NATIONAL ACCELERATOR LABORATORY

ENVIRONMENT, SAFETY & HEALTH DIVISION

Chapter 40: Chemical Lifecycle Management

Management and Use Requirements

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1 Purpose

The purpose of these requirements is to ensure the safe management and use of *chemicals* and other *hazardous materials*. They cover handling, use, storage, and inventorying of chemicals. They apply to workers (as *chemical users*, *requesters,* and *receivers)*, supervisors, *chemical storage asset custodians*, ESH coordinators, the SLAC fire marshal, and the chemical lifecycle management program manager.

2 Requirements

2.1 Handling and Use

Before using any chemical

- Check that all chemical *containers* are labeled properly (see Chemical Safety: Hazard Communication Requirements).
- Review the *safety data sheet (*SDS*)* and any applicable safe handling guideline and work planning and control documents, such as a job safety analysis or standard operating procedure, for specific hazards and controls.
- Review emergency measures:
  - Any local emergency procedures
  - Location and use of the nearest eyewash station and safety shower
  - Location and use of any chemical-specific antidotes
  - Location and use of the nearest fire extinguisher, emergency exit, and fire pull box and telephone for emergency notification
- Check that all controls are in place and working (such as personal protective equipment and ventilation.)

When using any chemical

- Handle chemicals carefully at all times, store in appropriate containers, and close containers after use.
- Transport chemicals in proper carrying devices (see Chapter 52, "Hazardous Materials and Waste Transportation").

For the safe handling of compressed gases, see Chemical Lifecycle Management: Compressed Gas Cylinder Storage and Handling Requirements; for use, see Pressure Systems: Installation, Inspection, Maintenance, and Repair Requirements.

2.2 Fire Prevention

The following requirements are specific to fire hazards of chemicals:

- Take measures to prevent ignition of flammables. Smoking, welding, cutting, grinding, and using open flames or ordinary electric equipment in the vicinity of flammable materials is prohibited. Contact the fire marshal for specific distance requirements. NO SMOKING signs must be posted on or near storage cabinets for flammables and in areas where flammables are stored, handled, or used.
- Anticipate the type of fire extinguisher required should an experiment or other use of chemicals result in a fire. Contact the fire marshal for information regarding type, spacing, and location of fire extinguishers.
- Equipment and containers dispensing flammable or combustible liquids must be properly bonded and grounded to prevent the accumulation of static electricity and a potential ignition source.
- Electrical wiring and equipment in close proximity to flammable and combustible liquids, flammable gases, and flammable solids must be installed and maintained in accordance with Section 500 of the NFPA *National Electrical Code* (NFPA 70) and Chapter 34 of the *California Fire Code* (24 CCR Part 9). Such operations must be classified appropriately and the appropriate class of electrical equipment must be used. Contact the fire marshal to assist in this classification.
- An open flame should only be used when necessary and authorized and extinguished when it is no longer needed.

See Chapter 12, "Fire and Life Safety", for information about fire prevention, protection, and suppression.

2.3 Storage

2.3.1 General

In any single room or laboratory, the quantity of any one chemical should be kept to a minimum. Any exceptions to the storage occupancy amounts or permissible exterior storage amounts in the *California Fire Code* (24 CCR Part 9) must be approved in writing by the fire marshal and line management (see Chemical Lifecycle Management: Planning Requirements). Managers may choose to further limit the amount of chemicals stored or used at their building, facility, or facility area when required to provide a safe work environment for personnel.

Best management practices for the storage of chemicals include the following:

- Only store what can be used within a reasonable amount of time, usually one year.
- Provide a designated storage place for each chemical and return the chemical to that location after each use.
- Store chemicals at or below eye level; keep lids and caps on securely when returning to storage.
- Avoid storing chemicals on bench tops, except for chemicals currently being used.

- Do not store chemicals in laboratory hoods except for those in use.
- Protect stored chemicals from direct heat or sunlight.

2.3.1.1 Additional Subcontractor Requirements

Subcontractors using and storing their own chemicals on-site must meet the following additional requirements:

- Keep on-site only those chemicals that are necessary to ensure proper performance of work for the current job.
- Have and make available upon request to the field construction manager (FCM)/service manager (SM) and contract administrator safety data sheets (SDSs) for all chemicals.
- Label all containers with either the original product label or an appropriate secondary label that clearly communicates what the material is, along with its hazards and enough information to determine which SDS is applicable (for example, unique ID or manufacturer information).
- Placard storage areas in use longer than 30 days in compliance with NFPA 704. Any material with an NFPA health hazard rating of 3 or 4, in quantities that equal or exceed 5 gallons, 40 pounds, or 200 cubic feet, must be reported to the SLAC fire marshal.
- Inventory and map locations of chemicals above threshold quantities (55 gallons, 200 cubic feet, or 500 pounds) and stored on-site longer than 30 days. This information must be made available to the FCM/PM, the SLAC fire marshal, and the chemical lifecycle management program manager.

2.3.2 Storage Area Access

All storage areas must be secured to prevent access by unauthorized personnel.

