Chapter 19

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Contents

Approved by Kurt Ettinger
Revised 6/20

NOTE:

. . . Denotes a new section.

. . . . . Denotes the beginning of changed text within a section.

. . . . . Denotes the end of changed text within a section.

19.1 Policy

Lawrence Berkeley National Laboratory (Berkeley Lab) personal protective equipment (PPE) requirements are established for each technical area based on the specific hazards of the area. PPE requirements for each technical area are listed on the Berkeley Lab technical area entrance placard, which can be downloaded from the Laboratory's *Chemical Hygiene and Safety Plan*. These area PPE requirements are in effect for the entire technical area.

A risk-based approach is applied to use of PPE at Berkeley Lab:

- Higher-hazard technical areas such as chemistry labs and machine shops have area PPE requirements specified by the Environment/Health/Safety (EHS) Division's subject matter experts (SMEs) through corresponding hazard control programs.
- Lower hazard technical areas have their area PPE requirements, if any, specified by the area safety lead (ASL).
- Technical areas that fall between these two categories, such as electronic shops and optics labs, have their area PPE requirements specified by the ASL with consultation from the EHS Division.

19.2 Scope

This program's scope includes Berkeley Lab technical areas, such as laboratories, shops, mechanical rooms, construction projects, and maintenance areas.

19.3 Applicability

This program applies to all Laboratory employees, subcontractors, vendors, visitors, and affiliates who work in or travel through technical areas.

19.4 Exceptions

Exceptions to this policy must be approved by the EHS Division Director using the process described in Appendix C, below.

19.5 Roles and Responsibilities

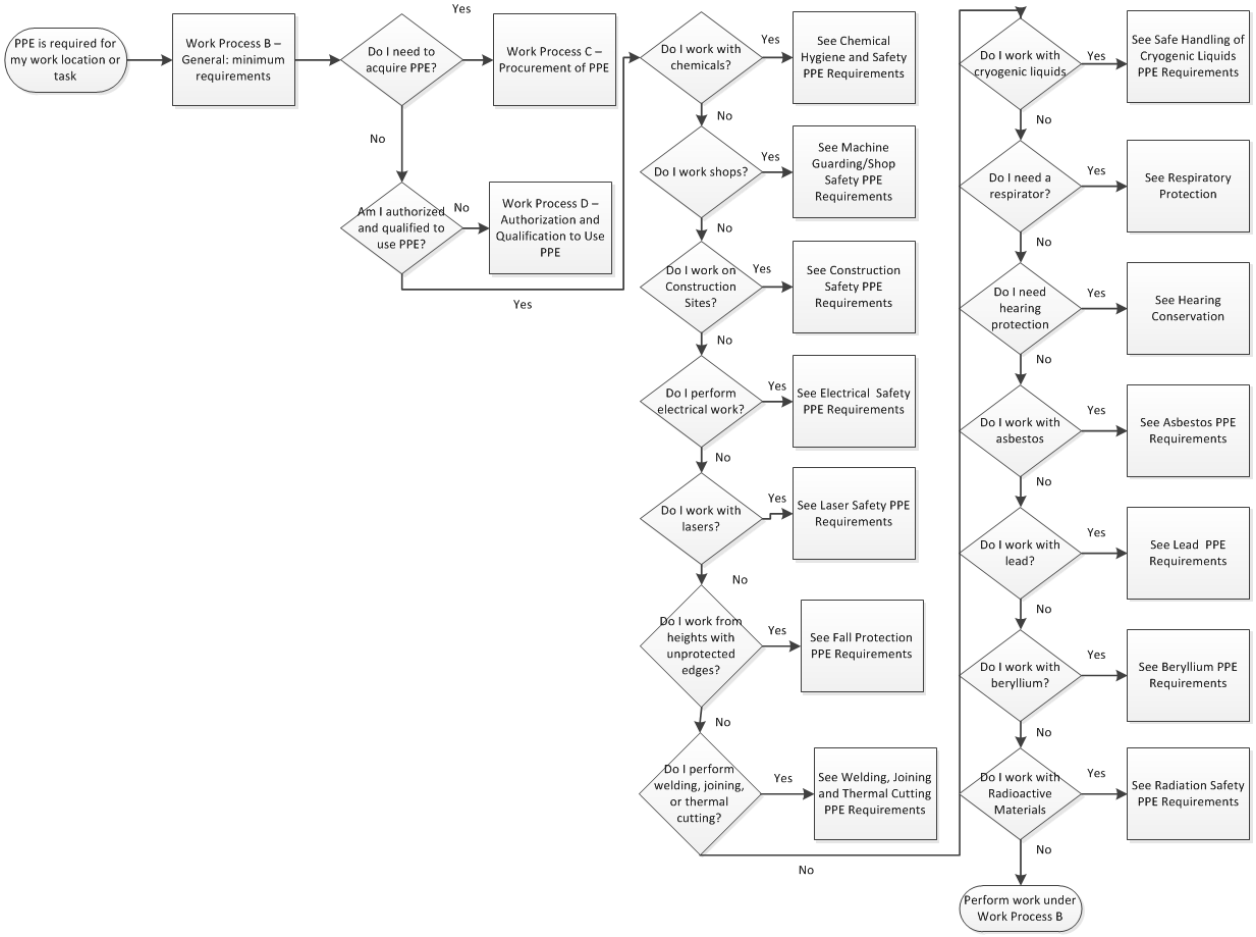
Roles	Responsibilities
Area Safety Leaders	• Determine (through consultation with supervisors ,work leads who authorized operations, and/or EHS) the area PPE requirements for their assigned low and medium hazard technical areas (see Appendix A) • Ensure that entrances are posted with these minimum requirements
Line Management	• Reviews operations within a technical area and determines process-dependent PPE requirements over and above the area PPE requirements for that area • Re-evaluates PPE requirements whenever the work or the physical layout changes • Coordinates with the area safety leader to ensure that the hazards associated with his or her operations are reflected in the entrance placard • Ensures PPE is available for workers as required
Workers	All workers in technical areas, including area safety leaders, supervisors, and work leads, are responsible for: • Knowing the PPE requirements for technical areas in which they work • Complying with the applicable PPE requirements • Informing others in the area of these requirements
EHS Liaisons and SMEs	EHS Liaisons are the first point of contact for the ASL to provide consultation for medium hazard technical area PPE selection. EHS SMEs may be asked by the Liaison to provide specific PPE consultation in their area of expertise.
EHS Division Director	Must approve exceptions to this policy

