II. Hazard Control Methods

1 Introduction

Hazard control methods in the laboratory refer to measures intended to minimize or eliminate exposures to potential hazards. This section will describe methods for controlling exposure to chemicals. The University requires that all feasible controls be implemented by the PI or lab supervisor to reduce employee exposure to hazardous chemicals. There are three types of hazard control methods:

- Engineering controls
- Administrative controls
- Personal Protective Equipment (PPE)

2 Engineering Controls

The primary method of hazard control in a lab should always be an engineering control. Engineering controls are devices such as chemical fume hoods, glove boxes, snorkel vents, or other enclosures that when operated properly can eliminate or greatly reduce exposure by removing contaminants or hazards from the work environment.

2.1 Chemical Fume Hoods

Chemical fume hoods work by moving air from the lab into the hood, and exhausting the chemical contaminants (dust, gas, mist or vapor) to the outside atmosphere. To safely operate a chemical fume hood the lab staff must assure that airflow is not interrupted:

- Keep sources of emission at least 6 inches inside the fume hood (behind sash).
- Minimize storage of chemicals in the hood
- Avoid blocking baffle exhaust slots
- Insure that the fan blower is working
- Work with the sash at the prescribed height for the hood, typically not to exceed 18 inches but as low as possible.

All chemical fume hoods must be certified annually. EH&S or its designee inspects fume hood performance, and places indicator stickers for proper sash height. Contact EH&S (412-624-9505) to request an evaluation of a chemical fume hood. Always work with the fume hood sash at or below the indicated height to assure that the capture air velocity is adequate to protect the fume hood user and other lab workers.

Note: Most biosafety cabinets and other laminar flow devices do not provide protection from gases and vapors. The use of volatile chemicals in biosafety cabinets is only allowed in a specific type and Class of biosafety cabinet. Contact EH&S (412-624-9505) to determine if a biosafety cabinet is the proper type for chemical usage.

3 Administrative Controls

A secondary method for controlling worker exposure to laboratory hazards is through implementation and enforcement of policies, procedures and guidelines. Examples of the administrative controls used in laboratories are:

- Chemical Labeling
- Chemical Storage, Handling and Disposal Practices
- Safety Data Sheets
- Chemical Hygiene Plan and Standard Operating Procedure Implementation
- Laboratory specific Standard Operating Procedures (SOPs)

3.1 Before Entering the Lab

These general safety rules apply to anyone entering labs at the University of Pittsburgh.

- Only authorized / approved personnel are allowed to enter a laboratory. Appropriate warning signs on all lab doors assist persons in identifying restricted areas and potential lab hazards.
- Protect exposed skin by wearing the appropriate lab attire.
- Skirts or shorts exposing the knee when seated and open toed shoes should not be worn in the lab.
- If anyone in the laboratory is handling chemicals, it is advisable that you wear protective equipment, especially safety glasses and a lab coat (even if you are not directly working with a chemical).

3.2 Lab Security

The University Police and EH&S have developed security procedures for laboratories. All employees working in the lab should comply with these procedures.

- Control access to areas where hazardous materials are used and stored. Keep doors locked when such rooms are unattended.
- Know who is in your laboratory area
- Know what materials are being brought into your lab
- Know what materials are being removed from your lab
- Have a site-specific emergency plan
- Recognize that laboratory security is related to but different from laboratory safety, and develop a site-specific security plan

3.3 Labeling Chemicals

Unlabeled or poorly labeled containers create a potential hazard in the lab. All containers in the lab must be labeled to identify the chemical contents according to these guidelines:

- Label all containers in the lab with common name. No abbreviations, acronyms, or formulas should be used.
- If practical also include the date of preparation, the concentration and any expiration date.
- All flasks, beakers and other containers of material should be labeled and capped when not in use.

- When several containers of the same material are in a box or tray it is permissible to label the box or tray with the chemical name. If containers are removed from this box or tray then they must be properly labeled.

3.4 Safety Data Sheets (SDS)

A Safety Data Sheet (SDS) is a valuable reference. It is important to consult an SDS before introducing a new chemical into a lab protocol. The SDS provides information to help you understand the intrinsic hazards of the chemical including:

Safety Data Sheets contain the following 16 headings:

1. Identification of the chemical
2. Hazard identification
3. Chemical composition
4. First Aid measures
5. Firefighting measures
6. Accidental release measures
7. Handling and storage
8. Exposure control/PPE
9. Physical and chemical properties
10. Stability and reactivity
11. Toxicology information
12. Ecological information
13. Disposal considerations
14. Transport information
15. Regulatory information
16. Other information

SDS for laboratory chemicals can be obtained via the EH&S website (www.ehs.pitt.edu). Labs must also prepare a Chemical Inventory List and review and update the inventory list on an annual basis. Contact EH&S at 412-624-9505 should you need help locating a SDS.

