



# Chemical Hygiene Plan

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# Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
CFR	<i>Code of Federal Regulations</i>
CHO	chemical hygiene officer
CHP	chemical hygiene plan
ES&H	Environment, Safety, and Health Division
fpm	feet per minute
FS	Field Safety Department
IHIM	Industrial Hygiene and Information Management Department
JHAM	job hazard analysis and mitigation
MSDS	material safety data sheet
NFPA	National Fire Protection Association
NOAA	National Oceanic and Atmospheric Administration
OEL	occupational exposure limit
OSHA	Occupational Safety and Health Administration
PEL	permissible exposure limit
PHS	particularly hazardous substances
PPE	personal protective equipment
RMR	Risk Management and Response Department
RP	Radiation Protection Department
SLAC	SLAC National Accelerator Laboratory
SOP	standard operating procedure
STA	SLAC Training Assessment
TLV	threshold limit value
WM	Waste Management Group



# 1 Introduction

This chemical hygiene plan (CHP) addresses hazard communication for chemicals and chemical processes within research laboratories at the SLAC National Accelerator Laboratory (SLAC). It is a component of the SLAC hazardous material program described in the *SLAC Environment, Safety, and Health Manual*, Chapter 40, “Hazardous Materials”.<sup>1</sup> Chapter 40 is referenced throughout this plan as the basis document for the chemical hygiene program, which consists of this plan, chemical hygiene training, and a laboratory safety checklist.<sup>2</sup>

The chemical hygiene plan

- States SLAC policy in the event of an emergency, accident, or potential overexposure
- Describes the roles and responsibilities associated with the chemical hygiene program
- Provides general guidance for lab supervisors to identify work hazards and suggests means to control them
- Describes activities and materials within SLAC chemical laboratories that could result in exposure to hazardous chemicals and suggests methods for working within required controls

## 1.1 Standards

The chemical hygiene program implements the Occupational Safety and Health Administration (OSHA) standard that applies to the protection of workers in chemical laboratories:

- Title 29, *Code of Federal Regulations*, Part 1910, “Occupational Safety and Health Standards”, Section 1450, “Occupational Exposure to Hazardous Chemicals in Laboratories” (29 CFR 1910.1450)<sup>3</sup>

Related standards are the following:

- Title 29, *Code of Federal Regulations*, Part 1910, “Occupational Safety and Health Standards”, Subpart Z, “Toxic and Hazardous Substances”, Section 1000, “Air Contaminants”
  - Table Z-1, “Limits for Air Contaminants” (29 CFR 1910.1000 Table Z-1)<sup>4</sup>
  - Table Z-2 (29 CFR 1910.1000 Table Z-2)<sup>5</sup>
  - Table Z-3, “Mineral Dusts” (29 CFR 1910.1000 Table Z-3)<sup>6</sup>

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1 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 40, “Hazardous Materials”, [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/haz\\_materials/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/haz_materials/policies.htm)

2 [ forthcoming ]

3 [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=10106](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10106)

4 [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9992](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992)

5 [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9993](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9993)

6 [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9994](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9994)

- Title 29, *Code of Federal Regulations*, “Labor”, Part 1910, “Occupational Safety and Health Standards”, Subpart I, “Personal Protective Equipment”, Section 133, “Eye and Face Protection” (29 CFR 1910.133)<sup>7</sup>
- American National Standards Institute (ANSI) Z87.1-2003, “Practice for Occupational/Educational Eye and Face Protection” (ANSI Z87.1-2003)<sup>8</sup>
- National Fire Protection Association (NFPA) 70-2005, *National Electrical Code* (NFPA 70-2005)<sup>9</sup>
- NFPA 45-2004, “Fire Protection for Laboratories Using Chemicals”, Section 9-2.2, “Refrigeration and Cooling Equipment” (NFPA 45-2004)<sup>10</sup>
- NFPA 54-2006, *National Fuel Gas Code*, Section 5.5.2, “Liquefied Petroleum Gas Systems” (NFPA 54-2006/ANSI Z223.1-2006)<sup>11</sup>

## 1.2 Scope and Application

This plan applies to all persons who work in designated chemical hygiene laboratories.<sup>12</sup>

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7 [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9778](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9778)

8 See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards.

9 See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards. A hard copy of NFPA 70-2005 is available; see <http://www.slac.stanford.edu/spires/find/books/www?key=327328>.

10 See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards.

11 See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards.

12 Hazardous Materials: Chemical Hygiene Program Laboratories List (SLAC-I-730-0A09V-001), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatListCHPLabs.pdf>

## 2 General Policy

This section provides an overview of chemical hygiene program policy. For requirements regarding laboratory safety, see Section 3; for safety equipment, see Section 4.

### 2.1 Chemical Laboratory Designation

The basis for designating a chemical laboratory as subject to the chemical hygiene program is outlined in the *ES&H Manual*, Chapter 40, “Hazardous Materials”.<sup>13</sup> The SLAC chemical hygiene officer (CHO) identifies such laboratories and informs the hazardous materials program manager, who will add the laboratory to the chemical hygiene program laboratories list.<sup>14</sup>

### 2.2 Hazard Communication

#### 2.2.1 Chemical Hygiene Plan

A copy of this plan must be readily available to any employee in the work areas defined in Section 1.2, “Scope and Application”.

*Note* Every person who plans to work in the listed chemical laboratories must provide written acknowledgment that he or she is familiar with the SLAC Chemical Hygiene Program and will comply with all its policies and requirements prior to beginning any work.

The plan is updated by the hazardous materials program manager, as required by changes in policy, or when Chapter 40 is updated, whichever comes first.

##### 2.2.1.1 Standard Operating Procedures Development

If policy or procedures outlined in this plan do not adequately address hazards in a particular area or situation, SLAC employees and supervisors in the affected work areas must develop lab-specific standard operating procedures (SOPs). Once lab-specific SOPs are developed and implemented, any deviation from these procedures requires prior approval of the lab supervisor.

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<sup>13</sup> *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 40, “Hazardous Materials”, [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/haz\\_materials/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/haz_materials/policies.htm)

<sup>14</sup> Hazardous Materials: Chemical Hygiene Program Laboratories List (SLAC-I-730-0A09V-001), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatListCHPLabs.pdf>

## 2.2.2 Material Safety Data Sheets

In addition to the plan, all affected areas must have access to all applicable material safety data sheets (MSDSs), as these contain detailed information for each chemical in use.<sup>15</sup>

## 2.3 Emergencies

Most emergencies require the attention of professional first responders: call 911 then SLAC Site Security (extension 5555). For additional information, see the SLAC Emergency web page.<sup>16</sup>

In chemical laboratories, emergencies include chemical exposure and chemical spills.

- Additional information on emergency response to chemical exposure is in Section 2.4.4, “Accidents and Potential Overexposure”.
- Information on handling chemical spills is in the *ES&H Manual*, Chapter 16, “Spills”<sup>17</sup> Chemical spills become emergencies
  - If the spill results in a release to the environment (such as the sink or floor drain)
  - If the material or its hazards are unknown
  - If the laboratory staff cannot safely manage the hazard because the material is known to be too hazardous or the quantity is too large

For policy and requirements pertaining to large-scale emergencies, see *ES&H Manual*, Chapter 37, “Emergency Management”.<sup>18</sup>

## 2.4 Chemical Exposure Limits and Accidents / Overexposure

### 2.4.1 Exposure Limits

The goal of SLAC’s exposure assessment strategy is to protect workers by controlling potential exposures to less than 10 percent of the *occupational exposure limits (OELs)*. The OEL is defined as the more protective limit of either OSHA *permissible exposure limits (PELs)* or American Conference of Governmental Industrial Hygienists (ACGIH) *threshold limit values (TLVs)*.