19.6 Definitions

Term	Definition
PPE	Personal protective clothing and equipment worn by workers designed to protect the body from injury by hazardous agents, conditions, or materials.
head protection	Protective helmet worn when working in areas where there is a potential for injury to the head from falling objects or electrical shock
face protection	Safety devices such as a face mask, face shield, or other splatter guard worn over all or part of the face to protect from injury or exposure to flying particles, molten metal, liquid chemicals, biological materials, chemical gases or vapors, or potentially injurious light radiation
eye protection	Safety devices such as safety glasses or goggles worn over the eyes to prevent injury or exposure to flying particles, molten metal, liquid chemicals, biological materials, chemical gases or vapors, or potentially injurious light radiation
foot protection	Protective footwear worn when working in areas where there is a danger of foot injuries from falling or rolling objects, or objects piercing the sole, and where an employee's feet are exposed to electrical hazards or chemical spills
hand protection	Gloves or other protective devices worn on the hand to prevent injury to the hand or direct skin contact with sharp edges, rough, hot, or cold surfaces, and exposures to electrical hazards, biological materials, or chemical hazards
skin protection	Protective clothing such as a lab coat, gown, smock, coveralls, or uniform designed to keep personal clothing, forearms or other exposed skin protected from contamination or injury by chemical, biological, or radiological materials or exposure to other hazards
technical area	Technical areas generally include laboratories, shops, workrooms, and similar areas. Offices, conference rooms, food preparation, and consumption areas such as the cafeteria, kitchenettes, and break rooms are generally not technical areas.

19.7 Required Work Processes

Work Process A. PPE Flowchart



Work Process B. General PPE Requirements

1. **Minimum Area PPE Requirements.** Minimum area PPE requirements for specific technical areas are as follows:
    a. ***Laboratories*** *w*here chemicals or biological materials are stored or handled: Protective eyewear (e.g., safety glasses with side shields), long pants, and closed-toe shoes must be worn at all times. Additional PPE may be necessary

when handling chemicals or biological materials (e.g., goggles, lab coat, and chemically resistant protective gloves for handling hazardous chemicals). Consult the following for more details:

i. *Chemical Hygiene and Safety Plan*
ii. Job Hazards Analysis
iii. Any formal authorizations

b. ***Machine, welding, and craft shops*** where a potential hazard exists: Protective eyewear (e.g., safety glasses with side shields), long pants, and closed-toe shoes must be worn at all times. Additional PPE may be necessary when handling chemicals or other hazardous materials (e.g., goggles, shop coat, and chemically resistant protective gloves for handling hazardous chemicals) or when performing other tasks. Consult the following for more details:

i. *Chemical Hygiene and Safety Plan*
ii. Chapter 25 Machine Safeguarding
iii. Job Hazards Analysis
iv. Any formal authorizations

c. **Other technical areas** (e.g., microscope rooms, electronics shops, assembly shops): The area safety lead, and when appropriate EHS, may perform a hazard analysis of the work being performed in the area to determine the types of PPE required. PPE selected to control the hazards in the area must be documented on the area's door signs or prominently posted to be visible from all approaches to the task requiring specific PPE. Before the hazard assessment and PPE controls are listed on the door sign, the minimum PPE requirement is safety glasses with side shields, long pants, and closed-toed shoes. For additional help, see Appendix A, *PPE Responsibilities Table,* and Appendix B, *PPE Selection FAQs*.

d. Visitors and others walking through a technical area but not performing work in that area must wear the minimum area PPE, but generally are not required to wear additional PPE that is assigned to those who are performing operations in the technical area.

e. Protective clothing is not a substitute for adequate engineering controls.

f. PPE requirements may be temporarily suspended for special tours of a particular technical area. Hazardous work may not take place nor may hazardous conditions exist while PPE requirements are suspended. A written description of the area(s) covered, the conditions necessary, and duration of

the suspended PPE requirements must be authorized by the principal investigator (PI) or line manager and communicated to all impacted workers.

