RISK ANALYSIS AND DISASTER MANAGEMENT

ASSIGNMENT-2

Q1 - What is the relationship b/w safety and rediablity. What are the steps involved in performing hazard analysis?

Soln Reliability and safety analyses complement each other. They can each provide the other more information than obtain indivisually. Neither, rarely can be submitted substituated for other but, when performed in collaboration. can, lead to better and more efficient products.

Two rediablity analyses (one a subset of the other) are often compared to hazard analyses. Perfomances of a failure mode and affects Analysis (FMEA) is the first step in generating the failure modes, effects and criticality Analysis (FMECA) Both types of analyses can serve as a final product depending on the situation. An FMECA is generated from a FMEA by adding a. Criticality figure of merit. These analyses are performed for reliability and supportability information.

A hazard analysis uses a top-down methodology that first indetifies risk and then isolate all possible causes. for an operational system it is performed for specific suspect hazard

In case of hazard analysis, failures, operating procedures, human factors and transient conditions are included in the list of hazard causes.

Reliability predictions establish either a failure rate for an assembly (or component) or a probablity of failure. This quantative data at both the component and assembly level, is a major source of data for quantative reliability analyers. This understanding is necessary to use it correctly. In summary however, hazard analyses are first performed in a qualitative manner identifying risk, their causes, and the significance of hazard associated with the risk.

⇒ The step which are in involved in hazard Analysis are:-

Establishing safety requirments baseline & applicable history (ie system restrain):-

→ Specification/detailed design requirment
→ mission requirments (eg. How is it supposed to operate).
→ General statuary regulation (eg. noise abatement)
→ Human factor standarised convention (eg. switches "up" or "forward" for on)
→ Accident experience and failure report

5) Indentifying general and specific potential accident contributory factor (hazards)

⇒ In the equipment (hardware, software & human)
⇒ Operational and maintenance environment
⇒ human machine interfaces (eg. procedural step's)
⇒ Operations
⇒ All procedures.
⇒ All configuration (eg. operational & maintenance)

Q Explain the hazard and safety measures in forging operation.

Forging process is used for plastic deformation of metals and alloys, either hot or cold by applying the compressive forces. Hammer or impact forging exerts multiples forces while press or roll forging excretes single force. Hammer and drop forging are carried out on hot metal only, while press forging is also possible on cold metal. Forging may be carried out manually or mechanically.

Accident in forge shops are generally due to hot and cold metal coming out, fall of the tup accidently starting of machine, crushing Hazards, radiant heat, burns, high noise etc. Forge workers may suffer chronic rheumatism, digestive disorders; inflammatory skin disease, respiratory trouble and hearing loss due to high noise and vibration.

⇒ General safety measures are :-

Good plant layout, uncongested machine and proce layout, good housekeeping and ventilation, good draft to furnace and efficient exaust of gases, water curtains and reflective or insulating screens for protection against radiant heat and hot air, local exaust system at the furnace, cold air shower at hot work places. noise absorbent panel and deep and massive foundation to suppress vibration.

⇒ Specific safety measures in forging operation are :-

Raw materials

In sequece of forging operations the first stage is recieving, storing and preparation of raw materials for actual forging process.

Recieving :- Raw materials, in bars of various length and shape, is recieved by railway wagon or automobile truck. unloading operation should be carried out safely under the experienced supervision. Mechanical lifting and carrying should be preffered.

Storage :- Adequate storage facilities should provided with overhead crane or hoist eg arrangement for safe mechanical handling. most storage areas have overhead cranes and either the electromagnet or sling suspension to carry

Electromagnet is permissible where the storage area is isolated from general manufacturing area or separated by walls and fences which will controll exposure to plant-personal not assigned to the handling operation. The magnet must be lowered to rest and power to magnet must be off at all times, when the crane operator is not at the controlls.

Q Explain the hazard and control measures in heat treatment process.

Hazards in heat treatment process are:-

(1) Burn due to high temp. heating (b/w 700° to 1100°C)
(2) Hazards of chemicals like N_2, NH_3, NaCN, Na_2CO_3, NaCl.
(3) contact of quenching medra like brine, water, oil, air and solution of NaOH or H_2SO_4 in water.
(4) Hazard of various types of furnace and temp measuring instruments and electrical apparatus.
(5) Handling of machines parts viz. steel, casting, forging (shafts, axles etc) springs, gears, wires, drills, screw taps, hammer dies, die moulds, high speed cutting tools and speed etc. for heat treatment process.
(6) Lifting and travelling mechanism and unguarded agency parts.
(7) Dust exposures.
(8) Hot surfaces and high air temprafures.

