DRAFT 2: 9-18-15

Minnesota
STATE COLLEGES
& UNIVERSITIES

Chemical Hygiene Program Guideline–Culture of Safety

With the promulgation of the Occupational Safety and Health Administration (OSHA) Laboratory standard (29 CFR 1910.1450), a culture of safety consciousness, accountability, organization, and education has developed in academic laboratories. Safety has been implemented to promote the safe handling of chemicals from ordering to disposal. Training programs have been implemented to train laboratory personnel and students in safe practices. Laboratory personnel must realize that the welfare and safety of each individual depends on clearly defined attitudes of teamwork and personal responsibility. Learning to participate in a culture of habitual risk assessment considering the health, physical, and environmental hazards of the chemicals they plan to use, experiment planning, and consideration of worst-case possibilities is as much part of a scientific education as learning the theoretical background of experiments or the step-by-step protocols for doing them in a professional manner. A crucial component of chemical education for all is to nurture basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities throughout their career.

However, the ability to accurately identify and assess laboratory hazards must be taught and encouraged through training and ongoing organizational support. This training must be at the core of every good health and safety program. For management to lead, personnel to assess worksite hazards, and hazards to be eliminated or controlled, everyone involved must be trained.

The purpose of this document is to provide guidance in the development of a comprehensive chemical hygiene program. Please use it as a guide and ensure that campus specific facilities and program procedures are included in your final document.

Institute a Chemical Hygiene Program

A comprehensive chemical hygiene program ~~should be~~ is designed to minimize exposures, injuries, illnesses and incidents. It needs to~~There should~~ be a regular, continuing effort that includes program oversight, safe facilities, chemical hygiene planning, training, emergency preparedness, and chemical security. The chemical hygiene program must be reviewed annually and updated as necessary whenever new processes, chemicals, or equipment is implemented. Its requirements will~~recommendations should~~ be followed in all laboratories. OSHA's Permissible Exposure Limits (PELs) must not be exceeded. The American Conference of Governmental Industrial Hygienists' Threshold Limit Values (TLVs) should also not be exceeded.

Responsibilities

Persons responsible for chemical hygiene include, but are not limited to, the following:

~~Vice President of Academic Affairs~~Upper Level Administration (President, Provost, Vice Presidents, Executive Team Members):

(a) Ultimate responsibility for chemical hygiene within the institution ~~and~~
(b) Promote the importance of safety in all activities
(c) Promote the same attitude among all levels of employment at the institution
(d) Support broad-based laboratory safety/chemical hygiene program that will protect laboratory employees from health effects associated with hazardous chemicals, physical or biological agents
(e) Ensure that deans, directors and department heads provide adequate time and recognition for employees who are given laboratory safety responsibilities.
~~(b) With other administrators, provide continuing support for institutional chemical hygiene~~

Facilities Director:

(a) Primary responsibility of maintenance of the campus facility and laboratories

Dean of Sciences:

(a) Is responsible to support safety in laboratories and help provide the resources as needed to ensure the faculty, staff and student safety
(b) Ensure timely actions are taken to address safety concerns in laboratories and protect personnel and facilities
(c) Ensure the Science Department remains in compliance with all applicable codes and regulations
(d) Provide budgetary arrangement to ensure the health and safety of departmental personnel, students and visitors in the laboratories
(e) Ensure that employees are provided adequate time and recognition for employees who are given laboratory safety responsibilities.
(f) Take appropriate measures to assure that department activities comply with Institution and OSHA safety policies.
(g) Identify Department Chairperson
(h) Identify and assign the role of Chemical Hygiene Officer to a qualified individual.
(i) Assist CHO in choosing qualified individuals to serve on the Chemical Hygiene Committee, this will include, at least, the CHO and the department Chairpersons.
~~(d)~~(j) Ensure that adequate time are resources are provided for the proper training of all employees.