2. **Protective Clothing**
    a. **Criteria for Issue.** To protect their health and safety, employees who work with hazardous materials are issued protective clothing. EHS is available for consultation as needed. The *Chemical Hygiene and Safety Plan* gives additional guidance for the selection and use of PPE.
    b. **Foot Protection**
        i. Berkeley Lab policy requires workers to wear protective footwear when working in areas where there is risk of foot injuries due to falling or rolling objects, objects piercing the sole, or work-related fatigue, or where workers' feet are exposed to electrical hazards. When safety shoes are required, they must meet the specifications of American Society for Testing and Materials (ASTM) F2413-05. Some examples of work that requires safety shoes are working in shops, equipment handling, and construction jobs. Workers exposed to hot, cold (cryogenic), corrosive, or poisonous substances, or who work in abnormally wet locations must wear safety shoes of adequate construction and type for the specific work area. For laboratory activities, minimum PPE required by the *Chemical Hygiene and Safety Plan* includes closed-toe footwear. Open-toe shoes and sandals are not permitted in laboratories. Footwear appropriate to work activities and conditions must be worn at all times.
        ii. Berkeley Lab encourages the wearing of protective footwear by making it available for employees to purchase. When protective footwear is required by Berkeley Lab policy, the department requesting the footwear will fund the purchase. Additional information regarding the approved procurement method for Berkeley Lab's protective footwear program can be obtained at the EHS Division's Personal Protective Equipment Web site.
    c. **Hand Protection**
        i. The Laboratory provides proper hand protection to employees exposed to known hand hazards, such as from absorption of harmful substances, severe cuts, lacerations or abrasions, chemical burns, contact with biological materials, and extreme temperatures. Supervisors must obtain suitable hand protection and must ensure that

it is used. The *Chemical Hygiene and Safety Plan* provides guidance for the selection of chemically resistant gloves. Central Stores stocks a variety of hand protection. Gloves may also be purchased through the eProcurement system. Individual departments are responsible for maintaining a supply of adequate hand protection.

ii. An Industrial Hygienist can assist with selecting appropriate hand protection.

d. **Head Protection**

i. The Laboratory provides hard hats that meet ANSI Standard Z89.1 (2003) for Laboratory employees who work in conditions where there is a potential for head injury from falling or flying objects or when there is a danger from exposed electrical conductors (8 CCR 3381). Hard hats are available through the eProcurement system, or from Central Stores.

ii. The Laboratory employee responsible for oversight of day-to-day operations at a job site is also responsible for specifying when head protection is required. This person is usually the construction superintendent. Head protection is required in the following situations:

1. Anytime there is a danger of falling or flying objects
2. Overhead construction is in progress
3. Any area near exposed electrical conductors where a danger of arcing may exist
4. Any excavation or trench where loose rock or soil could pose a danger by falling from the excavation face
5. Any area around a crane lift or similar situation where objects being swung, dropped, etc., may present a danger
6. Whenever the construction superintendent or other responsible employee has reason to believe danger exists

iii. A sufficient number of hard hats will be maintained at the site for visitors.

e. **Eye Protection**

i. All persons must wear safety glasses, goggles, or a face shield whenever they run a reasonable probability of eye injury resulting from work being performed. Staff must use appropriate eye or face protection when exposed to hazards from flying particles, molten metal, liquid chemicals, acids or caustics, biological materials, chemical

gases or vapors, or potentially injurious light radiation. Eye protection with side shields must be used when there is a hazard from flying objects. Some work areas (e.g., chemical laboratories and workshops) are designated as "eye-hazard areas." In these areas, the eye-protection requirement must be posted at each entrance (i.e., listed in the required PPE section of the area caution sign).

ii. Berkeley Lab provides appropriate eye-protection devices for employees assigned to tasks that expose them to an eye-injury hazard.

iii. When prescription safety glasses are issued, the Health Services optometrist completes a Notification of Issue of Safety Glasses form for the individual receiving the safety glasses and sends a copy to the individual's supervisor. The form specifies the conditions under which the employee must wear safety glasses.

iv. The individual is responsible for wearing eye protection devices at all times in eye-hazard areas and whenever his or her work poses a reasonable probability of eye injury.