(9) High humidity and air velocities.
(10) High voltages and electromagnetic radiation
(11) High noise levels.
(12) Infra-red radiations.
(13) Excessive brightness of illuminated surfaces.

⇒ control measures are as under :-

(1) Exhaust ventilation to remove chemical vapour, fumes, gases, flammable or explosive dust, vapour etc.
- A enclosed hood projecting over the entire tank and enclosed on two or three sides is preferable. A lateral exhaust convenient ~~cap~~ canopy hood, general room ventillation and push pull system can also be employed.

(2) flame proof or non-sparking fan and motor should be utilised in flammable area.

(3) Monitoring of HCN or NaCN is necessary.

(4) Excessive heat should be removed away.

(5) Air supply to the furnace should be uninterrupted and well controlled.

(6) Adequate method of storage handling and disposal are desired.

Q4 Explain the use of personal protective Equipment for safety and management in any industry.

Ans → For any accident prevention work, engineering control is the best control and aid of personal protective equipment should be the last resort or a supplementry control.

The use of PPE exist because.

(1) chances of failure of engg. control, material. process, equipment and safety devices. cannot be denied and in those circumstances, the PPE act as a barrier b/w man and hazard and to save from injury.

(2) There are certain operation or accidental situation where engineering control are less possible and PPE becomes necessary. For repair and maintenance or to enter into toxic or oxygen deficient atm. or. while working at height or doing jobs like welding, cutting, grinding chipping PPE gives good protection.

(3) It effectively avoid the contact of dangerous substances, noise, vibration and radiation.

(4) It protect from atmospheric contamination

(5) It is legal as well as moral duty to provide suitable PPE.

Q. Explain the role of management in motivati of worker v safety.
toward

Ans, Role of management in motivation of workers toward safety :—

(1) Insist for adequate sensory motor ability, free from accident proneness, disease and habit of intoxication, appropriate age, sex, appearance, and good safety record.

(2) By Induction training new workers should be given necessary safety instruction and training regaurding hazard and control measure in industry.

(3) company, safety and Heath policy. Environmental policy and quality policy should be explained with their objectives and benefits.

(4) workers should be encouraged to participate in safety committee, safety suggestions and all safety programmes.

(5) Team spirit and competitiveness should be built up. This will induct group motivation

(6) supervisor should take sufficient round to them. If any unsafe practice is noticed for good work and follow upto of safety rules, they should praise the worker.

(7) Poor attendance should be paid for basic needs of Health, safety and welfare facilities the factories Act and rules for the worker.

(8) Insist for man-machine matching ie designing machine tools equipment, control and situation most convenient to people at work. This can reduce accidents.

(9) Opportunity of advancement for R&D work new product, new market, new safety device, diversification and delegation of more power should be given to deserving workers.

(10) Accident case studies should be explained at all level by analysing the different roles in preventing different accident.

RISK ANALYSIS AND DISASTER MANAGEMENT

ASSIGNMENT-4

Q1 Explain Preliminary Hazard Analysis (PHA) & Hazard Analysis.

Ans→. Preliminary Hazard Analysis (PHA)

This is initial study to determine hazard causes, effects and control. facts of proposed product, process or operation are to be known to determine hazards. For example for the product using electric power the hazards to be presumed are:- electric shock burns, fire, sparking, hot surface, electric explosion etc. can be listed. Then appropriate remedies are selected and applied.

Since the PHA is fast & cost effective & not complicated like other method of hazard assesment, it should be adopted as the first step. As basic steps are as follow :-

(1) Assume a type of accident or hazard possible (eg. fire, explosion, toxic release etc)

(2) Find out which plant component system or machine can cause this accident (eg. storage vessel, reactor, pipeline etc)

This study indicates which ~~study~~ system is more or less important from major hazard point of view and to limit the assesment to priority problem and screening less important ones.