Campus Safety Director:

(a) Responsible to work with Facilities Director, Dean of Sciences, Chemical Safety Officer, and Faculty in promoting safety throughout the facility and all laboratories
(b) Responsible for the safety of the institution by ensuring regulatory compliance and making appropriate recommendations to ALL personnel
(c) Ensure that there is a written and implemented Chemical Hygiene Plan (CHP) for the facility
(d) Ensure that the CHP is reviewed annually and updates are made as needed

~~(d)~~(e) Participate in the Chemical Hygiene Committee

Chemical Hygiene Officer:

(a) Responsible for implementing and documenting appropriate safety policies and procedures in accordance with the Chemical Hygiene Plan
(b) Work with the Campus Safety Director~~Officer~~, faculty and other employees to develop and implement appropriate chemical hygiene policies and procedures
(c) Monitor~~s~~ procurement, use, storage, and disposal of chemicals used in the lab
(d) Ensure all laboratory inspections (e.g. eyewash, etc.) are maintained.
(e) Maintain~~s~~ inspection, personnel training, and inventory records
(f) Assist~~s~~ laboratory supervisors in developing and maintaining adequate facilities
(g) Seek~~s~~ ways to improve the chemical hygiene program

Department Chairperson:

(a) Assume~~s~~ responsibility for personnel engaged in the laboratory use of hazardous chemicals
(b) Provide~~s~~ the chemical hygiene officer (CHO) with the support necessary to implement and maintain the CHP
(c) After receipt of laboratory inspection report from the CHO, meet~~s~~ with laboratory supervisors to discuss cited issues and to ensure timely actions to protect trained laboratory personnel and facilities and to ensure that the department remains in compliance with all applicable federal, state, campus and departmental codes and regulations

Chemical Hygiene~~Campus Safety~~ Committee:

(a) Review~~s~~ accident reports and makes appropriate recommendations to the department chairperson regarding proposed changes in the laboratory procedures
(b) Monitor and advise for policies, procedures, equipment, and work practices to protect employees and students from health hazards related to chemical usage.
~~(a)~~(c) Conduct periodic laboratory inspection to identify any issues that may result in non-compliance with any applicable federal, state, campus, or department codes or regulations.

Faculty/Laboratory Supervisor:

(a) Ensure that laboratory personnel comply with the CHP and do not operate equipment or handle hazardous chemicals without proper training and authorization
(b) Always wear personal protective equipment (PPE) that is required according to the~~compatible to the degree of hazard of the~~ chemical Safety Data Sheet.
(c) Follow all pertinent safety rules when working in the laboratory to set an example
(d) Conduct~~s~~ hazard analysis and review applicable Safety Data Sheets before assigning to other laboratory personnel
(e) Assume responsibility for all students and ~~ensure that~~ visitors and ensure all provisions in the ~~follow the~~ laboratory rules are followed
(f) Ensure that PPE is available and properly used by each laboratory personnel
(g) Maintain and implement safe laboratory practices
(h) Provide regular, formal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment
(i) Monitor the facilities and the chemical fume hoods to ensure that they are maintained and function properly.

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Laboratory Personnel/Users:

(a) Read, understand, and follow all safety rules and regulations that apply to the work area
(b) Plan and conduct each operation in accordance with the chemical hygiene safe lab practices
(c) Promote good personal housekeeping and chemical hygiene practices
(d) Notify the supervisor of any hazardous conditions or unsafe work practices in the work area
(e) Use PPE as appropriate for each lab operation that involves hazardous chemicals
(f) Complete all applicable annual safety training

Everyone is responsible for understanding and following all safety rules and regulations that apply to the work area.

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If at any time an unsafe condition, practice, or incident is identified all efforts will be made to correct it. In the event that it either cannot or will not be immediately corrected, ANYONE has the authority to stop activities until the issue has been addressed. In the event that activities are suspended the CHO, the CHC, and the appropriate Dean will be contacted and the reason will be investigated.

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No one stopping work in good faith will be reprimanded.

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Chemical Hygiene Plan (CHP)

The OSHA Laboratory standard defines a CHP as ‘‘a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace.’’ (29 CFR 1910.1450(b)). The Laboratory Standard requires a CHP: ‘‘Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan.’’ (29 CFR 1910.1450(e) (1). The CHP is the foundation of the laboratory safety program and must be reviewed and updated, as needed, and at least on an annual basis to reflect changes in policies and personnel. A CHP should be facility specific and can assist in promoting a culture of safety to protect workers from exposure to hazardous materials. The plan should be written so that users clearly know how, by who, where, and when specific tasks will be accomplished.

