A Seminar

on

INDUSTRIAL SAFETY

Presented

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1.INTRODUCTION

DEFENITION OF INDUSTRIAL SAFETY

Industrial safety refers to reduce the risk of injury or loss and danger to persons, property from the industrial hazards. (Shah Prakashan,2007).

WHAT DOES A INDUSTRIAL HAZARD MEANT?

Hazard is a term associated with a substance,

That is likely to cause injury to a personnel,

(or)

One which may lead to loss of property, products etc;

(or)

A substance that might prove fatal to the personnel.

- Toxic corrosive chemicals, fire explosions and personnel falling into accident are major health and safety hazards encountered in the operations of chemical and pharmaceutical industries.

- Identification of hazards and employing protective measures to control the hazards are important to protect the people from their consequences.

OBJECTIVES OF INDUSTRIAL SAFETY

- Understand the harmful effects of industrial hazards
- Define the relationship between hazard and risk
- Explore the routes of exposure to industrial hazards
- Shed lights on type of toxicity by industrial hazards
- Know the most toxic environmental hazardous substances.

INDUSTRIAL HAZARD V/S RISK

- **Hazard** is the potential of a substance to cause damage.
- Toxicity is the hazard of a substance which can cause poisoning.
- **Risk** is a measure of the probability that harm will occur under defined conditions of exposure to a chemical. (Patrick et al., 1986).

$$R = f(H \times E) = f(H \times D \times t)$$

Where R=Risk, f=function, H=Hazard, E= Exposure ,D=Dose, t=time.

- Thus, chemicals which pose only a small hazard but to which there is frequent or excessive exposure may pose as much risk as chemicals which have a high degree of hazard but to which only limited exposure occurs

- Reducing risk is based on reducing exposure

2.TYPES OF HAZARDS

- **Fire hazards**
- **Chemical hazards**
- **Electrical hazards**
- **Mechanical hazards and**
- **pharmaceutical hazards.**

FIRE HAZARDS

Fire:

The self-sustaining process of rapid oxidation of a fuel which produces heat and light.

Fire is an exothermic chemical reaction between oxygen and fuel at certain temperature.

Three things essential for the combustion of fire are

- Fuel (any combustible material)
- Oxygen (At concentrations above 23 % in air, the situation becomes dangerous due to the increased fire hazard)
- Temperature.

SOURCES OF FIRE HAZARDS

Fuels include solids, liquids, vapours and gases.

solid fuels

wood, fabrics, synthetic materials, packing materials, papers etc.,.

Liquid fuels

flammable liquids (e.g., nitrophenol, ammonium nitrate and pottassium chlorate, paint and oil soaked rags, cotton or cellulose soaked with sulphuric acid etc.,.).

Other sources include flame, sparks, spontaneous ignition and self combustible chemicals. (Khanna,1992).

CLASSIFCATION OF FIRES

Most fires that occur will fall into one or more of the following categories

Class A

Fires involving ordinary combustible materials, such as Paper, wood, and textile fibers, where a cooling, blanketing, or wetting extinguishing agent is needed.

Class B:

Fires involving flammable liquids such as gasoline, thinners, oil-based paints and greases. Extinguishers for this type of fire include carbon dioxide, dry chemical* and halogenated agent types.

Class C

Fires involving energized electrical equipment, where a non conducting gaseous clean agent or smothering agent is needed. The most common type of extinguisher for this class is a carbon dioxide exinguisher.

Class D

Fires involving combustible metals such as magnesium, sodium, potassium, titanium, and aluminum. Special dry powder extinguishing agents are required for this class of fire, and must be tailored to the specific hazardous metal.

Class K

Fires involving commercial cooking appliances with vegetable oils, animal oils or fats at high temperatures. A wet potassium acetate, low pH-based agent is used for this class of fire.

DETECTION OF FIRE HAZARDS

Many automatic fire detection systems are used today in industry.

Some include

- Thermal expansion detectors,
- Heat sensitive insulation,
- Photoelectric fires,
- Ionization or radiation sensors and
- Ultraviolet or I .R detectors.

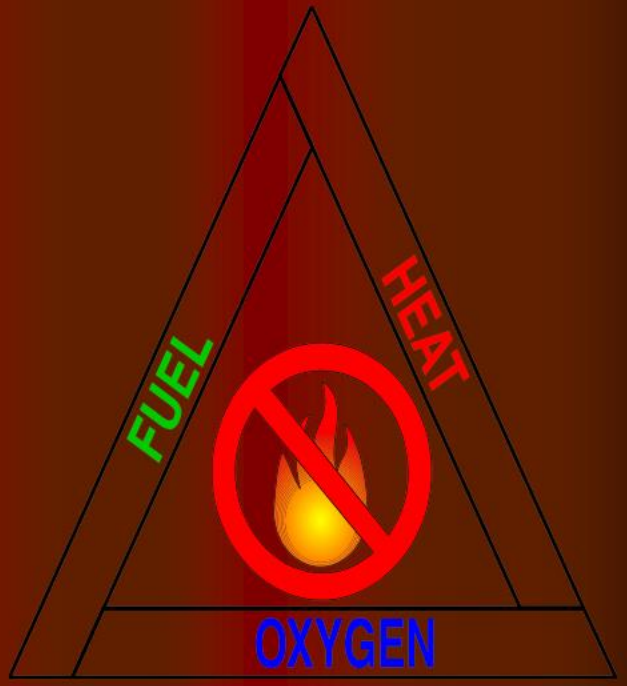
These sound an alarm through which fire flames are detected.

