

MODULE 1

Need For Safety

- To protect health of all employees
- To ensure well being of all workers
- To promote positive culture in all organization or company
- To ensure accident and incident prevention
- To ensure organization development and its growth
- To ensure continual improvement of company

Accident

- An accident is an unintentionally-caused event.
- An unexpected event that results in serious injury or illness of an employee and may also result in property damage.
- Accidents which take place in the workplace are referred to as occupational accidents.
- Workplace accidents include events that damage property, inhibit a particular workplace function, or cause harm to a person located in the workplace.

Unsafe Act	Unsafe Condition
The unsafe act is a violation of an accepted safe procedure which could permit the occurrence of an accident	The unsafe condition is a hazardous physical condition or circumstance which could directly permit the occurrence of an accident
80% of all injuries on duty are the result of unsafe Acts by people	A study attributes 20% of all injuries on duty to unsafe working conditions.
Eg: Due to Speed Using Defective equipment Using equipment improperly	Eg: Loud Noise Poor Layout of site Hazardous Environmental Conditions

THEORIES OF ACCIDENT CAUSATION

Accident causation theory is the art and science that seeks to understand the deeper roots of why accidents happen.

1. Henrich Domino Theory

A theory of accident causation and control, developed by H.W. Heinrich. That propose that all accidents, whether in a residence or a workplace environment, are the result of a chain of events. The chain of events consists of the following sequential factors: ancestry and social environment, an individual's mistake, an unsafe action and/or physical hazard, the actual accident, and an injury as the result of the preceding factors. These factors are described as dominoes, and the removal of any one of these five factors can prevent the accident.

3E 's of Henrich Domino Theory

Engineering

- Control hazards through product design or process change

Education

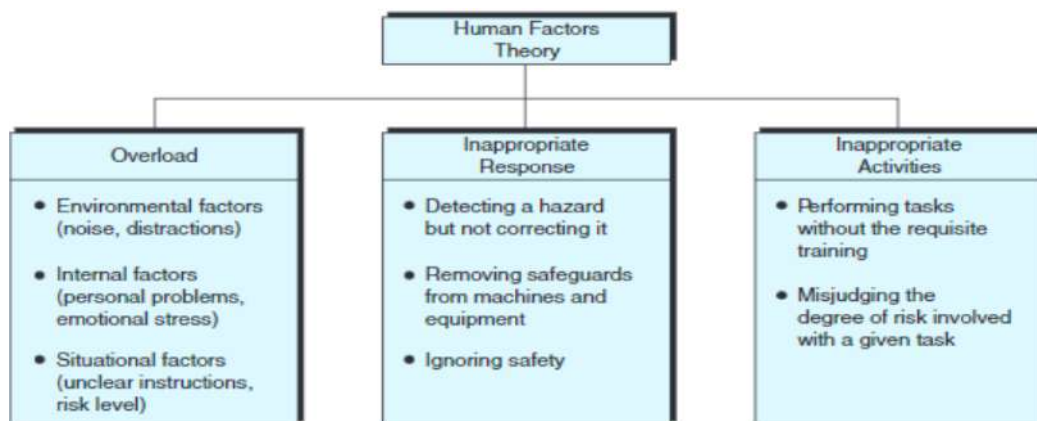
- Train workers regarding all facets of safety
- Impose on management that attention to safety pays off

Enforcement

- Insure that internal and external rules, regulations, and standard operating procedures are followed by workers as well as management.

2. Human Factors Theory

The human factors theory of accident causation attributes accidents to a chain of events ultimately caused by human error. It consists of the following three broad factors that lead to human error: overload, inappropriate response, and inappropriate activities.



Overload

- The work task is beyond the capability of the worker
- Includes physical and psychological factors
- Influenced by environmental factors, internal factors, and situational factors.

