NATIONAL ACCELERATOR LABORATORY

ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 58: Laboratory Safety

Chemical Hygiene Plan

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1 Purpose

The purpose of these requirements is to ensure the safety of workers in *chemical laboratories*. They cover designation of responsibility; information and training; selection and use of control measures; work planning and control; including prior approval, standard operating procedures, and additional protections; guidelines for specific hazard classes; chemical exposure procedures; chemical management; laboratory safety equipment; other controls, and medical surveillance.

They apply to workers (as *laboratory workers*, who use potentially hazardous chemicals or work in areas where they may be exposed to them), supervisors, *principal investigators* and *laboratory managers*, building managers, ESH coordinators, the chemical hygiene officer, and ESH.

Note *A* chemical laboratory *is defined as one in which hazardous chemicals are handled or used meeting all of the following conditions: 1) chemical manipulations are carried out on a* laboratory scale*; 2) multiple chemical procedures or chemicals are used; 3) the procedures involved are not part of a production process, nor in any way simulate a production process; and 4) protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals (8 CCR 5191).*

Laboratory scale *is defined as "work with substances in which the containers used for reactions, transfers, and other handling of substances is designed to be easily and safety manipulated by one person" (8 CCR 5191)*

These requirements are designed to comply with the California standard for chemical hygiene programs (8 CCR 5191). They are to be reviewed annually by the chemical hygiene officer.

2 Requirements

2.1 Designation of Responsibility

- The **ESH Division** designates a chemical hygiene officer (CHO) to develop and administer the institutional chemical hygiene program (Chapter 58, "Laboratory Safety").
- **Principal investigators** are responsible for ensuring the requirements of this program are met, and for ensuring the health and safety of personnel working in their laboratories.
- **Laboratory managers** implement the program requirements and monitor daily practices within laboratories to ensure compliance.

- **Building managers** implement general chemical safety requirements (making sure engineering and equipment controls are present and working) for their buildings.
- **ESH coordinators** are responsible for supporting them, particularly in the identification of hazards, development of controls, and work release.
- **Laboratory workers** are responsible for complying with these requirements.

Roles and responsibilities are further described in Chapter 58, "Laboratory Safety".

2.2 Information and Training

Laboratory personnel will receive chemical safety information and training, both general and laboratory-specific, at the time of initial assignment to the laboratory, and before assignments involving potential exposure. Training requirements are detailed in Chapter 58, "Laboratory Safety".

2.3 Selection and Use of Control Measures

Selection and use of control measures are part of the work planning and control (WPC) process detailed in Section 2.4. Risk severity and acceptability determine the need for formal analysis and use of substitution and engineering, administrative, and PPE controls, as described in Chapter 1, "General Policy and Responsibilities". General application of substitution and engineering, administrative, and PPE controls for chemical use are further described in Chemical Lifecycle Management: Planning Requirements. For laboratories, controls are described below.

2.3.1 Substitution

Substitution includes substituting one chemical for a less harmful one. Substitution guidance is provided in Chemical Lifecycle Management: Planning Requirements and Chemical Lifecycle Management: Chemical Screening Requirements.

2.3.2 Engineering Controls

Engineering controls include local exhaust ventilation systems, enclosures, and shields. Except for substitution, these provide the most effective means of control because they enclose the hazard or physically separate it from the employee. Local exhaust ventilation systems, enclosures and shields are described in Section 2.8.

2.3.3 Administrative Controls

Administrative controls include safety signs and posting, training, chemical management practices, standard operating procedures, and safety inspections, which are described in sections 2.2 through 2.9.

2.3.4 Personnel Protective Equipment

Laboratory personnel must use personnel protective equipment (PPE) appropriate for work they will be doing, including safety goggles, lab coats, chemical aprons, and protective gloves. For a full description of

PPE requirements and assessment tools, see Chemical Safety: Personal Protective Equipment Requirements.

2.4 Work Planning and Control in Laboratories

Work planning and control (WPC) is a critical foundation of safe laboratory management that identifies and mitigates risks when planning, authorizing, and releasing work. (See Chapter 2: "Work, Planning and Control".) Laboratory WPC systems incorporate the Integrated Safety and Environmental Management System (ISEMS) process. Laboratory WPC processes include defining the scope of work, access control, training, hazard identification and analysis, work authorization, control development, work release, and feedback. WPC components for laboratories are outlined below.

2.4.1 Planning and Work Authorization

2.4.1.1 Scope of Work Definition

The scope of a laboratory's activities is first defined by the principal investigator at the project creation and staff hiring levels, and at the proposal level for users. Initial scope of work definition precedes laboratory work. The principal investigator is responsible for defining workers' training requirements associated with the planned work. Changes in work scope must be re-evaluated as described below.