3.5 Chemical Storage Guidelines

Use the following guidelines for chemical storage in labs:

- Storage areas and labs should be posted with signage to identify the significant physical or health hazards present.
- All chemicals should be stored according to compatibility (not alphabetically). For example, oxidizers such as perchlorate salts are stored separate from organics, acids and flammables.
- Labs possessing over 10 gallons of flammable liquid or containers of flammable liquid with capacity of 5 gallons or more should be stored in a rated flammable material storage cabinet.
- If your lab has a flammable material storage cabinet, store all flammable liquids inside the rated cabinet(s). Most cabinets under lab benches and fume hoods are not fire rated.
- Corrosive materials and other hazardous liquids should always be stored below eye level.

3.6 Leaving the Laboratory

After completing work in the laboratory, or any time you leave the laboratory:

- Stabilize your experiment, equipment or process.
- Verify all chemical containers are closed, labeled, and stored properly.
- Clean all contaminated instruments or containers.
- Dispose of chemical waste in properly labeled and capped containers.
- Remove PPE and wash your hands thoroughly. Never touch doorknobs, phones or other equipment with contaminated gloves.
- Lock door when lab is unattended.

Good housekeeping must be practiced in labs at all times.

- Keep work areas clean and uncluttered
- Clean work areas upon completion of an operation or at the end of each workday
- Do not throw chemicals, sharps, broken glass or biohazardous material into regular trash

4 Personal Protective Equipment

If engineering and administrative controls do not adequately control hazards, the use of personal protective equipment is warranted. Personal protective equipment (PPE) includes any safety device or clothing worn by the worker to protect against the hazards in the lab environment.

Examples of PPE for the lab include:

- Lab coats
- Gloves
- Safety glasses
- Face shields
- Rubber aprons

4.1 Glove Selection and Use

Chemical resistant liquid barrier gloves are an important aspect of protection against hazardous materials. It is critical that users select the correct glove material based on the chemical properties and the glove's permeation data. Consult the manufacturer's glove guide for recommendations on how to select the best glove for your application.

Non-disposable gloves:

- Use when immersion or prolonged contact with chemicals is anticipated.
- Inspect gloves before each use, and replace whenever they become discolored or show signs of damage.
- Before reusable gloves are removed, thoroughly rinse with water.
- Remove and allow to air dry.

Disposable gloves:

- Disposable gloves provide a short term barrier protection when working with small amounts of laboratory chemicals.
- If a disposable glove becomes contaminated, remove immediately and replace with a new glove. Never re-use disposable gloves.
- Do NOT use disposable gloves when immersing hands in solvents or corrosives.

Always wash hands with soap and water after glove removal. Common glove materials and intended uses are provided below.

Latex - Water-soluble chemicals, agars, buffers

Neoprene - Corrosives, solvents and alcohols such as hydrochloric acid, nitric acid, potassium hydroxide, and methanol

Nitrile - Organic solvents (non-halogenated) such as hexane and methanol

Nomex and Zetex - Temperature and abrasion resistant for handling hot materials

Cryogenic gloves - Cold protection when using liquid nitrogen

Viton TM - Chlorinated and aromatic solvents such as chloroform & benzene

Butyl - Aldehydes, ketones, and esters

4.2 Eye and Face Protection

Appropriate eye and face protection must be worn at all times when performing tasks where the potential for chemical splash or projectile hazards exist. Personal prescription eye glasses are not a proper substitute for safety eyewear.

Guidelines for Selecting Appropriate Eye and Face Protection:

1. Safety glasses are required when:

- An impact or dust hazard exists
- When working with lower hazard chemicals
- When a probability of splash exists, for example, during:
    - o Pipetting
    - o Mixing solutions
    - o Opening centrifuge tubes

2. Chemical splash goggles are required when:

- Working with corrosive chemicals
- Higher probability of splash exists, for example, during:
    - o Pouring strong acids from a 1 liter bottle
    - o Working with liquids under pressure

3. Face shields in combination with safety eye wear are required when handling:

- Quantities of corrosive chemicals over one liter
- A higher probability of eye and face injury exists, for example, during:
    - o Working with an acid bath
    - o Handling highly reactive chemicals that may spatter

If you have a question about the level of eye protection required for a specific task contact EH&S at 412-624-9505.