

**THE UNIVERSITY OF ALABAMA IN HUNTSVILLE**  
**LAB PERSONAL PROTECTIVE EQUIPMENT POLICY**

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**Division** Vice President for Research and Economic Development – Office of Environmental Health and Safety

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**Purpose** To provide guidance and assistance to protect faculty, staff and students from exposure to biohazardous materials and to guard against the release of biohazardous materials that may harm humans, animals, plants or the environment.

**Policy**

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## PERSONAL PROTECTIVE EQUIPMENT (PPE)

PPE is defined by OSHA as "equipment worn to minimize exposure to hazards that cause serious workplace injuries and illnesses." The need for PPE is dependent upon the type of operations and the nature and quantity of the materials in use, and must be assessed on a case-by-case basis. PPE is the least preferred method of protection, and to be used when substitution or engineering controls and work practice controls are not feasible. It should be understood that PPE does not reduce or eliminate the hazard. Every user of the PPE must understand that the PPE will provide protection only to the wearer. The level of protection chosen shall take into account any hazards from other work being carried out in the vicinity that could affect the worker.

A student not wearing required PPE in a laboratory/technical area may not participate in lab activities until such PPE is worn. This policy may only be deviated from when a documented hazard assessment has been conducted and provides information that indicates that personal protective equipment is not necessary.

Each supervisor is responsible for ensuring that his/her workers (employees, students, and visitors) use the appropriate PPE. Individual departments, research centers, and other operating units must determine what type of PPE is necessary and if the workers supply their own or if it is department provided. Under no circumstances should the employee work without the necessary PPE. Students in teaching lab settings are required to provide a lab coat and safety goggles at their own cost. PPE is required in all undergraduate labs where chemical, biological, or radiological materials are used. This includes but is not limited to labs for Chemistry, Biology, Material Science Engineering, Chemical and Biomolecular Engineering, and Biomedical Engineering.

## TRAINING

Laboratory personnel must be trained in the selection, proper use, limitations, care, and maintenance of PPE. Training requirements can be met in a variety of ways including videos, group training sessions, and handouts. Periodic retraining should be offered to both the users and supervisors as appropriate.

As with any training sessions, PPE training must be documented. The Office of Environmental Health and Safety (OEHS) provides PPE training through the Percipio training software. This software will keep the names of the persons trained, the type of training provided, and the dates when training occurred. Information on the specific PPE required to carry out procedures within the laboratory using hazardous chemicals must also be included in the laboratory's Standard Operating Procedures (SOP). OEHS can provide information and assistance with conducting hazard risk assessments and the selection and proper use of appropriate PPE.

*It is the responsibility of the P.I. or laboratory supervisor to ensure laboratory staff have received the appropriate training on the selection and proper use of appropriate PPE, that appropriate PPE is available and in good condition, and that laboratory personnel use appropriate PPE when working in laboratories under their supervision.*

Users are responsible for:

- Attending training sessions on PPE

- Properly wearing the PPE
- Proper care and maintenance of the PPE
- Informing the P.I. or laboratory supervisor about the need for repair and replacement of the PPE

## SELECTION OF PPE

The first step in this selection process is to determine the types of hazards that exist in your lab: a lab hazard analysis must be conducted to identify the hazards. Below are some points to consider when doing the hazard analysis:

- Identify all hazards that may require protection. This should include a list of the chemicals, biological, and radioactive materials involved along with all other potential physical hazards such as abrasion, tearing, puncture, and temperature (cryogenic), light (lasers, welding), noise, and vibration.
- Nature of potential contact. Will the contact be splash, occasional or continuous immersion? Other types of contact or exposure potential include spray (pressurized or non-pressurized), mist (continuous or intermittent), vapors (gaseous contact) and dust.
- Contact location is very important. Which part of the body is most likely to get exposed to the hazards? Consider protection to the eyes, face, skin, nose, mouth, body and feet.
- Consider the type of engineering controls available in the lab (e.g.: fume hood, glove box)?
- Review SOP, US Safety Data Sheets (SDS), and other hazard information to determine appropriate PPE to wear based on chemical hazards encountered.

