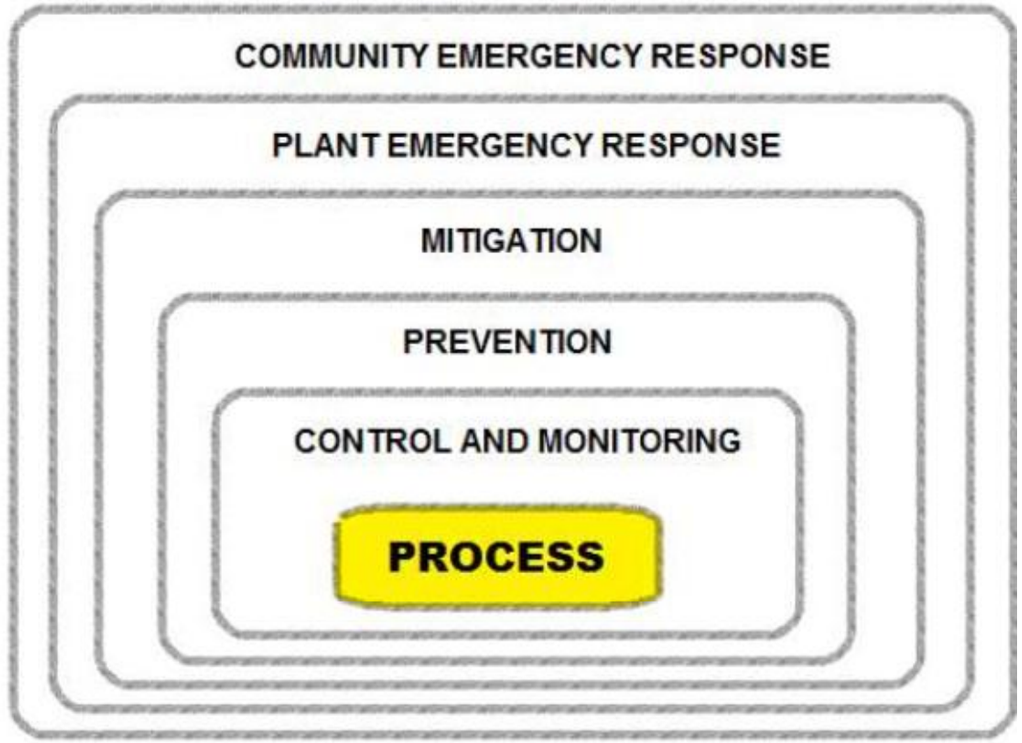
PLANT SAFETY

THE MOST EXPENSIVE SAFETY EQUIPMENT,YOU CAN BUY IS ONE YOU INSTALL AFTER THE CATASTROPHIC INCIDENT.

- HAZARD is a substance/situation that poses a threat to life, health, property, or environment.
- INDUSTRIAL HAZARD is a condition produced by an industry that may cause injury or death of personnel and loss of product or property.
- RISK is a measure of possible damage in case of an accident from a known hazard.
- SAFETY in simple terms means freedom from occurrence of accidents and loss of life.



Layers of Protection

SPECIFICATION

- THE HSE STUDY SUGGESTS THE MOST FAILURES ARE RELATED TO INADEQUATE TECHNICAL SPECIFICATION. THIS MAY BE DUE TO LACK OF PERSONNEL EXPERIENCE OR TRAINING OR SIMPLY DUE TO ERRORS MADE DURING THE ASSESSMENT OF THE FOLLOWING :

- PROCESS HAZARDS

- REQUIRED DEVICE FUNCTIONALLY

- FAILURE MODES ASSOCIATED WITH THE DEVICES USED TO IMPLEMENT THE PROTECTION LAYERS.

PROTECTION LAYERS

- PROCESS.
- CONTROL AND MONITORING.
- PREVENTION.
- MITIGATION.
- PLANT EMERGENCY RESPONSE.
- COMMUNITY EMERGENCY RESPONSE.

