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| **Chemical Hygiene Plan** |
| **Office of Environmental Health and Safety** |
| **IMPORTANT PHONE NUMBERS**  Fire and Medical Emergencies……………..911  Blue Ridge Poison Control……………………(800)451-1428  LU Campus Police………………………………. (434)395-2091  LU Environmental Health and Safety….. (434)395-2940  LU Emergency Management………………..(434)395-2457 |
| **201 High Street**  **Farmville, VA 23909**  **434.395.2940** |
| **Version 2020** |

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**INTRODUCTION**

**OSHA Standard 29CFR1910.1450 “The Lab Standard”**

OSHA’s Laboratory Standard covers all personnel engaged in the “laboratory use of hazardous chemicals”. Laboratory use of hazardous chemicals means the handling or use of chemicals in which all of the following conditions are met:

* Chemical manipulations are carried out on a laboratory scale.
* Multiple chemical procedures or chemicals are used.
* The procedures involved are not part of a production process, nor in any way simulate a production process.
* Protective laboratory practices and equipment are available to minimize the potential for employee exposure to hazardous chemicals.

A hazardous chemical is defined as a chemical for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles, that acute or chronic health effects may occur in employees who are exposed to the chemical. They include, but are not limited to, carcinogens, toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins as well as agents that may cause damage to the blood, lungs, skin, eyes or mucous membranes.

At Longwood University, this regulation is interpreted to apply to: Teaching and Research laboratories operated by the Science Departments, and Studios and Shops operated by the Theater, Art, Graphic and Animation Design Department.

**Longwood University’s Chemical Hygiene Plan**

The purpose of this Chemical Hygiene Plan (CHP) is to define work practices and procedures to help assure that faculty, staff and students working in Longwood University laboratory, shop and studio facilities are protected from the safety and health hazards associated with the chemicals with which they work.

The CHP addresses safety and health-related practices and policies common to all laboratory, shop and studio. Since few laboratory chemicals are without hazards, general precautions for handling all chemicals are presented here, rather than specific guidelines for particular chemicals. Individual laboratories shops and studios shall develop their own specific methods to augment this CHP when additional safety and health requirements are necessary.

**RESPONSIBILITIES**

Many individuals throughout Longwood University have an important role in managing chemical safety in the laboratories, shops and studios.

**Dean of the College of Arts and Sciences**

* Creates a budget line for safety and ensures that Art, Science and Theater safety is a priority.
* Ensures that the University’s Chemical Hygiene Plan, Student Safety Manual for the Department of Theater, Art, Graphic and Animation Design is implemented for the departments under his or her direction.

**Department Chairs**

* Act to promote safety for the department under his or her direction.
* Works with the Dean of the College of Arts and Sciences in creating a budget that ensures Art, Science and Theater Safety is a priority.
* Ensures that the University’s Chemical Hygiene Plan, Student Safety Manual for the Department of Theater, Art, Graphic and Animation Design is adhered to for the departments under his or her direction.

**Chemical Hygiene Officer (CHO)**

The Hazardous Materials Manager shall serve as the Chemical Hygiene Officer (CHO). The duties of the CHO include:

* Review and evaluate the effectiveness of the CHP at least annually and update it as necessary to assure that workers are protected from the hazards associated with the chemicals used in the laboratories, shops and studios.
* Provide technical assistance on the safe handling, use, storage and disposal of hazardous chemicals.
* Work with faculty, staff and students to develop and implement appropriate chemical hygiene policies and practices.
* Work with the Theatre Art Graphic and Animation Design Safety Technician, Biological & Environmental Laboratory Technician and Chemical Laboratory Technician to monitor the procurement, use and disposal of chemicals used in the laboratories.
* Assure that appropriate audits are conducted and corrective actions are completed.
* Know the current legal requirements concerning regulated substances.
* Support the PI with development of safety procedures for the use of new chemicals.
* Assure the records required by the Laboratory Standard are maintained.
* Seek ways to improve the CHP.
* In conjunction with the Dean and Department Chairs assure the faculty and staff complies with the CHP.
* Support in the determination of the required level of protective apparel and equipment.
* Assess the effectiveness of the CHP and laboratory, shop and studio safety in general on an annual basis.
* Remain cognizant of the chemicals used in the facility and their associated hazards.

**Laboratory Shop, and Studio Professors**

The laboratory supervisor, professor, or instructor (responsible faculty member) has the overall responsibility for chemical hygiene in the laboratory shop or studio. Their responsibilities include:

* Be familiar with the contents and follow the requirements of the CHP.
* Assure all who employees who work, under their care, in the laboratories, shops and studios are trained on the CHP.
* Assure all students in their laboratories, shops and studios sign and understand the student safety contract.
* Assure compliance and enforcement of the CHP.
* Assure that the necessary protective equipment is available and in working order and that appropriate training has been provided.
* Require mandatory use of eye protection, closed toed shoes, and gloves, while prohibiting the wearing of shorts and skirts when using hazardous materials.
* Develop written Standard Operating Procedures (SOP’S) incorporating health and safety considerations for work involving hazardous materials.
* Know how to access Safety Data Sheets (SDSs) for chemicals present in their workplace.
* Conduct routine, formal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment.
* Assure a hazard assessment has been conducted prior to any new materials being introduced into the laboratory.
* Remain cognizant of the chemicals stored and used in the lab and their associated hazards.
* Assure that the labels on the incoming containers of chemicals are not removed or defaced.
* Approve the acquisition and use of chemicals within the lab.
* Assure that emergency contact information is posted on every door to the laboratory.
* Request assistance from the CHO as needed.

**Departmental Safety Staff**

The Theatre Art Graphic and Animation Design Technician, the Biological & Environmental Technician and the Chemistry and Physics Laboratory Technician are the liaison between their departments and Environmental Health and Safety. Their responsibilities include:

* Provide general chemical safety guidance and training to the TAGAD, BES and CHEM/PHYS Departments.
* Assure all Professors who work in the laboratories, shops and studios are trained on the CHP.
* Monitor the purchase and use of chemicals in Appendix I OSHA Hazardous and Toxic Substances. Work with the CHO to assure that awareness training has been conducted prior to using these chemicals.
* Work with the CHO to monitor the procurement, use and disposal of chemicals used in the laboratories.
* Assure all chemicals in Bedford, Communications Studies and the Science Facilities have a Safety Data Sheet (SDS).
* Conduct routine, formal chemical hygiene and housekeeping inspections with laboratory, shop or studio professors.
* Conduct monthly inspections of eyewash stations, safety showers and drench hoses. Record the weekly inspections on the “Emergency Shower & Eye Wash Test Record”.
* Remain cognizant of the chemicals used in the facility and their associated hazards.

**Department of Environmental Health & Safety (EH&S)**

* Evaluate and monitor the use of chemicals covered by an OSHA Permissible Exposure Limit (PEL) and assure that appropriate exposure levels are not exceeded.
* Inspect/Assess Compliance in Laboratories, Studios and Shops.
* Provide applicable safety training to staff.
* Is responsible for the administering of the chemical inventory and working with the University’s IT Department to make sure that the chemical inventory software is up to date.
* Maintain an electronic data base for SDS sheets.
* Establish a Chemical Hygiene Officer.
* The Chemical Hygiene Officer (CHO) will consult with the Dean, Department Chairs, Departmental Safety Personnel, and Professors to promote the safe operations the University’s Chemical Hygiene Plan, Safety Manual for the Department of Theater, Art, Graphic and Animation Design, and update these plans as needed.

**Laboratory, Shop and Studio Facilities**

**General Ventilation**

Building general ventilation is 70-90% recirculated air. For laboratories working with hazardous materials, the air supplied may come from general ventilation, but must be 100% exhausted to the building’s exterior. General airflow should not be turbulent and should be relatively uniform throughout the lab with no high velocity or static areas. Eight to twelve room air changes per hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control.

**Local Exhaust Systems and Fume Hoods**

**Chemical Fume Hood**

Chemical fume hoods are the most important components used to protect laboratory personnel from exposure to hazardous chemicals and agents. A standard chemical fume hood is a fire and chemical resistant enclosure with one opening in the front with a movable window (sash) to allow users access to the interior.

**Down Draft Hood**

Downdraft tables are workstations with built-in ventilation that pulls air, odors, vapors, and aerosols down and away from the worker's face.

**Slot Hood**

Slot hoods are local exhaust ventilation hoods specifically designed to capture contaminants generated according to specific rate, distance from the hood, and release velocity for specific ambient airflow.