## MINIMUM PPE REQUIREMENT

- Protective eye wear
- Lab coat
- Closed-toed shoes
- Chemical resistant gloves (when working with hazardous substances)

## EYE PROTECTION

Eye protection is required (but not limited to):

- When chemicals, glassware, or a heating source is being used
- When dust or fumes are present
- When using preserved specimen
- When working with solid materials or equipment under stress, pressure, or force that might cause fragmentation or flying particles
- When an activity generates projectiles, or uses elastic materials under stress (e.g., springs, wires, rubber, glass), or causes collisions.

Eye protection devices must meet the current American National Standard for Occupational and Educational Personal Eye and Face Protection Devices (Z87.1). Eye protection devices that meet this standard should have a Z87 imprinted on the frame of the device.

There are three basic types of eye and face protection which will meet the majority of University laboratory requirements. These are: safety glasses (with side shields), goggles, and face shields.

### **Safety Glasses**

Safety glasses must have side shields and must be worn whenever there is a possibility of objects striking the eye, such as particles, glass, or metal shards. Many potential eye injuries have been avoided at the University by wearing safety glasses. Safety glasses may not always provide adequate protection from chemical splashes as they do not seal to the face. Safety glasses may be adequate where the potential splash is minimal. Ordinary prescription glasses do not provide adequate protection from injury to the eyes and could even be hazardous to the wearer.

### **Goggles**

Chemical splash goggles should be worn when there is a high potential for splash from a hazardous material. For example, goggles should be worn when working with glassware under reduced or elevated pressure and when glass apparatus is used in combustion or other high temperature operations. Chemical splash goggles shall have indirect ventilation so hazardous substances cannot drain into the eye area. Some can be worn over prescription glasses.

### **Face Shields**

Face shields are to be used when working with large volumes of hazardous materials, either for protection from splash to the face or flying particles. Face shields must be used in conjunction with safety glasses or goggles. The following examples where a face shield should be used:

- where glass apparatus is evacuated, recharged with gas, or pressurized;
- when pouring corrosive liquids;
- when using cryogenic fluids;
- when combustion processes are being carried out;
- where there is a risk of explosion or implosion;
- when using chemicals that can cause direct damage to the skin; and
- when using chemicals and biological agents that can be rapidly absorbed into the body via any path e.g. through the skin, eyes or nose.

### **Prescription Spectacles**

Prescription spectacles (as distinct from prescription eye protectors) are generally inadequate against flying objects or particles and could even be hazardous. For persons requiring eye protection in addition to sight correction, the use of prescription spectacles worn with additional protection, e.g. over glasses, wide vision goggles or clip-ons will be necessary.

### **Contact Lenses**

Contact lenses may be worn in the laboratory, but do not offer any protection from chemical contact. If a contact lens becomes contaminated with a hazardous chemical, rinse the eye(s) using eyewash and remove the lens immediately. Contact lenses that have been contaminated with a chemical must be discarded.

## **RESPIRATORY PROTECTION**

The Occupational Safety and Health Administration (OSHA) have strict requirements for respirator (e.g., full-face mask or N-95 filter mask) use. Even a simple paper filter mask is subject to OSHA rules. These requirements include a medical questionnaire and a respirator fit test for all users. This is necessary because wearing a respirator increases the work of breathing, which may cause health problems for some people. To avoid these problems, it is best to prevent inhalation exposures by using engineering controls, (e.g., increased room ventilation, fume hoods and gloveboxes) rather than respirators. OEHS can assist in helping a lab conform to these standards. Any individuals that are respirator fit tested must submit all forms including the fit test results and medical questionnaire with OEHS. The use of respiratory protection must be cleared through OEHS.

## HEAD PROTECTION

Head protection should be worn when hazards such as falling objects; flying objects; low-hanging objects; exposure to shock, electricity, and burns; are present. Head protection must follow the American National Standard for Industrial Head Protection (Z89.1). Ensure the head protection being worn protects from the hazard present. Different head protection devices and different protection standards. Head protection should never be used as a substitute for good engineering control measures.

## LAB COATS

A lab coat must be worn for admittance into any laboratory area in which work with hazardous materials, flammable and corrosive materials, radioactive materials, and biological agents is conducted.