SAFETY- PROCESS

- UK HEALTH AND SAFETY AND EXECUTIVE (HSE) ANALYSED THE MAIN CAUSE OF FAILURES IS SPECIFICATION.
- ALL SPECIFICATION SHALL BE AS PER GOOD ENGINEERING PRACTICES.
- ALL SYSTEM DESIGN SHALL AS PER NATIONAL/INERNATIONAL CODE /STANDARD-AS PER ASME,ASTM,DIN,BS ,IEC ,NFPA ,ISA,OSHA,EPA etc
- ALL PIPING COMFORM TO ASME B 31.1.
- ALL INSTALATION AND COMMISSIONING AS PER DESIGN.

CONTROL & MONITORING

- BASIC CONTROL SYSTEM.
- MONITORING SYSTEM.
- ALARM SYSTEM.
- GOOD OPERATOR SUPERVISION.

PREVENTION

- MECHNICAL SAFETY VALVE/SYSTEM
- PROCESS ALARM WITH OPERATOR ACTION
- SAFETY INSTRUMENTED CONTROL SYSTEM.

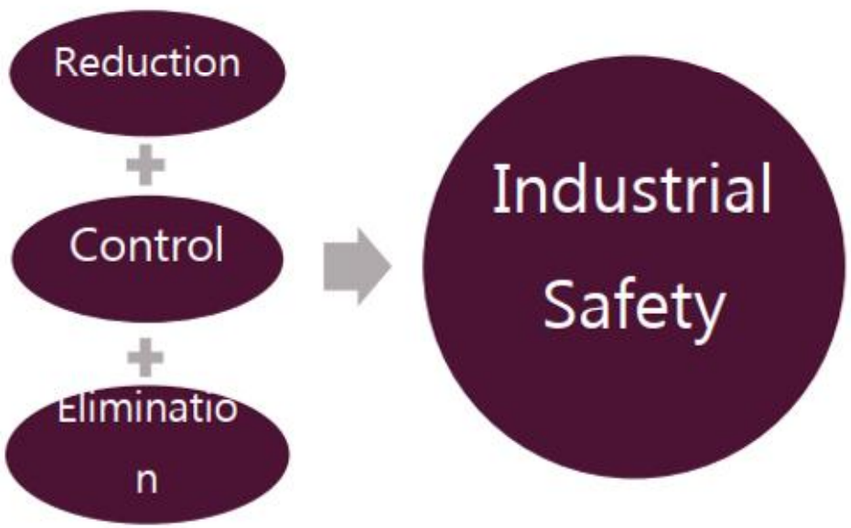
MITIGATION

- MECHANICAL SAFETY VALVE/FAIL DEVICES /MITIGATION DEVICES
- BURNER MANAGEMENT SYSTEM AS NFPA 85
- TURBINE PROTECTION
- INTERLOCK & PROTECTION DESIGN AS PER ISA 84,IEC 61508,IEC 61511
- OPERATOR SUPERVISION & ACTION

PLANT SAFETY OR INDUSTRIAL SAFETY

INDUSTRIAL ACCIDENTS are caused by chemical, mechanical, civil, electrical or other process failures due to accident, negligence, or incompetence in an industrial plant causing damage to life and property.

INDUSTRIAL SAFETY is defined as policies and measures put in place to ensure plant and factory workers' protection from hazards that could cause injury.



INDUSTRIAL HAZARDS : CLASSIFICATION

- FIRE HAZARD
- PHYSICAL HAZARD
- MECHANICAL HAZARD
- ELECTRICAL HAZARD
- CHEMICAL HAZARD

FIRE HAZARD

CAUSE :

- Overheating of electrical appliances
- High surface temperatures
- Sparking
- Carelessness

STEPS :

- Raise alarm and Evacuate
- Use staircases only
- On encountering thick smoke, crawl, cover nose and mouth with wet cloth.

