(Unit – 9)

Pharmaceutics – II

(Unit Operations I, including Engineering Drawing)

" Industrial Hazards and Safety Precautions "

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INTRODUCTION

- Hazard is a term associated with a substance that is likelihood to cause an injury in a given environment or situation.
- Industrial hazard may be defined as any condition produced by industries that may cause injury or death to personnel or loss of product or property.

- Safety in simple terms means freedom from the occurrence of risk or injury or loss.
- Industrial safety refers to the protection of workers from the danger of industrial accidents.

TYPES OF HAZARDS

1. Biological hazards
2. Chemical hazards
3. Mechanical hazards
4. Physical hazards
5. Electrical hazards
6. Fire hazards
7. Dust hazards

1. MECHANICAL HAZARDS

A mechanical hazard is involving a machine or process. Motor vehicles and air bags pose mechanical hazards. Compressed gases or liquids can also be considered a mechanical hazard.

SOURCE OF MECHANICAL HAZARDS

- It occurs when a machine is malfunctioning.
- Machines may run either manually or automatically.
- A few machines are cutting, shearing, crushing, breaking.
- Most injuries occur when the machine needs human intervention repeatedly for its proper functioning.
- The machines are driven by a suitable power supply (electricity or steam).

PREVENTION OF MECHANICAL HAZARDS

Requirements for Safeguards

Safeguards must meet these minimum requirements:

Prevent contact:

The safeguard must prevent hands, arms, or any part of a worker's body from making contact with dangerous moving parts.

Secure:

Workers should not be able to easily remove with the safeguard. Guards and safety devices should be made of durable material that will withstand the conditions of normal use.

Protect from falling objects:

The safeguard should ensure that no objects can fall into moving parts. A small tool which is dropped into a cycling machine could easily become a projectile that could strike and injure someone.

Create no new hazards:

The edges of guards, for instance, should be rolled or rounded in such a way that they eliminate sharp edges to prevent unwanted injuries.

Create no interference: Proper safeguarding can actually enhance efficiency, since workers will not be afraid of injuries then.

Allow safe lubrication:

If possible, one should be able to lubricate the machine without removing the safeguards. Locating oil reservoirs outside of the guard, with a line leading to the lubrication point, will reduce the need for the operator or maintenance worker to enter the hazardous area.

2. ELECTRICAL HAZARDS

Shock is one of the common electrical hazards. It occurs when the electric current passes through the body. This is possible when human is in contact with a conductor carrying a current and simultaneously in contact with the ground. This is referred to as short circuit.

SOURCE OF ELECTRICALCAL HAZARDS

- Different sources of electrical hazards are short circuit, electrostatic hazards and explosive materials.
- A worker will receive a shock when he/she: Touches two wires at different voltages at the same time.
- Touches the phase standing on the ground
- Touches the phase having wet cloth and high humidity.
- Receive a shock from electrical components those are not grounded properly.
- Touching another person receiving an electrical shock.

Prevention of electric hazards

All workplace has an electrical safety policy created by authority.

Electrical Safety Policy

The following items should be included in the electrical safety policy:

- Power equipment should be plugged into wall receptacles with power switches in the off position.
- Electrical equipment should be unplugged by grasping the plug and pulling. Never pull or jerk the cord to unplug the equipment.
- Frayed, cracked or exposed wiring on equipment cords must be corrected. Also check for defective cord clamps at locations where the power cord enters the equipment or the attachment plug.
- Temporary or permanent storage of materials must not be allowed within 3 feet of an electrical equipment.
- Any electrical equipment causing shocks or which has high leakage potential must be tagged with a DANGER—DO NOT USE label or equivalent.

PREVENTION OF ELECTRICAL HAZARDS

Responsibilities of individual employee

- Training and Education: Many accidents are caused due to lack knowledge of the equipment or its operation. So, employees should be trained in electrical safety work practices and equipment operation.
- Hazardous Condition Reporting: Employees should always report unsafe equipment, conditions or procedures. Under no condition should defective electrical equipment causing electrical shock be used immediately.
- Work Practices: Employees are responsible for following their employer's safe work practices, procedures and policy.
- Housekeeping: Good housekeeping requires all employees to observe activities that could cause electrical shock hazards. For example, using electrical equipment that is not properly grounded in areas that have water on the floor can create shock hazards. Cleaning tools and electrical equipment with solvents can create health and physical safety problems.

