Section 5 - Employee Health and PPE

Contents

A. ENVIRONMENTAL MONITORING AND MEDICAL SURVEILLANCE 5-2
   1. Exposure Limits ........................................................................................................... 5-2
   2. Special Chemical Air Monitoring ............................................................................. 5-2
   3. Possible Over-Exposure .......................................................................................... 5-3
   4. Medical Evaluations ............................................................................................... 5-3

B. PERSONAL PROTECTIVE EQUIPMENT (PPE) .......................................................... 5-4
   1. Eye Protection ........................................................................................................... 5-5
      a. Prescription Safety Glasses .............................................................................. 5-5
      b. Safety Glasses ................................................................................................... 5-5
      c. Splash Goggles ................................................................................................. 5-5
      d. Face Shields ...................................................................................................... 5-5
      e. Free-Standing Barrier Shields ......................................................................... 5-5
      f. Specialized Eye Protection ................................................................................ 5-5
   2. Personal Apparel ....................................................................................................... 5-6
      a. Appropriate Clothing .......................................................................................... 5-6
      b. Jewelry .............................................................................................................. 5-6
      c. Hair .................................................................................................................... 5-6
      d. Laboratory Coats ............................................................................................. 5-6
   3. Gloves ........................................................................................................................ 5-7
      a. When to Wear ..................................................................................................... 5-7
      b. Selection ............................................................................................................ 5-7
      c. Inspection ......................................................................................................... 5-7
      d. Removal ............................................................................................................ 5-8
      e. Replacement ..................................................................................................... 5-8
      f. Contaminated Gloves ....................................................................................... 5-8
      g. Latex Gloves ..................................................................................................... 5-8
   4. Respirators ................................................................................................................. 5-8
   5. Hearing Protectors ...................................................................................................... 5-8
   6. PPE Outside the Laboratory .................................................................................... 5-8

Tables

Table 5-1 Guidelines for Airborne Exposure Levels .................................................... 5-2
Table 5-2 Special Chemical Air Monitoring ................................................................. 5-3
Table 5-3 Hazards and Example PPE .......................................................................... 5-4
A. ENVIRONMENTAL MONITORING AND MEDICAL SURVEILLANCE

As a general principle, exposures to hazardous chemicals should be kept as low as possible and avoided when possible through good laboratory procedures. If there is reason to believe that exposure to a chemical routinely exceeds an exposure limit for a chemical, then the Principal Investigator (PI) or supervisor shall arrange to measure an employee’s exposure to that chemical. For assistance in determining if air monitoring should be conducted, contact EH&S at 206-543-7388. In most cases, EH&S can also perform the air monitoring.

1. Exposure Limits

Exposure limits can be defined by a regulation (identified as a Permissible Exposure Limit (or PEL) or by a guideline. PELs are listed in the Washington Administrative Code (WAC) at WAC 296-841-20025, which can be viewed at: [http://apps.leg.wa.gov/WAC/default.aspx?cite=296-841-20025](http://apps.leg.wa.gov/WAC/default.aspx?cite=296-841-20025). Some chemical-specific regulations set a limit called an Action Level (AL) in addition to the PEL. If an AL is exceeded, continuing actions must be taken to make sure the levels do not exceed the PEL.

There are only about 600 chemicals with a regulatory PEL, so it is frequently necessary to refer to a guideline to get an idea of a possible significant exposure. Guideline limits are considered “recommendations” and exposures should not exceed these levels. These guidelines are typically more up-to-date than the regulatory limits. Various organizations publish guidelines, as shown in Table 5-1, Guidelines for Airborne Exposure Levels.

