

INTRODUCTION TO INDUSTRIAL HYGIENE

COURSE OUTLINE

- **Industrial hygiene has been defined as...** *"The 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".*
- **More simply, "industrial hygiene" is the science of protecting and enhancing the health and safety of people at work and in their communities.**
- **Typically an Industrial Hygienist deals with five types of hazards...**
 - Physical hazards...
 - Chemical hazards...
 - Ergonomic hazards...
 - Biological hazards...
 - Air contaminants.
- **A Hygienist's focus is on...**
 - Recognizing, anticipating, and evaluating these hazards.
 - Developing or recommending methods to control these hazards.
- **Much of Industrial Hygiene involves measurements of noise levels, chemical concentrations, air quality and the like.**
- **When an Industrial Hygienist is assigned to a facility they will initially perform a "workplace analysis", to determine what jobs and workstations may be sources of potential problems.**
 - They will examine the workplace to determine what hazards currently exist there, as well as what types of hazards might develop in the future.
- **The Hygienist will then analyze the hazards and investigate what can be done to either eliminate or control them, so that they can achieve risk levels that are "As Low As Reasonably Practical".**
- **If once those steps have been taken the remaining risk levels still could result in harm to employees or the community, the Hygienist will determine what protections are needed to control the hazards and keep people safe.**

- **The first step in the process is to determine if "administrative controls" can be used to effectively protect workers from the hazards associated with a task.**
 - These can include adjusting the way a task itself, or steps within the task, are scheduled to minimize employees' exposure levels.
 - For example, a task with a high potential for exposure to a hazard might be scheduled during times when the fewest employees are in the area.
- **Next, "engineering controls" are examined, since they can remove or control a hazard at its source, or can isolate a worker from the hazard.**
- **Common engineering controls can include things such as...**
 - Substituting nontoxic chemicals for toxic ones.
 - Enclosing or confining work processes to certain areas.
 - Installing local or general ventilation systems.
- **If engineering controls cannot practically be implemented, the Hygienist will then look at what types of "work practice controls" could be used to change the way a task is performed and make it safer, such as...**
 - Regularly inspecting the equipment that is used in a task.
 - Ensuring that equipment is serviced and maintained appropriately.
 - Implementing good housekeeping procedures.
- **Other work practice controls that can be employed include...**
 - Putting procedures in place that will minimize potential exposure to hazards that could be encountered while performing a task.
 - Prohibiting eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics in the areas where the task is being performed.
 - Providing appropriate supervision of the task on a regular basis.
- **If after implementing administrative, engineering and workplace controls there is still a significant risk to employees, a Hygienist will look at the last "line of defense", personal protective equipment, and how it could be used when performing the task.**
 - This can include any number of things, from gloves, hard hats, safety glasses and goggles... to safety shoes, respirators and protective clothing.
- **The Hygienist will also check to see that PPE is...**
 - Worn correctly.
 - Properly fitted.
 - Regularly maintained.
 - Replaced when it becomes too worn to be effective.

- **But an Industrial Hygienist's job is not done even after they have identified the hazards that workers may be exposed to and implemented safeguards to provide them with adequate protection.**
 - They must then monitor the controls that have been put into place to see if the procedures need to be adjusted due to changes in the tasks themselves or the materials that are being used.
- **One of the first things that an Industrial Hygienist looks for in a facility is "air contaminants".**
 - These are classified as either "particulates" or "gases and vapors".
- **The most common particulate air contaminants include.**
 - Dusts.
 - Fumes.
 - Mists.
 - Aerosols.
 - Fibers.
- **Fumes are formed when a solid material has been transformed into a gas, such as by being heated, and then condenses in cool air.**
 - Examples include the fumes that are given off during welding operations or are formed from lead when it is heated.
 - Fumes typically cause the most problems when they are inhaled.
- **When a Hygienist is surveying a facility for dusts, they are looking for solid particles that are created from operations such as crushing and grinding materials like rock, ore, metal, coal, wood and grains.**
 - These can all be hazardous when they are inhaled or in some cases if they are swallowed.
- **Mists can also be a problem when they are inhaled or swallowed.**
 - They are formed when liquids that have been vaporized condense back into a liquid, or a liquid is dispersed by splashing or atomizing, such as when a cleaning solution is sprayed into the air.
- **Aerosols are a form of mist that are minute liquid particles that are very easily absorbed into the respiratory system, such as when spraying some air fresheners.**

