1. PROGRAM STATEMENT

   The University of North Alabama's (UNA) Chemical Hygiene Plan (CHP) is a written program which states the policies, procedures, and responsibilities that are intended to protect workers from the health hazards associated with the hazardous chemicals used in campus laboratories. A well-executed CHP can promote basic attitudes and habits of prudent behavior so that safety is a valued and inseparable part of all laboratory activities. The CHP is considered to be the cornerstone of a sound laboratory safety program and is designed to aid in maintaining a safe environment in which to teach and conduct research. Each laboratory worker is required to be familiar with the contents of the CHP.

2. REFERENCES
   a. Occupational Exposure to Hazardous Chemicals in Laboratory Standard, 29 CFR 1910.1450
   b. Safety in Academic Chemistry Laboratories, 8th Edition, Best Practices for First- and Second-Year University Students
   c. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version (2011)
   d. Hazard Communication Program, https://www.una.edu/facilities/environmental-health-and-safety/policies/chapter-6-hazard-communication.pdf.

3. SCOPE

   The CHP applies to all laboratories that use hazardous chemicals in accordance with the definitions of "laboratory use" and "laboratory scale", as defined in Attachment 1, *Definitions*.

4. CHP USE INSTRUCTIONS

   The information presented in the CHP represents best practices and provides a broad overview of the information necessary for the safe operation of laboratories that utilize hazardous chemicals. It is not intended to be all inclusive.

   Laboratories that engage in work with hazardous chemicals or hazardous operations that are not sufficiently covered by the CHP must create a Safe Operation Plan that identifies the hazards and defines how to mitigate risks. These plans will be in the form of standard operating procedures (SOPs), hazard assessments, and any other written (or referenced) lab-specific operating procedures or protocols.

5. EMPLOYEE RIGHTS AND RESPONSIBILITIES

   a. Personnel who work in laboratories have the right to be informed about the potential hazards of the chemicals in their work areas and to be properly trained to work safely with these substances. This includes custodial and maintenance personnel (support staff) who

work to maintain laboratories.

b. All personnel, including principal investigators, laboratory supervisors, laboratory technicians, student workers, and support staff have a responsibility to maintain a safe work environment.

6. RESPONSIBILITIES

a. Director of Environmental Health and Safety
   i. Serves as the Chemical Hygiene Officer (CHO) by providing technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan (CHP).
   ii. Monitors laboratory safety practices and conditions
   iii. Serves as the primary source for environmental health and safety information.
   iv. Assists the Principle Investigators in identifying hazardous operations, designing safe practices, and selecting protective equipment.
   v. Conducts laboratory inspections to ensure compliance with existing laboratory policies and government regulations.
   vi. Develops or helps source environmental health and safety training plans and programs
   vii. Assists with laboratory accident investigations.
   viii. Assists in the disposal of hazardous wastes

b. Laboratory Personnel
   i. Implements and adheres to the requirements outlined in the CHP.
   ii. Plans and conducts each operation in accordance with CHP Standard Operating Procedures including the use of PPE, administrative and engineering controls as appropriate;
   iii. Reports incidents and possible chemical exposures promptly to their supervisor.
   iv. Correctly segregates, packages, and labels hazardous waste.
   v. Ensures that employees receive the safety training required by the Hazard Communication Program, Hazardous Waste Management Policy, and the CHP.
   vi. Participates with laboratory accident investigations.

c. Department Safety Coordinator (when present)
   i. Serves as a first point of contact for the CHO regarding CHP matters.
   ii. Monitors laboratory safety practices and conditions.
   iii. Assists with periodic laboratory inspections and tracks action items to completion.

iv. Provides information necessary for the compliant management and disposal of chemicals.

d. Laboratory Employee
   i. Adheres to the requirements outlined in the CHP.
   ii. Contacts the CHO or Safety Coordinator with questions or reports of potential unsafe conditions.
   iii. Ensures students, coworkers, visitors, and contractors adhere to the requirements of the CHP.

e. Support Staff (e.g., Maintenance) and Visitors
   i. Follows the posted safety rules for each laboratory.
   ii. Wear the minimum PPE requirements (e.g., safety glasses, garments that fully covers skin beneath the waist, and fully enclosed shoes).