Preliminary hazard indentification is required at different stages of project under :-

1. R & D : chemical, reactions, impurities e.
2. Pre-design :- Hazard indices, hazard studies
3. Design : Process design check, HAZOP, failure mode and effects
4. Commisioning : Safety Audits, mechanical commissioning test, NDT, Emergency planning
5. Operation :- condition and corrosion monitoring.

PHA is generally used for early identification of hazard. It is based on -

Raw Material	Operating Environmental
Intermediate	operations
Final Product	other facilities
Plant Equipment	Safety Equipment etc
Interface among System component	

Hazard Analysis

In simple term, hazard analysis means classification of hazard eg. chemical hazards, mechanical hazards, electrical hazards, fall hazards, day & night wise hazards etc. in this way qualitative analysis.

Hazard Analysis is (i) Analysis of mechanism of hazard occurance and

(ii) Analysis of terminal consequeses of hazards. Which may include member of injury fatality, property damage and other loses.

In this way it is quantative analysis..

Its study known as HAZAN (Hazard Analysis)

It means identification of undesired event, which lead to the materialization of a hazard analysis of the mechanism by which such undesired event could occur, and estimation of extent, magnitude and likelihood of any affect or consequences.

Q2 Explain failure Mode and Effect Analysis (FMEA), Hazard and operability (HAZOP) study. Hazard Ranking (DOW & MOND Index)

Ans → ~~Effect~~ Failure Mode and Effect Analysis (FMEA)

This procedure consider each component of a plant in turn and all possible failure modes and rates. and their consequences. The results are in a standard format. HAZOP study is well developed form of FMEA.

It is a process of hazard indetification where all known failure modes of component or features of a system are considered in turn and undesired outcome are noted.

It is a tabulation of system/plant equipment failure mode - Each failure mode assign critical ranking. Human/operational error is not generally examined in FMEA

This is the method derived from reliablity engineering. A product or a piece of complex equipment is divided in its component and each component is studies to know how it can fail, at what rate and what could be affected on it or on the other component failure rates of each item are determined and listed. The method is used to determined satisfactory operational life of an equipment, how failure might occur, modes and frequencies of failure and the necessity for proper

and timely maintenance and replacement. This knowledge can be used to improve the life & quality of the product. Thus it is primarily more useful to a manufacturer than its users.

Hazard And Operability (HAZOP)

HAZOP is defined as 'The application of a formal systematic critical examination to the process and engineering intention of the facilities to assess the hazard potential of mal-operation or malfunction of individual item of equipment and the consequential effect on the facility as a whole'.

In HAZOP a multidisciplinary team searches deviations from design intent through fixed set of guide words or checklist or knowledge.

HAZOP can be conducted to check the design or operating procedure for a new project or an existing one. It can also be conducted to improve safety of existing facilities. It is also useful before implementing significant modification or for other operational or legal reason. After carrying out the PHA as explained earlier, the plant component system or machine/equipment part which can cause major hazard become known to us. Now to find out deviations or malfunction leading to such event and its mode of operation, HAZOP help us.

THUS HAZOP is complimentary to PHA. HAZOP study is carried out to determine deviation from normal operation and operational malfunction which could lead to uncontrolled events.

Hazard Ranking (DOW & MOND Index)

This is a method of identifying and ranking of Hazard present in a process plant. It was developed by DOW chemical, USA & is usually known as DOW fire and explosion Index. ICI improvement on this is known as mond index.

The Index provide weightage for inventory flamability, reactivity, toxicity and hazard due to reaction. exotherm, operating condition corrosivity, plant drainage, access, rotating equipment leacky joint etc.

The ranking indicates damage radius, maximum probable property damage (MPPD) and maximum possible days outage (MPDO). The ranking is usefull for desicion making, for example it shows why protection is more extensive in storage sphere than LPG reflux drum.