v. All eye-protection devices issued by the Laboratory must comply with ANSI Standard Z87.1 (2003); these eye protection devices are marked "Z87." Where there is a possibility of a hazard from flying particles, the eye protection must meet the High Impact Testing Requirements of Z87.1 (this eye protection is marked "Z87+"). When in use as eye-protection devices, safety glasses must have side shields or must be worn with safety goggles carrying the same ANSI approval.

vi. Four types of eye-protection devices are available:

- Personal prescription safety glasses are issued through the Health Services Group.
- Goggles, face shields, etc., may be purchased through the eProcurement system or from Stores.
- Temporary nonprescription safety glasses are provided to visitors in eye-hazard areas.
- Laser-safety eyewear is provided to employees by their division. The Laser Safety Officer, ext. 2544, will provide consultation regarding the appropriate type of eyewear and where to obtain it. See Chapter 16 Laser Safety for information

on obtaining eyewear approved for protection against laser light and for information on required medical examinations.)

Work Process C. Procurement of PPE

1. The Laboratory requires suitable equipment to protect employees from hazards in the workplace, as prescribed in 8 CCR 3380. The EHS Division advises on PPE required for a task, but the supervisor of the operation must obtain this equipment and see that it is used.
2. Protective clothing is purchased from approved vendors through the eProcurement system or through Stores (Building 79) with a valid account or work order number.
3. All Berkeley Lab full-time employees who engage in eye-hazard operations are eligible to obtain prescription safety glasses at Laboratory expense. Potential eye-hazard operations are those that produce flying particles (e.g., using machining equipment or portable power tools), that involve the handling of hazardous liquids (e.g., in chemical labs, plating shops, and plastic shops), or that involve exposure to intense light (e.g., working with ultraviolet light). Prescription or nonprescription dark glasses are available only upon completion of a Request for Tinted Safety Glasses form by the supervisor. This form is available from Health Services in Building 26.
4. The Health Services Group optometrist is available for consultation regarding occupational eye protection. Personnel requiring prescription safety glasses or laser-safety glasses should schedule an examination with the optometrist, who issues all safety glasses and screens individuals for use of laser-safety glasses. Damaged prescription safety glasses or frames issued by the Laboratory are replaced or repaired as necessary. The Health Services Group optometrist makes all adjustments and repairs to these safety glasses.

Work Process D. Authorization and Qualification to Use PPE

1. Supervisors authorize PPE use for their employees through the Job Hazards Analysis (JHA) system. The supervisor of an operation is responsible for determining when PPE is needed and what PPE is suitable and must ensure that all employees and visitors use PPE when in active technical areas.
2. Employees are qualified for PPE use based on the type of work that they perform. Employees who work in laboratories are trained in the use, maintenance, storage,

and limitations of PPE by taking the Chemical Hygiene and Safety training (EHS0348). Employees who work in technical areas other than laboratories are trained in the use, maintenance, storage, and limitations of PPE by taking the Personal Protective Equipment training, EHS0161.

Work Process E. Specific PPE Requirements

EHS Program	**Link**
Asbestos Work	http://www.lbl.gov/ehs/ih/forms/AsbestosMgmtPlan.pdf
Beryllium Work	Chapter 4 Exposure Assessment
Biosafety	Chapter 26 Biosafety
Chemical Safety	http://www.lbl.gov/ehs/chsp/html/materials.shtml#PPE
Construction Sites	PPE are specified on the JHA http://www.lbl.gov/ehs/pub3000/CH10.html#106
Cryogenics	Chapter 10 Safe Handling of Cryogenic Fluids
Electrical Work	Chapter 8 Electrical Safety Program
Fall Protection	Chapter 30 Fall Protection
Hearing Protection	Chapter 4 Exposure Assessment
Laser Areas	Chapter 16 Laser Safety
Lead Work	Chapter 4 Exposure Assessment
Machine Safeguarding	Work Process A in Chapter 25 Machine Safeguarding
Radioactive Materials Work	Chapter 21 Radiation Safety
Respiratory Protection	http://www.lbl.gov/ehs/ih/forms/respirator.pdf
Welding, Joining, and Thermal Cutting	Chapter 33 Welding, Joining, and Thermal Cutting Safety

19.8 Source Requirements

- 8 CCR GISO, Subchapter 7, 3380-3400
- 8 CCR CSO, Subchapter 4

19.9 Reference Documents

Document Number	ES&H Manual Reference	Title	Type
07.07.024.001	Chapter 19	*Personal Protective Equipment*	Program