University Policy requires a laboratory coat be worn for admittance into any laboratory area in which work with hazardous materials, flammable and corrosive materials, radioactive materials, and biological agents is conducted. This policy sets forth criteria for selection, use and care of lab coats. Failure/refusal to wear a required lab coat by employees is a basis for disciplinary action. A student not wearing a required lab coat in a laboratory/technical area may not participate in lab activities until such lab coat and/or other PPE is worn. This Policy may only be deviated from when a documented hazard assessment has been conducted and provides information that indicates that lab coat is not necessary.

Lab coats are an important part of personal protective equipment that serve to:

- Provide protection of skin and personal clothing from incidental contact
- Prevent the spread of contamination outside the lab (provided they are not worn outside the lab)
- Provide a removable barrier in the event of an incident involving a spill or splash of hazardous substances

**Each supervisor** is responsible for ensuring that his/her workers (employees, students, and visitors) use the appropriate lab coat per this Policy. Individual departments, research centers, and other operating units must determine what type of lab coat is necessary and if the workers supply their own or if it is department provided. Under no circumstances should the employee work without the necessary lab coat. Students in teaching lab settings are required to provide a lab coat at their own cost. Lab coats are required in all undergraduate labs where chemical, biological, or radiological materials are used. This includes but is not limited to labs for

Chemistry, Biology, Material Science Engineering, Chemical and Biomolecular Engineering, and Biomedical Engineering.

**All laboratory workers** are responsible for following the requirements for wearing and properly maintaining lab coats as outlined in this Policy and in laboratory-specific safety training.

Selection of Lab coats: Lab coats are available in a variety of materials and provide varying degrees of protection. Examples include: splash resistant coats, static free coats, chemical resistant coats, and flame-resistant coats. Please make sure that the coat you are selecting provides the type of protection that is appropriate for your needs. The first step in this selection process is to determine the types of hazards that exist in your lab and the reasons for the lab coats.

Considerations for conducting a hazard analysis:

- Does the lab conduct manipulations involve chemical, biological and radioactive materials?
- Does the lab store large quantities (>10gallons) of flammable liquids outside a flammable storage cabinet?
- Are there hot plates and open flames along with flammable liquids?
- Are there toxic chemicals in use or in storage in the lab?
- What types of engineering controls are available in the lab (e.g.: fume hood, glove box)?

After conducting a lab hazard analysis, it is time to select the appropriate lab coat. One coat may not provide protection against all the hazards present in one laboratory. A chart at the end of this document provides information about lab coats, materials, and protection offered.

Select lab coat/apron using the following requirements and recommendations:

- Length - At least hip length is required. Knee length or longer is recommended for most effective coverage.
- Wristband - It is recommended that a lab coat with a fitted wristband/cuff be used to reduce the potential for splashes up the arm and fire hazards. However, this is not required.
- Top button - It is best to use a lab coat that provides for a high-top button at the neck to provide most effective protection.
- Fire resistant - Use only those constructed of a flame-resistant material.

Lab coats made of polyester-cotton blends (no less than 35% cotton) are acceptable in labs where no open flames are present. Lab coats must be made of 100% cotton or flame resistant material in labs where open flames are used (such as alcohol burners). Labs that store large quantities (>10gallons) of flammable liquids outside a flammable storage cabinet must use lab coats made of 100% cotton treated with flame retardant material. Lab coats of flame resistant (FR) material are required in labs where pyrophoric materials are handled. Persons working with pyrophoric liquids are also required to wear 100% cotton clothing underneath the FR lab coat on days that they handle these materials in the lab.

Emergency spill or splash: In the event of a significant spill of a hazardous material on the lab coat, it should be immediately removed. If skin or personal clothing is impacted, it will be necessary to proceed to an emergency shower. Any contaminated clothing should also be

removed. Guidance should be sought from OEHS about whether the coat and clothing should be cleaned or discarded as hazardous waste.