**Snorkel or Elephant Trunk**

Snorkel or elephant trunk exhaust systems is a flexible duct or hose connected to an exhaust system. It can only capture contaminants that are very close to the inlet of the hose, typically less than a distance equal to one half of the diameter of the duct. Elephant trunks can be effective for capturing discharges from gas chromatographs, pipe nipples or the end of tubing. However, the effectiveness of the elephant trunk should be carefully evaluated before they are used to control releases of hazardous substances.

**Biological Safety Cabinets**

Biological Safety Cabinets are common containment and protection devices used in laboratories working with biological agents.

**Ductless Chemical Hoods**

Use of a ductless chemical fume hood is strongly discouraged. These devices work by using a fan to draw air into a chamber, through one or more filters, and back into the laboratory shop or studio. EH&S and several professional safety and engineering organizations do not recommend the use of ductless fume hoods for several reasons.

* First, it is difficult to determine whether the filters are functioning adequately or need to be changed; thus, the potential for recirculating toxic materials into the laboratory is significant. In the event of a chemical spill, the hood is usually not able to contain the spilled material or the potentially high concentrations of chemical vapors.
* Second, the face velocity of the hood is normally below 80 feet per minute. The hood is normally designed such that the air does not flow smoothly and evenly through the hood. Both of these characteristics make it likely for disruption of airflow or turbulence, causing unfiltered air to leak into the laboratory.

**Eyewashes and Drench Hoses**

Each laboratory, shop or studio where corrosive materials are used shall be equipped with eyewash capable of providing a gentle stream or spray of aerated water for at least 15 minutes. The minimum flow rate shall be 1.5 liters per minute. The eyewash shall be located as close to the safety shower as possible, so that the eyes may be rinsed while the body is being showered. Eyewashes shall be accessible from any point in the lab within 10 seconds and be no more than 100 feet from the hazard. For strong acids or caustics, eyewash fountains shall be adjacent to or within 10 feet of the hazard. All eyewashes shall be inspected monthly and the results recorded on a tag attached to the eyewash.

**Safety Showers**

Each chemical laboratory, shop or studio shall be equipped with a safety shower for the immediate first-aid treatment of personnel contaminated with hazardous chemicals and for extinguishing clothing fires. Each shower shall be equipped with a quick-opening valve that can remain open without being held and requires manual closing. Safety showers shall be capable of delivering 30 gallons per minute for at least 15 minutes. Safety showers shall be accessible from any point in the lab within 10 seconds and be no more than 100 feet from the hazard. Safety showers shall be inspected monthly and the results recorded on a tag attached to the shower.

**Laboratory, Shop and Studio Sinks**

A sink is essential for safety in the laboratory. Employees must wash their hands with soap and water after removal of gloves, before leaving the laboratory, shop or studio, or when skin comes in contact with chemicals. The sink is also used for washing equipment that comes in contact with chemicals. Sinks may only be used for aqueous, non-hazardous materials and be kept clean and free of debris. Sink drains must have a screen or appropriate cover to prevent solid material from entering the drain.

**Standard Operating Procedures (SOPs) for Laboratory Chemicals**

**General Safety Procedures**

All laboratory, shop and studio personnel should adhere to the following general safety procedures:

**Behaviors**

* Know the safety policies and procedures that are applicable to the task at hand.
* Be alert to unsafe conditions and actions.
* Do not intentionally smell or taste chemicals.
* Horseplay of any kind is strictly forbidden in the laboratory. Avoid practical jokes or other behavior that may confuse, startle or distract another worker.
* Avoid direct contact with any chemical.
* Mouth pipetting is forbidden. Use suction bulbs or other pipetting devices.
* Report unusual odors as soon as they are detected.
* Do not use damaged glassware. Order coated glassware whenever possible.

**Equipment**

* Use equipment for its originally designed purpose only.
* Use an approved chemical fume hood when pouring, mixing, heating or handling any chemicals.
* Inspect gloves and other protective equipment prior to use.
* Know the location of all emergency equipment in the laboratory, shop and studio, and the proper procedures for use.
* Avoid exposure to chemicals by using hoods, following the correct procedures and using the proper personal protective equipment.

**Procedure**

* Determine the potential physical and chemical hazards and appropriate safety precautions before beginning any new or modified procedure.
* Be familiar with all laboratory, shop and studio emergency procedures such as spill clean-up accident reporting and evacuation routes.
* Follow acceptable waste disposal practices found in Longwood University’s Hazardous Waste Plan.
* Assure that all chemicals are correctly labeled.
* Post warnings when unusual hazards exist.
* Know how and where to properly store chemicals.
* Keep all chemicals in closed, clean containers.
* Always close chemical containers after pouring out the required quantity for a procedure. Do not allow chemicals to evaporate into the general room air.
* Do not use any chemical from a container when the contents are in doubt due to missing or damaged labels.
* Purchase the minimum amount of chemicals necessary to accomplish your work.
* Dispense only the minimum amount necessary for immediate use.
* Vent apparatus that may discharge toxic chemicals. This includes vacuum pumps and distillation columns.

**Eating, Drinking and Personal Habits**

* Eating, drinking, applying cosmetics, chewing gum, adjusting contact lenses and smoking is not permitted in any laboratory shop and studio when working with chemicals.
* After working in the laboratory, shop or studio wash hands thoroughly before eating, drinking or smoking.
* Do not store food or beverages in the same refrigerator with chemicals.
* Refrigerators used to store chemicals and store food for laboratory experiments must have signs posted on them indicating “NOT FOR HUMAN CONSUMPTION”.
* Food items stored in laboratory refrigerators and freezers must be labeled “NOT FOR HUMAN CONSUMPTION”.
* Ice makers in laboratories must have signs posted on them indicating “NOT FOR HUMAN CONSUMPTION:
* Never use glassware or utensils that have been used in the laboratory to prepare or consume food or beverages.

**Housekeeping**

Safety performance, chemical exposure and good housekeeping practices in the laboratory, shop or studio are directly related to each other. There is a direct relationship between housekeeping and the perception of safety. The workplace should be kept clean and orderly and chemicals and equipment should be stored in the appropriate areas when not in use. The following housekeeping practices should be adhered to:

* Work areas should be kept clean and free of obstructions. Clean up should follow the completion of any operation and/or at the end of each workday. Clean up spills immediately.
* Access to emergency equipment such as showers, eyewashes and exits should never be blocked, even temporarily.
* Equipment and chemicals should be stored properly.

**Inspections**

Professors and Departmental Safety Staff shall conduct formal housekeeping and chemical hygiene self-inspections on a semester basis not including the summer. The results are to be recorded, signed by the Department Chairs and submitted to the CHO. Work orders should be submitted to correct any issues identified. Inspection Checklist can be found in Appendix P Lab Safety Inspection Checklist. EH&S will conduct formal housekeeping and chemical hygiene inspections on a yearly basis or as needed.

**Labeling of Containers**

* All chemicals must be labeled sufficiently that anyone who works in the area is able to determine the identity of the contents. The only exception is for immediate use containers that will be emptied by the end of that day’s process/work.
* No container shall be accepted by the department without an adequate identifying label. Manufacturers, importers and distributors are required to label chemical containers with their name and address, the identity of the chemical and appropriate hazard warnings.
* Labels on incoming containers shall not be destroyed, removed or defaced unless immediately replaced with another label containing the required information.
* Piping systems used for chemical, gas, air, water, vacuum or steam transport with in the laboratory shall be labeled with their content and direction of flow. See Appendix M Piping/Container Color Coding for the proper color coding of piping systems.

More information on labeling containers can be found in Appendix C Container Labeling Systems, NFPA, HMIS®, GHS, and Longwood Secondary.

**Safety Data Sheets**

The Safety Data Sheet (SDS) is a format for describing a chemical or product, its potential hazards, ways to minimize the hazards, first-aid and emergency procedures and the recommended exposure limits. It is the responsibility of the each PI to ensure all chemicals have an SDS readily available (i.e. <5 minute access time). Their responsibility includes assuring every chemical used in the laboratory is included in Longwood’s Chemical Environmental Management System (CEMS) chemical inventory and that we have the proper SDSs. The SDS database is maintained by MSDS Online under contract to EH&S. More information on what materials need to be entered into the CEMS can be found in Appendix S “Chemical Life Cycle” of the CHP.

Any chemical shipped to, mailed to or provided to Longwood University without a SDS shall be stored in a chemical stockroom and not released for use until a SDS is available. If a mixture without a known single SDS is brought onto Longwood property, a copy of the SDS for each ingredient in the mixture shall be provided.

