Physical Hazards in Bio Laboratories

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Determining RISK!!

First and most important is to do a Risk Assessment

The determination and evaluation of the level of risk and the mitigation of that risk to employees, the facility or laboratory, and the environment.

Managing Risk

- **Risk Management –**
  - The **continuous and ongoing** process of identifying, assessing, controlling and managing risk to ensure the risk is maintained at tolerable levels.
  - Risk Management includes any program, work practice, etc., that define the methods of risk identification, assessment of that risk, mitigation and control measures, and follow-up within the facility, equipment, processes, and/or activities.
  - An example of such programs would include:
    - Lockout/Tagout,
    - Bloodborne Pathogens Plan,
    - Fire Protection Programs,
    - Electrical safety,
    - Waste management Program,
    - Life Safety,
    - Compressed gas safety - and so forth.

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Setting the Controls

- **Hierarchy of Controls –**
  - A hierarchy of hazard control is a systematic step-by-step process used in workplaces to minimize or reduce exposure to hazards. A triangle with apex upwards shows the priority of actions and decreasing effectiveness from top to the bottom in sequence *elimination, substitution, engineering, work practices, administration and personal protective equipment (PPE).*

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HAZARDS

- General occupational safety and health hazards one might find in many manufacturing facilities:
  - Slips, trips, and falls;
  - Mobile equipment;
  - Improper lifting and resulting back injuries;
  - LOTO;
  - Electrical, and so forth

HAZARDS

- In Bio pharmaceutical manufacturing often includes additional hazards such as:
  - Flammable and combustible materials
  - Hazardous chemicals
  - Compressed gases
  - Biologic hazards
  - Ergonomic strains related to repetitive motion and/or awkward working positions
  - Bloodborne pathogens
  - Noise and other lab safety hazards (sharp glass, etc.)

HAZARDS

- **Flammable and Combustible Materials**
  - Present within bio-pharmaceutical manufacturing facilities can cause uncontrolled fires, leading to extensive and often costly property damage. Accidents involving flammable materials can also lead to serious and potentially fatal worker injury (e.g., burns, smoke inhalation).
  - Chemical Storage

HAZARDS

- **Hazardous Chemicals**
  - Working with, handling, transporting, and storing chemicals is a primary component of the pharmaceutical manufacturer's workday. Many chemicals used in both primary and secondary processing can be extremely hazardous to human health if accidentally ingested or inhaled.

HAZARDS

- **Biological Hazards**
  - Your industry continues to make rapid advances in the prevention and treatment of infectious pathogens, including bacteria, viruses, and fungi.
    - To drive this workers, scientists, and researchers must routinely handle these hazardous organisms, along with any chemicals and materials needed for the development of vaccines and other types of medicines.
  - To reduce the risk of accidental exposure to biological hazards, tightly controlled primary and secondary containment methods should be utilized. These methods include even the simplest strategies, such as routine handwashing, up to and including advanced ventilation systems.

HAZARDS

- **UV Radiation**
  - We typically think of ultraviolet (UV) radiation in the context of sunlight. However, the pharmaceutical manufacturing industry may use UV radiation for operations.
  - Excessive exposure to UV radiation has been associated with an increased risk of cataracts, skin cancer, and burns on the eyes and skin. When applicable, pharmaceutical workers should be offered apparel and accessories that can protect their eyes and skin from UV light.

First Line of Protection

- Recommended Personal Protective Equipment (PPE) varies considerably, but generally includes:
  - Protective apparel, including gowns and coveralls
  - Gloves
  - Shoe covers
  - Eye protection, including face masks and goggles
  - Respiratory protection, which includes N95 respirators and powered air-purifying respirators (PAPR)

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First Line of Protection

- In addition to wearing proper PPE, workers can take additional steps to maximize their safety on the job:
  - Keep Safety Data Sheets accessible
  - Thoroughly and routinely document all risk assessments, safety protocols, and other related information
  - Ensure that workspaces remain tidy and quickly clean up any spills or messes by following the appropriate containment protocol(s)
  - Practice proper hand hygiene and never eat within work areas

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First Line of Protection

- Routinely inspect PPE, equipment, etc. for damage and replace as needed
- Keep chemicals in their original containers and ensure all containers are properly labeled and stored
- Keep entryways clear
- Ensure appropriate ventilation systems are in place, including BSCs when indicated
- Position eye washing and handwashing stations close to work areas

OSHA Key Applicable Standards

- **The Occupational Exposure to Hazardous Chemicals in Laboratories standard (29 CFR 1910.1450)**, commonly referred to as the Laboratory standard, requires:
  - The employer designate a Chemical Hygiene Officer and have a written Chemical Hygiene Plan (CHP)
  - The CHP must include provisions for worker training, chemical exposure monitoring where appropriate, medical consultation when exposure occurs, criteria for the use of personal protective equipment (PPE) and engineering controls
  - Special precautions for particularly hazardous substances, and a requirement for a Chemical Hygiene Officer responsible for implementation of the CHP.

