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ENVIRONMENTAL HEALTH & SAFETY

Chemical Hygiene Plan

UNC CHARLOTTE
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I. PURPOSE

A. The Chemical Hygiene Plan (CHP) is a written program describing procedures, work practices, equipment, and personal protective equipment (PPE) used to protect laboratory workers from hazardous chemicals used in the laboratory. The basis for the CHP is the Occupational Safety and Health Administration (OSHA) standard 1910.1450 - Occupational exposure to hazardous chemicals in laboratories (Lab Standard).

B. In standard 1910.1450 Appendix A, OSHA references recommendations based on the National Research Council's (NRC) 2011 edition of Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, "Prudent Practices". It is available from the National Academies Press, 500 Fifth Street NW., Washington DC 20001 (www.nap.edu). "Prudent Practices" is cited because of its wide distribution, acceptance, and preparation by recognized authorities in the laboratory community.

C. Laboratory workers need to understand the hazards and risks associated with the activities performed in the laboratory prior to beginning experiments. They can then conduct their work under conditions that reduce the risks posed from these hazards.

II. SCOPE

A. The CHP includes each of the following elements and indicates specific measures that the University will take to ensure laboratory employee protection.

Table 1: OSHA Citations and Requirements

OSHA Citation	Requirement
1910.1450(e)(3)(i)	Standard operating procedures (SOPs) are to be followed when laboratory work involves the use of hazardous chemicals.
1910.1450(e)(3)(ii)	Control measures to reduce employee exposure to hazardous chemicals. These include engineering controls, the use of personal protective equipment and hygiene practices.
1910.1450(e)(3)(iii)	Fume hoods and other protective equipment must be functioning properly, and specific measures taken to ensure proper and adequate performance of this equipment.
1910.1450(e)(3)(iv)	Provisions for employee information and training.
1910.1450(e)(3)(v)	The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the responsible University oversight before implementation.
1910.1450(e)(3)(vi)	Provisions for medical consultation and medical examinations as required by regulation.

III. DEFINITIONS

A. Chemical Hygiene Officer (CHO) means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

B. Chemical Hygiene Plan (CHP) means a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment (PPE), and work practices that are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and meets the requirements of paragraph(e) in 1910.1450.

C. Emergency means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

D. Hazardous chemical means any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, or hazard not otherwise classified. (§1910.1200)

E. Health hazard means a chemical that is classified as posing one of the following hazardous effects:

1. Acute toxicity (any route of exposure)
2. Skin corrosion or irritation
3. Serious eye damage or eye irritation
4. Respiratory or skin sensitization
5. Germ cell mutagenicity
6. Carcinogenetic
7. Reproductive toxicity
8. Specific target organ toxicity (single or repeated exposure)
9. Aspiration hazard

F. The criteria for determining whether a chemical is classified as a health hazard are detailed in Appendix A of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definition of "simple asphyxiant").

G. Laboratory means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

H. Mutagen means chemicals that cause permanent changes in the amount or structure of the genetic material in a cell. Chemicals classified as mutagens in accordance with the Hazard Communication Standard (§1910.1200) shall be considered mutagens for purposes of this section.

I. Physical hazard means a chemical classified as posing one of the following hazardous effects:

1. Explosive
2. Flammable (gases, aerosols, liquids, or solids)
3. Oxidizer (liquid, solid, or gas)
4. Self-reactive
5. Pyrophoric (gas, liquid, or solid)
6. Self-heating
7. Organic peroxide
8. Corrosive to metal
9. Gas under pressure
10. In contact with water emits flammable gas or combustible dust

J. The criteria for determining whether a chemical is classified as a physical hazard are in appendix B of the Hazard Communication Standard (§1910.1200) and §1910.1200(c) (definitions of "combustible dust" and "pyrophoric gas").

K. Protective laboratory practices and equipment means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

L. Reproductive toxins mean chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard (§1910.1200) shall be considered reproductive toxins for purposes of this section.

M. Safety Data Sheet (SDS)

1. The SDS describes the specific hazards and properties of a chemical in a set format to allow end users to locate the information needed efficiently. For example, Section 4 on an SDS will always contain the First-Aid Measures from one chemical to the next. The SDS provides information on physical, environmental, and health hazards, along with safety handling and storage procedures.

N. Select carcinogen means any substance which meets one of the following criteria:

1. It is regulated by OSHA as a carcinogen; or
2. It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or
3. It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or
4. It 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:

    a. 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/m^3; or

    b. After repeated skin application of less than 300 (mg/kg of body weight) per week; or

    c. After oral dosages of less than 50 mg/kg of body weight per day.

O. Standard Operating Procedure (SOP)

1. A step-by-step instruction that describes in detail how to perform a task or process. Laboratories should maintain SOPs specific to their hazards, processes, and/or equipment required to perform the tasks safely.

IV. PROGRAM RESPONSIBILITIES

In addition to those defined by the University Policy Statement 703, the following individuals assume responsibility for the implementation of this plan as described below.

A. Executive Leadership

UNC Charlotte has the responsibility to ensure compliance with OSHA compliance regulations.

B. Environmental Health and Safety (EHS) Director

1. Planning and recommending EHS programs which comply with all federal, state, and local laws and regulations.

2. Overseeing the activities of the CHO.

C. Chemical Hygiene Officer (CHO)

1. Develop the Chemical Hygiene Plan and program.
2. Provide technical guidance to department heads, supervisors, and laboratory workers in the development and implementation of the provisions of the CHP.
3. Annually review and update, if needed, to the chemical hygiene program in accordance with 1910.1450(e)(4).

D. Department Head (Chair, Director)

1. Planning and developing budget requests ensure that the necessary health and safety measures under the CHP are implemented.
2. Developing and fostering proper attitudes towards Health and Safety.
3. Enforcing Environmental Health and Safety requirements by invoking disciplinary action or administrative sanction.

E. Principal Investigator (PI)/Lab Manager

1. Be familiar with the regulations and University policies and programs, which pertain to the laboratory.
2. Provide safe working conditions, knowing environmental health and safety guidelines, investigating accidents, reporting accidents and unsafe conditions, following up/correcting unsafe working conditions, enforcing EHS standards, and supplying appropriate equipment and training.
3. Conduct regular, informal Chemical Hygiene and Housekeeping self-inspections of their laboratory and correct any deficiencies. EHS can provide a Laboratory Safety Checklist that is used for this purpose.
4. Produce an annual chemical inventory list utilizing EHSA Onsite and the UNC Charlotte Chemical Inventory Form, which includes all chemicals present in their laboratory spaces.
5. Determine the required levels of protective apparel and equipment, ensure its availability to laboratory personnel and enforce its use.
6. Ensure that all appropriate hazard and warning signs are posted within the laboratory and that these are visible and legible.
7. Request assistance from EHS as needed, including laboratory start-ups, consultations, or other concerns.
8. Ensure that employees are trained in applicable details of the CHP and where to locate the CHP.
9. Approving lab activities outlined in Section XIV.

10. Provide written SOPs specific to potential safety and health risks arising from use of particularly hazardous chemicals or procedures within the laboratory. SOPs are used to train lab personnel on specific hazards in their lab, signed and maintained with their lab safety materials.
11. Conduct an assessment to determine the PPE requirements in the laboratory and train those under their direction on the proper use and function of PPE.
12. Ensure that the laboratory is properly decommissioned, in conjunction with the EHS office, after the completion of research activities and prior to departure from the University.

F. Laboratory Workers

1. Understanding and complying with University policies and programs, which pertain to his or her laboratory, work, including the planning and conducting of each operation in accordance with the University CHP; if you are unsure or have questions about a chemical, process/procedure ask your laboratory manager prior to starting work.
2. Using appropriate PPE as required by the operation being conducted.
3. Attending program training as required by their supervisor.

V. STANDARD OPERATING PROCEDURES (SOPs)

A. SOPs are written instructions that provide detailed information on performing a laboratory process or working with a chemical effectively and safely. Procedures that have been reviewed and documented are less likely to result in unintended and potentially harmful consequences.

B. SOPs can be specific or generic depending on the application. UNC Charlotte has developed a number of SOPs for common laboratory work. These are located under Chemical SOPs on the EHS website. Individual laboratories can use one of the existing SOPs found on the website and modify it to develop their own SOP for laboratory specific procedures.