Table 5-1 Guidelines for Airborne Exposure Levels

<table>
<thead>
<tr>
<th>GUIDELINE ORGANIZATION</th>
<th>GUIDELINE TITLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>National Institute for Occupational Safety and Health (NIOSH)</td>
<td>Recommended Exposure Limits (RELs)</td>
</tr>
<tr>
<td>American Conference of Governmental Industrial Hygienists (ACGIH)</td>
<td>Threshold Limit Values (TLVs)</td>
</tr>
<tr>
<td>American Industrial Hygiene Association (AIHA)</td>
<td>Workplace Environmental Exposure Limit Guides (WEEL Guides)</td>
</tr>
</tbody>
</table>

In addition to the organizations listed above, guidelines may also be produced by other organizations, nations, and chemical manufacturers. The recommended limits can be obtained from the publications of those organizations, found on Web pages, or sometimes listed on material safety data sheets/safety data sheets. Contact EH&S at 206-543-7388 concerning exposure limit questions. Due to lack of complete knowledge of the health effects of chemicals and possible chemical synergies, there may be an exposure issue even though levels do not exceed limits. Personnel should take reasonable steps to keep exposures and levels as low as feasible.

2. Special Chemical Air Monitoring

Washington State Department of Labor & Industries regulations specifically address the chemicals listed in Table 5-2, Special Chemical Air Monitoring, and require that air monitoring be done. Contact EH&S at 206-543-7388 for assistance if you routinely use any of these chemicals in Table 5-2:
Table 5-2  Special Chemical Air Monitoring

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Chemical</th>
<th>Chemical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrylonitrile</td>
<td>1,2-Dibromo-3-chloropropane</td>
<td>Methylene chloride</td>
</tr>
<tr>
<td>Asbestos</td>
<td>Ethylene oxide</td>
<td>4,4’-Methylene-dianiline</td>
</tr>
<tr>
<td>Benzene</td>
<td>Formaldehyde</td>
<td>Thiram</td>
</tr>
<tr>
<td>1,3-Butadiene</td>
<td>Inorganic Arsenic</td>
<td>Vinyl chloride</td>
</tr>
<tr>
<td>Cadmium</td>
<td>Lead</td>
<td></td>
</tr>
</tbody>
</table>

3. Possible Over-Exposure

Exposures exceeding recommended limits are considered “over-exposures.” Such limits apply to airborne levels which may result from operations that generate air contaminants outside of fume hoods, from a spill of a volatile chemical, or a leak of a gas. Other routes of entry into the body besides inhalation – ingestion, direct skin or eye contact with a chemical, injection under the skin by a sharp object or high-pressure source, or a combination of these routes – may also present a significant exposure. These exposures may occur if safe practices are not followed.

In some cases, workers may show signs of exposure such as headaches, rashes, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, and loss of motor dexterity or judgment. Such conditions should be evaluated if there is no pathological cause for such symptoms. Follow-up is especially important if the symptoms disappear when the person leaves the exposure area and then reappear soon after the employee returns to work, or if two or more persons in the same laboratory work area have similar complaints.


4. Medical Evaluations

Laboratory employees who were monitored and found to exceed recommended limits, or suspect they may have been over-exposed (such as during a spill clean-up), or have been advised by their private practitioners that they may be impacted by workplace chemical exposures, or are having symptoms consistent with over-exposure to a chemical, should contact the Campus Employee Health Center (206-685-1026 for most work areas; 206-744-3081 for HMC employees; 206-598-4848 for UWMC employees). The Occupational Health Nurse will coordinate medical consultation, exams and surveillance.

Staff involved in any emergency situation should go directly to the nearest emergency room or call 911 (on campus) for assistance, depending on the situation.
B. **PERSONAL PROTECTIVE EQUIPMENT (PPE)**

The purpose of PPE is to reduce student and employee exposure to laboratory hazards. It is to be used when substitution or engineering controls are not feasible. Examples of PPE include gloves, eye and foot protection, respirators, and protective clothing such as aprons and lab coats. (See Table 5-3 for example PPE by hazard type).

Principal Investigators (PIs) or laboratory managers are required to assess the hazards and risks of exposure based on the procedures performed in the laboratory and the controls in use. The PI or manager may have used the laboratory PPE Hazard Assessment Guide: [https://www.ehs.washington.edu/fsosurveys/ppetool.docx](https://www.ehs.washington.edu/fsosurveys/ppetool.docx) as a tool to perform the assessment. EH&S recommends that lab coats and eye protection always be worn when working in the laboratory as best practice.

