This chapter was last reviewed for currency 6/1/2021.
The next thorough review is due 6/1/2024.

ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 58: Laboratory Safety

Quick Start Summary

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1 Who needs to know about these requirements

The requirements of Laboratory Safety apply to workers (as *laboratory workers*), supervisors, *principal investigators* and *laboratory managers*, building managers, ESH coordinators, and the laboratory safety program manager/chemical hygiene officer. They cover chemical hygiene requirements for work with chemicals in SLAC research laboratories.

2 Why

The purpose of these requirements is to protect workers from the hazards associated with handling and using *hazardous materials* in laboratories.

3 What do I need to know

Laboratories are subject to the requirements of multiple ESH programs. The requirements of these different programs are brought together as appropriate for specific laboratories and experiments as described in the Laboratory Safety: Chemical Hygiene Plan. For higher risk activities or highly hazardous chemicals, laboratory workers must follow lab-specific standard operating procedures (SOPs) approved by the laboratory manager and ESH coordinator before work begins.

- All experiments must be discussed with the laboratory manager.
- All laboratory workers must be trained and familiar with controls.

The principal investigator is responsible for ensuring these requirements are met.

4 When

These requirements take effect 25 March 2022.

5 Where do I find more information

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

- Chapter 58, “Laboratory Safety”

Or contact the program manager.

NATIONAL ACCELERATOR LABORATORY

ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 58

Laboratory Safety

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1 Purpose

The purpose of this program is to protect workers from the hazards associated with handling and using *hazardous materials* in laboratories. It covers chemical hygiene requirements for work with chemicals in SLAC research laboratories. It applies to workers (as *laboratory workers*), supervisors, *principal investigators* and *laboratory managers*, building managers, ESH coordinators, and the laboratory safety program manager/chemical hygiene officer.

This chapter satisfies requirements for a written chemical hygiene plan (8 CCR 5191).

Laboratories are subject to the requirements of other ESH programs. Most prominent:

- Handling and using *chemicals* in general are covered under the hazard communication program requirements of Chapter 53, "Chemical Safety".
- Procurement, storage, and management of chemicals and other hazardous materials are covered in Chapter 40, "Chemical Lifecycle Management".
- Transportation, on-site and off, is covered in Chapter 52, "Hazardous Materials and Waste Transportation".
- Storage and disposal of chemicals no longer needed are covered in Chapter 17, "Hazardous Waste".

For other programs covering related hazards, such as radiation, biohazards, and cryogens, see Section 6.2, "Related Documents".

The requirements of these different programs are brought together as appropriate for specific laboratories as described in the Laboratory Safety: Chemical Hygiene Plan and in laboratory- and experiment-specific standard operating procedures.

2 Roles and Responsibilities

Functional roles and general responsibilities for each under this program are listed below. More detailed responsibilities and when they apply are provided in the procedures and requirements.

The roles may be performed by one or more individuals, and one individual may play more than one role, depending on the structure of the organizations involved. Responsibilities may be delegated.

2.1 Laboratory Worker

- Complies with the requirements of this program
- Complies with work planning and control (WPC) practices (see Chapter 2, "Work Planning and Control"), and hazard-specific ESH requirements
- Is familiar with safety data sheets (SDSs) and follows chemical safe handling guidelines where applicable
- Knows the location and proper use of hazard control and emergency equipment in *work area*
- Discusses experiments, including higher risk chemical usage and operations, with the laboratory manager before starting work
- Thoroughly understands the hazards of all experimental chemicals and participates actively in planning for control of hazards
- Develops thorough understanding of any experiment-specific standard operating procedure (SOP) before starting work and follows the procedure
- Develops the expertise for independent use of all experimental instruments and equipment
- Uses personal protective equipment (PPE) properly, as described in Chemical Safety: Personal Protective Equipment Requirements
- Complies with Chemical Safety: Hazard Control Ventilation Requirements
- Follows the Chemical Safety: Emergency Eyewash/Shower Use Procedure
- Complies with Chemical Safety: Accidental Exposure Requirements
- Submits requests for sink disposal to the laboratory manager and notifies the manager of each disposal, following the Laboratory Safety: Non-hazardous Waste Sink Disposal Procedure
- Promptly reports incidents in the workplace
- Notifies laboratory manager of opportunities to improve laboratory safe practices
- Notifies laboratory manager immediately when unlabeled chemical containers are discovered
- Reports problems with local exhaust ventilation systems

2.2 Supervisor

- Holds line management responsibility for workers, as defined in Chapter 1, "General Policy and Responsibilities", and provides the necessary tools, equipment, PPE, and other resources to work safely
- Sponsors safety meetings, including review of training and non-routine tasks involving chemicals
- Fully implements integrated safety and environmental management system (ISEMS) requirements and ensures ESH performance standards, as defined in Chapter 1, "General Policy and Responsibilities", are met
- Assigns training and authorizes work in accordance with Chapter 2, "Work Planning and Control", and hazard-specific ESH requirements
- Reports chemical overexposure, unsafe conditions, and near misses (see Incident Reporting and Investigation Process)

2.3 Principal Investigator / Research Leader

In laboratories, the *principal investigator (PI)* or *research leader* has the responsibilities listed below, in addition to those of a supervisor listed above.

- Ensures the requirements of Laboratory Safety: Chemical Hygiene Plan are met
- Provides for additional protection for work with particularly hazardous substances
- Ensures compliance with requirements for higher risk chemical usage and operations, including prior approval and standard operating procedures and other measures for controlling exposures below action levels or exposure limits
- Ensures compliance with requirements for chemical management, including those for particularly hazardous substances, chemicals of concern, and use-restricted chemicals (see Laboratory Safety: Chemical Hygiene Plan and Chemical Lifecycle Management: Chemical Screening Requirements)
- Appoints a laboratory manager or acts as the laboratory manager by default. Ensures all laboratory manager responsibilities are fulfilled, whether by him or herself, a laboratory manager, or other designee
- In laboratories with multiple principal investigators, works with other PIs to determine the distribution of laboratory management responsibilities

2.4 Laboratory Manager

In laboratories, the *laboratory manager* holds line management responsibilities as an area manager for individual laboratory *work areas.* The laboratory manager must either perform the functions below, or delegate them and ensure they are performed competently. In some instances, the principal investigator will serve as the laboratory manager and delegate responsibilities among several different *laboratory workers*.