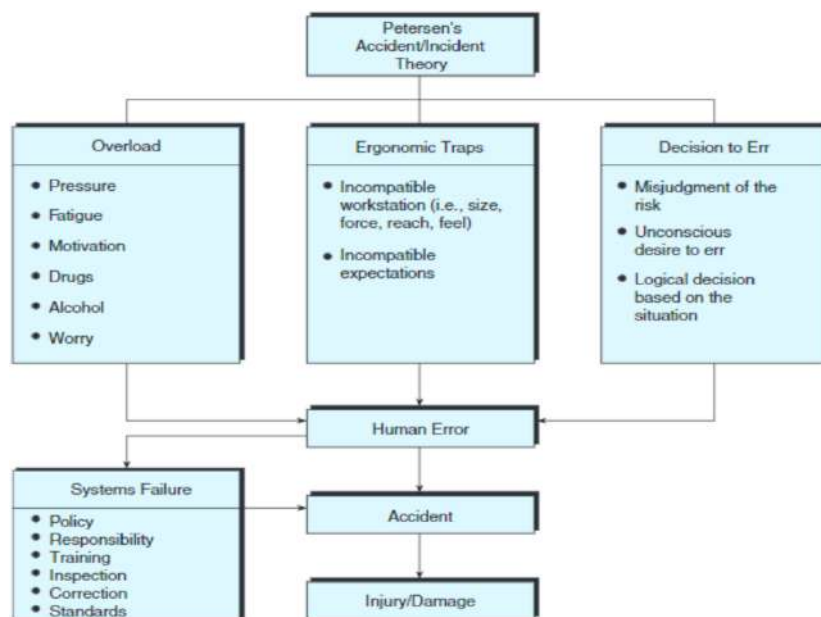
Inappropriate Worker Response

- To hazards and safety measures (worker's fault)
- To incompatible work station (management, environment faults)

Inappropriate Activities

- Lack of training and misjudgment of risk

3. Peterson's Accident Theory



4. Epidemiological Theory of Accident Causation

- This field studies relationship between environmental factors and disease
- Can be used to study causal factors in a relationship

Two key components:

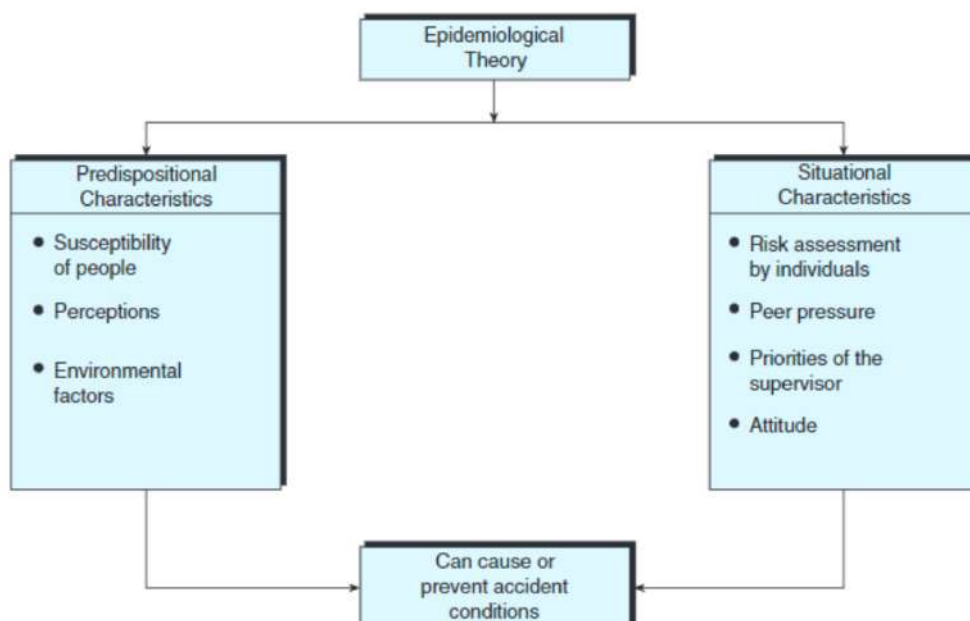
1 Predisposition characteristics

- Tendencies may predispose worker to certain actions

2 Situational characteristics

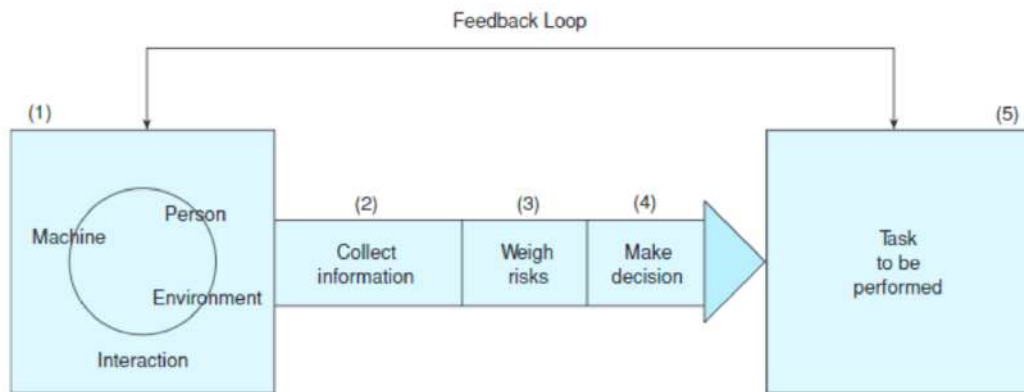
- Peer pressure, poor attitude, risk taking

Together these characteristics can cause or prevent accidents that a person predisposed to a given situation.