Each lab shall have access to the SDS database through the Chemical Inventory Program CEMS. Contractors shall be provided with copies of the SDSs upon request. <https://msds.longwood.edu/CEMS/Dashboard>

**Personal Protective Equipment**

An expanding array of federal, state, local law and regulations make the protection of worker health and safety a legal requirement. Virginia OSHA regulations make laboratory supervisors, coordinators, faculty members and research advisors responsible for making sure their laboratory, shop and studio employees (this includes students) wear personal protective equipment. This section summarizes various forms of personal protective equipment. Based on this information, knowledgeable choices for personal protection in the laboratory can be made. For more information contact EH&S. (434)395-2940

**Foot Protection**

Foot protection is designed to prevent injury from corrosive chemicals, heavy objects, electrical shock, as well as giving traction on wet floors. For this reason shoes that COMPLETLELY COVER AND PROTECT the foot are recommended. Fabric shoes, such and tennis shoes, absorb liquids readily and are not recommended to be worn in the laboratory. If chemicals happen to spill on fabric shoes remove the footwear immediately.

When selecting optimal footwear for the laboratory choose sturdy leather shoes that covers the foot. These will provide the best protection. Safety Toe Shoes, Rubber Boots or Plastic Shoe Covers can prevent contamination.

The following shoe types are **PROHIBITED** from being worn in the laboratory whenever hazardous materials are present:

* Sandals and Flip Flops
* Clogs
* High Heals
* Shoes that expose the foot **IN ANY WAY**

**Safety Glasses**

Because your eyes successfully navigate treacherous situations every day, it is easy to relax your guard in the laboratory, shop and studio environment. After all, for all of those people not used to wearing glasses, it can be regarded as a burdensome task to wear unattractive, often restrictive eye wear.

However, the laboratory, shop and studio is likely the most health-threatening place that you may encounter. Splashing chemicals and flying objects are poised to interact with your eyes at any moment, and your eyes usually get the short end of the deal. For this reason, eye protection is an important consideration.

Safety glasses with side shields should offer both front and side protection for laboratory, shop and studio personnel, students, and visitors and are required in all laboratories. Safety Glasses should be as comfortable as possible, fit snugly over the eyes and around the face, and not interfere with the movement of the user. Workers whose vision requires the use of corrective lenses should wear safety eye protection of one of the following types:

* Prescription safety glasses with protective lenses and side shields that meet all the requirements of ANSI Z87.1.
* Safety eye wear that can be worn over prescription glasses without disturbing the adjustment of the glasses.
* Safety eye wear over prescription contacts.

*Eye protection should be worn when using:*

* Caustics, Irritants or Corrosives
* Toxic Chemicals
* Organic Solvents
* Carcinogens
* Flammable Materials
* Boiling Liquids
* Glassware under reduced pressure
* Glassware under elevated pressure
* Cryogenic Materials
* Explosives
* Biohazards
* Radioactive Materials
* UV Light
* Lasers

**Goggles**

Goggles are required when the potential for a chemical splash exists.

**Face Shields**

Face shields are required when the potential for flying objects or chemical splash exists. These must be worn over the safety glasses or goggles.

**Laboratory Coats**

Laboratory coats shall be worn by Faculty, Staff, Teaching Assists and Research Students when working in any laboratory while working with chemicals. Students in teaching laboratories should wear lab coats when working with chemicals following the same criteria used for the use of safety glasses in the lab. A laboratory coat can provide protection against contact with dirt and minor chemical splashes or spills. It also provides protection for the user’s clothing. The lab coat does not however, significantly resist penetration by organic liquids or concentrated acids and bases. If the coat becomes contaminated, it should be removed immediately and placed in the laundry or place in trash. Do NOT take it home and launder it.

Laboratory coats shall not be worn in the cafeteria, break areas, lecture room or restrooms so chemical contamination is not spread to areas outside of the laboratories. Lab coats must be removed before exiting a laboratory except by those employees traveling from one lab to another in their normal duties and by auditors, inspection teams and visitors who are not involved in laboratory work activities.

**Aprons**

Rubber aprons can provide better protection from corrosives and irritating liquids. Aprons should be worn over the lab coats when transferring or handling larger containers of chemicals or when there is a significant risk of splashes. Aprons should be cleaned after use to prevent the inadvertent spread of chemical contamination.

**Gloves**

It is good idea to get into the habit of wearing gloves in the laboratory. Gloves act as a shield between your hands and the chemicals that you are working with. When working with solvents, corrosive liquids, or with allergenic, sensitizing or toxic chemicals, wear gloves made from a material known to be resistant to permeation by the chemical. Information on permeation resistance can be obtained from the CHO. Inspect gloves for tears, punctures, pinhole leaks or signs of degradation before each use.

Gloves should be selected on the basis of the material being handled and the particular hazard involved. The following is a guide for selecting gloves. If you have any question regarding the proper glove to use contact EH&S at (434)395-2940.

* Cotton: Absorbs perspiration, keeps objects clean, and provides some fire retarding properties.
* Latex: Provides light protection from irritants, but maybe an allergen.
* Natural Rubber: Protects against light corrosive material and electric shock.
* Neoprene: For working with solvents, oils, or light corrosive materials.
* Nitrile: For working with solvents, oils, of light corrosive materials.
* Plastic: Protects against light corrosive materials and irritants.
* Terry Cloth Flame Resistant Gauntlet: For handling hot materials (under 450⁰F) and small burning objects.

Remove gloves prior to leaving the laboratory. Care should be taken when removing gloves. Peel the glove off the hand starting at the wrist and working toward the fingers. Keep the working surface of the glove from contacting the skin during removal.

**Respirators**

Respiratory protection may be necessary to supplement existing inhalation exposure controls. Respirator users must be trained, fit-tested and receive the proper medical evaluation required by the OSHA Respiratory Protection Standard. If your lab procedure requires respirator protection, contact EH&S for assistance.

**Storage of Chemicals**

The following guidelines shall be followed for storing chemicals:

**General Storage**

* Segregate according to hazard class or compatibility, and then place alphabetically. Information on Chemical Storage can be found in Appendix D Chemical Storage and Incompatible Chemicals.
* Return all chemicals to their appropriate storage area at the end of the workday.
* Store chemicals on sturdy shelving that has a raised lip edging or some tip over protection, or in cabinets with doors.
* Never store chemicals in aisles, stairways, under stairways, hallways, on floors, on desk or in front of emergency equipment.
* Do not store chemicals in hoods unless the hood is a designated storage area and is not used for lab procedures. Plastic trays should be placed under the chemicals to contain spills.
* Stored chemicals must be tightly closed and labeled. Exposure to heat or direct sunlight should be avoided.
* Never stack bottles on top of each other.
* The amount of each chemical stored in a laboratory should be kept as low as possible.
* Stored chemicals should be examined periodically for deterioration, shelf life and container integrity.

**Flammable Storage**

* Flammable liquids should be stored in approved containers such as flammable material cabinets or safety cans with spring-loaded closures and flame arrester screens.
* Keep flammable material cabinet doors closed at all times.
* Follow the manufacturer’s established quantity limits for flammable material storage cabinets. Do not overload the cabinet.
* Flammable or unstable chemicals that should be refrigerated must be stored in an approved explosion proof refrigerator that has been labeled as such.

**Cold Storage**

Domestic refrigerators are appropriate for keeping food cold; they are not designed to meet the special hazards presented by flammable materials. Therefore, laboratory, shop and studio refrigerators should be carefully selected for specific chemical storage needs. If you have questions about refrigerated storage please contact EH&S. Each refrigerator, freezer or cooler should be permanently labeled with appropriate hazard signs to indicate whether it is suitable for storing hazardous chemicals.

Label with a sign **“FOR CHEMICAL STORAGE ONLY. NO FOOD OR DRINK ALLOWED”**

**Special Storage**

* Cyanides should be stored in a lockable metal cabinet.
* Water reactive metals such as Sodium and Potassium should be stored in a metal water resistant cabinet.

**Unattended Experiments**

No experiments will be run unattended unless EH&S approved fail-safes are in place. Those experiments that cannot be safely isolated shall not be performed unattended unless a suitable alarm/monitor is present and functioning. For all unattended operations, leave the lights on, place an appropriate sign on the door and provide for the containment of toxic substances in the event of a failure of the utility services. Appendix N contains the Unattended Experiment notification form.

**Warning Signs**

Laboratories, shops and studios shall be posted with warning signs such as radiological hazard, compressed gases, lasers, fire hazards, toxic chemicals etc. Emergency contact information shall be posted on the door to every laboratory. Door signs can be obtained by contacting EH&S. An example of a door sign is in Appendix Q Laboratory Door Signs. EH&S will work with the Department Chairs and department safety personnel to determine the appropriate information that is placed on the sign.

**Working After Hours / Working Alone**

There may be occasions when it is necessary to work alone with chemicals or after normal working hours. Normal working hours are considered to be 8:00 AM to 5:00 PM. As always, notify the Longwood Police Department at (434)395-2091 prior to reporting to your work location.