- **Fibers are another major hazard that an Industrial Hygienist looks for.**
 - They are solid particles that by definition have a length that is several times greater than their width.
 - Often, they are very lightweight, which makes them easily dispersible.
 - Because they often have an irregular shape, with ragged-like edges, they can be particularly hazardous when they are inhaled, such as with asbestos fibers which can lead to cancer.
- **The last type of air contaminants that an Industrial Hygienist will look for are gases.**
 - They can be the most dangerous of the airborne contaminants because they are often invisible to the naked eye and are constantly trying to expand.
- **As a result of this propensity to expand, when gases are confined they can exert a lot of pressure on the container that they are in.**
 - If they are not confined they can disperse quickly and affect a very large number of people.
- **Some gases are also flammable, so they can present a fire and explosion hazard as well.**
 - Examples of gases that can be found in workplaces and can be dangerous include Carbon Monoxide and Dioxide, Fluorine and Chlorine.
- **One group of hazards that has gotten a lot of publicity in recent years is chemical hazards.**
- **Since OSHA created the Hazard Communication Standard there has been a great deal of focus on what hazardous chemicals can be found in the workplace, and what type of damage they can cause to workers' health.**
 - So determining what types of chemicals are used in their facilities, and the hazards that they can pose to employees, is a significant part of an Industrial Hygienist's job.
- **Chemical hazards can be found in virtually any form, including...**
 - Solids.
 - Liquids.
 - Gases and vapors.
 - Fumes, mists and aerosols.
 - Dusts.

- **All of these substances can have toxic effects on the body in a number of ways, such as through...**
 - Inhalation (breathing in the substance).
 - Direct skin contact.
 - Absorption (through the skin of mucous membranes).
 - Ingestion (eating or drinking a substance that has gotten onto food or into a drink).
- **The degree of risk that a chemical hazard creates for workers depends on...**
 - The nature and potency of the substance.
 - How much of the chemical the person has been exposed to.
 - How long the exposure has occurred.
- **Information on the degree of risk that a chemical can pose can be found on its Safety Data Sheet (SDS).**
 - This summarizes important health, safety as well as toxicological information on a chemical's or mixture's ingredients.
- **The HAZCOM Standard requires that chemical manufacturers and distributors provide customers with SDS's for all of the substances that they supply.**
- **Depending on their facility's environment, an Industrial Hygienist may also need to be aware of biological hazards, which can include bacteria, viruses, fungi and other living organisms.**
 - Most biologicals can enter the body either directly or through breaks in the skin, and can cause acute or chronic infections.
- **There are a number of occupations where the likelihood of being exposed to biological hazards is high, including any job that deals with plants and animals (or their by-products) or are in the food or food processing industries.**
 - Laboratory and medical personnel can also frequently be exposed to biological hazards.
- **OSHA's Bloodborne Pathogens regulation also reminded us that almost anyone can be exposed to HIV or the Hepatitis virus through blood and other body fluids that are present at on-the-job accidents.**
 - And COVID-19 has demonstrated how easily an airborne virus can spread if it is not controlled.

- **In situations where exposure to biological hazards is a possibility an Industrial Hygienist focuses on several things, including...**
 - Educating employees on the personal hygiene practices that they should be using to guard against infections, particularly handwashing.
 - Making sure their facility has a plan in place if employees are exposed.
 - Assuring that proper personal protective equipment, such as gloves and respirators, is available for employees who need it.
- **In healthcare environments a Hygienist will also look at...**
 - The ventilation systems, to make sure that they are strong enough to remove potential hazards from all of the work areas where exposure could occur.
 - Controls such as isolating infected patients from staff and each other.
 - Infectious waste disposal systems, to make sure they are adequate.
- **In occupations where live animals are involved, the focus will include preventing and controlling diseases in the animals themselves, as well as properly caring for and treating infected animals.**
- **When thinking about an Industrial Hygienist's involvement with "physical" hazards it helps to remember that it often has to do with things that are "measured".**
- **The physical hazards that Industrial Hygiene frequently deal with include...**
 - Noise.
 - Vibration.
 - Light levels.
 - Temperature.
 - Radiation.
 - ... all things that can be measured.
- **But measuring these hazards is only the beginning of the process.**
 - Once it is determined that there is a problem, an Industrial Hygienist has to figure out how to eliminate or mitigate it.
- **With noise there are several options. Noise can be reduced (or eliminated) by...**
 - Replacing existing equipment with equipment that has been designed to operate more quietly.
 - Enclosing the existing equipment with sound-absorbing material.