- Ensures day-to-day functioning of the laboratory, including keeping spaces well organized and maintaining inventories and other records
- Works closely with the ESH coordinator to develop and direct the lab-specific safety program and work planning and control (WPC) processes, including access policies, orientation training programs, and other operational protocols
- Is recommended to request an exposure assessment from ESH if there is potential for exposure exceeding 10 percent of either the *action level* or, if no action level exists, the *occupational exposure limit (OEL),* or if an overexposure has occurred (see Chemical Safety: Accidental Exposure Requirements)
- Provides laboratory orientation training to workers. Ensures training meets the requirements outlined in Section 4
- Assists laboratory workers and ESH coordinator in the development of experiment-specific SOPs that address hazards and controls. Verifies researcher knowledge of, and adherence to, experimental SOPs
- Releases work in accordance with Chapter 2, "Work Planning and Control", and hazard-specific ESH requirements. Ensures adherence to all applicable policies
- Coordinates with the ESH coordinator, ESH, and workers to properly manage chemicals, hazardous or radioactive materials, and waste streams. May perform routine inspections, maintain hazardous

material inventories, and signage posting as a chemical storage asset custodian or hazardous waste storage area custodian

- Reviews requests for and provides worker oversight and recordkeeping for discharge of non-hazardous substances into sanitary sewer (see Laboratory Safety: Non-hazardous Waste Sink Disposal Procedure)
- Develops and oversees administration of equipment-specific training and protocols, including specialized equipment training and protocols for standard use and advanced techniques. Ensures adherence to all applicable policies
- Provides oversight for laboratory procurement of equipment, hazardous materials, and services from outside vendors. Ensures adherence to SLAC policies, including requirements for particularly hazardous substances, chemicals of concern, and use-restricted chemicals (see Laboratory Safety: Chemical Hygiene Plan and Chemical Lifecycle Management: Chemical Screening Requirements)
- Ensures proper maintenance of laboratory equipment, hazard control ventilation systems, and emergency equipment, including coordination with internal facilities groups and/or external vendor contracts for maintenance and repair
- Performs inspections and walkthroughs to assess success of laboratory policies and practices and solicits feedback from laboratory workers
- Coordinates laboratory moves, upgrades, or renovations as needed with the building manager

2.5 Building Manager

- Ensures eye wash/emergency showers are in operational condition, clearly labeled, and meet routine inspect and activation requirements, as described in Chemical Safety: Emergency Eyewash/Shower Requirements
- Complies with requirements for emergency exits, lighting, and fire extinguishers, as described in Chapter 12, “Fire and Life Safety”
- Ensures oxygen deficiency monitors (ODMs) are monitored and repaired, as described in Cryogenic and Oxygen Deficiency Hazard Safety: ODH Requirements
- Ensures gas cylinder seismic restraints are in good condition and adequate and that cylinders are properly labeled, as described in Chemical Lifecycle Management: Compressed Gas Cylinder Storage and Handling Requirements
- Determines and authorizes locations for storage of chemical/flammable cabinets, hazardous/radioactive storage areas, waste storage areas, and equipment storage areas for their building, in accordance with requirements in Chapter 17, “Hazardous Waste”, and Chapter 40, “Chemical Lifecycle Management”

2.6 ESH Coordinator

- Serves as primary ESH primary point of contact within the directorate, as defined in Chapter 1, “General Policy and Responsibilities”
- Supports line management to meet responsibilities under institutional and directorate policy, plans, procedures, and in review of all ISEMS and ESH matters and work plans in accordance with in Chapter 1, “General Policy and Responsibilities”
- Supports line management in identification, analysis, and control of hazards; reviews and approves work plans, and releases work in accordance with Chapter 2, “Work Planning and Control”

- Works with laboratory managers to devise lab-specific safety programs and access control policies. Releases work for experiment-specific SOPs
- Discusses particularly complex SOPs or of SOPs involving unusually hazardous chemicals or materials worker and laboratory manager to ensure full understanding
- Consults with subject matter experts (SMEs) and ESH program managers to resolve any outstanding technical questions in new protocols
- Performs routine inspections and walkthroughs to ensure compliance and to interface with workers regarding challenges or assistance needed
- Discusses selection, procurement, installation, and balancing of all local exhaust ventilation systems
- Supports directorate self-assessments and external reviews and supports correction of deficiencies
- Reviews requests for discharge of non-hazardous substances into sanitary sewer (see Laboratory Safety: Non-hazardous Waste Sink Disposal Procedure)

2.7 Laboratory Safety Program Manager / Chemical Hygiene Officer

- Fulfills ESH program manager responsibilities, as defined in Chapter 1, "General Policy and Responsibilities"
- Develops the laboratory safety program, including training
- Develops or makes available laboratory safety guides and resources
- Provides technical assistance to laboratories and assists line organization with implementation
- Conducts program assessments annually and revises as necessary
- Communicates program needs to line and ESH Division management

3 Procedures, Processes, and Requirements

These documents describe the detailed requirements for this program and how to implement them:

- Laboratory Safety: Chemical Hygiene Plan (SLAC-I-730-0A09S-040). Describes chemical hygiene requirements for laboratories
- Laboratory Safety: Non-hazardous Waste Sink Disposal Procedure (SLAC-I-730-0A09C-009). Describes process for authorizing, implementing, and verifying the disposal of laboratory materials in sinks

These are the forms and tools for this program:

- Laboratory Safety: Laboratory Standard Operating Procedure Template (SLAC-I-730-0A09J-009). Recommended template for creating experiment-specific standard operating procedures (SOPs)
- 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
- Laboratory Safety: Laboratory Inspection Checklist (SLAC-I-730-0A09J-012). Recommended form for conducting weekly laboratory inspections

- Chemical Management System. System used for ordering and tracking chemicals and storing safety data sheets

4 Training

Supervisors are responsible for ensuring laboratory personnel are trained at the time of their initial assignment to the laboratory and prior to changes involving new exposure situations (for example, when new experimental processes with unique hazards are added to the laboratory work area). In practice, the duty of ensuring that training requirements are met is often delegated to the laboratory manager because he or she is most familiar with day-to-day operations.