2.3.2.1 Additional Subcontractor Requirements

Subcontractors using and storing their own chemicals on-site must ensure SLAC Site Security, chemical lifecycle management, and emergency response personnel have access to their chemical storage areas for inspection and response purposes. Locks must be keyed to be opened by the SLAC master key. Subcontractor locks will be cut if this requirement is not met.

2.3.3 Chemical Storage Asset Custodian Program

SLAC has implemented a program to ensure ownership of every *chemical storage asset* or *area*. For each asset or area, a *custodian* is designated by line management and given authority and responsibility for the safe storage within that asset, including carrying out periodic inspections. (See Chemical Lifecycle Management: Chemical Storage Asset Requirements.)

2.3.4 Proper Segregation of Incompatible Chemicals

Many chemicals are incompatible with one another and must be kept separate to avoid the dangerous reactions that would occur if they mixed. This can be accomplished by distance or by *secondary*

containment, depending on the type of incompatibility, the severity of any possible reactions, and the quantities of the respective chemicals[1].

Incompatible chemicals must be separated when the stored chemicals are in containers having a capacity of more than five pounds of solid (2.3 kilograms) or 0.5 gallon of liquid (1.9 liters). Incompatible gases in cylinders with an internal volume of 2 liters or greater may not be stored within the same cabinet or exhausted enclosure.[2] Separation can be accomplished by one of the following techniques:

- Segregating incompatible chemicals storage by a distance of not less than 20 feet (6.1 meters)
- Isolating incompatible gas storage by a noncombustible partition extending not less than 18 inches (0.46 meter) above and to the sides of the stored gas
- Storing liquid and solid chemicals in hazardous materials storage cabinets meeting fire and building code specifications
- Storing compressed gases in approved gas cabinets or exhausted enclosures meeting fire and building code specifications

Do not store chemicals alphabetically as a general group. Chemicals may be separated into compatible groups and stored alphabetically within those compatible groups. Observe all precautions regarding the storage of incompatible chemicals and refer to the safety data sheet (SDS) and any applicable SLAC safe handling guidelines. (See Chemical Safety: Safe Handling Guidelines.)

2.3.5 Time- or Shock-sensitive Chemicals

Because many chemicals cannot be stored indefinitely, the user should establish shelf-life guidelines. Chemicals that form peroxides or are shock-sensitive should be marked in accordance with the criteria set forth for unstable, time-sensitive, and pyrophoric chemicals:

- Write the date received and date opened on all containers of shock-sensitive and peroxide-forming chemicals. Some chemicals become increasingly sensitive with age.
- Unless an inhibitor was added by the manufacturer, closed containers of shock-sensitive or peroxide-forming materials should be discarded after one year.

2.3.6 Storage of Compressed Gases

Storage requirements for gases are described in Chemical Lifecycle Management: Chemical Storage Asset Requirements. All safety requirements and precautions pertaining to the class of hazard the gas belongs to must be observed.

2.3.7 Storage of Acetylene and Oxygen Gas Cylinders Used for Welding

Special requirements apply to the storage (and handling and use) of portable gas cylinders used for welding. (See Chemical Lifecycle Management: Portable Welding and Cutting Fuel Requirements.)

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1 See Stanford University's Chemical Safety: Storage Groups. Also, the American Institute of Chemical Engineers (AIChE) has made available a chemical reactivity worksheet (CRW) that allows one to identify the reactivity of substances or mixtures of substances.

2 Lecture bottles have an internal volume of approximately 0.5 liter.

2.3.8 Seismic Restraints

Safe chemical storage includes providing seismic restraints. Chemical storage and work areas must be evaluated for possible earthquake hazards and mitigations. Include the following:

- Use shelf lips, wire kept taut by a spring, or individual container restraints and cabinet door locking systems instead of bungee cords. A two-inch lip is recommended for laboratories.
- Anchor all tall furniture and storage cabinets to the wall and/or floor. Fallen cabinets frequently block exit paths if not anchored.
- Use engineered restraints on storage cabinets with contents that weigh 400 pounds or more.
- Store heavy items on lower shelves and never store liquids above eye level.

2.4 Spill Prevention and Containment

Spill prevention is an umbrella term to cover all methods used to prevent unplanned release of chemicals. It can include engineered and administrative controls. Examples of spill prevention methods are valve locks, overfill prevention, high-level alarms, and inspections. The purpose of spill prevention in any of its forms is to prevent

- Worker exposure
- Mixing of incompatible materials
- Release to the environment

A method to contain spills is often used. *Spill containment* can include drip pans, gas cabinets, storm drain mats, and absorbent material, as well as double-walled piping and tanks.

2.4.1 Secondary Containment

Secondary containment is required if the following conditions are met:

1. A chemical could come in contact with an incompatible material (that is, it could produce an incompatible chemical reaction, for example, emitting toxic gas, igniting, or exploding).
2. A chemical could threaten personnel or the environment (for example, by contaminating soil or water directly or entering a floor drain or sink) if it escapes from its primary container

General secondary containment is seen in laboratories when containers are in trays, but the trays are not sized to contain the full content of the container.

