COURSE n°7: Industrial Hygiene

1. INTRODUCTION

Industrial hygiene has been defined as "science and art devoted to the anticipation, recognition, evaluation, and control of those environmental factors or stresses arising in or from the workplace, which may cause sickness, impaired health, and well-being, or significant discomfort among workers or the citizens of the community." Industrial hygienists use environmental monitoring and analytical methods to detect the extent of worker exposure and employ engineering, work practice controls, and other methods to control potential health hazards.

Industrial hygienists *analyze*, *identify*, and *measure workplace hazards* or *stresses* that can cause sickness, impaired health, or significant discomfort in workers through chemical, physical, ergonomic, or biological exposures.

2. WORKSITE ANALYSIS

A worksite analysis is the first step that helps an industrial hygienist determine what jobs and workstations are the sources of potential problems. During the worksite analysis, the industrial hygienist measures and identifies exposures, problem tasks, and risks. The most effective worksite analyses include all jobs, operations, and work activities. The industrial hygienist inspects, researches, or analyzes how the particular chemicals or physical hazards at that worksite affect worker health. If a situation hazardous to health is discovered, the industrial hygienist recommends the appropriate corrective actions.

3. RECOGNIZING AND CONTROLLING HAZARDS

Industrial hygienists recognize that engineering, work practice, and administrative controls are the primary means of reducing employee exposure to occupational hazards.

4. EXAMPLES OF JOB HAZARDS

To be effective in recognizing and evaluating on-the-job hazards and recommending controls, industrial hygienists must be familiar with the hazards' characteristics. Potential hazards can include air contaminants and chemical, biological, physical, and ergonomic hazards.

⇒ **Air Contaminants:** These are commonly classified as either particulate or gas and vapor contaminants. The most common particulate contaminants include dust, fumes, mists, aerosols, and fibers.

a) **Dusts:** are solid particles generated by handling, crushing, grinding, colliding, exploding, and heating organic or inorganic materials such as rock, ore, metal, coal, wood, and grain;
b) **Fumes:** are formed when material from a volatilized solid condenses in cool air. In most cases, the solid particles resulting from the condensation react with air to form an oxide. The term mist is applied to liquid suspended in the atmosphere;
c) **Mists:** are generated by liquids condensing from a vapor back to a liquid or by a liquid being dispersed by splashing or atomizing. Aerosols are also a form of a mist characterized by highly respirable, minute liquid particles;
d) **Fibers:** are solid particles whose length is several times greater than their diameter, such as asbestos;
e) **Gases:** are formless fluids that expand to occupy the space or enclosure in which they are confined. They are atomic, diatomic, or molecular as opposed to droplets or particles which are made up of millions of atoms or molecules. Through evaporation, liquids change into vapors and mix with the surrounding atmosphere. Vapors are the volatile form of substances that are normally in a solid or liquid state at room temperature and pressure. Vapors are gases in that true vapors are atomic or molecular.

⇒ **Chemical Hazards:**

Chemical hazards in the workplace refer to the potential risks and dangers posed by chemical compounds which can take the form of gases, solids, liquids, dust, mists, vapors, and fumes. When employees inhale, ingest, or absorb these hazardous chemicals, it can have detrimental effects on their health.

⇒ **Biological Hazards**:

Biological hazards in the workplace refer to the potential risks or dangers that arise from exposure to biological agents such as bacteria, viruses, fungi, and parasites. These types of hazards are present in various industries including healthcare, laboratories, agriculture, and food processing. These hazards can lead to illnesses, infections, and even death if not properly managed and controlled.

⇒ **Physical Hazards:**

Physical hazards in the workplace can include the following:

a) **Heat:** this can occur from working in hot temperatures and being exposed to high levels of humidity or thermal radiation. This can lead to heat exhaustion or heat stroke, which can be life-threatening if not addressed;
b) **Noise:** high levels of noise can become hazardous over an extended period, leading to hearing loss, increased stress levels, and decreased productivity;
c) **Radiation:** radiation hazards are typically present in nuclear, defense, aviation, and oil and gas industries;
d) **Vibration:** vibration hazards typically occur in the transportation industry or in factories where heavy equipment is used. To mitigate this problem, workplaces can install shock absorbers and suspension systems in vehicles or utilize specialized mounts to minimize vibrations caused by heavy equipment.

⇒ **Ergonomic Hazards:**

Ergonomic hazards in the workplace refer to conditions or factors that can cause physical strain or discomfort to employees, potentially leading to injuries or health issues. These hazards can arise from inadequate equipment, repetitive tasks, or poor workplace design. These hazards can result in musculoskeletal disorders such as back pain, neck pain, carpal tunnel syndrome, and eye strain.

5. CLEAN-IN-PLACE (CIP)

Cleaning In Place, many installations require systems to clean tanks, pumps, valves, filters, heat exchange units, and process piping. Using CIP increases efficiency, improves safety, and ensures plant product quality. However, monitoring and controlling the CIP process makes it possible to optimize the heating stages, the quantity of cleaning products, and water consumption.

5.1. The steps of cleaning and disinfection protocols :

Generally, 5 steps follow one another in a complete cleaning cycle:

- A pre-rinse with hot water diffused by high-flow nozzles (for the tanks) which removes, for example, food or solid residues ;

- A first pass of cleaning products which eliminates deposits and particles in the pipes ;
- An intermediate rinse with water to remove these cleaning products ;
- A second pass of detergent product to completely remove the last micro-organisms;
- A final complete rinse with clean water.

5.2. Determining the benchmarks for Cleaning In Place cycles

Cleaning in place is carried out according to the different principles of **TACT**:

- **Temperature:** The programming defines the minimum and maximum temperature of liquids (water or water with added cleaning products or detergents). A minimum temperature level is expected ;
- **Action:** The mechanical action of washing depends on the flows, characterized by the flow rate and the resulting pressure ;
- **Chemistry (Concentration):** The use of cleaning products such as soda or acid is required to dissolve organic and mineral materials. Dosages and concentration are quantified ;
- **Time:** The minimum duration expected for each of the three previous criteria is quantified beforehand depending on the washing phase.