Other References

Chapter 4 Injury Response and Review	*Chemicals*
Chapter 4 Injury Response and Review	*Respiratory Protection*
Section 4.5 Chapter 4 Injury Response and Review	*Noise*
Section 4.8 Chapter 4 Injury Response and Review	*Asbestos*
Section 4.11 Chapter 4 Injury Response and Review	*Lead*
Chapter 8 Electrical Safety	*Electrical Safety*
Chapter 10 Construction Safety	*Construction Safety Manual Administrative Policies*
Chapter 16 Laser Safety	*Laser Safety*
Chapter 21 Radiation Safety	*Radiation Safety*
Chapter 25 Machine Safeguarding – Shop and Lab Machine Safety	*Machine Safeguarding – Shop and Lab Machine Safety*
Chapter 26 Biosafety	*Biosafety*
Chapter 29 Safe Handling of Cryogenic liquids	*Safe Handling of Cryogenic liquids*
Chapter 30 Fall Protection Program	*Fall Protection Program*
Chapter 33 Welding, Joining and Thermal Cutting	*Welding, Joining, and Thermal Cutting*

10 CFR 851.22	*Hazard Prevention and Abatement*
10 CFR 851.23	*Safety and Health Standards*
10 CFR 851.24	*Functional Areas*
10 CFR 851.25	*Training and Information*
10 CFR 851.26	*Recordkeeping and Reporting*

19.10 Appendices

Appendix A. PPE and Food/Drink Requirements and Responsibilities Tables

Institutional Minimum Area PPE Requirements and Responsibilities

All task-specific PPE requirements in PUB-3000 and PPE requirements in formal authorizations or division ISM plans take precedence over this table. Incidental chemical use refers to:

- Cleaning with common cleaning solvents such as acetone, ethanol, isopropanol, or methanol
- Working with aqueous non-corrosive (2<pH<12.5) solutions, such as diluted bleach, that do not contain strong toxins

Temporary task-generated area hazards include machine tool use, soldering, and wire-cutting.

Technical area	Party responsible to set minimum area PPE requirements	ES&H Manual PPE exceptions allowed?	Relative risk level
Chemistry lab/dedicated chemical storage area	*Chemical Hygiene and Safety Plan*	Yes	High
Machine, craft, welding, or sheet metal shop	PUB-3000, Chapter 25	Yes	High
Areas controlled for radioactive contamination (e.g., designated work area, contamination area, etc.)	RPG (work authorization)	No	High
Biosafety Level 1 (BL1) or Biosafety Level 2 (BL2) laboratory	Area safety leader with EHS consultation	NA	Medium
Other technical area with incidental chemical use	Area safety leader with EHS consultation	NA	Medium
Other technical area with temporary task-generated area hazard	Area safety leader with EHS consultation	NA	Medium
Other technical area with no chemical use or machine tools	Area safety leader	NA	Low

Institutional Food and Beverage Requirements

Incidental chemical use refers to:

- Cleaning with common cleaning solvents such as acetone, ethanol, isopropanol, or methanol
- Working with aqueous non-corrosive (2<pH<12.5) solutions, such as diluted bleach, that do not contain strong toxins

Temporary task-generated area hazards include machine tool use, soldering, and wire-cutting. Covered food and closed drink containers may be transported through technical areas where food and beverage are not allowed.

Technical area	Are food and beverages allowed?	Relative risk level
Chemistry lab/dedicated chemical storage area	No	High
Machine, craft, welding, or sheet metal shop	No (exceptions allowed per ES&H Manual, Chapter 25)	High
Areas controlled for radioactive contamination (e.g., designated work area, contamination area, etc.)	No	High
Biosafety Level 1 (BL1) or Biosafety Level 2 (BL2) laboratory	No	Medium
Other technical area with incidental chemical use	Yes (with area safety leader approval and EHS consultation)	Medium
Other technical area with temporary task-generated area hazard	No (during task)	Medium
Other technical area with no chemical use or machine tools	Yes (with area safety leader approval)	Low

Appendix B. FAQs about Reducing Personal Protective Equipment (PPE) Requirements and Changing the No-Food/Drink Policy in Technical Areas

Who makes the decision about area PPE requirements?

It is based on risk. In technical areas with no area hazards, the area safety lead decides. In technical areas with minimal area hazards, the area safety lead decides in consultation with the EHS Division. Area PPE requirements in higher-hazard spaces are set by Berkeley Lab policy.

I already have a PPE exception approved by EHS. Is this still valid?

Yes. Existing approved PPE exceptions remain valid.

How do I go about modifying the area PPE requirements in my space?
Contact your division safety coordinator to get started. He or she will be familiar with the interpretations and will know who to contact in the EHS Division if they need to be consulted.

I have some chemicals in my technical area (solvents, glue, etc.), but it is not a full chemistry lab. Can I modify the area PPE requirements in my space?
This area may qualify for reduced area PPE requirements. Talk with your Division Safety Coordinator to verify. Remember that task-based PPE requirements still apply!

Can I designate a space within a chemistry or biology lab for lower area PPE requirements?
Yes. You will need to demonstrate that this area really does have minimal area hazards. Part of this demonstration will be showing that there is an effective separation, through some kind of physical barrier, space or other demarcation from the other laboratory hazards. Another part will be to show that you have effective controls in the lab to maintain this separation.