*Note* For more information, see 29 CFR 1910.1000, tables Z-1,<sup>19</sup> Z-2,<sup>20</sup> and Z-3.<sup>21</sup>

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15 “Hazard Communication and MSDS References”, <http://www-group.slac.stanford.edu/esh/groups/cgs/hmaq/hazmat/hazcom.htm>

16 “Emergency Information”, <http://www-group.slac.stanford.edu/esh/emergency/>

17 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 16, “Spills”, <http://www-group.slac.stanford.edu/esh/environment/spills/policies.htm>

18 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 37, “Emergency Management”, <http://www-group.slac.stanford.edu/esh/emergency/chapter/policies.htm>

19 Title 29, *Code of Federal Regulations*, Part 1910, “Occupational Safety and Health Standards”, Subpart Z, “Toxic and Hazardous Substances”, Section 1000, “Air Contaminants”, Table Z-1, “Limits for Air

## 2.4.2 Exposure Control

Industrial Hygiene and Information Management Department industrial hygienists carry out policy established in the *ES&H Manual*, Chapter 5, “Industrial Hygiene”, to control exposures through the development and implementation of an exposure assessment strategy.<sup>22</sup> In addition to this strategy, guidance in sections 3, “Laboratory Safety”, and 4, “Safety Equipment Requirements”, of this plan help to ensure that no PEL is exceeded.

## 2.4.3 Monitoring

Upon request, the ES&H Industrial Hygiene Group conducts ventilated laboratory hood evaluations and laboratory equipment surveys for such equipment as eye washes, safety showers, and compressed gas cylinders. Reports of such evaluations are available upon request; contact the ES&H Industrial Hygiene Group.<sup>23</sup>

## 2.4.4 Accidents and Potential Overexposure

Potential overexposure to hazardous chemicals or substances may be indicated when one or more of the following occurs:

1. A laboratory worker manifests certain physical symptoms (such as headache, rash, nausea, coughing, tearing, irritation or redness of the eyes, irritation of the nose or throat, dizziness, loss of motor dexterity or judgment), and one of the following also occurs:
  - Some or all of the symptoms disappear when the worker is removed from the exposed area
  - The symptoms reappear soon after the worker returns to work with the same hazardous chemicals
2. Two or more persons in the same laboratory work area have similar physical symptoms as described above.
3. A hazardous chemical is leaked, spilled or otherwise rapidly released in an uncontrolled manner.
4. A laboratory worker has direct skin or eye contact with a hazardous chemical.

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Contaminants” (29 CFR 1910.1000 Table Z-1),

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9992](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9992)

20 Title 29, *Code of Federal Regulations*, Part 1910, “Occupational Safety and Health Standards”, Subpart Z, “Toxic and Hazardous Substances”, Section 1000, “Air Contaminants”, Table Z-2 (29 CFR 1910.1000 Table Z-2),

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9993](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9993)

21 Title 29, *Code of Federal Regulations*, Part 1910, “Occupational Safety and Health Standards”, Subpart Z, “Toxic and Hazardous Substances”, Section 1000, “Air Contaminants”, Table Z-3, “Mineral Dusts” (29 CFR 1910.1000 Table Z-3),

[http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9994](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9994)

22 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 5, “Industrial Hygiene”, [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/industrial\\_hygiene/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/industrial_hygiene/policies.htm)

23 “Ventilated Lab Hoods”, [http://www-group.slac.stanford.edu/esh/groups/cgs/ih/vent\\_hoods.htm](http://www-group.slac.stanford.edu/esh/groups/cgs/ih/vent_hoods.htm)

*Note* Odor is not a reliable indicator in determining exposure; if there is any reason to believe a chemical exposure limit has been exceeded, notify the lab supervisor, even if a suspicious odor is not detected.

#### 2.4.4.1 Accident Emergency Response Requirements

In the event of any accident or spill in which the victim uses an emergency eye wash or shower, or the victim is overcome by an inhalation exposure that requires leaving the immediate area for fresh air, the following must occur immediately:

- Medical attention must be sought, even if no injury is apparent. Call 911 then SLAC Site Security (extension 5555). For additional information, see the SLAC Emergency web page.<sup>24</sup>
- The chemical lab supervisor must be notified. (See Section 2.4.4.2, “Accident or Suspected Overexposure Investigation”, for the supervisor’s role in incident investigation.)

#### 2.4.4.2 Accident or Suspected Overexposure Investigation

If a person has been exposed to a hazardous chemical due to a spill or accident, or an overexposure is suspected, supervisors must, within 24 hours of the injury

- Ensure that the injured employee fills out side A of the SLAC Occupational Accident/Incident Report (SLAC SU-17)<sup>25</sup>
- Have injured employees report to the SLAC Medical Department

This initiates the investigation process outlined in the *ES&H Manual*, Chapter 28, “Incident Investigation”.<sup>26</sup>

#### SLAC Medical Department Examination

In the event of an accident or potential overexposure, the SLAC physician’s role may include providing first aid or making a first determination of any further recommended medical examinations, treatment, or procedures.

In all cases, an examination by the SLAC physician is required within 24 hours to determine if an investigation is warranted.

- All involved persons must fully disclose to the physician the chemical(s), conditions of the exposure, and all symptoms. If possible, it is recommended that the specific MSDS be provided at the time of the examination.<sup>27</sup>
- The SLAC SU-17 form must be fully completed by the indicated parties.

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24 “Emergency Information”, <http://www-group.slac.stanford.edu/esh/emergency/>

25 SLAC Occupational Accident/Incident Report (SLAC SU-17). Available from the SLAC Medical Department, <http://www-group.slac.stanford.edu/esh/medical/>

26 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 28, “Incident Investigation”, <http://www-group.slac.stanford.edu/esh/general/incident/policies.htm>

27 “Hazard Communication and MSDS References”, <http://www-group.slac.stanford.edu/esh/groups/cgs/hmaq/hazmat/hazcom.htm>

Because the SLAC Medical Department may not be equipped to deal with certain types of exposures, a recommendation may be made to seek exposure-specific types of medical examination or treatment.

*Note* Medical records requirements and access are described in ES&H Manual, Chapter 3, "Medical".<sup>28</sup>

#### Exposure Assessments

An exposure assessment is conducted by an ES&H industrial hygienist to

- Determine if proper safety controls were in place that could have prevented the exposure
- Recommend any new controls that may be necessary to prevent or mitigate future exposures

The industrial hygienist must report the results of assessment to the affected chemical lab supervisor within 15 working days after completing the assessment. Assessment results are added to other records per established SLAC standards. If exposure controls were found to be inadequate, further action will be required.

For further information, see *ES&H Manual*, Chapter 5, "Industrial Hygiene",<sup>29</sup> in particular Industrial Hygiene: Exposure Assessment Strategy, Surveying, and Monitoring Guidelines.<sup>30</sup>

## 2.5 Training

### 2.5.1 SLAC Employees

Employees who work with potentially hazardous chemicals in laboratories within the scope of this plan must complete the following:

- ES&H Course 199, Laboratory User Chemical Hygiene Plan Training<sup>31</sup>

The course must be completed upon initial assignment to the lab. It covers OSHA standards for occupational exposure to hazardous chemicals in laboratories.