Chemical hygiene training must include information on the following:

- The location and applicable details of "Occupational Exposure to Hazardous Chemicals in Laboratories" (8 CCR 5191)
- The location and applicable details of Laboratory Safety: Chemical Hygiene Plan
- Classes of physical and health hazards of laboratory chemicals, as described in Laboratory Safety: Chemical Hygiene Plan
- Availability of reference material on the physical and health hazards, safety data sheets, safe handling, storage, and disposal of hazardous chemicals found in the laboratory
- "Permissible Exposure Limits for Chemical Contaminants" (8 CCR 5155, Table AC1)
- Methods and observations used to determine the presence or release of hazardous chemicals, such as monitoring devices, and the visual appearance or odor of hazardous chemicals being used
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory
- Measures that laboratory workers can take to protect themselves from exposure, such as appropriate work practices, appropriate engineering and administrative controls, and PPE

4.1 Laboratory Worker

All workers in laboratories must complete the following course to fulfill the chemical hygiene training requirements:

- ESH Course 128, Laboratory Safety Orientation (ESH Course 128) (every 24 months). This course is geared towards staff in research laboratories.

Staff working with hydrofluoric acid and their supervisors/lab managers, hazardous waste staff supporting locations using hydrofluoric acid, and SLAC emergency medical technicians who will be providing emergency services to these locations must take this course:

- ESH Course 187, Working Safely with Hydrofluoric Acid (ESH Course 187)

User and subcontractor personnel are expected to receive chemical hygiene training provided by their home institution or employer before starting work at SLAC. They still must complete the lab-specific training below.

4.2 Lab-specific Orientation Training

In addition to the formal training above, laboratory workers must receive lab-specific orientation training provided by the laboratory manager. Well-defined training orientation programs are required for new laboratory workers and should acquaint them with laboratory operations. During orientation the lab manager ensures that new workers achieve understanding of laboratory practices and policies. The lab manager ensures additional resources, assistance, restrictions, or supplementary requirements are provided as needed. Orientation may include equipment-specific training and/or mentoring or oversight practices. The laboratory manager must be technically competent to fulfill training and assessment obligations. Orientation training may include OJT.

Lab-specific orientations will include the topics below.

- Lab contacts
- Lab access and training policies
- Lab-specific WPC practices
- PPE requirement and availability
- Safety signs and postings
- Lab-specific or experiment-specific operating procedures
- Hazards unique to the lab, their safe work controls, signs and symptoms of exposure and emergency protocols
- Hazardous material and hazardous waste labeling, handling, storage, and disposal practices
- Location and correct use of all safety equipment within the laboratory
- Emergency procedures

Workers must complete both chemical hygiene and lab-specific training before they are authorized to work unsupervised in areas containing hazardous chemicals. The frequency of refresher training is at the lab manager's discretion. Lab managers must maintain lab-specific orientation records.

5 Definitions

action level. A concentration for a specific substance, "calculated as an eight (8)-hour time weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance" (8 CCR 5191). For chemicals, SLAC uses Cal/OSHA action levels.

acute toxicity. The ability of a chemical to cause harmful effect after a single exposure (Prudent Practices)

area manager. Person designated by line management who is responsible for a defined area of a given building. These areas generally contain experimental and/or industrial equipment and are associated with special hazards. Not all buildings have an area manager, and other buildings, such as the linac accelerator housing and klystron gallery, may have several.

chemical. Any element, multi-element covalent or ionic compound, or mixture of elements and/or compounds

chemical laboratory. A laboratory in which "*laboratory use* of hazardous chemicals occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis." (8 CCR 5191)

container. Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical

container, secondary. Any container other than the original container provided by the manufacturer

containment, secondary. There are two types: general and sized.

- *containment, secondary, general*. See *containment, spill*.
- *containment, secondary, sized.* A specific spill containment method that contains the total contents of the primary container or more

containment, spill. Method of containing spills such as drip pans, gas cabinets, storm drain mats, absorbent material, double-walled piping and tanks, and response plans and equipment

hazard control ventilation. An industrial exhaust system that captures and removes contaminants emitted from local sources before dilution into ambient workplace air can occur; includes chemical fume hoods, soldering bench hoods, extractor arms, glove boxes, and biological safety hoods or cabinets

hazardous material. Any chemical or material that, due to its physical or chemical properties, poses a risk to the health or safety of humans, environment, or the physical plant

label. Any written, printed, or graphic material displayed on or affixed to containers of chemicals

laboratory manager. Area manager for a laboratory *work area*

laboratory scale. 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

laboratory use. Of hazardous chemicals means "handling or use of such chemicals in which all of the following conditions are met: 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 worker. Person whose job responsibilities or tasks include the transportation, dispensing, disposal, other handling, or use in experimental protocols of hazardous materials in a research laboratory, or whose work environment provides for a reasonable probability of exposure to a hazardous material

nanomaterial. Material with at least two dimensions between one and 100 nanometers

occupational exposure limit (OEL). A limit for exposure of a worker to a chemical substance or physical agent. OELs are typically set by national agencies and safety and health organizations to prevent adverse health effects from workplace exposures. OELs may be mandatory, as with the *permissible exposure limits (PELs)* set by the Occupational Safety and Health Administration, or recommended, as with *threshold limit values (TLVs)* set by the American Conference of Governmental Industrial Hygienists (ACGIH) or

recommended exposure limits (RELs) set by the National Institute for Occupational Safety and Health (NIOSH). For chemicals, SLAC uses Cal/OSHA PELs as its OELs.