5. System Theory of Accident Causation

This theory views a situation in which an accident may occur as a system comprised of the following components: person (host), machine (agency), and environment.



6. Combination Theory

Accidents may/may not fall under any one model

- Result from factors in several models.
- One model cannot be applied to all accidents

7. Behavioural Theory

Often referred to as behavior-based safety (BBS)

7 basic principles

- Intervention
- Identification of internal factors
- Motivation to behave in the desired manner
- Focus on the positive consequences of appropriate behavior
- Application of the scientific method
- Integration of information
- Planned interventions

8. Energy Release Theory

Willam Haddon a medical doctor and the administrator of NHTSA at one point in time, in 1966 helped to impose the following regulations for new cars:

1. Seat belts for all occupants
2. Energy-absorbing steering column
3. Penetration-resistant windshield
4. Dual braking systems
5. Padded instrument panel
6. All measures correspond with the energy and barrier concept

Roles

Roles of Management in Safety

- Management decisions are at the forefront of working practices and outcomes.
- Timely payment of compensation
- Compliance of applicant
- Following specific rules and regulations
- Appointment of medical, welfare and safety officers
- Formation of committee(safety, welfare, pollution control, canteen..)
- Education and training employees

Roles of Supervisor

- Are responsible and accountable for their team's health and safety performance;
- Conduct informal health and safety meetings with their employees at least monthly;
- Enforce all safe systems of work procedures that the Departmental Manager has issued
- Enforce PPE requirements

Responsibility of Safety Officer

- Plan and implement OHS policies and programs
- Advise and lead employees on various safety-related topics
- Prepare educational seminars and webinars on a regular basis
- Review existing policies and procedures
- Adhere to all the rules and regulations
- Work with HR to set up a new employee on-boarding process for safety
- Conduct risk assessment
- Enforce preventative measures
- Identify process bottlenecks and offer timely solutions
- Check if all the employees are acting in adherence with rules and regulations
- Prepare and present reports on accidents and violations and determine causes
- Oversee workplace repair, installations and any other work that could harm employees' safety

Role of Union ins Safety

- Trade Unions protect the worker from wages hike, provides job security through peaceful measures.
- Trade Unions also help in providing financial and non-financial aid to the workers during lock out or strike or in medical need.

Safety Committee

- A safety committee is an organization group that operates within a workplace and is composed of members from its various departments, including management, frontline workers, and office staff.
- The main purpose of a safety committee is to mitigate the risk of workplace injuries and illnesses.

Functions:-

- o Developing written safety programs
- o Promoting safe work practices
- o Facilitating safety training
- o Performing workplace inspections
- o Carrying out accident investigations

MODULE 2

TYPES OF PPE

SL No.	Types	Description	Example
1	Eye Protection	Help to protect the mucus membranes of the eyes, as well as help to reduce the risk of foreign objects entering the eyes and damaging them.	Goggles
2	Head Protection	Head protection can protect the head from physical hazards, they can also protect other parts of the upper body, such as the neck, hair, nose and ears. Types ; Class A, B ,C, Bump Hats	Industrial Safety Helmets, Bump Caps
3	Ear Protection	Exposure to noise levels over 85 dB can cause hearing loss Hearing protection required at 90 dB	Ear muffs, Ear plugs, Canal caps
4	Foot Protection	To protect foot from falling objects.	Safety Shoes, Boots , Wellington shoes, Leggings, Toe guards, Foundry Shoes
5	Hand & Arm protection	To protect hand from hazardous materials and from chemical reactions	Gloves, Sleeves, Thermal gloves
6	Skin Protection	Protective clothing must be suitable for the hazard . To protect skin from hazardous materials	Jackets , Tops, Trousers, Vests
7	Fall Protection	Used by individuals when they are working at height, they can wear the harness	Ropes, Cliff Hanger
8	Body Protection	To Protect body from injuries	Thermal Jackets, Shields, Body Proofs

Frequency Rate

The frequency rate is the number of disabling injuries per one million man-hours worked

Number of workers=500

Number of disabling injuries per year= 5.

Average number of hours worked by worker per year=2000.

Sol. Frequency rate=numbers of disabling injuries/number of man-hours worked x 1000,000

$$= 5/500 \times 2000 \times 1000000 = 5.$$

Severity Rate

Severity rate=days lost in year due to accidents/number of man-hours worked x 1000,000

Eg:

Number of workers=2000.