It is essential that laboratory personnel do not work alone under the following circumstances when working with:

**Chemicals**

* Pyrophoric Chemicals
* Water Reactive Chemicals
* Potentially Explosive Chemicals
* Explosive Salts
* Acutely Toxic Chemicals or Gases
* Peroxide Forming Chemicals
* Strong Corrosives
* Strong Oxidizing Agents
* Strong Reducing Agents
* Regulated Carcinogens

**Biological Agents**

* Select Agents (ex. Botulinum neurotoxins, Tetrodotoxin, Yersinia pestis)
* A complete list can be found at: <http://www.selectagents.gov/SelectAgentsandToxinsList.html>

**Procedures**

* Use of machine shop equipment
* Procedures involving high-pressure equipment
* Transferring large quantities of chemicals (e.g., 10 liters or more) of hazardous materials
* Handling animals that could cause serious injury

Situations where working alone may occur:

* Periodic attendance to check laboratory equipment/experiments
* Cleaning and maintenance activities in the laboratory
* Working with analytical equipment
* Working in storage areas
* Feeding animals
* Working in offices and computer work stations

**Minors Working on Research in the Laboratory**

Due to their lack of experience with hazard recognition in a laboratory environment, restrictions are placed on minors when working in laboratories to help ensure a safe research experience. A minor is a person under 18 years of age. These requirements apply regardless of whether the minor participates as a volunteer, employee, or a registered student.

The professor or instructor has the responsibility for the health and safety of minors working in his or her laboratory. The professor or instructor may delegate daily supervision of minors to trained knowledgeable lab personnel. However, the PI retains primary responsibility. Minors may only work in laboratories under the direct supervision by the professor or instructor or designated lab personnel. Minors are not permitted to be alone in the lab. For these reasons, minors are not permitted to have their own building and laboratory access.

Minors are not permitted to work with the following materials:

**Biohazardous Materials**

* BSL-2 and BSL-3 materials
* Human blood, body fluids and tissues, including tissue cultures
* Select Agents (ex. Botulinum neurotoxins, Tetrodotoxin, Yersinia pestis)

A complete list can be found at: <http://www.selectagents.gov/SelectAgentsandToxinsList.html>

**Chemicals**

* Restricted chemicals
* Controlled substances
* Select carcinogens
* Reproductive toxins
* Highly acutely toxic substances
* Self-reactive chemicals

**Visitors and Children in the Laboratory**

Visitors, including children are permitted in laboratories where hazardous substances are stored or are in use or hazardous activities are in process as long as they are properly protected. If minors are expected to be in the laboratory (as part of educational or classroom activity), ensure that they are under the direct supervision of a qualified adult (professor or instructor) at ALL Times. If they are not in the laboratory for an educational event, they must be under the direct supervision of a parent or guardian at ALL times. Other laboratory personnel should be made aware that visitors and children will be in the laboratory.

No pets are permitted in laboratories. Note that service animals are not pets. They are highly trained and may be present in the laboratory. However, a clean, safe area should be provided where the animal can wait.

**Special Chemical Precautions**

**Corrosives**

A corrosive is a chemical that attacks human tissue and causes irritation, chemical burns and in severe cases, tissue destruction. In case of skin or eye contact with corrosives, promptly flush the area with water for at least 15 minutes. Some examples of corrosives are:

**Acids**

Inorganic or mineral acids such as sulfuric, nitric, hydrochloric, and phosphoric and hydrofluoric are strong corrosives. Organic acids with a carboxyl group are generally less corrosive than the inorganic acids. Examples of organic acids are acetic, benzoic, citric and oxalic.

**Bases**

Bases are also strong corrosives. Some common bases include ammonium hydroxide, calcium hydroxide, potassium hydroxide, sodium carbonate and sodium hydroxide. Contact with bases causes a “slippery” or “soapy” feeling. The eye is especially susceptible to bases, or alkalis, and splash goggles or a face shield is required whenever there is a possibility of eye contact.

**Halogens**

The elemental halogens are all extremely corrosive, especially to the respiratory system. They include bromine, chlorine, fluorine and iodine.

**Organic Compounds**

Organic compounds may be as corrosive as the inorganic acids and bases. Many organics can be absorbed through the intact skin and produce toxic effects. Examples are phenols, amines and some unsaturated ketones.

**Hydrofluoric Acid**

Hydrofluoric acid is a clear colorless liquid miscible with water, with an irritating odor. It is an extremely corrosive liquid and vapor can cause severe injury via skin and eye contact, inhalation, or ingestion. It can readily destroy tissue by penetrating human skin, destroying soft tissue and decalcifying bone. Not only is it a contact hazard to the skin but also exposure to the eyes can result in blindness or permanent eye damage. Hydrofluoric acid attacks glass, concrete, and many metals. It also attacks carbonaceous natural material such as wood materials, leather, and rubber. Some materials resist the corrosive action of the acid, such as platinum, wax, polypropylene, polyethylene, and Teflon. In contact with metals with which it will react, hydrogen gas is liberated and the danger exists to spark or flame resulting in an explosion.

* Always review the Safety Data Sheet for the appropriate personal protective equipment to wear but as a minimum wear chemical resistant goggles, face shield, neoprene or nitrile gloves and a rubber apron when handling this chemical. Work in a chemical fume hood with the required personal protective equipment to avoid chemical contact or exposure to vapors.
* EH&S shall be notified prior to ordering this chemical.

**Perchloric Acid**

**ATTENTION! MUST HAVE A PERCHLORIC ACID HOOD TO WORK WITH THIS SUBSTANCE. LONGWOOD UNIVERSITY DOES NOT HAVE A WASH DOWN HOOD FOR WORKING WITH PERCHLORIC ACID**.

Perchloric acid is a strong acid used for complete digestions of organic material. It is normally supplied in bottles up to one gallon in capacity at 70-72% strength. In many respects, its hazards are similar to those of nitric acid, as both are strong oxidants. Perchloric acid presents an additional hazard in that Perchloric acid mist and vapor can condense in ventilation systems to form metallic perchlorates, which can be explosive. It is a highly corrosive substance and causes severe burns on contact with the eyes, skin and mucous membranes. Always use impact-resistant chemical goggles, a face shield, neoprene glove and a rubber apron when handling Perchloric acid. The quantities of Perchloric acid stored should be kept to a minimum, and stored in its original container.

Depending on concentrations, Perchloric acid should only be used in a specially designed fume hood. Any questions about this should be referred to the EH&S Office for review prior to ordering and using this chemical.

**Explosive and Shock-Sensitive Compounds**

Shock-sensitive and/or explosive compounds are an obvious safety problem, even for laboratory scale quantities. The first step in safe operations with such substances is recognition of the potential for damage and personal injury. Some examples of these compounds are lead azide, Perchloric acid and its salts, picric acid and its salts and benzoyl peroxide. A key to safe operations with explosive or shock-sensitive substances is to use very small quantities at any one time or place and if possible, avoid their use altogether. A more complete list of potential shock-sensitive chemicals is included in Appendix E Potential Peroxide Forming Chemicals.

**Incompatible Materials**

Some materials can react violently and/or liberate toxic gases when mixed together. Materials that do so are referred to as incompatible. The classic examples of materials that are incompatible are cyanides or sulfides and acid. Mixture of the two generates hydrogen cyanide or hydrogen sulfide, respectively. Both are very deadly gases. Laboratory personnel should be aware of groups of material in their lab that could be incompatible. These materials should be physically isolated from their incompatible counterparts. Emergency procedures must also be in place to guide the laboratory personnel in the event that materials are inadvertently mixed together. A partial list of incompatible materials is given in Appendix D Chemical Storage and Incompatible Chemicals.

**Oxidizers**

Oxidizers can react vigorously at ambient temperatures when they contact organic material or reducing substances. Oxidizers are compounds (solid, liquid, gas) that evolve oxygen or are electron acceptors either at room temperature or upon slight heating. This group includes peroxides, chlorates, perchlorates, nitrates, permanganates and the elemental halogens.

**Reactive and Sensitive Compounds**

**Oxygen and Moisture Sensitive Compounds**

Many chemical compounds deteriorate when exposed to air. For most of these, oxidation only causes a decrease in purity. For a few others, extreme reactivity with oxygen can lead to other effects. Another group of compounds reacts with atmospheric moisture and causes the release of toxic or flammable gases or vapors or the generation of enough heat to cause fires and explosions. Some examples are as follows:

* Aluminum alkyls react with moisture to generate extremely flammable hydrocarbon vapor.
* Dichlorosilane forms silicon dioxide and hydrogen chloride on contact with air. This will detonate spontaneously under the right conditions.
* Phosphides react with moisture to form highly toxic phosphine.
* Selenides react with moisture to cause the release of highly toxic hydrogen selenide.
* Sodium reacts with moisture to release hydrogen. The heat generated may cause a fire.