2.4.1.2 Hazard Identification

The laboratory manager performs hazard identification with assistance from the ESH coordinator. Automatically generated e-mail notifications built into the Chemical Management System should supplement, rather than replace, individual communications with laboratory workers regarding their processes and protocols. Hazard identification systems should be tied to all of the following:

- Routine chemical, gas, and equipment procurement
- Major equipment procurement
- New protocols, experiments, or updates
- Laboratory upgrades, renovations, or other construction projects
- Orientation of new students, employees, or visitors/users
- User laboratory check ins associated with experiments
- Non-routine access by vendors or facilities workers

2.4.1.3 Access Protocols

SLAC requires policies controlling laboratory access for laboratory workers, visitors or users, and external vendors. Secure access control tools, such as RFID badge readers or code-entry door locks support these policies. Access control measures should be complementary to training policies and are part of work authorization practices.

2.4.1.4 Laboratory Training

Laboratory training is part of work authorization. For training requirements, see Chapter 58, "Laboratory Safety".

2.4.2 Prior Approval and Work Release

All experiments that will be performed in a chemical laboratory must be discussed with the laboratory manager before work starts. All new hazards and protocols must be analyzed and approved before work can be released. In certain cases, written approval is required. As a best practice, the laboratory manager should consult with the ESH coordinator on all significant protocols or processes.

The laboratory manager must work closely with the ESH coordinator to determine an experimental project review process that assesses the degree of risk associated with laboratory activities. The laboratory manager and ESH coordinator should determine the lower limit thresholds for formal review. According to WPC, review and approval may be informal for *green work* and routine *yellow work*, where risks are relatively low and acceptable. Formal prior approval is required for higher risk activities or higher hazard chemicals and is given through approval of written *standard operating procedures (SOPs)*, as outlined below.

Prior approval by line management, typically the principal investigator or laboratory manager, is also required for "use-restricted" chemical usage, such as Drug Enforcement Agency (DEA)-listed substances or precursors, and for highly hazardous chemicals "of concern" as defined in the chemical screening criteria (see Chemical Lifecycle Management: Chemical Screening Requirements).

2.4.3 Standard Operating Procedure Requirements

For higher risk activities or highly hazardous chemicals, laboratory workers and laboratory managers must develop lab-specific standard operating procedures (SOPs). The laboratory manager must work closely with the ESH coordinator and any relevant ESH program managers and subject matter experts to analyze and approve controls. Following joint safety assessment, the laboratory manager releases the researcher to perform the SOP within the laboratory, with attention to researcher competence and experience. Once lab-specific SOPs are developed and implemented, any deviation from these procedures requires prior approval from the laboratory manager.

2.4.3.1 Types of Work Requiring SOPs

Red work or yellow work involving high or medium risk activities require formal hazard analysis, mitigations, and controls, using written standard operating procedures (SOPs). Examples of yellow or red work are provided below.

- Chemicals of concern, as defined in Chemical Lifecycle Management: Chemical Screening Requirements, are highly hazardous and require formal SOPs. This group includes highly reactive, highly corrosive, and highly toxic chemicals, as well as explosives and chemicals that have permissible exposure limits (PELs) below monitoring levels.
- When there is potential for exposures that exceed 10 percent of either the *action level* or, if no action level exists, the *occupational exposure limit (OEL)*, an SOP and use of local exhaust ventilation is required. Exposure assessments prior to work are strongly recommended as part of SOP development (see Chemical Safety: Accidental Exposure Requirements).
- Work with red level nanomaterials typically requires formal review in either a written SOP or nanomaterial checklist. See Nanomaterial Safety Plan.

2.4.3.2 Additional Protections

Cal/OSHA *particularly hazardous substances (PHSs)* include *select carcinogens*, *reproductive toxins*, and substances that have a high degree of *acute toxicity*. A written SOP is required for work with PHSs. Table 1 relates degree of acute toxicity to animal test data available in safety data sheets (SDSs).

Table 1 Acute Toxicity Hazard Level (from Prudent Practices)

Hazard Level	Toxicity Rating	Oral LD_{50} (rats, per kg)	Skin Contact LD_{50} (rabbits, per kg)	Inhalation LC_{50} (rats, ppm for 1 h)	Inhalation LC_{50} (rats, mg/m^3 for 1 h)
High	Highly toxic	<50 mg	<200 mg	<200	<2,000
Medium	Moderately toxic	50 to 500 mg	200 mg to 1 g	200 to 2,000	2,000 to 20,000
Low	Slightly toxic	500 mg to 5 g	1 to 5 g	2,000 to 20,000	20,000 to 200,000

Moreover, principal investigators and laboratory managers will ensure additional protection to laboratory personnel for work with particularly hazardous substances, such as the provisions outlined below.