What if the area is a mixed room and there is no area safety leader?
Consider dividing the mixed room into several technical areas with one or more area safety leader(s). Consult with the appropriate division safety coordinator(s) to assist. If this cannot be done, then the most conservative regime should apply to the entire space.

Can you give examples of temporary task-generated area hazards?
Soldering, saw cutting, lifts, cutting wire are some examples.

I work in a lab that has no chemical use or task-based hazards (we test electronic equipment). Can I keep a cup of coffee at my work station in the lab?
Ask your area safety leader first. There might be non-safety reasons why coffee would not be allowed in the lab.

Why aren't there more clear definitions of area PPE requirements?
We recognize the great diversity of technical areas at Berkeley Lab and realize that a single rule would not be able to meet the real risks in all of these different situations. Also, we want to encourage risk analysis and understanding rather than simply following rules.

Appendix C. Guidelines for Exceptions to Policy on Personal Protective Equipment and Food in Technical Areas with a High Relative Risk Level

1. **Introduction**

   Divisions may request exceptions to the *Personal Protective Equipment* policy in certain technical areas that are considered to have a high relative risk level. The *Chemical Hygiene and Safety Plan* *discusses* exceptions to the *Food and Drink Restrictions in Technical Areas* policy. This appendix establishes the policy and describes the process for requesting, approving, and posting these exceptions to the existing PPE and Food and Drink Restrictions in Technical Areas policies for high-hazard technical areas.

2. **Procedure**

   a. The requester (a member of the division "owning" the space and wishing the exception to policy) completes the *PPE and Food/Drink Policy Exception Worksheet Template* (see below) and submits it to his/her division.
   b. The division forwards the completed template to the EHS Division Deputy Director.
   c. The EHS Division Deputy Director reviews the completed template for conformance with existing policy and the guidelines below. The EHS Division Deputy Director may require a site visit, and he/she can request support from the EHS Subject Matter Experts.

      i. If the EHS Division Deputy Director determines that the completed template supports the requested exception, he/she forwards it to the EHS Division Director with an "Approve" recommendation.
      ii. If the EHS Division Deputy Director determines that the completed template does not support the exception, he/she may return it to the requester with comments or forward it to the EHS Division Director with a "Deny" recommendation.

   b. The EHS Division Director approves or denies the package and returns it to the requester.
   c. If approved, a signed and dated copy of page 1 of the worksheet must be posted in each PPE-exception area.

3. **Guidelines**

The following are examples of situations where exceptions to existing policy may be granted using the procedure described above. Note that these are only examples — all exceptions must be approved by the EHS Division Director:

a. Non-hazardous work areas (e.g., offices, work stations) that are within technical areas but are clearly delineated by physical barriers (e.g., walls, doors, or cubicle dividers). It must be clear that the area is intended to be a self-contained, dedicated area. Readily movable furniture does not constitute a physical barrier.
b. Optical microscopes or similar instruments requiring close contact between the eyes and the eyepieces and located within a technical area may be delineated by a 36-inch-deep marked area where safety glasses may be removed. Other PPE requirements for this area will not be waived. Remote viewing must be considered as part of the exception request.
c. Non-PPE-required corridors may be delineated within technical areas provided that the corridor does not pass near any potential source of hazard. A clear, open, and free horizontal distance of at least three feet from chemical-use areas (e.g., hoods, lab benches, etc.) or six feet from portable or stationary machine tools may be considered adequate.
d. Exceptions for individual desks or work spaces within a technical area are discouraged.

4. **PPE and Food/Drink Policy Exception Worksheet Template**

This worksheet template is used for requesting, approving, and posting exceptions to the existing policies. Each technical area requires a separate Exception Worksheet. Provide the following information for each technical area for which an exception to policy is being requested:

Page 1:

1. *A diagram of the technical area, clearly showing all entrances to the technical area and the proposed boundaries of the exception. Clearly indicate which side of the boundary will be excepted from the policy*.

2. *Approval signature wording to be added to the bottom of page 1 of the worksheet*:

Approved by:

_____

Director, EHS Division Date

Conditions of Approval:

_____

Continuing Pages:

Page 2: *Name and division of the person requesting the exception. It is strongly suggested that the requester be the area safety leader for the technical area*.

Page 3: *A narrative discussion on why the exception should be granted. Note that inconvenience, infrequent hazardous operations, and difficulty of assuring compliance with the policy are generally not sufficient justifications for the exception.*

Page 4: *Describe how the requester will assure the presence, physical limits, and PPE requirements of PPE-required and PPE-exception areas*.

Submit this document and any supporting information to the EHS Division Deputy Director for review*.*

Appendix D. Lab Coat Selection FAQs

1. **How do I determine the most appropriate lab coat to use for my work?**

Like other PPE, lab coats should be selected based upon the hazards in the workplace. A hazard assessment of the work area and task(s) should be conducted

to make this determination. The LBNL Lab Coat Selection Tool (see Appendix E of this program) can be used to assist with this process.