7. EXPOSURE DETERMINATION

a. Employee exposure monitoring will be conducted for substances regulated by a standard which requires monitoring (e.g., benzene, 29 CFR 1910.1028) if there is reason to believe that exposure levels for that substance routinely exceed the Action Level (or in the absence of an Action Level, the Permissible Exposure Limit).
b. If the initial monitoring discloses employee exposure above the Action Level or the PEL, the requirements of the corresponding standard's provisions will be complied with.
c. Employees will be notified of monitoring results within 15 working days after the receipt of the monitoring report.

8. CONTROL MEASURES

When a hazard cannot be eliminated, control measures will be utilized. These methods include engineering controls, administrative controls, and personal protective equipment

a. Engineering Controls
As general lab ventilation cannot be relied upon to protect personnel from localized exposures to hazardous levels of airborne chemicals, engineering controls such as laboratory fume hoods, glove boxes, and other local exhaust systems (e.g., drop down flexible ducts aka "snorkels") are often necessary to provide additional exposure control. In general, laboratory fume hoods are recommended whenever using hazardous chemicals that:
- Have a high degree of acute toxicity, are carcinogens, or are reproductive toxins, except where there is very low risk of exposure (e.g., use of minimal

quantities in a closed system).
- Have a permissible exposure limit of less than 50 ppm (or 0.25 mg/m^3 for particulate matter).
- Are appreciably volatile (e.g., solvents) or are easily dispersible in air (e.g., dust).

b. To assure that primary engineering controls and safety equipment provide proper and adequate performance, the University provides performance verification checks by a third-party consultant on a routine basis.

ATTACHMENT 2, *Chemical Fume Hood Usage Guide*, contains instructions for use of laboratory chemical fume hoods.

c. Administrative Controls

Administrative controls for minimizing exposures to hazardous chemicals include:

- Substituting a less hazardous chemical that can provide the desired results.
- Isolating or enclosing an experiment within a closed system (e.g., glove box, sealed chamber).
- Micro-scaling the size of the experiment to reduce the amount of chemical usage.
- Scaling up reactions in small steps and evaluating safety issues after each step to fully understand the reactive properties of the reactants and solvents, which may not have been evident at a smaller scale.
- Keeping and consuming food, beverages, cosmetics, and medication outside the laboratory.
- Keeping all doors to the laboratory closed. Open laboratory doors can adversely affect chemical fume hood performance and appropriate air flow through the building.
- The laboratory manager should maintain proper oversight of inexperienced personnel working with hazardous substances.

d. Personal Protective Equipment

In addition to both engineering and administrative controls, personal protective equipment (PPE) may be necessary to ensure an adequate margin of safety in case of incidental/accidental chemical release or contact. See ATTACHMENT 3, *Selecting the Proper Glove*, for information on selecting the proper glove for a task.
- Eye and face protection are necessary to prevent ingestion and skin absorption of hazardous chemicals.
- Gloves should be worn to prevent skin contact with chemicals. Carefully select gloves to ensure that they are impervious to the chemicals being used and the

correct thickness to allow reasonable dexterity while also ensuring adequate barrier protection.
- Always remove gloves before leaving the lab.
- Lab coats and gloves should be worn when working with hazardous materials in the laboratory.
- Wear closed-toe shoes and long pants or other clothing that covers the legs when in a laboratory where hazardous chemicals are used.
- Additional protective clothing should be used when there is the potential for skin contact exposures to chemicals, matching the protective clothing's characteristics to the chemical.
- Never wear gloves or lab coats outside of the laboratory or into areas where food is stored and consumed.
- Hair should be tied back/secured. It can become entangled in equipment, be exposed to chemicals, or can catch on fire by direct exposure to lit Bunsen burners.
- Jewelry should not be worn – chemical seepage between jewelry and the skin can trap the chemicals there.

