LABORATORY PERSONAL PROTECTIVE EQUIPMENT

I. INTRODUCTION

The Occupational Safety and Health Administration (OSHA) ensures workplace safety through the enforcement of established federal legislation. The California Occupational Safety and Health Administration (Cal-OSHA) operates as the acting regulatory enforcement body under the direction of the OSHA Act.

Title 29 of the Code of Federal Regulations, Part 1910, Subpart 7. Personal Protective Equipment, states that "protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition whenever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.” Pursuant to this regulation, and in an effort to prevent workplace injuries and illnesses, UCSB has established this Policy regarding Personal Protective Equipment (PPE) requirements for all campus laboratory workers.

II. SCOPE

This policy governs all non-represented University of California Santa Barbara laboratory workers engaged in academic activities, research, or teaching in laboratories owned or managed by the University (University laboratories).

III. POLICY

The University of California is committed to providing a healthy and safe working environment for all members of the campus community. It is University policy to comply with all applicable health, safety and environmental protection laws, regulations and requirements. Therefore, all laboratory workers shall wear/use the required personal protective equipment, as presented in this policy, at all times when in a University laboratory engaged in academic activities, research, or teaching.

IV. RESPONSIBILITIES

Preventing workplace injuries and illnesses is the responsibility of every member of the campus community. Ensuring safety in University laboratories and for the implementation of and continual compliance with this Policy is the responsibility of members of the research and teaching community, as follows:
The chancellor has overall responsibility for compliance with health and safety requirements at all University facilities and programs.

The vice chancellor for Research is responsible for the implementation of this Policy in all applicable research and teaching laboratories within his/her jurisdiction.

The UCSB Laboratory Safety Committee is responsible for promoting a safe working environment in all University research and teaching laboratories.

Department chairpersons are responsible for communicating, promoting and enforcing the Policy in their respective research and teaching areas.

Principal Investigators and laboratory management staff are responsible for complying with this policy, ensuring their staff receive appropriate training, and comply with this Policy as it relates to their research and teaching activities. Each supervisor is responsible for ensuring that his/her workers have been provided with the appropriate PPE per this Policy, at no cost to the worker. However, students in teaching lab settings may in some cases be required to provide PPE at their own cost.

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

Environmental Health & Safety (EH&S) is responsible for inspection of laboratories and enforcement of this Policy. In cases where laboratory activities pose an immediate danger to life or health, designated EH&S staff have the responsibility and authority to order the temporary cessation of the activity until the hazardous condition is abated.

V. PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS

A. The following minimum requirements pertain to all University research and teaching laboratory environments in which hazardous chemicals are used/handled and/or which pose physical hazards, except as noted in 1-3, below:

1. See VI.B. for biological and radiological hazards PPE procedures and requirements.

2. These requirements do not apply to activities in research and teaching laboratories that involve solely mechanical, computer, laser, other non-ionizing radiation, or electrical operations. Requirements for mitigating these hazards may be addressed by separate policies or regulations, as appropriate.

3. In addition, these requirements do not apply to laboratories which have been designated by EH&S approval as non-hazardous materials use areas or for specific lab operations. EH&S, in cooperation with regulation-mandated safety committees, has the final authority for determining whether any specific material is classified as hazardous.

B. Provisions for Minimum Personal Protective Equipment
(Refer to VI. for Definitions)

The minimum PPE requirements to maintain safety in University laboratories are outlined below. Some operations and materials may warrant further PPE, beyond the
minimum, as noted by Standard Operating Procedures, local facility policies, the Material Safety Data Sheet, or regulatory requirements. Accordingly, individual supervisors should impose those additional warranted requirements necessary to ensure safety in the laboratory.

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**CATEGORY 1: Significantly Hazardous Materials**

Examples (see Definitions in VI.B.):
- Corrosives (e.g., acids and bases) in concentrations above 5% by weight
- Materials readily absorbed through the skin/eyes
- Significant skin/eye irritants
- Violently air or water-reactive chemicals, e.g. pyrophorics
- Flammable or combustible liquids greater than one (1) liter
- Strong oxidizing agents
- Highly toxics
- Recognized chemical carcinogens and reproductive toxins

Minimum PPE (see Definitions in VI.A.) required while handling these materials:
- Approved eye protection
- Laboratory coat, or
- Flame-resistant laboratory coat for greater than one (1) liter volume of flammable or combustible liquid, or for any quantity of pyrophoric
- Appropriate protective gloves
- Long pants covering the entire leg and closed-toe shoes

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**CATEGORY 2: Chemical Hazards (other than those in Category #1) listed in VI.B.**

