Institutional Chemical Hygiene Plan

Approved by the University of Kentucky Chemical Safety Committee: September 17, 2025

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1.0 INTRODUCTION

Purpose

The University of Kentucky is committed to providing a healthy and safe working environment for the campus community, free from recognized hazards in accordance with all local, state, and federal regulations. The purpose of the University of Kentucky (UK) Chemical Hygiene Plan (CHP) is to comply with 29 CFR 1910.1450, the Occupational Safety and Health Administration (OSHA)'s "Laboratory Standard," by providing guidance that defines administrative and engineering controls, personal protective equipment (PPE), work practices and safety procedures to protect all workers in research laboratories at UK from exposure to chemical hazards associated with their work. The Chemical Hygiene Plan (CHP) establishes a formal written program for protecting laboratory personnel against adverse health and safety hazards associated with potential exposure to hazardous chemicals and must be made available to all laboratory personnel.

Background

The Chemical Hygiene Plan is part of the University's compliance with the regulations promulgated on January 31, 1990, by the U.S. Department of Labor Occupational Safety and Health Administration (OSHA) and adopted by Kentucky OSH. This standard, "Occupational Exposures to Hazardous Chemicals in Laboratories" [29 CFR 1910.1450], is hereafter called the Laboratory Standard (See Appendix A).

Scope

All UK laboratories using, storing, or handling hazardous chemicals and all personnel working within them must comply with the Laboratory Standard. It does not apply to research labs involving **exclusively** radiological or biological materials, as these safety procedures and regulatory requirements are outlined in the UK Biosafety Manual and UK Radiation Safety Manual. Research involving more than one type of hazard must comply with all applicable regulatory requirements and follow guidance outlined in the relevant safety manuals. Additional oversight may be required based on the materials handled and the work performed.

The information presented in the UK institutional CHP represents best practices and provides a broad overview of the information necessary for the safe operation of laboratories that utilize potentially hazardous chemicals. It is not intended to be all inclusive. Departments, divisions, or other work units engaged in work with potentially hazardous chemicals that have uncommon characteristics or are otherwise not sufficiently covered in the institutional CHP, shall be addressed in the laboratory's specific Chemical Hygiene Plan by adding information addressing the hazards and how to mitigate their risks, as appropriate.

For questions about situations, locations, materials, or procedures to which the Lab Standard applies, or for whom it covers, the Department of Research Safety can assist in making this determination. In addition, the University of Kentucky Division of Environmental Health and Safety (EHS) houses safety professionals and subject matter experts within a range of disciplines that may be consulted related to laboratory safety. See **Appendix B** for an organizational chart and contact information.

OVERVIEW

A wide variety of educational activities and research utilizing hazardous materials is conducted at the university, requiring the responsibility for ensuring workplace safety to be shared among faculty, staff, students, and campus health and safety professionals.

All UK laboratories using, storing, or handling hazardous chemicals and all personnel working within these laboratories, are required to comply with 29 CFR 1910.1450, The Occupational Health and Safety (OSHA)'s Occupational Exposure to Hazardous Chemicals in Laboratories, also known as the "OSHA Laboratory Standard". **Compliance with these regulations includes having a written laboratory specific Chemical Hygiene Plan**.

This institutional Chemical Hygiene Plan (CHP) applies to all research laboratories utilizing hazardous chemicals at the University of Kentucky and university-owned research facilities and properties and is reviewed annually by the institutional Chemical Hygiene Officer (UK CHO) and the University of Kentucky Chemical Safety Committee (UK CSC). A Laboratory Specific CHP Template is accessible on the Department of Research Safety's website (researchsafety.uky.edu) for use by UK research labs to create their own OSHA compliant CHP. This institutional CHP may be used by principal investigators and lab-designated Chemical Hygiene Officers (CHO) to develop their Lab Specific CHP. Each laboratory under the direction of the Principal Investigator and/or lab-designated Chemical Hygiene Officer, shall develop a laboratory specific CHP which will be made available to all laboratory personnel and reviewed annually.

The laboratory specific CHP must, at a minimum, meet the elements outlined below. For any laboratory or site-specific CHP to be valid, it shall contain information specific to the materials and procedures conducted at that location and shall include:

1. Standard operating procedures relevant to safety and health considerations for each activity involving the use of hazardous chemicals.
2. Criteria that the employer will use to determine and implement control measures to reduce exposure to hazardous materials [i.e., engineering controls, the use of personal protective equipment (PPE), and hygiene practices] with particular attention given to selecting control measures for extremely hazardous materials.
3. A requirement to ensure that fume hoods and other protective equipment are functioning properly and identify the specific measures the employer will take to ensure proper and adequate performance of such equipment.
4. Information to be provided to lab personnel working with hazardous substances include:
    a. The contents of the Laboratory standard and its appendices.
    b. The location and availability of the employer's CHP.
    c. The permissible exposure limits (PELs) for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard (e.g., NIOSH REL, ACGIH TLV).
    d. The signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

    e. The location and availability of known reference materials on the hazards, safe handling, storage, and disposal of hazardous chemicals found in the laboratory including, but not limited to, the Material Safety Data Sheets received from the chemical supplier.
5. The circumstances under which a particular laboratory operation, procedure or activity requires prior approval from the employer or the employer's designee before being implemented.
6. Designation of personnel responsible for implementing the CHP, including the assignment of a Chemical Hygiene Officer and, if appropriate, establishment of a Chemical Hygiene Committee.
7. Provisions for additional worker protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins, and substances that have a high degree of acute toxicity. Specific consideration must be given to the following provisions and shall be included where appropriate:
    a. Establishment of a designated area.
    b. Use of containment devices such as fume hoods or glove boxes.
    c. Procedures for safe removal of contaminated waste.
    d. Decontamination procedures.
8. The employer must review and evaluate the effectiveness of the CHP at least annually and update it as necessary.

A template was developed for UK research laboratories to create their Laboratory Specific Chemical Hygiene Plan. This Lab Specific CHP Template can be found in Appendix I of this document. A fillable pdf Lab Specific CHP template can be accessed at researchsafety.uky.edu .

The laboratory specific CHP applies to all personnel performing procedures in the laboratory. OSHA defines an employee as "an individual employed in a laboratory workplace who may be exposed to hazardous chemicals during their assignments." OSHA does not consider students in an academic laboratory as employees. However, as a matter of university policy, the principles outlined in this Chemical Hygiene Plan apply to students in University of Kentucky laboratories. Visiting professors and volunteers working in the lab are also included. Thus, designated laboratory CHO's must ensure that these groups in their laboratories are adequately instructed about safe laboratory procedures and that training has been documented.