Before work is initiated, ask to see a copy of the completed assessment or other documents detailing the lab PPE requirements such as standard operating procedures (SOPs). If PPE is required, the University must provide PPE at no cost to an employee (except for prescription safety glasses and closed shoes [http://www.washington.edu/admin/rules/APS/10.04.html](http://www.washington.edu/admin/rules/APS/10.04.html)). The PI or manager must also instruct employees in how to select, inspect, use, maintain, and store the PPE. PPE training records should be maintained (as described in Section 8 of this manual).

Although students must be protected to the same degree as employees, they may be liable for purchase of their own PPE, such as safety goggles or respirators. Some common use PPE, such as aprons, can be purchased and made available for student use by the department.

**Table 5-3  Hazards and Example PPE**

<table>
<thead>
<tr>
<th>HAZARD</th>
<th>PERSONAL PROTECTIVE EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biohazards</td>
<td>Splash goggles, gloves, liquid resistant surgical masks, lab coats, aprons, sleeve covers</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Gloves, chemical-resistant clothing, aprons, sleeves and shoe covers, vapor-proof or splash goggles; lab coats for general use</td>
</tr>
<tr>
<td>Cuts/Abrasions</td>
<td>Cut-resistant gloves (leather, Kevlar, chain-mail)</td>
</tr>
<tr>
<td>Dust</td>
<td>Dust goggles, respirators</td>
</tr>
<tr>
<td>Electricity</td>
<td>Electrically-resistant gloves, mats, hard hats</td>
</tr>
<tr>
<td>Explosions</td>
<td>Protective vests, face shields</td>
</tr>
<tr>
<td>Falling Objects</td>
<td>Hard hats, steel-toe shoes, metatarsal guards</td>
</tr>
<tr>
<td>Falls</td>
<td>Fall harness, strap-on hard hat</td>
</tr>
<tr>
<td>Fires</td>
<td>Fire-resistant lab coat</td>
</tr>
<tr>
<td>Flying Particles</td>
<td>Safety glasses w/ side shields, goggles, face shields</td>
</tr>
<tr>
<td>Hot Environments</td>
<td>Cooling vests, reflective suits</td>
</tr>
<tr>
<td>Hot or Cold Objects</td>
<td>Thermal gloves (Note: Asbestos gloves are prohibited and must be turned in as hazardous waste.)</td>
</tr>
<tr>
<td>Intense Light</td>
<td>Opaque glasses, goggles, welding hoods</td>
</tr>
<tr>
<td>Kneeling</td>
<td>Knee pads</td>
</tr>
<tr>
<td>Lifting</td>
<td>No PPE available, use engineering controls/training</td>
</tr>
<tr>
<td>Low Overhead Objects</td>
<td>Bump cap, hard hat</td>
</tr>
<tr>
<td>Noise</td>
<td>Hearing protection devices</td>
</tr>
<tr>
<td>Over-Water Work</td>
<td>Life vests, flotation devices</td>
</tr>
</tbody>
</table>
1. **Eye Protection**

Appropriate eye protection must be worn when working with chemicals. EH&S recommends that eye protection always be worn when working in the laboratory, as best practice, due to potential accidents affecting individuals away from the scene. Avoid use of contact lenses in the laboratory. If you wear contact lenses, notify the PI or laboratory supervisor and always wear chemical splash goggles or a face shield.

- **Prescription Safety Glasses**
  Prescription safety glasses are available from optical stores. Do not use regular glasses as safety glasses; they are not strong enough.

- **Safety Glasses**
  Safety glasses with side-shields are designed to provide impact protection but provide little protection from chemical splashes, dusts, or hot particles.

- **Splash Goggles**
  Wear splash goggles with splash-proof sides when there is a danger of a chemical splashing. Goggles that have screened sides or other vents are not splash proof, but can be worn when working with apparatus that could produce flying particles (e.g. glassware under reduced or elevated pressure).