9. INFORMATION PROVIDED TO EMPLOYEES
    a. The full OSHA Standard, titled Occupational Exposure to Hazardous Chemicals in Laboratory Standard, 29 CFR 1910.1450, is found at https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1450.
    b. The Chemical Hygiene Plan is available on the Department of Environmental Health and Safety's Polices webpage, https://www.una.edu/facilities/environmental-health-and-safety/policies/chapter-5-laboratory-safety.pdf .
    c. Exposure Limits
        i. Permissible Exposure Limits for OSHA-regulated substances are located at https://www.osha.gov/laws-regs/regulations/standardnumber/1910.
        ii. Recommended Exposure Limits for substances where there is no applicable OSHA standard are located at https://www.cdc.gov/niosh/npg/pgintrod.html.
    d. Signs and symptoms associated with exposures to hazardous chemicals are defined in the chemical's Safety Data Sheet (SDS).
    e. SDSs for chemicals used in UNA laboratories are located at UNA's cloud-based chemical inventory management system called Chemventory, https://chemventory.flinnsci.com/.
    f. Employee training is required to ensure personnel are apprised of the hazards of chemicals present in their work area. The training will be provided at the time of an employee's initial assignment and prior to assignments involving new exposure situations. Training may be conducted in person by the lab supervisor, principle investigator, or online through a system such as Canvas. Training records will be

maintained by the department.

10. STANDARD OPERATING PROCEDURES
    a. Standard Operating Procedures (SOPs) relevant to safety and health considerations are to be followed when laboratory work involves the use of hazardous chemicals.
    b. SOPs should be written by lab personnel who are most knowledgeable of the experimental process and approved by the lab supervisor or Department Chairperson. The Department Chairperson is required to approve all SOPs defined in Section 12 of the CHP, *Situations Requiring Prior Approval*.
    c. SOPs should contain information about the hazards and how these hazards will be mitigated. Refer to ATTACHMENT 4, *SOP Template*, for an example.
    d. SOPs within the CHP must be reviewed by lab workers and be kept where workers can easily access them.
    e. Special focus should be on SOPs for "Particularly Hazardous Substances' (PHS), which are human carcinogens and reproductive toxins, acutely toxic materials.
    f. The list below defines best practices for typical laboratory scenarios and equipment and the proper steps to follow.
    g. Chemical Procurement
        - Procurement of a chemical involves a commitment to handle and use the chemical properly from initial receipt to ultimate disposal.
        - Laboratory supervisors will review information on hazardous properties and proper handling, storage, and disposal practices before acquiring new chemicals. Purchase will be conditioned to laboratory accommodations, which should be adequate for the safe handling of these chemicals.
        - Chemical containers will not be accepted without accompanying labels, safety data sheets, and proper packaging.
        - All chemical shipments should be dated when received and opened.
        - Chemical inventories should be regularly reviewed and edited to ensure short shelf life chemicals remain on site for extended periods of time. Refer to ATTACHMENT 5, *Management of Peroxide-Forming Chemicals*. Work with the CHO for guidance of safe and timely disposal.
    h. Chemical Storage
        - Received chemicals will be immediately moved to a designated storage area.
        - The storage area will be well illuminated, with all storage maintained below eye level.
        - Large glass bottles will not be stored more than two feet from ground level.
        - Chemicals will be segregated by hazard classification and with the principle of avoiding incompatible chemical reactions. See ATTACHMENT 6, *Incompatible Chemicals* for more information.
        - Mineral acids should be separated from flammable and combustible materials. Separation can be attained by distance or barriers.

- Flammable materials will be stored in well-ventilated areas.
- Acid-resistant trays will be placed under bottles of mineral acids.
- Cyanides and sulfides will be prevented from contact with acids.
- When possible, highly toxic chemicals whose containers have been opened will be stored in unbreakable secondary containers.
- The storage area will not be used as a preparation or repackaging area.
- When acids, bases, flammable, combustible, reactive and highly toxic materials contained in breakable containers are taken from the storage area, they will be placed in an outside container or bucket.
- Chemicals at the lab bench or working area will be limited to a minimum necessary. Chemicals will not be exposed to sunlight or heat.
- Periodic inspection of chemicals outside the storage area will identify those that need to be discarded or returned to the storage area.

i. Chemical handling

- As a rule, all exposures to chemicals will be considered hazardous and therefore shall be minimized.
- Skin contact with all chemicals will be avoided.
- Potential areas of skin exposure will be thoroughly cleaned before leaving the laboratory.
- Mouth suction for pipetting or starting a siphon is prohibited.
- Eating, drinking, smoking, gum chewing, or application of cosmetics is prohibited in laboratory areas.
- Food or beverages will not be stored in laboratory or laboratory storage areas and shall not contact glassware used for laboratory activities.
- Risk determinations will be conservative. Any mixture of chemicals will be considered to be as toxic as its most toxic component. Substances of unknown toxicity will be assumed toxic.
- Laboratory personnel will be aware of the symptoms of exposure to the chemicals they handle.
- Unprotected respiratory exposures at or above the OSHA's Permissible Exposure Limits and/or ACGIH's Threshold Limit Values are considered unacceptable. When airborne concentrations are suspected to exceed the occupational limits, they will be evaluated by air sampling methods.

k. Laboratory Equipment and Glassware

- All laboratory equipment will be used only for its intended purpose.
- All broken glassware will be immediately disposed of in a special broken glass container.
- Evacuated glass containers will be shielded to contain chemicals and glass fragments in case of implosion.
- All chemical container contents will be identified by proper labels.
- Waste receptacles will be identified as such.