PHYSICAL HAZARD

REASONS :

- Negligence
- Hurry
- Lack of Maintenance

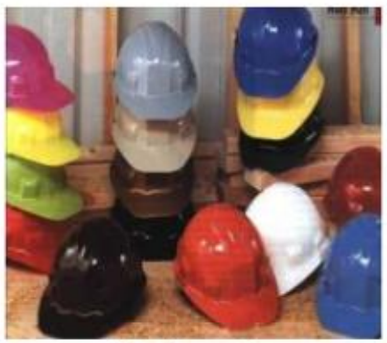
STEPS to be taken :

- Use of Personal Protection Equipment (PPE) at all times
- Safety Training
- Warning Labels

PERSONAL PROTECTIVE EQUIPMENTS

- PPE is designed to protect employees from serious workplace injuries or illnesses.
- It includes various devices and garments, such as :

Hand Protection



Helmets

Eye Protection

Ear Plugs

Foot Protection

Respirators

MECHANICAL HAZARD

REASONS :

- Insecurely fixed machines
- Worn-out parts
- Dangerous parts (sharp edges etc.)
- Improper maintenance

SAFETY MEASURES :

- Guarding and Fencing of moving machine parts
- Emergency Shutdown button within reach of operator
- Turnkey system for cleaning and repairing
- Safe Distance from machine

Electrical Hazards

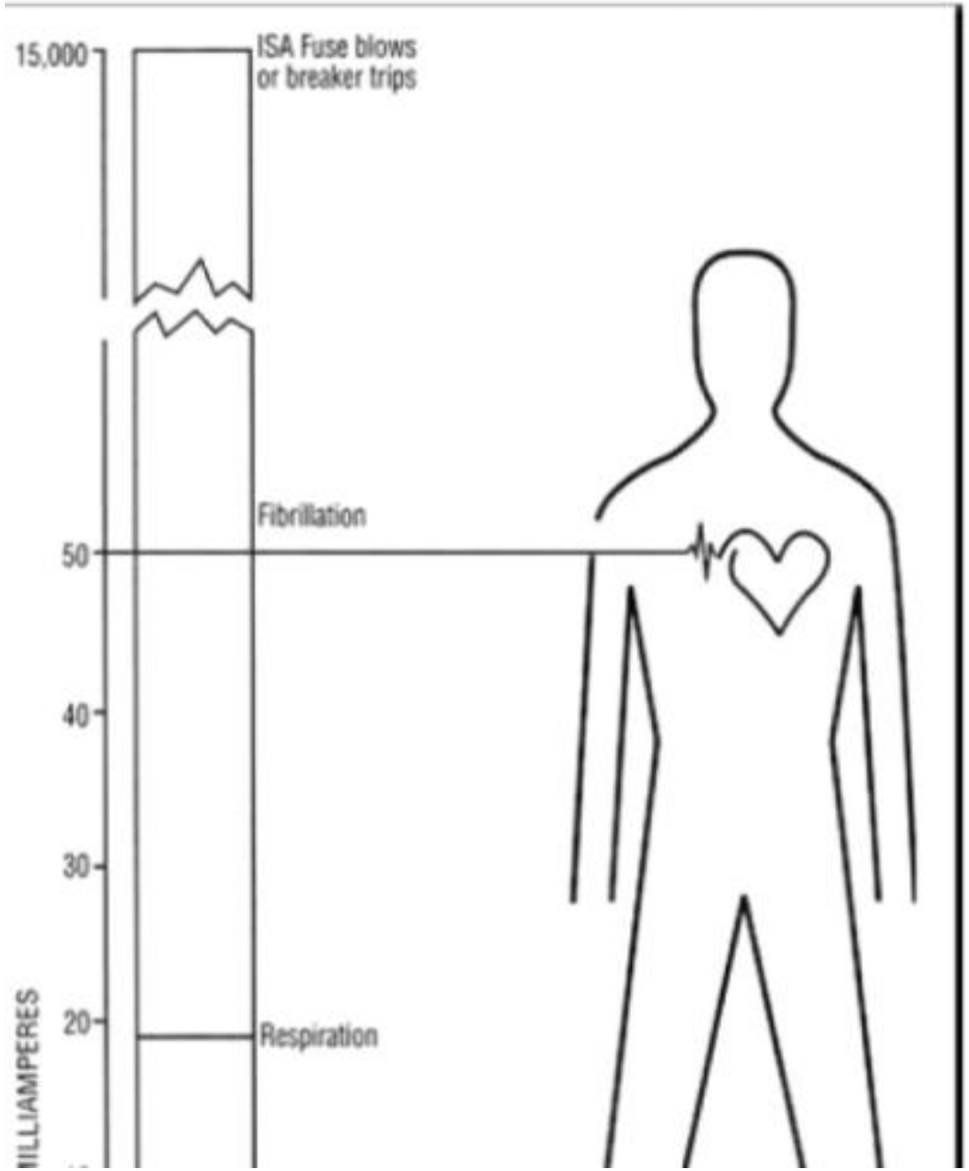
Electrical Injuries

The most common types of electrical injuries are:

- Electrical shock
- Electrocution (death due to electrical shock)
- Burns
- Falls

SAFETY MEASURES

- Don't wear metal objects
- Turn power off
- Wear appropriate clothing
- Don't touch live parts
- Don't install or repair electrical equipment
- Use qualified personnel
- Clean and dry leads and plugs before use
- Heed warning signs
- Use the right equipment
- Study the operation manual
- Take care of extension leads



Readings		Effects
Safe Current Values	1 mA or less	Causes no sensation - not felt.
	1 mA to 8 mA	Sensation of shock, not painful; Individual can let go at will since muscular control is not lost.
Unsafe current values	8 mA to 15 mA	Painful shock; individual can let go at will since muscular control is not lost.
	15 mA to 20 mA	Painful shock; control of adjacent muscles lost; victim can not let go.
	50 mA to 100 mA	Ventricular fibrillation - a heart condition that can result in death - is possible.
	100 mA to 200 mA	Ventricular fibrillation occurs.
	200 mA and over	Servere burns, severe muscular contractions - so severe that chest

ELECTRICAL HAZARD

CAUSES :

- Contact with power lines
- Grounding is missing or discontinuous
- Equipment not being used under prescribed conditions
- Damaged insulations

REMEDY :

- Safer power distribution systems to automatically detect failure and notify operators
- Regular checking of all equipment
- Safety trainings, safe work practice & warning labels
- Proper cooling arrangement for heat-producing electrical equipment

CHEMICAL HAZARD

Chemical Hazards may be caused by inhaling toxic fumes, or direct contact with corrosive/carcinogenic chemicals.

EFFECTS :

- Skin Burn
- Irritation in windpipe
- Ulcer in hand, nose, etc.
- Cancer

STEPS :

- Personal Protective Cloths, Respirators
- Leak-proofing
- Pressure regulators and relief valves
- Colour coded piping and storage
- Warning labels

How to Control Hazard ?

3 step process

Step 1: Hazard Identification Techniques

Step 2. List, rank and set priorities for hazardous jobs

Step 3. Controlling Hazards

Hazard Identification Techniques

- ## Safety audit

A systematic & independent examination of all or part of a total operating system to determine whether safety activities comply with planned arrangements

Safety survey

Safety survey is a detailed & in-depth examination of a narrow field of activity *eg*...

•Individual plants OR A specific problem.

- ## Safety inspection

A routine scheduled inspection of a department or unit which may be carried out by personnel within the unit. During inspection deviations from safety standards, employee's unsafe work practices and unsafe conditions are checked.

- ## Safety tour

Safety tour is an unscheduled examination of a work area, carried out by any personnel from manager to safety committee members to ensure that company's safety standards and procedures are being observed.

- ## Safety sampling

A specific application of safety inspection / tour designed for random sampling of any activity

Steps to Control Hazard

Step 2. List, rank and set priorities for hazardous jobs -

List jobs with hazards that present unacceptable risks, based on those most likely to occur and with the most severe consequences. These jobs should be your first priority for analysis.

Steps to Control Hazard

Step 3. Controlling Hazards

finding Solutions to Control Hazards and execution of measures

Hazard can be eliminated

(i) At the Source

(ii) Along the path from hazard to the Worker

(iii) At the level of the worker

Hazard Removal at the Source

Elimination –

Getting rid of a hazardous job, tool,machine or substance is perhaps the best way of protecting workers.

Substitution –

Sometimes doing the same work in a less hazardous way is possible.

Redesign –

Jobs and processes can be reworked to make them safer.

Automation –

Hazard Removal along the path from Hazard to Worker

1. **Barriers -** A hazard can be blocked before it reaches workers. Proper equipment guarding will protect workers from contacting moving parts.

2. **Absorption -** Enclosures can block or absorb noise.

3. **Dilution -** Some hazards can be diluted or dissipated. For example, ventilation systems can dilute toxic gasses before they reach operators.