particularly hazardous substance (PHS). "*Select carcinogens*, *reproductive toxins*, and substances that have a high degree of *acute toxicity*" (8 CCR 5191)

principal investigator. Individual responsible for the scientific or technical direction of a research project, and for the safety and management of workers in their lab space. May also be referred to as *research leader*

reproductive toxin. Chemical that affects "the reproductive capabilities, including chromosomal damage (mutations), effects on fetuses (teratogenesis), adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring" (8 CCR 5191)

research leader. See *principal investigator*

safety data sheet (SDS). A document produced by chemical manufacturers and importers to relay chemical, physical, and hazard information about specific substances

select carcinogen. Per 8 CCR 5191, any substance which

- Is regulated by Cal/OSHA as a carcinogen
- Is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (1985 edition)
- Is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (Volumes 1–48 and Supplements 1–8)
- Is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
  - After inhalation exposure of 6–7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m3
  - After repeated skin application of less than 300 mg/kg of body weight per week
  - After oral dosages of less than 50 mg/kg of body weight per day

tank. Container larger than 60 gallons (227 liters)

threshold limit value (TLV). Recommended guideline for occupational exposure published by the American Conference of Governmental Industrial Hygienists (ACGIH). TLVs represent the average concentration for an eight-hour workday and a 40-hour workweek to which nearly all workers may be repeatedly exposed without adverse effect.

work area. A room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present. A work area is often controlled by one person or work group but may be used by one group or many.

6 References

6.1 External Requirements

The following are the external requirements that apply to this program:

- 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)

The following are external guidance documents that apply to this program; their use is not mandatory:

- Occupational Safety and Health Administration. Laboratory Safety Guidance

6.2 Related Documents

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

- Chapter 1, "General Policy and Responsibilities"
- Chapter 2, "Work Planning and Control"
- Chapter 8, "Electrical Safety"
- Chapter 9, "Radiological Safety"
- Chapter 10, "Laser Safety"
- Chapter 14, "Pressure Systems"
- Chapter 16, "Spills"
- Chapter 17, "Hazardous Waste"
- Chapter 34, "Biosafety"
- Chapter 36, "Cryogenic and Oxygen Deficiency Hazard Safety"
  - Cryogenic and Oxygen Deficiency Hazard Safety: ODH Requirements (SLAC-I-730-0A06S-002)
- Chapter 40, "Chemical Lifecycle Management"
  - Chemical Lifecycle Management: Chemical Screening Requirements (SLAC-I-730-0A09S-033)
  - Chemical Lifecycle Management: Compressed Gas Cylinder Storage and Handling Requirements (SLAC-I-730-0A09S-030)
- 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-021)
  - 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

- Nanomaterial Safety Plan (SLAC-I-730-0A09M-008)
- Chemical Management Services (includes safety data sheets)
- Gas Cabinet Guidance
- SLAC Occupational Health Center
- Incident Reporting and Investigation Process (SLAC-I-701-O03-006-00)

Other Documents

- Stanford University, Department of Environmental Health and Safety. Chemical Safety
- 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. Information on Peroxide-Forming Compounds
- 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"
- National Research Council. *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards* (Prudent Practices)

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.)

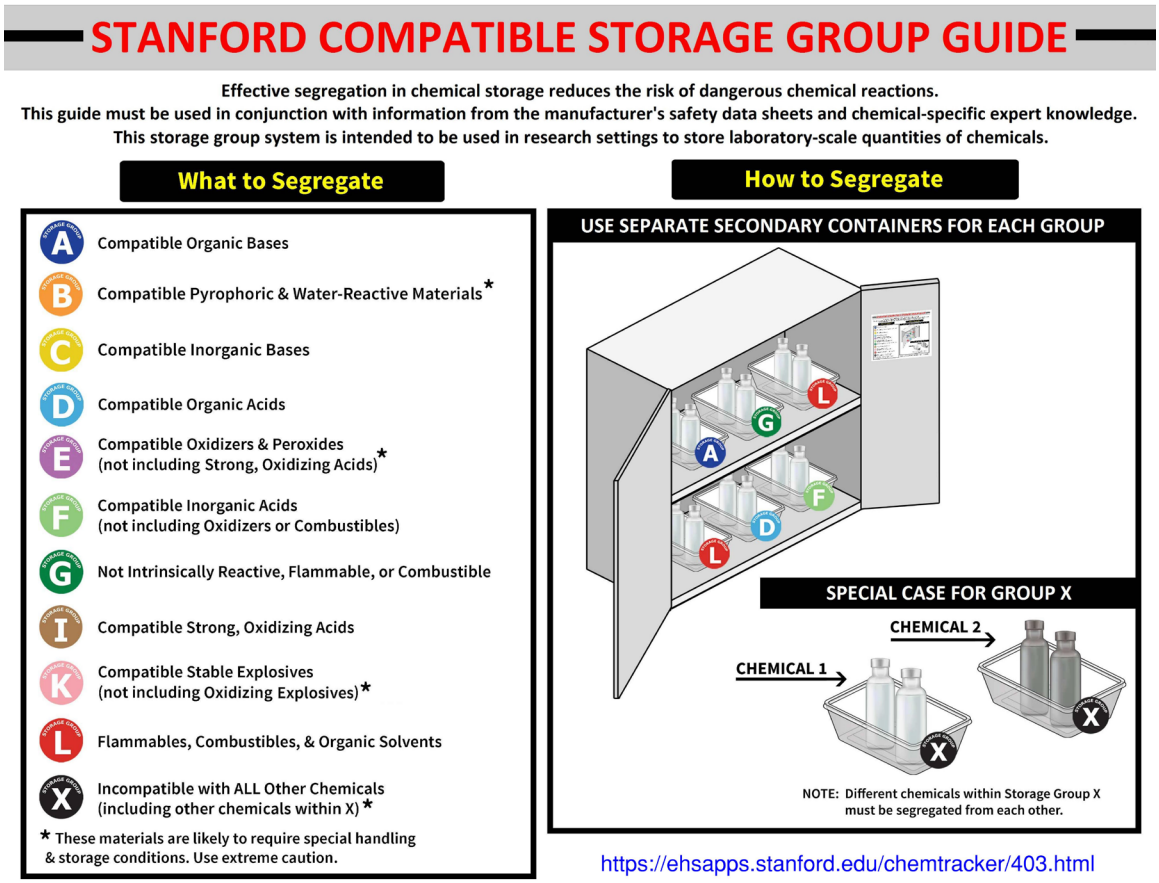

Figure 1 Stanford Storage Groups

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.