Examples (see Definitions in VI.B.):
- Flammable and combustible organic solvents less than one (1) liter volume
- “Dilute” Corrosives (e.g., acids/bases) in concentrations below 5% by weight
- Liquid cryogens (e.g. liquid nitrogen, dry ice/solvent baths)

Minimum PPE (see Definitions in VI.A.) required while handling:
- Approved eye protection
- Appropriate protective gloves

Recommended:
- Laboratory coat
- Long pants covering the entire leg and closed-toed shoes
### CATEGORY 3: Chemical Hazards not listed in VI.B. and Physical Hazards listed in VI.B

**Examples:**
- Glass vessels under vacuum
- Vessels above atmospheric pressure
- When operating equipment that offers a mechanical hazard to body
- Very low hazard chemicals\(^5\), i.e., hazard classes not listed in VI.B.

**Minimum PPE required while handling:**
- Approved eye protection

**Recommended:**
- Appropriate protective gloves
- Laboratory coat
- Long pants covering the entire leg and closed-toed shoes

### C. Other Personal Protective Equipment Provisions

1. An EH&S-approved **respirator** may be legally required when other controls (e.g., fume hoods) are unavailable or unable to sufficiently control exposure levels below legal limits.\(^6\) For example, most organic solvents have legal limits in the parts per million range. Respirator use is governed separately by the campus Respiratory Protection Policy and by specific Cal-OSHA regulations. With the exception of filtering facepiece respirators used for non-hazardous materials, all respirator use must be reviewed and approved by EH&S.

2. Chemical **protective gloves** must not be worn in any public area outside of the laboratory (i.e., hallways, elevators, offices), unless, a.) the individual is traveling directly to an adjacent lab work area, or b.) needed for protection while transporting hazardous materials between work areas. Before transporting, clean gloves should be donned. Gloves must be removed prior to handling any equipment that could result in cross-contamination (e.g., telephones, computer work stations, door handles).

3. **Face shields** offer far greater protection than safety glasses and are strongly recommended to be worn while conducting processes that have a potential for severely impacting the head/face. For example, potentially explosively-unstable materials and vessels under high pressure.

4. It is recommended that each department or research group provide **professional laundry services**\(^7\) as needed to maintain the hygiene of laboratory coats. They should not be cleaned at private residences or public laundries.

### VI. APPENDIX

A. **Definitions of Personal Protective Equipment**
1. **Approved eye protection**: approved by the American National Standards Institute (ANSI) and appropriate for the work being done. Note that prescription reading glasses are generally not ANSI-approved safety eyewear.

2. **Appropriate protective gloves**: must be able to provide adequate protection for the material being used. No glove type offers protection from all materials. The Material Safety Data Sheet (MSDS) for the material should be referenced when determining the type of glove to be used. Additionally, the EH&S Website offers guidance on glove selection based on the material handled.

3. **Appropriate laboratory coats**: all coats must be appropriately sized for the individual and buttoned to their full length. Laboratory coat sleeves must be of sufficient length to prevent skin exposure while wearing gloves. **Flame-resistant laboratory coats** are currently available for purchase in all laboratory storerooms on campus. These coats are generally blue in color.

**B. Definitions and References for Laboratory Hazards**

"Handling" of hazardous materials/processes: for the purposes of this Policy "handling" includes those operations where there is a reasonable possibility that individual(s) could be exposed to the material by eye/skin/clothing contact, or via inhalation. Examples: during transferring, mixing, manipulating and transporting materials, attending reactions in open or closed systems, etc. It would typically not include those operations where the user is remote from the material, such as when samples are well-isolated within enclosed lab instrumentation, e.g. NMR, glove box, spectrophotometer, etc.

The following materials/hazards are defined or referenced for guidance purposes. The list does not cover all possible hazards and it is important to note that a given material can have more than one associated hazard. The container label and Material Safety Data Sheet (MSDS) should be consulted if the hazard(s) of a material are not understood. MSDS access links: [http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschemmsdsacc.htm](http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschemmsdsacc.htm)

**Chemical Hazards**

1. **Corrosives** are acids, bases, or any chemical that causes visible destruction of, or irreversible alterations in, living tissue at the site of contact. For the purposes of this Policy only a “dilute corrosive” (Category 2) is one below 5% by weight concentration. **Example acids**: hydrochloric, sulfuric, phosphoric, hydrofluoric. **Bases**: sodium, potassium and ammonium hydroxides