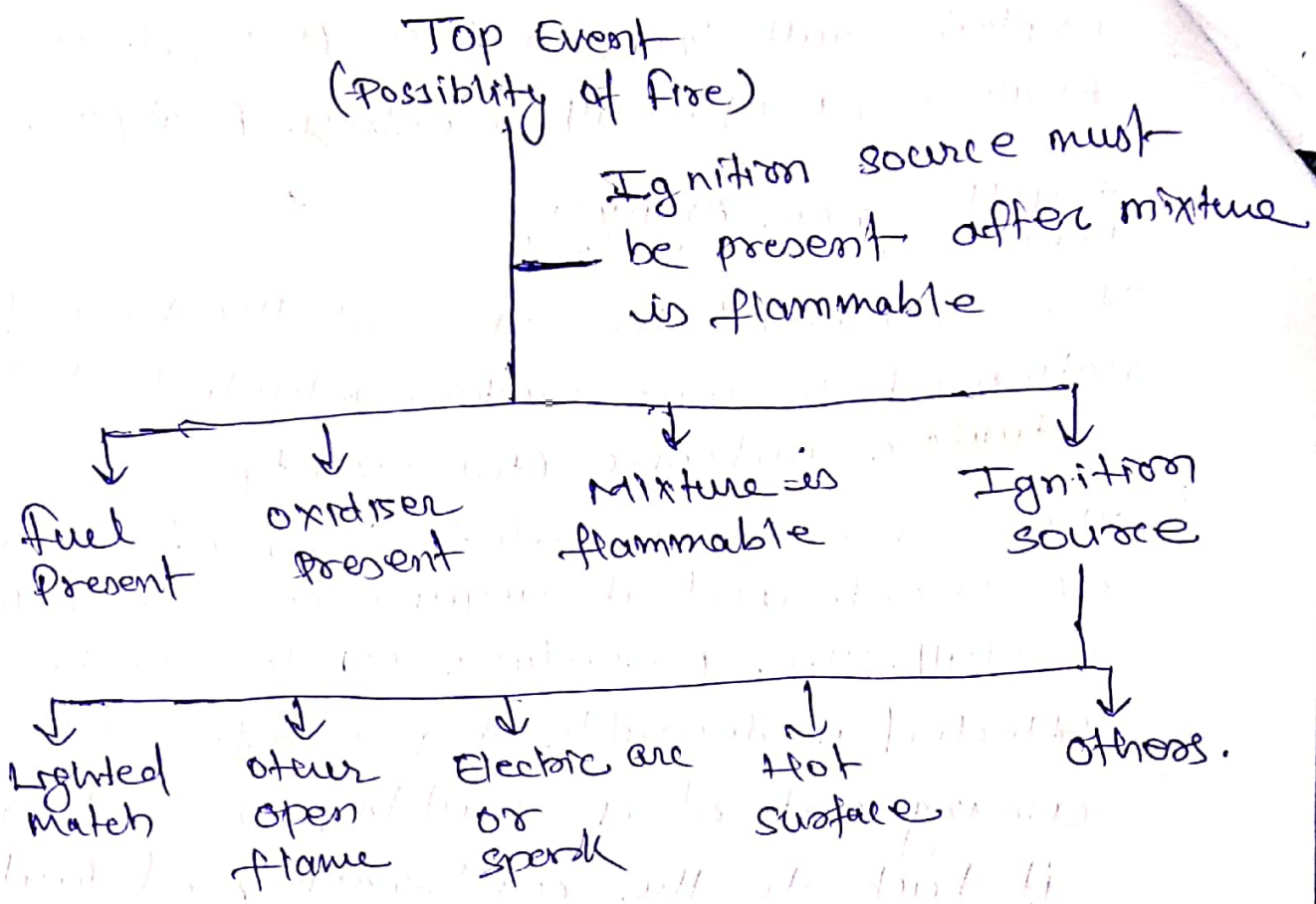
Q8 Explain Fault Tree Analysis (FTA), Event Tree Analysis (ETA); Vulnearablity Analysis.

Fault Tree Analysis

⇒ It is a method to represent the logical combination of various system which lead to a particular outcome (top event)

⇒ This is a sophisticated form of reliability assesment and it require considerable time & skill. The procedure is to start from a selected undesirable top event such as gas coming out of a scrubber and then trace it back to the combination of fault and condition which could cause the event to occur. Apart from identification of hazard it is widely used for quantitative risk analysis. It will be necessary to obtain meaningfull failure data each component to arrive at the frequency of occurence to the 'top event'

