

PROTECTIVE GLOVE SELECTION AND USE GUIDANCE DOCUMENT

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A. PURPOSE

All University of California, Riverside (UCR) students, faculty, staff, and affiliates (collectively, “UCR personnel”) are required to use protective gloves, when handling infectious materials, radioactive materials, chemicals, and harmful temperature extremes; or when performing other inherently hazardous activities. The protective gloves should be appropriately selected on the basis of the present hazard(s).

The Protective Glove Selection and Use Guidance Document (the “Guidance Document”) is intended to provide instructions and information on performing a hazard assessment to determine if protective gloves are necessary, appropriate selection of protective gloves, donning/doffing and disposal of protective gloves, allergy information, and limitations of protective gloves.

B. HAZARD ASSESSMENT

The Principal Investigator (PI)/Supervisor is required to assess hazards in the laboratory or research setting using the UCR [Laboratory Hazard Assessment Tool \(LHAT\)](#). The LHAT’s objectives are to determine if protective gloves are necessary, provide UCR personnel with guidance to select the appropriate gloves, and training in the use of protective gloves among other personal protective equipment (PPE). In addition to considering the protective gloves recommended by the LHAT, UCR personnel must carefully review and understand (i) the considerations/limitations associated with protective gloves and (ii) proper procedures for donning/doffing protective gloves, as outlined in Sections D and E of this Guidance Document.

The LHAT is UCR’s primary and recommended workplace hazard assessment process. However, in the event that the LHAT cannot be completed or is inapplicable, such as when potential hazards are present outside of a typical workplace setting (i.e., laboratory, research environment), the PI/Supervisor is responsible for the hazard assessment process. The PI/Supervisor should then complete a Job Hazard Analysis form for submittal to the UCR Industrial Hygiene (IH) Department via ehsih@ucr.edu.

C. RECEIVING PROTECTIVE GLOVES

Based on the inputted workplace hazards, the LHAT will recommend protective glove(s) to be used, if necessary. The PI/Supervisor should provide UCR personnel with the protective gloves recommended in the LHAT.

If the LHAT recommends the use of fire-resistant protective gloves (e.g., due to the handling of pyrophoric materials), the UCR Environmental Health & Safety department (EH&S) will issue fire-resistant gloves. In the LHAT, UCR personnel must first “acknowledge” the workplace hazards outlined by the LHAT and complete an online training module. After which, an appointment can be scheduled via the [UCR PPE Request webpage](#) to receive the fire-resistant gloves; please print and bring a copy of the PPE voucher (issued via the LHAT website) to the scheduled PPE appointment.

D. GLOVE CONSIDERATIONS AND LIMITATIONS

Different types of gloves provide different types of protection. No single protective glove is protective against all potentially present hazards (e.g., chemical, fire), and no protective glove is completely impermeable. Depending on the hazardous substances present in the workplace, a combination of protective gloves may provide the necessary protection.

To ascertain which protective glove material is most suitable for a particular hazardous exposure, always refer to the Safety Data Sheet (SDS) of the chemicals present in the workplace environment, the protective glove manufacturer, and consult the [National Institute for Occupational Safety and Health \(NIOSH\) Recommendations for Chemical Protective Clothing Database](#). A general non-exhaustive glove selection guidance table is presented in Section G of this Guidance Document. When selecting the appropriate protective glove, consider the following factors:

- ✓ Chemical type
- ✓ Temperature extremes
- ✓ Equipment used (e.g., sharps, piercing objects)
- ✓ pH
- ✓ Toxicity
- ✓ Duration of contact

Additionally, the following protective glove characteristics, techniques, and equipment should be considered:

- ✓ **Double gloving** – A second set of protective gloves may be worn over the initial set of protective gloves to provide an additional layer of protection. If the outer set of protective gloves becomes damaged or contaminated, the inner set of gloves will continue to provide protection until the outer set of protective gloves is replaced. The physical characteristics (e.g., swelling, cracking) of the outer set of gloves should be closely monitored; if signs of damage or contamination are observed, promptly dispose of and replace the outer set protective glove. The combination of double gloves used should not significantly hinder the UCR personnel’s dexterity, which may ultimately result in the unsafe handling of hazardous materials.
- ✓ **Sleeve length** – At a minimum, the worn protective gloves should cover the wrists. Ensure that the protective gloves overlap the cuffs of the laboratory coat or overalls, and that the

sleeve lengths of the worn protective gloves are appropriate for the present workplace hazards.

