

Lecture (5) safety measuring and industrial hazards in pharmaceutical factories 1. Introduction

Definitions INDUSTRIAL SAFETY : refers to actions that aimed to reduce the risk of injury or loss, and danger to persons, property from the industrial hazards. **INDUSTRIAL 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

Major health and property, products etc; (or) A substance that might prove fatal to the personnel. If

safety hazards encountered in the operations of chemical and pharmaceutical industries are : 1. Toxic

Therefore the identification of corrosive chemicals 2. Fire explosions 3. Personnel falling into accident if of hazards and employing protective measures to control the hazards are important to protect the people

Understand the harmful effects from their consequences. **OBJECTIVES OF INDUSTRIAL SAFETY** i

Explore the routes of Define the relationship between hazard and risk i of industrial hazards i

Know the Shed lights on type of toxicity by industrial hazards i exposure to industrial hazards i

Hazard : is the most toxic environmental hazardous substances. **INDUSTRIAL HAZARD vs Risk** i

Risk : is a measure of the probability that harm will occur potential of a substance to cause damage. i

Toxicity : is the hazard of under defined conditions of exposure to a chemical. (Patrick et al., 1986). i

a substance which can cause poisoning. Risk (R) = f (H x E) = f (H x D x t) Where R = Risk F = function

Thus, chemicals which pose only a small hazard but to H = Hazard E = Exposure D = Dose T= Time i

which there is frequent or excessive exposure may pose as much risk as chemicals which have a high

Reducing risk is based on reducing degree of hazard but to which only limited exposure occurs. i

exposure Types of hazards 4. Fire hazards 2. Chemical hazards 3. Electrical hazards 4. Mechanical

hazards and 5. pharmaceutical hazards. 1. 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

Fuel oxygen and fuel at certain temperature. Three things essential for the combustion of fire are : if

Oxygen (At concentrations above 23 in air, the situation becomes any combustible material) if

Temperature. Sources of fire hazards Fuels include dangerous due to the increased fire hazard) if

solids, liquids, vapours and gases. solid fuels wood, fabrics, synthetic materials, packing materials,

flammable liquids (e.g., nitrophenol, ammonium nitrate and potassium papers etc.,. Liquid fuels i

Other chlorate, paint and oil soaked rags, cotton or cellulose soaked with sulphuric acid etc.,. i

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

CLASSIFICATION 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 extinguisher. **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 Well which fire flames are detected. FIRE ALARMS FIRE SENSORS Prevention of fire hazards • Proper training • Chemical data sheets • Proper ventilated systems • planned design and layout • use of fire extinguishers, alarms ,sensors, • Proper maintenance of surroundings • of personnel • Sprinkler systems Fire suppression It is done by using hydrant • Fire fighting equipment • detectors • Water • Hydrant systems include if • systems/water sprinkler systems and fire extinguishers. • Manually hydrant • Automatic sprinkler and if • Semi automatic hydrant system if • sprinklers if Water and water based extinguishers • portable extinguishers • system. Fire extinguishers include if • Dry chemical • Foam extinguishers. if • soda acid extinguishers • antifreeze extinguishers. if • Halon extinguishers Halon 1301 (bromo tri fluoro • Carbon dioxide extinguishers. if • extinguishers. if methane) Vaporizing liquid. Non-Magnetic stored pressure Spinkler systems Halotron 1 Fire extiguisher deionized water mist fire extinguisher K Class Wet chemical ABC Dry chemical fire extinguisher. Many chemicals • extinguisher Carbon dioxide (CO2) Portable fire extinguisher 2. Chemical hazards if • can cause severe burns, if these coming to contact with living tissue or other routes like inhalation. if • Living tissue may be destroyed by chemical reactions such as dehydration, digestion, oxidation etc. if • Eye and mucus membrane of the throat are particularly susceptible to the effect of corrosive dust, mist Chloroform, benzene, chlorinated hydro carbons, low boiling fractions of petroleum are • and gases. if • some of the common organic solvents used in pharmaceutical industry. SOURCES OF CHEMICAL AIR BORN TOXICS Irritants Ipecac,podophyllumetc .,. Asphyxiants Carbon dioxide, • HAZARDS if • monoxide, methane, ethane, hydrogen cyanide, hydrogen sulphide, helium,nitrogen etc.,. Carcinogens Coaltar, • Narcotics/anaesthetics Acetone, ether, chloroform, methyl-ethyl ketone etc.,. if • Hazards may arise when • cresote oil, anthracene oil, parafin oils, chromium, nickel, cobalt etc.,. if • By products may accumulate relatively high • impure or contaminated chemicals are used. if • In pharmaceutical industry most • concentrations in parts of the plant and cause un expected effects. if • of the dermatitis can be attributed to synthetic drugs, especially acridines and phenothiazines. SAFETY Application of barrier creams before commencing the work • ASPECTS IN CHEMICAL HAZARDS if • While using the high • has been found useful in protecting individuals from hazardous chemicals. if • vapor pressure solvents and grinding of vegetable drugs (e.g., capsicum and podophyllum) safety We must know the exposure limits and • goggles are to be worn. Because these will effects the eyes. if • toxicity of different chemicals. chemicals Exposure limit (ppm) Ethyl alcohol 1000ppm acetone 1000ppm Tolerance levels for toxic chemicals should be • Methylene 125ppm chloride Isopropyl alcohol 400ppm if • Occupational safety and health administration also • followed as set by international regulations. if • 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). 3. 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.