3. **Skin or eye irritants** are chemicals which are not corrosive, but which cause a reversible inflammatory effect on living tissue by chemical action at the site of contact. **Examples**: xylenes, formamide, many amines like triethanolamine, carbon tetrachloride, perchloroethylene, many inorganic salts like cobalt and nickel sulfate
4. **Flammable liquids** have a flash point below 100 °F (38 °C). **Combustible liquids** have a flash point above 100°F (38°C). Note that all/most chlorinated solvents are not flammable or combustible. *Examples: organic solvents – ethers, alcohols, toluene, pentane, acetone*

5. Violently **air-reactive** or **water-reactive** chemicals, including **pyrophorics** (substances that spontaneously ignite in air). *Examples: sodium or potassium metal, diethyl zinc, lithium aluminum hydride, t-butyl lithium, aluminum alkyls, calcium carbide, phosphine*

6. **Chemical Carcinogens or Regulated Carcinogens** *Examples: formaldehyde, dichloromethane, benzene, chloroform, Others: [http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschphazsubstance.htm](http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschphazsubstance.htm)*

7. **Reproductive Toxin Chemicals** *Examples: acrylamide, Cd, Pb, Hg, Cr(VI), carbon disulfide, toluene, chloroform, ethylene glycol ethers [http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschphazsubstance.htm](http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschphazsubstance.htm)*

8. **Toxic or Highly Toxic Chemicals, including Neurotoxins** *Examples: [http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschphazsubstance.htm](http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lschphazsubstance.htm) [http://www.neuroassist.com/Neurotoxins.htm](http://www.neuroassist.com/Neurotoxins.htm)*

9. **Oxidizing agents** – a material that readily yields oxygen or that readily reacts to promote or initiate combustion of combustible materials. *Examples: nitric and perchloric acids, chromates, nitrates, nitrites, hydrogen peroxide, chlorates*

**Physical Hazards**

1. **Liquid cryogens** *Examples: liquid nitrogen and solvent/cryogen cold baths*
2. Glass vessels under **vacuum**; vessels above **atmospheric pressure**
3. Equipment that offers a **mechanical hazard** to the eyes/body

**Biological and Radiological Hazards**

All proposed uses of **infectious biological agents** (e.g., Biosafety Level-2) and **radioactive isotopes** are specifically reviewed and authorized by the Institutional Biosafety Committee or Radiation Safety Committee, respectively. The associated PPE requirements for a particular lab usage are imposed through those authorization processes. Therefore, this Policy does not address the PPE requirements while using those materials and does not supersede the actions of those committees.

**VII. RELATED POLICIES AND RESOURCES**


UCSB Environmental Health and Safety Policy
VIII. FOOTNOTES

1. Postdoctoral scholars fall under a labor/management agreement with UC. The agreement notes that postdoctoral scholars are to be provided with approved prescription safety glasses at no cost to those that wear corrective lenses.8

2. Facilities such as the Animal Resource Center have local and unique PPE policies.

3. Only for the purposes of this policy, a concentration of 5% by weight is used herein as the threshold between Category 1 and 2. However, note that beyond the concentration of a corrosive, there can be other intrinsic hazards associated with a particular corrosive. For example, hydrofluoric acid is particularly penetrative of skin tissue and therefore full skin protection should be employed at all concentrations.

4. While handling flammables or pyrophorics it is recommended that synthetic clothing, which is more ignitable, not be worn – cotton clothing is preferable.

5. “Chemicals” that are essentially non-hazardous or even edible are exempt from any PPE requirements. Examples: table salt, vinegar, soap, etc.

6. Cal-OSHA regulates approximately 500 materials and defines the maximum airborne concentrations to which an unprotected employee can legally be exposed (Permissible Exposure Limits). See: http://www.dir.ca.gov/Title8/5155table_ac1.html

7. There are currently two local professional laundry services which offer routine lab coat pickup, laundering and return services for University laboratories. See the factsheet at: http://www.ehs.ucsb.edu/units/labsfty/labscfactsheets/Lab_Coats_FS35.pdf

8. All safety eyewear sold by UCSB lab storerooms/bookstore should meet American National Standards Institute (ANSI) standards. Likewise, safety eyewear purchased directly from vendors meet ANSI standards. ANSI-approved eyewear is designated by the “Z87” stamp on the frame. Note that most prescriptions glasses (e.g., reading glasses) are not ANSI-approved, unless specifically provided as such by an optometrist. Local optometrists, including UCSB Student Health can provide ANSI safety glasses. Wearing of lab goggles over prescription glasses may be a practical option for some individuals; or the wearing of contact lenses beneath approved safety glasses.

9. Research areas that have specialized clothing requirements (e.g., “bunny suits” in clean rooms) may be exempted by EH&S where it is impractical to wear a lab coat.

10. The flash point of a flammable liquid is defined as the minimum temperature at which the application of a test flame causes the vapors to ignite at atmospheric pressure.