2. **What are the risk level (RL) categories that LBNL uses for determining whether and what type of a flame-resistant (FR) lab coat should be used?**

   The LBNL PPE Program uses RL-A, RL-B, and RL-C to categorize flammable hazards from highest to lowest risk.

   An **RL-A** exists when any of the following conditions occurs:

   a. Pyrophoric materials are used or handled outside of a glovebox
   b. Handling NFPA Class I, II, or III flammable or combustible liquids (quantity > than 15 liters)
   c. Handling organic peroxide formers (quantity > than or = to 1 liter)
   d. High-risk flammable environment (open flame, distillation apparatus, heating, pressure, or other ignition source)

   An **RL-B** exists when any of the following conditions occurs:

   a. Air and water-reactive chemicals (except pyrophorics) are handled
   b. Handling NFPA Class I flammable liquids (quantity > 1 liter but < 15 liters) or Class II or III combustible liquids (quantity > 4 liters but < 15 liters)
   c. Organic peroxide formers (quantity < than 1 liter)
   d. High-pressure or vacuum rotary evaporators

   An **RL-C** exists under the following conditions:

   a. No spark, flame, heated apparatus, or other ignition source is present
   b. Handling NFPA Class I flammable liquids (quantity < 1 liter) or Class II or III combustible liquids (quantity < 4 liters)

3. **How are NFPA flammable and combustible liquids defined?**

   Flammable liquids are defined as any liquid having a flash point below 100°F. These are divided into Class 1A, 1B, or 1C. Combustible liquids have a flash point above 100°F, and are divided into Class II, Class IIIA, or Class IIIB.

a. Class IA — Flash point less than 73°F; boiling point less than 100°F
b. Class IB — Flash point less than 73°F; boiling point equal to or greater than 100°F
c. Class IC — Flash point equal to or greater than 73°F, but less than 100°F
d. Class II — Flash point equal to or greater than 100°F, but less than 140°F
e. Class IIIA — Flash point equal to or greater than 140°F, but less than 200°F
f. Class IIIB — Flash point equal to or greater than 200°F

4. **Which lab coat should be selected for an RL-A, RL-B, or RL-C flammable risk level?**

   RL-A — A Nomex or other inherently flame-resistant (FR) lab coat should be used
   RL-B — An inherently FR or chemically treated FR lab coat may be used
   RL-C — A 100% cotton lab coat may be used if handling NFPA Class I flammable liquids (quantity < 1 liter) or Class II or III combustible liquids (quantity < 4 liters).

5. **Why can't I use a 100% cotton lab coat in an RL-A or RL-B environment?**

   An untreated 100% cotton lab coat is not considered flame resistant. Unlike an FR garment, untreated cotton will continue to burn if it is exposed to an ignition source even after the ignition source has been removed.

6. **What is the difference between an inherently FR fabric and a chemically treated FR fabric?**

   There are two primary types of flame-resistant fabrics that are used in the production of FR garments: those made of inherently flame-resistant fibers, and those made from chemically treated fabrics such as cotton. Although there is some debate as to whether the terminology is misleading, there is some legitimate concern that certain lesser-quality chemically treated FR fabrics may lose their flame resistance through improper laundering. Consequently, only use chemically treated FR garments produced by fabric manufacturers that guarantee the protection will last for the life of the garment.

7. **If an FR lab coat is specified by the hazard assessment, which requirements apply?**

For the highest hazard activities (i.e., RL-A), a Nomex or other inherently FR garment should be selected. For RL-B hazards, a chemically treated FR garment would be acceptable. In either case, the FR garment must be NFPA 2112 compliant.

8. **What is NFPA 2112?**

   NFPA 2112 is a consensus standard that addresses Flame-Resistant Garments for Protection of Industrial Personnel Against Flash Fire. It specifies the **minimum** design, performance, certification requirements, and test methods for flame-resistant garments for use in areas at risk from flash fires.

9. **If NFPA 2112 is a standard for the protection of industrial personnel, does it apply to a laboratory setting such as LBNL?**

   NFPA 2112 is one of the only standards in the United States that specifies design, performance, certification, and test methods for FR garments. Even though this is a consensus standard and not a law, OSHA could cite an employer under the General Duty Clause, which states:

   (a) Each employer –
   (1) shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;
   (2) shall comply with occupational safety and health standards promulgated under this Act.

   Under Section 6 of the OSH Act of 1970, OSHA can cite an employer for not following national consensus standards.

10. **If I wear an NFPA 2112 certified lab coat, will it protect me from burn injuries in the unlikely event of a flash fire?**

    The purpose of FR garments is to resist ignition, prevent the spread of flame, and self-extinguish upon removal of the ignition source. An added goal of FR garments is to insulate the wearer and provide some thermal protection. These attributes help minimize burn injuries but cannot eliminate them completely.