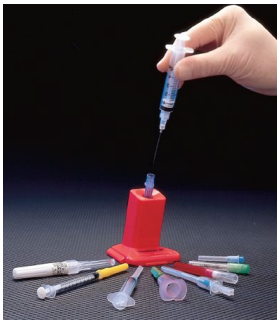

Figure 2 Syringe Holder

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"

ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 58: Laboratory Safety

Laboratory Standard Operating Procedure Template

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URL: https://www-group.slac.stanford.edu/esh/eshmanual/references/labsafetyTemplateSOP.pdf | docx

All experiments that will be performed in a *chemical laboratory* must be discussed with the ESH coordinator and *laboratory manager* before starting work. In certain cases, formal written prior approval is required, at the discretion of the laboratory manager and ESH coordinator. Written prior approval will take the form of a written standard operating procedure (SOP) outlining steps and mitigations of the experimental process. The SOP must be approved at a minimum by the *laboratory manager* and ESH coordinator, and every worker performing the experiment must acknowledge that he or she is familiar with the SOP before starting work. The following is the recommended template for SOPs. Other formats are acceptable as long as all the required elements of an SOP are included. (See Laboratory Safety: Chemical Hygiene Plan [SLAC-I-730-0A09S-040].)

Procedure title	
Procedure author	
Date of creation / revision	
Name of responsible person	Principal investigator and/or laboratory manager
Location to be performed	Building or lab number, beam line
Proposal number(s):	
1.	**This standard operating procedure (SOP) is for a**

☐ Specific laboratory procedure or experiment
Examples: synthesis of chemiluminescent esters, folate functionalization of polymeric micelles

☐ Generic laboratory procedure that covers several chemicals
Examples: distillation, chromatography

☐ Generic use of specific chemical or class of chemicals with similar hazards
Examples: organic azides, mineral acids

2.	**Process or experiment description** *Briefly summarize the process or experiment, including an estimate of how long the process takes and how frequently it will be conducted. Include total quantities (volume, mass) of the materials you to expect to use.*

3.	**Risk assessment** *Identify potential safety hazards. For chemical hazards, be specific (for example, flammability, corrosivity, reactivity/explosion, acute toxicity, or carcinogenicity). List OSHA hazards, NFPA ratings, and occupational exposure limits.*
4.	**Safety equipment** *Specify all equipment needed to perform research or experiment safely.*
4.a.	Engineering / ventilation controls Examples: fume hood use, explosion shielding, equipment interlocks

4.b.	Personal protective equipment and other safety equipment Examples: safety glasses, nitrile gloves, cryo gloves, absorbent bench paper
4.c.	Location of nearest emergency safety equipment Examples: organic azides, mineral acids

Item	Location
Eyewash / safety shower	
First aid kit	
Chemical spill kit	
Fire extinguisher	
Telephone	*Telephones are located near the entrance to laboratories.*
Fire alarm manual pull station	
Safety stations	

5.	**Shipping and receiving requirements** *Describe shipping or receiving requirements, especially for highly toxic, highly reactive/unstable, highly flammable, and corrosive materials.*

References:
ESH Manual Chapter 52, "Hazardous Materials and Waste Transportation" (https://www-group.slac.stanford.edu/esh/hazardous_substances/hazmattransport/)

6.	**Designated area** *Where highly toxic, highly reactive/unstable, highly flammable, corrosive, or nanomaterials are used, identify the designated work area(s) and the necessary personnel decontamination after completion of work.*

7.	**Step-by-step operating procedure** *Provide a sequential description of work, including details such as chemical concentrations and when special safety equipment is to be utilized. Include temperature, pressure, and other experimental conditions. Schematics or pictures are suggested for complex setups.*
1. Step 2. Step	
8.	**Special handling procedures, transport, and storage requirements** *Describe special handling and storage requirements for hazardous chemicals in your laboratory, especially for highly reactive/ unstable and highly flammable materials and corrosives. Describe transport and secondary containment requirements, between the laboratory and beam lines or between facilities.*
9.	**Beam line handling and storage requirements** *Describe sample handling procedures and sampling set up at the beam lines. Are samples sealed or open? Is ventilation required? Are heating, cooling, or gas distribution systems present?*

10.	**Emergency procedures** *Indicate how spills, personnel exposure/injury, and other accidents should be handled and by whom. List emergency contact numbers.*

Life-threatening emergencies (for example, fire, explosion, large-scale spill or release, compressed gas leak, valve failure)

1. **Call 911.**
2. Alert people in the vicinity and activate the local alarm systems.
3. Evacuate the area and go to emergency assembly point (EAP). *Indicate EAP here.*
4. Remain nearby to advise emergency responders.
5. Once personal safety is established, call ext. 5555 to activate internal response.
6. Provide local notifications.

Identify the area management staff who must be contacted and include their work and home numbers. This must include the PI and may include the safety coordinator and facilities manager.

If personnel exposed or injured

1. Remove the injured/exposed individual from the area, unless it is unsafe to do so because of the medical condition of the victim or the potential hazard to rescuers.
2. Administer first aid as appropriate.
3. Flush contamination from eyes/skin using the nearest emergency eyewash/shower for a minimum of 15 minutes. Remove any contaminated clothing.
4. Bring to the hospital copies of safety data sheets (SDSs) for all chemicals to which the victim was exposed.

Non-life-threatening emergencies

1. Call ext. 5555 to activate internal response.
2. Provide local notifications.

Identify the area management staff that must be contacted and include their work and home numbers. This must include the PI and may include the safety coordinator and facilities manager.

