UAHUNTSVILLE LABORATORY PERSONAL PROTECTIVE EQUIPMENT

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PPE is defined as a device or clothing worn by a worker to help prevent direct exposure to hazards and protect workers from bodily Injury. 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 and does nothing to anyone else in the lab. 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.

The minimal PPE is chemical resistant gloves or gloves appropriate to the hazard, lab jacket or apron, goggles, and closed- toed shoes. The use of respiratory protection must be cleared through the OEHS.

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, including a description of the information covered during the training session and a copy of the sign-in sheet. Training records must be kept of 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. OEHS can provide information, and assistance with conducting hazard assessments and the selection and use of proper 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 use of proper PPE, that proper PPE is available and in good condition, and that laboratory personnel use proper 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 employer about the need for repair and replacement***

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 of 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 nonpressurized), 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 and mouth, body and feet.
- Consider the type of engineering controls available in the lab (e.g.: fume hood, glove box)?
- Review SOP, SDS and other hazard information to determine appropriate PPE to wear based on chemical hazards encountered

Mandatory Minimum PPE Requirement

- Protective eye wear
- Lab coat
- Close-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

- When using preserved specimen

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 in order 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:

1) where glass apparatus is evacuated, recharged with gas or pressurized;
2) when pouring corrosive liquids;
3) when using cryogenic fluids;
4) when combustion processes are being carried out;
5) where there is a risk of explosion or implosion;
6) when using chemicals that can cause direct damage to the skin; and
7) 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. If you must wear respirators, contact the Occupational Health Office at Safety. We will help you conform to OSHA regulations.

Lab Coats

(Refer to Lab Coat Policy-hyper link)

Lab coats:

- 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

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.

The table below (taken from the Columbia University website) 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
Polyester/Cotton Blend **80% Polyester / 20% Cotton, 65/35, and 40/60 are common blends.**	**Liquid Resistance** Splash resistant. No specific chemical resistance. Anecdotal evidence suggests polyester blends provide better protection against corrosive material than cotton. **Flame Resistance** No Polyester blends burn more readily than 100% cotton or flame-resistant materials. **Comfort** 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.
100% Cotton	**Liquid Resistance** Not splash resistant. No specific chemical resistance. Anecdotal evidence suggests cotton lab coats provide better protection from solvent contamination than corrosive contamination. **Flame Resistance** No Burns less readily than polyester blends. **Comfort** Lightweight and breathable.	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.
100% Cotton treated with flame retardant.	**Liquid Resistance** Not splash resistant. No specific chemical resistance. Anecdotal evidence suggests cotton lab coats provide better protection from solvent contamination than corrosive contamination. **Flame Resistance** Yes Flame-resistant (FR) fabrics and garments are intended to resist ignition, prevent the spread of flames away from the immediate area of high heat impingement, and to self-extinguish almost immediately upon removal of the ignition source. **Comfort** Lightweight and breathable.	Appropriate for use in research laboratories where substantial fire risk exists from flammable material handling or open flame use. Laundering will not damage the flame resistant coating.	More costly than a traditional 100% cotton lab coat.
Nomex IIIA	**Liquid Resistance** **Flame Resistance** Yes When in contact with direct flame or extreme heat, fibers in the protective clothing enlarge, enabling greater distance between the user's skin and heat source. **Comfort** Breathable, but slightly bulkier than polyester blend or 100% cotton materials.	Appropriate for use in research laboratories where there is extreme fire danger from open flame, electrical arc flash, and pyrophoric material.	Expensive.
Polypropylene	**Liquid Resistance** Not splash resistant.	Appropriate for use when protection from dirt and grime in nonhazardous environments is	Offers no protection from hazardous materials.

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

Select lab coat/apron using the following recommendations:

- **Length -** At least 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.
- **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

Disposable outer garments (i.e., Tyvek suits) may be useful when cleaning and decontamination of reusable clothing is difficult.

Lab coats are required:

- Lab coats are required in all undergraduate labs where chemicals, biologicals, or radiologicals are used including labs for Chemistry, Biology, Material Science Engineering, Chemical and Biomolecular Engineering, Biomedical Engineering.
- 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.

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, considered the following:

- Degradation Rating
- Breakthrough Time
- Permeation Rate
- 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 or 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 Ressistance Chart and Ansell Glove Selection Guide for selecting the appropriate gloves: (below links)

http://webfiles.ehs.ufl.edu/Assurance.pdf http://www.ansellpro.com/download/Ansell_7thEditionChemicalResistanceGuide.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:

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

Should the conditions in which the PPE is used alter, a new risk assessment should be conducted and the PPE changed if necessary.

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.

Video on PPE

http://cenblog.org/the-safety-zone/2013/06/new-lab-safety-video-on-personal-protective-equipment/