3. CHEMICAL HAZARDS

Source of Chemical Hazards

Solvents used in extraction plants, purification of synthetic drugs and in chemical analysis may produce vapors.

1. This vapors or gases may produce:

- Breathing problem and suffocation to worker.
- Irritation or burn to eye or skin of the worker.
- Explosion in the work place.
- General anesthesia or death e.g. chloroform and ether vapor.

2. Liquid chemicals if spilled on workers may produce

- Dehydration by strong dehydrating agents e.g. concentrated sulfuric acid.
- Burning by strong acid or alkalis.
- Oxidation by strong oxidizing agents.

3. Dusts of chemicals produced from different equipment may produce

- Dermatitis or dust allergies to the workers.
- Skin and eye irritations.
- Resistance to certain antibiotics e.g. resistant to chloroform if the same worker is exposed to it regularly. Some dusts may be carcinogenic (producing cancers).

Safety Measures

- Before starting work with a chemical a "chemical hazard pocket guide" should be consulted for necessary information about the chemical. It will give the type of reaction the chemical may produce, its inflammability, carcinogenicity, prevention and treatment procedures etc.
- No eating, drinking, or smoking where chemicals are used.
- Skin should be covered with protective clothing.
- Clothing should be removed immediately it gets wet or contaminated with a chemical.
- Eyes or skins should be washed with plenty of water after an accident.
- Face mask may be used in toxic dust or gases.
- Workers working in antibiotic related products must be changed routinely so that an individual is not exposed to a certain antibiotic for a long period of time.
- Whenever a dust allergy or respiratory problem precipitates the worker should immediately be removed from the work place and put under proper healthcare.
- In case of inflammable gas or solvent leakage the exhaust fans should be started and all the source of fire should be extinguished

4. DUST HAZARDS

Dust Hazards Source of Dust Hazards

- Grinding or milling of drugs, excipients, or herbal products.
- During weighing dusts may float on air.
- During powder mixing dusts may be generated.
- During coating operation dusts are generated.
- During capsule filling and tablet punching operation dusts may be generated.

Prevention of Dust Hazards

Filtration

Air is sucked through a suitable filter medium (like paper, wool, cotton-wool and nylon). Filter bags can be attached with machines where dust is produced.

Inertial separator

In cyclone separator the air is circulated at high speed in a spiral manner. Due to centrifugal force the dust particles are thrown outward and the particles are collected at the bottom and the clean air comes out through the top.

Electrostatic separator

It consists of metal tubes though which a conductor wire is passed. Several thousand volts of DC current is applied on the metal wire. When air is passed through the pipes the dust particles becomes charged and precipitates on the inner wall of the tube and clean air passes out. Periodically the dust is collected.

5. FIRE HAZARDS

Source of Fire Hazards

Types of fire Class

- A Fires

These are fires in ordinary combustible materials such as wood, cloth, paper etc. those produce glowing ember.

- Class B

Fires These are fires of flammable petroleum products, liquids, gases and greases etc.

- Class C

Fires These fires involve energized electrical equipment.

- Class D

Fires These are fires in combustible metals.

PREVENTION OF FIRE HAZARDS

Fire Extinguishers

Fire extinguishing agents work by:

- removal of fuel e.g. blanketing with foam or interposing a layer of gas between the fuel and the flames.

- by removal of oxygen e.g. by dilution with inert gases or vapors.
- by removal of heat by cooling with water or other extinguishing agents

Water based fire extinguishers

They produce CO 2 by reaction with acid and carbonates, or CO 2 is kept under pressure. E.g. Portable fire extinguisher, Soda-Ash Extinguisher, Antifreeze Extinguisher.

Water based foams

Two types of foams are available. Chemical foams and Mechanical foams. Chemical foams are bubbles filled with CO 2 produced by chemical reaction in an aqueous solution mixed with a foaming agent. The reacting chemicals are usually of sodium carbonate and ammonium sulfate. Mechanical foams are bubbles filled with air. Foams forms barrier and prevents contact between fuel and air.

