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Lab Safety

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Lab Safety

Working in a laboratory setting involves the use of many potentially hazardous chemicals. A laboratory safety program depends on every employee's participation and cooperation.

Regulatory Requirements

The Occupational Safety and Health Administration (OSHA) issued a standard titled Occupational Exposure to Hazardous Chemicals in Laboratories, 29 CFR 1910.1450. This standard:

- Covers all laboratories engaged in the laboratory use of chemicals
- Requires the establishment of a written chemical hygiene plan

The **chemical hygiene plan** provides a written program detailing procedures, equipment and work practices for protecting employees from laboratory health hazards. Familiarize yourself with your laboratory's chemical hygiene plan.

Routes of Exposure

Chemicals can enter your body in four ways:

- Inhalation
- Skin absorption
- Injection
- Ingestion

Inhalation and skin absorption are the most common routes of entry in the laboratory setting. Work practices should always try to minimize exposure to all chemicals

Chemical Hazards

- A hazardous substance is defined as any substance that is a physical hazard or a health hazard
- Health hazards can cause acute or chronic effects on the human body
- Physical hazards can cause harm to both people and property
- Labeling markings typically contain one of the following terms:
    - **Danger:** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.
    - **Warning:** Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
    - **Caution:** Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

Effects of Exposure

- An acute effect of chemical exposure happens suddenly, typically from a single exposure
- Chronic effects to chemical exposure do not happen suddenly. They are the result of repeated or prolonged exposures over a long period of time

Signs and Symptoms

- If you experience any signs or symptoms of chemical exposure, notify your supervisor immediately
- Signs or symptoms of exposure include:
    - Skin or eye irritation
    - Shortness of breath
    - Nausea
    - Headache, etc.

Exposure Limits

To reduce the effects of exposure, always observe the PEL and TLV of the chemicals you work with in the laboratory. These levels should never be exceeded

- PEL (Permissible Exposure Limit)—defined by OSHA as: 8-hour, Time Weighted Average (TWA) that is deemed the maximum safe concentration
- TLV (Threshold Limit Value)—established by the ACGIH (American Conference of Governmental Industrial Hygienists) as the airborne concentration of substances that represent conditions under which it is believed that nearly all workers may be exposed day after day with no adverse effect

Non-regulatory exposure limits are also established by several organizations:

- The REL (Recommended Exposure Limit) exposure level set by NIOSH (National Institute for Occupational Safety and Health); these are 10-hour TWAs (time-weighted averages)
- The WEEL (Workplace Environmental Exposure Level), established by the American Industrial Hygiene Association, is an exposure guide for chemical and physical agents and stresses

Chemical Information

Hazardous substances must have a Safety Data Sheet (SDS) provided by the manufacturer or third party. The SDS describes the chemical or product you are working with, its PEL and TLV exposure limits, potential hazards, and ways to minimize its hazards.

Detection and Control

Your senses alone are often NOT enough to detect the presence of hazardous chemicals. Methods that may be used to detect the presence of a hazardous chemical include:

- Monitoring conducted by your employer
- Continuous monitoring devices
- Visual appearance or odor of hazardous chemicals when being released

Controls must be put in place to eliminate or reduce the risk of exposure to hazardous substances. Control techniques fall into three broad classes, in order of preference:

- Engineering controls
- Administrative controls
- Personal protective equipment

Engineering Controls

Engineering controls eliminate or reduce exposure to a chemical or physical hazard through the use or substitution of engineered machinery or equipment:

- Conducting work with hazardous chemicals in a laboratory hood or glove box
- Providing secondary containment in the event of spills

The primary purpose of a **laboratory hood** is to keep toxic or irritating vapors and fumes out of the general laboratory working area.

- Lowering the sash of the hood creates a shield between the worker and equipment being used
- Use a hood or other local ventilation device when working with any appreciably volatile substance with a PEL or TLV of less than 50 ppm
- Work should be performed as deeply within the hood as possible
- Keep the hood closed at all times except when adjustments within the hood are being made
- Keep materials stored in the hood to a minimum; the lab hood is not a storage cabinet

Administrative Controls

Administrative controls require that workers take active steps to observe warning signs and follow appropriate procedures. Examples include:

- Posting hazard signs on laboratory doors
- Minimizing exposure time when working with hazardous chemicals
- Restricting access to areas where hazardous chemicals are used
- Adopting standard operating procedures

PPE

Personal protective equipment (PPE) is the last line of defense against exposure to hazardous chemicals. Wearing appropriate PPE and practicing good personal hygiene will minimize exposure to hazardous chemicals during routine use.

