LABORATORY (CHEMICAL HYGIENE) REQUIREMENTS
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For information call 919-733-3265 or email mfulmer@ospadmin.osp.state.nc.us
Online at http://www.osp.state.nc.us/ Click on Safety/OSP Industrial Hygiene Requirements.

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Purpose

Requirements for protection of employees against exposure to hazardous chemicals in laboratories have been established to provide guidelines for compliance with 29 CFR 1910.1450, the OSHA Occupational Exposure to Hazardous Chemicals in Laboratories Standard.

Scope and Definitions

The OSHA Laboratory Standard applies to laboratories using hazardous chemicals. OSHA defines a hazardous chemical as a substance for which there is statistically significant evidence, based on at least one scientific study, showing that acute or chronic harm may result from exposure to that chemical. This broad definition clearly applies to all, or almost all, of the chemicals typically used in State laboratories.

The standard applies to all laboratory employees. In addition to employees who ordinarily spend their full time working within a laboratory space, “laboratory employee” also includes office, custodial, maintenance, and repair personnel, and others who, as part of their duties, regularly spend a significant amount of their working time within a laboratory environment. Each state agency must determine what constitutes a “significant amount” of working time. The definition is subject to review at the time of an OSHA visit.

The Laboratory Standard does not apply to laboratories where commercial quantities of materials are produced.

Some laboratories may come under the requirements of a substance-specific standard. For example, laboratories involved in histology, pathology, and human or animal anatomy must comply with the specific requirements of the OSHA formaldehyde standard.

Responsibilities of State Agencies and Universities

OSHA requires that a Chemical Hygiene Officer be appointed who is responsible for preparing, carrying out, and maintaining a Chemical Hygiene Plan.

The Chemical Hygiene Officer needs to be qualified by training and experience to provide technical guidance in developing and carrying out the plan. While the head of the agency has the ultimate responsibility for chemical safety, the Chemical Hygiene Officer acts as the representative of the agency head in this capacity. Where there is more than one laboratory, more than one person may serve as a Chemical Hygiene Officer.
The attached generic chemical hygiene plan gives broad guidelines for the Chemical Hygiene Officer in preparing a plan. It is for the simple case, the case that exists generally in State laboratories, where:

1. Chemicals used do not include select carcinogens, reproductive toxins, or substances with a high degree of acute toxicity that require sophisticated precautionary measures. Complex situations requiring sophisticated safety measures are usually confined to research laboratories. If these chemicals are being used in undergraduate teaching laboratories or analytical laboratories, safe alternatives or substitutes need to be found.
2. There is no indication that exposures are at or above the OSHA limits. It is rare nowadays to find concentrations of chemicals above OSHA permissible exposure limits in State workplaces and extremely rare to find concentrations above safe limits in State laboratories. Not only are exposures not excessive, they are well below what is commonly accepted as a safe level, i.e., below regulatory concern. OSHA requires exposure monitoring when there is reason to believe that employee exposures routinely exceed the OSHA action level or permissible exposure limit in the absence of an action level. It is expected that little or no monitoring will need to be done in State laboratories. If the Chemical Hygiene Officer believes monitoring needs to be carried out it is always worth asking: Is the material needed? Is there a safer alternative? Is there a substitute?

Respirators are appropriate for use in few, if any, State laboratories. The proper use of respirators is in emergency situations where material cannot be fully contained and people must be in a zone of contamination. Even then their use requires careful consideration, technical knowledge, and training. If an emergency occurs as the result of an accident, it is generally the policy to call the Fire Department to handle it. Furthermore, it should be the policy in every laboratory that no one handles a toxic substance in an open laboratory

thereby creating the potential for unsafe concentrations in the air. One person handling a toxic substance in an open laboratory has no right to be protected with a respirator while other workers are exposed.

OSHA Directive CPL 2-0.120 states that if the employer has followed the proper protective measures required by the standard, and it is unlikely that lack of a plan or a deficiency in the plan will result in failure to follow proper practices in the future, a citation for an other-than-serious violation with no penalty shall normally be issued. In such cases, OSHA will provide literature to assist in developing a plan and inform the employer of possible penalties for subsequent violations.