- ✓ **Glove boxes** – A glove box is a sealed container, equipped with protective gloves, used to manipulate hazardous materials with minimal exposure. Glove boxes generally provide adequate protection from highly-hazardous substances. The following general considerations should be understood prior to the operation of a glove box; always consult the glove box's operating manual prior to the use of a glove box.
 - The glove box should first be inspected for damage or leaks; a glove box should never be operated if the glove box's protective gloves are suspected of damage (e.g., pinholes, tears) or if there is indication of a leak in the glove box. Promptly notify your PI/Supervisor if a glove box is suspected of damage or a leak.
 - Nitrile gloves should be donned prior to operation of the glove box, which will act as a base protection layer. The base pair of nitrile gloves will also keep the glove box's protective gloves clean from sweat, which may degrade the protective glove material (e.g., rubber).
 - Use of sharps in the glove box should be minimized. If the use of sharps in the glove box is necessary, extreme caution should be exercised. Additionally, the glove box's protective gloves should be operated slowly and carefully; abrupt movements or "pumping" of the glove box's protective gloves may result in a pressure differential which may present safety concerns.

The condition and effectiveness of the protective gloves in use should be closely monitored. Generally, protective glove effectiveness is measured in the below-listed characteristics. If any observable changes are noted in the protective gloves' physical characteristics (e.g., swelling, cracking), promptly dispose of and replace the protective gloves. Disposable gloves should never be reused.

- ✓ **Degradation** — A change in a glove's physical characteristics (e.g., swelling, softening, cracking, tears, change in color or texture).
- ✓ **Permeation rate** — The speed at which a hazardous substance penetrates the glove material.
- ✓ **Breakthrough time** — The time between initial contact and first detection of the hazardous substance inside the glove.

E. PROTECTIVE GLOVE DONNING, DOFFING, AND DISPOSAL

The terms donning and doffing refer to the practice of dressing (donning) and undressing (doffing) PPE. It is critical that PPE, including protective gloves, is properly donned/doffed to avoid direct contact with contaminants (i.e., transmission, exposure) and subsequent contamination of non-workplace surfaces (e.g., dining areas). The following instructions outline safe practices in donning/doffing protective gloves.

Donning Protective Gloves –

- ✓ Prior to use, inspect the appropriately-selected protective gloves for holes, punctures, tears, cracking, and discoloration. If any observable changes are noted in the protective glove's physical characteristics (e.g., swelling, cracking), promptly dispose of and replace the protective glove. Protective gloves that have been used for an extended period of time may be at higher risk of degradation.
- ✓ Prior to donning the protective gloves, ensure that the protective gloves are of proper size for the UCR personnel. Improperly sized gloves (e.g., too small or large) may result in tears or dexterity issues which could compromise safety.
- ✓ Hands should be thoroughly washed prior to donning protective gloves. In an uncontaminated work area, insert five fingers into the cuff of the first protective glove, and pull the cuff over the wrist; repeat this process with the second protective glove. For disposable gloves (e.g., nitrile, latex), ensure a secure fit around the palms and wrists; the cuffs should fit snugly around the wrists.

Doffing Disposable Protective Gloves –

- ✓ Prior to doffing protective gloves, it should be understood that disposable gloves should never be washed or reused.
- ✓ Disposable protective gloves should be doffed prior to exiting the workplace; it is critical that contaminated protective gloves are not worn or doffed outside the immediate workplace. UCR personnel must be prudent in avoiding protective glove contact with public/non-workplace-related surfaces such as office/mobile phones, door handles, and public drinking fountains.
- ✓ Following hazardous workplace activities, the dominant hand should be used to pinch the outer surface of the non-dominant hand's cuff, and carefully pull off the non-dominant hand's protective gloves. The removed protective glove should then be balled by the worn protective glove. After which, two fingers should be slipped beneath the gloved hand and carefully peeled off the hand until it is inside out. The below images depict the aforementioned disposable protective glove doffing process. Throughout the doffing process, the UCR personnel must be mindful not to touch the bare skin of the hand or wrist with the outer surface of the contaminated protective gloves. The doffed protective gloves can then be disposed.



Doffing Reusable Protective Gloves –

- ✓ Protective gloves should be doffed prior to exiting the workplace; it is critical that contaminated protective gloves are not worn or doffed outside the immediate workplace. UCR personnel must be prudent in avoiding protective glove contact with public/non-workplace-related surfaces such as office/mobile phones, door handles, and public drinking fountains.
- ✓ If authorized based on the handled chemicals, rinse and wash the exterior surface of the reusable protective gloves. Carefully loosen both protective gloves by slightly pulling on the glove fingertips. The protective gloves should be handled by the cuffs and placed in a designated storage area (e.g., drying rack), located away from chemical(s) and uncontaminated areas. The protective glove storage area should be assumed to be contaminated. Throughout the doffing process, the UCR personnel must be mindful not to touch the bare skin of the hand or wrist with the outer surface of the contaminated protective gloves.

Proper Disposal of Protective Gloves –

If the protective gloves are not contaminated with any hazardous substances, they may be disposed of in the general trash. However, if the waste protective gloves are suspected to be contaminated by radioactive, chemical, or biohazardous substances, they should be handled and disposed of in accordance with appropriate hazardous waste management requirements, as outlined by [UCR's Hazardous Waste Management webpage](#) and the [UCR Laboratory Waste Disposal Requirements Guide](#).

F. ALLERGY INFORMATION

Use of natural rubber or latex protective gloves may result in allergic reactions such as irritant contact dermatitis, allergic contact dermatitis, and general latex allergic reactions.