Emergency fire: The action will depend on circumstances of the fire. If only the lab coat is on fire, remove it, leave area, and call 6911 or activate fire alarm. If lab coat and clothing are on fire, shout for help then stop, drop, and roll; or proceed to an emergency shower (if close by) to extinguish fire. If the area is on fire, leave area, closing doors as you leave. Activate fire alarm and or call 6911. Seek follow-up medical attention. The table below (taken from the Columbia University website <http://ehs.columbia.edu/>) provides information on some typical lab coat materials available, with guidance on use and limitations. There is little or no information provided by manufacturers or distributors about the capability of a lab coat for a combination of hazards. A coat that is “flame resistant”, such as treated cotton, may not be chemical resistant or acid resistant. The term “flame resistant” refers to the characteristic of a fabric that causes it not to burn in air. There are limited criteria for testing lab coat materials with respect to typical lab use scenarios, and some of the information is anecdotal.

Material/Source	Features	Pros	Cons
<b>Polyester/Cotton Blend</b>  <b>80% Polyester / 20% Cotton, 65/35, and 40/60 are common blends.</b>	<b>Liquid Resistance</b> Splash resistant. No specific chemical resistance. Anecdotal evidence suggests polyester blends provide better protection against corrosive material than cotton. <b>Flame Resistance</b> No Polyester blends burn more readily than 100% cotton or flame-resistant materials. <b>Comfort</b>  Lightweight and breathable.  More cotton in the blend results in better breathability.	Appropriate for use in clinical settings and research laboratories where biological material is manipulated.	Polyester blends burn readily when ignited, and are not appropriate for use with flammable liquids, pyrophoric materials, or near open flame.
<b>100% Cotton</b>	<b>Liquid Resistance</b> Not splash resistant. No specific chemical resistance. Anecdotal evidence suggests cotton lab coats provide better protection from solvent contamination than corrosive contamination.  <b>Flame Resistance</b> No Burns less readily than polyester	Appropriate for use in clinical settings and research laboratories where there is light flammable liquid or open flame use.	Cotton lab coats should be supplemented with a chemical splash apron when corrosive material is handled.



<b>Microbreathe</b>	<p><b>Liquid Resistance</b></p> <p>Barrier to particles, biological fluids, and chemicals.</p> <p><b>Flame Resistance</b></p> <p>Not flame-resistant.</p> <p><b>Comfort</b></p> <p>Lightweight, breathable, and stretches to allow ease of movement.</p>	<p>Appropriate for use in clinical settings and research laboratories where biological material and chemicals are handled.</p> <p>Low particle count fabric is ideal for clean room activities.</p> <p>Disposable.</p>	<p>Inappropriate for use in environments with a significant fire danger</p>
<b>DuPont Tyvek lab coats</b>	<p><b>Liquid Resistance</b></p> <p>Barrier to particles, biological fluids, and chemicals.</p> <p><b>Flame Resistance</b></p> <p>Not flame retardant and melts at 135°C (275°F)</p>	<p>Appropriate for use in clinical settings and research laboratories where biological material is manipulated</p> <p>Excellent protection against microscopic airborne particles</p>	<p>Inappropriate for use in environments with a significant fire danger,</p>

## HAND PROTECTION

### Gloves

Protective gloves should be worn when handling hazardous materials, chemicals of unknown toxicity, corrosive materials, rough or sharp-edged objects, and very hot or very cold materials. When handling chemicals in a laboratory, disposable latex, vinyl, or nitrile examination gloves, are usually appropriate for most circumstances. These gloves will offer protection from incidental splashes or contact.

When working with chemicals with high acute toxicity, working with corrosives in high concentrations, handling chemicals for extended periods of time, or immersing all or part of a hand into a chemical, the appropriate glove material should be selected, based on chemical compatibility.

Never reuse disposable glove.

When selecting the appropriate glove, consider the following:

- Degradation Rating
- Breakthrough Time
- Permeation Rate
- US SDS Recommendation

*Degradation* is the change in one or more of the physical properties of a glove caused by contact with a chemical. Degradation typically appears as hardening, stiffening, swelling, shrinking or cracking of the glove. Degradation ratings indicate how well a glove will hold up when exposed to a chemical. When looking at a Chemical Compatibility Chart, degradation is usually reported as E (excellent), G (good), F (fair), P (poor), NR (not recommended) or NT (not tested).

