -</u> <u>Ground</u>	<u>Defects of</u> <u>Person</u>	<u>An Unsafe</u> <u>Act</u>	<u>An</u> <u>Accident</u>	<u>A Personal</u> <u>Injury</u>
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### To Eliminate the 'Unsafe Act ':

If we eliminate ' Unsafe Act ' from the accident chain, the accident chain will be broken. Before taking any measures against the accidents the company experts should observe the ' Man in Motion', and identify the unsafe acts being performed by the men. This should lead to plan for their elimination.

There are several steps and procedures by means of which an organisation can undertake a campaign designed to prevent or reduce accidents. The usual steps commonly followed for accident prevention are as below :-

#### I) Accident Investigation and Reporting:

Firstly, detailed and accurate data on past accidents in the organisation must be accumulated. Surely the best way to develop protective and preventive measures against future accidents is to be find out what went wrong in the past. In other words the purpose of accident investigation is to discover hazards conditions and practices so that accidents from similar causes may be prevented. This is accomplished through :-

(a) A detailed investigation of each individual accident to discover the causative factors involved.

(b) An analysis of the factors found.

- (c) Thirdly recommendations for corrective action based upon the investigation and findings.

The idea of seeking fix the blame should be definitely avoided, for, where this is allowed, an attitude of covering up develops amongst the employees, making it difficult and many times impossible to get all the facts. Care must be taken to make sure that every person involved the supervisors, the workmen and the person or persons conducting the investigation are aware that the sole purpose is to prevent future accidents and not to affix blame. If this is made known, there will be no motive for any one to withhold essential information and the people conducting the investigation will also have full facts to aid them plan to prevent further accidents. If a policy of thoroughly investigating each and every accident is established a wealth of information on preventive measures will be gradually built up . It will also provide valuable findings from investigations so that inspections can be carried out to the particular hazards carefully. Proper investigations are part of the foundation of accident prevention.

Accident data from different firms, and from various departments and activities within the same firm can be analysed, to determine particularly dangerous industries and operations so that greater attention can be focused on them. It is probably true that an accident program is no

better than the quality and thoroughness of its accidents reports. All accidents no matter how minor any personal injury, should be reported.

An Accident Report should contain the following information :

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- i) Precise time and location of the accident, many aspects of a job, as well as overall working conditions, can change during a work day, especially from one shift to another. These background factors must be thoroughly understood since they may have contributed to the accident.
- ii) Type of the job and the number of employees performing it. Specifies of the job classification and required operating procedures should be known as well as the number of people performing that job. It is important to determine how many employees in the same job have had accidents in a given period of time.
- iii) Personal characteristics of the accident victim, Age, health and job experience are influential factors in accident behavior. This information , plus psychological test and background data available from selection procedures and supervisors ratings of performance efficiency, should all be reported in as much detail as possible.
- iv) Nature and Cause of the accident. The accident report should describe exactly what led up to the accident, what happened to the worker(s) and if

applicable, damage to equipment. The cause if known or suspected - such as equipment failure, careless operating procedures or failure to use safety devices - should be noted.

- v) Results of the accident, specific damage to equipment, raw materials, and the manufacturing process should be described. If a personal injury resulted a detailed medical report of the extent of the injuries, treatment and prognosis for recovery should be included.

A model form of accident report is given at the end of dissertation.

## II) Proper design of the work and its environment:

Although most accidents are caused by the human elements the physical work environment can provide potential sources of accidents. For example a poorly designed machine, or work area often leads to what is defined in an accident report as a human error, but which as an error that could have been prevented through proper equipment design.

This aspect of accident prevention, the engineering phase, is probably the single most important aspect of a safety program. No matter how much is known about past accidents or how well trained and motivated are the workers to avoid accidents, if the equipment is unnecessarily dangerous, accidents are likely to occur. Machinery and work areas designed for safety may also serve

to increase workers confidence and allay apprehensions about accidents.

As far as the work environment is concerned, the illumination must be adequate for the job tasks, and the temperature maintained at a comfortable level. The work area should be kept clean and orderly ; accidents have been traced directly to poor housekeeping. Oil or grease spots on the floor and equipment cluttering stairways have directly caused expensive and injurious accidents that could easily have been prevented. Proper maintenance of all operating machinery is also a safety aid. A machine allowed to function improperly, or one that has been repaired incorrectly, often causes accidents.

First-aid equipment, fire extinguishers and the other safety accessories should be conveniently placed throughout a work area and painted in such colours as to be easily indentified. Time lost in searching for a fire exlignisher, for example, greatly increases the seriousness of the accident.