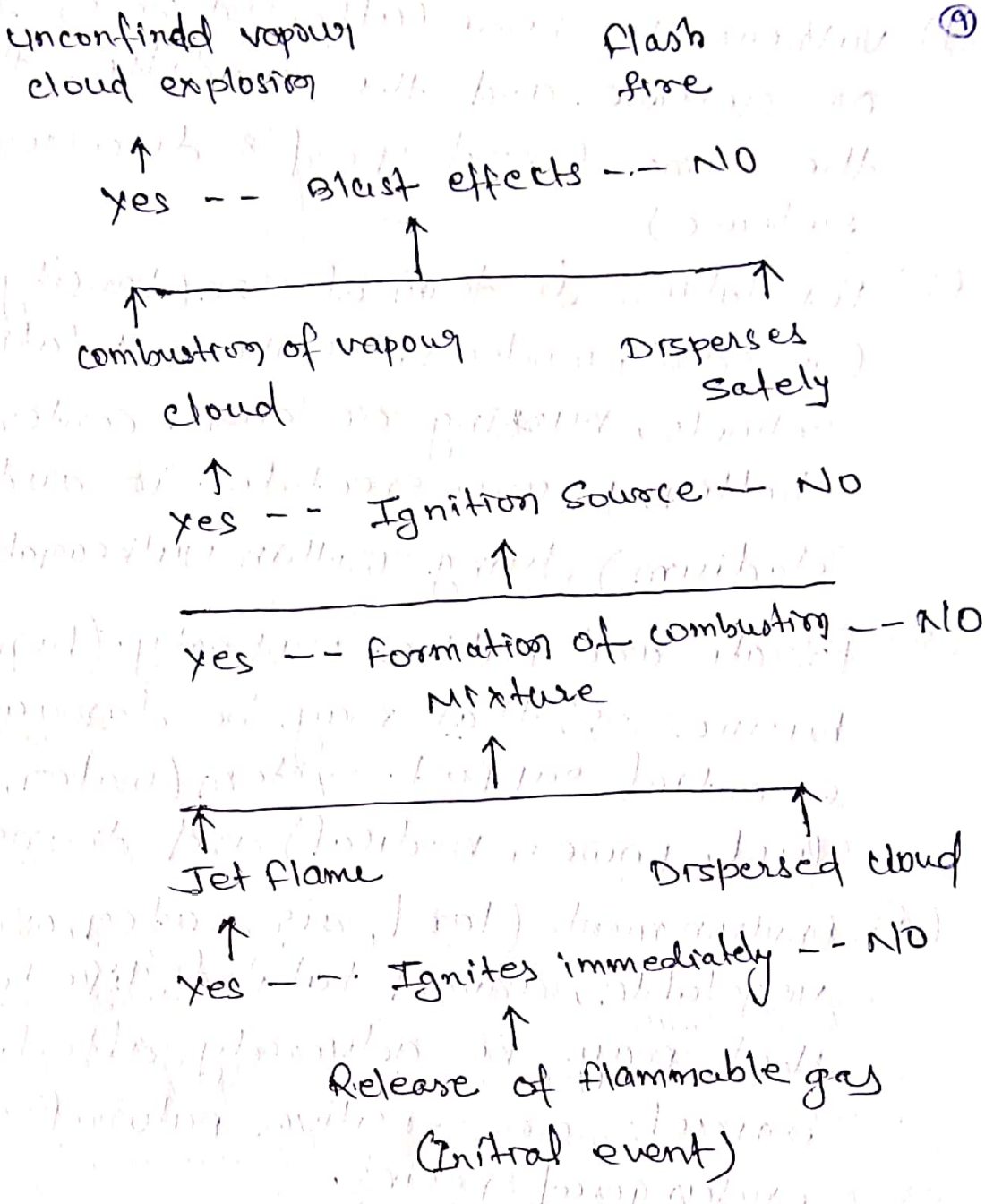
⇒ In fault tree analysis, abnormal operation are assumed in normal operations of a plant. The ultimate abnormal event Top. Then all combination of individual failure that can lead to that abnormal event are shown in the logical format of the fault tree.



Even Tree Analysis

Event tree Analysis is a method to illustrate te intermediate and final outcome which may arise after the occurance of a selected initial event.

This Technique is complementry to fault tree, but in reversed direction. Whereas a fault tree start from a final event and work from the top down, an event tree begin with initial event such as a power failure and explore all possible outcome by working from the buttom up. An Illustration is shown below, for an initial event of release of flamable gas.