If personnel exposed or injured

1. Call the SLAC Occupational Health Center at ext. 2281 for more information and to schedule an appointment.

For small spills / local cleanup

In the event of a minor spill or release that can be cleaned up by local personnel (personnel are authorized via work planning and control to handle spilled material, appropriate PPE is available, compatible spill response material is readily available in sufficient quantity, and cleanup is safe):

1. Notify personnel in the area and restrict access. Eliminate all sources of ignition.
2. Review the SDS for the spilled material or use your knowledge of the hazards of the material to determine the appropriate level of protection.
3. Wearing appropriate personal protective equipment, clean up spill. Collect spill cleanup materials in a tightly closed container. Manage spill cleanup debris as hazardous waste.
4. Submit waste pickup request (https://www-group.slac.stanford.edu/esh/forms/hazpickup.pdf) to Waste Management.

Building maintenance emergencies (for example, power outages, plumbing leaks)

Submit a Facilities service request (https://slacprod.servicenowservices.com/self_service?id=facilities) or call appropriate building manager.

Identify the building manager using the SLAC Building Information database (https://oraweb2.slac.stanford.edu/apex/epnprod/f?p=111:1).

Additional emergency procedures

Describe additional, local emergency procedures.

11.	**Waste disposal** *Identify amounts of waste anticipated and appropriate disposal procedures. Segregate waste by hazard class (for example, flammable, corrosive) and state (solid, liquid), label appropriately, and place in the laboratory's hazardous waste cabinet.*

Additional waste guidelines

Describe additional, local waste guidelines.

12.	**Training requirements** *List the general and laboratory-specific training required*

- ☐ ESH Course 128, Laboratory Safety Orientation (ESH Course 128)
- ☐ ESH Course 105, Hazardous Waste Management (ESH Course 105)
- ☐ ESH Course 161, Nanomaterials Laboratory Safety (ESH Course 161)
- ☐ ESH Course 122, Pressure System Operator (ESH Course 122)
- ☐ ESH Course 125, Pressure System Mechanic (ESH Course 125)
- ☐ ESH Course 175, Cryogenic Liquids and Oxygen Deficiency Safety Training (ESH Course 175)
- ☐ ESH Course 172, Compressed Gas Safety (ESH Course 172)
- ☐ ESH Course 187, Working Safely with Hydrofluoric Acid (ESH Course 187)
- ☐ Lab-specific orientation

☐ Other: _____

Additional training requirements

List additional, local training requirements, such as equipment or technique training.

1. Additional training requirement
2. Additional training requirement

13.	**Approval** *Standard operating procedures must be approved by the laboratory manager and directorate ESH coordinator.*

Principal investigator **or** Laboratory Manager *(name, signature, date)*: _____

Directorate ESH coordinator *(name, signature, date)*: _____

Additional approvals

List subject matter experts consulted for approval (name, title):

1. Person consulted
2. Person consulted

Hydrofluoric Acid First Aid Kit Instruction Template

Product ID: 749 | Revision ID: 2494 | Date Published: 25 March 2022 | Date Effective: 25 March 2022

URL: https://www-group.slac.stanford.edu/esh/eshmanual/references/labsafetyTemplateHF.pdf

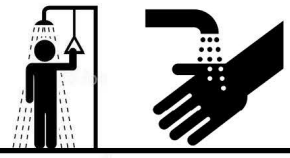
This is a template for instructions to be posted with hydrofluoric acid first aid kits. All chemical laboratories in which hydrofluoric acid is used must be equipped with specialized hydrofluoric acid (HF) first aid kits. The instructions must be posted with the kits. Staff and supervisors must be trained in their use (ESH Course 187). (See Laboratory Safety: Chemical Hygiene Plan [SLAC-I-730-0A09S-040].)

Hydrofluoric Acid (HF) First Aid Kit

All HF exposures **must be evaluated by an appropriate physician or nurse**. Follow the directions below to provide emergency treatment before seeking professional medical care.

SKIN CONTACT:

1



Immediately rinse skin with water for **5 min**. Remove contaminated gloves & clothing.

Put on new gloves to prevent re-contamination.

2

Immediately massage Calgonate gel into skin (no need to dry off.)

Gel will turn white when it contacts HF.

3

Call 911, then SLAC Security (x5555).

Obtain immediate medical attention.

4

Re-apply Calgonate gel every **10-15 min** until medics arrive or until you receive medical attention.

EYE CONTACT:

1

Rinse eyes in eyewash for **15 min** or until medics arrive.

Hold eyelids open.

DO NOT apply Calgonate in eyes.

2

Call 911.

Continue rinsing eyes until medics arrive.

Follow up with an ophthalmologist.

CALGONATE **NITRILE GLOVES**

Replace Calgonate gel if opened and before expiration.

Chapter 58: Laboratory Safety

Lab Inspection Checklist

Product ID: 730 | Revision ID: 2464 | Date Published: 1 June 2021 | Date Effective: 1 June 2021

URL: https://www-group.slac.stanford.edu/esh/eshmanual/references/labsafetyChecklistInspect.pdf | docx

Laboratory managers should inspect laboratories on a routine schedule. Weekly inspections are recommended. The following is the recommended checklist for weekly inspections. The checklist may be tailored for the individual lab. Other formats are acceptable as long as applicable topics are covered. (See Laboratory Safety: Chemical Hygiene Plan [SLAC-I-730-0A09S-040].)