11. **Are all NFPA 2112 compliant garments created equal?**

    No. "*For a garment to pass NFPA 2112 testing, it must exhibit 50 percent or less total predicted body burn using a standardized burn injury model."* (See http://www.dupont.com/products-and-services/personal-protective-equipment/thermal-protective/articles/nfpa-2112.html).The difference between a 49 percent predicted body burn and an 8 percent predicted body burn is significant in terms of potential survivability; however, both garments would be considered NFPA compliant. For this reason, NFPA 2112 should be considered a starting point. When evaluating FR garments for selection, it is important to compare NFPA 2112 test results. The garment manufacturer should provide this information upon request.

12. **I am using an FR lab coat because of moderate-to-high risk posed by flammable hazards in my workspace. Am I protected from chemical splash hazards as well?**

    No. FR garments are typically made of a loose-weave fabric that is not designed to provide splash protection. If you are splashed with a flammable liquid, some of the liquid could pass through the FR garment to the undergarments. If this were to occur in the presence of an ignition source, the fuel on both the FR garment and the undergarment will potentially burn. If you are wearing non-FR garments over or under FR garments, they may catch on fire and/or melt. Consequently, overgarment and undergarment selection is critical when working in RL-A or RL-B environments.

    Even in instances where there are no flammable hazards, lab coats (including 100% cotton) are not intended nor designed to provide chemical splash protection. They provide limited protection against incidental contact with chemicals. If you work in an area where there is a high splash hazard, you should supplement your lab coat with an appropriate chemical and/or FR apron. Additional PPE, such as chemical goggles, face shield, and gloves may be necessary.

13. **If there is a high risk of splash, can I use a regular chemical apron over my FR lab coat?**

    No. Garments that are worn over FR clothing must also be FR rated, or they may burn if exposed to an ignition source. For undergarments, use only non-melting

fibers (cotton or other natural fiber) or other FR rated garments.

14. **What are some examples of clothing materials that should not be used as undergarments when an FR lab coat is required?**

    Spandex, polyester, nylon, polypropylene, or acetate.

15. **I work in a lab that handles flammables but the larger risk would appear to be from splash or contact with non-flammable materials. Which lab coat should I use?**

    If you are working in an RL-A or RL-B environment and there is a high splash hazard, you may need to supplement the FR lab coat with an FR apron designed to protect you from chemical splashes. Additionally, you may need to consider the use of splash resistant and FR sleeves.

16. **Can I use a barrier coat for anything other than work involving the handling of bloodborne pathogens (BBP) or other biohazardous materials?**

    Barrier coats should only be used for handling BBP or biohazardous materials.

17. **If my lab coat becomes contaminated with flammable or non-flammable chemicals, what should I do?**

    The lab coat should be removed immediately and replaced with a clean coat. Contaminated lab coats must be disposed of in accordance with applicable Berkeley Lab medical/biohazardous, hazardous, and radiological waste management requirements.

18. **How should lab coats be worn?**

    Lab coats should be worn fully buttoned and with sleeves rolled down.

19. **I am preparing to purchase some lab coats for my lab. All things equal, are lab coats with snaps preferable to those with buttons?**

Yes. In the event of an emergency, a lab coat with snaps can be removed more rapidly and with one hand, if necessary.

20. **Is it okay to wash my lab coat at home or at a public Laundromat?**

No. Lab coats should only be laundered by an authorized vender providing lab coat services to the Lab.

21. **Can I have emblems or embroidery added to my FR garments?**

Yes. However, emblems and/or embroidery (including the thread used) should also be FR and should be sewn by an authorized vendor following the manufacturers' specifications.

22. **How should lab coats be sized?**

Lab coats should be sized taking into consideration comfort, shrinkage, and protection. Like other forms of PPE, uncomfortable lab coats are less likely to be worn.

Some garment manufacturers provide sizing charts to help with the proper sizing of lab coats. Depending on the material, lab coats may shrink from 2 to 6% through normal washing. Shrinkage should be taken into consideration when purchasing lab coats.

If a coat is too small or too large, the protection provided will not be optimal. Sleeves that are too short will not adequately cover the skin of the wrist and/or forearm. Sleeves that are too long may create hazards as well.

Tight-fitting lab coats should be avoided. Looser-fitting clothing provides additional insulation and thermal protection because of air space between the clothing and skin.

23. **When should lab coats be removed from service?**

Some FR lab coats may have a shelf or service life and will need to be replaced prior to exceeding either one. Additionally, FR lab coats as well as non-FR lab coats should be removed from service and replaced for the same reasons that regular clothes are

replaced: when they no longer fit; develop rips, holes, or tears that cannot be repaired; become permanently stained; or become contaminated with a hazardous substance that cannot be removed.

Appendix E. LBNL Lab Coat Selection Tool.

Download the LBNL Lab Coat Selection Tool here.

Appendix F. Flame-Resistant (FR) Lab Coat Selection Guide Matrix

Download the FR Lab Coat Selection Guide Matrix here.