We discussed the importance of properly designed production machinery and noted that it must be compatible with the capabilities and limitations of the operators. Controls that are hard to reach or require unusual force to operate or dials and displays that are excessively complicated and so easily misread, are obvious design mistakes that are ready sources of accidents.

Emergency controls must be easily accessible and quickly operated. A machine designed so that if a worker gets a hand caught, the shutoff control is difficult to reach, is an open invitation to a serious accident. Safety engineers and engineering psychologists are now aware of these design dangers. The design of safety aids and devices is a crucial part of the engineering phase of accident prevention. Perhaps no machine safety device can be made totally foolproof but it is possible to come close. Two general principles apply to the design of safety devices. First, the machine should not function unless the safety device is in place or in operation. A punch press that will not work unless the hand guard is in place as safe as possible. In this case, the worker is forced to manually engage the hand guard in order to operate the machine. If the press were designed to operate whether or not the hand guard was in place a lazy or careless worker might decide it is not worth the effort to swing the guard into place each time, and lose a hand as a result.

Secondly, the safety device must not interfere with production. If the installation of a safety guard on the punch press means that fifteen fewer units will be produced each day, management and the incentive-paid worker will be dissatisfied. Also, the safety device should not cause the employee to work harder or to engage in additional operations in order to maintain the same production level. The

frustration and possible fatigue induced by such extra effort may in themselves lead to accidents.

There are, also further several steps, a company can take in the proper design of the quipment and the work environment in order to reduce the possibility of accidents. Although the engineering phase is vital to the success of an accident prevention program, the program may not be totally effective unless the workers are carefully trained and sufficiently motivated to work safety.

### III) Training for Accident Prevention :

The training phase of an accident prevention program focuses on specific safe job skills and attitudes toward safety. Neither aspect is fully effective alone, both on the job behaviour and attitude must be oriented toward reducing accidents. Workers may be well aware of the safest way to operate the equipment but if their attitude toward safety is negative, this job knowledge alone may not protect them from harm. Similarly a possitive attitude will not prevent accidents if employees do not know the rules for safe operation of their equipment.

With respectto job skills, inexperienced workers are highly susceptible to accidents during the initial period on the job. Research studies have shown that training in the safe way of performing a work task leads to reduction in accidents for new employees.

Most company training programs devote some time to safety matters. Special dangers and potential hazards of the job are pointed out and information presented on the nature, causes and results of past accidents. The company's rules for safety on the job are taught, as are the location of emergency, first-aid equipment and the medical facility. It is not unusual, for particularly dangerous jobs, to teach employees the principles of first aid. Safety training, however, should not stop when employees begin work. Most companies continue some form of safety training throughout an employee's career. Systematic safety inspections are frequently made and safe working habits continually checked upon. Publicity campaigns designed to maintain safety awareness are periodically launched.

Further, when accident rates are observed to increase, retraining is often put into effect. Some times, experienced employees become careless or forgetful of safety procedures, so a refresher course is required. Some firms periodically offer safety training programs to all employees, regardless of the accident rate. The goal is to maintain in employees a constant awareness of safety and a continuing interest in safe working habits. Generally, firms that continue safety efforts in systematic and thorough fashion have been rewarded with substantial reductions in lost hours of work. The money thus saved usually more than pays the cost of the safety training programs.



A key role in any successful safety training and awareness program is played by the foremen. Many companies pay special attention to their safety training. More than any other level of management, foremen, because of their close daily association with workers, must be alert to unsafe working conditions and practices. They are in the best position to remind employees of safe working habits and to arrange for proper maintenance of machinery and the work environment.

Foremen are also in the best position to advise the safety engineer on weaknesses in the safety program and to suggest to the training department when retraining might be advisable. The best safety training program will be less than maximally effective if foremen do not follow it up by insisting on adherence to safe working procedures. Further, foremen, by example and instruction, can maintain proper motivation toward safety. If foremen display a lack of concern for safe procedures, certainly the workers will not be concerned about them.

However, foremen can not be expected to display proper awareness of safety problems unless their superiors do also. Tolerance to sloppy accident reporting and a negative or even mental attitude toward safety on the part of higher management, neither encourages nor reinforces foremen to attend to the problem. All levels of supervision must demonstrate to subordinates that safety is everybody's

responsibility. Only with such broad support will training programs be most effective.

#### IV) Safety Publicity Campaigns :

In order to motivate employees to follow the safe working practices they have been taught, many organisations engage in publicity and promotional campaigns. Bright, attractive posters are located throughout the plant, booklets on safety are distributed, charts noting accident free days are displayed and safety contests ( companywide or nationwide ) are conducted.