- Establishment of a designated area
- Use of containment devices such as fume hoods or glove boxes
- Procedures for safe removal of contaminated waste
- Decontamination procedures

2.4.3.3 Laboratory Equipment

Many types of laboratory equipment have inherent physical hazards associated with their use, including pressure and fire hazards. Care must be taken when choosing the type of equipment, its proper use, and maintenance and training requirements. A partial list of laboratory equipment that typically require standard operating procedures is provided below.

- Rotary evaporators
- Distillation apparatus
- Schlenk lines
- Ball mills
- Metal 3D printers

2.4.3.4 SOP Format

The format of the SOP may vary, but all the elements included in the Laboratory Safety: Laboratory Standard Operating Procedure Template must be covered. SOPs must be readily available to experimenters performing work and be reviewed periodically.

Required SOP Elements

- Procedural information
  - Overview
  - Step-by-step instructions
  - Shipping and receiving

  - Transport
  - Special handling and storage
  - Waste disposal
- Safety information
  - Risk assessment
  - Safety equipment
  - Designated areas
  - Emergency procedures
  - Requirements to perform work
  - Training
- Approval

2.4.4 Pre-job Briefing

A pre-job briefing may be necessary before work can be released. For green and routine yellow work, pre-job briefings may be routine parts of laboratory orientation training. For red or non-routine yellow work, the pre-job briefing will accompany the approval of a new SOP and may involve a demonstration of equipment or engineering controls.

2.4.5 Feedback and Walkthroughs

The laboratory manager is a daily presence in the laboratory and performs frequent walkthroughs to assess success of laboratory support, policies and practices. Walkthroughs are an opportunity to improve operations and should include conversations with laboratory workers about their work and any needed assistance or challenges. Laboratory walkthroughs are most successful when workers are actively encouraged toward open communication and can both offer and receive constructive criticisms or suggestions. The laboratory manager should look for potential improvements, issues, or necessary updates.

2.5 Guidelines for Specific Hazard Classes

Laboratory personnel must be familiar with and follow safe handling guidelines for the chemicals they use. General safe handling requirements for chemicals are covered in Chemical Lifecycle Management: Management and Use Requirements.

2.5.1 Classes of Chemical Hazards

Types of chemical hazards are listed below.

- Chemical physical hazards:
  - Flammables and combustibles
  - Pyrophorics
  - Reactive and self-heating chemicals

  - Organic peroxides
  - Explosives
  - Oxidizers
  - Compressed gases
- Chemical health hazards:
  - Irritants
  - Sensitizers
  - Corrosives
  - Asphyxiants and cryogens
  - Toxic chemicals, including particularly hazardous substances (acutely toxic, select carcinogens, and reproductive toxins)

2.5.2 Safe Handling Guidelines

Safe handling guidelines for specific chemicals or hazard classes of chemicals can be found at the sources below.

- Chemical Safety: Safe Handling Guidelines. SLAC guidelines on specific chemicals or chemical hazard categories
- Compressed gas cylinder safe handling is covered in Chemical Lifecycle Management: Compressed Gas Cylinder Storage and Handling Requirements
- Stanford University, Department of Environmental Health and Safety. Chemical Safety Toolkit. Includes a listing of general SOPs by hazard category.
- Stanford University, Department of Environmental Health and Safety. References. A listing of references, fact sheets, lessons learned and general SOPs on a wide variety of chemical hazard categories, specific families or chemicals, equipment, or laboratory processes
- *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards*. National Research Council's laboratory safety guide, the most widely accepted standard for safe laboratory practices
- Laboratory Safety Guidance. Occupational Safety and Health Administration overview of laboratory safety and related topics

Additionally, as a best practice, laboratory managers should maintain a consulting library of reference works that describe best methods for using or purifying hazardous chemicals, and for carrying out hazardous experimental procedures, as applicable to their lab. The reference books below are excellent guides for safe handling of laboratory chemicals, processes and equipment.

- Armarego, W.L.F. *Purification of Laboratory Chemicals*, 8th ed. Butterworth-Heinemann.
- Armour, M.-A. *Hazardous Chemical Disposal Guide.* CRC Press.
- Lenga, R.E., ed. *Sigma-Aldrich Library of Chemical Safety Data*, 2-volume set. Aldrich Chemical Company.
- Lunn, G. *Destruction of Hazardous Chemicals in the Laboratory*. John Wiley & Sons.