Ergonomics

Primary ergonomics workplace risks in laboratories include:

- Biosafety cabinets. The largest problem has been compromising the human neutral position. New cabinets incorporate footrests and height-adjustable work surfaces.
- Pipette usage (frequency/force): Newer models are completely electronic and some can handle as many as 8 pipettes. Trigger mechanisms are being incorporated into these models to avoid single digit functioning, which has led to heightened repetitive strain injuries. Typically, initiating a pipette can exert 5 to 8 lb. of pressure on a finger. Rotate worker activities and have frequent microbreaks.
- Microscope use: Predominant hazards include neck flexion, back flexion, and the rounding of the back and shoulders. Use adjustable chairs, analyze work height and provide table leg cut-outs, adequate arm/hand rests, and microbreaks.
- Officer ergonomics (worksite design): Entering data and creating reports is a key function of research. See *REQUIREMENTS FOR REDUCING PROBLEMS OF HAND AND ARM PAIN OF VDT USERS AND REQUIREMENTS FOR VDT SAFETY* on this website.

Web Sites and Videos

The Centers for Disease Control and Prevention's web site defines acronyms and terminology in MSDSs at: www.cdc.gov/od/ohs/manual/chemical/chmsaf5.htm.

OSHELINK has training outlines, etc on http:www.oshelink.com.

Call 919 807 2848 or fax 919-733-6197 to request videos on laboratory safety from the Department of Labor.

A GENERIC CHEMICAL HYGIENE PLAN

This document sets forth the procedures for carrying out a Chemical Hygiene Plan at the (name of laboratory) Laboratory. Components of the Plan are in Section A. The responsibilities of participants are set forth in Section B.

The purpose of the Plan is to protect employees from health hazards associated with hazardous chemicals in the laboratory. It is intended for use by managers, supervisors, laboratory employees, and other interested or affected parties concerned with laboratory chemical hygiene.

Attached is a list of the chemicals employees use in the laboratory. (NOTE: The decision whether or not to compile a list is left up to the Chemical Hygiene Officer. OSHA does not require a list, but to be sure all hazardous chemicals are covered in the Plan, a list is useful.)

A COMPONENTS OF THE CHEMICAL HYGIENE PLAN

1 Basic Rules and Procedures

The laboratory supervisor is responsible for making sure that these rules and procedures are followed in laboratories:

- Use locally exhausted workplaces for operations when their use is prescribed in the Standard Operating Procedure. (NOTE: As a general rule, a hood or other local ventilation device is needed when working with volatile substances. Brief intense inhalation of solvents can produce a high brain concentration and symptoms such as dizziness and nausea.)
- Use gloves, aprons, and chemical goggles plus face shields as splash protection as needed when handling substances that can affect the skin and/or eyes: OSHA does not mandate use of eye protection in laboratories but it is our policy that eye protection shall be the norm all the time in any laboratory where chemicals are handled. OSHA policy about contact lenses as stated in the preamble to the revisions to 29 CFR 1910. Subpart I is as follows: "Contact lenses do not pose additional hazards to the wearer. The Agency wants to make it clear, however, that contact lenses are not eye protective devices. If eye hazards are present, appropriate eye protection must be worn instead of, or in conjunction with, contact lenses."
- Promptly flush eyes with water for at least 15 minutes if chemicals contact the eyes; seek medical attention if needed.
- Promptly flush skin with water if chemicals contact skin and seek medical attention if symptoms persist.
- Inspect gloves before use, wash them before removal, replace them periodically, and use the type of glove specified in the Standard Operating Procedure. Remove clothing and gloves immediately upon contamination.

(NOTE: Gloves should not be relied upon to prevent exposure. Proper technique should prevent material from getting onto the hands; gloves should be worn just in case anything goes wrong. Many chemicals can penetrate rubber and plastic.)