OSHA Key Applicable Standards

- CHP (Chemical Hygiene Plan) must be tailored to reflect the specific chemical hazards present in the laboratory where it is to be used.
- Laboratory personnel must receive training regarding the Laboratory standard, the CHP, and other laboratory safety practices, including:
  - exposure detection,
  - physical and health hazards associated with chemicals, and
  - protective measures.

OSHA Key Applicable Standards

- **The Hazard Communication standard (29 CFR 1910.1200)**
  - The standard requires:
    - evaluating the potential hazards of chemicals, and
    - communicating information concerning those hazards and appropriate protective measures to employees.
    - The standard includes provisions for: developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of safety data sheets (SDSs)

OSHA Key Applicable Standards

- **The Bloodborne Pathogens standard (29 CFR 1910.1030)**
  - including changes mandated by the *Needlestick Safety and Prevention Act of 2001*, re-quires employers to protect workers from infection with human bloodborne pathogens in the workplace. The standard covers all workers with “reasonably anticipated” exposure to blood or other potentially infectious materials (OPIM).

OSHA Key Applicable Standards

- **The Personal Protective Equipment (PPE) standard (29 CFR 1910.132)**
  - Requires that employers provide and pay for PPE and ensure that it is used wherever “hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants are encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or phys- ical contact.”

OSHA Key Applicable Standards

- **The Eye and Face Protection standard (29 CFR 1910.133)**
  - Requires employers to ensure that each affected worker uses appropriate eye or face protection when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation, 29 CFR 1910.133(a).

OSHA Key Applicable Standards

- **The Respiratory Protection standard (29 CFR 1910.134)**
  - Requires that a respirator be provided to each worker when such equipment is necessary to protect the health of such individual. The employer must provide respirators that are appropriate and suitable for the purpose intended, as described in 29 CFR 1910.134(d)(1). The employer is responsible for establishing and maintaining a respiratory protection program, as required by 29 CFR 1910.134(c),

OSHA Key Applicable Standards

- **The Hand Protection standard (29 CFR 1910.138)**
  - Requires employers to select and ensure that workers use appropriate hand protection when their hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes, 29 CFR 1910.138(a).

OSHA Key Applicable Standards

- **The Control of Hazardous Energy standard (29 CFR 1910.147)**
  - Often called the “Lockout/Tagout” standard, establishes basic requirements for locking and/or tagging out equipment while installation, maintenance, testing, repair, or construction operations are in progress.

OSHA Key Applicable Standards

- **Noise**
  - OSHA's Occupational Noise Exposure standard, 29 CFR 1910.95, requires employers to develop and implement a hearing conservation program that includes the use of PPE (e.g., hearing protectors), if workers are exposed to a time-weighted average (TWA) of ≥ 85 dBA over an 8-hour work shift. In addition, when workers are exposed to noise levels ≥ 85 dBA, the employer must develop a monitoring program to assess noise levels.

OSHA Key Applicable Standards

- Compressed gases.
  - Within laboratories, compressed gases are usually supplied either through fixed piped gas systems or individual cylinders of gases. Compressed gases can be toxic, flammable, oxidizing, corrosive, or inert. Leakage of any of these gases can be hazardous. Leaking inert gases (e.g., nitrogen) can quickly displace air in a large area creating an oxygen-deficient atmosphere; toxic gases (e.g., can create poison atmospheres; and flammable (oxygen) or reactive gases can result in fire and exploding cylinders. In addition, there are hazards from the pressure of the gas and the physical weight of the cylinder.

OSHA Key Applicable Standards

- **Cryogenic Safety Hazards**
  - *Cold contact burns* - Liquid or low-temperature gas from any cryogenic substance will produce effects on the skin similar to a burn.
  - *Asphyxiation* - Degrees of asphyxia will occur when the oxygen content of the working environment is less than 20.8% by volume. This decrease in oxygen content can be caused by a failure/leak of a cryogenic vessel or transfer line and subsequent vaporization of the cryogen. Effects from oxygen deficiency become noticeable at levels below approximately 18% and sudden death may occur at approximately 6% oxygen content by volume.

OSHA Key Applicable Standards

- Liquid oxygen can condense oxygen from the atmosphere. Repeated replenishment of the system can thereby cause oxygen to accumulate as an unwanted contaminant. Similar oxygen enrichment may occur where condensed air accumulates on the exterior of cryogenic piping. Violent reactions, e.g., rapid combustion or explosion, may occur if the materials which contacting the oxygen are combustible.

- **PPE -** Whenever handling or transfer of cryogenic fluids might result in exposure to the cold liquid, boil-off gas, or surface, protective clothing must be worn. This includes:
  - Face shield or safety goggles;
  - Safety gloves; and
  - long-sleeved shirts, lab coats, and aprons.

A Good Reference

OSHA – Laboratory Safety Guidance - **OSHA 3404-11R 2011**

https://www.osha.gov/sites/default/files/publications/OSHA3404laboratory-safety-guidance.pdf

Thank you!

And … Questions??