- O'Neil, M. J., ed. The Merck Index. The Royal Society of Chemistry.
- Pohanish, R. P. *Sitting's Handbook of Toxic and Hazardous Chemicals and Carcinogens*. Elsevier.
- Rumble, J. R., ed. *CRC Handbook of Chemistry and Physics*. CRC Press.
- Schriver, D.F. *Manipulation of Air Sensitive Compounds*. John Wiley & Sons.
- Urben, P. J., ed. *Bretherick's Handbook of Reactive Chemical Hazards*. Elsevier.

2.6 Chemical Exposure Procedures

When there is potential for exposures that exceed 10 percent of either the *action level* or, if no action level exists, the *occupational exposure limit (OEL)*, an SOP and use of local exhaust ventilation is required. Exposure assessments prior to starting work are strongly recommended.

If there is any reason to believe the *action levels* or *OELs* may be exceeded, monitoring is required. ESH will provide monitoring that meets the following conditions:

1. Initial monitoring. ESH will provide an industrial hygienist to monitor worker exposure.
2. Periodic monitoring. If exposure is observed that exceeds either the action level or the exposure limit, the frequency of exposure monitoring provisions will comply with the relevant regulation.
3. Termination of monitoring. Monitoring may be terminated in accordance with the relevant regulation.
4. Employee notification. Monitoring results will be provided to workers within 15 working days after the receipt of any results. Monitoring records are maintained by ESH.

Exposure assessment, signs of exposure, response, and reporting for accidental chemical exposures are covered in Chemical Safety: Accidental Exposure Requirements. Laboratory personnel, principal investigators, and laboratory managers must follow these procedures in case of accidental exposure.

2.7 Chemical Management

Chemical planning, purchasing, and storage requirements are covered in Chapter 40, "Chemical Lifecycle Management". Below, a summary of chemical management topic specific to laboratories is provided.

2.7.1 Purchasing

All chemicals must be purchased through Chemical Management Services (CMS), which provides chemical screening, inventory support, and other services.

2.7.1.1 Chemical Categories that Require Additional Permissions

Certain types of chemicals require additional permissions or review by a designated ESH program manager or group before purchase is allowed. See Chemical Lifecycle Management: Chemical Screening Requirements. A short summary with examples is provided below.

- Banned (asbestos, explosives, polychlorinated biphenyls)
- Of concern (highly hazardous chemicals; pyrophorics, picric acid, cyanide compounds)
- Material-restricted (greenhouse gases, ozone-depleting substances)

- Use-restricted (radioactive materials, deuterated materials, DEA-listed precursors)

2.7.2 Storage

Safe storage, inspection of chemical cabinets, chemical refrigerators, gas cabinets, and classes of compressed gas cylinders are covered in Chemical Lifecycle Management: Chemical Storage Asset Requirements.

2.7.2.1 Segregation of Incompatibles

Laboratories must store chemicals in a manner that separates incompatible chemicals and prevents accidental contact or mixing, especially in the case of a spill. Laboratories should store chemicals in accordance with the Stanford Storage Group system and Stanford Chemical Safety Database. (Access to the Chemical Safety Database requires VPN log in to Stanford University.)