- When inserting glass tubing into stoppers or corks and placing rubber tubing on glass hose connections:
  - use adequate hand protection
  - lubricate tubing
  - fire-polish ends of glass tubing
  - hold hands close together to limit movement of glass should a fracture occur
  - when possible, substitute plastic or metal connections for glass to decrease the risk of injury
  - when handling broken glass wear hand protection

l. Use of Gas Cylinders

- Valve damage due to overpressure or mechanical failure (as when a cylinder falls or drops) may result in catastrophic consequences. To avoid these accidents, cylinders will:
  - be restrained in an upright position using non-combustible straps, chains or a suitable stand
  - not be stored in hallways
  - be stored in well-ventilated areas, protected against extreme weather conditions, and not reach temperatures higher than 125^{o}F:
  - Be prevented/protected from contact with sparks, flames, and electrical hazards
- Combustible and oxidizing gases will be stored in separated locations.
  - Separation can be achieved by distance (at least 20 feet apart) or barriers (five-foot high, half-hour fire resistant wall).
- Only regulators approved for the specific gas at hand will be used. Oxygen-compatible threading compounds such as Teflon tape will be used when handling oxidizing gases.
- Oil, grease, or other lubricants will not be used on valves or fittings.
- When opening cylinder valves, the discharge direction will be away from the employee.
- When cylinders are not in use, the valve will remain closed and pressure relieved, and the protective cap in place.
- Cylinders will be moved with a help of a cart or hand truck. During transportation, the cylinder will be secured to the cart and with the cap in place.
- Cylinders will not be lifted by the cap.
- Wrenches will not be used on valves equipped with a hand wheel.
- If a cylinder develops a small valve leak, or a leak occurs in any safety device, it will be carefully removed out-of-doors or to an exhausted cabinet, away from any possible ignition source.

m. Use of Refrigerators

- Do not store food or beverages intended for human consumption in laboratory refrigerators.
- Refrigerators used to store flammable materials must be designed for flammable storage, explosion proof and approved for Class 1, Division I locations as described in Article 501 of the National Electrical Safety Code (NFPA No. 70 and NFPA No. 45).
    - These refrigerators should be labeled with the following legend: "Acceptable for Storage of Flammable Materials."
- Laboratory refrigerators should be:
    - placed against fire resistant walls
    - equipped with heavy-duty cords
    - protected by a separate circuit breaker.
- Accumulation of vapors inside refrigerators will be prevented by:
    - Placing inside only closed containers
    - Using vapor tight seals

n. Use of Heating Devices

- Electrical devices that supply heat for reactions and separations are common in laboratories. Improper use of these devices can result in electrical hazards, fire hazards, and burns.
- Baths that need to be hot at the start of the shift should be equipped with timers.
- Flammable and combustible solvents in heated baths will be maintained in fume hoods.
- Inspect the unit before use to assure that it has automatic shutoff to prevent overheating, is in good working condition, and has been maintained according to manufacturer recommendations.

o. Personal Protective Equipment

- Safety glasses are required when working with chemicals. Safety glasses must meet the requirements set forth by the American National Standards Institute (ANSI) Standard Z87. Additional details are found in Chapter 10 of the Policy Manual, Personal Protective Equipment.
- Contact lens use is prohibited with the following 5 chemicals, based on OSHA and NIOSH Current Intelligence Bulletin 59 guidance: acrylonitrile, methylene chloride, 1,2 dibromo-3-chlorpropane, ethylene oxide, and methylene dianiline.
- Chemical goggles and/or full-face shield will be worn when there is a potential for splashes, projections or sudden release of pressure.
- Sandals, perforated shoes, and bare feet are prohibited in the laboratory area.
- Laboratory coats must be worn when working in the laboratory. Coats shall be removed if significant contamination occurs.

