

## **Personal Protective Equipment Selection Guide**

This document provides guidance on the different types of personal protective equipment (PPE) commonly available for laboratory workers, as well as how to select the PPE that may be appropriate for your hazardous chemical use. Any PPE required to work in the laboratory beyond the minimum requirements (i.e. lab coat, examination gloves, safety glasses, long pants, and closed-toed shoes) must be explicitly mentioned in the Approval Holder's Laboratory Chemical Hygiene Plan.

Only items that meet American National Standards Institute (ANSI) requirements should be purchased or accepted for use; there are a number of safety equipment suppliers within the Arizona Buyways program that sell a wide variety of PPE. See the "Common Purchase List" on the RLSS website for a list of suppliers for various PPE. Contact the RLSS for assistance in determining if additional PPE should be used for a particular experiment or process.

### **General Considerations:**

Take the following factors into consideration when deciding on the proper PPE for an experiment or procedure:

1. the chemical(s) being used, including concentration and quantity,
2. the hazards associated with the chemical(s),
3. the route of exposure for the chemical hazard(s),
4. the work environment (e.g. laboratory vs. field work),
5. the compatibility of the desired PPE material with the chemical(s) being used, and
6. the length of time the PPE will be in contact with the chemicals.

Steps 2 and 3 can be accomplished by looking at the Safety Data Sheet (SDS) for the chemicals that will be used. This selection guide will assist with completing step 4 of this process. Visit the PPE manufacturer's website for information on PPE limitations (e.g. chemical breakthrough times) to assist with step 5.

### **Hand Protection:**

Many different types of gloves exist; no one glove protects against all types of chemical hazards. Before working with any chemicals, laboratory workers should consult that chemical's SDS and container labels for recommended glove types. If this information is not listed, use Table 1 to determine the most appropriate glove for your experiment or procedure. Latex and nitrile gloves are commonly used for incidental, non-planned contact, and nitrile is the preferred glove for chemical protection. The other gloves listed in the table below are for either extended contact (e.g. cleaning up a spill) or specific use (e.g. handling cryogenic liquids).



**Table 1.** Utility of different glove types for hand protection in the laboratory.

Glove Type	Use
Latex (Natural Rubber)	Good for very dilute acids and bases; Poor for organics
Nitrile	Excellent general use glove; Good for a wide variety of solvents, oils, greases, some acids and bases
Butyl Rubber	Good for highly corrosive acids, ketones and esters; Poor for gasoline and aliphatic, aromatic and halogenated hydrocarbons
Neoprene	Good for most hazardous chemicals; Good for acids and bases, alcohols, peroxides, hydrocarbons, fuels and phenols; Poor for halogenated and aromatic hydrocarbons
Polyvinyl chloride (PVC)	Good for acids, bases, oils, fats, peroxides and amines; Poor for most organic solvents
Polyvinyl alcohol (PVA)	Good for aromatic and chlorinated solvents; Poor for water-based solutions
Cryogenic Resistant Material (thick, insulating materials)	For use with cryogenic materials; Designed to prevent frostbite; Note: never dip gloves directly into liquid nitrogen
Nomex	For use with pyrophoric materials; Consider using this flame-resistant glove with a thin nitrile glove underneath
Puncture-Resistant Material (e.g. leather)	For administration of hazardous drugs or chemicals to animals, particularly via injection

### Protective Clothing:

Laboratory workers may utilize many types of protective apparel to prevent exposure to hazardous chemicals in the laboratory. Apparel such as coveralls, shoe covers, and hair nets are often required in clean rooms. Splash-resistant chemical aprons should be considered when working with large quantities of corrosive liquids or liquids that are toxic upon skin contact.

A laboratory coat must be worn when working with hazardous chemicals, as part of the minimum required PPE. As with gloves, all types of laboratory coat material do not protect against the same hazards. Table 2 provides information about some of the laboratory coats that are available, and the situations in which each coat is most effective.