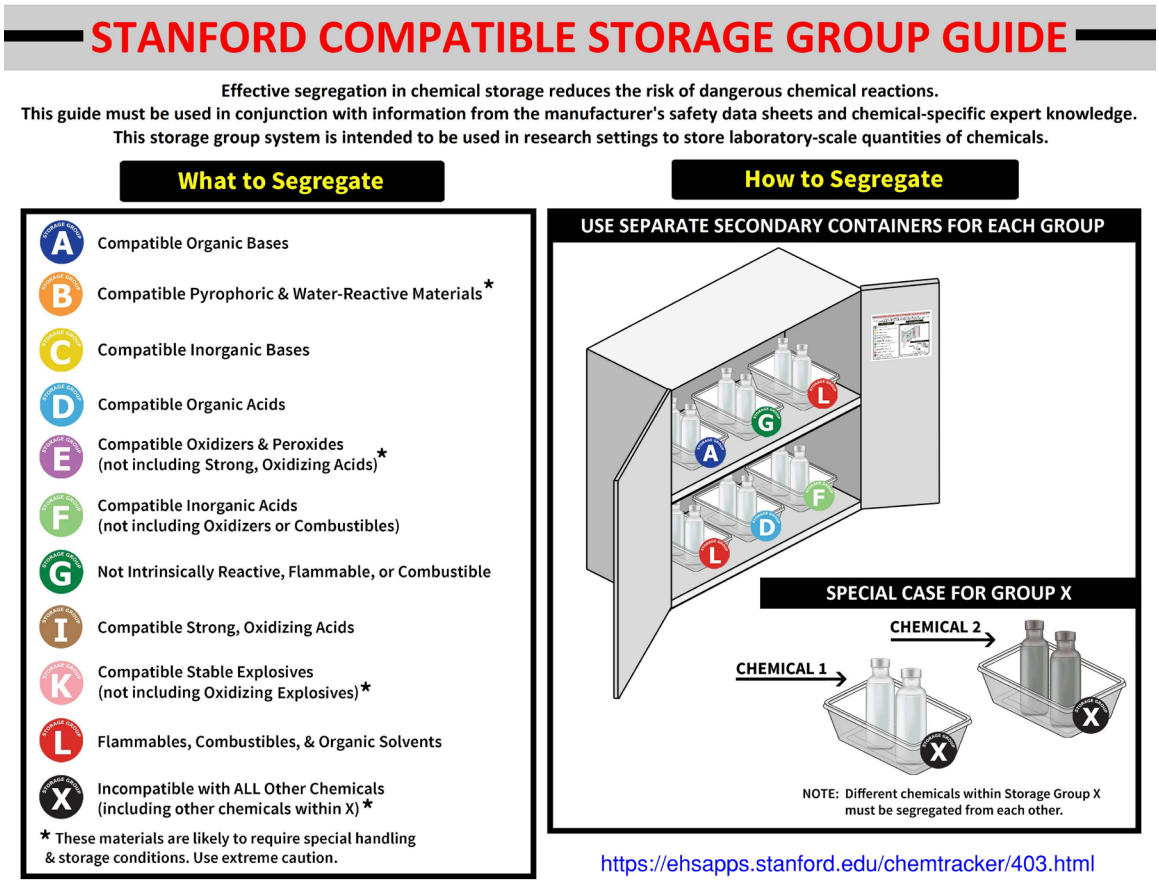

Figure 1 Stanford Storage Groups

The following references describe incompatible chemicals and/or the reactions that occur when they are mixed.

- Stanford University, Department of Environmental Health and Safety. Chemical Incompatibility Guide

- Lawrence Berkeley National Laboratory. Environment, Safety, and Health Manual (PUB-3000), Chapter 45, "Chemical Hygiene and Safety Plan", Work Process K, "Chemical Storage", Table K-2, "Incompatibilities by Hazard Class"

2.7.2.2 Secondary and Spill Containment

Chemicals must be stored in a manner that prevents the release of hazardous chemicals to the environment in the case of a spill or container failure. Secondary and spill containment requirements are covered in Chemical Lifecycle Management: Management and Use Requirements.

Note *Laboratories that contain floor drains must protect the floor drains from chemical intrusion by use of a temporary plug, sump or berm system, or by storing chemicals in spill containment.*

2.7.2.3 Time- and Shock-sensitive Chemicals

As described in Chemical Lifecycle Management: Management and Use Requirements, time- and shock-sensitive chemicals have storage time limitations and governing rules for safe storage. For all unstable, time-sensitive, shock-sensitive, and pyrophoric chemicals:

- Write the date received and date opened on all containers.
- In the absence of a manufacturer's expiration date, generally discard closed containers after one year from date received. Open containers typically have shorter shelf lives, ranging from three months to one year.

2.7.2.4 Peroxide-forming Chemicals

Peroxide-forming chemicals are divided into three categories, A, B, and C; moving from most to least dangerous respectively.

A: Peroxides form without concentration

B: Peroxide hazard upon concentration (evaporation, distillation)

C: May autopolymerize if inhibitors are removed or depleted

Tables of common A, B, and C peroxide forming chemicals and their recommended disposal time frames are described in Information on Peroxide-Forming Compounds.

2.7.3 Inventories

Chemical Management Services (CMS) maintains a site-wide hazard communication inventory, which is used to ensure that a safety data sheet (SDS) is available for every hazardous chemical in the workplace.

Individual work areas should maintain local inventories of hazardous chemicals. They can be generated using the Chemical Management System or manually. The chemical coordinator can provide more information on how to create and maintain a work-area specific inventory. (See Chemical Lifecycle Management: Management and Use Requirements.)

Note *The inventory is particularly important if hazardous chemicals are moved from the storage area indicated at the time of delivery or if the area has materials obtained outside the CMS system, such as legacy materials obtained before 2006 or research samples.*

Laboratory chemical inventories typically include the following information:

- Chemical or product name and CAS number
- Quantity, container size, and container units
- Storage location (room, cabinet)
- Chemical storage group
- Owner (lab manager, researcher)

2.7.3.1 Chemicals with Special Inventory Requirements

Certain use-restricted chemicals, as described in Chemical Lifecycle Management: Chemical Screening Requirements, have routine inventory requirements.