- **Substituting quieter work methods is another way that noise can be abated, such as welding parts rather than riveting them.**
- **Treating floors, ceilings and walls with acoustical materials can reduce or redirect noise, and erecting insulated screens around noise workstations can help to protect workers from harmful noise levels as well.**
- **It's also possible to reduce workers' exposure to noise by increasing the distance between the noise and workers in surrounding areas.**
 - Additionally, for employees who must be close to the noise to operate the machine that is creating it, acoustical booths can be installed or schedules can be adjusted to limit the length of time they are exposed to high noise levels.
- **If these adjustments cannot reduce noise to safe levels or are impractical for the situations that need to be addressed, appropriate personal protective equipment, such as ear-plugs or ear-muffs, can be issued to help affected employees.**
 - But no matter what is done to alleviate employees' exposure to noise, good Industrial Hygiene practices must include arranging for periodic testing for workers who are exposed, as a precaution against potential hearing loss.
- **Where there is noise there is often vibration, but equipment that is relatively quiet can generate damaging vibrations as well.**
 - While the creation of many vibrations is unintentional, there are situations where machinery is designed to vibrate, such as to feed or mix materials together.
- **While vibration does not typically pose a significant threat to workers, it can cause significant damage to the machine that is generating it, as well as the infrastructure surrounding it, so this is something that an Industrial Hygienist will look at as well.**
- **There are a number of potential causes of vibration in machinery that a Hygienist will look for, such as:**
 - Imbalanced installation.
 - Bearing failures.
 - Loose, worn or misaligned parts.
 - Bent shafts and gearbox failure.
 - Sound resonance and natural frequency generation.
 - The speed at which the equipment is operating.

- **So if there are situations where vibration is occurring, levels need to be tested to make sure that they won't cause any damage.**
 - Typically for this a Hygienist will use an accelerometer or similar equipment for this.
- **If a vibration problem is identified, the first course of action will be to determine if adjustments can be made to the machine or worn parts can be replaced to alleviate it.**
 - If this is not possible, installing "shock-absorbing mounts" can sometimes fix the problem.
- **Unlike other physical hazards, light and temperature levels can be "multi-directional" problems for an Industrial Hygienist.**
 - A work area can be too bright or not bright enough... or too hot or not hot enough.
- **If there is so much light in a work area that it is uncomfortable for employees' eyes, a Hygienist will see if...**
 - Light fixtures can be "disabled" by unscrewing their bulbs.
 - If the light can just be turned off at a workstation.
- **Some activities, like welding or working with lasers, can also give off harmful light.**
 - In these cases shields or PPE such as welding helmets and specially tinted glasses or goggles will be solutions that a Hygienist will explore.
- **"Reflected" light can be a little tougher to deal with.**
 - Here changing the angle of a computer monitor, or installing a "screen" at a workstation will often do the trick.
- **Adjusting the temperature in a work area can be even more of a challenge for a Hygienist.**
 - Some work environments, such as steel mills or outdoor operations like doing roadwork in the Summer, are naturally hot.
 - In indoor situations fans may need to be used or special HVAC systems may need to be installed or treat the heat.
- **If these solutions are not practical, or the work is being performed outside, a Hygienist may suggest that workers wear heat reflective clothing or special "self-cooling" vests.**
 - In any "high-heat" situation staying hydrated will also be key to maintaining workers' health.