FIRE ALARMS

FIRE SENSORS

PREVENTION OF FIRE HAZARDS

- Well planned design and layout
- Proper ventilated systems
- Chemical data sheets
- Proper training of personnel
- Proper maintenance of surroundings
- use of fire extinguishers, alarms ,sensors, detectors
- Fire fighting equipment
- Sprinkler systems



FIRE SUPRESSION

It is done by using hydrant systems/water sprinkler systems and fire extinguishers.

- Hydrant systems include
  - Water sprinklers
  - Semi automatic hydrant system
  - Automatic sprinkler and
  - Manually hydrant system.

- Fire extinguishers include
  - Water and water based extinguishers
    - portable extinguishers
    - soda acid extinguishers
    - antifreeze extinguishers.
  - Foam extinguishers.
  - Dry chemical extinguishers.
  - Carbon dioxide extinguishers.
  - Halon extinguishers
    - Halon1301(bromo tri fluoromethane)
    - Vaporizing liquid.

Spinkler systems

Halotron 1 Fire extiguisher

Non-Magnetic stored pressure deionized water mist fire extinguisher

K Class Wet chemical extinguisher.

ABC Dry chemical fire extinguisher

Carbon dioxide (CO_2) Portable fire extinguisher

CHEMICAL HAZARDS

- Many chemicals can cause severe burns, if these coming to contact with living tissue or other routes like inhalation.
- Living tissue may be destroyed by chemical reactions such as dehydration, digestion, oxidation etc.
- Eye and mucus membrane of the throat are particularly susceptible to the effect of corrosive dust, mist and gases.
- Chloroform, benzene, chlorinated hydro carbons, low boiling fractions of petroleum are some of the common organic solvents used in pharmaceutical industry.(Muir,2002).

SOURCES OF CHEMICAL HAZARDS

- AIR BORN TOXICS

Irritants

Ipecac,podophyllumetc .,.

Asphyxiants

Carbondioxide, monoxide, methane, ethane, hydrogen cyanide, hydrogen sulphide, helium,nitrogen etc.,.

Narcotics/anaesthetics

Acetone, ether, chloroform, methyl-ethyl ketone etc.,.

- CARCINOGENS

Coaltar, cresote oil, anthracene oil, parafin oils, chromium, nickel, cobalt etc.,.

- Hazards may arise when impure or contaminated chemicals are used.
- By products may accumulate relatively high concentrations in parts of the plant and cause un expected effects.
- In pharmaceutical industry most of the dermatitis can be attributed to synthetic drugs, especially acridines and phenothiazines.

SAFETY ASPECTS IN CHEMICAL HAZARDS

- Application of barrier creams before commencing the work has been found useful in protecting individuals from hazardous chemicals.
- While using the high vapor pressure solvents and grinding of vegetable drugs (e.g., capsicum and podophyllum) safety goggles are to be worn. Because these will effects the eyes.

- We must know the exposure limits and toxicity of different chemicals.

chemicals	Exposure limit (ppm)
Ethyl alcohol	1000ppm
acetone	1000ppm
Methyline chloride	125ppm
Isopropyl alcohol	400ppm

- Tolerance levels for toxic chemicals should be followed as set by Federal regulations.
- Occupational safety and health administration also include to Check

- Compiling of process safety information
- Maintaining safe operating procedures
- Training and educating employees
- Conducting incident investigations
- Developing safety compliance audits
- Conducting emergency response plans. (Niosh,2005).

MECHANCAL HAZARDS

- These are associated with powers-driven machine, whether automated or manually operated by steam, hydraulic and/or electric power introduced new hazards into work place.
- Mechanical hazards are exacerbated by the large number and different designs of equipment, crowded work place conditions and different interaction between workers and equipment.
- Hazardous electrical and pneumatic thermal energy must be released or controlled before working on active equipment.
- High sound levels may be generated by manufacturing equipment (e.g., ball mill) there by increasing their exposure to noise.
- Injuries like cutting, tearing, shearing, puncturing and crushing may occur with moving machinery. (Barbara et al.,2005).