Mild symptoms may include:

- itchiness
- dryness
- irritation
- rashes
- blisters

More-severe symptoms may include:





- sneezing
- runny nose
- itchy/watery eyes
- scratchy throat
- difficulty breathing
- wheezing
- coughing







The most-severe reaction to natural rubber or latex protective gloves is anaphylaxis, an acute allergic reaction which is potentially life-threatening. UCR personnel should be aware of these potential allergic reactions prior to the use of natural rubber or latex protective gloves. If the above-listed symptoms are observed, the natural rubber or latex protective gloves should be promptly doffed and the PI/Supervisor notified.

G. PROTECTIVE GLOVE COMPARISON TABLE

The following protective glove comparison table is intended to provide general guidance for selecting protective gloves; the information provided in the protective glove comparison table is not exhaustive of all potential hazards associated with hazardous substances encountered in the workplace. The information

contained within this table should be referenced in combination with the protective glove recommendations provided by the LHAT, and the protective glove considerations and limitations outlined in Section D of this Guidance Document. Manufacturer databases or websites, such as the [Cole Palmer Safety Glove Chemical Compatibility Database](#), may also be referenced to determine which protective gloves are effective against a certain hazardous substance.

Protective Glove Material	Intended Use	Advantages	Disadvantages	Sample Photograph
<p>Latex (natural rubber)*</p> <p>*Note: Hypoallergenic gloves, glove liners, and powderless gloves may provide the necessary protection for those with allergies to natural rubber and latex.</p>	Incidental contact	<ul style="list-style-type: none"> ✓ Effective against biological and water-based materials 	<ul style="list-style-type: none"> ✓ Ineffective against organic solvents ✓ Minimal chemical protection ✓ Difficult to detect puncture holes ✓ May cause or trigger latex allergies (see Section F of this Guidance Document) 	
Nitrile	<p>Incidental contact</p> <p>Extended contact</p>	<ul style="list-style-type: none"> ✓ Excellent general use glove ✓ Protective against solvents, oils, greases, and some acids/bases ✓ Clear indication of tears and breaks ✓ Alternative for individuals with latex allergies 	<ul style="list-style-type: none"> ✓ Generally not recommended for use with strong oxidizing agents, aromatic solvents, ketones and acetates 	
Butyl rubber	Extended contact	<ul style="list-style-type: none"> ✓ Protective against wide variety of chemicals ✓ Effective against ketones and esters 	<ul style="list-style-type: none"> ✓ Ineffective against gasoline and aliphatic, aromatic, and halogenated hydrocarbons 	
Neoprene	Extended contact	<ul style="list-style-type: none"> ✓ Protective against acids, bases, alcohols, fuels, peroxides, hydrocarbons, and phenols ✓ Protective against most hazardous chemicals 	<ul style="list-style-type: none"> ✓ Ineffective against halogenated and aromatic hydrocarbons 	

<p>Norfoil (Silver Shield)*</p> <p>*Note: Dexterity can be partially regained by using a heavier weight Nitrile glove over the Norfoil/Silver Shield glove</p>	<p>Extended contact</p>	<ul style="list-style-type: none"> ✓ Protective against most hazardous chemicals. 	<ul style="list-style-type: none"> ✓ Poor fit/limited dexterity 	
<p>Viton</p>	<p>Extended contact</p>	<ul style="list-style-type: none"> ✓ Protective against chlorinated and aromatic solvents ✓ Resistant to cuts and abrasions 	<ul style="list-style-type: none"> ✓ Ineffective against ketones ✓ Expensive 	
<p>Polyvinyl chloride (PVC)</p>	<p>Specific use</p>	<ul style="list-style-type: none"> ✓ Protective against acids, bases, oils, fats, peroxides, and amines ✓ Resistant to abrasions 	<ul style="list-style-type: none"> ✓ Ineffective against most organic solvents 	
<p>Polyvinyl alcohol (PVA)</p>	<p>Specific use</p>	<ul style="list-style-type: none"> ✓ Protective against aromatic and chlorinated solvents 	<ul style="list-style-type: none"> ✓ Ineffective against water-based solutions 	
<p>Stainless steel, Kevlar, leather*</p> <p>*Note: If there is potential for biological or chemical contamination, wear appropriate disposable gloves over the cut-resistant gloves and discard after use</p>	<p>Specific use</p>	<ul style="list-style-type: none"> ✓ Cut-resistant gloves ✓ Sleeves are available to provide protection to wrists and forearms 	<p>--</p>	 <p>Left to right: stainless steel gloves, Kevlar gloves, leather gloves.</p>
<p>Cryogenic resistant material, leather*</p> <p>*Note: Never dip gloves directly into liquid nitrogen</p>	<p>Specific use</p>	<ul style="list-style-type: none"> ✓ Protective against cryogenic materials ✓ Designed to prevent frostbite 	<p>--</p>	 <p>Cryogenic resistant gloves (left), leather gloves (right)</p>