1. The Laboratory’s CHP must be readily available to employees ensure that employees know where/how to access the plan. Ensure that the plan is capable of protecting lab users from health hazards and minimizing exposure. Include the following topics in the CHP:
   (a) Individual chemical hygiene responsibilities
   (b) Standard operating procedures
   (c) Personal protective equipment, engineering controls and apparel
   (d) Laboratory equipment
   (e) Safety equipment
   (f) Chemical management

(g) Housekeeping
(h) Emergency procedures for accidents and spills
(i) Chemical waste
(j) Training
(k) Safety rules and regulations
(l) Laboratory design and ventilation
(m) Exposure monitoring
(n) Compressed gas safety
(o) Medical consultation and examination

***It should be noted that the nature of laboratory work may necessitate addressing biological safety, radiation safety and security issues.

2. Chemical Procurement, Distribution, and Storage

Chemical Procurement:

(a) Information on proper handling, storage, and disposal should be known to those who will be involved before a substance is received
(b) Only containers with adequate identifying labels should be accepted
(c) Ideally, a central location should be used for receiving all chemical shipments
(d) Shipments with breakage or leakage will~~should~~ be refused~~. or opened in a chemical hood~~
(e) Only the minimum amount of the chemical needed to perform the planned work should be ordered
(f) Purchases of high risk chemicals ~~should~~ must be reviewed and approved by the CHC~~O~~
(g) Proper protective equipment and handling and storage procedures should be in place before receiving a shipment

Chemical Storage:

(a) Chemicals should be separated and stored according to hazard category and compatibility
(b) SDS and label information should be followed for storage requirements
(c) Maintain existing labels on incoming containers of chemicals and other materials
(d) Labels on containers used for storing hazardous chemicals must include the chemical identification and appropriate hazard warnings
(e) The contents of all other chemical containers and transfer vessels, including, but not limited to, beakers, flasks, reaction vessels, and process equipment, will~~should~~ be properly identified
(f) Chemical shipments should be dated upon receipt and stock rotated
(g) Peroxide formers will~~should~~ be dated upon receipt, again dated upon opening, and stored away from heat and light with tightfitting, nonmetal lids. Once open they need to be periodically tested with peroxide test strips.
(h) Open shelves used for chemical storage should be secured to the wall and contain 3/4-inch lips. Secondary containment devices should be used as necessary
(i) Consult the SDS and keep incompatibles separate during transport, storage, use, and disposal
(j) Oxidizers, reducing agents, and fuels should be stored separately to prevent contact in the event of an accident
(k) Chemicals may~~should~~ not be stored in the chemical hood, on the floor, in areas of egress, on the benchtop, or in areas near heat or in direct sunlight

(l) Laboratory-grade, flammable-rated refrigerators and freezers should be used to store sealed chemical containers of flammable liquids that require cool storage. These refrigerators and freezers must be labeled with "Do not store food or beverages" ~~in the laboratory refrigerator~~

(m) Highly hazardous chemicals should be stored in a well-ventilated and secure area designated for that purpose

(n) Flammable chemicals should be stored in a spark-free environment and in approved flammable-liquid containers and storage cabinets. Grounding and bonding should be used to prevent static charge buildups when dispensing solvents

(o) Chemical storage and handling rooms will~~should~~ be controlled-access areas. They should have proper ventilation, appropriate signage, diked floors, and fire suppression systems

Chemical Handling:

(a) As described above, a risk assessment should be conducted prior to beginning work with any hazardous chemical for the first time

(b) All SDS and label information should be read before using a chemical for the first time

(c) Trained laboratory users should ensure that proper engineering controls (ventilation) and PPE are in place

Chemical Inventory:

(a) Prudent management of chemicals in any laboratory is greatly facilitated by keeping an accurate inventory of the chemicals stored

(b) Unneeded items should be discarded or returned to the storeroom

Transporting Chemicals*:*

(a) Secondary containment devices should be used when transporting chemicals

(b) When transporting chemicals outside of the laboratory or between stockrooms and laboratories, the transport container should be break-resistant.

(c) High-traffic areas should be avoided.

Transferring Chemicals:

(a) Use adequate ventilation (such as a fume hood) when transferring even a small amount of a particularly hazardous substance (PHS)

(b) While drum storage is not appropriate for laboratories, chemical stockrooms may purchase drum quantities of solvents used in high volumes. Ground and bond the drum and receiving vessel when transferring flammable liquids from a drum to prevent static charge buildup. Drums should be placed on a spill pallet, not directly on the floor, that is designed to contain 10% of the total volume of chemicals or 100% of the largest container, whichever is greater.