Name(s) (print)	Lab Name
Bldg/Location	Month/Year

	*Week 1	*Week 2	*Week 3	*Week 4
General Safety				
Laboratory doors are labeled with lab and ESH/emergency contacts, hazards present, and PPE/attire requirements for work?				
Is overall lab housekeeping in good order (clean bench paper, clutter)?				
Are aisles free of obstructions? Minimum clearance for lab aisles is 2 ft.				
Is PPE readily available and in good condition?				
Supplies are stored minimum of 18 inches away from ceiling?				
Overhead storage is minimized and restrained from falling?				
Overhead cabinet doors are closed?				
Heavy equipment of furniture is earthquake braced?				
Hot plates and heaters are in good order and out of harm's way. Unplugged when not in use?				
Chemical Storage				
Chemicals are labeled legibly, contents are identifiable. Chemical name and hazards preferred. (Abbreviations ok.)?				
All chemical containers are closed when not actively adding or removing materials?				
Chemicals are not stored on lab benches in excessive quantities?				
Chemicals are not stored in personal drawers in excessive quantities. (Liquids: Single containers </= 250mL, total volume </= 500mL)?				
Chemicals are not stored in lab fume hoods?				
No hazardous materials are stored in, around or above sinks?				
Are stored chemicals segregated according to hazard classification/compatibility (acids, bases, flammables, oxidizers, water reactives, etc.)? https://ehs.stanford.edu/wp-content/uploads/Storage-Group-Poster.pdf?1559595169 https://www.ehs.ucsb.edu/files/docs/ls/factsheets/SafeStorage_FS7.pdf				
Liquids are stored in spill/secondary containment. Incompatible mixing is mitigated?				
Chemical storage is not exceeding capacity or chemicals are not piled on top of each other?				
Chemicals are not stored above eye-level and not directly on floor?				
Are all containers of peroxide-forming chemicals (e.g., ethers) dated upon receipt and disposed of within the prescribed time?				
Highly flammable liquids are used away from sources of heat and ignition?				
Flammable liquids in fume hoods do not exceed 3L?				
A chemical inventory is available?				
Compressed Gases				
Toxic gases are used and stored in approved toxic gas cabinets or approved controls?				
Corrosive gases (e.g. HF, HBr, HCl, H2S) can degrade the cylinder over time and/or produce dangerously high pressures of hydrogen. Dispose of within 2 years. Is it dated?				

Are cylinders secured upright with chains or straps and brackets bolted to a wall, bench or other secure object (no C-clamps)?				
Are protective caps in place while cylinders are not in use?				
No teflon tape on CGA connections unless specified by the equipment manufacturer. Particularly avoid this with oxygen systems.				
Flammable gases (e.g. hydrogen, methane) tubing should be used with metal tubing. Welding rigs should be equipped with a flash arrestor to prevent flame flashback to cylinder. Available from gas vendors.				
Highly toxic gas cylinders should be equipped with a reduced flow orifice (RFO) connection to prevent rapid discharge of cylinder contents.				
Gas cabinets with toxic or flammable gas delivery manifolds often have an excessive flow detection and auto-shutoff valve built-in. Verify that this safety feature is functional.				
Hazardous Waste				
Are all hazardous waste containers labeled with chemical name, state, hazards, date, contact, and “Hazardous Waste”?				
Labels are legible and undamaged?				
Incompatible materials (e.g. acids and bases) are not stored together?				
HazWaste containers are not full?				
Waste not stored over allowable time (45 days)?				
Is hazardous waste housekeeping generally in order?				
Are all “sharps” (syringes, razor blades, etc.) disposed of in proper containers?				
Broken glassware bin is available, adequate, and is in good condition, and does not contain hazardous chemical wastes?				
Laboratory Safety and Emergency Equipment				
Are the eyewash and emergency shower stations free of any obstructions which would prevent ready access? Run eyewash units to maintain clean water in the lines?				
Are spill kits available?				
Fume hoods have current (annual) inspection stickers in place?				
Fume hood doors are aligned with arrows while the hood is being used?				
Fume hood contents do not obstruct air flow? (Storage in hood is minimal.)				
All work is performed at least 6 inches inside sash?				
Are biological safety cabinets certified annually or when moved (check sticker) and are they the proper types for the work being conducted?				
Are fire protection systems in place and adequate for lab activities (e.g. fire suppression, fire extinguishers)?				
Laboratory Refrigerators				
Refrigerators are clearly labeled “Chemical Storage”?				
Refrigerators do not contain flammable materials unless “flammables or explosion proof”?				
Electrical Safety				
Plugs do not have exposed wires, are or terminal screws? (Not touch safe.)				
Power cords and extensions are not daisy chained?				
Temporary cords are neither a trip hazard nor will they be subject to damage, such as under rugs or through doorways.				
Cords not routed through holes in or concealed behind walls, ceilings, or floors? (ie. line of sight between equipment and outlet).				
Cords and connectors not strained; connections to equipment have proper strain relief?				
Electrical cords are not frayed?				
Equipment > 50V has NRTL certification or EEIP tag?				

Week 1 Comments

Week 2 Comments

Week 3 Comments

Week 4 Comments

NATIONAL ACCELERATOR LABORATORY

ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 58: Laboratory Safety

Non-hazardous Waste Sink Disposal Procedure

Product ID: 633 | Revision ID: 2016 | Date published: 1 June 2021 | Date effective: 1 June 2021
URL: https://www-group.slac.stanford.edu/esh/eshmanual/references/labsafetyProcedDisposalSink.pdf

1 Purpose

The purpose of this procedure is to

- Reduce the laboratory waste burden
- Reduce storage of non-hazardous waste in hazardous waste storage areas
- Segregate hazardous and non-hazardous laboratory wastes into discrete disposal streams.

This procedure describes a data-based determination of the hazards of laboratory waste materials, by reference to regulatory criteria (such as pH and LD50). It allows disposal into the sanitary sewer of experimental aqueous solutions, typically buffers, found to be non-hazardous. It covers authorizing, implementing, and verifying the discharge of non-hazardous laboratory wastes in local laboratory sinks. It applies to workers (as *laboratory workers*), *principal investigators*, *laboratory managers*, ESH coordinators, the industrial wastewater program manager, and Waste Management.

2 Procedure

Step	Person	Action
Authorization		
1.	Requester	Submits request for sink disposal to ESH coordinator / laboratory manager. The request must include the following information: ▪ Descriptive name of the candidate solution, including all solutes and/or suspended solids with their concentrations and/or mass/volume ppm, respectively. ▪ Lab location ▪ Experiment date range ▪ CAS numbers of chemical components ▪ Confirmation that components are under max concentration of 1000 mM unless otherwise noted ▪ Volume that needs to be disposed ▪ pH of solution ▪ Safety data sheets (SDSs), including LD50 and eco-toxicological data, if possible