- Gloves selection shall be based on chemical and physical resistance properties. Selected gloves shall be worn at all times when there may be a potential for chemical skin contact. Re-usable gloves shall be inspected prior usage. Damaged gloves shall be discarded. Gloves shall be washed prior removal from the hands.
- Chemically resistant aprons and gloves shall be worn when there is a potential for chemical splashes and projections.
- Thermal resistant gloves shall be worn when handling hot materials or conducting exothermic reactions. Cryogenic gloves are recommended when handling liquid nitrogen and similar cold materials.
- If environmental conditions require the use of respirators, selection and use shall comply with the respiratory protection program.

q. Safe Work Practices
- Procedures established in this CHP must be known and followed.
- Unsafe practices and conditions observed in the laboratory must be reported to the laboratory supervisor or Department Chairperson.
- Avoid unnecessary exposure to chemicals by any route by using personal protective equipment and engineering controls.
- Horseplay is forbidden.
- Safety and health protection shall be considered when planning new projects.

r. Labeling
- All containers shall be labeled.
- The existing label on a container entering the workplace from a supplier must not be removed, altered or defaced.
- The identity of the chemical and appropriate hazard warnings must be shown on the label. Chemicals in containers other than the original shall include identity of the chemical and appropriate hazard warnings.
- When a new container is received, the acquisition date will be placed on the label. If the material has a short shelf life, the recommended disposal date shall be written on the label. The Department owning the chemical shall develop a method to ensure it is used or compliantly discarded in advance of the expiration date.
- Hazardous Waste containers will be labeled per the requirements of EHS Manual Chapter 7, Hazardous Waste Management.
- Portable containers shall be identified by the person using the container.
- Labeling is exempted when transferring material into a container for immediate use of the person who is performing the transference.

s. Housekeeping
- Laboratory shall be maintained clean and free of residues.
- Laboratory benches shall be kept clear of equipment and chemicals except those necessary for the work currently being performed.

- All spills shall be cleaned and residues disposed of properly. Large releases and chemical spills which require special protective equipment and response procedures should be handled by a trained chemical emergency response team.
- Aisles, exits, fire-extinguishing equipment, eyewash stations, emergency showers, electrical disconnects, and other emergency equipment shall remain unobstructed. See ATTACHMENT 7, *Emergency Equipment* for more information.
- All chemical wastes will be disposed of in accordance with Chapter 7 of the Environmental Health and Safety Manual, Hazardous Waste Management Policy.

11. PARTICUALRY HAZARDOUS SUBSTANCES

a. Working with Carcinogens

i. Special work areas may be designated for work with carcinogens. The areas may be as simple as a particular fume hood, or as complex as a laboratory of restricted access. In any case, the areas shall have appropriate warning signs and be of controlled access.
ii. Rinse water and other wastewater shall be collected for proper disposal.
iii. Extra precautions shall be taken to maintain good personal hygiene.
iv. HEPA filters shall be used to protect vacuum lines and filters.
v. Chemical resistant gloves and long sleeves shall be used in the designated areas to prevent skin contact with the carcinogens.
vi. Work with carcinogens should be conducted by using the smallest amount possible.
vii. Purchases should be restricted to a minimum necessary to permit uninterrupted work.

b. Working with Chemicals of Moderate Chronic or High Acute Toxicity

i. Use and store chemicals in areas of restricted access with special warning signs.
ii. Use reliable hoods (minimum face velocity of 60 fpm) or other containment device for activities that that may result in the generation of aerosols or vapors.
iii. Wear gloves and long sleeves. Wash hands immediately after working with these chemicals.
iv. Assure that at least two people are present at all times when working with highly toxic chemicals.

c. Working with Chemicals of High Chronic Toxicity
    i. Use these substances only in a designated or controlled area. Prepare a plan for the use and disposal of these chemicals.
    ii. Use ventilation systems with air cleaning devices (scrubbers, charcoal filters or HEPA filters).
    iii. Decontaminate equipment before removing it from the designated area.

d. When working with allergens and embryotoxins
    i. Wear chemically resistant gloves.
    ii. Conduct all work in hoods of confirmed satisfactory performance.
    iii. Store chemicals in adequately ventilated areas in unbreakable secondary containers.