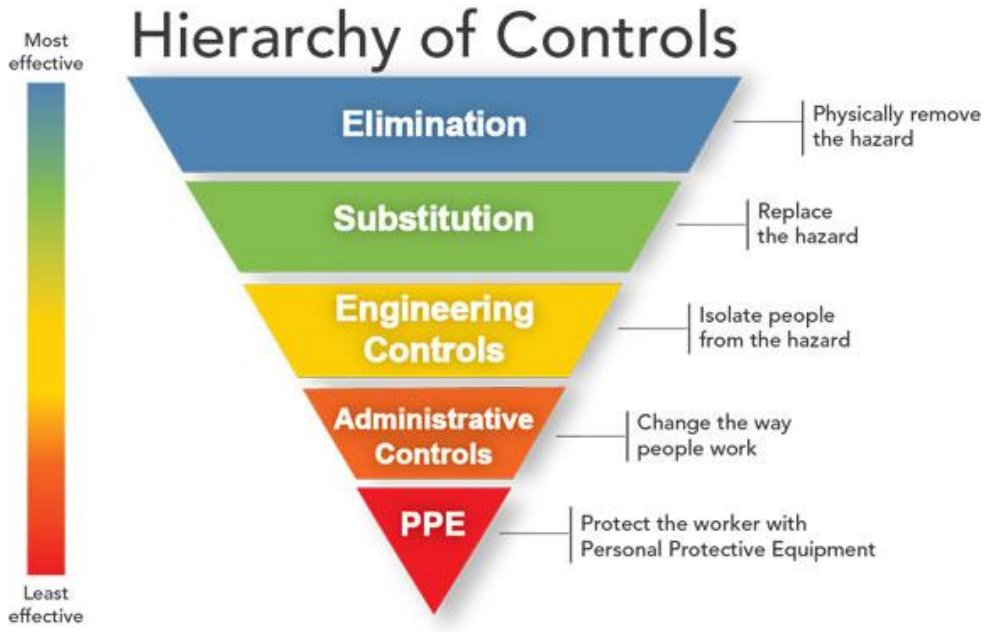
C. It is the PI's responsibility to provide written SOP specific to potential safety and health risks arising from use of hazardous chemicals or procedures within the laboratory. PIs should keep these SOPs with their safety materials and use them to train lab personnel on specific hazards in their lab.

D. In particular, the PI should develop or use SOP templates found on the EHS website for:

1. *Particularly Hazardous Chemicals*, as defined by OSHA, and includes carcinogens, reproductive toxins, and substances with a high acute toxicity.
2. *Highly Reactive Chemicals*, including highly reactive or unstable chemicals that may polymerize or decompose violently, are shock sensitive, or may react violently when exposed to pressure, temperature, light, water, or another material. Examples are pyrophoric materials, explosives, azides, and organic peroxides.
3. *Select Agents and Toxins*, as defined by the Center for Disease Control (CDC). CDC Select Agents and Toxins List

VI. CONTROL MEASURES

A. In addition to SOPs, other control measures are implemented to protect workers within the laboratory. These are defined in a hierarchy of most to least effective. The National Institute for Occupational Safety & Health (NIOSH) has a Hierarchy of Controls that should be used as a basis to eliminate or reduce occupational hazards. The control measures at the top of the pyramid are generally more effective and provide greater worker protection than those at the bottom.



1. Elimination and Substitution

Elimination and substitution are the most effective control measures since they remove the hazard completely. Elimination and substitution of hazards may be cost effective and simple to

implement during development of research, but this usually becomes more difficult for research that is in progress. Examples would be substituting toluene for benzene (a known carcinogen), non-lead solder for lead solder, or using alternatives to Ethidium bromide when DNA staining.

2. Engineering Controls

   Engineering controls physically separate the hazardous chemical and the individual working in the laboratory. They are designed to remove the hazard at the source. The main piece of engineering control in the laboratory is the chemical fume hood.

3. Administrative Controls and PPE

   Administrative controls and PPE are used where hazards cannot be controlled by elimination, substitution, or engineering controls. Aside from SOPs, general laboratory safety rules and housekeeping are administrative controls that need to be established in every laboratory (refer to Section VII).

VII. GENERAL LABORATORY SAFETY RULES

A. Prudent Practices (pgs. 15-17) describes several General Safety Rules for working in the laboratory. Below, there are eleven basic safety procedures that must always be followed:

1. Do not work alone when using hazardous materials. If an incident occurs, help will not be available.
2. Always follow SOPs, and never perform unauthorized experiments.
3. Read the SDSs and label prior to using a chemical.
4. Always wear appropriate PPE. Suitable clothing and closed toe shoes are mandatory for anyone entering a laboratory. At no time may sandals or other open toe shoes be worn in the laboratory.
5. Use a fume hood whenever working with hazardous chemicals.
6. Know the location of, and how to use, emergency equipment (i.e., safety shower, eyewash, fire-extinguisher).
7. Make sure other laboratory workers are aware of any special hazards associated with your work and be aware of hazards posed by the work of others within the laboratory.
8. Never ingest anything in the laboratory. No eating, drinking, chewing gum, etc. This is only to be done in approved break areas.
9. Immediately report any injuries, accidents or near-misses to PI or supervisor.
10. Report any unsafe conditions to the PI or supervisor.

11. Properly dispose of all chemical waste following Section XV in this plan. Waste disposal instruction and information can also be found on the EHS website under the Hazardous & Universal Waste page.

B. Housekeeping

1. Good housekeeping reduces the chance of chemical exposure and reduces the risks associated with hazardous chemicals. A clean and orderly laboratory allows for easier identification of items while working and reduces the chance of scientific error due to contamination. Referring to Prudent Practices (pgs. 113-114), the following housekeeping items should be implemented in all laboratories:

a. Do not block exits. Leave aisleways open. Keep clearance around emergency equipment (eyewashes, fire-extinguishers) and make sure electrical panels are not blocked.

b. Close drawers and cabinets when not in use. Especially fire cabinets.

c. Properly label all chemical containers. This includes transfer vessels, which must be labeled with the chemical name and hazard class. Store all chemicals with the label outward for easy identification. Refer to Section XII for more detail on labeling requirements.

d. Do not store incompatible material together.

e. Never store glass bottles on the floor, where they may be inadvertently knocked over.

f. Close all chemical containers unless you are adding or removing contents.

g. Secure gas cylinders to walls or benchtops with chains or straps.

h. Keep all containers at least 2 inches from the edge of benchtops to avoid knocking them onto the floor.

i. Clean up spills, even minor spills, immediately. This applies to liquids and solids.

j. Don’t pile up dirty glassware in the sink. “Clean as you go”. Piles of dirty glassware can hide potentially dangerous broken glass and sharp edges. It is recommended to place a rubber mat at the bottom of the sink to prevent glassware from breaking.

k. Dispose of broken glass in clearly labeled and lined Broken Glass boxes.

l. Sharps and needles are not to be re-used and must be placed in an authorized Sharps Disposal container.

VIII. PERSONAL PROTECTIVE EQUIPMENT (PPE)

A. In the laboratory, the main types of protective equipment are eyewear, gloves, and the laboratory coat. Since any work conducted that may result in vapors, fumes or dust is performed in the fume hood, respiratory protection would only be required on a case-by-case basis and requires prior approval by EHS.

B. The PI or their designee must conduct a complete assessment to determine the PPE requirements in the laboratory. This assessment should be task specific, so that the requirements are known prior to beginning work. The PI or designee is also responsible for training those under their direction on the proper use and function of PPE. This includes identification of proper PPE for the hazard, donning (put on) and doffing (take off) PPE, decontamination (if applicable), and disposal.

C. Before working with hazardous chemical(s), the user must do the following:

1. Ensure appropriate PPE is selected for the task being performed.
2. Examine the PPE to ensure it is in good working condition and free of damage.
3. Make sure PPE is the appropriate size for the user.

D. Different laboratory processes will require various types and levels of PPE. At a minimum the following PPE must be worn when working in the laboratory:

1. Closed-toe shoes that protect the entire foot.
2. Suitable clothes that covers the skin.
3. Lab coats, appropriate gloves and safety glasses or goggles are required when working with hazardous materials.

E. Due to specific hazards in the lab, additional PPE may be required. The PI or designee must determine the specific PPE requirements in their laboratory.

F. OSHA standards for PPE:

1. Eye and Face Protection 29 CFR 1910.133
2. Head Protection 29 CFR 1910.135
3. Foot Protection 29 CFR 1910.136

G. The PI must ensure that laboratory personnel follow all PPE rules and re-evaluate the hazard assessment for their laboratory whenever a new process is introduced. It is the responsibility of the PI and laboratory personnel to fully understand the hazards that require the use of PPE, both chemical and physical. Training must be completed prior to working in the laboratory.