When working in the lab:

- Wear a lab coat or apron
- Make sure your legs and feet are covered
- Confine loose clothing and long hair
- Remove laboratory coats immediately upon contamination

Always wear appropriate **eye protection** where chemicals are stored or handled:

- Goggles are recommended when chemical splashes are possible
- Full-face shields must be worn when conducting a procedure that may result in a violent reaction

Gloves are essential when working with hazardous substances:

- Wear appropriate gloves for the chemical you are using
- Inspect the gloves before each use, wash them before removal and replace them as needed
- The proper gloves will prevent skin absorption, infection and burns

You must use appropriate **respiratory equipment** when air contaminant concentrations are not sufficiently restricted by engineering controls:

- If your work requires that you wear a respirator, additional training will be provided
- Always inspect the respirator before each use

Good **personal hygiene** is important:

- Wash hands throughout day, after glove removal, before leaving lab, after contact with hazardous material, and before eating, drinking, smoking or applying cosmetics
- Never smell or taste chemicals and never use mouth suction for pipetting or starting a siphon
- Avoid storage, handling or consumption of food or beverages in areas that are also used for laboratory operations

Other Lab Hazards

- Glassware
- Gas cylinders
- Electrical hazards
- Ergonomic risk factors

Glass wear
Glass breakage is a common cause of injuries in laboratories.

- Only glass in good condition should be used
- Discard or send for repair all broken, chipped or badly scratched glassware
- Handle and store laboratory glassware with care to avoid damage
- When inserting tubing into stoppers, lubricate tubing and wear leather gloves to protect your hands from being cut
- Use extra care with Dewar flasks and other evacuated glass apparatuses

Remember: Use equipment only for its designed purpose.

Gas Cylinders
Many laboratory operations require the use of compressed gases. Because compressed gas cylinders present unique hazards, care must be taken during their use, transport and storage.

- Use appropriate hand carts to move compressed gas cylinders
- Gas cylinders should be capped and secured to a cart during transport
- Highly toxic gases should not be moved through the corridors
- Always consider cylinders “full” and handle them with corresponding care
- Gas cylinders should be stored in well-ventilated areas with their protective caps in place
- Gas cylinders should be secured (strapped or chained in place) to reduce the chance of being knocked over
- Do not store cylinders near heat or high-traffic areas
- Do not store flammables and oxidizers together
- Do not store empty and full cylinders together
- Oxygen cylinders must be stored at least 20 feet from combustible materials
- Storage of large quantities of cylinders should be in an approved gas cylinder storage area

Electrical Hazards
Laboratory environments contain electrical hazards that, if not controlled, can lead to shock, fire and explosions.

- Ground Fault Circuit Interrupters (GFCIs) should be used in locations involving wet processes
- Only use multi-outlet plugs with a built-in circuit breaker
- Make sure all electrical hand tools are grounded or double insulated

When using extension cords in a laboratory environment:

- Keep electrical extension cords visible and inspect them for damage or defects
- Keep cords away from aisles or corridors
- Do not wrap around fixtures, place under rugs, or drape over pipes, lights or ductwork

Ergonomics
Laboratory researchers are at risk for repetitive motion injuries during routine laboratory procedures.

To reduce your risk of ergonomic injury:

- Use ergonomically-designed lab equipment when possible
- Follow proper lifting techniques
- Avoid static posture – take mini-breaks and perform stretching exercises
- Talk with your supervisor about other methods to control laboratory ergonomic risk factors

General Safety Rules

- Be alert to unsafe conditions and see that they are corrected upon detection
- Avoid working alone in a building or laboratory
- Avoid practical jokes or other behavior that might confuse, startle or distract another worker
- If leaving an operation unattended, leave the lights on, place an appropriate sign on the door and provide for containment of toxic substances in the event of failure of a utility service

Emergency Response

In the event of an emergency, follow your facility's emergency response plan.

Successful response to **fires** requires preparedness.

- Know the locations of fire alarm pull boxes, fire extinguishers and evacuation routes
- If a major fire, evacuate immediately
- Extinguish a small fire only if you are trained and if it is safe to do so

You should know the location and proper usage of **safety showers** and **eyewash stations**:

- Safety showers are designed to flood the entire body in the event of a clothing fire or a major spill of a chemical
- Flood the affected area for a minimum of 15 to 30 minutes
- In the case of a corrosive liquid spill, remove the affected portion of clothing while under the activated shower

In the case of eye contact, promptly flush the eye with water:

- Always flood the eyes for at least 15 to 30 minutes, flushing from the eye outward
- After washing, authorities should be notified and medical attention sought

Spills

In the event of a chemical spill or release, you should respond as outlined in the emergency response plan.

- If there is any doubt about your ability to safely clean up the spill, get help; only trained personnel can respond to certain types of spills
- Ensure that spill-absorbent material is readily at hand prior to commencing operations
- Use only the minimum amount of chemical necessary, and mix and use the chemical in unbreakable plastic containers, whenever possible

Housekeeping

- Keep the work area clean and uncluttered, with chemicals and equipment properly labeled and stored
- Clean up the work area on completion of an operation or at the end of each day

Waste Disposal

- Be familiar with the policies and procedures for waste disposal at your laboratory
- Deposit chemical waste in appropriately labeled receptacles
- Never pour chemicals down sink or sewer drains