12. SITUATIONS REQUIRING PRIOR APPROVAL

Circumstances requiring prior approval from the PI/Laboratory Supervisor must be addressed in laboratory-specific SOPs. These circumstances are based on the inherent hazards of the material being used, the hazards associated with the experimental process, the experience level of the worker, and the scale of the experiment. Some examples of circumstances that may require prior approval include working alone in a laboratory, unattended or overnight operations, the use of highly toxic gas of any amount, the use of peroxide-forming chemicals, the use of large quantities of toxic or corrosive gases, the use of extremely reactive chemicals (e.g., pyrophorics, water reactive chemicals), or the use of carcinogens.

13. MEDICAL CONSULTATIONS AND EXAMS

a. An appropriate medical consultation or examination will be made available to employees under the following circumstances:
    i. An employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
    ii. 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 exposure monitoring and medical surveillance requirements.
    iii. An event takes place in the work area such as a spill, leak, explosion, or other occurrence resulting in the likelihood of a hazardous exposure.
b. The medical consultations and examinations shall be provided without cost, without loss of pay, and at a reasonable time and place.
c. The examining physician shall provide a written report including the following information:

i. Any recommendations for further medical follow-up.
ii. Results of the medical examination and diagnostic tests.
iii. Any medical condition revealed in the course of the examination that can place the person at increased risk of a result of exposure to chemicals.
iv. A statement that the employee has been informed by the physician of the results of the consultation or medical examination.

14. CHEMICAL HYGIENE PLAN PERIODIC REVIEW
    a. The CHP is reviewed by a team composed of affected department representatives and the CHO. It will be reviewed and updated, if needed, when new processes, chemicals, or equipment is implemented. This review includes a determination of effectiveness and the CHP is updated based upon this outcome.

ATTACHMENT 1 - DEFINITIONS

Action Level means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance.

Carcinogen (see *select carcinogen*).

Chemical Hygiene Officer 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.

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

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.

Employee means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Hazardous chemical means any chemical which is classified as health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (§1910.1200).

Health hazard means a chemical that is classified as posing one of the following hazardous effects: Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); aspiration hazard. 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").

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.

Laboratory scale means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood means a device located in a laboratory, enclosure on five sides with a moveable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals means handling or use of such chemicals in which all of the following conditions are met:

(i) Chemical manipulations are carried out on a "laboratory scale;"
(ii) Multiple chemical procedures or chemicals are used;
(iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and
(iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

Medical consultation means a consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

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.

Permissible Exposure Limits (PELs) means an exposure limit for OSHA regulated substances specified in 29 CFR part 1910.1000, Subpart Z, Toxic and Hazardous Substances.

Physical hazard means a chemical that is classified as posing one of the following hazardous effects: Explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid, or gas); self-reactive; pyrophoric (gas, liquid or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; or combustible dust. 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").

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.

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.

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

(i) It is regulated by OSHA as a carcinogen; or

(ii) 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

(iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or

(iv) 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:

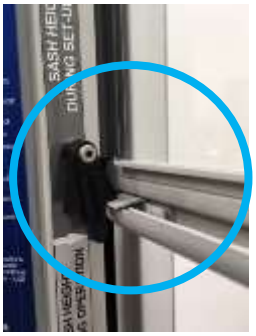
(A) After inhalation exposure of 67 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;

(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.

ATTACHMENT 2 – CHEMICAL FUME HOOD USAGE GUIDE

a. Always work with the sash at or below the level of the preset sash stop. These are level indicators on your hoods and they are set at the sash height at which the hood was tested and achieved the desired flow rate: 100 fpm. This is the recommended sash height when working in the chemical fume hood.



b. If the low-flow alarm engages, lower the sash until the alarm stops. Do not over-ride the safety alarm by permanently engaging the "Mute" or "Emergency" button (e.g., with tape); do not corrupt/disable hood alarms by disconnecting them from the hood controls. If your hood is consistently alarming enter a Work Request through the Limble Work Order System, https://app.limblecmms.com/loc-problem/8ea6kf16273/57478 .

c. A lowered sash protects you against airborne chemicals and incidents better than a fully open sash.

d. The lower the sash, the greater the energy savings – lower sash when not in use.

e. Store only the minimum of equipment and chemicals in your hood because:
   i. Excess materials block air flow into the slots at back of the hood. Permanent equipment should be raised up several inches on blocks or a stand to allow good air flow below. Ensure that the blocks/stand are level and secure.
   ii. Most lab fires/explosions occur in hoods. Minimizing chemical volumes will reduce the chances of a small accident escalating into a large one.

f. Always work at least 6 inches inside the hood to maximize hood capture efficiency.