H. Eye Protection

1. Eye protection is required at all times in the laboratory and where hazards to the eye may exist. Safety glasses with side shields are appropriate for situations where there is no risk of fumes or vapors. In cases where fumes, vapors, or a chemical splash may be present, chemical splash goggles must be worn. Contact lenses may be worn in the laboratory. In the event of eye exposure be sure to remove the lenses prior to using the emergency eyewash. Special eye protection will be necessary for protection from Ultraviolet (UV) radiation and lasers. The PI or designee will determine the eye protection that is necessary for their specific hazards.

I. Skin and Hand Protection

1. Proper attire in the laboratory is essential to prevent skin exposure from chemical or physical hazards. Clothing should not leave torso or legs exposed. Lab coats are an additional layer of protection and should be worn closed and buttoned up. The appropriate gloves should be selected based on the type of hazard. The PI or designee is responsible for assessing the hazards and determining the type(s) of gloves (i.e., nitrile, neoprene, Viton, cryogenic) or whether additional protections (i.e., acid aprons, face shield) are needed.

J. Respiratory Protection

1. If conditions exist where effective engineering controls are not possible, proper respiratory protection must be provided by the PI. Prior to working under such conditions, notification must be made to

EHS so an analysis can be performed to determine if additional controls may be put in place to avoid the use of respiratory protection. It should be noted that N-95 Filtering Facepiece Masks are considered respirators under OSHA.

K. OSHA sets Permissible Exposure Limits (PELs) to protect workers against exposure to airborne hazardous substances. In some cases, PELs may also be set for skin exposure. The OSHA PEL is based on an 8-hour time weighted average (TWA) exposure, above which laboratory personnel may not exceed. The list of chemicals with a specific PEL may be found in OSHA 1910. This list is published in 29 CFR 1910.1000 Table Z-1.

L. Medical Evaluation and Respiratory Protection Program

1. Prior to wearing a respirator, the laboratory worker must complete a medical evaluation questionnaire to determine fitness to wear the respirator. Any individual required to wear a respirator must be enrolled in the University Respiratory Protection Program. This program is administered by EHS. All medical evaluations and program training must be completed prior to using a mandatory respirator.

IX. LABORATORY SAFETY EQUIPMENT

UNC Charlotte has multiple types of Safety Equipment in use in labs to both mitigate and respond to hazard exposures. Equipment shall be maintained in accordance with both regulatory requirements and UNC Charlotte policy.

A. Emergency Eyewashes and Showers

All laboratories in which the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching and/or flushing of the eyes and body shall be provided within the work area for immediate emergency use 29 CFR 1910.151.

1. Eye washes and drench showers should be no further than 10 seconds (approximately 50 feet) from where corrosive chemicals or substances are being used. Eyewashes need to be activated periodically to ensure they are functioning safely and properly. Periodic activation helps clear the supply lines of sediment and bacteria build-up that is caused by stagnant water. Eyewashes and drench showers shall be installed per ANSI Z358.1-2014. Bottled eyewashes are not an approved alternative for plumbed eyewash stations.
2. Eyewashes should not be blocked by items or be difficult to access. When exposed staff and laboratory personnel should flush their eyes

for a minimum of 15 minutes. Remove contact lenses, if possible, before flushing.

B. Fire Extinguishers and Extinguishing Agents

Fire Safety Equipment must be easily accessible to the lab staff, including, but not limited to an available fire extinguisher. Extinguishers are not required to be placed directly in the lab, but instead may be in a main hallway outside of the lab. PIs should train and educate all members of their lab on where to locate fire extinguishers. There are four types of fires that laboratories are most susceptible to, and different extinguishers are used for each:

1. Class A fire – Ordinary combustible (ABC Extinguisher or water)
2. Class B fire – Flammable Liquids (ABC or BC extinguishers) Do not use water.
3. Class C fire – Electrical Fires (ABC or BC extinguishers) Do not use water.
4. Class D fire – Combustible Metal fire (Sand or powdered extinguishing agents, such as Met-L-X)

C. Local Exhaust Ventilation (Fume Hoods)

The chemical fume hood is an effective means of capturing toxic, carcinogenic, offensive, or flammable mists, vapors, fumes or dusts that would otherwise be released into the laboratory environment. Hoods can also provide a physical containment for laboratory operations.

1. Laboratory hoods should have a continuous monitoring device to allow confirmation of adequate hood flow. Hood face velocity should ideally be 80-120 linear feet per minute. Laboratory fume hoods will be inspected, and performance tested by EHS. When a hood is found to not be functioning properly, all hazardous chemicals should be capped or removed, and Facilities Management should be contacted as soon as possible for repair. The hood should be clearly labeled as “Out of Order” until repaired.

D. Fume Hood Usage

1. Keep your head out of the hood at all times.
2. Use proper eye protection, gloves, and laboratory coat.
3. Be sure nothing is blocking the airflow through the airfoil at the front of the hood and the baffles in the rear of the hood.
4. Elevate equipment at least two inches off the base of the hood.
5. Keep all materials at least six inches from the sash opening.

6. Do not open and close the sash rapidly, as this will cause turbulence and disturb flow.
7. Close the sash when work is complete.

E. Fume Hood Housekeeping

1. Keep the hood and adjacent areas free of clutter.
2. Keep airfoil and baffles clear to allow proper air flow.
3. Minimize the amount of equipment in the hood to prevent blockage of air flow.
4. Do not permanently store any chemicals in the hood.
5. Remove any unnecessary items from the hood.
6. Do not use the hood as a means of intentionally disposing of compressed gases or to let solvents evaporate.

F. When necessary, equipment in hoods should be fitted with traps, condensers, or filters to remove hazardous gases, vapors, or dust and prevent their release to the environment.

G. Do not use perchloric acid in an ordinary laboratory fume hood. When perchloric acid is heated above ambient temperature, vapors may condense within the exhaust system and form explosive perchlorates. To use perchloric acid, a special perchloric acid hood with a dedicated exhaust and wash down system is required. Identify perchloric hoods with appropriate signage, and do not use them as general-purpose fume hoods. Contact EHS for additional considerations, procedures, and precautions for the selection and use of perchloric acid fume hoods.

X. GUIDANCE FOR WORKING SAFELY IN THE LAB

A. Lab Specific Safety Plan

1. The PI or lab manager shall ensure that their laboratory has a laboratory specific safety plan. The plan should include:

   a. SOPs

   b. Names and phone numbers of laboratory personnel

   c. Emergency Information. Location of eyewash/shower, fire extinguisher, First Aid, automated external defibrillator (AED).

   d. Pertinent guidance documents (e.g., Radiation Safety Handbook, Laser Safety Manual).

e. Continuity of Operations guidance. Procedures to follow in the event of a short-term or long-term disruption to the lab.

B. Chemical and Physical Hazards

1. Understanding the chemical and physical properties of the materials being worked with in the laboratory is critical to limiting exposure and preventing accidents. Global standards have been established so identification of hazards will be uniform.
2. Under the CDC, the National Institute of Occupational Safety and Health (NIOSH) has published the NIOSH Pocket Guide to Chemical Hazards. This guide references physical and health hazards of 677 distinct chemicals. This guide also lists OSHA Permissible Exposure Limits.
3. The Globally Harmonized System of Classification and Labeling (GHS) includes criteria for classifying health, physical, and environmental hazards. GHS specifies information that must be included on hazardous chemical labels and on SDSs.

C. Safety Data Sheet (SDS)

1. The SDS is often the main source of information on physical and health hazards associated with a chemical or chemical product. The SDS includes information pertaining to chemical properties; the physical, health, and environmental health hazards; protective measures; and safety precautions for handling, storing, and transporting the chemical.
2. There are 16 sections in the SDS. These section headings will be the same for all SDS, no matter the manufacturer. General information about the chemical, identification, hazards, composition, safe handling practices, and emergency control measures are located in sections 1 through 8.
3. The remaining sections contain technical and scientific information, such as physical and chemical properties, stability and reactivity information, toxicological information, exposure control information, and other information including the date of preparation or last revision.
4. An up-to-date SDS must be available for all chemicals in the laboratory. Files may be electronic or paper copy, but all laboratory workers must know how to quickly access the SDS and understand the basic layout of the document.
5. The SDS should be reviewed by the laboratory worker prior to working with a chemical for the first time. Safety Data Sheets are available through the EHS website under Laboratory and Research Safety (SDS INDEX).