**Water Reactive Substances**

Water sensitive compounds react exothermically and violently with water, particularly if it is present in limited quantities, since no significant cooling effect will occur. The following are examples of water reactive substances:

* Alkali and alkaline earth metals such as potassium and calcium.
* Anhydrous metal halides such as aluminum bromide and germanium chloride.
* Non-metal halides such as boron tribromide and phosphorous pentachloride.
* Anhydrous metal oxides such as calcium oxide and cesium trioxide.
* Non-metal oxides such as sulfur trioxide.
* Non-metal halide oxides such as phosphoryl chloride.

**Peroxide Forming Compounds**

Some organic compounds are unusually susceptible to atmospheric oxidation. Peroxidizable substances slowly react under ambient conditions with atmospheric oxygen to form peroxides that may create an explosion hazard. They require special storage and handling procedures to minimize the formation of peroxides. Once formed, peroxides are thermally unstable and may also be shock- sensitive. The types of compounds that are most apt to form peroxides are aldehydes and ketones, ethers, allylic or benzylic structures and vinyl and vinylidine compounds. Peroxide forming compounds must be dated upon receipt. All peroxide-forming chemicals must be closely monitored so that they are used or disposed of before the manufactures expiration date. Disposal of dated peroxide-forming materials is quite difficult and must be accomplished by specially trained and outfitted personnel.

Prior to using peroxide forming liquids examine for visible crystals or viscous liquids, and for discoloration or surface crust. This indicates that peroxide crystals tend to form on the inner surface of the container.

Once the bottle of peroxide forming liquid is opened quarterly testing of the material is required. Commercially available test strips may be purchased from most safety and laboratory suppliers for the semi-qualitative detection of peroxides in organic solvents. Follow manufactures instructions for the test strips. Please note that these strips have finite ranges. Record the quarterly test on the chemical bottle. Bottles can be used until low levels of peroxides form or the manufacture’s expiration date.

A list of potential peroxide forming compounds is included in Appendix F Potential Peroxide Forming Chemicals.

**Pyrophoric Compounds**

Pyrophoric chemicals are those substances that react so rapidly with air and its moisture that the ensuing oxidation and/or hydrolysis lead to ignition. Ignition may be instantaneous, delayed, or occur only if the material is finely divided or spread in a diffuse layer. Some examples are:

* Finely divided metals such as magnesium and zirconium.
* Metal and non-metal hydrides such as germane and diborane.
* Partially or fully alkylated derivatives of metal or non-metal hydrides such as diethylaluminum hydride and trimethylphosphine.
* Alkylated metal alkoxides or non-metal halides such as diethylethoxyaluminum and dichloromethylsilane.
* Carbonyl metals such as pentacarbonyl iron and octacarbonyl dicobalt.

**Compressed Gases**

Many laboratory, shop and studio operations require the use of compressed gases for analytical or instrument operations. Gases are mobile and pose one or more of the following risks in all areas they are stored, plumbed and used. Compressed gasses may be flammable, combustible, explosive, corrosive, poisonous, inert or a combination of hazards. If the gas is flammable, flash points lower than room temperature compounded by high rates of diffusion present a danger of fire or explosion. Additional hazards of reactivity and toxicity of the gas, as well as asphyxiation and freezing.

**Storage Area**

Large quantities of cylinders should be stored in an approved gas cylinder storage area. Cylinders must be stored in a well ventilated area with their protective cap screwed on and the cylinder secured (strapped or chained). Separate flammables and oxidizers. Full and empty cylinders shall be stored separately.

Liquefied gas containers shall be stored with adequate ventilation. Do not store containers in a confined area or in an area unprotected from the extremes of weather. Acetylene tanks shall always be stored upright. Cryogenic containers are equipped with pressure relief devices designed to control the internal pressure. Under normal conditions these containers will periodically vent product. Do not plug, remove or tamper with any pressure relief device. Cryogenic containers must be stored, handled and transported in the upright position. When moving, never tip, slide or roll containers on their side. Use a suitable hand truck for moving smaller containers. Move larger containers by pushing, not pulling. Avoid mechanical and thermal shock.

**Laboratory, Shop or Studio Use**

Cylinders in the laboratory, shop or studio shall be safely secured with a strap or chain to prevent tipping. Cylinders may be attached to a bench top, individually to a wall, placed in a holding cage or have a non-tip base attached. The contents of the cylinder shall be clearly identified for easy, quick and complete determination by any lab worker. All gas lines leading from a compressed gas supply shall be clearly labeled to identify the gas. Some general safety precautions are as follows:

* Keep protective plugs and caps in place on cylinders at all times when they are not plumbed for use.
* A cylinder status tag should be attached to each cylinder.
* Do not expose cylinders to temperatures higher than 122⁰F. Some rupture devices on cylinders will release at about 149⁰F. Some small cylinders, such as lecture bottles, are not fitted with rupture devices and may explode if exposed to high temperatures.
* Never lubricate, modify, force or tamper with cylinder valves.
* Never direct high-pressure gases at anyone, serious injury could result.
* Be aware that the rapid release of a compressed gas will cause an unsecured cylinder gas hose to whip dangerously and may also build up a static charge that could ignite a combustible gas.
* Do not put oil or grease on the high-pressure side of oxygen, chlorine or other oxidizing agent cylinder. An explosion could result.
* Never bleed cylinders completely empty. Leave a slight pressure to keep contaminants out.
* Always use safety glasses when handling and using compressed gases.

**Transport of Cylinders**

Use approved handcarts to move cylinders. Cylinders must be secured to the cart during transport, with the protective cap in place.

**Cryogenic Liquids**

Cryogenic liquids are liquefied gases having boiling points of less than -100⁰F. The primary hazards of cryogenic liquids are physical hazards such as fire, explosion and pressure buildup and health hazards such as severe frostbite and asphyxiation. Contact with living tissue can cause frostbite or thermal burns. Prolonged contact can cause blood clots. All laboratory personnel shall follow the following prudent safety practices when handling, moving and storing cryogenic liquids:

* Ensure containers are properly labeled. Do not remove or destroy identification tags or labels.
* Push wheeled containers. Move other containers with a suitable hand truck.
* When transporting containers on an elevator, do not allow passengers on the elevator.
* Store containers in the upright position in a well ventilated secure location. Do not use or store in a confined space or areas where an oxygen deficient or hazardous atmosphere could develop.
* Do not expose a liquefied gas container to elevated temperature.
* Do not alter, obstruct, defeat or tamper with relief valves, rupture discs or fittings.
* Vent relief valves away from walkways or work areas.
* Keep equipment clean and free of contaminating materials.
* Transfer cryogens slowly to prevent thermal shock or excessive pressure buildup.
* Prevent ice buildup and check areas where ice could plug the system, such as cold traps.
* Avoid eye or skin contact with all cryogenic materials. Wear safety glasses and side shields or goggles and a face shield, an impervious lab coat or apron and insulated gloves.
* Handle objects in contact with cryogenic gases or liquids with tongs or insulated gloves.
* Understand the hazards of working with cryogenic liquids, their containers and the systems you will be using. Read the SDS prior to starting work.
* Transfers or pouring of cryogenic liquid shall be done very slowly to minimize the potential for boiling or splashing.

**Other Special Precautions**

**Biosafety**

A biohazard is an agent of biological origin that has the capacity to produce deleterious effects on humans. Biosafety Levels (BSL)

* BSL1 – agents not known to cause disease.
* BLS2 – agents associated with human disease. Work typically conducted on the bench top.
* BSL3 – indigenous/exotic agents associated with human disease and with the potential for aerosol transmission. Work typically conducted in a biological safety cabinet.
* BSL4 – dangerous/exotic agents of life threatening nature. Work typically conducted in a dedicated biological safety room specifically designed and maintained for containment of the pathogen.

The Longwood University laboratories are only designed for BSL 1 and BSL 2 work. No BSL 3 or BSL 4 work is allowed at our university. Scientists and technicians working with biological agents shall be trained according to the Biosafety Procedures. All work with biological materials shall be conducted according to the safe work practices found in the Biosafety Plan.

**Laser Safety**

A laser is a device which produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions to lower energy levels.