### 2.5.2 Visiting Scientists, Guest Researchers, and Other Lab Users

Visiting scientists, guest researchers and other lab users who are not SLAC employees or subcontractors must demonstrate that they understand applicable chemical hygiene principles. This can be accomplished

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28 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 3, "Medical", <http://www-group.slac.stanford.edu/esh/medical/chapter/policies.htm>

29 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 5, "Industrial Hygiene", [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/industrial\\_hygiene/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/industrial_hygiene/policies.htm)

30 Industrial Hygiene: Exposure Assessment Strategy, Surveying and Monitoring Guidelines (SLAC-I-730-0A09T-020), <http://www-group.slac.stanford.edu/esh/eshmanual/references/IHGuideSurvey.pdf>

31 ES&H Course 199, Laboratory User Chemical Hygiene Plan Training, [https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog\\_item.asp?course=199](https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=199)

by providing proof of training from another institution or passing a SLAC Chemical Hygiene Program exam.

## 2.6 Roles and Responsibilities

### 2.6.1 Chemical Hygiene Officer

The chemical hygiene officer (CHO)

- Has overall responsibility for the chemical hygiene program
- Identifies laboratories to be included in the CHP list and ensures labs implement program requirements
- Develops program requirements and communicates any updates to the hazardous materials program manager on an annual basis or more often if circumstances warrant
- Develops and documents chemical hygiene training
- Provides technical assistance to labs covered in the scope of this plan

### 2.6.2 Hazardous Materials Program Manager

The hazardous materials program manager

- Updates the chemical hygiene program laboratories list
- Updates the chemical hygiene plan based on input from the CHO and industrial hygienists

### 2.6.3 Industrial Hygiene Program Manager

Industrial hygienists

- Perform exposure and risk assessments for laboratories within the scope of this plan
- Perform routine laboratory inspections to ensure that protective equipment such as fume hoods, eyewashes, and safety showers are functioning properly
- Coordinate with the CHO

### 2.6.4 SLAC Medical Department

The SLAC physician

- Conducts medical consultations and examinations
- Completes the SLAC SU-17 form

### 2.6.5 Managers, Supervisors, and ES&H Safety Coordinators

Managers, supervisors, and ES&H safety coordinators

- Select appropriate control measures for hazards identified using the MSDS and lab risk assessments
- Authorize the purchase of required personal protective equipment (PPE)

### 2.6.6 Chemical Lab Supervisors

Chemical lab supervisors

- Develop lab-specific chemical hygiene standard operating procedures (SOPs)
- Sponsor safety meetings to review training
- Monitor work practices on a daily basis
- Answer questions regarding safety procedures as necessary
- In the event of a chemical overexposure, follow the required reporting procedure as described in Section 2.4.4 of this plan and in the *ES&H Manual*, Chapter 28, “Incident Investigation”<sup>32</sup>

### 2.6.7 Employees, Visiting Scientists, and Guest Lab Users

Anyone using the lab must

- Follow policies and procedures for working with hazardous chemicals as outlined in this plan
- Wear appropriate personal protective equipment (PPE) as required (see Section 4.1)

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<sup>32</sup> *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 28, “Incident Investigation”, <http://www-group.slac.stanford.edu/esh/general/incident/policies.htm>



# 3 Laboratory Safety Requirements

This section includes guidelines and requirements for hazardous chemical handling, storage, and waste disposal.

## 3.1 Handling

Listed below are references for obtaining hazard information, general laboratory safety guidelines, and information on handling specific classes of hazardous chemicals.

### 3.1.1 Primary References and Resources

Primary references for identifying specific hazards associated with hazardous chemicals include

- *ES&H Manual*, Chapter 40, “Hazardous Materials”
  - Safe use guidelines for specific chemicals commonly used at SLAC (scroll down the webpage to the heading and select the required guideline)<sup>33</sup>
  - Hazardous Materials: Laboratory Safety Checklist<sup>34</sup>
  - Hazardous Materials: Chemical Use Planning Guidelines<sup>35</sup>
- Material safety data sheets<sup>36</sup>
- OSHA / EPA Occupational Chemical Database<sup>37</sup>
- National Oceanic and Atmospheric Administration (NOAA) Cameo Chemical Search<sup>38</sup>

### 3.1.2 General Laboratory Safety Guidelines

Each laboratory within the scope of this plan must follow safe laboratory practices such as the general safety guidelines below.

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33 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 40, “Hazardous Materials”, [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/haz\\_materials/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/haz_materials/policies.htm)

34 [ forthcoming ]

35 Hazardous Materials: Chemical Use Planning Guidelines (SLAC-I-730-0A09T-018), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatGuideUsePlan.pdf>

36 “Hazard Communication and MSDS References”, <http://www-group.slac.stanford.edu/esh/groups/cgs/hmaq/hazmat/hazcom.htm>

37 “OSHA / EPA Occupational Chemical Database”, <http://www.osha.gov/web/dep/chemicaldata/ChemicalResult.asp?RecNo=401>

38 “Cameo Chemicals Search”, <http://cameochemicals.noaa.gov/search?action=new&type=simple>

*Note See Hazardous Materials: Laboratory Safety Checklist for a template that can be adapted to include lab-specific good practices.*<sup>39</sup>

- Know the location of safety equipment such as emergency showers, eye washes, fire extinguishers, fire alarms, and emergency telephone numbers<sup>40</sup>
- Ensure a chemical spill kit is present and fully stocked and laboratory workers are trained in its use
- Purchase the minimum amount of hazardous materials necessary to accomplish work and dispense only amounts necessary for immediate use
- Use hazardous materials only as directed and only for their intended purpose
- Avoid direct contact with any chemical and never smell or taste a hazardous chemical
- Wear safety glasses or face shields and a lab coat or chemical safety apron when working in the lab; review the MSDS for specific recommendations for each chemical
- Do not smoke, drink, eat, or apply cosmetics where hazardous chemicals are in use
- All containers must be labeled. Do not remove labels on original containers. If an original label becomes torn or faded, replace only with an approved secondary labels and include the full chemical name, manufacturer, and relevant hazard information.
- Confirm ventilation is adequate for the chemicals in use, and when possible, handle all materials under a chemical fume hood
- Electrically ground and bond containers using approved methods before transferring or dispensing a flammable liquid from a large container
- Store chemicals only with compatible chemicals

### 3.1.3 Specific Hazard Classes

#### 3.1.3.1 Toxic Chemicals

Exposure to toxic chemicals results in effects that may present as acute or chronic, depending on the circumstances. Acute exposure effects include such reactions as burns, allergic reactions, or eye damage, which generally present immediately. Chronic exposure effects include cumulative damage to organs due to long-term exposure.

Protection from toxic chemicals is realized by identifying potential routes of exposure (inhalation, oral ingestion, skin contact or puncture) and minimizing or eliminating the possibility of exposure by implementing administrative and engineering controls.