Vulnearability Analysis

vulnearability is the suspectibility of life, property and the environment to injury or damage if a hazard manifest its potential. The vulnearability analysis indentifies what part of the community is suspectible to more damage if hazardous substance release. It provide information on:—

(1) Vulnearable zone (affected zone) for a release and the condition that affe the zone (wind speed & direction, size of release)

(2) Population in term of size (density) and types (resident, workers, sesitive population hospitals, schools, nursing or care centers, old men's shelter, prisons, spectator in auditorium or stadium) lying within vulnearable zone.

(3) Private and public property (homes, offices, businesses) that may be damaged, including essential support system (water, milk, food, fuel, power, medical) and transport center,

(4) Environments (land, air, water, crops, food, vegetable, animal habitat, livestock etc) that may be adversely affected and impact on sensitive natural areas. endangered species.

To get info on 4 (ie vulnearable zone) mathematical and computer model of probit equation can be used. To get into on 2, 3, 4, following step are useful.

(1) Survey of the area (first hand into by driving through the area)

(2) Interviews of fire, police, emergency and planning department personnal.

(3) Review of planning department document & statistics on land use, population, highway usage and the area's infrastructure.

Q. What is the need for Safety Audit? Explain the procedure in Safety Audit

Need of Safety Audit :-

Safety Audit is mainly required for two reasons :-

(a) Safety Requirment :- It is utmost necessary for the purpose of maintaining safety (accident free atmosphere) in industry that all system of work should be throughly checked from safety ~~Audit~~ point of view at regular interval and deficiencies identified should be removed by due compliance of Safety recommendation - A - pre - determined checklist is useful for fixed class of industry (eg. chemical industry) but, however audit point are variable and should be best suitable to type of industry to be audited.

(b) Legal Requirment

Rule - 12C & 6B-O of the Gujrat Factories Rule 1963 and rule 10 & 12 of the manufacture, Storage and Import of Hazardous chemical rules 1989 need submission of Safety Audit report to the concerned authorities within prescribed time.

Safety Audit procedure :-

Lead auditor along with his team may adopt following procedure :-

(1) Constitution of Audit team (at least two 'member)
(2) Constitution of Auditee representative
(3) Recording Indentification and brief history of the auditee industry
(4) Deciding audit goal, objectives and scope
(5) Drawing audit plan with time schedule
(6) Holding ~~operating~~ opening meeting with auditee
(7) Study of process and aplicablity of safety law & standard.
(8) Taking plant round and document
(9) Examining record and document
(10) Filling checklist of audit point (eg. filling of annexure A, B, & C of IS 14489) Element wise (Annex A) file will be usefull
(11) Holding of closing meeting and discussing finding.
(12) Preparation and submission of audit report
(13) Report distribution for compliance
(14) Compliance audit if required by auditee or client
(15) Visit for compliance audit and its report.

Explain the need & types of emergency plan

Need for Emergency Planning

(1) Experience of year have shown that accident dangerous occurange, emergency or disasters occur at any time and we lose life, property production etc. if not fully pepared to control over and minimize it. therefore it is most advisable to foresee such situation and to plan for total loss prevention and control.

(2) There is no alternative to emergency planning only the best planning, periodically drill or rehersal, coordinated and sincere by all authorities at all times and speedy follow up as per planning will help to achieve the goal.

(3) Planning reduces the thinking time for necessary step at the time of accident.

(4) Prevention is better than cure. Planning intends first prevention and if it fails, subsequent control. to cure the situation Emergency need such planning.

(5) It is easy to set in motion all machinery already planned and trained in advance to meet the situation.

(6) Planning helps to contain the incident and to minimise the loss to the national wealth including live resources, bussiness & Administration.

Types of emergencies :—

There are three basic emergencies

(1) Operating Emergency :- It is an emergency, that can be locally handled by unit personel alone without help eg. small fire, air failure cooling water failure, steam failure. gas leak etc

(2) Fire Emergency :- It is fire which is beyond the control of operating staff or the unit. It requires the assistance of the other fire fighting force.

(3) Distaster :— A disaster is a catastrophic situation in which the day to day pattern of life are in many instances, suddenly disrupted and plunged into helpness and suffering and as a result need protection clothing. shelter, medical & social care and other, necessities of life