All personnel working in a UK research laboratory must read this CHP before the commencement of lab duties and the plan always made accessible to them. In addition to the CHP, lab personnel must be familiar with and adhere to prudent laboratory safety guidelines developed by their Laboratory CHO in conjunction with University of Kentucky Environmental Health and Safety (EHS) guidance and requirements, and those of federal, state, and local regulatory agencies. A written record must be maintained in the CHP for each laboratory worker that documents they have been informed of the hazards in their workplace, have reviewed the laboratory specific Chemical Hygiene Plan, laboratory specific policies, and written standard operating procedures (SOP) for performing work procedures safely. These records shall be maintained by the laboratory-designated Chemical Hygiene Officer (i.e., Principal Investigator or Laboratory CHO) and made available for review upon inspection. A Laboratory Specific Training Record is available for UK Laboratories to use for this purpose and is available in **Appendix C** of this document and on the UK Department of Research Safety's website.

In addition, the laboratory's entry door signage must be reviewed annually by the specific laboratory's designated Chemical Hygiene Officer (PI or Laboratory CHO), with the revision date documented on the plan itself. Any rooms in the laboratory that house hazardous materials also must be signed to alert personnel to their presence.

Minors in Research Laboratories or Animal Facilities

Students under 18, not enrolled as a University of Kentucky student, who wish to conduct research or perform procedures in a UK research laboratory must follow the Safety of Minors in Research Policy and required procedures. The policy and process to receive approval to host a minor student in the research laboratory can be accessed at: https://researchsafety.uky.edu/chemical-safety/cs-policies-and-procedures/safety-minors-research-program

2.0 ROLES AND RESPONSIBILITIES

Background

The University of Kentucky is committed to providing a safe and healthful environment for all persons associated with the institution. The University intends to be a role model for the Commonwealth in its environmental stewardship, health protection and safety standards, and compliance with all laws and regulations relating to the environment, health, and safety.

Management, faculty, staff, and students are asked to support these goals in all university activities, and the university administration will provide the necessary resources to achieve these goals.

A vast array of educational activities and research utilizing hazardous materials is conducted at the university, which requires all parties involved to ensure that such activities are conducted safely to protect workers, students, the community, and the environment. The following outlines specific responsibilities associated with laboratory safety and this Chemical Hygiene Plan.

Environmental Health and Safety Division responsibilities include the following:

- Appoint an Institutional Chemical Hygiene Officer who will routinely review the model Chemical Hygiene Plan and suggest modifications as needed
- Provide technical assistance to Laboratory Supervisors and workers concerning appropriate storage, handling, and disposal of hazardous chemicals
- Provide general laboratory safety training upon request
- Conduct exposure assessments and laboratory inspections upon request and on a routine basis
- Provide technical assistance concerning personal protective equipment and laboratory safety equipment; and
- Remain current on rules and regulations concerning chemicals used on campus.

University Chemical Safety Committee

- Review and recommend chemical safety policies and procedures.
- Annually review the institutional Chemical Hygiene Plan, as required by OSHA 29 CFR 1910.1450
- Maintain confidentiality as appropriate, maintain meeting minutes, and prepare reports as requested by university administration.

Deans, Directors, and Heads of Academic and Administrative Units responsibilities regarding the implementation of the Chemical Hygiene Plan:

- Collaborate with faculty and staff to adapt the institutional Chemical Hygiene Plan to include departmental and/or lab-specific guidelines and to develop strategies to implement the Plan.
- Consider the idea of developing departmental-wide laboratory safety training programs, committees, and shared-use facilities.
- Make budget arrangements for health and safety improvements. These respective individuals are responsible for requesting the necessary monies in the budget process.

Faculty and Staff in charge of supervising laboratories (referred to as Laboratory Supervisors throughout the document) have the following responsibilities for implementing the Chemical Hygiene Plan:

- Inform and train employees concerning chemical safety as required by this Plan. Retain lab specific training records and documentation verifying personnel successfully understood its content.
- Digital records for completed online training modules hosted by EHS/Research Safety will be maintained in a secured database. Compliance liaisons, Lab Supervisors, and Principal Investigators have access to personnel safety training records through the SciShield system.
- Implement and enforce rules and standards of this plan concerning health and safety for laboratories under the supervisor's authority and restrict access of the laboratory to authorized individuals.
- Serve as the designated "Chemical Hygiene Officer" for their laboratories.
- Ensure compliance of laboratory personnel with the lab CHP
- Ensure the availability and enforce the proper use of appropriate personal protective equipment and relevant health and safety reference materials.
- Remain aware of chemicals stored and used in labs and their associated hazards.
- Review and update the laboratory's chemical inventory annually.
- Conduct internal inspections of the lab to identify health and safety concerns and implement corrections as needed.
- Request assistance from EHS/Research Safety as needed.
- Request allocation of funds from superiors for health and safety improvements as needed, or budget these into research grant proposals.
- Maintain written SOPs for procedures utilizing hazardous chemicals.

Laboratory Personnel responsibilities regarding implementation of the Chemical Hygiene Plan:

- Follow all university, local, state, and federal health and safety standards and rules.
- Report any hazardous conditions to the Laboratory CHO
- Wear or use prescribed protective equipment.
- Report any suspected job-related injuries or illnesses to the Laboratory CHO and seek treatment immediately.
- Refrain from the operation of any equipment or instrumentation without proper instruction and authorization
- Remain aware of the hazards of the chemicals in the lab and how to handle hazardous chemicals safely. Follow written SOP for procedures.
- Know the signs and symptoms of exposure to the hazardous chemicals in use in the laboratory
- Request information and training when unsure how to handle a hazardous chemical or procedure

3.0 DEFINITIONS

Definitions for selected terms used in this plan are included below. Please see paragraph (b) of OSHA's Occupational Exposure to Hazardous Chemicals in Laboratories ("The Laboratory Standard," 29 CFR 1910.1450) for additional definitions related to the chemical hygiene program.

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 (1) are capable of protecting employees from the hazards presented by hazardous chemicals used in that particular workplace, and (2) meets the requirements of paragraph (e) OSHA's Laboratory Standard.