In addition to the general guidelines listed in Section 3.1.2 above:

- Use and store toxic chemicals only in established, clearly labeled designated control areas
- Keep the smallest amount of toxic chemicals possible in your inventory
- Store and transport toxic chemicals in secondary containment trays

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39 [ forthcoming ]

40 Hazardous Materials: Eyewash/Shower Inspection Form (SLAC-I-730-0A09J-003), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormShowerInspect.pdf> | [.doc \(Word\)](#)

- Handle highly toxic chemicals in containment devices such as fume hoods and glove boxes
- Use proper gloves and protective gear
  - Wash non-disposable protective gear after each use
  - Discard disposable items in marked containers inside the work area
- Wash immediately after any skin contact with toxic chemicals
- Contaminated washes and materials from experiments must be decontaminated and disposed of properly. Normal lab work should not resume until the work area is decontaminated. Contact the Waste Management Group for guidance on proper disposal of hazardous waste.<sup>41</sup>

### 3.1.3.2 Flammable and Combustible Chemicals

Flammable or combustible chemicals are defined as any chemical capable of generating a vapor sufficient to cause a fire in the presence of an ignition source. Flammables are more volatile than combustibles. Safe handling of these chemicals requires controlling one or more of the elements necessary to initiate a fire: fuel, ignition source, and oxygen.

In addition to the general laboratory safety guidelines in Section 3.1.2 above:

- Eliminate any ignition sources such as: open flames, smoking materials, hot surfaces, sparks from welding or cutting, operation of electrical equipment, and static electricity
- Post conspicuous NO SMOKING signs in areas where flammable materials are used or stored
- Store chemicals in approved flammable liquid containers (safety cans) and storage cabinets or in a special storage room designed for that purpose
- Store chemicals away from any oxidizers
- Flammable liquids stored in glass containers should not exceed one quart unless chemical purity is preserved. If the chemical purity cannot be adequately preserved in any other type of container, then storage in glass containers up to one gallon is permissible
- Use refrigerators and freezers approved and rated for storage of flammable materials
- Confirm there is proper bonding and grounding when transferring or dispensing flammable liquid from a large container
- Confirm appropriate sprinklers and fire extinguishers are installed in the work area

### 3.1.3.3 Corrosive Chemicals

Corrosive chemicals can be in solid, liquid or gaseous form and may be a strong acid, strong base, dehydrating agent, oxidizing agent or water-reactive.

From a health effects perspective, a corrosive chemical is any chemical that causes visible destruction or irreversible alterations of body tissue from contact with the chemical. Such exposures can cause debilitating health effects through direct contact, inhalation, or ingestion. Most exposures involve corrosive liquids, but gaseous forms are particularly dangerous because chemical vapors are readily absorbed through skin contact or inhalation.

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41 “Environmental Protection – Hazardous Waste Management”, <http://www-group.slac.stanford.edu/esh/groups/ep/hwm/>

In addition to the general laboratory safety guidelines in Section 3.1.2 above:

- Use eye and skin protection when handling corrosive chemicals. Splash proof goggles, safety glasses, face shields, chemical resistant gloves, aprons, and boots may also be appropriate, depending upon the work being performed. Always check the MSDS for personal protective equipment recommendations.
- Contact lenses are not allowed when working with corrosive chemicals, even when using protective eyewear
- Ensure emergency eyewashes and safety showers are accessible in work areas where corrosive chemicals are used and stored. In the event of skin or eye contact with corrosives, immediately flush the area of contact with cool water for 15 minutes and remove all affected clothing. Seek emergency medical assistance immediately.
- Slowly add water to any dehydrating agents such as sulfuric acid, sodium hydroxide, phosphorus pentoxide, and calcium oxide to avoid violent reaction and splattering
- Store and use strong oxidizing agents such as chromic and perchloric acids in glass or other inert containers (preferably unbreakable). Do not use corks and rubber stoppers.
- Use safety rubber bottle carriers or non-breakable bottles (PVC-coated) to transport strong acids and bases
- Use only corrosion-resistant containers and equipment for storage
- Store acids and bases separately. Organic acids should be stored with flammable materials, and separated from oxidizers, including oxidizing acids.

#### 3.1.3.4 Compressed Gases

For SLAC-specific policy regarding compressed gas cylinders, see *ES&H Manual*, Chapter 38, “Compressed Gas Cylinders”.<sup>42</sup> See in particular: CGC: Safety Requirements, which includes information pertaining to specific hazard categories (corrosive, flammable, toxic, oxidizer, and asphyxiant).<sup>43</sup>

#### 3.1.3.5 Cryogenics

Cryogenics are a special category of compressed (liquefied) gas that pose unique hazards such as asphyxiation, pressure and chemical explosions, material stiffness, and cold burns upon contact. To prevent such hazards observe the following precautions in addition to the general guidelines listed in Section 3.1.2 above:

- Wear safety goggles and/or a face shield. If there is a splash or spray hazard, wear an impervious apron or coat, cuff-less trousers, and high top shoes. Gloves should also be impervious and provide good thermal insulation.
- Ensure all containers and systems containing cryogenics have pressure relief mechanisms
- Ensure all containers and systems containing cryogenics are capable of withstanding extreme cold without becoming brittle

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42 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 38, “Compressed Gas Cylinders”, [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/compressed\\_gases/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/compressed_gases/policies.htm)

43 CGC: Safety Requirements (SLAC-I-730-0A09S-027), <http://www-group.slac.stanford.edu/esh/eshmanual/references/cgcReqSafety.pdf>

For SLAC-specific policy regarding cryogenics and other gases exhibiting an oxygen deficiency hazard, see *ES&H Manual*, Chapter 36, "Cryogenic and Oxygen Deficiency Hazard Safety".<sup>44</sup>

#### 3.1.3.6 Peroxidizable Chemicals

Peroxidizable chemicals are defined as chemicals that react with oxygen to form peroxides, which can explode from impact, heat, or friction under certain circumstances. Once a container is opened, taking note of maximum recommended storage times is of particular importance for chemicals in this hazard class.

In addition to the general guidelines listed in Section 3.1.2 above, observe precautions that pertain to flammable or combustible chemicals:

- Date all peroxidizables upon receipt and opening
- Unless an inhibitor has been added by the manufacturer, materials should be disposed as specified on the label
- Do not open any container that has obvious crystal formation around the lid
- Consider testing for peroxides and minimizing the hazards of peroxide formation by adding oxidation inhibiting compounds (for example, alcohol in ethyl ether or calcium hydride in solvents)

#### 3.1.3.7 Reactive Chemicals

The reactive chemical category includes any chemical that displays a broad range of reactions. Chemical types include explosives, oxidizers, reducers, unstable chemicals, and those that are water, acid, or air sensitive.

- Reactive chemicals can produce toxic gases, explode, react violently with water, or contain cyanide or sulfide.
- Reaction rates can vary from moderate to extremely rapid and include materials capable of rapid release of energy by themselves (self-reaction, or polymerization), and/or rates of reaction that may be increased by heat, pressure or by contact with incompatible substances.
- The level and rate of reactivity of individual chemicals in specific chemical classes (such as alkali metals) varies considerably and can be affected by aging or contamination.

Work with reactive chemicals must be conducted in such a manner as to control reactions. Extra care must be taken to identify potentially unexpected reactions.