ATTACHMENT 3 - SELECTING THE PROPER GLOVE

Know that:	Do this:
There is no universal glove that protects you from all chemicals.	Refer to the manufacturer's glove permeability reference chart. The correct gloves protect against chemicals; the wrong gloves enhance chemical contact.
All gloves are permeable.	The permeation rate varies, depending on the chemical, the glove material and thickness, temperature, concentration gradient, etc. However, once a material begins to permeate the glove, it will continue until an equilibrium is reached. Therefore, you must decide when it is appropriate to discard dirty gloves.
It is important to check gloves before use for signs of wear or penetration.	Disposable gloves can be inflated to check for pinholes. Do not use gloves which show signs of wear or penetration. When removing gloves, be careful to avoid touching the outside of the gloves with your bare hands. Always remove gloves before leaving lab.
Disposable gloves provide minimal protection and should be used accordingly.	If using concentrated solvents, corrosives or toxics, more heavy-duty gloves should be worn. These provide more protection, but have the drawback of being more cumbersome.

For individuals with known or suspected allergies to latex, consider the information provided by the Centers for Disease Control: https://www.cdc.gov/niosh/docs/97-135/.

ATTACHMENT 4 - STANDARD OPERATING PROCEDURE (SOP) TEMPLATE

Standard Operating Procedures (SOP) are written safety and health guidelines for laboratory work with hazardous chemicals and are required as a part of a laboratory-specific Chemical Hygiene Plan. Standard Operating Procedures can be written in one or more of the following ways:

1. By process (e.g. distillation, peptide synthesis, or glove box use).
2. By hazardous chemical (e.g. benzene, perchloric acid, chloroform).
3. By class of hazardous chemicals (e.g. organic solvents or peroxidizable chemicals).

INSTRUCTIONS: When an SOP is required and does not exist, fill out the form (complete all sections), print, and place in your Chemical Hygiene Plan. Train all affected lab personnel before proceeding.

Date:
Principal Investigator Name:
Process description:
1. Hazardous Chemicals/Class of Hazardous Chemicals *Define the hazardous chemicals/class of hazardous chemicals to be used*.
2. Personal Protective Equipment (PPE) See Section 8 of the UNA Chemical Hygiene Plan for assistance. *Enter the PPE you plan to use here*.
3. Engineering/Ventilation Controls Guidance: Describe engineering controls designed to reduce employee exposures to hazardous chemicals, such as fume hoods, snorkels, glove boxes, or safety features on equipment. In general, hazardous materials/processes should be used in a properly functioning chemical fume hood. For further information see in Section 8 of the Chemical Hygiene Plan *Enter the engineering controls you plan to use here.*

ATTACHMENT 4 - STANDARD OPERATING PROCEDURE (SOP) TEMPLATE, Continued

4. Special Handling Procedures/Storage Requirements

Define the special handling procedures/storage requirements.

5. Spill/Accident Procedures

Guidance: Indicate how spills or injuries should be handled. Refer to the "Chemical and Radiation Spill" and "First-Aid Guidance" tabs of the UNA *Emergency Procedures* Flipchart.

Define spill and accident procedures elements.

6. Waste Disposal

Define waste disposal elements.

7. Prior Approval Required

Guidance: Review Section 12 of the Chemical Hygiene Plan for details regarding Prior Approval.

Prior Approval Required per Section of this Chemical Hygiene Plan? Yes/No

Principal Investigator _____
Print Name Signature

Department Chairperson _____
Print Name Signature

8. Decontamination

Define the decontamination procedures for equipment and glassware, if needed.

9. Designated Area

Define the designated area requirements, if needed.

10. Lab Specific Information

Guidance: Add appropriate lab-specific information describing how this material(s) is generally used, e.g., typical frequency, quantities used, temperature and any additional safety measures, etc.

ATTACHMENT 5 – MANAGEMENT OF PEROXIDE FORMING CHEMICALS

Refer to pp.72-23 of *Prudent Practices in the Laboratory* for complete details on the likelihood of peroxide formation related to certain compounds. When it is not possible to use a less hazardous chemical, it is important to order the minimum, date the bottle upon receipt, and have a plan to use the material before its shelf life date, or be prepared to dispose of it before the date, to minimize the potential for an explosion.