Chemical High Risk Procedures are lab procedures that pose significant risk of severe injury or major property damage if a malfunction were to occur (such as a utility outage, runaway reaction, container failure, or chemical spill/release) and/or which require any of the following:

- Engineering controls are more specialized than good room ventilation, chemical fume hoods, biological safety cabinets and/or local exhaust such as snorkel or canopy hoods.
- Personal protective equipment in addition to gloves, lab coats, eye/face protection, and/or chemical or thermal protective aprons or sleeves.
- Chemical-specific first aid treatments or antidotes.

Designated area means an area which may be used for work with "select carcinogens," reproductive toxins, or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood.

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 during their assignments.

**PLEASE NOTE: OSHA does not consider students in an academic laboratory as employees. However, as a matter of university policy, the principles outlined in this Chemical Hygiene Plan will apply to students in University of Kentucky's laboratories. Visiting professors and volunteers working in the lab are also included. Thus, Laboratory Supervisors must ensure that these groups in their laboratories are adequately instructed about safe laboratory procedures, proper disposal of hazardous materials utilized, and protocol in the event of injury or emergency situations.*

Hazardous chemical means any chemical classified as a physical or health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, or hazard not otherwise classified.

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 use of hazardous chemicals means handling or use of 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.

Particularly Hazardous Substance means a substance that is categorized as a select carcinogen, reproductive toxin, or that has a high degree of acute toxicity. The OSHA Laboratory Standard requires the following for work with a particularly hazardous substance:

- Establishment of a designated area
- Use of containment devices such as chemical fume hoods or glove boxes
- Procedures for safe removal of contaminated waste; and
- Decontamination procedures.

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.

Safety Data Sheets (SDS) is written or printed material about a hazardous chemical prepared in accordance with the OSHA Hazard Communication Standard.

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 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;
(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

Wet Lab means a laboratory designed for experimentation or other work involving the handling of biological, chemical, radiological, or other potential hazards. These spaces require certain plumbing, ventilation, and equipment for safe conduct of procedures.

WET lab	DRY lab
Chemicals, drugs, biologicals are tested and analyzed using liquids	Mathematical analysis and computational work are done by digital equipment
Designed with refrigerators, freezers, and safety cabinets for containment of spills or release	Designed to control and support humidity and cooling.
Materials and lab finishes are resistant to infectious agents and chemicals	Materials do not pose a hazard. Equipment is not used in conjunction with hazard materials which could contaminate them or the space, powered instruments, network communication, and sensitive computers and equipment
Direct ventilation, piping, benches and sinks	Focused on an effective communication system
Various equipment with functions for handling and sampling biological, chemical, or radiological materials	Computers are used to carry out modeling, analysis and simulation

4.0 PRIOR APPROVALS REQUIRED FOR WORK

Prior approval is a critical aspect to the overall safety of the lab which allows for thorough and timely communication between the Department/Principal Investigator and research staff. This communication and process ensures safety precautions are reviewed and upgraded where appropriate and that any possible changes needed for safety are addressed. Examples of circumstances which might call for prior approval are:

- Scaling up experiments, increase in the amount of precursor materials or by-products.
- Unattended operations, overnight experiments
- Chemical properties requiring higher than usual engineering controls, PPEs, or altered procedures.
- Utilization of new equipment, new high-risk chemical, or new location

Due to the large variety of research being conducted in laboratories at the University of Kentucky, there is no established single approval process applied for all laboratory and instructional research involving the use of hazardous chemicals.

Colleges, Departments, and Principal Investigators are responsible for all materials used and procedures performed in the spaces assigned to them and for the safety of the employees and students under their direction. High hazard types of activities shall be identified by the Principal Investigator or person responsible for the work, and any type of approval process addressed in the laboratory's standard operating procedures and documented in the lab's Chemical Hygiene Plan (CHP).

The UK Department of Research Safety can assist in providing information to researchers about working safely with particularly hazardous substances (select carcinogens, reproductive toxins, and acute toxins) or other high hazard chemicals (i.e., self-reactive, pyrophoric, or moisture sensitive chemicals) substances. Guidance, toxicological information, and recommendations for the safe handling, use and control of high hazard materials is also provided in chemical manufacturers' SDS, PubChem, and reference sources such as Prudent Practices in the Laboratory and Safety in Academic Chemistry Laboratories.

The following require approvals from University of Kentucky appointed oversight committees for the use and/or acquisition of the following:

- Biohazardous materials and Select Toxins (please contact the university Biosafety Officer)
- Radiological materials, equipment with radioactive sources, lasers (please contact university Radiation Safety Officer
- Laboratory Animals (please contact university IACUC)
- Human Subjects or patient samples (please contact university IRB)

The following situations and/or materials require approval from the Principal Investigator and/or Laboratory CHO for the acquisition and use within the laboratory:

- Substances requiring the use of respiratory protection
- Use of regulated known carcinogens
- Use of self-reactive, moisture sensitive or pyrophoric chemicals
- Use of GHS categorized Acute Toxins
- Formulation of nanomaterials
- Presence of students not enrolled at UK under the age of 18

5.0 LAB PERSONNEL TRAINING

The OSHA Laboratory Standard requires the following for training laboratory personnel, to be provided by the PI/Laboratory CHO and documented in the lab's specific CHP:

- Methods and observations that may be used to detect the presence or release of hazardous chemicals in use (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 of chemicals in use the work area.
- The measures workers can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect workers from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
- The applicable details of the written laboratory specific Chemical Hygiene Plan.

The trainings listed below are also required of all personnel working in wet labs conducting research at the University of Kentucky.

- Chemical Hygiene/Laboratory Safety- Initial and Annual Refresher training (online hosted in SciShield)
- Hazardous Waste (online module hosted by UK EHS)
- Fire Extinguisher (online module hosted by UK EHS)*
- General Lab Specific Training (See Appendix C for documentation form)

*students under the age of 18 not enrolled at the university are exempted from the requirement for completion of this training

Additional trainings may be required, depending on the procedures and materials in use in the laboratory. Training specific for the lab where an employee is assigned is the responsibility of that employee's PI or lab designated CHO. Lab Specific training should be done initially and then again if the following conditions have changed:

- A new process, piece of equipment or chemical is introduced into the laboratory
- A new process, piece of equipment or chemical is added to an existing procedure
- A scale up of a procedure, such as increasing from 5 milligrams to 5 grams
- Remodel of the laboratory

6.0 PLANNING FOR EMERGENCIES

Laboratory emergencies may result from various factors that can result in serious injuries, fires, explosions, spills, or potential exposures. All laboratory employees shall be trained and familiar with the location of their laboratory's emergency response equipment and operating procedures. The Principal Investigator/Laboratory CHO of is responsible for ensuring this is completed. The Lab-Specific Training Record Template provided in Appendix C documents the review with lab personnel of the location of safety equipment, including first aid kits, eye washes, safety showers, fire extinguishers, fire alarm pull stations, and spill kits (See Appendix C). This training must be maintained for all lab personnel in the lab-specific CHP.