Number of days lost in a year due to accidents=100 Average number of hours worked by

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

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

NOTE 1 — If the injury does not cause loss of time in the period in which it occurs but in a subsequent period, the injury should be included in the frequency rate of the period in which the loss of time begins.

NOTE 2 — If an injury causes intermittent loss of time, it should only be included in the frequency rate once, that is, when the first loss of time occurs.

NOTE 3 — Since frequency rate F_B is based on the lost time injuries reportable to the statutory authorities, it may be used for official purposes only. In all other cases, frequency rate F_A should be used for comparison purposes.

worker per year=2000.

Sol. Severity rate=days lost in year due to accidents/number of man-hours worked x1000,000

Number of man-hours worked in this case=2000 X 2000.

Days lost in year due to accidents=100+35=135.

$$\text{Severity rate} = \frac{135}{2000 \times 2000} \times 1000,000 = \frac{135}{4} = 33.75 \text{ answer.}$$

House Keeping

- Refers to the management of duties and chores involved in the running of a household, such as cleaning, cooking, home maintenance, shopping, and bill payment.
- These tasks may be performed by members of the household, or by other persons hired for the purpose.

Responsibility of management and employees.

- Managers must train employees to recognize potentially hazardous conditions and take corrective actions before they cause injuries like sprains, strains, falls;
- Proper training to identify hazards and risks associated with these tasks will help prevent employee injury
- Prepare a safety manual that is read and understood at the time of induction of new employees.
- Paste safety rules on walls at strategic points in the work area.
- Reinforce safety rules in daily briefings.

5 s in House Keeping



Work Permit System

The work permit specifies the conditions and procedures for safe execution of the work and allows the work to be carried out under controlled risk conditions.

Aim:

The purpose of the work permit system is to ensure that:

1. Only authorized persons are allowed to work in hazardous area which is clearly notified.
2. The person permitted for work are being aware of the various safety issues involved and knows that necessary safety precautions have been taken.
3. Work permit is legal documents between issuer and executor for commencement of job inside refinery.
4. Client has implemented the work permit system to distribute the equal responsibilities of job being performed.

So don't do anything without proper work permit.

Hot Work Permit

During process of work where ignition comes out or heat generates its own is considered as hot work.

The permit is required for following jobs:

Welding

Flame cutting

While using pneumatic/ hydraulic power tools

Cold Work Permit

Authorization to operate machinery or other functions that do not generate any form of heat in the manufacturing process.

Example:- Mechanically induced bending, shearing, squeezing and drawing etc.

MODULE 3

SAFETY ISSUES IN CONSTRUCTION

The major areas considered for safety considerations at the Construction site are:

1. Excavation work at Construction

Serious hazards can be provided to the workers involved in the trenching and excavation works.

- The major risk is during the cave-ins which is severe than any excavation issues.
- Before entering the trench, it must be assured that adequate protections are provided to prevent the cave-in hazards.
- Other issues associated with the same are hazardous atmosphere, falling loads and safety issues from the mobile equipment.
- The sides of excavation work must be sloped and benched for easy movement. This avoids further collapse. A slope not steeper than 1 and half to 1 is safe for any form of soil
- The sides of excavation must be supported.
- The side of the excavation and the working area must be separated by means of a shield.
- Protective barricades can be used to avoid falling of soil rock over the workers

2. Housekeeping

Housekeeping practice in a construction site means keeping the work area neat, orderly and avoid slip and trip hazards.

Proper maintenance of the building area and the working equipment is the primary safety practice. This ensures that the building, equipment and the machinery are efficiently working

→ Regular cleaning during the work shifts

→ Proper waste disposal

- Unused materials can be removed and
- Proper inspection of the work area by a competent person
- The access and exit for the construction site must be safe and clear
- General safety signs must be erected and placed in order
- There must be safe and neat storage spaces for the materials and the plant
- Maintain a neat and orderly workplace environment.

3. Scaffolding Issues

Scaffolding is a temporary frame used to support people and material in the construction or repair of building^o and other large structures.

- Improper scaffolding will result in hazards. Fall hazards are occurred if scaffolds are not properly erected or used.
- The scaffolding must be erected on a solid footing with proper foot bearing plates
- The scaffolding used must be strong and rigid
- The scaffolding must carry its dead weight and almost 4 times the maximum load coming over it. This must be carried without any form of displacement or settlement.
- Scaffolding must not be supported by means of boxes, loose bricks or any other unstable objects
- Any repair or damage to the scaffolding accessories like braces, screw legs, ladders or trusses have to be repaired and replaced

4. Working at Heights

The major safety practice that is to be provided when the workers are at heights are to provide sufficient fall protection.