D. Avoidance of "routine" exposure

1. Develop and encourage safe habits and avoid unnecessary exposure to chemicals by any route. Never smell or taste chemicals. Be sure to vent any apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into fume hoods. Don't allow the release of toxic substances in cold rooms and warm rooms, since these often have contained, recirculated atmospheres. Finally, use only those chemicals for which the available ventilation system is appropriate.

E. Equipment and Glassware

1. Handle and store laboratory glassware with care to avoid damage. Examine glassware carefully before use and do not use glassware that is cracked, scratched, or showing other signs of wear or damage. Use extra care with an evacuated glass apparatus; shield or wrap to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose.

2. In the event of breakage, clean broken glassware with a brush and dustpan. Always wear hand protection if it is necessary to handle broken glassware. Never dispose of broken glass in the laboratory's general trash container. Place all broken glassware in separate, dedicated puncture-proof boxes with a clear plastic liner.

F. Personal Practices

1. Wash areas of exposed skin well before leaving the laboratory.
2. Avoid practical jokes, horseplay or other behavior that might confuse, startle, or distract another worker. Be alert to unsafe conditions and see that they are corrected when observed.
3. Do not eat, drink, smoke, chew gum, or apply cosmetics in laboratories. Dedicated areas outside of laboratories are available for eating or drinking.
4. Never store food or beverages in laboratory refrigerators. Laboratory refrigerators should have signage stating, "No Food or Drink".
5. Do not work alone in the laboratory, especially if working with chemical or physical hazards.

XI. CHEMICAL RECEIVING, DISTRIBUTION, AND STORAGE

A. Receiving

1. Before a substance is received, the individual who requisitioned the material must obtain information on proper handling, storage, and disposal. They must be aware of all hazardous properties of the

material and determine if the facilities where it will be used, and the training of the personnel involved are adequate. Often the SDS will provide the required information. An accessible copy of the SDS must be kept in the Laboratory/Department (electronic access is acceptable). Receiving personnel should be advised that the material has been ordered and should be familiar with the appropriate Department of Transportation (DOT) shipping labels. No container will be accepted without an appropriate identifying label.

2. The container label should contain the following information (as a minimum):

    a. Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party

    b. Product Identifier

    c. Signal Word

    d. Hazard Statement(s)

    e. Precautionary Statement(s)

    f. Pictogram(s)

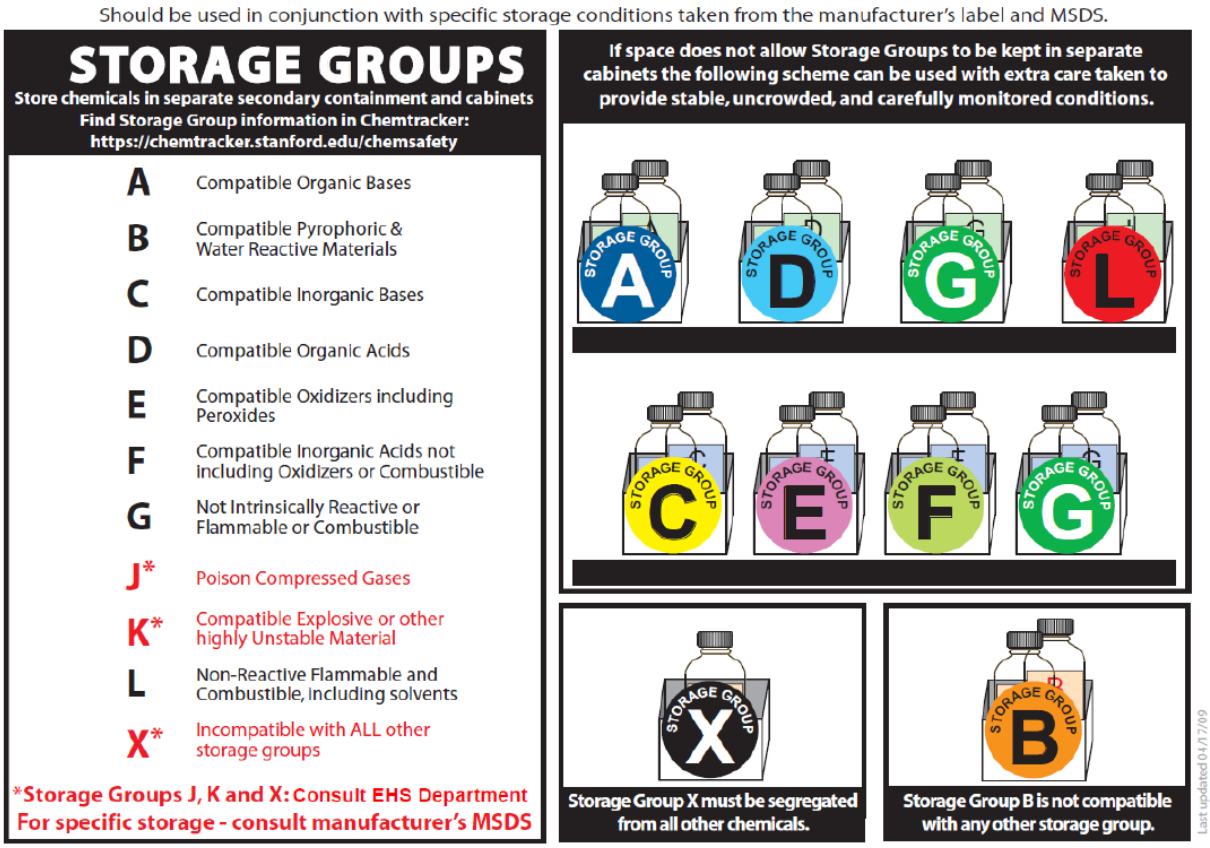
B. Chemical Distribution

1. The method of transport of chemicals should reflect both the potential danger and the potential for facility disruption posed by a specific substance. For example, for highly toxic or caustic materials, particular attention must be paid to the personal protection of the transporter.
2. When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used when possible. Carts should be sturdy and have adequately sized wheels. Flammable liquids should only be transported in proper containers.
3. Compressed gas cylinders must be handled carefully. The valve cover must always be in place for transport. Cylinders should never be rolled or dragged. A handcart should be utilized with the cylinder strapped in place, even for short distances.

C. Chemical Storage

1. Amounts of chemicals stored within the laboratory itself should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided.

Periodic inventories should be conducted, with unneeded items being properly disposed of or returned to the storeroom/stockroom. Chemicals should not be stored on the floor. Chemicals should be stored on shelves containing a lip to avoid accidental spillage.



2. Chemicals should be stored according to the following graphic from Prudent Practices (page 97), and lists examples of compatible storage groups.

D. Toxic Chemicals

1. Chemicals that are highly toxic should be stored in unbreakable secondary containers. Stored chemicals should be examined periodically for deterioration and container integrity. It is recommended that chemicals that are more hazardous be stored below eye level.

E. Pyrophoric and Spontaneously Combustible Material

1. Pyrophoric materials must be stored in tightly closed containers under an inert atmosphere or liquid. Pyrophoric materials are those that are capable of spontaneous combustion in the presence of air.

All transfers and manipulations of pyrophoric materials must also be carried out under an inert atmosphere or liquid.

F. Compressed Gas

1. Compressed gas cylinders must be stored in an upright position and securely restrained. Full cylinders not in use should have the valve cover in place. Full cylinders must be kept separate from empty cylinders and clearly identified as full or empty. Cylinders with flammable contents should be stored separated from oxygen containing cylinders by at least 20 feet.

XII. CHEMICAL LABELING

Chemical labeling is important to identify the chemical to anyone working in shared laboratory spaces or in the case of a chemical leak or spill that a third party may be responding to, so that they can be informed on the hazard(s) of the chemical. Containers or bottles with non-hazardous materials, such as water, should also be labeled to identify it to others.

A. Original Containers

Manufacturer label must remain visible and is not to be removed from the bottle while product remains. If a label becomes defaced or otherwise illegible, it is to be replaced. The replacement label must at a minimum contain the following:

1. Chemical name
2. Hazard(s)
3. Manufacturer
4. Manufacturer address and phone number

B. Secondary Containers or Stock Solutions

1. Chemicals transferred from their original container or mixed into a stock solution must be labeled with:

a. Chemical name, concentration, and hazard(s). Hazards can be communicated with words or the use of GHS pictograms.

b. The label must be legible, permanent, and in English.

c. Abbreviations may be used (e.g., 2N HCl, MeOH) with a legend posted in the lab referencing the full chemical name and primary hazard.

d. For chemicals that become more hazardous over time (such as peroxide formers), a date must be labeled and is best practice for all materials.