- Nuclear materials (deuterated chemicals). A detailed account of nuclear material inventory requirements can be found in the Nuclear Material Control and Accountability Plan.
- Controlled substances (DEA precursors). See Chemical Lifecycle Management: Chemical Screening Requirements.
- Precious metals (gold, platinum). See Property Control, "Precious Metals".

2.7.4 Container Labeling

Chemical *containers* will be labeled meeting the following requirements:

- Manufacturer-affixed labels must not be removed or defaced on the primary chemical container if it still contains the chemical.
- At a minimum, contents of *secondary containers* (containers other than original) must be identifiable.
- Secondary containers should be labeled with the chemical name or product identifier, and hazard information, where words, pictures, symbols, or combination thereof, provide general information about the hazards of the chemicals. Name of the person responsible and date of first use are recommended.
- Abbreviations on sample containers are accepted as long as a reference is readily accessible.
- Small containers (for example, tubes and vials) may be labeled via a tray or rack that holds the containers, bench paper underlying the vials, or applying a numbering or coding system. The material's identity and hazards should be readily accessible and decipherable to personnel in the laboratory.
- Lab managers should be notified when unlabeled chemical containers are present for longer than a single work day. The contents of unlabeled containers should be assumed to be hazardous. An attempt should be made to determine the contents of the container and a correct label should be affixed to the container. If a determination cannot be made about the contents, the chemical lifecycle management program manager should be contacted.
- All piping containing chemicals must be labeled. All new installations of hazardous material pipes and tubes will be labeled in accordance with ASME A13.1 requirements.

2.7.4.1 Exceptions

Portable secondary containers for immediate use during a workday, by a single employee who performs the transfer himself/herself, are exempt from the labeling requirements above.

2.7.5 Transportation

Chemicals being transported on- and off-site must meet the requirements of Chapter 52, "Hazardous Materials and Waste Transportation".

2.7.6 Disposal

Once no longer needed chemicals are considered hazardous waste and must meet the requirements of Chapter 17, "Hazardous Waste". In some cases, sink disposal in labs is allowed. (See Laboratory Safety: Non-hazardous Waste Sink Disposal Procedure for details.)

2.8 Laboratory Safety Equipment

Safety equipment is mandatory in laboratories to control exposure to harmful chemicals and mitigate the level of harm in the event of accident.

2.8.1 Local Exhaust Ventilation

Information on the certification, application, and safe use of laboratory fume hoods, biosafety cabinets, gas cabinets, glove boxes and other hazard control ventilation devices is detailed in Chemical Safety: Hazard Control Ventilation Requirements.

Activities requiring local exhaust ventilation include the following:

- Using particularly hazardous substances (such as acutely toxic, carcinogenic, or reproductive toxins)
- Performing operations that could expose workers to more than 10 percent of either the *action level* or, if no action level exists, the *occupational exposure limit (OEL)*
- Handling toxic substances in an enclosed area
- Handling volatile, flammable liquids that could generate a flammable atmosphere
- Conducting procedures that generate airborne particulates (dust) or liquid aerosols of even moderately toxic chemicals
- Using pungent or noxious odiferous compounds
- Handling concentrated acids or bases

2.8.2 Safety Shields

Safety shields must be used for protection against possible explosions or uncontrolled reactions. Laboratory equipment must be shielded on all sides to ensure there is no line-of-sight exposure of personnel. The ESH coordinator must be consulted to determine the appropriate level of control for specific experiments.

2.8.3 Emergency Eyewash / Shower Stations

Eyewash and shower stations are required in areas where workers can come into contact with injurious corrosive chemicals. Laboratory managers must

- Know where the equipment is located
- Ensure that workers who use corrosive chemicals are aware of the location and use of eyewash/shower stations
- Ensure that workers are instructed in the location and proper use of eyewash/shower stations. A Chemical Safety: Emergency Eyewash/Shower Use Procedure may be placed at each station to supplement training.

(See Chemical Safety: Emergency Eyewash/Shower Requirements for more information.)

2.8.4 Spill Kits

Laboratories containing hazardous materials must contain spill kits. Spill kits are meant to confine and limit the spill and must be tailored to the types of hazardous materials present in the work area. Detailed guidance on spills, including the qualities of emergency and non-emergency spills, are provided in Chapter 16, "Spills".

As a general guideline for laboratories, spills are broadly classified into two groups, above 500 mL and below 500mL. If a spill is large (> 500 mL) or involves a corrosive, highly toxic, reactive or radioactive material, then evacuate the laboratory promptly, limit access to the area, and call ext. 5555 and/or 911 immediately.

Waste Management provides guidance on spill kit contents and materials.