In general, the hazards within the laboratory shall be assessed by the PI/Laboratory CHO and lab specific emergency plans established that cover the procedures and materials of the lab regarding:

- Handling small and large chemical spills
- Procedures for responding to fires, including the need for the use of any special extinguishers
- Response procedures for when equipment or instruments fail
- Response for if ventilation systems fail
- Responses to local equipment alarms

Principal Investigators and/or lab supervisors must report any incident involving personal injury, exposure or illnesses, unintended fire, property damage or incidents involving an environmental release of hazardous materials directly to UK Environmental Health and Safety after emergency evacuation and/or First Aid has been completed.

6.1 Laboratory Posting Requirements

Door signs must be placed on ALL entry doors to spaces that contain hazardous materials and/or equipment. Door signs shall be reviewed and revised, as necessary, on no less than an annual basis. A compliant door sign shall accurately display:

- PI/Lab CHO or responsible individual and accurate emergency contact information
- Symbols for materials stored or used within the space (i.e., universal biological or radiological hazard symbols, GHS pictograms for chemicals and compressed gas cylinders)
- Text or symbols indicating any other present hazards such as electrical, strong magnetic, noise, etc.
- Required PPE and precautions required for or upon entry

Instructions for generating a door sign are in the SciShield System, under the Research Tools menu, in the Document Library. For more information, please visit researchsafety.uky.edu or contact labsafety@uky.edu

All labs are required to post **emergency phone numbers** and **injury reporting procedures** in a readily accessible location known to all lab workers.

6.2 Alarms and Equipment Monitors

All types of monitors and alarms are used to warn personnel of an unsafe condition. When an alarm is activated, appropriate response is mandatory by all personnel. Report equipment alarms to the Principal Investigator, Laboratory CHO, and/or Facility Manager. If the alarm or

monitoring system is facility-specific, follow the established specific emergency response procedures. Alarms on chemical fume hoods or other engineering control devices shall be brought to the attention of those responsible for repair as soon as they are discovered. Alarms shall not be tampered with or silenced without ceasing procedures with the equipment. For Chemical fume hood alarms and concerns, please contact the UK Department of Occupational Health and Safety.

6.3 First Aid and Medical Treatment

FOR MEDICAL EMERGENCIES CALL 911 OR GO TO THE UK CHANDLER HOSPITAL (OR CLOSEST) EMERGENCY DEPARTMENT

As part of the university's Occupational Health Program, the opportunity for Laboratory Workers to receive medical evaluation must be provided under the following circumstances:

- If an employee develops any symptoms thought to arise from exposure to a hazardous chemical. **Please note: Individuals exhibiting the acute onset of symptoms due to known exposure should seek immediate medical attention.**
- After an incident such as a spill, leak or explosion which may have resulted in an exposure.
- When an over exposure is identified through evaluation or assessment.
- There is an existing medical surveillance program in place for the work conducted.

Any medical examination required from the above listed situations must be **provided without cost** to the employee, without loss of pay and at a reasonable time and place. Records of any medical examination will be maintained at the medical facility providing service or with appropriate medical personnel at the University.

All workplace incidents, and workplace acquired injuries or illnesses sustained by UK personnel shall be reported by the Principal Investigator/Laboratory CHO to Workers Care by calling (800)440-6285.*

UK students may contact University Health Services (859) 323-APPT during business hours, or (859) 323-5321 after business hours, on weekends or holidays. *

***If known, the following information should be presented to the clinician when being seen for evaluation/treatment:**

- **Identity of the hazardous chemical(s) to which the individual may have been exposed**
- **A description of the conditions under which the exposure occurred.**
- **A copy of the chemical's SDS**

Chemical Specific First Aid

Work environments with specific potential health hazards with known recommended immediate first aid beyond what is available in most first aid kits, shall be equipped with any known, and accessible immediate first-aid treatment needed for **dermal exposures** and lab personnel trained (with documentation maintained in the lab specific CHP) on its applicable use and location.

Two common examples of these types of chemical-specific first aid treatments are :

- Calcium gluconate gel for treatment of dermal exposure to Hydrofluoric acid.
- A 50% solution of PEG-300/400 for treatment of dermal exposure to phenol.

If the laboratory stores and/or utilizes a hazardous chemical with a known dermal first aid product:

a) The product shall be mentioned on a documented lab SOP for the procedures with the chemical.
b) The product shall be made available and maintained in a lab first aid kit in a location known to all lab personnel, regularly checked, and replaced when expired.
c) Lab personnel shall be trained on location and proper use of chemical first aid. This training shall be documented and maintained in the lab specific CHP.

6.4 Exposure Monitoring and Medical Surveillance

Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the permissible exposure limit) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance must be established for the affected worker(s) as prescribed by the specific standard.

In some instances, it may be necessary to perform personnel exposure monitoring when administrative controls, engineering controls, and PPE may not be sufficient for adequate protection from exposure to a hazardous chemical. This can occur when chemical exposure levels approach or exceed OSHA's Permissible Exposure Limit (PEL) and/or ACGIH's Threshold Limit Value (TLV). This is usually indicated when engineering controls, such as a chemical fume hood, cannot be used for procedures.

If any research lab is working with one of the federally regulated substances listed below, please contact labsafety@uky.edu so exposure monitoring, ventilation, and any other regulatory requirements, and/or other concerns can be documented and addressed.

Arsenic
Asbestos
Asphalt fumes
Benzene
Beryllium
1-Bromopropane
1,3-Butadiene
Cadmium
Chromium
Diacetyl
Diesel exhaust
Ethylene oxide
Formaldehyde
Hexavalent chromium
Hydrogen sulfide
Isocyanates
Lead
Mercury
Metals, toxic
Metalworking fluids
Methylene chloride
Silica, crystalline
Solvents
Synthetic mineral fibers
Toluene

6.5 Chemical Spill Response

Major spills of stock solution:

Leave the area and notify others not to enter. Report the spill to the UK Environmental Quality Management Department (EQMD)at (859) 323-6280 (M-F 8am-5pm) or after hours by dialing 911 from any on-campus phone or by contacting the UK Police at (859) 257-UKPD (8573).