XIII. SIGNAGE

Signs in and around laboratories are in place as a means of quick identification of potential hazards, means of egress, and location of safety equipment. It is the responsibility of the PI to ensure that all appropriate signs are posted within the laboratory and that these are visible and legible. EHS can assist with obtaining and placement of signs for lab doors, equipment, storage, or designated use areas.

A. Labs must have postings for:

1. Emergency telephone numbers
2. Where present, signs for radiation hazard, laser hazard, strong magnet, or biohazard

B. In addition, signs indicating specific chemical storage areas and types of storage (i.e., Flammable, Corrosive) should be posted as appropriate. EHS can provide assistance with appropriate signage.

XIV. ACTIVITIES REQUIRING PRIOR APPROVAL

Some activities will require prior approval from the PI before laboratory personnel begin the activity. It is the PI's responsibility to ensure that all preliminary approval steps are complete (proper license, permit, committee approval, etc.) and that laboratory workers are trained to the hazard. Items requiring prior approval include Particularly Hazardous Substances, including carcinogens, reproductive toxins, and acutely toxic material. Radiological Material, Select Agents, Controlled Substances, Lasers, Pyrophoric or Explosive Material and Nanomaterials. These materials require specific SOPs and the PI must confirm laboratory workers are competent to work with the material, aware of the hazards, the methods of protection, and understand emergency procedures should an accident or exposure occur with the material.

A. Particularly Hazardous Substances

OSHA requires provisions be made for laboratory personnel protection when working with Particularly Hazardous Substances (PHS). This is cited under 29 CFR 1910.1450 (e)(3)(viii). These materials include carcinogens, reproductive toxins, and acutely toxic substances.

The provisions for working with these substances may include, but are not limited to:

1. Establishing a designated area for work.

2. Use of containment devices such as a fume hood or glove box.
3. Procedures for safe removal of waste contaminated with the substance.
4. Decontamination procedures.

    a. Select Carcinogens, reproductive toxins, and substances with a high degree of toxicity are all considered particularly hazardous and should be decontaminated properly.

    b. Refer to manufacturer/chemical producer guidelines when decontaminating.

    c. For more information refer to the Laboratory Decontamination Fact Sheet located on the EHS website or call EHS at 704-687-1111.

5. Storage in secondary containment.
6. Storage clearly marked to ensure personnel don't inadvertently encounter a PHS.
7. These provisions are to be listed in the SOP for the substance and are to be reviewed by laboratory personnel prior to working with the substance.
8. Carcinogens

    a. Carcinogens are substances capable of causing cancer. Carcinogens cause damage after repeated exposure or after exposure for long durations. Effects of carcinogens are typically not evident until after a long latency period. The University will follow the guidance of OSHA, the NTP and the IARC, when determining if a material is a potential carcinogen.

OSHA regulated carcinogens found in 29 CFR 1910 Subpart Z.

1,2-dibromo-3-chloropropane	Asbestos	Ethyleneimine
1,3-Butadiene	Benzene	Formaldehyde
2-Acetylaminofluorene	Benzidine	Inorganic arsenic
3,3'-Dichlorobenzidine (and its salts)	beta-Naphthylamine	Methyl chloromethyl ether
4-Aminodiphenyl	beta-Propiolactone	Methylene Chloride
4-Dimethylaminoazobenzene	bis-Chloromethyl ether	Methylenedianiline
Acrylonitrile	Cadmium	N-Nitrosodimethylamine
4-Nitrobiphenyl	Coke oven emissions	Vinyl chloride
alpha-Naphthylamine	Ethylene oxide	

9. NTP and IARC Carcinogens

    a. NTP carcinogens are categorized into several classes. Those listed as “known to be human carcinogens” and those listed as “reasonably anticipated to be human carcinogens” in the NTP’s *Report on Carcinogens* (RoC) are applicable to this section.

10. Reproductive Toxins

    a. Reproductive toxins are defined by OSHA as “chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring.” These chemicals are classified by OSHA under 29 CFR 1910.1200. The Globally Harmonized System (GHS) for chemical hazards uses the following categories:

<table>
<tr><th colspan="2">Category 1</th><th>Category 2 Suspected</th><th>Additonal Category</th></tr>
<tr><td colspan="2">Known or presumed to cause effects on human reproduction or on development</td><td rowspan="2">Human or animal evidence possibly with other information</td><td rowspan="2">Effects on or via lactation</td></tr>
<tr><td>Category 1A Known based on human evidence</td><td>Category 1B Presumed based on experimental animals</td></tr>
</table>

These categories will be identified on the SDS if they are applicable to the chemical in question.

11. Acutely Toxic Substances

    a. The preamble to OSHA Lab Standard states, substances with high acute toxicity “may be fatal or cause damage to target organs as a result of a single exposure or exposure of short duration”. Examples given are substances such as hydrogen cyanide, hydrogen sulfide, and nitrogen dioxide. Follow the GHS standard for acute toxicity, where compounds falling under Category 1 or 2 meet the criteria for this section.

Acute Toxicity

Acute toxicity	Cat. 1	Cat. 2	Cat. 3	Cat. 4	Category 5
Oral (mg/kg)	≤ 5	> 5 ≤ 50	> 50 ≤ 300	> 300 ≤ 2000	Criteria: ▪ Anticipated oral LD50 between 2000 and 5000 mg/kg; ▪ Indication of significant effect in humans;* ▪ Any mortality at class 4;* ▪ Significant clinical signs at class 4;* ▪ Indications from other studies.* *If assignment to more hazardous class is not warranted.
Dermal (mg/kg)	≤ 50	> 50 ≤ 200	> 200 ≤ 1000	> 1000 ≤ 2000	
Gases (ppm)	≤ 100	> 100 ≤ 500	> 500 ≤ 2500	> 2500 ≤ 5000	
Vapors (mg/l)	≤ 0.5	> 0.5 ≤ 2.0	> 2.0 ≤ 10	> 10 ≤ 20	
Dust & mists (mg/l)	≤ 0.05	> 0.05 ≤ 0.5	> 0.5 ≤ 1.0	> 1.0 ≤ 5	

Other sources of information include the SDS, the Registry of Toxic Effects of Chemical Substances (RTECS), TOXNET, and the Poison Control Center.

B. Radiological Materials

Specific information on the use of radiological material and sources may be found in the UNC Charlotte Handbook for Radiation Safety. This Handbook has been prepared by the UNC Charlotte EHS as a guide for persons using radioactive materials and/or ionizing radiation producing machines in an effort to meet the conditions of the UNC Charlotte licenses and registrations. All appropriate requirements listed in the Handbook must be fulfilled prior to using radioactive materials or sources.

C. Select Agents and Toxins

1. Select Agents and Toxins are biological agents or substances that have the potential to pose a severe threat to human, animal, and/or plant health, or to animal and plant products. These agents are regulated through a joint federal program administered by CDC and the Animal and Plant Health Inspection Services/Agricultural Select Agent Program (APHIS).
2. Possession, transfer, and use of select agents and toxins is regulated under 7 CFR 331, 9 CFR 121, and 42 CFR 73. An Application for Registration must be completed through the National Select Agent Registry prior to possession, transfer, or use. This must be reviewed by EHS and the UNC Charlotte Biosafety Office prior to submission. Due to potential hazard of these substances, a full review of the laboratory requesting the application, personnel involved, and all procedures must take place prior to submittal.

D. Controlled Substances

1. The Office of Diversion Control of the Drug Enforcement Agency (DEA) regulates the possession and use of controlled substances. Controlled substances are drugs or other substances, or immediate

precursor, included in schedule I, II, III, IV, or V of 21 CFR 1308. The term does not include alcoholic beverages or tobacco.

2. The PI must register with the DEA and obtain a DEA license prior to accepting possession of a controlled substance. Detailed storage and use records must be maintained, and special controlled substance disposal procedures must be followed. Information and requirements available from the EHS Office. The list of controlled substances is located on the DEA website.

E. Lasers

UNC Charlotte requires that all lasers and laser systems be operated in accordance with the American National Standards Institute (ANSI) Z136.1, "American National Standard for Safe Use of Lasers" and ANSI Z136.8, "American National Standard for Safe Use of Lasers in Research, Development, or Testing", as well as other applicable federal and state regulations. ANSI Z136.8 standard provides recommendations for the safe use of lasers with wavelengths between 180nm and 1000um. Specific information on the use of lasers and laser systems may be found in the UNC Charlotte Laser Safety Manual.