2.8.5 Fire Blankets

Fire blankets are often available in chemical laboratories or other laboratories where flammable chemicals are used. Fire blankets can be used to smother flames on a burn victim, contain a small fire on a bench, cover a shock victim, or provide a privacy barrier for a victim under a safety shower. However, fire blankets can be dangerous if used incorrectly. In laboratories that contain fire blankets, workers must be trained in proper emergency procedures.

2.8.6 Fire Extinguishers

Laboratories will typically require a portable fire extinguisher within the laboratory or in the nearby vicinity. Fire extinguisher type is chosen by assessment of the types of hazardous materials and processes in the laboratory, with attention to maximum quantity and other controls. Laboratory managers must consult with the ESH coordinator and the SLAC fire marshal for proper fire extinguisher selection, location, and other requirements. (See Fire and Life Safety: Portable Fire Extinguisher Requirements.)

Note *Training is required for use of portable fire extinguishers. Fire extinguisher training is required for lab managers.*

2.8.7 First Aid Kits

All chemical laboratories within the scope of this plan must maintain a first aid kit.

Note ESH first aid and CPR training is recommended for laboratory managers.

All chemical laboratories in which hydrofluoric acid is used must be equipped with specialized hydrofluoric acid (HF) first aid kits. The instructions must be posted with the kits (see Laboratory Safety: Hydrofluoric Acid First Aid Kit Instruction Template). Staff and supervisors must be trained in their use (ESH Course 187).

2.8.8 Laboratory Phone

All laboratories should be equipped with a landline phone to support emergency calls for assistance.

2.9 Other Controls

2.9.1 Safe Use of Needles and Other Sharps

Accidental needle pricks can result in exposure to harmful chemicals or infectious disease. When using needles, follow the safe use guidelines below.

2.9.1.1 Safe Needle Use Guidelines

- Minimize the use of Luer-lock needles and cannulas.
- Switch to safer needle products that have shielding or guards.
- Avoid re-capping needles whenever possible. If you MUST recap, never recap a needle by hand; use a single-handed syringe holder.
- Never leave uncapped needles on the bench. Use a holder or falcon tube holder.
- Uncap needles only when they are about to be used. Use a hemostat to loosen and remove the cap.
- Ensure that the needles is always pointed away from your body. Maintain visual contact with the sharps at all times.
- Always dispose of needles in a sharps container. The container is FULL when three quarters filled.

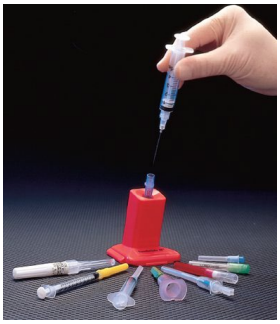

Figure 2 Syringe Holder

Sharps disposal is covered under the Chapter 46, "Blood-borne Pathogens".

2.9.2 Lab Inspections

In addition to operational walkthroughs discussed in Section 2.4.5, laboratories will undergo routine inspections with attention to housekeeping and compliance with SLAC policy and state and local regulations.

Required weekly inspections for hazardous material and hazardous waste storage areas are discussed in Chemical Lifecycle Management: Chemical Storage Asset Requirements and Chapter 17, "Hazardous Waste".

Required eyewash and shower inspections are detailed in Chemical Safety: Emergency Eyewash/Shower Requirements.

Laboratory managers should perform general safety inspections in laboratories for housekeeping and chemical hygiene on a routine schedule. Weekly inspections are recommended. A recommended checklist for weekly inspections is provided in Laboratory Safety: Lab Inspection Checklist. The checklist may be tailored for the individual lab. Other formats are acceptable as long as applicable topics are covered.

2.10 Medical Consultations, Examinations, and Surveillance

Laboratory personnel who work with hazardous chemicals will be provided the opportunity to receive medical attention/consultation, through the Occupational Health Center, when

1. Symptoms or signs of exposure to a hazardous chemical develop
2. Exposure monitoring reveals an overexposure that exceeds an action level or exposure limit.
3. A spill, leak, explosion, or other occurrence results in a hazardous exposure (potential overexposure)
4. A regulatory standard triggers medical surveillance

3 Forms

The following forms and systems are required by these requirements:

- Laboratory Safety: Laboratory Standard Operating Procedure Template (SLAC-I-730-0A09J-009). Recommended template for standard operating procedures. Other formats are acceptable as long as all the required elements of an SOP are included.
- Laboratory Safety: Laboratory Inspection Checklist (SLAC-I-730-0A09J-012). Recommended form for weekly laboratory inspections. Checklist may be tailored to fit individual labs. Other formats are acceptable as long as applicable topics are covered.
- Laboratory Safety: Hydrofluoric Acid First Aid Kit Instruction Template (SLAC-I-730-0A09J-013). Template for instructions to be posted with hydrofluoric acid first aid kits
- Chemical Management System. System used for ordering and tracking chemicals and storing safety data sheets

4 Recordkeeping

The following recordkeeping requirements apply for these requirements:

- Laboratory managers must ensure that approved SOPs are readily available to experimenters performing work and are reviewed periodically.
- Laboratory managers must maintain lab-specific orientation records.
- If personal exposure monitoring is required, monitoring records are maintained by ESH.