Step	Person	Action
2.	ESH coordinator / laboratory manager	Reviews Approved Components or Standard Solutions lists (in the Laboratory Sink Disposal Database) to confirm if proposed chemicals are approved for sink disposal ▪ If listed, carries out disposal (go to step 7)
3.	ESH coordinator / laboratory manager	Reviews Chemicals Not Approved list to confirm if proposed chemicals are not approved for sink disposal ▪ If listed as not approved, requests disposal (go to step 6)
4.	ESH coordinator / laboratory manager	Completes a New Component Request Form for review by the industrial wastewater program manager (step 5)
5.	Industrial wastewater program manager	▪ Reviews request against the Max Concentration Master Lab Waste Solution Components list, LD50 data, eco-toxicological data, and the conditions of SLAC's industrial wastewater discharge permit ▪ If approved, adds material to the Approved Components or Standard Solutions list, with any other conditions of disposal. Notifies ESH coordinator / laboratory manager of approval (step 7) ▪ If not approved, notifies ESH coordinator / laboratory manager (go to step 6)
6.	ESH coordinator / laboratory manager	▪ Arranges for disposal through Waste Management
Implementation		
7.	ESH coordinator / laboratory manager	Ensures laboratory workers understand the conditions of disposal: volume, concentration, approved material, and discharge approval process
8.	Worker	Notifies laboratory manager of each disposal
9.	Worker	Carries out disposal following conditions
10.	Laboratory manager	Logs each discharge in the Discharge Log of the Laboratory Sink Disposal Database
Verification		
11.	Industrial wastewater program manager	Initiates periodic program verification to ensure that conditions of the industrial wastewater discharge permit are being met

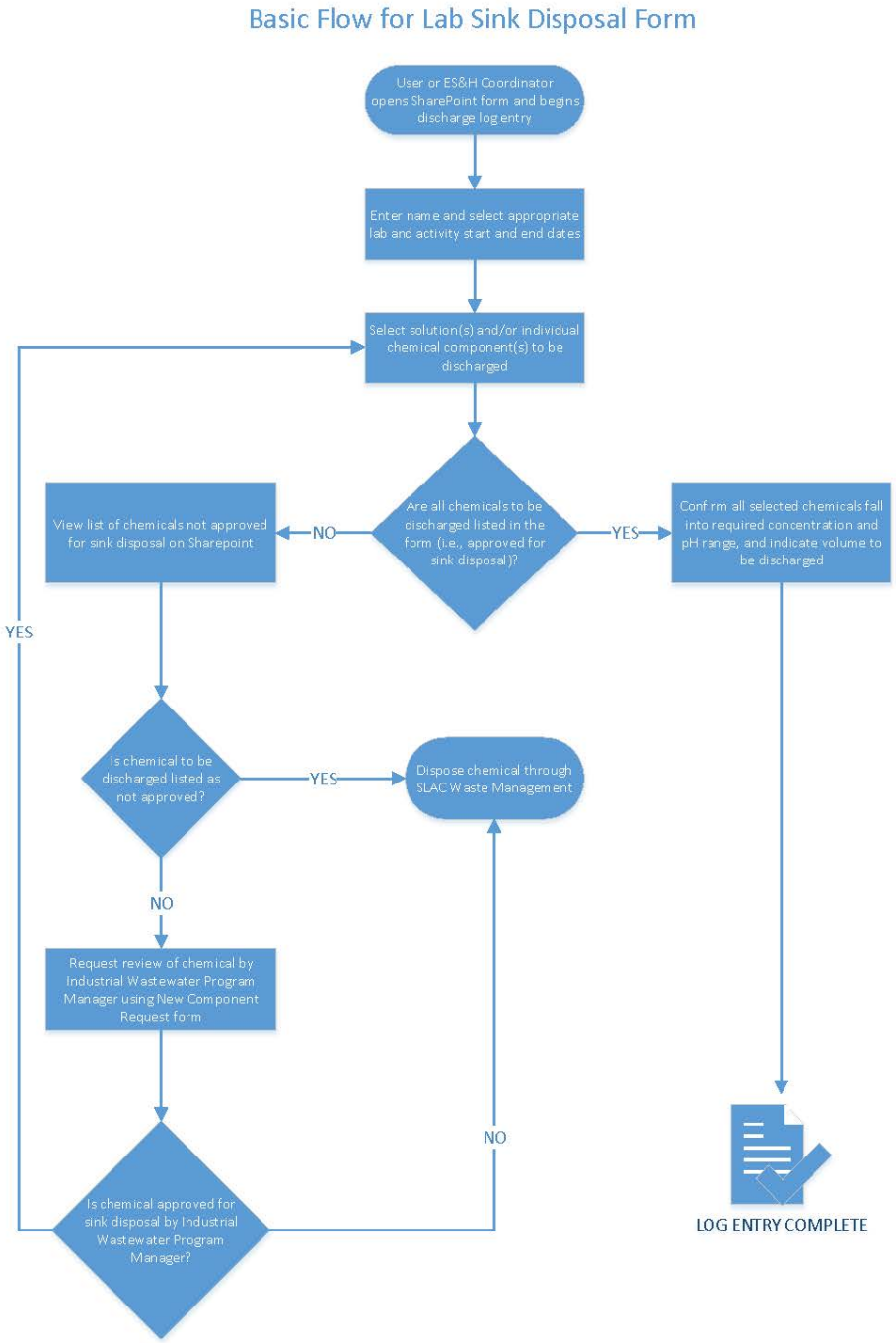


Figure 1 Non-hazardous Waste Sink Disposal Process

3 Forms

The following forms and systems are required by this procedure:

- New Component Request Form. Form for requesting review of a new component or solution for sink disposal (in the Laboratory Sink Disposal Database)
- Laboratory Sink Disposal Database. Database of chemical components and solutions approved for sink disposal and related information

4 Recordkeeping

The following recordkeeping requirements apply for this procedure:

- The industrial wastewater program manager maintains the Laboratory Sink Disposal Database.

5 References

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

- Chapter 58, "Laboratory Safety"
  - Laboratory Safety: Chemical Hygiene Plan (SLAC-I-730-0A09S-040)
- Chapter 16, "Spills"
- Chapter 17, "Hazardous Waste"
- Chapter 40, "Chemical Lifecycle Management"
- Chapter 43, "Industrial Wastewater"
- Chapter 53, "Chemical Safety"

Other SLAC Documents

- Chemical Management Services

Other Documents

- Industrial Wastewater permit (IW permit)