F. Pyrophoric and Explosive Materials

Pyrophoric materials are substances that will ignite spontaneously in the air. Explosives, however, are reactive materials that detonate with a corresponding shock wave. Working with either material requires great care to prevent accidental ignition or detonation. Review your laboratory's standard operating procedures before working with these materials.

1. Pyrophoric Materials

a. Pyrophoric materials are used routinely in some laboratories, especially within the Chemistry Department. Common pyrophoric compounds include:

Organolithium compounds (t-Butyllithium)	Organozinc compounds (Diethylzinc)
Organomagnesium (Grignard reagent)	Aluminum alkyls
Metallic hydrides (sodium or potassium hydride)	Metal powders and fines (Aluminum, Lithium, Sodium, Magnesium)

b. Pyrophoric reagents are typically stored in highly flammable solvents such as Ethyl ether, Hexanes, or Tetrahydrofuran (THF). This adds to potential hazard of the pyrophoric material in that it is mixed with a flammable liquid.

2. Pyrophoric Engineering Controls

   a. Pyrophoric liquids are to be stored in PTFE septa bottles to prevent exposure to air.

   b. Pyrophoric liquids may only be transferred using syringes with needle locking mechanisms to prevent inadvertent release.

   c. Mineral oil bubblers must be used to release pressure from reaction vessels. Balloons are unacceptable.

   d. Handling of pyrophoric liquids must take place in an operational fume hood with the sash lowered as much as practicable.

   e. Pyrophoric solids may only be handled in an inert atmosphere glove box.

3. Pyrophoric Administrative Controls

   a. Lab personnel must be trained by the PI or designee prior to using pyrophoric materials and show competency before working individually. The training will include understanding of the hazards and emergency procedures. Personnel using pyrophorics are highly encouraged to wear a fire-resistant lab coat (Nomex coated). Kevlar or leather gloves should be worn beneath nitrile gloves to provide greater fire protection. Prior to working with pyrophorics, the following Aldrich Technical Bulletins should be read and kept available: AL-134, Handling Air-Sensitive Reagents and AL-164 Handling Pyrophoric Reagents.

4. Explosive Material

   a. Explosive reactions cause immediate release of pressure, gas, and shock. Aside from these hazards, flying debris as a by-product of the explosion can cause injury or death.

5. Explosive Material Engineering Controls

   a. A rated blast shield must be used whenever working with explosives. All work with explosives must be performed in the fume hood. Any unnecessary material in the hood must be removed prior to working with explosives. Do not rely on the fume hood sash alone as protection. The sash will not protect from flying debris.

6. Explosive Material Administrative Controls

    a. As with pyrophorics, lab personnel must be trained by the PI or designee prior to using explosive materials and show competency before working individually. The training will include understanding of the hazards and emergency procedures. All other personnel in the area are to be alerted that explosives will be used prior to beginning work.

G. Nanomaterials

1. Nanomaterials generally exhibit unique properties when compared to larger forms of the same material. The health effects of these materials are not well known, nor is the primary route of exposure. For these reasons, engineering and administrative controls are to be put in place prior to working with nanomaterials.
2. The fume hood is the primary engineering control for limiting exposure to nanomaterials. The procedures previously mentioned under Local Exhaust Ventilation should be followed for operation and best practices when using the fume hood. Nanomaterials should not be used outside a fume hood, glove box, or other handling enclosure.
3. Nanomaterials suspended in a liquid will often reduce airborne exposure.
4. Administrative controls, such as warning signs and prohibiting untrained individuals in the lab when working with nanomaterials, will also help in minimizing exposure.

H. Methylene Chloride (Dichloromethane) Workplace Chemical Protection Program

1. The Environmental Protection Agency (EPA), under the Toxic Substances Control Act (TSCA), has determined that methylene chloride, also known as dichloromethane (DCM), poses an unreasonable risk of injury to health because cumulative exposures to DCM can cause cancer and damage to the liver and kidneys. Acute exposures to high concentrations of DCM vapor in poorly ventilated spaces has caused central nervous system harm, up to and including unconsciousness and death through respiratory paralysis.
2. In the final EPA rule issued in April 2024, commercial uses of dichloromethane as a paint thinner, paint remover, or degreaser were prohibited. The EPA has allowed use of dichloromethane to continue in research laboratories if strict requirements were met to ensure the safety of laboratory personnel. This rule includes any chemical that contains > 0.1% dichloromethane. UNC Charlotte EHS has

requested that PI's and lab managers follow the hierarchy of controls and first try to eliminate the use of DCM or find a suitable substitution. If a laboratory has deemed there is no suitable replacement and the research being performed must include the use of DCM, then the dichloromethane Workplace Chemical Protection Program will be used as follows:

I. Exposure Monitoring

1. Under this program, long-term exposures to DCM will be kept below 2 ppm (8-hour TWA) and short-term exposures will be kept below 16 ppm (15-minute TWA). Additional monitoring will be implemented whenever long-term exposure exceeds 1 ppm. Any deviation from these limits will be documented in a written exposure control plan. This documentation will include a respiratory protection program to be implemented in work areas receiving a variance.
2. Initial monitoring for DCM is required to establish a baseline for DCM users and inform the development of the Exposure Control Plan (ECP). All initial monitoring shall be conducted by May 5, 2025, or within 30 days after the introduction of DCM in the workplace. Initial monitoring results will be used to determine the frequency of compliance activities such as periodic monitoring. Monitoring must be taken when and where operating conditions are best representative of each potentially exposed person's highest likely full shift, and 15-minute exposure occur.

    1. Sampling Requirements

        i. Sampling must be conducted for every potentially exposed person or a representative sample representing all exposed persons.
        ii. Sampling must be taken when the where the operating conditions are representative of full shift exposures.
        iii. All potentially exposed persons must be given the opportunity to observe exposure monitoring.
        iv. Must be taken at the personal breathing zone.
        v. Notification of monitoring results to monitored person and potentially exposed persons within 15 working days after receipt of results.

2. Sampling Report

The sampling report should include the following elements:

i. The ECEL, Action Level, EPA STEL, and significance of each.
ii. The quantity, location, and manner of DCM use at the time of the monitoring.
iii. The monitoring results.
iv. Indicate whether the concentration exceeds the ECEL, action level, and EPA STEL.
v. Provide a description of actions taken to reduce exposure to below exposure limits.
vi. Description of the respiratory protection measures if needed.
vii. List any identified releases of DCM during monitoring.

3. Periodic Monitoring

The results of the initial monitoring will determine the frequency of periodic monitoring that will be required. Periodic monitoring can range from every 3 months, every 6 months, or every 5 years depending on the following conditions:

DCM Concentration (exposure monitoring results)			**Re--monitoring Frequency**
8-hr TWA (ECEL)		**15-min TWA (STEL)**	
< 1 ppm	and	≤ 16 ppm	ECEL and EPA STEL periodic monitoring at least once every 5 years
< 1 ppm	or	> 16 ppm	ECEL monitoring at least once every 5 years AND EPA STEL periodic monitoring required every 3 months
> 1 ppm & ≤ 2 ppm	or	< 16 ppm	ECEL monitoring every 6 months
> 1 ppm & ≤ 2 ppm	or	> 16 ppm	ECEL periodic monitoring every 6 months AND immediate suspension of

			tasks causing the 15-min TWA to exceed 16 ppm in the monitored lab
> 2 ppm	or	> or ≤ 16 ppm	Immediate suspension of use of DCM in the monitored lab

J. Dichloromethane Training

PI's and/or laboratory managers are responsible for training laboratory personnel on their specific process(es) that includes any use of dichloromethane for those that will directly use the chemical or could be exposed to it. The PI or lab manager shall implement and document hands-on training for laboratory personnel specific to dichloromethane use.

1. Training must be done in a comprehensive manner that is understandable to potentially exposed persons.
2. Shall cover hazards associated with DCM as required by the OSHA Hazard Communication Standard 1910.1300(b)(3)(iii).
3. PPE and Engineering Controls.

    i. Dermal protection must cover glove selection (type and material), use, expected duration of glove effectiveness, storage, procedure for glove removal, and disposal.
    ii. Eye protection and lab coat use.
    iii. Training should inform all dichloromethane use to be conducted within a fume hood to ensure proper ventilation including appropriate fume hood sash level.

4. Training is required to be repeated as necessary to maintain requisite knowledge of safe use and handling.
5. Employees for whom exposure monitoring results exceed the EPA action level or EPA STEL shall be re-trained as necessary to ensure that each employee maintains the requisite understanding of the principles of safe use and handling of DCM.
6. Training should be updated when workplace modifications are made, there are changes in procedures, or new processes introduced to the laboratory.