There are four classes of lasers:

* Class 1 – Low Power – Exempt Lasers and Laser Systems: No special warnings or control measures are required.
* Class 2 – Low Power Visible Lasers and Laser Systems: The power output is sufficiently low enough to prevent injury (acute exposures), but may produce retinal injury when stared at for a long period of time.
* Class 3– Medium Power Visible Lasers and Laser Systems:
  + Class 3A Injury may result when the energy is collected and put into the eye, as with optical components.
  + Class 3B Medium Power Lasers and Laser Systems: Biological damage is possible from acute direct or secularly reflective exposure. Special precautions are required as outlined in the Longwood University Laser Safety Policy.
* Class 4 – High Power Lasers and Laser Systems: Biological damage is possible from acute direct, diffuse or secularly reflective exposure. Special precautions are required as outlined in Longwood University Laser Safety Policy. *In daft as of September 2019*

Personal protective equipment, when required, shall be specified based on the intensity and wavelength of laser and associated hazards. All work with lasers shall be conducted according to the safe work practices found in the Laser Safety Procedures. *In daft as of May 2020*

**Radiation Safety**

Longwood University does not hold a broad scope license for radioisotopes. Therefore the only ionizing radiation hazards are from:

* + Button sources – small quantities of long lived radioisotopes encapsulated in sealed metal or plastic containers.
  + X-ray generating devices. Each is permitted separately via the Virginia Department of Health.
  + Neutron generating device.

All work with radioactive materials shall be conducted according to the safe work practices found in the Radioactive Materials Management Plan. *In daft as of October 2019.*

**Hazard Control Measures**

The accepted hierarchy for controlling hazards in descending order of preference is:

1. Remove the hazard
2. Engineering controls to keep hazard away from workers
3. Behavioral changes-also called administrative controls
4. Use of personal protective equipment

**Direct Methods of Control**

Direct methods of control are those which involve a change in practice concerning the use of the toxic chemical. A change may involve the use of a smaller amount of the chemical, alternating personnel using the chemical, substitution with a less toxic agent or a change in the procedure that eliminates the need for the toxicant.

**Engineering Methods of Control**

Engineering control methods generally do not affect the potential for exposure; rather they direct the toxicant away from the personnel by some method. They are usually considered to be indirect methods of control. For this reason, they are not the first choice for control. Engineering methods of control include general laboratory ventilation, local ventilation such as fume hoods, glove boxes and canopies and equipment and work area modifications. Used in conjunction with good laboratory work procedures, properly designed and operated exhaust ventilation is effective in minimizing employee air contaminant exposures.

**Administrative Controls**

Administrative controls for minimizing inhalation and physical contact exposures include:

* General laboratory safety and health procedures.
* Self-audits and walk-throughs conducted by laboratory personnel to identify and evaluate potential health hazards.
* Health and safety orientation and training sessions to inform employees about the ways they can minimize their exposure to hazards.
* Chemical use authorization controls to assure that prospective chemical users have the knowledge and protective equipment available to them for adequate control of their chemical exposures.
* Limiting duration of exposure.

**Personal Protective Equipment**

Personal protective equipment (PPE) is the least preferable method of control. However, unless methods 7.2 and 7.3 totally eliminate the possibility of exposure to chemicals, then PPE is required. Section 4.7 discusses the PPE requirements in our laboratories.

**Control Methods for OSHA Listed Hazardous / Toxic Chemicals**

**OSHA Hazardous Chemicals**

The Lab Standard defines “Hazardous Chemicals” as chemicals for which there is statistically significant evidence, based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The OSHA listed hazardous chemicals are included in Appendix G OSHA Hazardous and Toxic Substances. However, this is not intended to be a complete list or an exclusive categorization scheme. If there is available scientific data that supports including other chemicals on this list, the data must be evaluated for applicability.

**Carcinogens**

A carcinogen is any substance or agent that is capable of causing cancer. Cancer is the abnormal or uncontrolled growth of new cells in any part of the body in humans or animals. Carcinogens are chronic toxins with long latency period that can cause damage after repeated of long duration exposures and often do not have immediate apparent harmful effects. Always refer to the SDS sheet to see if a material is cancer causing or not.

For more information on Carcinogens see Appendix H Selected Carcinogens.

**OSHA Substance Specific Regulated Chemicals**

OSHA has specific regulations for chemicals they consider being especially toxic or carcinogenic. The presence or use of these chemicals requires initial exposure evaluations and awareness training. Based on the results of the exposure evaluations, other regulations may apply. A list of the OSHA Substance Specific Regulated Chemicals is included in Appendix I OSHA Substance Specific Regulated Chemicals.

**Handling OSHA Listed Hazardous / Toxic Chemicals**

The systems in place to assure employee protection and compliance with the applicable regulations are as follows:

* All chemicals received shall be entered into the Cis-Pro System with a SDS when receiving new chemicals. On an annual basis, the chemical handling procedure is reviewed for potential employee exposure. Based on this review, personal exposure monitoring may be required.
* The CHO shall be notified of new procedures involving hazardous substances. This is not meant to be a way to control what procedures may be implemented or to restrict the capabilities of our labs, but simply a method by which we can assure employee protection and compliance with all the applicable regulations.

**Designated Areas**

A “Designated Area” is an area that may be used for work with carcinogens, reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be an entire laboratory, an area of a laboratory or a device such as a fume hood. OSHA’s Laboratory Standard requires these areas shall be labeled or have the appropriate signage. The following sign shall be posted in all appropriate locations approved by the CHO:

**DANGER – DESIGNATED AREA**

**Select Carcinogens, Reproductive Toxins and Acute Toxicity Chemicals in Use**

**Authorized Personnel Only**

**General Safety Precautions for Working with Hazardous/Toxic Chemicals**

The following safety precautions shall be followed when working with hazardous, toxic or carcinogenic chemicals:

* The quantity of the chemical stored should be minimized.
* Use the smallest amount of chemical that is consistent with the requirements of the work to be done.
* Work with these chemicals must be performed within a functioning fume hood, ventilated glove box, sealed system or other system designed to minimize exposure to these chemicals.
* Compressed gas cylinders which contain acutely toxic chemicals should be kept in ventilated gas cabinets.
* Gloves and other appropriate personal protective equipment must be worn.
* Lab workers of child-bearing age should be especially cautious when working with reproductive toxins. Handle these chemicals only in a hood whose satisfactory performance has been confirmed. Wear appropriate PPE to prevent skin contact.
* Minimize exposure to these chemicals by any exposure route (inhalation, skin contact, ingestion, injection) using all reasonable precautions.
* Assure that all laboratory personnel in the designated area are aware of the substance being used and take any necessary precautions.
* Decontaminate a designated area when the work is completed.
* When leaving a designated area, remove any protective apparel, clean and decontaminate or dispose of it properly. Thoroughly wash hands, forearms and face.

**Laboratory, Shop and Studio Safety Equipment**

An array of federal and state laws and regulations make the protection of worker health and safety legal requirements. Personal and laboratory safety can be achieved only by informed responsible individuals. This section summarizes various forms of laboratory safety equipment. Based on this information knowledgeable choices for maximum personal protection can be made.

**Chemical Fume Hoods**

A chemical fume hood with a minimum of 2.5 linear feet of hood space per person shall be provided for those working with hazardous materials. The personnel working with chemicals shall verify that the hood is functioning properly before each use. In addition, all hoods shall be inspected annually the results posted on the hood and reported in writing to EH&S. Hood flow rates are to be measured and recorded on an inspection tag attached to the individual hood. Hoods not meeting the minimum performance rating of 80 linear feet per minute with the sash open 18 inches (or open to the indicator latch) are to be marked with an “Out of Service” sign until such time that they are functioning properly.

The following general guidelines shall be observed for safe and effective use of all laboratory hoods:

* Verify the hood is operating correctly (e.g., not in alarm) and has been inspected within the last year. Never use an inoperable laboratory hood or one that has been red-tagged.
* Fume hoods should be used for one of two purposes, either procedural use or storage, but not both.
* Do not allow stored chemicals to block vents or airflow.
* When the hood is being used, keep the sash as low as possible to increase the inward velocity of the air.
* Do not place your face inside the hood. Keep the sash low enough that it will protect your face in the event of an explosion or splash.
* The apparatus inside the hood should be placed on the floor of the hood at least six inches away from the front edge. Elevating the apparatus is preferred because air flow is better.
* Place plastic trays under chemicals stored in a hood. Trays should be large enough to contain the volume of the largest container plus 10%.
* In the event of a power outage or hood failure. Stop work, turn off devices, close containers and close the hood sash.
* **DO NOT USE** chemicals that form explosive perchlorate crystals (e.g., Perchloric acid) in Chichester Science Center. The fume hoods in Chichester Science Center are not designed to use these types of chemicals.
* The fume hoods in Chichester Science Center are equipped with electronic anemometers. If the hood alarm activates (either high or low flow) discontinue use and contact the building coordinator for placing a work order for repair.