- Greatest fatalities in the construction industry are caused due to falls.

Use of aerial lifts or elevated platforms to provide safer working surface

- The holes in the floors must be covered
- Personal fall arrest systems or safety net systems must be used
- Provide guard rails
- Warning lines or control lines can be installed

5. Issue with Under – Water works

Underwater construction work is an area which requires extensive training.

Extreme familiarity with their diving equipment.

- Check working condition of equipment.
- Plan the dive: time, depth, work to be done and stick to the plan.
- Never dive alone. Always have at least one partner that we will stay close to.
- Have a rescue plan in place.
- Know where the nearest decompression chamber is located and how to get help.
- Descend slowly.
- Ascend slowly with the scheduled breaks.
- Monitor air supply regularly during the entire dive.

6. Issues with Under pinning

It is the process of strengthening and stabilizing the foundation of an existing building or other structure.

- The original foundation is simply not strong or stable enough, e.g. due to decay of wooden piles the foundation.
- The usage of the structure has changed.
- The properties of the soil supporting the foundation may have changed (possibly through subsidence) or were mischaracterized during planning.
- The construction of nearby structures necessitates the excavation of soil supporting existing foundations.
- It is more economical, due to land price or otherwise, to work on the present structure's foundation than to build a new one.

7. Shoring

- It is a general term used in construction to describe the process of supporting a structure in order to prevent collapse so that construction can proceed. The phrase can also be used as a noun to refer to the materials used in the process.
- Shoring is used to support the beams and floors in a building while a column or wall is removed.
- In this situation vertical supports are used as a temporary replacement for the building columns or walls.
- Trenches - During excavation, shoring systems provide safety for workers in a trench and speed excavation. In this case, shoring should not be confused with shielding.
- Shoring is designed to prevent collapse where shielding is only designed to protect workers when collapse occur.
- Concrete structures shoring, in this case also referred as falsework, provides temporary support until the concrete becomes hard and achieves the desired strength to support loads.

8. Issues while using ladders

People who work at a construction site often overlook ladder safety

Ladder is a common piece of equipment used in construction site

A fall from a ladder can result in permanent disabilities, and may even lead to death.

In fact, numerous people get injured every day due to not following proper ladder safety.

9. Safet



y in Tunnelling

1. The floor of the tunnel should be kept dry and clean.
2. Open flames, electric short-circuiting should be avoided by providing proper covering over the power line and light.
3. Medical equipment and doctors should always be available at the site.
4. Fire fighting equipment with an excellent operator and sufficient water supply should be available at the site at all times.
5. Light and electric lines need to be entirely secured and insulated.
6. Unnecessary machines, tools, and construction materials should be avoided to store in the tunnel.
7. All the machines and tools should be maintained in usable condition.
8. Working platforms should be checked periodically.

10. Safety in Blasting

- Blasting is a process of reduction of rocks or hard soil into fragments with the help of explosives
- The blasting operation involves drilling of holes, installation of a detonator and charge, detonating the charge, and removal of debris.
- The blasting operations shall be carried out under the supervision of a responsible authorized blasting engineer.

- In case of blasting with dynamite, the position of all the boreholes to be drilled shall be marked in circles with white paint.

11. Safety in Demolition

Demolition or dismantling refers to breaking up of buildings, structures either fully or partially.

- Utmost consideration is to be given to demolition or dismantling of structures than to erection, construction and maintenance.
- The problems, hazards and uncertainties can be much greater in demolition if it is also carried out by the unskilled workers.
- The design engineers have responsibility for safety for not only for design and construction but also for the demolition of the structures at the end of its usual life.

12. Safety in Confined Space

A confined space is one which is both enclosed, or largely enclosed, and which also has a reasonably foreseeable risk of fire, explosion, loss of consciousness, asphyxiation or drowning to workers.

- It may be small and restrictive for the worker or it could be far larger such as a grain storage silo with hundreds of cubic meter capacity.

National Building Code Provisions

- The National Building Code (NBC) is a document that provides guidelines for construction of structures- residential, mercantile, institutional, educational, commercial, assembly, storage spaces or even hazardous buildings.
- It is important to follow these guidelines that are meant to protect the overall health of the construction and ensure the health and safety of the public and the residents.

Residential buildings are classified into the following categories:

- Lodging or rooming houses.
- One or two-family private dwellings.
- Dormitories.
- Apartment houses or flats.
- Hotels

Ergonomic Hazards

Ergonomic hazards are physical conditions that may pose a risk of injury to the musculoskeletal system.