Minor spills of manageable amount**:**

If necessary, contact EQMD for guidance. Consult manufacturer's SDS for instructions and compatibilities for your chemical. Keep aware of any materials such as paper towels or water that could be incompatible with the spilled chemical.

6.6 Incident Reporting Procedures

All workplace incidents, and workplace acquired injuries or illnesses sustained by UK personnel shall be reported by the Principal Investigator/Laboratory CHO to Workers Care by calling (800)440-6285.

UK students may contact University Health Services (859) 323-APPT during business hours, or (859) 323-5321 after business hours, on weekends or holidays.

Unsafe working conditions or "near-miss" incidents (incidents not resulting in injury or release of hazardous material) is encouraged to be reported to UK Occupational Health and Safety at: https://ehs.uky.edu/apps/incident

6.7 Procedures for Selected Emergencies

Lab personnel shall be trained on and informed of the following emergency procedures as well as the procedures detailed in their Building Emergency Action Plan (BEAP)

Fire, rupture of containers resulting in large spills, failure of engineering controls or safety equipment, and/or any other circumstance resulting in uncontrolled release of hazardous materials:

1. Alert personnel in the immediate vicinity. Give instructions to sound the alarm and call for assistance.
2. Only where safe and possible: turn off any heat sources, confine the fire or emergency, shut the chemical fume hood sash and close any doors. These measures can help to prevent the spread of vapors, gases, or fire.
3. Evacuate the building or hazardous area. Use the evacuation alarm system. Follow posted evacuation procedures. Assemble at your lab's designated meeting point. Practice evacuation and assembly in drills.
4. Summon aid from a safe location and call 911. Give location and explain the emergency.

Clothing Fire and Severe Thermal Burns

Thermal burns from a clothing fire or large splash of hot material can be life-threatening if they are deep, extensive, or located on critical areas of the body. Severe burns of the hands, feet, face, and genital areas are considered critical. To extinguish a clothing fire:

1. Stop the person on fire from running! Have the person cover their face with their hands if possible.

2. Drop the person to the floor. Standing will allow flames to spread upward to eyes and nose.
3. Roll the person to snuff out the flames.
4. Cool the person. Remove smoldering clothing. Use cold water or ice packs to cool burns and minimize injury.
5. Get medical assistance immediately.

Chemical Splash to the Eyes or Skin

Immediate flushing with water is a critical step to response of a chemical splash to eyes or skin. In general, chemical splashes require at least 15 minutes of flushing before a victim can proceed to emergency medical treatment. Knowing the location and how to properly use safety equipment such as eye washes and safety showers is the first step in emergency preparedness.

Using an Eyewash

1. Flush with tepid water or eye solution from the inside edges of the eyes to the outside; this will help to avoid washing the chemicals back into the eyes or into an unaffected eye.
2. Water or eye solution should **NOT** be directly aimed onto the eyeball but aimed at the base of the nose.
3. Flush eyes and eyelids with water or eye solution for a **minimum** of 15 minutes. “Roll” eyes around to ensure full rinsing.
4. Immediately seek medical attention.

Using a Safety Shower

1. Stand directly under the shower head.
2. Pull handle to activate shower.
3. Wash with tepid water for a **minimum** of 15 minutes.
4. To turn off the shower push the handle up.

7.0 CHEMICAL LABELING, STORAGE, AND INVENTORY

Prudent chemical management includes the following processes:

7.1 Chemical Procurement

To prevent the accumulation of aged and potentially dangerous chemicals in the lab, the following best practices should be implemented:

- **Order only the necessary amount for planned experiments.**
  Do not order larger quantities that cannot be used in a reasonable amount of time for the space available. Having a larger amount on hand means that there is a greater potential for a harmful exposure, accident, or emergency.
- **Order a less hazardous form of the same chemical.**
  - Dilute solutions are generally safer than more concentrated solutions.
  - Aqueous solutions are generally safer to handle than powders requiring reconstitution.
  - Pellets, tablets, granules, or flakes are generally safer to handle than powders.
- **Purchase the chemical in a safer container.**
  Order chemicals in containers that enhance employee safety.
  - When ordering corrosives or highly flammable chemicals, choose containers that are less likely to break, such as metal, plastic, or PVC-coated glass.
  - When ordering hazardous powders, consider purchasing in a pre-weighed vial with a rubber septum. This eliminates the need to handle the powder, as the diluent can be injected directly into the container.
  - Check the existing inventory before ordering more of a particular chemical.
  - If only a small amount of a chemical is needed, consider asking another lab to borrow it, rather than purchasing a full supply for the lab.

- Lab personnel shall be trained on Information for proper handling, storage, and disposal before a substance is received. Proper personal protective equipment, engineering controls, and handling and storage procedures shall be in place in the form of a documented SOP before receipt of a new chemical.
- Ideally, a central location shall be used for receiving all chemical shipments. Only containers with adequate undefaced identification labels shall be accepted. Shipments with breakage or leakage shall be refused or opened in a chemical hood.
- Purchases of high-risk chemicals shall be reviewed and approved by the Principal Investigator/Laboratory CHO.

7.2 Chemical Labeling Requirements

All chemical containers must have the following information displayed:

1. **Name**
   Original chemical stock containers must have the full chemical name in English. In the case of secondary containers, an abbreviation may be used for which there is a definition posted in a central location for all personnel (i.e. Chemical Abbreviations Sheet) where chemicals are stored, prepared, or used.

2. **Date(s)**
   - All labels on original manufacturer stock chemical containers must be legible and undefaced, with dates of **receipt, opened date, and expiry date (if applicable)**.

- Secondary containers must be marked with **the date of preparation** or dispensed date. Solutions with time sensitive chemicals also require the expiration date.

3. **Hazard Information**
   All U.S. Manufacturer's stock chemical containers are required to display this information using the Global Harmonized System's pictograms, signal word, and/or Hazard Statements. This information is also available on the Manufacturer's SDS for the chemical.

   For secondary containers, **any primary hazards must be indicated to personnel.** This may be conveyed by the utilizing GHS pictograms or hazard statements (i.e. "Causes serious eye damage"). If a chemical is hazardous, the **GHS Signal Word** (Danger or Warning) must also be used.

PLEASE NOTE: Reaction intermediates shall also be properly labeled. These chemicals shall be assumed hazardous and subject to the Chemical Hygiene Plan. To ensure compliance, label the container with as much information as possible such as parent compounds, potential hazards, and health effects.