PREVENTON OF MECHANICAL HAZARDS

Mechanical hazards can be reduced by the application of appropriate safeguards.

REQUIREMENTS OF SAFEGUARDS

- Prevent contact
- Securable and durable
- Protect against falling objects
- Do not create new hazard
- Do not create interference
- Allow safe mantainance.

TYPES OF SAFEGUARDS

Point of operation guards-Fixed guards, interlocked guards and adjustable guards.

Point of operation devices-photoelectric devices, radiofrequency devices, pull back devices, restraint devices and safety trip devices.

Feeding and ejection systems-automatic feed system, semi automatic, automatic and semiautomatic ejection systems.

Robot safeguards.

LOCKOUT/TAGOUT SYSTEMS

Padlock systems

Tagout systems.

(Shah Prakashan,2007).

SAFETY ASPECTS IN MECHANICAL HAZARDS

- All the operators should be trained in safe operation, maintainance and emergency procedures to take care when accidents occur.
- Inspection ,adjustment repair and calibration of safe guards should be carried out regularly.
- Ear protection devices must be used to prevent the excessive noise.
- Effort should be made to reduce the noise to a safe level.

ELECTRICAL HAZARDS

Electrical hazards occurs when a person come in contact with the conductor carrying current and simultaneously contacts with the ground, usually known to be work place hazard.

SOURCES OF ELECTRCAL HAZARDS

- Short circuts
- Electrostatic hazards
- Arcs and spark hazards
- Combustible and explosive materials
- Improper wiring
- Insulation failure

DETECTION OF ELECTRICAL HAZARDS

- Circuit tester
- Receptance wiring tester.

PREVENTION OF ELECTRCAL HAZARDS

- Grounding of electrical equipments
- Prevention of static electricity
- Bending and grounding
- Humidification
- Antistatic materials
- Ionizers and electrostatic neutralizers
- Radioactive neutralizers and
- Magnetic circuit breaker.

SAFETY ASPECTS IN ELECTRICAL HAZARDS

- Ensure that power has been disconnected from the system working with it.
- Do not wear conductive material like such as metal jewellary.
- Perodically inspect insullation.
- Verify circuit voltages.
- Use only explosion proof devices and non sparkling switches in flammable liquid storage areas.
- All electrical parts should confirm ISI specifications.
- Ensure all flexible wires and power cables are properly insulated.
- Installation of earth trip devices for all electrical equipments.
- Safe guarding is essential for all electrical equipments. (Niosh,1986).

PHARMACEUTICAL HAZARDS

- Hazardous drugs that pose a potential health risk to health care workers who may be exposed during drug manufacturing, packing and storage.

CRITERIA FOR DEFINING HAZARDOUS DRUGS

Drugs that meet one or more of the following criteria should be hazardous.

- Carcinogenicity.
- Teratogenicity.
- Reproductive toxicity.
- Organ toxicity at lower doses.

ROUTES OF EXPOSURE TO HAZARDOUS DRUGS

- Inhalation of an aerosolized drug.
- Dermal absorption.
- Ingestion.
- Injection.

TYPES OF HAZARDS TOXICITY

- Acute poisoning.
- Chronic poisoning.(Akunuru,1997).

SAFETY ASPECTS IN PHARMACEUTICAL HAZARDS

Personal protective equipment for hazardous drug handling

- Disposable gowns made of fabric that has low permeability to the agents in use, with closed fonts and cuffs,intended for single use.
- Powder free gloves, labeled and tested for drugs used with chemotherapy , made of latex, nitrile or neoprene.
- Face and eye protection when splashing is possible.
- Approved respirator when there is a risk of inhaling drug aerosols. The labelling of solvents to indicate their properties and health and fire hazards, is an extremely important method for controlling the hazards.
- Substitution of more harmful material by one which is less danger to health.

- To prevent or reduce dangerous expose to toxic materials.

i. Gas releases should be vented outside buildings and away work areas and other populated areas.

ii. Exhausts and ventilations should be provided to remove emissions.

- Every bulk drug and pharmaceutical unit must prepare its disaster management plan.

3.SAFETY ASPECTS IN PHARMA INDUSTRY

- Standard operating procedures
- Handling of hazardous materials
- Water supply and drainage
- Floors and floor coverings
- Emergency exits
- Back up plan if anything goes wrong
- Specially trained personnel
- Health polices and insurance
- Written procedures
- Safety audits
- Risk analysis
- Appropriate training and education to employee
- Regular monitoring of workplace
- Written documentation of policies
- Create awareness of the environment.

4.CONCLUSION

- From the previous discussion it is clear that the safety aspects must be considered by the pharmaceutical industry not only in the interest of the employees or property but also in terms of the neighboring environment as well.

- The source of possible hazards , risk analysis, control procedures ,preventive measures &contingency plan are the main five essentials for ensuring a complete work atmosphere in the industry

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THANK YOU