- **Face Shields**
  Face shields, in addition to safety glasses or splash goggles, provide maximum protection to the face and neck from flying particles and harmful liquids. Face shields also may be needed when a vacuum system is used.

- **Free-Standing Barrier Shields**
  Free-Standing barrier shields can be used to protect yourself and bystanders from possible explosion.

- **Specialized Eye Protection**
  Specialized eye protection is needed when working with intense light sources such as infrared light, ultraviolet light, glassblowing, welding, and lasers. Glasses, goggles, or face shields with adequate filtration are needed. For assistance, contact EH&S Radiation Safety at 206-543-0463.
2. Personal Apparel

a. Appropriate Clothing

The clothes you wear in the laboratory are an important consideration for personal safety and can influence the severity of consequences of spills, splashes and burns. The following guidelines should be followed when working in the laboratory:

- Shoes should fully cover the feet to protect against spills; no open-toed shoes or sandals are permitted, and shoes constructed of mesh (such as athletic shoes) are not recommended.
- Clothing should cover your legs
- Materials you wear in the laboratory can make a difference. Many synthetic fabrics may be dissolved by solvents or may melt into your skin, causing more extensive burns if they catch on fire. Preferred materials are cotton, wool, and resistant polyester. Synthetic materials, such as acrylics, rayon, and polyester are not recommended.
- Loose, flowing garments and scarves should be avoided; they may easily pick up spills or trail through a burner flame.

b. Jewelry

Loose jewelry such as bracelets, watches, and necklaces, should be avoided since they may catch on equipment. Also avoid rings that can damage protective gloves or make removing gloves difficult.

c. Hair

Tie back long hair so it does not get caught in equipment, come in contact with chemicals, or interfere with your field of view.

d. Laboratory Coats

Laboratory coats are personal protective equipment and protect the skin and clothing from splatter and spills. Laboratory coats are a critical component to worker protection in laboratory areas. All students, faculty, staff, and visitors who conduct work activities with hazardous chemicals, biohazards, and radiological hazards are required to be provided with and wear a laboratory coat.

Laboratory employees and students should wear laboratory coats or aprons and sleeves whenever there is a potential for contaminating skin or clothing. Laboratory coats that extend to the knees must be worn during any work in the laboratory and should be buttoned completely in order to protect skin and clothing from splatter and spills. Lab coats are loose-fitting by design so that it is faster and easier to remove a laboratory coat than street clothes, therefore minimizing skin contact with hazardous materials.

There are a number of types of lab coats which provide varying degrees of protection. A few examples of the different protection available include splash resistant coats, static-free coats, chemical resistant coats, and flame-resistant coats. Please make sure that the coat you wear provides the type of protection that is appropriate for the task and activities performed.

Flame-resistant lab coats are recommended when working with highly flammable, pyrophoric, or potentially explosive chemicals.

Lab coats and other protective wear used in a lab should be kept in the work area to minimize the possibility of spreading chemicals to public places (including eating or office...
areas). Contaminated personal clothing may spread hazards to family and friends, as well as contaminate public areas such as doors, hallways, elevators, and food services.

**Laboratory Laundry Requirements:**
- Laboratory coats must be laundered when soiled or potentially soiled, and on a determined schedule to help ensure they are laundered regularly. Labs should determine a laundering schedule based on the work activities and frequency of use.
- Laboratory coats may not be taken home to be cleaned in a domestic washer, nor should they be taken to a laundry service that is not equipped to handle contaminated items.
- Laboratory coats should be laundered through the University of Washington Consolidated Laundry or similar industrial laundry service. To establish service at UW Consolidated Laundry, contact laundry@uw.edu and provide a contact name, Department, box number, room number, and budget number. They will send you a nylon bag to collect lab coats for laundry, and a form to complete for the service, including drop off/pick-up location and schedule.

### 3. Gloves

**a. When to Wear**

Wear gloves whenever working with chemicals, biohazards, radioactive materials, rough or sharp-edged objects, or very hot or very cold materials.