(c) If chemicals from commercial sources are repackaged into transfer vessels, the new containers will~~should~~ be labeled with all essential information on the original container

3. Waste Management:

A waste management plan and how to access that plan must~~should~~ be in place before work begins on any laboratory activity. The plan should utilize the following hierarchy of practices:

(a) Reduce waste sources. The best approach to minimize waste generation is by reducing the scale of operations, reducing its formation during operations, and, if possible, substituting less hazardous chemicals for a particular operation

(b) Reuse surplus materials. Only the amount of material necessary for an experiment should be purchased, and, if possible, materials should be reused
(c) Recycle waste. If waste cannot be prevented or minimized, the organization should consider recycling chemicals that can be safely recovered or used as fuel
(d) Dispose of waste properly. Sink disposal may not be appropriate. Proper waste disposal methods include incineration, treatment, and land disposal. The organization's environmental health and safety (EHS) office should be consulted in determining which methods are appropriate for different types of waste

Collection and Storage of Waste:
(a) Chemical waste should be accumulated at or near the point of generation, under the control of laboratory supervisors
(b) Each waste type should be stored in a compatible container pending transfer or disposal. Waste containers must~~should~~ be clearly labeled and kept sealed when not being actively filled~~in use~~
(c) Incompatible waste types must~~should~~ be kept separate to ensure that heat generation, gas evolution, or another reaction does not occur
(d) Waste containers should be segregated by how they will be managed. Waste containers should be stored in a designated location that does not interfere with normal laboratory operations. Ventilated storage and secondary containment may be appropriate for certain waste types
(e) Waste containers must~~should~~ be clearly labeled and kept sealed when not being actively filled~~in use~~. Labels should include the accumulation start date and hazard warnings as appropriate
(f) Non-explosive electrical systems, grounding and bonding between floors and containers, and non-sparking conductive floors and containers should be used in the central waste accumulation area to minimize fire and explosion hazards. Fire suppression systems, specialized ventilation systems, and dikes should be installed in the central waste accumulation area
(g) Waste management workers will~~should~~ be trained in proper waste handling procedures as well as contingency planning and emergency response. Trained laboratory users most familiar with the waste should be actively involved in waste management decisions to ensure that the waste is managed safely and efficiently. Engineering controls should be implemented as necessary, and personal protective equipment should be worn by workers involved in waste management.

(See System Procedure 5.24.1-Hazardous Waste Management and Donated Materials)

4. Inspection Program:
Maintenance and regular inspection of laboratory equipment are essential parts of the laboratory safety program. Management should participate in the design of a laboratory inspection program to ensure that the facility is safe and healthy, workers are adequately trained, and proper procedures are being followed. The program should include an appropriate combination of routine inspections, self-audits, program audits, peer inspections, EHS inspections, and inspections by external entities.

Elements of an inspection:
(a) Inspectors should bring a checklist to ensure that all issues are covered and a camera to

document issues that require correction
(b) Conversations with workers should occur during the inspection, as they can provide valuable information and allow inspectors an opportunity to show workers how to fix problems
(c) Issues resolved during the inspection should be noted
(d) An inspection report containing all findings and recommendations should be prepared for management and other appropriate workers
(e) Management should follow-up on the inspection to ensure that all corrections are implemented

4. Training and Information:
Personnel training at all levels within the organization, is essential. Responsibility and accountability throughout the organization are key elements in a strong safety and health program. The employer is required to provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area (29 CFR 1910.1450(f)). This information must be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training should be determined by the employer. At a minimum, laboratory personnel should be trained on their facility's specific CHP, methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released), the physical and health hazards of chemicals in the work area and means to protect themselves from these hazards. Trained laboratory users must know shut-off procedures in case of an emergency. All SDSs must be made available to the laboratory users.

5. Medical Consultation and Examination:
The employer must provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations that the examining physician determines to be necessary, whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory. If an employee encounters a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee must be provided an opportunity for a medical consultation by a licensed physician. All medical examinations and consultations must be performed by or under the direct supervision of a licensed physician and must be provided without cost to the employee, without loss of pay and at a reasonable time and place. The identity of the hazardous chemical, a description of the incident, and any signs and symptoms that the employee may experience must be relayed to the physician.