- Ergonomic hazards include awkward postures, static postures, high forces, repetitive motion, or short intervals between activities.
- The risk of injury is often magnified when multiple factors are present.
- Factors such as whole-body or hand/arm vibration, poor lighting, poorly designed tools, equipment, or

workstations all contribute to negative interactions with the worker/user

Module 4

1) Which are the hazards associated with manual material handling?

- • Use of equipment and machinery without valid OSHA inspection certificates.
- • Inadequate and wrong selection of handling tools and machines.
- • Mechanical damage and faulty equipment.
- • Congested space for operation.
- • Incompetent operator.
- • Overloading of machines, tools and equipment.
- • Loading and transporting unbalanced materials.
- • Poor rigging and lifting.
- • Over speeding and unauthorized operation
- • Use of machines without machine guard.

2) Discuss the safety issues of Gas welding operations.

- • fire caused by heat, sparks, molten metal or direct contact with the flame;
- • explosion when cutting up or repairing tanks or drums which contain or may have

contained flammable materials;

- • fire/explosion caused by gas leaks, backfires and flashbacks;
- • fumes created during flame cutting;
- • fire/burns resulting from misuse of oxygen;
- • burns from contact with the flame or hot metal;
- • crushing or impact injuries when handling and transporting cylinders.

3) Which are the various types of machine guarding devices used industries. Discuss the suitability of each machine guarding devices.

- • Fixed guards
- • Fixed limited access guards
- • Fixed adjustable access guard
- • Interlock guards
- • Semi automatic guards
- • Automatic guards

4) Explain the different types of material handling Equipments with its applications.

• Conveyers

Gravity or powered devices

Used for moving loads from one point to point over fixed paths.

Belt Conveyor - Motor driven belt usually made of metal fabric

Chain Conveyor - Motor driven chain that drags material along a metal side base. Roller

conveyor - Boxes, Large parts or units loads roll on top of a series mounted on

rigid frame

Pneumatic Conveyor - High volume of air flows through a tube carrying materials

along with air flow.

- • Cranes, Elevators and Hoists

Cranes - Devices mounted on overhead rail or ground wheels or rails

They lift and transport heavy materials Elevators - Types of cranes

Lift materials usually between floors Hoists - Move vertically or horizontally

- • Industrial Trucks

Maybe electric , diesel , gasoline or gas powered. Eg; Fork lift truck | Pallet truck

- • Auxiliary Equipments

Devices or attachments used with handling equipments to make their use more effective and versatile

Eg ; Expendable | Skid boxes

5) Which are the key parts of the machines according to hazards.

- • The frame
- • Motor
- • Flywheel
- • Crankshaft
- • Clutch
- • Brake

6) Explain the different safety precautions while turning, drilling, grinding and milling operations.

Milling

- • Locate and ensure you are familiar with all machine
- • operations and controls.
- • Ensure all guards are fitted, secure and functional. Do not operate if guards are

missing or faulty.

- • Check workspaces and walkways to ensure no slip/trip hazards are present.
- • Ensure cutter is in good condition and securely mounted.
- • Check coolant delivery system to allow for sufficient flow of coolant.
- • Switch off the machine when work completed.
- • Remove milling cutters and store them safely.

Drilling

- Safety glasses are required.
- Don't wear loose clothing or gloves, keep long hair tied back. These items will get caught in bit or spindle.
- Never adjust the drill press or setup while it is running.
- Never leave chuck key in press. It should only be on the chuck when power is off and you are changing a bit.
- Always follow 4 inch rule.
- Never force the bit. Let it cut at its own rate.
- Work must be clamped or secured to table by some means other

than holding it. Do not hold pieces to drill them.

- Never remove guard unless authorized by Technician or WRL Manager.
- Setups requiring anything other than the standard drill press equipment must be approved by supervisor.
- If machine is malfunctioning stop immediately and report to Supervisor.

Grinding

- • Wear goggles for all grinding machine operations.
- • Check grinding wheels for cracks before mounting.
- • Never operate grinding wheels at speeds in excess of the recommended speed.
- • Never adjust the workpiece or work devices when the machine is operating.
- • Do not exceed recommended depth of cut for the grinding wheel or machine.
- • Remove workpiece from grinding wheel before turning machine off.
- • Use proper wheel guards on all grinding machines.
- • On Grinders, adjust tool rest 1/16 to 1/8 inch from the wheel.

8) Explain the different types of maintenance of machines in detail.