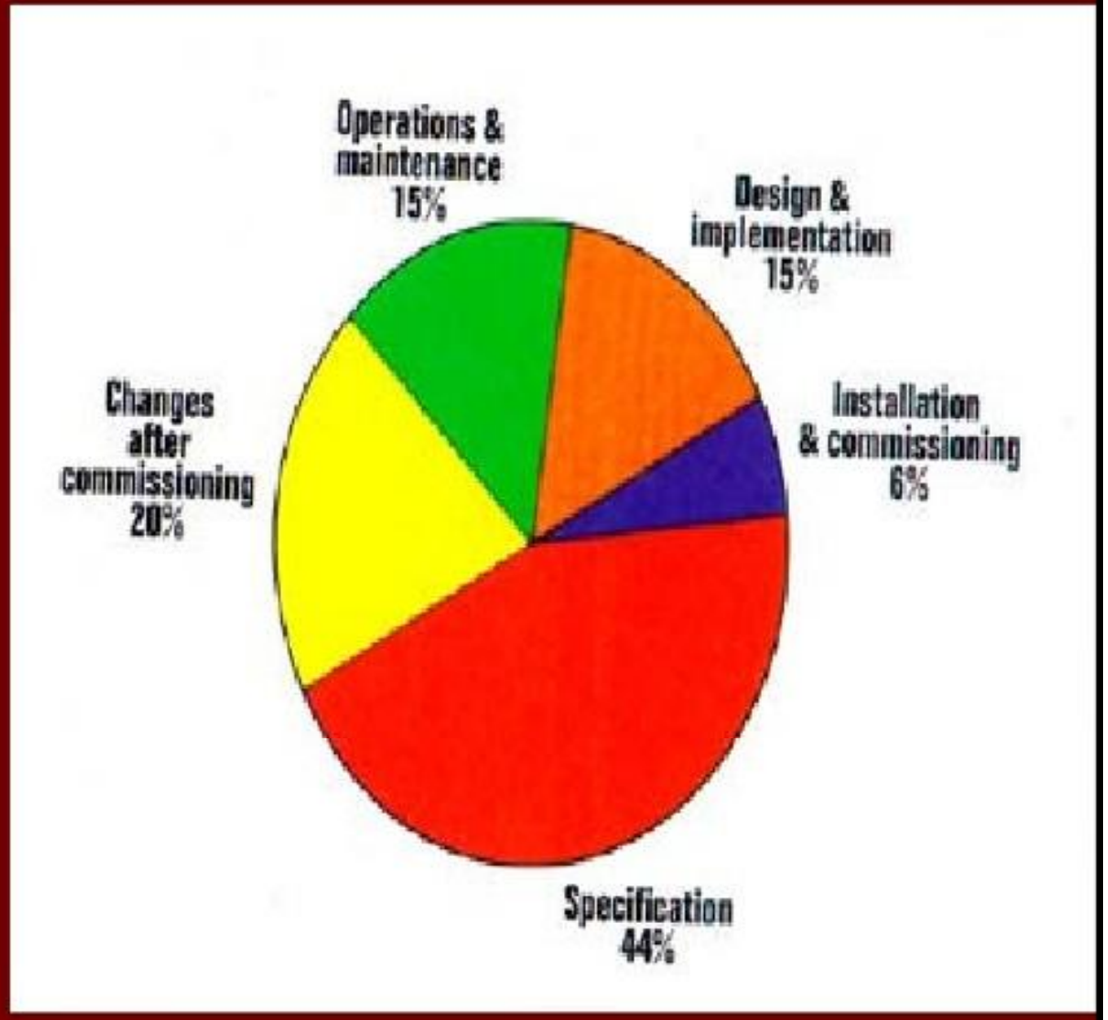
Hazard Removal at the Level of Worker

- Work procedures, supervision and training
- Job rotations and other procedures can reduce the time that workers are exposed to a hazard
- Housekeeping, repair and maintenance programs
- **Personal protective equipment (PPE)**

CAUSE OF INDUSTRIAL ACCIDENT

- UK HEALTH AND SAFETY AND EXECUTIVE (HSE) ANALYSED THE CAUSE OF A NUMBER OF FAILURES/ACCIDENT:

3. SPECIFICATION-44%
5. CHANGES AFTER COMMISSIONING-2O%
7. OPERATION & MAINTANCE-15%
9. DESIGN & IMPLEMENTATION-15%
11. INSTALATION & COMMISSIONING-6%



CAUSE OF MAJOR ACCIDENTS

In any incident there are usually two types of causes:

- Direct causes, that occur immediately prior to the undesirable event;
- Underlying causes, either in time or space, there are that contributed to the immediate, direct event.