Time-Sensitive Chemicals
Containers of the following class of materials are required to be labeled with **the date of receipt, opening date**, and in the case of original stock container AND mixed solutions in secondary containers, **expiration date**:

- Anhydrous HF/HBr
- Chloroform (NOTE: Amylene stabilized chloroform must be disposed of after 1 year)
- Concentrated formic acid
- Perchlorates
- Peroxides (Be aware: Some organic peroxides are also temperature sensitive!)
- Peroxidizable material (e.g., aldehydes, ethers, compounds containing benzylic hydrogen atoms)
- Picric acid and Picrates
- Potassium metal and alloys, alkali metal amides

As a part of good chemical hygiene and compliance with the OSHA Laboratory Standard, it is the responsibility of the Principal Investigator/Laboratory CHO to inform all laboratory of the hazardous properties of all experimental chemicals utilized in the laboratory and how to store and handle them safely as a part of good chemical hygiene and compliance with the OSHA Laboratory Standard. Information about a chemical's hazardous properties, incompatibilities with other chemicals, and proper storage may be found on the chemical manufacturer's SDS. The NIH PubChem website (https://pubchem.ncbi.nlm.nih.gov/) also aggregates available data for any specific chemical with additional annual information updates regarding regulations and toxicity studies.

Unattended chemical experiments in progress
If experiments with particularly hazardous chemicals are left unattended, place signage on the chemical fume hood or the location where the experiment is taking place for others to be informed

of the materials in use and measures to take in the event of an emergency. A sign for this purpose is available for use on the chemical safety website (researchsafety.uky.edu) and in **Appendix D** of this document.

7.3 Chemical Incompatibility, Segregation and Storage

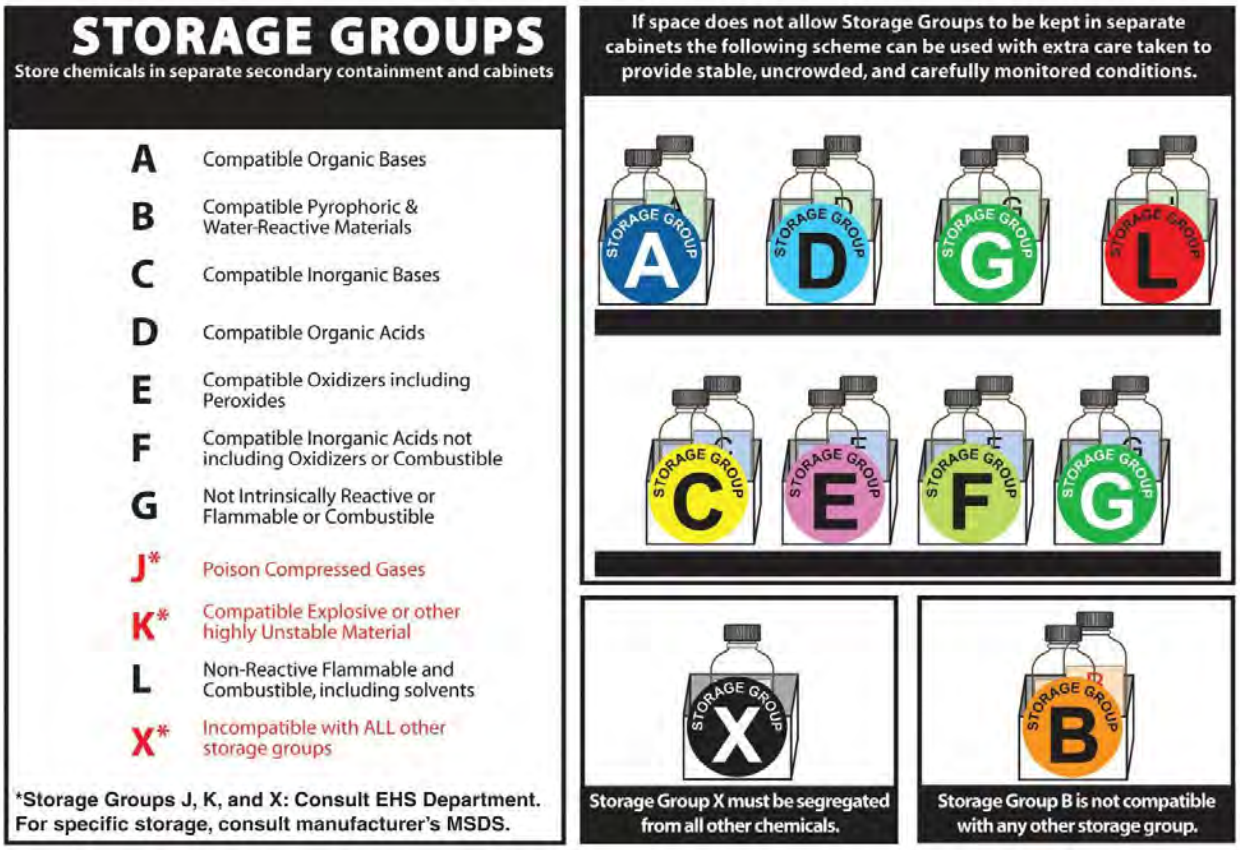
Many guides to separation and storage are available through online searching. No single method is required to be used at the University of Kentucky; however, it is of primary importance to know the properties of all chemicals utilized in the lab. Laboratory staff must familiarize themselves with the Globally Harmonized System (GHS) for categorizing chemicals and the pictograms used. Whichever storage system the laboratory chooses to use for their chemical storage, the following chemical groups are kept separate by using secondary containment, cabinets, or distance:

- oxidizers, including peroxides;
- corrosives—acids separated from bases; inorganic separated from organic;
- flammable materials;
- reproductive toxins; select carcinogens; and substances with a high degree of acute toxicity

Please be aware that self-reactive, pyrophoric, water-sensitive or other chemicals with properties requiring more than the usual storage at ambient temperatures must be stored utilizing information found on the manufacturer's Safety Data Sheet (SDS). Labs shall not purchase high-risk chemicals with special chemical storage requirements, without first ensuring that proper storage and security of these items can be accomplished.

A chemical in storage shall be stored in an appropriate and compatible container with a secure, tight-fitting lid. Screw top lids are preferred, but septums may be used where use of screw top lids is not possible. When using glass stoppers, a keck clamp is recommended when a secured seal is achievable. Electrical or plumber's tape or parafilm can also be used to secure stoppers. Glass stoppered containers must be stored stably, within a spill bin for long term storage. Round bottom flasks are not considered proper storage containers, unless they are placed in a secure holder or cork ring. Parafilm and aluminum foil are not considered secure lids except in cases of sterilized cell culture media. In this case, any containers using parafilm or aluminum foil as a lid, must be kept in secondary containment (spill trays or bins) to prevent spills.