â€¢ Mechanical hazards are exacerbated by the large number and different designs of equipment, crowded work place conditions and different interaction between workers and equipment. â€¢ Hazardous electrical and pneumatic thermal energy must be released or controlled before working on active equipment. â€¢ High sound levels may be generated by manufacturing equipment (e.g., ball mill) there by increasing their exposure to noise. â€¢ Injuries like cutting, tearing, shearing, puncturing and crushing may occur with moving machinery. **Prevention of mechanical hazards Mechanical hazards can be reduced by the application appropriate safeguards.** REQUIREMENTS OF SAFEGUARDS â€¢ Prevent contact â€¢ Securable and durable â€¢ Protect against falling objects â€¢ Do not create new hazard â€¢ Do not create interference â€¢ Allow safe maintenance. 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 **All the operators** Tagout systems. (Shah Prakashan,2007). Safety aspects in mechanical hazards **if should be trained in safe operation, maintenance and emergency procedures to take care when** Inspection ,adjustment repair and calibration of safe guards should be carried out **if accidents occur.** **if** Effort should be **if** Ear protection devices must be used to prevent the excessive noise. **if** regularly. **if** made to reduce the noise to a safe level 4. **Electrical hazards Electrical hazards occurs when a person come in contact with the conductor carrying current and simultaneously contacts with the ground, usually** **if** Short circuits **if** known to be work place hazard. SOURCES OF ELECTRICAL HAZARDS **if** **if** Combustible and explosive materials **if** Arcs and spark hazards **if** Electrostatic hazards **if** Circuit tester **if** Insulation failure DETECTION OF ELECTRICAL HAZARDS **if** **if** Improper wiring **if** Grounding of electrical **if** Receptance wiring tester. PREVENTION OF ELECTRICAL HAZARDS **if** **if** Humidification **if** **if** Bending and grounding **if** **if** Prevention of static electricity **if** **if** Equipments **if** **if** Radioactive neutralizers and **if** **if** Ionizers and electrostatic neutralizers **if** **if** Antistatic materials **if** Ensure that power has **if** Magnetic circuit breaker. SAFETY ASPECTS IN ELECTRICAL HAZARDS **if** Do not wear conductive material like such as **if** been disconnected from the system working with it. **if** **Use only explosion** **if** Verify circuit voltages. **if** **if** Periodically inspect insulation. **if** **if** metal jewellery. **if** All electrical parts **if** **if** proof devices and non sparking switches in flammable liquid storage areas. **if** Ensure all flexible wires and power cables are properly insulated. **if** should confirm ISI specifications. **if** Safe guarding is essential for all **if** Installation of earth trip devices for all electrical equipments. **if** **if** Hazardous drugs that pose **if** electrical equipments. (Niosh,1986). 5. PHARMACEUTICAL HAZARDS **if** 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. **if**,§ Carcinogenicity. **if**,§ Teratogenicity. **if**,§ Reproductive toxicity. Inhalation of **if**,§ Organ toxicity at lower doses. ROUTES OF EXPOSURE TO HAZARDOUS DRUGS **if** Injection. TYPES OF HAZARDS **if** Ingestion. **if** **if** Dermal absorption. **if** **if** an aerosolized drug. **if** Chronic poisoning.(Akunuru,1997). SAFETY ASPECTS IN **if** Acute poisoning. **if** **if** TOXICITY **if** PHARMACEUTICAL HAZARDS Personal protective equipment for hazardous drug handling **if**,§

Disposable gowns made of fabric that has low permeability to the agents in use, with closed fronts and cuffs, intended for single use. i,§ Powder free gloves, labeled and tested for drugs used with chemotherapy, made of latex, nitrile or neoprene. i,§ Face and eye protection when splashing is possible. i,§ 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. i,§ Substitution of more harmful material by one which is less dangerous to health. i,§ To prevent or reduce dangerous exposure to toxic materials. i. Gas releases should be vented outside buildings and away from work areas and other populated areas. ii. Exhausts and ventilations should be provided to remove emissions. i,§ Every bulk drug and pharmaceutical unit must prepare its disaster Standard operating procedures & management plan. 3.SAFETY ASPECTS IN PHARMA INDUSTRY i Floors and floor coverings i Water supply and drainage i Handling of hazardous materials i i Health i Specially trained personnel i Back up plan if anything goes wrong i Emergency exits i Appropriate i Risk analysis i Safety audits i Written procedures i i policies and insurance i Written documentation of i Regular monitoring of workplace i i training and education to employee i From the previous discussion i Create awareness of the environment. 4.CONCLUSION i i policies i it is clear that the safety aspects must be considered by the pharmaceutical industry not only in the The i interest of the employees or property but also in terms of the neighboring environment as well. i 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