Corrective/ Breakdown Maintenance

- • Corrective or Breakdown maintenance implies that repairs are made after the equipment is failed and can not perform its normal function anymore.
- • Less expensive

Scheduled Maintenance

- • Scheduled maintenance is a stitch-in-time procedure and incorporates .
 - inspection
 - lubrication
 - repair and overhaul of equipments
- • If neglected can result in breakdown
- • Generally followed for:
 - overhauling of machines
 - changing of heavy equipment oils
 - cleaning of water and other tanks etc.

Preventing Maintenance

- • Principle - "Prevention is better than cure"
- • Procedure - Stitch-in-time
- • It
 - locates weak spots of machinery and equipments
 - provides them periodic/scheduled inspections and minor repairs to reduce the danger of unanticipated breakdowns

Predictive (Condition- Bases) Maintainance

- In predictive maintenance, machinery conditions are periodically monitored and this

enables the maintenance crews to take timely actions, such as machine adjustment, repair or overhaul.

-
- It makes use of human sense and other sensitive instruments, such as audio gauge, vibration analyzer, amplitude meter, pressure, temperature and resistance strain gauges etc.

Module 5

1) Differentiate Hazard and Risk.

Risk. • Hazard: Any situation that has

potential/capability to cause Injury/harm to the worker, damage to the property, Loss/contamination to the environment.

• Risk: Any situation that has probability to cause Injury/harm to the human, damage to the property, Loss/ contamination to the environment.

2) Why MSDS is mandatory for chemical products

-Material Safety Data Sheet is horoscope of the chemical.

-MSDS reveals the properties of chemical, its nature, different hazards, preventive measures in storage and handling, First aid measures

-Hazard Identification

-contains information to help you make a risk assessment

3) Explain the types of fire extinguishers with its applications

- A fire extinguisher is a device which can be used to control a fire. Fire extinguisher can help remove the fire, and may stop it from burning

Type of Fire extinguishers	Label	Class	Description	Application
Water	Solid Red	A	Helps to cover larger surface area. Simplest and most common	Schools, Hospitals, Offices, Shops
Foam	Cream	A,B	More Expensive	Apartments, Hospitals, Offices, Shops
Dry Powder	Blue	A,B,C,D, Electrical	No Cooling effect, Should be placed at well ventilated areas	Garages , Welding, Boiler rooms, LPG Plants
CO2	Black	B, Electrical	More Expensive Leaves no residue.	Server Rooms, Offices
Wet Chemical	Yellow	A, K	More expensive	Kitchens Canteen
ABC	Blue	A,B	This acts to blanket fire and suffocate it.	Home, Offices , Building