**Ductless Fume Hoods**

Ductless fume hoods are not acceptable in place of a traditional ventilated hood. NFPA 45 states “Ductless chemical fume hoods that pass air from the hood interior through an absorption filter and then discharge the air into the laboratory are only applicable for use with nuisance vapors and dust that do not present a fire or toxic hazard.”

The select few applications that EH&S would approve the use of these hoods involve specific types, limited numbers and minimal volumes of chemicals. The following general guidelines shall be observed for safe and effective use of all laboratory ductless fume hoods:

* Contact EH&S to review information about the intended use.
* Write Standard Operating Procedures (SOP) for the proper use, training and maintenance of the ductless fume hood following the manufacturer’s instructions.
* Use only small quantities of chemicals in the hood.
* Do not conduct reactions involving heat and pressure.
* Do not store chemicals in the hood.
* Keep all chemicals capped while in the hood.
* Filters shall be replaced every six months. Note: depending on the chemicals used in the hood the filters may be a hazardous waste.
* Document all filter changes and keep a log of use.
* Will be inspected and certified on a quarterly basis.

**Biological Safety Cabinets**

**Eyewash Stations**

Eyewash stations provide an effective means of treatment when chemicals come in contact with the eyes. Eye wash stations should be readily available and accessible to all laboratory, shop and studio personnel where corrosive chemicals are being handled in a way that can create a splash hazard to the face and eyes. The eye wash station should be clearly marked, free of obstructions and in accessible locations no more than 10 seconds or 50 feet away from the lab work station. Laboratory, shop and studio workers should be able to locate the nearest eye wash station with their eyes closed; eye injuries may cause temporary blindness. An eye injury usually accompanies a skin injury. For this reason, eye wash stations should be located near the safety shower so that eyes and body can be washed.

The following general guidelines shall be followed for safe and effective use of all eye wash stations:

* Eyelids have to be forcibly opened to ensure effective washing behind the eyelid.
* Flood eyes and eyelids with water for a minimum of 15 minutes.
* Remove contact lenses as soon as possible to rinse eyes of any harmful chemicals.
* If possible cover both of the victim’s eyes with clean or sterile gauze.
* Call 911, 7-911(from Campus phone) or Campus Dispatch at (434)395-2091.
* Plumbed eye wash stations should have a water tempering valve.
* Plumbed eye wash stations shall be activated weekly to verify proper operations.
* Eye wash stations should be inspected annually to assure conformance with ANSI Z358.1 section (6) requirements.

**Safety Showers and Drench Hoses**

Safety showers provide an effective means of treatment in the event that chemicals are spilled or splashed onto the skin or clothing. Safety showers facilities should be installed wherever chemicals are present and must be readily available to all personnel. The following general guidelines shall be observed for safe and effective use of all safety showers and drench hoses:

* Safety showers should be clearly marked and free of obstructions.
* The safety showers should be no more than 50 feet or 10 seconds away for the lab work stations.
* Laboratory workers should be able to locate the shower with their eyes closed. Emergency situations may leave victim temporarily blind.
* Safety showers are activated by grasping and pulling the activation bar, ring chain or triangular rod.
* The pull mechanism should be designed for people of all heights. It should be accessible and free of obstructions.
* Safety shower should supply a continuous stream of water to cover the entire body.
* Individuals should remove clothing, including shoes and jewelry, while under an operating shower.
* Sink mounted drench hoses are activated by squeezing the trigger and should be used for quick spot washing of injuries.
* Safety showers should be located AWAY from electrical panels or outlets.
* Plumbed safety showers and drench hoses should be activated monthly to verify proper operations.
* Safety showers should be inspected annually to assure conformance with ANSI Z358.1 Section (4) requirements.

**Fire Safety Equipment**

Alarms are designed so that all endangered laboratory personnel are alerted. All faculty, staff and students should know the EXACT LOCATION of the fire alarm station nearest to or in their laboratory. If the fire alarm is activated EVACUATE to your designated area. The laboratories and classrooms in Chichester Science Center that have flammable gasses plumbed to them are equipped with an emergency shut off button located near the exit door. If the fire alarm is activated push in this button on as the lab is exited.

Fire extinguishers are not designed or intended to extinguish large fires, but if used properly, can control or extinguish a small fire. A small fire is defined as one that could occur in a standard office trash can. When a fire or suspected fire is discovered. The first reaction should be to activate the fire alarm system, call 911and evacuate the building according to the evacuation plan. Fire extinguishers are provided in all University buildings and intended as an aide to egress. If there are any questions on how to obtain an extinguisher, extinguisher training or have one inspected call EH&S (434)395-2940.

**Automated External Defibrillators (AED)**

An AED is the only effective treatment for restoring a regular heart rhythm during sudden cardiac arrest and is an easy to operate tool for someone with no medical background. An AED is a medical device that analyzes the heart’s rhythm. If necessary, it delivers an electrical shock, known as defibrillation, which helps the heart re-establish an effective rhythm. The 2010 consensus on science for CPR and Emergency Cardiovascular Care (ECC) agrees that Sudden Cardiac Arrest can be treated most effectively by a combination of CPR and Defibrillation. EH&S will conduct CPR and AED training by request.

**Employee Information and Training**

All employees who work in laboratories, shops and studios and may be exposed to hazardous chemicals must be apprised of the hazards of the chemicals present in their workplace, this includes student awareness. This information and training shall be provided at the time of an employee’s initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations.

Employees shall be informed of the following:

* The contents of the Lab Standard, its appendices and its location and availability.
* The location and availability of the Longwood University Chemical Hygiene Plan.
* The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA Standard.
* Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.
* The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to Safety Data Sheets (SDS) received from chemical suppliers.

Employee training shall include:

* Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.).
* The physical and health hazards associated with chemicals in the workplace.
* The measures employees can take to protect themselves from these hazards, including specific procedures that have been implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures and personal protective equipment to be used.
* The location of safety equipment such as showers, eyewash stations, fire extinguishers, fire alarm pull boxes and emergency exits.
* What actions to take in the event of a hazardous material emergency.
* The applicable details of the Longwood University Chemical Hygiene Plan.

**Emergency Reporting, First Aid, Chemical Spills, and Fire Safety**

All emergencies, medical, fire and /or spills shall be reported to LUPD on ext. 2091. Provide LUPD with information regarding the exact nature of the emergency, the building and location, chemicals which may be involved and the number of injured. Stay on the line until security has all the information they need and releases you.

**EMERGENCY CONTACT INFORMATION**

Rescue Squad: 911 or from a Campus Phone 7-911

Campus Dispatch: (434)395-2091

LU EH&S: (434)395-2940

LU Emergency Management: (434)395-5457

Blue Ridge Poison Control: (800)451-1428

**First Aid**

The first aid procedures detailed below could be lifesaving. Become familiar with the information described below so that disasters can be speedily contained. It is the responsibility of the faculty member and staff member to report bodily injury, carcinogenic, mutagenic or teratogenic chemical exposures or property damage. Non-working students (taking the lab) and visitors must report bodily injury, carcinogenic, mutagenic or teratogenic chemical exposures or property damage to a Longwood University faculty or staff member. Longwood University faculty or staff members must complete Material Management‘s “INCIDENT REPORT FORM”.

Always wash your hands before (if possible) and after giving first aid to avoid the risk of infection and transmission of disease. If possible, use latex gloves, or some equivalent if you have a latex allergy, before giving first aid.

The first aid kit should include specially selected items to carry out emergency treatment of cuts, burns, eye injuries or sudden injury. The first aid kit should contain individually sealed packages for each type of item. The content of the kit should be inspected weekly to ensure that expended items are replaced. The Building Coordinator will be responsible for maintaining the contents of the first aid kit. For replenishment of first aid supplies contact EH&S (434)395-2940

**Wounds (Small Cuts, Significant Bleeding and BURNS)**

**Small cuts and Scratches**

* Cleanse area with soap and water.
* Place clean dressing over the wound.

**Significant Bleeding**

* IMMEDIATELY call 911, 7-911(from a Campus Phone) or Campus Dispatch at (434)395-2091.
* Calm and reassure the victim.
* Lay the victim down. This will reduce the chance of fainting.
* DO NOT remove any objects impaled in the victim.
* Put direct pressure on the wound with a sterile bandage or clean cloth.
* If direct pressure does not control the bleeding, elevate the wound above the heart if possible.
* If bleeding is severe elevate the victim’s legs about 12 inches and cover with a blanket.
* **DO NOT APPLY TORNIQUET**.

**First Degree Burns**

(e.g., sunburn or mild steam burn, characterized by pain, redness and swelling).