K. PPE and Engineering Controls

1. PI's and laboratory managers are responsible for ensuring that laboratory personnel have access and are using the proper PPE for dichloromethane use. This includes eye protection, laboratory coats,

gloves, and proper ventilation. All dichloromethane use should be conducted with adequate ventilation or within a fume hood.

2. Appropriate glove selection includes polyvinyl alcohol, Silver Shield ®, or laminate gloves. Double nitrile gloves may be used where dexterity is required, and low volumes of dichloromethane are being used in manner that reduces the risk of splashes or spills.

L. Regulated Areas

1. A regulated area must be established wherever airborne concentration of DCM exceed, or could reasonably be expected to exceed, the ECEL of 2 ppm or STEL of 16 ppm based on monitoring. Regulated areas and boundaries must be approved by UNC Charlotte EHS.
2. Regulated areas must be established and clearly demarcated by signage indicating the use of dichloromethane in the area. Signage alerts potentially exposed persons of the boundaries of the area and minimizes the number of exposed persons.
3. The exact wording will be tailored to each area, and may be in multiple languages as needed. An example of wording for signage is as follows:

Methylene Chloride Warning

Authorized Personnel Only

Airborne Concentrations may exceed:

- ECEL: 2 ppm
- STEL: 16 ppm

Avoid Exposure. Follow safety protocols. Respiratory protection is required when Methylene Chloride is in Use.

M. Exposure Control Plan

The EPA rule requires an exposure control plan to be developed as part of the WCPP (40 CFR 751.109)(e)). The Exposure Control Plan must describe efforts that will be taken to protect potentially exposed persons through use of the hierarchy of controls. PI's and/or Laboratory Managers are responsible for establishing an exposure control plan by October 30, 2025. In accordance with 40 CFR 751.109(e)(2)(i), the following elements are required in an exposure control plan:

1. Identification of possible exposure control measures and the rationale for using or not using available exposure controls in the sequence described by hierarchy of controls.

2. For the exposure controls not selected, documentation of the efforts identifying why these are not feasible, not effective, or otherwise not implemented.
3. A description of actions that must be taken to implement exposure controls selected, including proper installation, regular inspections, maintenance, training or other steps.
4. A description of regulated areas, how they are marked, and persons authorized to enter the regulated areas.
5. A description of activities conducted by the PI or lab manager to review and update the exposure control plan to ensure effectiveness of the exposure controls, identify and necessary updated to the exposure control, and confirm all persons are properly implementing the exposure controls.
6. An explanation of the procedures for responding any change that may reasonably be expected to introduce additional sources of exposure to methylene chloride, or otherwise result in increased expose to methylene chloride, including procedure for implementing corrective action to mitigate exposure to methylene chloride.

In addition to the elements required to be in an exposure control plan, the PI or lab manager must also do the following:

7. Maintain effectiveness of engineering controls, administrative controls, or work practices instituted as part of the exposure control plan.
8. Review and update the exposure control plan as necessary, and at least every 5 years. Updates should reflect any significant changes in the status of the approach to compliance with the exposure control requirements.
9. Make the exposure control plan and associated records available to potentially exposure persons and EPA enforcement as requested.

N. Recordkeeping

Compliance records must be retained for a period of five years. PI's or lab managers who oversees the location where DCM is used or a person who uses DCM, are required to participate in generation and maintenance of these records. These records are crucial in proving adherence to the restrictions set forth by the EPA including, but not limited to, training records and air monitoring records.

1. Exposure Control Records.

    a. These records will be maintained by their generator as specified below:

        i. Lab Specific Exposure Control Plans will be maintained by the PI or Lab Manager responsible for that laboratory space.
        ii. Implementation records, including inspections, evaluations, and exposure control updates, as well as confirmation that affected persons are properly implementing exposure controls.
        iii. Documentation of Personal Protective Equipment being used as part of the program.
        iv. Training records for general laboratory safety training as well as lab specific DCM training.
        v. Maintenance, shutdown, or malfunction documentation for facility exposure controls that cause air concentrations to exceed the ECEL or STEL. Potentially exposed persons in such an event should be notified immediately.

2. Exposure Monitoring Records.

    a. Monitoring records will be maintained by the EHS office for potentially exposed employees including:

        i. All measurements made to determine conditions affecting monitoring results, including copies of the notification to the potentially exposure persons.
        ii. The identities of all potentially exposed persons whose exposure was not measured and whose exposure is intended to be represented by the monitoring.
        iii. Description of analytical methods.
        iv. Information on air monitoring equipment, including calibration dates, limits of detection, and malfunctions.
        v. Objective data being used to forgo initial exposure monitoring including the use being evaluated, the source of the data, the measurement methods and results, and any other relevant information.

XV. WASTE DISPOSAL

A. The goal of proper waste disposal is to ensure that minimal harm to people, other organisms, and the environment will result from the disposal of

laboratory chemicals. Hazardous waste disposal shall be in accordance with the University Hazardous Waste Management Program. Hazardous waste pickups for disposal are requested through the EHS website.

B. Hazardous waste should be labeled clearly with the following information:

1. The words “Hazardous Waste”.
2. The contents using chemical names and not abbreviations or chemical formulas.
3. The hazard characteristic(s) of the waste: Toxic, Reactive, Flammable, Corrosive.
4. A date when the container has become FULL, ready for disposal, or placed in a central accumulation area. Waste containers should not be labeled with a date until they are full and/or ready for disposal.

Figure 1: Hazardous Waste Label Example.

C. Unlabeled containers of chemicals and solutions should undergo prompt disposal. Unknown materials should be reported to EHS to determine the proper labeling and disposal of the material. EHS will conduct an investigation to try to gather as much information about the unknown material as possible. Unlabeled containers should not be opened except by highly trained personnel using appropriate personal protective equipment.

D. Hazardous waste accumulation at the point of generation should be in a suitable container for the waste being generated. The waste container should have secondary containment that can hold the entire contents. The hazardous waste container should only be opened when material is being added, removed, or transferred. Use caution when multiple chemicals are placed in the same waste container to ensure that they will be compatible when mixed together. Refer to the Fisher Scientific Chemical Compatibility Chart to obtain information on chemical incompatibilities and chemical

resistant plastics information for waste container considerations. Incompatible materials mixed together can create a serious safety issue as they can create toxic gases, heat, and/or build-up pressure causing glass containers to explode.

E. Avoid mixing waste streams of highly toxic materials with those of significantly lower toxicity. Lower toxicity materials will not lower the overall classification of the mixture; therefore, it will only generate a larger amount of high toxicity waste for disposal. Keeping waste streams in separate containers saves financial resources and reduces their impact on the environment.

F. In-line waste containers for instruments similar to High Performance Liquid Chromatography (HPLC) and Ion Chromatography (IC) should have appropriate caps on the waste container that ensures a snug fit between the cap opening and the waste tube. Parafilm or aluminum foil wrapped around the container top and tubing is not acceptable. Solvent bottle caps can be purchased or safety cans to be used as the in-line waste container. Unused ports in the solvent caps should be plugged closed. If a vent is required, then it should be fitted with an exhaust filter.

Figure 2: Unacceptable In-Line Waste Containers.

Figure 3: Acceptable In-Line Waste Containers.

G. Before a worker's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable. Hoods should not be used as a means of disposal for volatile chemicals. Disposal by recycling or chemical decontamination should be used when possible.

XVI. SPILLS AND ACCIDENTS

A written emergency plan should be included with the laboratory's specific safety plan. Accidents or near accidents should be carefully analyzed with the results distributed to all who may benefit.

A. Incidental Spills with Human Contamination

1. Be prepared, know where the nearest eyewash and safety shower are located.
2. Eye Contact. Promptly flush eyes with water for a prolonged period (15 minutes) while holding the eyes open (manually if necessary) and rotating the eyeballs; then seek medical attention.
3. Ingestion. Encourage the victim to drink large amounts of water. Do not induce vomiting, unless instructed to do so by the SDS or medical source (Poison Control Center), seek medical attention.
4. Skin Contact. Promptly flush the affected area with water (15 minutes) and remove any contaminated clothing or jewelry. When

removing pullover shirts and sweaters, take care not to contaminate the eyes. Wash affected areas with mild soap. If symptoms persist after washing, seek medical attention.

5. Consult the SDS for first-aid recommendations. Keep the SDS with the victim.
6. Promptly clean up spills, using appropriate protective apparel, equipment, and dispose of all contaminated materials in accordance with the University Hazardous Waste Management Program.
7. For assistance with spills, contact Laboratory Safety Manager/EHS Chemical Hygiene Officer at 704-687-1111 or refer to the Chemical Spill Procedures.