The storage system below is an example of one method for storing chemicals by compatibility.



Prudent Practices in the Laboratory, Adapted from Stanford University's ChemTracker Storage System. Used with permission from Lawrence M. Gibbs, Standford University

Compatible storage group classification system

This system should be used with specific storage conditions taken from the manufacturer's label and SDS.

Examples of Compatible Storage Groups

A: Compatible Organic Bases

Diethylamine
Piperidine
Triethanolamine
Benzylamine
Benzyltrimethylammonium hydroxide

B: Compatible Pyrophoric & Water-Reactive Materials

Sodium borohydride
Benzoyl chloride
Zinc dust
Alkyl lithium solutions such as methyl lithium in tetrahydrofuran
Methanesulfonyl chloride
Lithium aluminum hydride

C: Compatible Inorganic Bases

Sodium hydroxide
Ammonium hydroxide
Lithium hydroxide
Cesium hydroxide

D: Compatible Organic Acids

Acetic acid
Citric acid
Maleic acid
Propionic acid
Benzoic acid

E: Compatible Oxidizers Including Peroxides

Nitric acid
Perchloric acid
Sodium hypochlorite
Hydrogen peroxide
3-Chloroperoxybenzoic acid

F: Compatible Inorganic Acids not Including Oxidizers or Combustibles

Hydrochloric acid
Sulfuric acid
Phosphoric acid
Hydrogen fluoride solution

J: Poison Compressed Gases

Sulfur dioxide
Hexafluoropropylene

K: Compatible Explosives or Other Highly Unstable Materials

Picric acid dry(<10% H_2O)
Nitroguanidine
Tetrazole
Urea nitrate

L: Nonreactive Flammables and Combustibles, Including Solvents

Benzene
Methanol
Toluene
Tetrahydrofuran

X: Incompatible with ALL Other Storage Groups

Picric acid moist (10-40% H_2O)

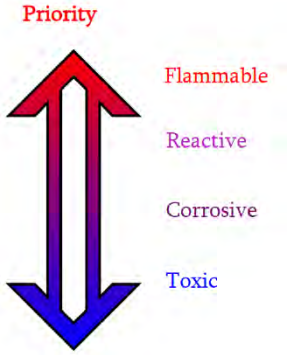
Phosphorus
Benzyl azide
Sodium hydrogen sulfide

Table 5.1 Because chemicals in storage are contained, their separation by compatibility groups can be simplified. The color-coded system described here allows for ease of storage.

Source: *Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards: Updated Version. National Research Council (US) Committee on Prudent Practices in the Laboratory. Washington (DC): National Academies Press (US); 2011.*

Chemical Segregation for Chemicals with Multiple Hazardous Properties

When a chemical has multiple hazardous properties, the chemical is stored based on the priority of hazards. The graphic below shows this prioritization. For example, if a chemical is both flammable and toxic, it is stored with flammables, since this is the most immediately hazardous property of the chemical.



Evaluate Integrity of Chemicals and Their Containers

Chemicals demonstrating any of the characteristics listed below shall be evaluated for disposal:

- Containers showing evidence of decomposition, disintegration, corrosion, or other damage
- Containers with unidentifiable contents, or the labels are illegible or defaced
- Containers showing evidence of pressure buildup
- Liquids with cloudiness or change in color
- Caking or crystallization
- Change in state (e.g., solids with liquid, or liquid with evidence of solids or crystals)

Promptly dispose of expired chemicals by submitting a waste ticket. Chemicals that have surpassed the container's listed expiration date, if not promptly disposed, shall be documented as regularly tested (e.g., ethanol-stabilized chloroform over 5 years old). Testing logs must include the date of testing, the manufacturer and lot of the chemical, the chemical inventory ID number or barcode, the method of testing, and the outcome. Contact labsafety@uky.edu for more information.

Secondary Containers

All secondary containers shall be clearly labeled with the name of the chemical(s) they contain, dispensed date or date of preparation, and date of expiration (if applicable). Primary hazards of the chemical shall also be communicated on containers via GHS Hazard Statement verbiage or

GHS pictogram (e.g., “Causes eye irritation”) to fully communicate the hazards to all personnel.

Secondary Containment

Secondary containment enhances the safe storage of hazardous materials by the following:

- Localizes and contains spillage from defective or broken chemical containers.
- Prevents incompatible materials from mixing.
- Minimize spread of contamination from hazardous materials.

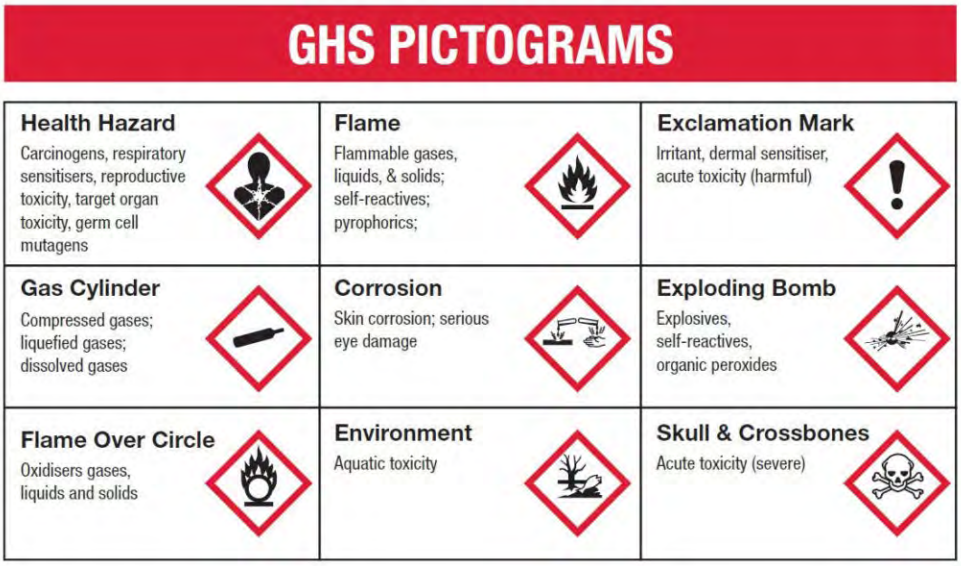
Ensure that secondary containment is large enough to contain the full volume of the contents of the inner containers should they break. In general, open-topped plastic secondary containment is satisfactory for hazardous material storage but lab personnel should ensure the containers material cannot be compromised or degraded by the chemicals they contain. Materials with acute toxicity or reactive properties must be stored in closed secondary containers.