- Obtain approval of the Chemical Hygiene Officer before modifying ventilation systems.
- Do not eat, drink, smoke, chew gum, or apply cosmetics in the laboratory and wash hands before conducting these activities.
- Beware of overly simple rules such as storing like chemicals together. E.g., this puts concentrated nitric acid with acetic acid, a combination of oxidant and fuel that will combust immediately and violently.
- Store flammables in a flammable storage cabinet. (NOTE: A proper flammable cabinet will be made either of thick wood or double-walled metal to provide insulation; it will have hinges and locks that will not fail in a fire, flame-proofed ventilation, and an effective tray to retain the contents of several containers.)
- Store flammables in refrigerators designed for flammable storage and labeled as to use; do not store flammables in conventional refrigerators.
- Handle explosive chemicals with care. An explosive chemical on some type of initiation (heat, shock, friction, light, and contamination from noncompatible material) undergoes a sudden violent change releasing excessive energy. To prevent explosions:
    - Use peroxide forming solvents such as diisopropyl ether used in chromatography within 24 hours. Peroxide forming solvents to which a peroxidization inhibitor has been added can be used longer.
    - Keep multi-nitro-aromatics such as picric acid and hexanitrodiphenylamine hydrated and away from metal-bearing compounds.
    - Keep metal-bearing compounds such as copper or lead away from azides and perchlorates to prevent formation of heavy metal azides and peroxides which are notoriously shock-sensitive and potentially explosive, especially when allowed to dry out. Don’t use a metal spatula
    - Keep potassium and sodium metal covered with oil or a hydrocarbon solvent. These metals can form superoxide layers on the surface when exposed to air as can some sodium and potassium compounds such as the amides of sodium and potassium.
- Label all containers and do not deface labels. If a container is unlabeled it is not always possible to determine if the container is safe or merely unmarked.
- Do not store food or beverages in storage areas, refrigerators, glassware, or utensils which are used for laboratory operations.
- Do not use damaged glassware.
- Use equipment only for its designated purpose.
- Avoid practical jokes or other behavior which might confuse startle, or distract other employees.

- Call the Fire Department to handle emergencies.
- Do not use mouth suction for pipetting or starting a siphon.
- Confine loose clothing and long hair.
- Wear shoes but do not wear sandals, perforated shoes, or sneakers.
- Keep the work area clean and uncluttered with chemicals and equipment.
- Whenever possible, keep chemicals in cupboards rather than on the bench, with a sign to remind users to wear eye protection when getting material out.
- Clean up the work area on completion of an operation or at the end of each day.
- Avoid working alone in the laboratory.
- Promptly clean up spills, using appropriate protective apparel, equipment and disposal procedures described in the Standard Operating Procedure.
- Avoid unnecessary exposure to chemicals.
- Do not smell or taste chemicals.

2 Criteria Used to Determine and Implement Control Measures

The Chemical Hygiene Officer will make sure that the following specific measures are taken to ensure that control measures are in place and are adequate and effective:

- Standard Operating Procedures relevant to all laboratory operations to be followed by laboratory employees are in the laboratory and employees have been told where they are located.
- Monitoring is performed when employees report symptoms that could be related to workplace exposure or there is any indication that the action level or permissible exposure limit is approached. In the unlikely event that exposure monitoring shows safe limits are exceeded, control measures to reduce employee exposure to hazardous chemicals are carried out. Control measures when exposures exceed safe limits include engineering controls, use of personal protective equipment, and personal hygiene practices. Examples of engineering controls include (1) provision for at least 2.5 linear feet of hood space for every two workers who spend most of their time working with chemicals, (2) checking hood flow rates every 3 months and checking that airflow into and within the hoods is not excessively turbulent--hood face velocities generally need to be within the range of 75 to 135 linear feet per minute with a coefficient of variation of <20% (a face velocity of 100 fpm when the hood is open 18" is an often quoted rule of thumb), (3) conducting airflow visualization tests (smoke) that show there is complete containment of smoke and good distribution and capture in hoods, and (4) providing 4 to 12 air exchanges per hour in the laboratory.

Criteria used at present to evaluate control measures are these:

- An adequate supply of clean personal protective equipment that is free of defects is maintained in the laboratory.
- Air flow is not turbulent and is relatively uniform throughout the laboratory.
- The laboratory is under negative pressure with respect to the hallway as indicated by smoke tests.
- The exhaust hoods are equipped to allow confirmation that they are working. A simple test that shows if the hood is working is to place a strip of thin plastic or other light flexible material cut into thin lengths of about 4 to 6" or a ping pong ball at the bottom of the hood. They should move to an inward deflected position

3 Provision for Employee Information and Training

The laboratory supervisor will provide laboratory employees with information and training about hazards of chemicals present in their work area before the employee's initial assignment to the area and again when an assignment involves new exposure situations.

Classroom training of employees is often desirable but is not essential. OSHA does not mandate how employees are to be informed and trained. OSHA requires that, if questioned by an OSHA inspector, employees must be able to answer questions about the hazards of the chemicals they work with. Informal group or individual discussions with the Chemical Hygiene Officer or supervisor, posted notices, or handout booklets can be effective. Commercial "canned" programs can be effective, especially if supplemented with information specific to the work site. Information provided to employees must include as a minimum:

- The content and requirements of the OSHA laboratory standard.
- The content, location, and availability of the Chemical Hygiene Plan.
- The permissible exposure limits, action levels, and other recommended exposure limits for hazardous chemicals used in the laboratory.
- Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
- The location and availability of MSDSs and other reference material.
- Any operation in their work area where hazardous chemicals are present.