#### 3.1.3.8 Carcinogenic, Teratogens, and Highly Toxic Chemicals

OSHA defines certain carcinogens, teratogens, and substances with high acute toxicity as *particularly hazardous substances (PHS)*. These substances require additional precautions above those for handling other toxic substances. Check the MSDS and the OSHA-published lists for a list of known PHSs.<sup>45, 46</sup>

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44 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 36, "Cryogenic and Oxygen Deficiency Hazard Safety", [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/cryogenic/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/cryogenic/policies.htm)

45 "OSHA / EPA Occupational Chemical Database", <http://www.osha.gov/web/dep/chemicaldata/default.asp>

46 "State of California EPA", [http://www.oehha.ca.gov/prop65/prop65\\_list/files/060107LST.pdf](http://www.oehha.ca.gov/prop65/prop65_list/files/060107LST.pdf)

In addition to the general guidelines listed in Section 3.1.2 above, follow extra precautions to prevent or mitigate the hazards associated with PHSs:

- Inform lab occupants in affected areas about the use of these chemicals
- Consult the relevant MSDS to determine if additional precautions are required and amend or add procedures as needed to safeguard health. Consider factors such as potency, concentration, quantity, physical properties and working conditions surrounding the use of the substances. In particular, consider if additional precautions are needed, including
  - Posting additional warning signs in affected areas or lab facilities (that is, fume hood, glove box, or entire room)
  - Determining the appropriate PPE for these chemicals
  - Adding containment devices (for example, fume hoods or glove boxes)
  - Seeking additional training
- Review procedures for decontamination
- Dispose of waste properly (see *ES&H Manual*, Chapter 17, “Hazardous Waste”<sup>47</sup>)

## 3.2 Storage

Chemical storage asset requirements are addressed in the *ES&H Manual*, Chapter 40, “Hazardous Materials.”<sup>48</sup> In addition to requirements specified in Chapter 40, refer to the MSDS and follow the general guidelines below.

### 3.2.1 General Storage Guidelines

- Verify all containers are in good condition and properly labeled
- Tightly close all containers after use and before returning chemicals to storage
- Store incompatible chemicals 20 feet apart or in separate containment or chemical storage cabinets
- Store chemicals by hazard class before organizing in alphabetical order
- Only store chemicals in chemical safety cabinets; do not store chemicals on the floor, on the bench top, in a fume hood, or on top of cabinets or shelving units
- Provide anti-roll lips on shelves
- Avoid use of removable shelf supports
- Select shelving that can be cleaned and does not soak up spilled chemicals
- Store chemicals, especially liquids, below eye level
- Store particularly hazardous substances (PHSs) in a dedicated, secured cabinet

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47 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 17, “Hazardous Waste”, [http://www-group.slac.stanford.edu/esh/environment/hazardous\\_waste/policies.htm](http://www-group.slac.stanford.edu/esh/environment/hazardous_waste/policies.htm)

48 Hazardous Materials: Chemical Storage Asset Requirements (SLAC-I-730-0A09S-018), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatReqStorage.pdf>

- Check with the SLAC fire marshal to ensure the amount of chemicals stored in your area are within quantity thresholds
- Seismically secure all chemical safety cabinets to floors or walls. Cabinets with contents that weigh over 400 pounds require engineered seismic restraints.

### 3.2.2 Spills

A chemical spill is the release of any hazardous chemical that results in an increased risk or potential risk to human or environmental health. Chemical laboratory personnel should only handle spills of the order they are qualified and authorized to handle as described in their employee job hazard analysis and mitigation (JHAM) and in the *ES&H Manual*, Chapter 16, "Spills."<sup>49</sup>

#### 3.2.2.1 Spill Prevention and Minimization

Though it is impossible to prevent all spills, lab users can lower the chance of a spill occurring, or minimize the effects of a spill as follows:

- Use spill containment
  - If there is the potential that the stored material could mix with incompatibles, be released to environment (such as the floor drain, sink drain) or become an exposure risk, use secondary containment. Secondary containment requires that the tray is large enough to hold the contents of the largest container if it breaks or leaks.
  - Visually inspect the bottoms of the flammable liquid storage cabinets to ensure they are sealed and can act as secondary containment. Inserting trays on the floor and shelves is recommended.
  - Buy liquids in plastic-coated bottles
  - Use bottle carriers for protection and containment when transporting liquids
  - Use traps on vacuum lines
- Be prepared
  - Understand potential hazards
  - Post an emergency telephone call list near the entrance to each work area as appropriate
  - Maintain a chemical spill kit. Kits are available from SLAC Stores.

*Note* If kit seal is broken, check if the contents of the kit are complete, replenish as needed, and reseal with a new, identical, seal.

- Minimize the amount of chemicals used and stored
- Stay organized. Understand and comply with the organization of the work area.
- Become more highly trained to handle the consequences of a spill
- Follow the industrial wastewater best management practices for chemical laboratories<sup>50</sup>

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49 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 16, "Spills", <http://www-group.slac.stanford.edu/esh/environment/spills/policies.htm>

50 *Industrial Wastewater: Wet or Chemical Lab Best Management Practices* (SLAC-I-750-0A16E-016), <http://www-group.slac.stanford.edu/esh/eshmanual/references/iwBMPLab.pdf>

### 3.3 Nanotechnology Safety

SLAC policy and procedures for nanotechnology safety are described in the *Nanomaterial Safety Plan*.<sup>51</sup>

### 3.4 Waste Disposal

#### 3.4.1 Sharps

Sharp objects such as needles, syringes, and razors require proper handling and disposal to prevent accidents.

- For proper disposal of sharp objects, see *ES&H Manual*, Chapter 46, “Blood-borne Pathogens”<sup>52</sup>
- Sharp items that are not contaminated with bodily fluids but may have been contaminated by a hazardous substance should be treated as hazardous waste. Special consideration should be given to minimize the risk of cuts. Certain sharp objects may need additional labeling and handling based on their hazardous and radioactive constituents:
  - For hazardous constituents, consult the Waste Management Group (WM) and see *ES&H Manual*, Chapter 17, “Hazardous Waste”<sup>53</sup>
  - For radioactive constituents, consult the Radiation Protection Department (RP) and see the *ES&H Manual*, Chapter 9, “Radiological Safety”<sup>54</sup>

#### 3.4.2 Hazardous Waste

Policy and procedures for handling hazardous waste are described in the *ES&H Manual*, Chapter 17, “Hazardous Waste”.

Chemical laboratory hazardous waste includes

- Chemicals that have exceeded their shelf life
- Chemicals that are no longer used
- Contaminated chemicals
- Empty chemical containers
- Chemical residue or wastes

For more information, contact the Waste Management Group.<sup>55</sup>

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51 *Nanomaterial Safety Plan* (SLAC-I-730-0A09M-008), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatPlanNano.pdf>

52 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 46, “Blood-borne Pathogens”, [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/bloodborne/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/bloodborne/policies.htm)

53 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 17, “Hazardous Waste”, [http://www-group.slac.stanford.edu/esh/environment/hazardous\\_waste/policies.htm](http://www-group.slac.stanford.edu/esh/environment/hazardous_waste/policies.htm)

54 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 9, “Radiological Safety”, [http://www-group.slac.stanford.edu/esh/general/radiological\\_safety/policies.htm](http://www-group.slac.stanford.edu/esh/general/radiological_safety/policies.htm)

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55 “Environmental Protection – Hazardous Waste Management”, <http://www-group.slac.stanford.edu/esh/groups/ep/hwm/>



# 4 Safety Equipment Requirements

## 4.1 Personal Protective Equipment

Because the proper use of personal protective equipment (PPE) minimizes or eliminates exposure to chemical hazards, chemical laboratory personnel are required to wear the PPE listed unless information or engineering controls are available that document the absence of need. Policies and procedures pertaining to PPE are described in the *ES&H Manual*, Chapter 19, “Personal Protective Equipment”.<sup>56</sup>

In addition to requirements listed in Chapter 19, following the general guidelines listed below ensure maximum protection:

- Select PPE based upon the greatest hazard: ensure the PPE provides both the kind and degree of protection needed for the potential hazard as well as the task
- Understand PPE limitations: for instance, splash-proof goggles must be used when handling corrosives because regular glasses are insufficient
- Ensure the PPE fits properly
- Maintain the equipment according to the manufacturer’s instructions
- Attend ES&H training on the proper use of PPE<sup>57</sup>

### 4.1.1 Protective Apparel

Protective apparel includes coats, aprons, jump suits, special types of boots, shoe covers, and gauntlets. Appropriate protective apparel is required for certain tasks and is generally recommended for most laboratory work. Appropriate laboratory apparel resists physical hazards while enabling easy execution of manual tasks.