FACTORS OF RISK CONTROLS

- ✓ **ELIMINATION** - The most effective control measure is to remove the hazard or hazardous work practice associated with the plant.
- ✓ **SUBSTITUTION** – Substitute the plant(hazardous parts of the plant).
- ✓ **ISOLATION** – Separate the hazardous plant from people, either by distance or physical barrier.
- ✓ **ENGINEERING CONTROLS** – Include modifications to tools or equipment, for example installing guards to prevent contact with moving parts machinery.

PERSONS ARE INVOLVED IN PLANT SAFETY

OFFICERS - Ensure the business to comply with safety standard.

WORKERS – Take care for own health and safety and no adversely affect the health and safety of other persons.

DESIGNERS – Eliminating hazards and risks before plant is introduced in the workplace and provide specific information to the manufacturer.

Cont'd

MANUFACTURERS – Advise the designer of any hazards you identify during manufacturer and ensure that the hazards are not incorporated into the manufacture of the plant.

INSTALLERS – Sets up, assembles, places in position and connects or otherwise makes plant ready for use.

SAFETY CONCERNS ON PLANTS

❑ SLECTION OF PLANT

- Select plant that is suitable for the intended use along with the right equipment for the job.
- Provide proper maintenance, installation and operation of equipments a/c to the proper instructions.

❑ INSTRUCTION, TRAINING & SUPERVISION

- Provide workers and other persons who are to use plant with information, training, instruction or supervision that is necessary to protect them from risks arising from the use of plant.

❑ INSPECTION & TESTING

- Must be carried out regularly by an authorized person to check if the plant and its equipments still falls under safety standards.

❑ MAINTENANCE, REPAIR & CLEANING

- Ensure that plant is maintained and repaired according to the manufacturer's specifications and accordance.
- Make sure that plant should be isolated and shutdown before maintenance, service or cleaning commences.

SPECIFIC CONTROL MEASURES & PERSONAL PROTECTION

- **OPERATOR CONTROLS**

- Suitable identified so as to indicate their nature, function and direction of operations.

- **EMERGENCY STOPS**

- Be prominent, clearly and durably marked. For example EMERGENCY STOP-PRESS

- **WARNING DEVICES**

a. Audible devices

b. Motion sensors

c. Lights

Cont'd

PEDESTRIAN SAFETY

- Pedestrian policy – A pedestrian's safety depends on being responsible for his or her well being.

  Pedestrians have the "right-of-way". But must exercise caution and not walk into the path moving vehicles.

- .Pedestrian Rules

a. Running is not allowed on-site.

b. Use a free hand to hold handrails.

c. Pedestrian must recognize their personal responsibility.

Cont'd

PERSONAL PROTECTION

a. Foot Protection rules

1. toecaps are acceptable for short-term use.
2. keeps all safety shoes.

b. Head Protection

1. welding hood and face shield.
2. chemical goggles.

c. Hand Protection

1. glove selection is based on the hazard.
2. check with your standard procedure.

d. Eye & Ear Protection

e. Policy On Hair & Clothing

RIGHTS AND RESPONSIBILITIES

EMPLOYER RESPONSIBILITIES

- Ensure health and safety of employees and of other workers at your workplace conditions.
- Learn and follow safe work procedures.
- Use protective equipment, devices and clothing.
- Perform work in a safe manner.
- Cooperate with joint committee or worker health and safety representative.
- Be alert to hazards/problems.

Cont'd

EMPLOYERS RIGHTS

- Use safe work procedures.
- Report any unsafe conditions in the workplace.
- Wear their personal protective equipment(PPE) at all times.
- Use well-maintained and functioning personal protective equipment(PPE)
- Refuse unsafe work
- Receive proper health and safety information, training and instructions.


THANK
YOU

Any Question?