- **Both ionizing and non-ionizing radiation can also be physical hazards in some facilities.**
 - Time, distance and shielding are the most important tools that an Industrial Hygienist can use to help protect workers in these situations.
- **The danger from radiation increases with the length of time that someone is exposed to it.**
 - So in many cases, scheduling employees for short periods of work can help to keep exposure to acceptable levels.
- **Increasing the distance a worker is from the source of radiation can significantly mitigate its effect.**
 - For example, the strength of radiation 10 feet from its source is only one hundredth of its strength when it is 1 foot from the source.
- **But limiting the time of exposure or increasing the distance from the source of the radiation may not be effective for certain forms of non-ionizing radiation.**
 - In these cases a Hygienist will look to protect workers by installing shielding around the source of the radiation.
 - The strength of the radiation that is being generated will determine the density of the shielding material that will be needed to provide adequate protection.
- **Potential ergonomic hazards abound in many work environments, and can almost be a full-time job in themselves for many Industrial Hygienists.**
 - Hazards can run from well-known issues such as repetitive motion and difficult lifting activities to excessive vibration and eye strain.
- **These situations can be caused by a number of things, many of which have been exacerbated in recent years, including...**
 - Increased assembly line speeds.
 - Jobs becoming more and more specialized.
 - Increasingly repetitive tasks.
- **Ergonomic injuries can also result from poorly designed job tasks that force workers into awkward and stressful positions.**

- **The types of jobs that an Industrial Hygienist will often examine first when looking for ergonomic problems typically involve activities such as...**
 - Sorting.
 - Assembling.
 - Lifting.
 - Pushing.
 - Walking.
 - Reaching.
 - Even data entry.
- **Many of these actions can create strain in the hands, wrists and arms, and cause the most common of all ergonomic injuries... carpal tunnel syndrome.**
- **There are a number of things that can be done to address ergonomic problems.**
 - The process, as with all hazards, starts with worksite analysis, since the best solutions address a problem throughout an entire work area by using engineering controls.
 - This can include reconfiguring workstations, improving the lighting in the area, and finding the equipment and tools that are designed to minimize stress when they are used.
- **If engineering controls are not practical, modifying the "work practices" that are used when performing a task is what a Hygienist will look at next.**
- **For example, as common a task as it is, many people do not know the correct steps to take to lift something safely to avoid injuring or straining their back.**
 - So training workers on proper safe lifting techniques can be essential.
- **Another approach an Industrial Hygienist will take to deal with ergonomic problems is applying administrative controls to the situation. These can include...**
 - Periodically shifting workers among several different tasks during their workday, so that they aren't stressing the same parts of their bodies all the time.
 - Reducing the speed on production lines or adjusting daily quotas so that tasks can be done more slowly.
 - Increasing the number of "breaks" that workers can take during their shift, to give their body a rest.
- **In some cases, materials handling equipment, or "strength-assisting devices" can also be utilized to eliminate stress and strain from a task.**

- **Having an Industrial Hygienist examine a workplace and the tasks that are being performed there, and making any adjustments that are necessary to create an ergonomically well-designed working environment, can result in a number of benefits, including...**
 - Increased efficiency.
 - Fewer accidents and injuries.
 - Lower operating costs.
 - The more effective use of personnel.

*** * * SUMMARY * * ***

- **Industrial Hygiene is the science of protecting and enhancing the health and safety of people at work and in their communities.**
- **In the end, an Industrial Hygienist's job comes down to three things...**
 - Looking at the work environments.
 - Identifying problems that could affect workers' safety and health.
 - Finding ways to eliminate or alleviate those problems.
- **Industrial Hygiene primarily deals with five types of hazards...**
 - Physical.
 - Chemical.
 - Ergonomic.
 - Biological.
 - Air contaminants.
- **Much of what an Industrial Hygienist does involves "measurements"... of noise, air quality, chemical concentrations and the like.**
- **The first step an Industrial Hygienist will take in a facility is to conduct a "worksite analysis", to identify potential problems.**
- **There are three types of controls that an Industrial Hygienist will use to try to mitigate hazards...**
 - Administrative.
 - Engineering.
 - Work practice controls.
- **When "controls" aren't able to reduce a hazard to acceptable levels, a Hygienist will look at what types of PPE workers should use to protect themselves.**
- **While an Industrial Hygienist's job may sound complex, their objectives are as basic as it gets... to keep the workers in their facilities, and the community around them, safe and healthy... every day.**