PART 1: Classes of Chemicals That Can Form Peroxides

Class A: Chemicals that form explosive levels of peroxides without concentration

- Isopropyl ether
- Butadiene
- Chlorobutadiene (chloroprene)
- Potassium amide
- Potassium metal
- Sodium amide (sodamide)
- Tetrafluoroethylene
- Divinyl acetylene
- Vinylidene chloride

Class B: These chemicals are a peroxide hazard on concentration (distillation/evaporation). A test for peroxide should be performed if concentration is intended or suspected.

- Acetal
- Cumene
- Cyclohexene
- Cyclooctene
- Cyclopentene
- Diaacetylene
- Dicyclopentadiene
- Diethylene glycol dimethyl ether (diglyme)
- Diethyl ether
- Dioxane (*p*-dioxane)
- Ethylene glycol dimethyl ether (glyme)
- Furan
- Methyl acetylene
- Methyl cyclopentane
- Methyl-isobutyl ketone
- Tetrahydrofuran
- Tetrahydronaphthalene
- Vinyl ethers

Class C: Unsaturated monomers that may autopolymerize as a result of peroxide accumulation if inhibitors have been removed or are depleted

- Acrylic acid
- Butadiene
- Chlorotrifluoroethylene
- Ethyl acrylate
- Methyl methacrylate
- Styrene
- Vinyl acetate
- Vinyl chloride
- Vinyl pyridine

PART 2: Types of Compounds Known to Autoxidize to Form Peroxides

- Ethers containing primary and secondary alkyl groups (never distill an ether before it has been shown to be free of peroxide)
- Compounds containing benzylic hydrogens
- Compounds containing allylic hydrogens (C=C—CH)
- Compounds containing a tertiary C—H group (e.g., decalin and 2,5-dimethylhexane
- Compounds containing conjugated, polyunsaturated alkenes and alkynes (e.g., 1,3-butadiene, vinyl acetylene)
- Compounds containing secondary or tertiary C—H groups adjacent to an amide (e.g., 1-methyl-2-pyrrolidinone)

APPENDIX 6 - INCOMPATIBLE CHEMICALS

SOURCE: Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Research Council, Washington, D.C., 2011.

CHEMICAL	INCOMPATIBILITY
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals (lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens, powdered metals (e.g., aluminum or magnesium)
Ammonia(anhydrous)	Mercury (e.g., in manometers), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See Chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium, Chlorates, Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromatic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Isolate from everything

APPENDIX 6 - INCOMPATIBLE CHEMICALS, continued

CHEMICAL	INCOMPATIBILITY
Hydrocarbons (e.g., butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable: liquids, solids, or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, Organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Phosphorus pentoxide	Water
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate	(see Sulfuric and other acids also chlorates)
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

ATTACHMENT 7 - EMERGENCY EQUIPMENT

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<td>Fire Extinguishers are located in the hallways. Most are the ABC variety (for flammable liquids/paper & wood/electrical, but not for flammable metals).

UNA coordinates hands-on extinguisher training periodically and you are encouraged to attend this training. Chapter 3 of the Environmental Health and Safety Manual defines the university's Fire Safety Plan and a brief training module is included in that Policy, https://www.una.edu/facilities/environmental-health-and-safety/policies/chapter-3-fire-safety-plan.pdf.</td>
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<td>Emergency Showers and Eyewashes

• Know where your nearest unit is located. Units must always be accessible - no items should block access.
• In the case of chemical exposure to eyes or skin, flush the injury for a minimum of 15 minutes. Be sure to leave the eyes open under the water to flush them.
• When a wall-mounted shower or eyewash station is activated, the Burford Science and Engineering Building's fire alarm system is alerted and a trouble signal is sent to the alarm panel. This alerts the alarm monitoring company to contact the UNA Facilities Department. They will investigate the cause of the trouble alarm.
• Individual labs are encouraged to regularly (e.g., weekly) flow water at the sink-mounted drench hoses located. This is done for the following reasons:
- To ensure unit is operating as intended
- To flush microorganisms and debris from the lines that can build up in stagnant water lines.
• Shower and eyewash units are not equipped with floor drains. Use the equipment only when necessary. Periodic testing is performed by trained personnel who know how to temporarily disarm the fire alarm panel.</td>
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