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Personal Protective Equipment

What is Personal Protective Equipment- PPE?

- 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
- PPE is the least preferred method of protection, and should be used following engineering and administrative controls methods.

Hierarchy of Control Measures

1. Engineering Controls
2. Administrative Controls
3. Personal Protective Equipment

Most Effective Control

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Least Effective Control

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Engineering Controls

- Engineering Controls are built into an operation and require no activation from the employee.
- Examples include self-capping syringe needles, ventilation systems, fume hoods and substitution to a less hazardous process or chemical

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Administrative Controls

- Are changes in work practices such as supervision, schedules, and training with the goal of reducing the duration, frequency, and severity of exposure to hazardous situations
- Less effective method used when engineering controls are not feasible.
- Examples include
  - Written operating procedures, training and limiting exposure times
  - Personal hygiene
  - Housekeeping and maintenance

Appropriate Attire for the Lab

- Always wear a lab coat in the laboratory.
- Do not wear tank-tops and shorts inside a lab.
- Tie back or secure long hair and loose clothing.
- Wear shoes that protect or cover your feet. Do not wear flip- flops, sandals or perforated shoes

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Mandatory minimum PPE requirement

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

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Establishing a PPE Program

- First – Hazard Assessment
  - Assess the workplace to determine if hazards are present, or are likely to be present, which necessitate the use of PPE
- Once the proper PPE has been selected, training must be provided to everyone required to use PPE

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Training

Employees required to use PPE must be trained to know at least the following:

- When PPE is necessary
- What type of PPE is necessary
- How to properly put on, take
- off, adjust, and wear
- Limitations of the PPE
- Proper care, maintenance, useful life and disposal

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Users Responsibilities

- Attending training sessions on PPE
- Properly wearing the PPE
- Proper care and maintenance of the PPE
- Informing the supervisor about the need for repair and replacement

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Eye Protection

Eye protection is required (but not limited to):

- When chemicals, glassware, or a heating source is being used
- 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 dust or fumes are present
- When using preserved specimen

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Types of eye protection

- Eye protection is mandatory in all areas where there is a potential for injury.
- The type of eye protection required depends on the hazard. For most situations safety glasses with side shields are adequate.
- Goggles or face shields are required in specific operations where there is danger from splashes of corrosive liquids or flying particles
- If a splash occurs proceed to nearest eyewash fountain and flush eyes with water from the eye outward for at least 15-30 minutes.
- Recommended that contact lenses not be worn in laboratory.

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Goggles

- Usually enclose or protect the eye and the facial area immediately surrounding the eyes from impact, dust, and splashes
- Often worn when danger from splashes of corrosive liquids or flying particles

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Welding Shields

Protect eyes from burns, flying sparks, metal spatter, and slag chips produced during welding, brazing, soldering, and cutting.

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Face Shields

- Device used to protect the entire face from flying objects, debris and chemical splashes or potentially infectious fluid.
- Do not protect from impact hazards

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Choosing Gloves: Compatibility

Three important properties determine the type of chemical-resistant gloves worn:

1. Chemical degradation – Some chemicals cause gloves to deteriorate, rendering them useless. For example, most organic solvents will dissolve latex rubber.
2. Permeation rate – The rate at which a specific chemical diffuses through glove material.
3. Breakthrough time - The amount of time required for a given chemical to penetrate through a glove.

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Glove compatibility

- You can find charts and recommendations for glove compatibility here: https://www.calpaclab.com/chemical-compatibility-charts/
- And https://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf

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Types of Gloves (cont.)

- Norfoil laminate resists permeation and breakthrough by an array of toxic/hazardous chemicals. Resistant to a wide range of solvents, acids, and bases
- Butyl provides the highest permeation resistance to gas or water vapors; frequently used for ketones (M.E.K., Acetone) and esters (Amyl Acetate, Ethyl Acetate).

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Types of Gloves (cont.)

- Viton is made specifically for handling chlorinated and aromatic solvents, exhibit a high degree of impermeability to these solvents and can be used in or around water and water-based solutions. Viton also has superior resistance to PCBs
- Nitrile provides protection against a wide variety of solvents, harsh chemicals, fats and petroleum products and also provides excellent resistance to cuts, snags, punctures and abrasions.

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Ways to protect your skin

- Choose the right PPE for the specific agent you are working with.
- Cover any portion of the skin that is likely to be exposed
- Examples include lab coats, aprons, sleeves, coveralls, head coverings, or protective footwear.

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Lab coat requirements

- 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.

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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

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.

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Material/Source	Features	Pros	Cons
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.
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.

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Protection against inhalation hazard

- The use of a respirator may be necessary to protect against vapors and chemical particulates.
- The keys to effective respirator use are proper fit and the selection of the appropriate cartridge
- Anyone using a respirator (including N95 dust masks) must first receive a medical evaluation, approval, and training

Chemical Cartridge Color Coding

All manufacturers use the same color coding for gas/vapor protection	
Color	Type
White	Acid Gas
Black	Organic Vapors
Green	Ammonia Gas
Yellow	Acid Gas & Organic Vapor
Olive	Multi-gas (protects against numerous gases and vapors)
Magenta	Particulate Filter Cartridge (HEPA) (Also called P100)

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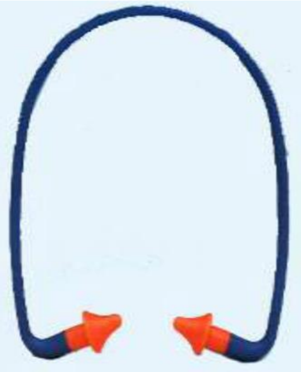
Hearing Protection

- Examples of Hearing Protectors

Earmuffs
can reduce noise by as much as 15 to 30 decibels

Earplugs
foam earplugs to fit ear canals of different sizes

Canal Caps
provide less protection than earmuffs or plugs



Contact OEHS for a noise level evaluation if you suspect noise pollution

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Foot Protection

- Wear shoes that cover your toes.
- No sandals or flip flops in the lab

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PPE Maintenance

- Always inspect PPE for damage (tears, holes, worn elastic, etc.) and contamination prior to use.
- 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)

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Proper use of PPE

- 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.

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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.

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Limitations of PPE

- No single PPE will protect you from all hazards.
- Consider permeation rates, compatibility and degradation for the chemicals you are working with.
- PPE may limit your dexterity, vision, grip strength, or comfort.
- Plan your work accordingly

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Summary

- Conduct a risk analysis for the workplace for likely hazards at the work place
- Use engineering and work practice controls to eliminate or reduce hazards before using PPE
- Educate the everyone about the importance of the PPE program and how and when to use PPE
- Train everyone how to use and care for their PPE and how to recognize deterioration and failure
- Employees are to required to wear the PPEs as recommended by the supervisor

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References

- OSHA Office of Training and Education
- EH&S, University of California, Los Angeles

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Acknowledge Training

Click here to acknowledge receipt of training

- **If you have any questions contact:**
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    Huntsville, AL 35899
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