*Breakthrough Time* is the elapsed time between the initial contact of the test chemical on the surface of the glove and the analytical detection of the chemical on the inside of the glove. *Permeation Rate* is the rate at which the test chemical passes through the glove material once breakthrough has occurred and equilibrium is reached.

*Permeation* involves absorption of the chemical on the surface of the glove, diffusion through the glove, and desorption of the chemical on the inside of the glove. Resistance to permeation rate is usually reported as E (excellent), G (good), F (fair), P (poor), NR (not recommended). If chemical breakthrough does not occur, then permeation rate is not measured and is reported as ND (none detected).

For mixtures, it is recommended that the glove material be selected based on the shortest breakthrough time.

The following table includes major glove types and their general uses. This list is not exhaustive.

Glove Material	General Uses
Butyl	Offers the highest resistance to permeation by most gases and water vapor. Especially suitable for use with esters and ketones.
Neoprene	Provides moderate abrasion resistance but good tensile strength and heat resistance. Compatible with many acids, caustics and oils.
Nitrile	Excellent general duty glove. Provides protection from a wide variety of solvents, oils, petroleum products and some corrosives. Excellent resistance to cuts, snags, punctures and abrasions.
PVC	Provides excellent abrasion resistance and protection from most fats, acids, and petroleum hydrocarbons.
PVA	Highly impermeable to gases. Excellent protection from aromatic and chlorinated solvents. Cannot be used in water or water-based solutions.
Viton	Exceptional resistance to chlorinated and aromatic solvents. Good resistance to cuts and abrasions.

Silver Shield	Resists a wide variety of toxic and hazardous chemicals. Provides the highest level of overall chemical resistance.
Natural rubber	Provides flexibility and resistance to a wide variety of acids, caustics, salts, detergents and alcohols.

Please refer to the Assurance Resistance Chart and Ansell Glove Selection Guide for selecting the appropriate gloves linked below.

<http://webfiles.ehs.ufl.edu/Assurance.pdf>

## Proper Glove Removal

Gloves should be removed avoiding skin contact with the exterior of the glove and possible contamination. Disposable gloves should be removed as follows:

1. Grasp the exterior of one glove with your other gloved hand.
2. Carefully pull the glove off your hand, turning it inside-out. The contamination is now on the inside.
3. Ball the glove up and hold in your other gloved hand.
4. Slide your ungloved finger into the opening of the other glove. Avoid touching the exterior.
5. Carefully pull the glove off your hand, turning it inside out again. All contamination is contained.
6. Discard appropriately.

## KEEP PPE INSIDE THE LAB

All 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. Do not use PPE outside the room even when transporting chemicals, radioactive materials or biological hazards. The recommended method of transporting hazardous material within lab buildings is to utilize secondary containment. Secondary containment must be plastic, securely sealed, Tupperware-type containers. This method allows your hands to be free from exposure to any hazardous material, thus eliminating your need to wear gloves or lab coat.

## MAINTENANCE, TESTING, AND REPLACEMENT

- Always inspect PPE for damage (tears, holes, worn elastic, etc.) and contamination prior to use.
- All PPE must be: checked for defects on a regular basis, e.g. perished tubing, holes in gloves, etc.
- If an item cannot be properly cleaned or becomes damaged it should be discarded. When in doubt, throw it out.
- Reusable PPE should be immediately cleaned after each use with the appropriate cleanser (usually soap and water).
- Disposable items should only be used once and replaced when contaminated.
- Always assume PPE is contaminated: it is worn to protect against hazardous substances.
- Remove PPE prior to exiting the lab to help prevent the spread of contamination.

- Be sure you know the proper methods for putting on, taking off, and fit-checking any PPE worn.

If the conditions under which the PPE is used for change, a new risk assessment should be conducted and the PPE should be adjusted or replaced as needed.

## **STORAGE OF PPE**

- Separate from chemicals and other contaminants.
- Store away from sources of heat.
- Do not store under heavy objects.
- Be aware that some equipment may have a limited shelf life.

**Review**      The Office of Environmental Health and Safety (OEHS) is responsible for the review of this policy every five years (or whenever circumstances require).