In addition to wearing appropriate protective apparel, these general guidelines apply:

- Do not use wear loose, skimpy, or torn clothing
- Wear proper shoes at all times: do not wear sandals, perforated shoes, or cloth sneakers

### 4.1.2 Eye and Face Protection

PPE for eye and face protection must be selected in accordance with 29 CFR 1910.133<sup>58</sup> and meet the requirements specified in ANSI Z87.1-2003.<sup>59</sup> Protective equipment related to lasers, X-rays, gamma rays,

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56 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 19, “Personal Protective Equipment”, <http://www-group.slac.stanford.edu/esh/general/ppe/policies.htm>

57 ES&H Course 255, Personal Protective Equipment, [https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog\\_item.asp?course=255](https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=255)

and microwaves are not covered by the Z87.1 standard. Lab supervisors may contact equipment manufacturers or the Industrial Hygiene Group for proper equipment selection.<sup>60</sup>

Eye and face protection is required where there is a reasonable probability an injury could be prevented from such protection. General eye and face protection guidelines include the following:

- Safety glasses with permanently attached side shields are required whenever there is a potential for projectile objects in the work area
- Safety goggles are required when handling any chemical that can create fine dust, fumes, mists, and sprays
- Face shields are required to protect against the hazards identified above
- Do not use face shields as a substitute for eye protection; when both face and eye protections are needed, both types of protective equipment must be used
- Eye and/or face protection is required when radiant energy sources are present in the work area

SLAC Stores provides safety glasses, goggles, and face shields. For information on the purchase of prescription safety glasses, see PPE: Prescription Safety Glasses Purchase and Reimbursement Procedure.<sup>61</sup>

#### 4.1.3 Hand Protection

Gloves are required whenever there is potential for contact with a corrosive or toxic materials, or materials of unknown toxicity.

- Be sure to select the gloves appropriate for protection from the hazard
- Understand the limitations of the selected glove and discard the gloves properly before they become permeated by chemicals and lose their protective function
- Wash gloves after you completed a procedure, but before removing them from your hands
- Ensure gloves are air tight; fill the gloves with air and check for leaks

#### 4.1.4 Inhalation Protection

Properly functioning chemical fume hoods prevent most inhalation exposures to hazardous vapors or fumes. When procedures cannot be performed in a fume hood or ventilation is not adequate to provide protection against inhalation hazards, respiratory protective equipment may be required. For SLAC policy

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58 Title 29, *Code of Federal Regulations*, “Labor”, Part 1910, “Occupational Safety and Health Standards”, Subpart I, “Personal Protective Equipment”, Section 133, “Eye and Face Protection”, [http://www.osha.gov/pls/oshaweb/owadisp.show\\_document?p\\_table=STANDARDS&p\\_id=9778](http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9778)

59 American National Standards Institute (ANSI) Z87.1-2003, “Practice for Occupational/Educational Eye and Face Protection”. See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards.

60 “Industrial Hygiene”, <http://www-group.slac.stanford.edu/esh/groups/cgs/ih/>

61 PPE: Prescription Safety Glasses Purchase and Reimbursement Procedure (SLAC-I-730-0A21C-018), <http://www-group.slac.stanford.edu/esh/eshmanual/references/PPEProcReimburseGlasses.pdf>

regarding this type of respiratory protection, consult the *ES&H Manual*, Chapter 29, “Respiratory Protection.”<sup>62</sup>

## 4.2 Laboratory Equipment

Laboratory safety equipment that protects worker safety includes engineered safeguards, controls, fume hoods, and specialized equipment for storage including laboratory refrigerators and flammable liquid cabinets.

All such equipment must never be loaded beyond design limits, and must be properly maintained and inspected on a regular basis. Laboratory supervisors are required to detect and report any malfunctions of these controls.

### 4.2.1 Chemical Fume Hoods

A chemical fume hood is a local exhaust device designed to protect workers from the hazards of airborne chemical contaminants. A fume hood also protects people and property against small fires and explosions.

#### 4.2.1.1 Annual Inspection

A fume hood survey sticker indicating the certification date and performance data should be clearly visible.<sup>63</sup> In addition, a sticker on the side frame should indicate with an arrow the allowable sash height.

The certification date should be within one year of the current date. If the sticker is out of date, contact an ES&H industrial hygienist and request a required annual performance test.

#### Inspection Criteria

A fume hood is considered adequate for use if the face velocity averages 100 linear feet per minute (fpm) at the sash sticker arrow, which indicates the maximum sash opening height. If the hood does not meet performance criteria, a WARNING sticker must be placed at the sash opening, indicating the hood does not meet minimum safety requirements.

For more information, see

- Industrial Hygiene: Hazard Control Ventilation Requirements<sup>64</sup>
- Hazardous Materials: Fume Hood Velocity Survey Form<sup>65</sup>

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62 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 29, “Respiratory Protection”, [http://www-group.slac.stanford.edu/esh/hazardous\\_substances/respirator/policies.htm](http://www-group.slac.stanford.edu/esh/hazardous_substances/respirator/policies.htm)

63 Hazardous Materials: Fume Hood Survey Sticker (SLAC-I-730-0A09S-016), <http://www-group.slac.stanford.edu/esh/forms/>

64 Industrial Hygiene: Hazard Control Ventilation Requirements (SLAC-I-730-0A09S-021), <http://www-group.slac.stanford.edu/esh/eshmanual/references/IHReqVent.pdf>

65 Hazardous Materials: Fume Hood Velocity Survey Form (SLAC-I-730-0A09J-002), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormFumeHoodVelocity.pdf> | [.doc \(Word\)](#)

#### 4.2.2 Refrigerators

Chemical laboratory supervisors should consult with the SLAC fire marshal to determine if laboratory refrigerators meet National Fire Protection Association (NFPA) standards.<sup>66</sup> Additional requirements include

- An explosion-safe refrigerator must be used for flammable solvents that must be refrigerated. Chemical labs within the scope of this plan generally require this type of refrigerator.
- Laboratory refrigerators must never be used to store food.
- Domestic refrigerators located in labs must be labeled DO NOT STORE FLAMMABLES IN THIS REFRIGERATOR.