B. Incidental Spills with No Human Contamination

1. Warn all nearby people of the spill and potential danger.
2. If the material is flammable, turn off all possible sources of ignition such as Bunsen burners (DO NOT TURN OFF or ON electrical switches).
3. Evaluate the hazardous properties and size of the spill to determine if evacuation of the building or additional assistance are needed.
4. Contain the spill (keep doors closed, close the fume hood sash if the spill is in the hood, etc.).
5. Absorb liquid spills using commercially available spill absorption materials while wearing appropriate personal protective equipment.
6. Dispose of all contaminated materials in accordance with the University Hazardous Waste Management program.

C. Major Spills

1. On the UNC Charlotte campus, major spills of volatile hazardous materials must be referred to the Campus Police by calling 911 from a campus phone or 704-687-2200 from any phone. Campus Police will contact Charlotte Fire Department (CFD) and the EHS Office. Hazardous Materials Response Team will respond if conditions warrant. For major spills, it is important to immediately leave the area and inform building occupants of the situation.
2. The following are criteria that clearly indicate a major spill:

    a. The need to evacuate employees.

    b. The need for a response from outside the immediate release area.

    c. The release has potential to be immediately dangerous to life and health, poses a serious threat of fire and/or explosion, or

releases or has the potential to release high levels of toxic substances.

XVII. FIRE

Uncontrolled fire in the laboratory is life threatening due to the storage of potential sources of fuel and oxygen located in many laboratories. Use a fire extinguisher only if you know the type of fire that has occurred (chemical, electrical, paper, etc.), you have the correct extinguisher for the fire, and the fire is not an immediate threat to life or health. If the fire is an immediate threat, pull the fire alarm while leaving the area immediately, and call 911.

A. Types of Fire

There are five classes of fire. These are categorized based on the material (fuel) that is burning. Most laboratories are susceptible to at least three, if not four of these categories. The information below is from the Fire Equipment Manufacturers' Association:

1. Class A fires are fires in ordinary combustibles such as wood, paper, cloth, trash, and plastics.
2. Class B fires are fires in flammable liquids such as gasoline, petroleum oil and paint. Class B fires also include flammable gases such as propane and butane.
3. Class C fires are fires involving energized electrical equipment such as motors, transformers, and appliances. Remove the power and the Class C fire becomes one of the other classes of fire.
4. Class D fires are fires in combustible metals such as potassium, sodium, aluminum, and magnesium.
5. Class K fires are cooking oils and grease fires of animal and vegetable fat.

B. Fire Prevention

Fire prevention is accomplished by reducing the potential for fire by observing safe work practices, housekeeping, and inspections. Fire prevention guidelines include:

1. Observing proper housekeeping by keeping work areas and storage uncluttered and clean.
2. Always plan laboratory work before executing it. The majority of laboratory fires have resulted from mental or procedural errors or carelessness.
3. Do not store large quantities of flammable, combustible liquids, and gases outside a flammable storage cabinet.
4. Avoid using extension cords and maintain electrical equipment in good working order. Periodically check for potential electrical

hazards such as frayed cords, broken plugs and overloaded electrical outlets.

C. Flammable Cabinets

Flammable liquids exceeding a total of 10 gallons in a laboratory must be stored in flammable storage cabinets. Flammable storage cabinets shall be designed to meet NFPA and North Carolina Fire Code.

1. No more than 60 gallons of a Class I flammable liquids (flash point below 100°F) or Class II combustible liquids (flash point between 100°F to 140°F) may be stored in a flammable liquids storage cabinet.
2. No more than 120 gallons of a Class III combustible liquid (flash point between 140°F and 200°F) may be stored in a flammable liquids storage cabinet.
3. All flammable liquid storage cabinets must be grounded. The grounding cable must be connected to a building structural member or an electrical building ground.
4. No paper products should be stored in a flammable cabinet.
5. Flammable cabinet doors must remain closed.

D. Refrigeration of Flammables

Fires and explosions can and do occur in either general-purpose laboratories or ordinary consumer refrigerators or freezers when these types of appliances are used to store volatile or flammable materials. The three types of refrigerators/freezers often found in the lab are:

1. Consumer Refrigerator

These can be used in laboratories for storage of aqueous solutions and nonflammable chemicals and samples. The use of a household refrigerator for the storage of flammable liquids presents a significant hazard to the laboratory work area. Household refrigerators commonly contain exposed sources of ignition such as thermostat, lights, defrost heater, defrost control switch, the compressor unit, and the fan that can ignite flammable vapors released from poorly sealed or broken containers of flammable materials and result in explosions. When household refrigerators are used in the lab, they must be labeled with “Not for Flammable Storage and No Food or Drink” signs.

2. Flammable Storage Refrigerator

Flammable Storage Refrigerators are used for storage of flammable or explosive materials. This type of refrigerator is designed with cooling technology which has no internal switching devices that can

arc or spark as a source of ignition. Special inner shell materials control or limit damage should an exothermic reaction occur within the storage compartment. The electrical components in this type of refrigerator are outside the refrigerator, and the compressor is sealed or located at the top of the unit.

3. Explosion-proof Refrigerator

Explosion-proof refrigerators are designed to protect against ignition of flammable vapors both inside the storage compartment and outside the refrigerator. These are used in areas where the air outside the refrigerator might be explosive. These refrigerators feature enclosed motors to eliminate sparking and bear a FM® (Factory Mutual) or UL ® (Underwriters Laboratory) explosion-proof label. These refrigerators must meet the requirements for Class 1, Division 1 Electrical Safety Code (NFPA 45 and 70) and require direct wiring to the power source via a metal conduit. These refrigerators should be used in locations such as solvent dispensing rooms, where a flammable atmosphere may develop during solvent decanting. To prevent refrigerator and freezer explosions, materials with a flashpoint below 100°F (38°C) may ONLY be stored in a UL approved flammable materials storage refrigerator or freezer.

XVIII. TRAINING PROGRAM

A. The goal of information dissemination and training is to assure that individuals at risk are adequately informed about the nature of work in the laboratory, its risks, and what to do if an accident occurs. Literature and consultative advice concerning chemical hygiene is readily available to laboratory personnel through EHS.

B. EHS has provided online laboratory safety training courses that will assist PIs with meeting basic safety training requirements. All Lab employees must complete Laboratory Safety, PPE: Personal Protective Equipment 2.0, and Hazardous Waste Management training available through the Learning & Development Portal. These trainings must be provided for new lab employees prior to working in the lab and periodically thereafter as needed. Additional training courses may also be required depending on the hazards present and the type of work being conducted in the lab. These additional courses include but are not limited to Compressed Gas Safety, Cryogenic Liquid Safety, Laser Safety and Radiation Radionuclide Safety. More information can be found on the EHS training webpage. Online training is also available to students at the request of the PI or Lab Manager. Please fill out the Training Request Form to have online training assigned.

C. In addition to the online training, PI's or Lab managers must provide lab-specific training to all laboratory personnel before starting work in the lab.

Lab-specific training is relative to the specific hazards associated with their lab. An example of a lab specific safety training plan is available for use on the EHS website.

XIX. MEDICAL PROGRAM

A. If a laboratory worker develops signs or symptoms associated with a hazardous chemical exposure, they shall be provided the opportunity to receive the appropriate medical examination. If exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are medical surveillance requirements, medical surveillance shall be established for the laboratory worker as prescribed by the particular standard. If an event takes place in the laboratory such as a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure, the affected laboratory workers shall be provided with the opportunity for a medical examination.

B. Anyone who believes they are exposed to, or whose work involves regular and frequent handling of toxicologically significant quantities of a chemical, should contact student health center for referral to a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is warranted.

C. The Laboratory Standard requires the following records be maintained for at least 30 years and that they be accessible to the laboratory workers or their representative.

1. Air concentration monitoring results
2. Exposure assessments
3. Medical evaluations
4. Medical examination

XX. INSPECTIONS

A. It is the responsibility of the PI or Lab Manager to conduct regular, informal Chemical Hygiene and Housekeeping inspections of their laboratory and correct any deficiencies. Please contact EHS for a copy of the Laboratory Safey Checklist that can be used for this purpose.

B. The EHS office is charged with conducting or overseeing formal inspections for laboratories. These may come in the form of announced or unannounced visits, with the scope of these inspections covering the Chemical Hygiene Plan and/or other laboratory safety requirements.