Emergency Planning

In addition to laboratory safety issues, laboratory personnel should be familiar with established campus policies and procedures regarding emergency situations. Topics may include, but are not limited to:
(1) Evacuation procedures—when it is appropriate and alternate routes
(2) Emergency shutdown procedures—equipment shutdown and materials that should be stored

safely
(3) Communications during an emergency—what to expect, how to report, where to call or look for information
(4) How and when to use a fire extinguisher
(5) Security issues—unauthorized access
(6) Protocol for absences or illness
(7) Safe practices for power outage
(8) Shelter in place—when it is appropriate
(9) Handling suspicious mail or phone calls
(10) Laboratory-specific protocols relating to emergency planning and response
(11) Handling violent behavior in the workplace
(12) First-aid and CPR training, including automated external defibrillator training if available.

It is prudent that laboratory personnel are also trained in how to respond to short-term, long-term and large-scale emergencies. Laboratory security can play a role in reducing the likelihood of some emergencies and assisting in preparation and response for others. Every institution, department, and individual laboratory should consider having an emergency preparedness plan. The level of detail of the plan will vary depending on the function of the group and institutional planning efforts already in place.

Emergency planning is a dynamic process. As personnel, operations, and events change, plans will need to be updated and modified. To determine the type and level of emergency planning needed, laboratory personnel need to perform a vulnerability assessment. Periodic drills to assist in training and evaluation of the emergency plan are recommended as part of the training program.

Emergency Procedures

(1) Fire alarm. Most organizations use fire alarms whenever a building needs to be evacuated—for any reason. When a fire alarm sounds in the facility, evacuate immediately. Check on and assist others who may require help evacuating. If possible stop any experiment in progress, shut off gas, etc.
(2) Emergency safety equipment. The following safety elements should be met:
  a. A written emergency action plan has been provided to laboratory users
  b. Fire extinguishers, eyewash units, and safety showers are available and tested
  c. First-aid equipment, fire alarms, and telephones are available and accessible.
(3) Chemical spills. Workers should contact the CHO or EHS office for instructions before cleaning up a chemical spill. All SDS and label instructions should be followed, and appropriate PPE should be worn during spill cleanup
(4) Accident procedures. In the event of an accident, immediately notify appropriate personnel and local emergency responders. Provide an SDS of any chemical involved to the attending physician. Complete an accident report and submit it to the appropriate office or individual within 24 hours
(5) Employee safety training program. New workers should attend safety training before they begin any activities. Additional training should be provided when they advance in their duties or are required to perform a task for the first time. Training documents should be recorded and maintained. Training should include hands-on instruction of how to use safety equipment appropriately
(6) Conduct drills. Practice building evacuations, including the use of alternate routes. Practice

shelter-in-place, including plans for extended stays. Walk the fastest route from your work area to the nearest fire alarm, emergency eye wash and emergency shower. Learn how each is activated. In the excitement of an actual emergency, people rely on what they learned from drills, practice and training

(7) Contingency plans. All laboratories should have long-term contingency plans in place (e.g., for pandemics). Scheduling, workload, utilities and alternate work sites may need to be considered

(8) Signs. Prominent signs of the following types should be posted:
   a. Emergency telephone numbers of emergency personnel/facilities, supervisors, etc.
   b. Location signs for safety showers, eyewash stations, other safety and first aid equipment, and exits
   c. Warnings at areas or equipment where special or unusual hazards exist

Laboratory Security

Laboratory security has evolved in the past decade, reducing the likelihood of some emergencies and assisting in preparation and response for others. Most security measures are based on the laboratory's vulnerability. Risks to laboratory security include, but are not limited to:

(1) Theft or diversion of chemicals, biologicals, and radioactive or proprietary materials, mission-critical or high-value equipment
(2) Threats from activist groups
(3) Intentional release of, or exposure to, hazardous materials
(4) Sabotage or vandalism of chemicals or high-value equipment
(5) Loss or release of sensitive information
(6) Rogue work or unauthorized laboratory experimentation.

Security systems in the laboratory are used to detect and respond to a security breach, or a potential security breach, as well as to delay criminal activity by imposing multiple layered barriers of increasing stringency. A good laboratory security system will increase overall safety for laboratory personnel and the public, improve emergency preparedness by assisting with preplanning, and lower the organization's liability by incorporating more rigorous planning, staffing, training, and command systems and implementing emergency communications protocols, drills, background checks, card access systems, video surveillance, and other measures. The security plan should clearly delineate response to security issues, including the coordination of institution and laboratory personnel with both internal and external responders.

Reference: 29 CFR 1910.1450, Appendix A