#### 4.2.3 Eyewash Stations and Safety Showers

Eyewash stations and safety showers are required in all labs subject to the scope of the plan. For equipment and maintenance requirements, consult the *ES&H Manual*, Chapter 40, “Hazardous Materials”, especially:

- Hazardous Materials: Eyewash/Shower Inspection Procedure<sup>67</sup>
- Hazardous Materials: Eyewash/Shower Inspection Form<sup>68</sup>

#### 4.2.4 First Aid Kits

All chemical laboratories within the scope of this plan must maintain a first aid kit. The kits available from SLAC Stores are approved by SLAC’s occupational health physician.

*Note* ES&H first aid and CPR training is recommended for lab employees.<sup>69</sup> Supervisors indicate training requests through the SLAC Training Assessment (STA).<sup>70</sup>

#### 4.2.5 Electrical Extension Cords

The *National Electrical Code*<sup>71</sup> and local government ordinances prohibit the use of extension cords as a substitute for permanent wiring. If additional electrical outlets are needed in a work area, the department

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66 National Fire Protection Association (NFPA) 45-2004, “Fire Protection for Laboratories Using Chemicals”, Section 9-2.2, “Refrigeration and Cooling Equipment” (NFPA 45-2004)

See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards.

67 Hazardous Materials: Eyewash/Shower Inspection Procedure (SLAC-I-730-0A09C-003), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatProcedShowerInspect.pdf>

68 Hazardous Materials: Eyewash/Shower Inspection Form (SLAC-I-730-0A09J-003), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormShowerInspect.pdf> | [.doc \(Word\)](#)

69 ES&H Course 138, CPR/First Aid, [https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog\\_item.asp?course=138](https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=138)

70 “Training - SLAC Training Assessment”, <http://www-group.slac.stanford.edu/esh/training/sta/default.htm>

responsible for the chemical lab must request installation of additional outlets from the Facilities Department.

The only exception to the requirement to install additional outlets is if the electric safety committee has approved the use of electrical power strips for personal computers and related equipment in older existing buildings. If a building housing a lab is subsequently renovated, ground fault circuit interrupters must be installed.

#### 4.2.6 Flammable Liquid Storage Cabinets

For details pertaining to flammable liquid storage cabinets, see Hazardous Materials: Chemical Asset Storage Requirements.<sup>72</sup>

#### 4.2.7 Safety Guards

All mechanical equipment must be equipped with guards to prevent access to electrical connections or moving parts (such as belts or vacuum pump pulleys). Inspect equipment before each use to ensure guards are in place and functioning.

#### 4.2.8 Safety Shielding

Safety shielding is PPE and/or a physical barrier designed to protect against damage resulting from an accidental explosion. Safety shielding must be used for any operation with the potential for explosion and must be installed to protect all personnel in the work area. Safety shielding is required in any of the following situations:

- When a reaction is attempted for the first time (use small quantities to minimize the hazard)
- A familiar reaction is attempted in larger than usual quantities (that is, five to 10 times more material)
- An operation is carried out under non-ambient conditions

#### 4.2.9 Gas Hose Connectors

In accordance with the *National Fuel Gas Code*,<sup>73</sup> gas hose connectors that connect a gas source to a lab appliance or other equipment can be used for laboratory equipment (such as Bunsen burners), provided all the following design requirements are met:

- The gas hose connector has a shut-off valve.

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71 National Fire Protection Association (NFPA), National Electrical Code (NFPA 70-2005). See the "SLAC Research Library Community Pages", <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards. A hard copy of NFPA 70-2005 is available; see <http://www.slac.stanford.edu/spires/find/books/www?key=327328>.

72 Hazardous Materials: Chemical Storage Asset Requirements (SLAC-I-730-0A09S-018), <http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatReqStorage.pdf>

73 National Fire Protection Association (NFPA) 54-2006, *National Fuel Gas Code*, Section 5.5.2, "Liquefied Petroleum Gas Systems" (NFPA 54-2006/ANSI Z223.1-2006)

See the "SLAC Research Library Community Pages", <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards.

- The connector hose does not exceed six feet in length.
- The connector hose is not concealed and does not traverse rooms or through walls, ceilings, or floors.
- Only “listed” gas hose connectors can be installed.

*Note Latex tubing as a connector between the gas source and a Bunsen burner is strictly prohibited.*

## 5 Related Documents

The following are related documents and forms. Always locate and use the latest version, either online from the addresses below or from the originating group.

Table 1 Related Documents

Title	Document Number	Originating Unit	URL
"Training - SLAC Training Assessment"		IHIM	<a href="http://www-group.slac.stanford.edu/esh/training/sta/default.htm">http://www-group.slac.stanford.edu/esh/training/sta/default.htm</a>
"Cameo Chemicals Search"		NOAA	<a href="http://cameochemicals.noaa.gov/search?action=new&amp;type=simple">http://cameochemicals.noaa.gov/search?action=new&amp;type=simple</a>
"OSHA / EPA Occupational Chemical Database"		OSHA	<a href="http://www.osha.gov/web/dep/chemicaldata/ChemicalResult.asp?RecNo=401">http://www.osha.gov/web/dep/chemicaldata/ChemicalResult.asp?RecNo=401</a>
"State of California EPA"		Cal/EPA	<a href="http://www.oehha.ca.gov/prop65/prop65_list/files/060107LST.pdf">http://www.oehha.ca.gov/prop65/prop65_list/files/060107LST.pdf</a>
SLAC Environment, Safety, and Health Manual, Chapter 3, "Medical"	SLAC-I-720-0A29Z-001	RMR	<a href="http://www-group.slac.stanford.edu/esh/medical/chapter/policies.htm">http://www-group.slac.stanford.edu/esh/medical/chapter/policies.htm</a>
ES&H Course 138, CPR/First Aid	ES&H Course 138	RMR	<a href="https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=138">https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=138</a>
SLAC Environment, Safety, and Health Manual, Chapter 5, "Industrial Hygiene"	SLAC-I-720-0A29Z-001	IHIM	<a href="http://www-group.slac.stanford.edu/esh/hazardous_substances/industrial_hygiene/policies.htm">http://www-group.slac.stanford.edu/esh/hazardous_substances/industrial_hygiene/policies.htm</a>
Industrial Hygiene: Exposure Assessment Strategy, Surveying and Monitoring Guidelines	SLAC-I-730-0A09T-020	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/IHGuideSurvey.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/IHGuideSurvey.pdf</a>
Industrial Hygiene: Hazard Control Ventilation Requirements	SLAC-I-730-0A09S-021	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/IHReqVent.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/IHReqVent.pdf</a>
"Ventilated Lab Hoods"		IHIM	<a href="http://www-group.slac.stanford.edu/esh/groups/cgs/ih/vent_hoods.htm">http://www-group.slac.stanford.edu/esh/groups/cgs/ih/vent_hoods.htm</a>
"Industrial Hygiene"		IHIM	<a href="http://www-group.slac.stanford.edu/esh/groups/cgs/ih/">http://www-group.slac.stanford.edu/esh/groups/cgs/ih/</a>