Dry chemicals

These are finely divided solid particles usually discharged through a hose pipe. Usually they contain sodium bicarbonate, potassium bicarbonate and ammonium sulfate.

❖ INDUSTRIAL DERMATITIS

Dermatitis is an inflammation of the skin. The term dermatitis is synonymous with eczema. The skin becomes red, itchy, and can be blistered. The skin becomes hard, thickened and cracked. Many people suffer from skin conditions. Most of these are not work related. In some instances, these started during childhood. Dermatitis is the main work- related skin disease.

An important clue for diagnosis is the site of the area affected. If it is the hands, contact dermatitis should always be suspected. The next question is whether the 'contact' arises from work or outside work.

A work-related cause is suggested if:

- The rash is mainly on the hands and exposed skin
- The condition improves away from work and relapses on return
- More than one person is affected in same work area or handling same materials

The following suggest a non-occupational cause:

- there is a history of childhood/ endogenous eczema
- there is major involvement of the body trunk or covered area of skin

What is contact irritant dermatitis?

In contact irritant dermatitis the substance that damages the skin is known as the irritant. A highly irritant substance is known as a corrosive. Irritant dermatitis makes up about 80% of contact dermatitis. The other 20% is allergic.

There are several ways that skin damage can be caused.

- Detergents, soaps such as in repeated hand washing or the use of solvents can remove the protective oily layer and so leave the skin exposed to damage.
- Physical damage such as friction, minor cuts for example from fiber glass and grazes can breakdown the protective layer and allow substances access.
- Chemical such as acids or alkalis can burn the layer.

Irritation is analogous to a chemical burn. It acts by eroding or burning the outer protective layers of the skin. Irritant contact dermatitis usually occurs only on the parts of the body in direct contact with the irritant substance e.g. hands, forearms, face.

Common irritants are wet work, cutting oils, solvents and degreasing agents which remove the skins outer oily barrier layer and allow easy penetration of hazardous substances, alkalis and acids. Wet cement coming into contact with exposed feet and hands is a particular example of a skin irritant.

What do employees need to know?

Employees are entitled to information about hazards in the workplace and those contained in the Risk Assessment. They are also entitled to information on the protective and preventive measures to be taken.

Employees who are likely to work with and be exposed to substances causing dermatitis need information, instruction and supervision so that they know and understand the following;

- Label and safety data sheet for chemicals used in the workplace
- Substances which are known to cause dermatitis in the workplace
- Risk Assessment
- Proper use of control measures
- Need to report any failures in control measures
- Risks to health
- Symptoms of sensitization
- Importance of reporting symptoms at an early stage
- Role of health surveillance

ACCIDENT RECORD

An accident book is used on construction projects to record details of any accidents that occur. This is a requirement of the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations.

Details of accidents that must be recorded include:

- The date and time on which it occurred.
- The person who was injured.
- Any witnesses.
- The type and nature of the injuries sustained.
- The cause and full circumstances of the accident.

These details should be entered into the accident book by the injured person or a colleague as soon after the accident as possible. This forms a valuable source of evidence in the event of any legal claims, and can also be valuable for employers helping identify systems or processes that need to be changed to make them safer. For example, if it is clear from examining the accident book that a project has experienced a number of accidents involving the movement of vehicles, then the site management team can take steps to address that particular issue.

The Health and Safety Executive (HSE) recommend that all forms of accidents are recorded in the accident book, as even small incidents can provide an warning of more severe accidents that could happen in the future. However, RIDDOR identifies the more serious types of accidents which must be reported to HSE as well as being recorded in the book. These include:

- Any injury that stops an employee doing their normal work for a period of 3 days or more.
- Major injuries such as broken arms, ribs, legs, etc.
- Fatalities.
- Disease.
- Dangerous instance occurring at work such as machinery breaking, scaffolding collapsing and any other appliances defecting and causing damage.

The information contained in the accident book should be kept in an accessible location on site, usually with a nominated person responsible for accident reporting. Information contained in the book should be kept confidential, and to assist with this, accident books may have removable pages. It is a legal requirement that the information in the book is stored safely for a period of three years.