5 References

SLAC Environment, Safety, and Health Manual (SLAC-I-720-0A29Z-001)

- Chapter 58, "Laboratory Safety"
  - Laboratory Safety: Non-hazardous Waste Sink Disposal Procedure (SLAC-I-730-0A09C-009)
- Chapter 1, "General Policy and Responsibilities"
  - General Policy and Responsibilities: Project Review Procedure (SLAC-I-720-0A24C-001)
  - General Policy and Responsibilities: Hazards Control Selection and Management Requirements (SLAC-I-720-0A24S-001)
- Chapter 2: "Work, Planning and Control"
- Chapter 12, "Fire and Life Safety"
  - Fire and Life Safety: Portable Fire Extinguisher Requirements (SLAC-I-730-0A12S-001)
- Chapter 16, "Spills"
- Chapter 17, "Hazardous Waste"
- Chapter 40, "Chemical Lifecycle Management"
  - Chemical Lifecycle Management: Chemical Screening Requirements (SLAC-I-730-0A09S-033)
  - Chemical Lifecycle Management: Planning Requirements (SLAC-I-730-0A09S-039)
  - Chemical Lifecycle Management: Management and Use Requirements (SLAC-I-730-0A09S-038)
  - Chemical Lifecycle Management: Chemical Storage Asset Requirements (SLAC-I-730-0A09S-018)
- Chapter 46, "Blood-borne Pathogens"
- Chapter 52, "Hazardous Materials and Waste Transportation"
- Chapter 53, "Chemical Safety"
  - Chemical Safety: Hazard Communication Requirements (SLAC-I-730-0A09S-042)
  - Chemical Safety: Hazard Control Ventilation Requirements (SLAC-I-730-0A09S-040)
  - Chemical Safety: Emergency Eyewash/Shower Requirements (SLAC-I-730-0A09S-043)
  - Chemical Safety: Emergency Eyewash/Shower Use Procedure (SLAC-I-730-0A09C-008)

- Chemical Safety: Personal Protective Equipment Requirements (SLAC-I-730-0A09S-017)
- Chemical Safety: Accidental Exposure Requirements (SLAC-I-730-0A09S-041)
- Chemical Safety: Safe Handling Guidelines

Other SLAC Documents

- ESH Course 187, Working Safely with Hydrofluoric Acid (ESH Course 187)
- Chemical Management Services
- Gas Cabinet Guidance
- Waste Management
- SLAC Occupational Health Center
- Nanomaterial Safety Plan (SLAC-I-730-0A09M-008)
- Nuclear Material Control and Accountability Plan (SLAC-I-760-2A30C-008)
- Property Control. Precious Metals

Other Documents

- Title 8, *California Code of Regulations*, "Industrial Relations", Division 1, "Department of Industrial Relations", Chapter 4, "Division of Industrial Safety", Subchapter 7, "General Industry Safety Orders", Group 16, "Control of Hazardous Substances", Article 109, "Hazardous Substances and Processes", Section 5191, "Occupational Exposure to Hazardous Chemicals in Laboratories" (8 CCR 5191)
- Occupational Safety and Health Administration. Laboratory Safety Guidance
- American Society of Mechanical Engineers (ASME) A13.1, "Scheme for Identification of Pipelines" (ASME A13.1)
- National Research Council. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards* (Prudent Practices)
- Stanford University, Department of Environmental Health and Safety. Lab Safety
- Stanford University, Department of Environmental Health and Safety. Laboratory Chemical Safety Toolkit (includes SOPs)
- Stanford University, Department of Environmental Health and Safety. Chemical Hygiene Plan
- Stanford University, Department of Environmental Health and Safety. Stanford Storage Groups
- Stanford University, Department of Environmental Health and Safety. References
- Stanford University, Department of Environmental Health and Safety. Chemical Incompatibility Guide
- Stanford University, Department of Environmental Health and Safety. Information on Peroxide-Forming Compounds
- Stanford University. Advancing Safety Culture in the University Laboratory
- Lawrence Berkeley National Laboratory. Environment, Safety, and Health Manual (PUB-3000), Chapter 45, "Chemical Hygiene and Safety Plan", Work Process K, "Chemical Storage", Table K-2, "Incompatibilities by Hazard Class"