Do not wear gloves around an unguarded, moving machine as it could snag the glove and pull your hand into it.

Do not wear gloves when touching common surfaces such as telephones, computers, door knobs, elevator buttons, or objects that may be touched without gloves by others.

**b. Selection**

Select gloves based on the material being handled, the particular hazard involved, and their suitability for the procedures being conducted (such as whether the glove provides appropriate dexterity for the procedures). To select the appropriate chemical-protective glove, see the glove selection chart in Appendix G, read the MSDS, or consult EH&S at 206-543-7388. Thin, disposable gloves should not be expected to provide long-term protection from immersion in a chemical; use thick gloves if immersing hands in a chemical.

Other types of gloves used in a laboratory may be designed to protect from biological hazards, sharp objects, and temperature extremes, among other hazards. Asbestos gloves are prohibited and any found in a laboratory should be turned in as hazardous waste.

**c. Inspection**

Inspect gloves before each use and discard if you see discoloration, punctures, and tears. Do not blow into gloves to check for integrity, but if there is no external contamination, the glove may be squeezed to determine if the trapped air is escaping through small holes.
d. Removal
Take off gloves before leaving the laboratory. If using reusable gloves, wash them with soap and water before removing them, to remove possible contaminants. Get in the habit of removing gloves without touching the outside of the glove to clothing or skin. Wash hands with soap and warm water after removing gloves.

e. Replacement
Replace gloves often, depending on their frequency of use and permeability of the chemical(s) handled. Do not re-use disposable gloves.

f. Contaminated Gloves
Dispose of contaminated gloves by carefully removing them and placing them in a plastic bag. If they are grossly contaminated with hazardous chemicals, then manage them as hazardous waste. For more information, see http://www.ehs.washington.edu/epowaste/chemwaste.shtm.

g. Latex Gloves
Do not wear thin latex gloves in the lab for chemical protection. They provide very little protection from chemicals.
Latex gloves can be the source of allergic reactions, which can range from powder abrasion dermatitis to a life threatening hypersensitivity to the latex protein (Also see Appendix G).

4. Respirators
Respirators should not be needed in a normal laboratory setting. However, if you suspect laboratory airborne hazardous chemical concentration is near the PEL, contact EH&S at 206-543-7388 for a consultation.

All use of respirators at the UW must comply with the UW Respiratory Protection Program prior to first use. For more information, contact EH&S at 206-543-7388 and refer to the Respiratory Protection Program web page at http://www.ehs.washington.edu/ohsresp/index.shtm. This program includes evaluating hazards and medical fitness of each user, training, selecting equipment and understanding its limits, fit testing, and annual re-certification.

5. Hearing Protectors
Hearing protectors (earplugs or earmuffs) may be needed for some procedures or in some laboratory settings. If you suspect the noise levels may be potentially harmful, contact EH&S at 206-543-7388 for an evaluation. (A rule of thumb is that if you are in a noise environment for most of the day where you have to raise your voice to be intelligible to someone standing next to you, the noise levels may be potentially hazardous.)

6. PPE: Outside the Laboratory
It is standard practice to remove all PPE, including gloves and lab coats, prior to exiting the laboratory. This prevents any possible contamination of “clean” areas such as restrooms, elevators, offices, and cafeterias. When you are seen wearing gloves or a lab coat in the hallway, the general public perception is that you have been handling something that is possibly harmful to humans. Furthermore, if you have been working with or handling potentially harmful materials, your gloves or lab coat may be contaminated and you may not know it.
It is also critical to remove all PPE, including gloves and lab coats, when leaving areas where any hazardous materials, which may have contaminated the PPE, are in use. This includes hazardous chemicals, radioactive materials, nanoparticles or other hazardous materials.

When transporting hazardous materials through common hallways, the outer surface of the container must be free from contamination. This minimizes potential contact with any hazardous material, thus eliminating your need to wear gloves or lab coat outside of the laboratory.