Sized secondary containment is more specific and is required when any single container is in excess of 55 gallons of liquid, 550 pounds for solids, or when the aggregate capacity of multiple vessels exceeds 1,000 gallons (10,000 pounds for solids).

2.4.2 Spill Response

A chemical spill is the release of any hazardous chemical from its primary container that results in an increased risk or potential risk to human health, the environment, and property. Refer to Chapter 16, “Spills”, for detailed information about spill response.

Note *Preparation is essential to minimizing the hazards caused by a chemical spill. Assemble a chemical spill kit, and understand the hazards associated with the chemicals used and stored in the work area. Consult the SDS for more information. Post an emergency telephone call list near the entrance to each work area as appropriate.*

2.5 Transfer or Repackaging of Chemicals

Gas delivered in refillable cylinders, unlike dewars, cannot be refilled at SLAC and may only be refilled by the gas supplier. Liquid and solid hazardous material that is transferred or repackaged must have a secondary label (see Chemical Safety: Hazard Communication Requirements). This includes squirt bottles and safety cans.

2.6 Inventory and Use Reporting

A current, accurate inventory of *chemicals* and other *hazardous materials* must be maintained by line management for each work area, both for reporting purposes described below and for hazard communication (see Chemical Safety: Hazard Communication Requirements). All chemicals purchased through the Chemical Management System can be captured for inventory. Contact the chemical lifecycle management program manager for assistance in generating a work-area-specific inventory. Programmed barcode scanners are available for use in developing these reports. Chemicals purchased before 2006 or research samples may not be captured in the Chemical Management System and may require physical inventory by work area personnel.

2.6.1 Hazardous Materials Inventory Statement

Work area inventories are reconciled annually by the chemical lifecycle management program manager, with assistance as necessary from chemical storage asset custodians and ESH coordinators, and submitted to San Mateo County (the certified unified program agency [CUPA] for SLAC) to satisfy hazardous material business plan reporting obligations.

2.6.2 Chemical Use Reporting

SLAC has reporting requirements for numerous programs within the Environment, Safety, and Health Division (ESH) associated with chemical use, as well as internal reporting programs required by the Department of Energy. Some of the more important programs that require such information include SLAC's annual emissions report, hazardous materials business plan, and toxic release inventory (TRI) submittals. The chemical lifecycle management program manager has the responsibility to establish the necessary Chemical Management System reporting templates to support this reporting.

2.6.2.1 Additional Subcontractor Requirements

Subcontractors using and storing their own chemicals on-site must meet the following additional requirements:

- Provide both a pre-work chemical list and post-work chemical usage report to the FCM/SM.
- Log fuel consumption for hazardous materials equipment.
- Submit quantified receipt and usage information if needed to meet regulatory reporting needs.

3 Forms

The following forms and systems are required by these requirements:

- 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:

- A hazard communication inventory listing all the chemicals present in an area will be maintained, either through the Chemical Management System or locally.

5 References

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

- Chapter 40, "Chemical Lifecycle Management"
  - Chemical Lifecycle Management: Planning Requirements (SLAC-I-730-0A09S-039)
  - Chemical Lifecycle Management: Compressed Gas Cylinder Storage and Handling Requirements (SLAC-I-730-0A09S-030)
  - Chemical Lifecycle Management: Portable Welding and Cutting Fuel Requirements (SLAC-I-730-0A09S-024)
  - Chemical Lifecycle Management: Chemical Storage Asset Requirements (SLAC-I-730-0A09S-018)
  - Chemical Management Services (CMS)
  - Chemical Management Services Program Site (SharePoint)
- Chapter 1, "General Policy and Responsibilities"
- Chapter 2, "Work Planning and Control"
- Chapter 12, "Fire and Life Safety"
- Chapter 14, "Pressure Systems"
  - Pressure Systems: Installation, Inspection, Maintenance, and Repair Requirements (SLAC-I-730-0A21S-053)
- Chapter 16, "Spills"
- Chapter 52, "Hazardous Materials and Waste Transportation"
- Chapter 53, "Chemical Safety"
  - Chemical Safety: Hazard Communication Requirements (SLAC-I-730-0A09S-042)
  - Chemical Safety: Safe Handling Guidelines
- Chapter 58, "Laboratory Safety"

Other Documents

- Title 24, *California Code of Regulations*, "California Building Standards Code", Part 9, "California Fire Code", Chapter 34, "Flammable and Combustible Liquids" (24 CFR Part 9, Chapter 34)
- National Fire Protection Association (NFPA) 30, *Flammable and Combustible Liquids Code* (NFPA 30)
- National Fire Protection Association (NFPA) 70, *National Electrical Code* (NFPA 70)
- National Fire Protection Association (NFPA) 704, "Standard System for the Identification of the Hazards of Materials for Emergency Response" (NFPA 704)
- American Institute of Chemical Engineers (AIChE). Chemical Reactivity Worksheet (CRW)
- Stanford University, Office of Environmental Health and Safety. Chemical Safety: Storage Groups