Employee training must include as a minimum:

- Methods and observations used to detect the presence or release of a hazardous chemical.
- A discussion of the hazards associated with the chemicals used in the laboratory.
- The measures they can use to protect themselves from these hazards.
- Emergency procedures.
- The details of the laboratory's Chemical Hygiene Plan.

It is useful to keep a roster of employees who have attended training sessions to document training.

4 Medical Consultation and Medical Examinations

The Chemical Hygiene Officers, or their designees, will see that employees are given the opportunity to receive medical attention whenever there is a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure.

Chemical Hygiene Officers, or their designees will give the physician specific information on the identity of the hazardous chemical, conditions under which the exposure occurred, and a description of the signs and symptoms experienced by the employee. The Chemical Hygiene Officer will obtain information from the physician about follow-up examinations, results of examination(s), medical condition of the employee that might pose increased risk, and a statement that the employee was informed of the results of the examination.

5 Hazard Identification

Laboratory supervisors will see that chemical containers are labeled. They will also keep Material Safety Data Sheets for hazardous chemicals and make them readily accessible to employees. A chemical identifier such as the trade name of the substance will be used to link the MSDS with the label information and with its location on the list of chemicals if a list of chemicals is maintained.

6 Recordkeeping

The Chemical Hygiene Officer will make sure that monitoring records, if any, are kept for at least 30 years and that medical records, if any, are kept for at least the duration of employment plus 30 years.

B RESPONSIBILITIES FOR THE CHEMICAL HYGIENE PLAN

1 Department Head

The department head is responsible for:

- Selecting competent people to carry out the Plan.
- Issuing standard operating procedures for each phase of the plan; e.g., an information and training program.
- Issuing specific policy statements for elements of the program; e.g., emergency response.
- Budgeting money if monitoring, medical evaluation, personal protective equipment, or engineering controls are needed.
- Acting on recommendations submitted by the Chemical Hygiene Officer.
- Adopting a plan for disciplinary action as a corrective measure against employees who violate procedures in the Plan.

2 Laboratory Supervisor

The laboratory supervisor is responsible for:

- Notifying employees of monitoring results, if any.
- Enforcing use of engineering controls, safe work practices, and required personal protective equipment.
- Making sure that hoods and exhaust fans are functioning properly.
- Maintaining an adequate supply of personal protective equipment in the laboratory and noting misuse that would diminish effectiveness of the equipment.
- Answering employee's questions and concerns and carrying out employee's ideas when they are workable.
- Forwarding unresolved questions and concerns and unworkable ideas to the Chemical Hygiene Officer for response.
- Providing training and information to laboratory employees.
- Considering disciplinary action as a corrective measure against offenders and sending a report of each disciplinary action to the Chemical Hygiene Officer.
- Making sure that employees who develop signs or symptoms associated with hazardous chemicals are given an opportunity to receive medical attention.
- Making available to employees the Chemical Hygiene Plan, permissible exposure limits for hazardous chemicals, information on signs and symptoms associated with exposures to hazardous chemicals used, and Material Safety Data Sheets for hazardous chemicals used.

3 Laboratory Employees

Laboratory employees are responsible for:

- Sharing their knowledge of potential workplace hazards with the Chemical Hygiene Officer and the laboratory supervisor.
- Telling their supervisor if they develop signs or symptoms associated with a hazardous chemical to which they are exposed.
- Complying with basic laboratory rules and procedures.
- Following established safe work practices.
- Making an effort to be fully informed, obtaining help when necessary, and using engineering controls and personal protective equipment correctly at all times.

4 Chemical Hygiene Officer

The Chemical Hygiene Officer is accountable for making sure the Plan works. The Chemical Hygiene Officer is responsible for:

- Keeping the Chemical Hygiene Plan up to date.
- Replying to unresolved questions, concerns, and ideas forwarded by the supervisor.
- Maintaining, reviewing, interpreting, and analyzing records of monitoring results.
- Making sure all "laboratory employees" have been adequately trained and informed.
- Providing technical support.

ADMINISTRATION

1 **_____** **Signature:_____**
Department head is responsible for overall Plan administration
Date:_____

2 **_____** **Signature:_____**
Chemical Hygiene Officer is responsible for technical support and making sure the Plan works
Date:_____

3 **_____** **Signature:_____**
Laboratory Supervisor is responsible for carrying out the Plan.
Date:_____