Class A - Combustible Materials - Wood, Paper

Class B - Flammable Liquids - paint , Petrol

Class C - Flammable Gases - Butane and Methane

Class D - Flammable Metals - Lithium and potassium

Electrical - Computers and generators

Class K - Deep Fat Fryers

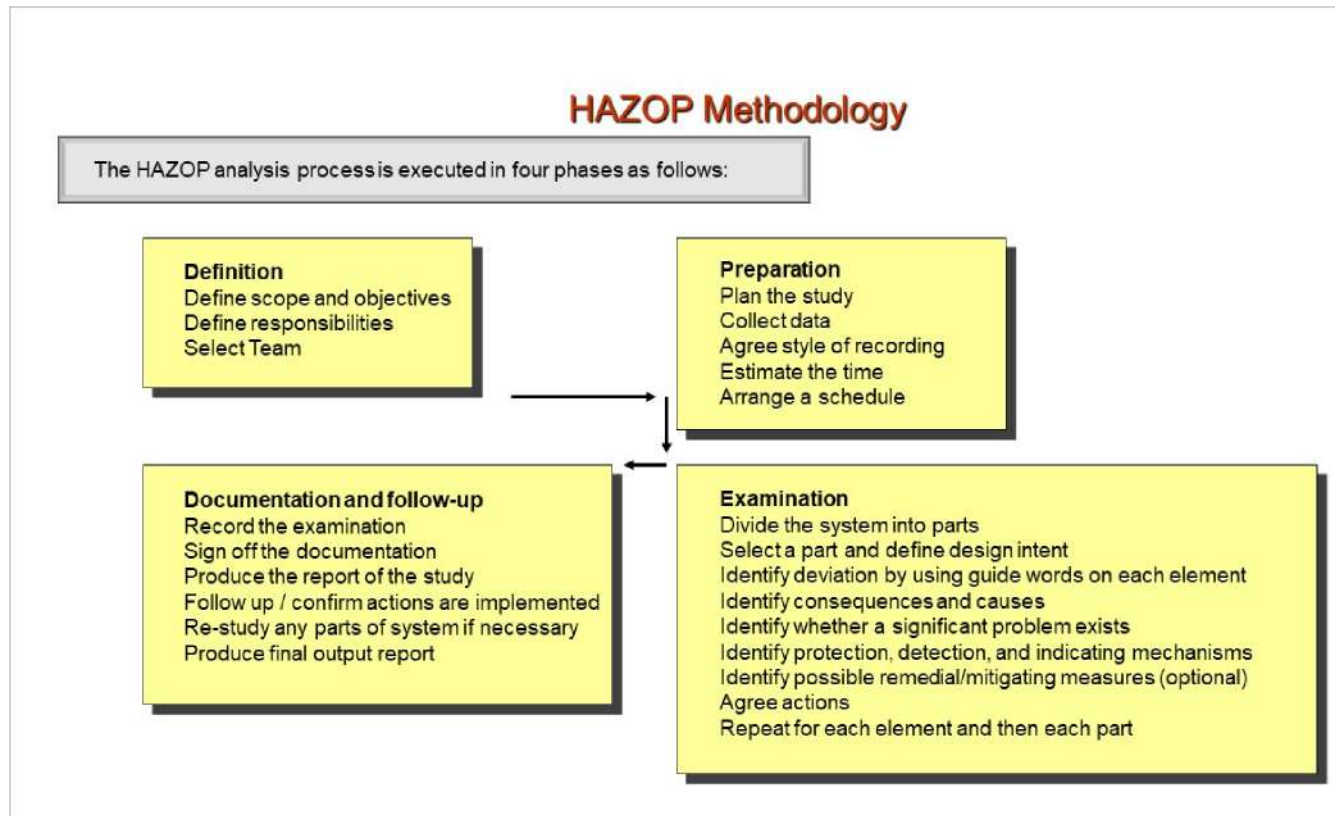
4) Which are the types or classes of fire hazards

- Class A - Combustible Materials - Wood, Paper
- Class B - Flammable Liquids - paint , Petrol
- Class C - Flammable Gases - Butane and Methane
- Class D - Flammable Metals - Lithium and potassium
- Electrical - Computers and generators
- Class K - Deep Fat Fryers

5) What is Hazard and Operability Analysis

- Hazard and Operability Analysis (HAZOP) is a structured and systematic technique for system examination and risk management.
- In particular, HAZOP is often used as a technique for identifying potential hazards in a system and identifying operability problems likely to lead to nonconforming products.
- HAZOP is based on a theory that assumes risk events are caused by deviations from design or operating intentions.
- Identification of such deviations is facilitated by using sets of "guide words" as a systematic list of deviation perspectives.
- This approach is a unique feature of the HAZOP methodology that helps stimulate the imagination of team members when exploring potential deviations.

6) How do you conduct a HAZOP analysis



7) Which are the different types of hazards

- Biological
- Chemical
- Ergonomic
- Physical
- Psychological
- Safety

8) Explain the types of chemical hazards in detail.

- Irritant chemical

Primary irritant cause inflammation is one of the body's defense mechanisms. It is the reaction of tissue to harm which is sufficient to kill the tissue and is typified by constriction of the small vessels in the affected area, dilation of the blood vessels, increased permeability of vessel walls, and migration of the white blood cell and defensive cells to the invading harmful chemicals i.e. sulphur dioxide may have a blistering effect on upper respiratory.

- Sensitizers

generally sensitizers may not on first contact result in any ill effects, although cellular changes can be induced and the body's immune system affected (some chemicals may act as primary irritants as well as sensitizers).

- Anesthetic and Narcotic anesthetic and narcotic e.g. hydrocarbons and certain derivatives such as the various chlorinated solvents or other, exert a depressant action on the central nervous system i.e. Aliphatic alcohols, petroleum etc.
- Systematic poisons
Systematic poisons attack organs other than the initial site of contact. The critical organs are the kidneys, liver, blood and bone marrow. Many halogenated hydrocarbons are effects the Visceral organs in Hematopoietic (i.e. blood-forming system) Nervous system.
- Respiratory Fibro gens]
The hazard of particulate matter is influenced by the toxic and size and morphology of the particles. The critical size of dust (and aerosol) particles is 0.5 to 7 μm , since these can become deposited in the respiratory bronchioles and alveoli. i.e. Free crystalline silica.
- Carcinogens
Cancer is a disorder of the body's control of the growth of cells. The diseases may be a genetic or influenced by life style or exposure to certain chemicals, termed carcinogens i.e. Coal tar pitch dust, Asbestos etc.