Posters are the most frequently used technique but their effectiveness depends on the kind of message displayed. Negative themes ( ' dno't do this ' ) coupled with gruesome scenes of mangled bodies ( 'or this is what will happen ' ) are particularly ineffective. These fear-oriented appeals create resentment and even anger toward the company as well as toward the message itself. The most effective safety posters stress positive themes such as ' Wear Hard Hat in This Area,' or ' Hold on to Railing.' They should be attention-getting through the use of bright colours, sharply defined lettering and visible placement. The effect of safety posters on behaviour has rarely been studied but results have shown increases in safety practices within six weeks after the introduction of posters into the plant.

Booklets of instructions and safety rules do not seem to be very effective, no matter how widely they are

distributed. It is relatively simple to make sure that all workers in a factory receive a booklet. It is far more difficult to make them read it. In truth, such booklets are rarely read.

Safety contests can be an effective device for maintaining an interest in safety. Some contests reward workers on an individual basis for accident-free work over a given period of time. Other contests operate on a group basis where the work crew or department receives an award if it remains accident-free for a period of time. Another approach pits one department against another to see which has fewer accidents per unit of time. Nationwide contests are sponsored by organizations such as the National Safety Council.

Contests serve to make workers more conscious of safe operating procedures and thus result in a reduction in accident rates. Unfortunately, this awareness does not usually last much longer than the life of the contest. One possible solution is to have continuous contests, changing the awards frequently enough to maintain interest.

A disadvantage of safety contests is that they may pressure workers, foremen, or executives to suppress the number of reported accidents. However, incomplete accident records will be self-defeating in the long run since successful accident prevention programs depend on accurate and complete statistics.

and complete statistics.

If any one of these steps to accident prevention analysing past accidents, optimizing work conditions and equipment, training employees in safe working procedures and attitudes and continually promoting safety awareness is ignored the safety program as a whole will suffer.

5) Accident Prevention and Responsibility of Management, Supervisors, Safety Engineers and Workers.:

Prevention of accidents is a cooperative efforts of management, supervisors, safety engineers and workers. The employer and his supervisors must adopt the appropriate technique based on sound principles and the worker must willingly cooperate by using the safety appliances and following the safety instructions.

(a) Management :

The first and most indispensable requirement is that the employer and his supervisors must sincerely and enthusiastically want to prevent accidents. Half-hearted attempts will not succeed and will doubly injure the work by infusing the same half heartedness into the workers in accident prevention work. Employers must not only show clearly that they are taken keen on prevention, but also infuse the same enthusiasm into the workers and the supervisory staff. ' In short the work must start from the top and preventive measures be adopted by all. '

(b) Supervisory Staff:

Good intentions of management, as regards safety, will not be effective unless every supervisor takes practical steps on the floor of the workshop. The supervisor is the last link of the management with the workers and he is in continuous touch with the working group under his control. It is, therefore, he who can put into practice the intentions of the management and make the workers safety minded.

The Supervisor in charge of safety should be a man of sincerity and ability. He must be well conversant with the processes and be aware of the hazards involved. He should know the working of the machines and must be capable of appreciating the problems of production. He should have keenness of observation and the patience to learn. Where every person looks and passes on, he should be capable of seeing and recognising a danger. He should have a tact in imparting his ideas to others and make others accept them. He must be friendly with all, so that his remarks and discussions are accepted in a spirit of friendliness and cooperation.

(c) Safety Engineer:

The safety executive must not only be enthusiastic in his work but should also clearly demonstrate his enthusiasm. He should make it clear that he wants the cooperation of all his colleagues and the workmen. He should reach every person on his own plane and should be able, by the force of his personality, to influence

them in the interest of safety.

There is no doubt that regular safety inspection of a factory is necessary. While the officer in charge is able to carry it out, it is not sufficient if one inspection is made and instructions given. There is a great need to follow up. The worker must be continually reminded of what he has been told and what has been impressed on him in the interest of his safety. An investigation of an accident must be followed up with a discussion with the workers engaged on the type of work in which the accident has occurred. This is more effectively done by the formation of safety committees in which every accident and near accident is discussed.

(d) The Worker:

No amount of effort on the part of management, supervisors and the safety engineers will achieve the desired result of preventing accidents unless the programme receives the active and whole hearted support and cooperation of the workers and their organisation. Generally, 'it is the worker who is both the cause and the victim of an accident'<sup>6</sup>. The workers and their leaders have, therefore, to realise the seriousness of the problem and constantly keep in mind their own interest in the elimination of all unsafe practices, and in ensuring that safety appliances are invariably used and safety rules and regulations scrupulously observed.

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6. V.V.Giri - 'Labour Problems in Indian Industry '  
(3rd Ed) Asia-Publishing House, Bombay.