**Table 2.** Utility of different laboratory coat types for use in the laboratory.

<b>Material</b>	<b>Splash Resistance / Chemical Resistance</b>	<b>Flame Resistance</b>	<b>Uses / Comments</b>
Polyester/Cotton Blend 80/20 or 65/35	Splash resistant No specific chemical resistance May provide better protection against corrosive materials than cotton	No	Good for clinical settings and labs handling biological materials with limited use of flammables
100% Cotton	Liquid resistant; not splash resistant No specific chemical resistance Degraded by corrosives May provide better protection against solvent contamination than corrosives	No, but burns less readily than poly/cotton blends	Good for clinical settings and labs handling flammables, heat or flame, where splash resistance is not a concern and minimal corrosives are used
Cotton treated with flame retardant	Liquid resistant; not splash resistant No specific chemical resistance Degraded by corrosives May provide better protection against solvent contamination than corrosives	Yes, somewhat	Good for lab settings with a significant fire hazard from flammables, pyrophorics, or open flames; will not lose flame resistance with laundering, as long as bleach is not used; less expensive than Nomex
Dupont Nomex	Liquid resistant Unknown splash and chemical resistance	Yes	Good for settings where there is extreme fire danger from open flame, electrical arc flash, and pyrophorics; flame resistance maintained even with laundering, as long as bleach is not used; expensive
Polypropylene lab coat (disposable)	Liquid resistant; not splash resistant	No, burns readily	Protects from dirt, grime and dry particulates in a relatively non-hazardous environment
VWR Microbreathe Lab Coat (disposable)	Liquid resistant	No	For clinical and biological lab settings, where biological materials and non-corrosive, non-flammable chemicals are used

### Eye and Face Protection:

As with all other forms of PPE, there are many options for eye and face protective equipment, each of which has different applications and limitations. All protective eye and face equipment must comply with the ANSI Standard Z87.1-1989. Table 3 describes the most common forms of eye and face protection, and the situations in which each piece of equipment is effective in protecting the laboratory worker. Eyewear for laser protection can be described in the Laser Protection Reference Guide found in the “Lasers” portion of the RLSS website.

**Table 3.** Utility of different laboratory coat types for use in the laboratory

Eye/Face Protective Device	Description	Uses
Safety Glasses	Safety glasses rest on the nose of the laboratory worker and may or may not have side protectors  Can be worn over regular prescription eyeglasses	Protect from moderate impact and particles, as well as minor chemical splashes  Do not protect against heavy chemical use such as stirring, pouring or mixing
Prescription Protective Eyewear	Eye protection that incorporates a laboratory worker’s corrective prescription	When working with hazardous chemicals, if not wearing eye protection that can be worn over prescription lenses  Risk Management Services offers the Fisher/3M prescription safety eyewear program
Splash Goggles	Cover all sides of the eye, and are usually attached by an elastic band over the head  Goggles can either have vented or non-vented frames	Protect against potential chemical splash hazards, use of concentrated corrosive material and bulk chemical transfer
Face Shields	Consist of an adjustable headgear and face shield that can either be clear or tinted	Use when the entire face needs protection, to protect eyes and face from flying particles due to explosions and vigorous splashes  Face shields should not be used alone, and are not a substitute for protective eyewear  Should be used in conjunction with a primary form of eye protection such as safety glasses or splash goggles

## **Respiratory Protection:**

Respirators are generally not recommended for controlling exposures to hazardous chemicals in a laboratory setting. If a respirator is necessary in a laboratory, however, the RLSS will perform a hazard assessment of the proposed respirator use. This assessment is required before a laboratory worker can be registered into Risk Management Service's Respiratory Protection Program.

Different types of respirators (e.g. N-95, half-face mask, full-face mask, PAPR, etc.) provide different levels of protection against different chemical hazards. Contact the RLSS to begin the process of determining appropriate respiratory protection when exposure to hazardous chemicals cannot be controlled by engineering controls, such as chemical fume hoods.