* Run cool water over the area of the burn or soak in cool water for at least 5 minutes.
* Cover the burn with a sterile bandage or clean cloth.
* DO NOT APPLY ANY OINTMENTS, SPRAYS OR SALVES.

**Second and Third Degree Burns**

Are characterized by red or mottled skin with blisters (second degree), white or charred skin (third degree).

* If the victim is on fire put the fire out.
* Call 911, 7-911(from Campus phone) or Campus Dispatch at (434)395-2091.
* Do not remove any burnt clothing unless it comes off easily.
* Cover burns with dry sterile or clean bandaging.
* DO NOT APPLY ANY OINTMENTS, SPRAYS OR SALVES.

**Chemical Burns**

DO NOT become a victim; wear gloves and safety goggles to protect yourself if you are attempting to assist someone covered in chemicals.

**Chemical Skin Burns**

* Remove victim’s clothes – do not let modesty stand in the way.
* Remove victim’s shoes – chemicals may collect in the shoes
* Rinse the area with large quantities of water for at least 15 minutes.
* DO NOT apply burn ointments/sprays to affected areas.
* Cover with dry clean or sterile material.
* For large affected areas call 911, 7-911(from Campus phone) or Campus Dispatch at (434)395-2091.

**Chemical Eye Burns**

* Eyelids have to be forcibly opened to ensure effective washing behind the eyelid.
* Be sure to wash from the nose to the ear this will avoid washing chemicals back into the eyes.
* Flood eyes and eyelids with water for a minimum of 15 minutes.
* Remove contact lenses as soon as possible to rinse eyes of any harmful chemicals.
* If possible cover both of the victim’s eyes with clean or sterile gauze.
* Call 911, 7-911(from Campus phone) or Campus Dispatch at (434)395-2091.

**Chemical Ingestion**

* IMMEDIATELY CALL 911, 7-911(from Campus phone) or Campus Dispatch at (434)395-2091.
* Call Blue Ridge Poison Control (800)451-1428
* If the victim is unconscious, turn their head or entire body onto their left side. Be prepared to start CPR, but be cautious about exposing yourself to chemical poisoning via mouth-to-mouth resuscitation. If available, use a mouth-to-mouth resuscitator.

**Chemical Inhalation**

* Evacuate the area and move the victim to fresh air if possible. DO NOT become a victim yourself.
* IMMEDIATELY CALL 911, 7-911(from Campus phone) or Campus Dispatch at (434)395-2091
* If the victim is not breathing perform CPR until the rescue squad arrives, be cautious about exposing yourself to chemical poisoning via mouth-to-mouth resuscitation. If available, use a mouth-to-mouth resuscitator.
* If breathing, loosen victim’s clothing and maintain the airway.
* Lay victim flat on their back.
* Place one hand under their neck and lift.
* With the heel of the other hand on the victim’s forehead, rotate or tilt the head backward for maximum extension.
* If additional airway opening is required, it can be achieved by thrusting the lower jaw into a jutting-out position.
* Treat for chemical burns of the eyes and skin.

**Chemical Spills**

**Spills Inside a Building**

The procedures below describe the cleanup of small chemical spills (typically1 to 2 pints). For larger spills (2 pints or more) contact EH&S (434)395-2940 or Campus Dispatch (434)395-2091. Wear appropriate personal protective equipment (e.g., gloves, goggles) when cleaning up spills.

* Immediately evacuate the area and notify addicted personnel. If possible, do not evacuate trough the contaminated area.
* Seal off the area to prevent further contamination of others until the arrival of emergency personnel

**Acid Spills**

* Apply neutralizer (or sodium bicarbonate) to perimeter of spill.
* Mix thoroughly until fizzing and evolution of gas ceases. NOTE: it may be necessary to add water to the mixture to complete the reaction. Neutralizer has a tendency to adsorb acid before fully neutralizing it.
* Transfer the mixture to a plastic bag, tie shut, fill out a waste label, and place it in a SAA. Notify EH&S for disposal.

**Solvent Spills**

* Use a solvent pad or
* Apply activated charcoal to the perimeter of the spill.
* Mix thoroughly until material is dry and no evidence of solvent remains.
* Transfer absorbed solvent to a plastic bag, tie shut, fill out and attach a waste label, and place in a SAA. Notify EH&S for disposal.

**Mercury Spills**

* Dampen the mercury sponge with water, and then wipe the contaminated area.
* Do this procedure slowly to allow for the complete absorption of all free mercury. A silvery surface will form on the sponge.
* Place contaminated sponge in its holder, place the holder in a plastic bad, tie shut, and fill out and attach a waste label, and place in a SAA. Notify EH&S for disposal.

**For Spills Outside a Building, Larger than 2 Pints or Near Drains**

For spills, releases or incidents requiring special training, procedures or personal protective equipment (PPE) that is beyond the abilities of present personnel, take the following steps:

* Immediately evacuate the area and notify affected personnel. If possible, do not evacuate through the contaminated area. Pull the fire alarm if building evacuation is required.
* Call 2091/7-911/911 to report the incident.
* Give the operator the following information:
  + Your name, telephone number, and location.
  + Time and type of incident
  + Name and quantity of spilled material, if known.
  + Extent of injury or damage, if known.
* Seal off area to prevent further contamination of others until the arrival of emergency personnel.
* Use water hose or emergency shower for anyone who is contaminated by the spill to wash off the contamination, remain in the vicinity, and give his or her name to the emergency personnel.
* Render first aid if necessary. Remember, if you are helping to provide first aid use the appropriate PPE. Do not become contaminated from the clothes of those who are exposed.
* No effort to contain or clean up the spill should be made unless you have been trained in the proper methods to do so.
* If alarm sounds, follow established building evacuation procedures.
* Do not re-enter the area until directed by emergency personnel.

**Fire Safety**

**Small Building and Laboratory Fires**

The fire extinguishers provided are intended to aid in emergency egress, of may be used to extinguish small fires. Such use is not an expectation of any member of the University. Self-preservation via evacuations is the preferred action.

Small fires are extinguishable within 1 or 2 minutes and they are the size of office trash can or smaller.

The **PASS** method is a commonly used way to describe the use of a fire extinguisher.

* **P**ULL THE PIN: Place your hand on top to the cylinder and pull the pin. This will unlock and activate the unit.
  + - **A**IM: Point the nozzle of the hose at the base of the fire.
* **S**QUEEZE: The handle (lever) releasing the firefighting agent.
* **S**WEEP: The nozzle from side to side at the base of the fire. Empty the fire extinguisher onto the fire.

**Large Fires**

* REMAIN CALM
* Activate the manual pull alarm
* Close the door behind you as you exit the room on your way out of the building.
* Evacuate by the stairwell, NOT the elevator, Assist the injured.
* Exit the building as quickly as possible.
* IMMEDIATELY CALL 911, 7-911(from Campus phone) or Campus Dispatch at (434)395-2091

**Medical Consultation and Medical Exams**

All employees who work with hazardous chemicals in laboratories shall be provided the opportunity to receive medical consultation and examinations under the workers compensation or a panel physician under the following circumstances:

* Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.
* Where exposure monitoring reveals an exposure level routinely above the action level for an OSHA regulated substance.
* Whenever 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.

**Hazardous Wastes**

Hazardous waste management is ruled by increasingly stringent and complex regulations. The proper management of chemical and hazardous wastes is the responsibility of the generator of the waste. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is not allowed. Hoods shall not be used as a means of disposal for volatile chemicals. All wastes shall be collected and stored according to the Hazardous Waste Plan. Hazardous waste shall be stored in a safe and secure area with the proper labels attached. For further information see Longwood University’s Hazardous Waste Plan.

**Recordkeeping**

**Medical Records**

Longwood University Office of Human Resources shall maintain the medical records for each employee with occupational exposure. The records shall be maintained for the duration of employment plus 30 years, in accordance with 29CFR1910.20.

**Exposure Monitoring Records**

Longwood University Office of Human Resources shall maintain the records of any measurements taken in order to monitor employee exposures to hazardous chemicals in the laboratory, shops and studios. The records shall be maintained for the duration of employment plus 30 years, in accordance with 29CFR1910.20.

**Access to Records**

Per OSHA Standard 29CFR1910.20 “Access to Exposure and Medical Records”, employees have the right to receive copies of MSDSs, exposure monitoring records and medical records associated with their jobs. Information shall be provided in accordance with the standard and with the Longwood University “Access to Employee Exposure and/or Medical Records” procedure available on the EH&S website.

**Training Records**

All regulatory safety and health training is documented by employee name, or employee identification number, date, topic of training, length of class and instructor name. This data is maintained by the EH&S Office.

**Inspection Records**

All laboratory, shop and studio inspection records are available for review from the CHO and are maintained according to the record’s retention schedule.