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SLAC Environment, Safety, and Health Manual, Chapter 9, "Radiological Safety"	SLAC-I-720-0A29Z-001	RP	<a href="http://www-group.slac.stanford.edu/esh/general/radiological_safety/policies.htm">http://www-group.slac.stanford.edu/esh/general/radiological_safety/policies.htm</a>
SLAC Environment, Safety, and Health Manual, Chapter 12, "Fire and Life Safety"	SLAC-I-720-0A29Z-001	RMR	<a href="http://www-group.slac.stanford.edu/esh/general/fire_safety/policies.htm">http://www-group.slac.stanford.edu/esh/general/fire_safety/policies.htm</a>
SLAC Environment, Safety, and Health Manual, Chapter 16, "Spills"	SLAC-I-720-0A29Z-001	EP	<a href="http://www-group.slac.stanford.edu/esh/environment/spills/policies.htm">http://www-group.slac.stanford.edu/esh/environment/spills/policies.htm</a>
SLAC Environment, Safety, and Health Manual, Chapter 17, "Hazardous Waste"	SLAC-I-720-0A29Z-001	EP	<a href="http://www-group.slac.stanford.edu/esh/environment/hazardous_waste/policies.htm">http://www-group.slac.stanford.edu/esh/environment/hazardous_waste/policies.htm</a>
"Environmental Protection – Hazardous Waste Management"	Number	EP	<a href="http://www-group.slac.stanford.edu/esh/groups/ep/hwm/">http://www-group.slac.stanford.edu/esh/groups/ep/hwm/</a>
SLAC Environment, Safety, and Health Manual, Chapter 19, "Personal Protective Equipment"	SLAC-I-720-0A29Z-001	IHIM	<a href="http://www-group.slac.stanford.edu/esh/general/ppel/policies.htm">http://www-group.slac.stanford.edu/esh/general/ppel/policies.htm</a>
PPE: Prescription Safety Glasses Purchase and Reimbursement Procedure	SLAC-I-730-0A21C-018	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/PPEProcedReimburseGlasses.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/PPEProcedReimburseGlasses.pdf</a>
ES&H Course 255, Personal Protective Equipment	ES&H Course 255	IHIM	<a href="https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=255">https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=255</a>
SLAC Environment, Safety, and Health Manual, Chapter 28, "Incident Investigation"	SLAC-I-720-0A29Z-001	RMR	<a href="http://www-group.slac.stanford.edu/esh/general/incident/policies.htm">http://www-group.slac.stanford.edu/esh/general/incident/policies.htm</a>
SLAC Occupational Accident/Incident Report	SLAC SU-17	RMR	Available from the SLAC Medical Department, <a href="http://www-group.slac.stanford.edu/esh/medical/">http://www-group.slac.stanford.edu/esh/medical/</a>
SLAC Environment, Safety, and Health Manual, Chapter 29, "Respiratory Protection"	SLAC-I-720-0A29Z-001	IHIM	<a href="http://www-group.slac.stanford.edu/esh/hazardous_substances/respirator/policies.htm">http://www-group.slac.stanford.edu/esh/hazardous_substances/respirator/policies.htm</a>
SLAC Environment, Safety, and Health Manual, Chapter 36, "Cryogenic and Oxygen Deficiency Hazard Safety"	SLAC-I-720-0A29Z-001	FS	<a href="http://www-group.slac.stanford.edu/esh/hazardous_substances/cryogenic/policies.htm">http://www-group.slac.stanford.edu/esh/hazardous_substances/cryogenic/policies.htm</a>
SLAC Environment, Safety, and Health Manual, Chapter 37, "Emergency Management"	SLAC-I-720-0A29Z-001	RMR	<a href="http://www-group.slac.stanford.edu/esh/emergency/chapter/policies.htm">http://www-group.slac.stanford.edu/esh/emergency/chapter/policies.htm</a>

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"Emergency Information"		RMR	<a href="http://www-group.slac.stanford.edu/esh/emergency/">http://www-group.slac.stanford.edu/esh/emergency/</a>
SLAC Environment, Safety, and Health Manual, Chapter 38, "Compressed Gas Cylinders"	SLAC-I-720-0A29Z-001	IHIM	<a href="http://www-group.slac.stanford.edu/esh/hazardous_substances/compressed_gases/policies.htm">http://www-group.slac.stanford.edu/esh/hazardous_substances/compressed_gases/policies.htm</a>
CGC: Safety Requirements	SLAC-I-730-0A09S-027	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/cgcReqSafety.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/cgcReqSafety.pdf</a>
SLAC Environment, Safety, and Health Manual, Chapter 40, "Hazardous Materials"	SLAC-I-720-0A29Z-001	IHIM	<a href="http://www-group.slac.stanford.edu/esh/hazardous_substances/haz_materials/policies.htm">http://www-group.slac.stanford.edu/esh/hazardous_substances/haz_materials/policies.htm</a>
Nanomaterial Safety Plan	SLAC-I-730-0A09M-008	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatPlanNano.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatPlanNano.pdf</a>
"Hazard Communication and MSDS References"		IHIM	<a href="http://www-group.slac.stanford.edu/esh/groups/cgs/hmaq/hazmat/hazcom.htm">http://www-group.slac.stanford.edu/esh/groups/cgs/hmaq/hazmat/hazcom.htm</a>
Hazardous Materials: Chemical Hygiene Program Laboratories List	SLAC-I-730-0A09V-001	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatListCHPLabs.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatListCHPLabs.pdf</a>
ES&H Course 199, Laboratory User Chemical Hygiene Plan Training	ES&H Course 199	IHIM	<a href="https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=199">https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=199</a>
Hazardous Materials: Chemical Storage Asset Requirements	SLAC-I-730-0A09S-018	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatReqStorage.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatReqStorage.pdf</a>
Hazardous Materials: Chemical Use Planning Guidelines	SLAC-I-730-0A09T-018	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatGuideUsePlan.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatGuideUsePlan.pdf</a>
Hazardous Materials: Eyewash/Shower Inspection Form	SLAC-I-730-0A09J-003	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormShowerInspect.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormShowerInspect.pdf</a>   <a href="#">.doc (Word)</a>
Hazardous Materials: Eyewash/Shower Inspection Procedure	SLAC-I-730-0A09C-003	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatProcedShowerInspect.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatProcedShowerInspect.pdf</a>
Hazardous Materials: Fume Hood Survey Sticker	SLAC-I-730-0A09S-016	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormFumeHood.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormFumeHood.pdf</a>   <a href="#">.doc (Word)</a>

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Hazardous Materials: Fume Hood Velocity Survey Form	SLAC-I-730-0A09J-002	IHIM	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormFumeHoodVelocity.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/hazmatFormFumeHoodVelocity.pdf</a>   <a href="#">.doc (Word)</a>
Hazardous Materials: Laboratory Safety Checklist [ forthcoming ]			
SLAC Environment, Safety, and Health Manual, Chapter 43, "Industrial Wastewater"	SLAC-I-720-0A29Z-001	EP	<a href="http://www-group.slac.stanford.edu/esh/environment/industrial_wastewater/">http://www-group.slac.stanford.edu/esh/environment/industrial_wastewater/</a>
Industrial Wastewater: Wet or Chemical Lab Best Management Practices	SLAC-I-750-0A16E-016	EP	<a href="http://www-group.slac.stanford.edu/esh/eshmanual/references/iwBMPLab.pdf">http://www-group.slac.stanford.edu/esh/eshmanual/references/iwBMPLab.pdf</a>
SLAC Environment, Safety, and Health Manual, Chapter 46, "Blood-borne Pathogens"	SLAC-I-720-0A29Z-001	RMR	<a href="http://www-group.slac.stanford.edu/esh/hazardous_substances/bloodborne/policies.htm">http://www-group.slac.stanford.edu/esh/hazardous_substances/bloodborne/policies.htm</a>