7.4 Chemical Inventory

The University of Kentucky Department of Research Safety policy and best practices stipulate that an accurate chemical inventory, to be reviewed and updated no less than annually, is required for each location that stores chemicals with the following characteristics:

- Carcinogenic or otherwise harmful to human health
- Corrosive
- Flammable
- Oxidizing
- Reactive
- Toxic
- Harmful to the environment
- Liquids and gases under pressure, including liquid nitrogen tanks and compressed air cylinders

These materials are identified by both their container and chemical manufacturer's provided SDS. All hazardous chemicals shipped after June 1, 2015, are required to be labeled with specified elements including Global Harmonization (GHS) pictograms, signal words, and hazard and precautionary statements per the OSHA Hazard Communication Standard (29 CFR 1910.1200). The GHS Pictograms are shown below.



If the original domestic stock container for a chemical in the lab does not display the GHS pictograms, they were shipped prior to June 1, 2015 and shall be evaluated for expiration date and/or any signs of compromised integrity. Labs are encouraged to promptly submit waste tickets for removal of these item (Please contact the UK Environmental Management Department at (859) 323-6280 for more information).

Items that are not required to be listed in the laboratory's chemical inventory:

- Etiologic agents (bacteria, viruses, select agents, and toxins)
- Radioactive materials (unless mixed with hazardous chemicals)
- Biological culture media, agar, serum proteins, albumin
- Enzyme preparations
- Non-hazardous buffers
- Commercial food, drugs, and cosmetics, covered by the FDA
- Commercially packaged drugs in solid, final form (tablets, pills) for direct administration
- Pre-packed test kits for medical labs
- Materials to be used within 1-2 days (“working solutions”)
- Retail products used and stored in amounts and frequencies typical to ordinary household usage.

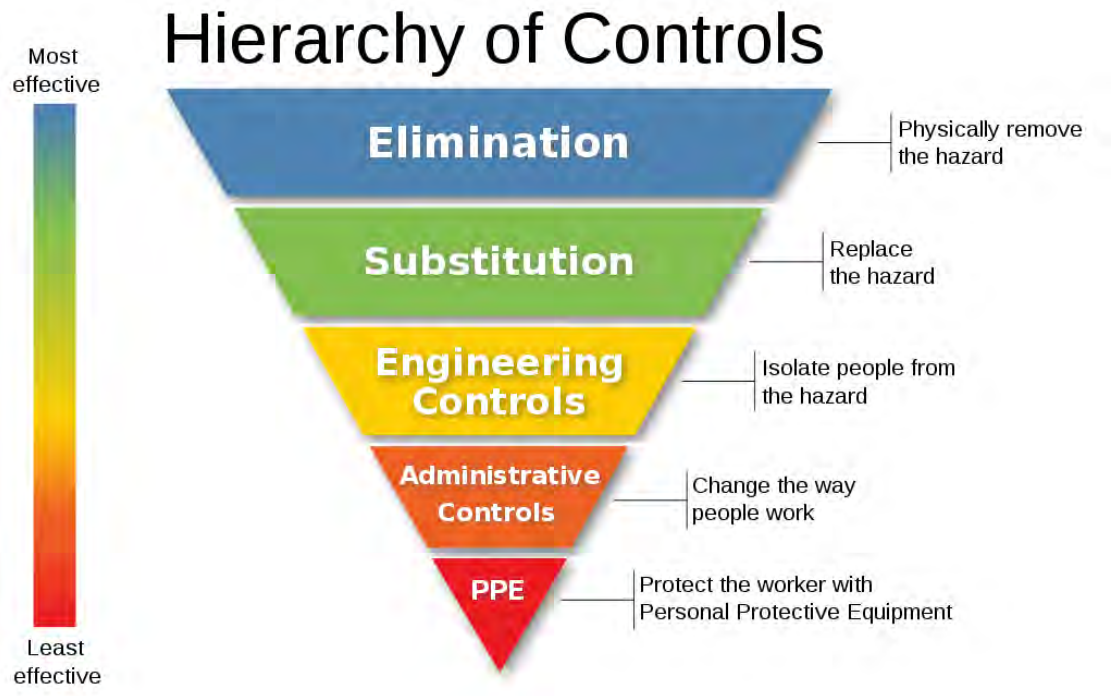
While some laboratories have opted to utilize alternative systems to document their inventories, the university requires the lab’s inventory to be submitted into the online Research Safety-hosted chemical inventory system on a yearly basis and in conjunction with the Lab Safety Inspection. This furthers compliance by keeping accurate totals of hazardous material storage within acceptable regulatory limits and facilitates prompt chemical waste pick up.

8.0 CONTROLLING CHEMICAL EXPOSURES

The OSHA Laboratory Standard requires the employer (i.e., the specific Principal Investigator/Laboratory CHO for the research lab) to determine and implement control measures to reduce employee exposure to hazardous chemicals with particular attentiongiven to selecting control measures for chemicals known to be highly hazardous.

Hazardous chemicals can cause harm when they enter the body in sufficient amounts. There are three primary entry routes for a chemical to enter the body: inhalation, absorption, and ingestion. In laboratories, incidental parenteral inoculation is an added concern when sharps are used in conjunction with hazardous chemicals.

The nature of the hazardous chemical and the route(s) by which it enters or encounters the body determine the type of controls that are needed. OSHA and other organizations have set occupational exposure limits on for airborne exposures. Keeping exposures below these limits is generally believed to protect employees. Permissible Exposure Limits (PELs) can be found on the OSHA website. Threshold Limit Values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH) are available on chemical manufacturer's SDSs and the NIH PubChem website. For many laboratory chemicals, exposure limits have not been established. In addition, little is known about the effects of combined exposures. Therefore, all laboratory workers should take steps to minimize chemical exposure via all routes of entry.



The most effective method of avoiding exposure is to eliminate the need for use of the hazardous chemical and/or substituting its use with a less harmful alternative. When evaluating chemical hazards and designing experiments for optimal safety, if the hazardous chemical in question cannot be eliminated or a less hazardous chemical substituted, the three methods of control to limit chemical exposure are:

- Engineering controls
- Administrative controls
- Personal protective equipment (PPE)

Please note that PPE is the FINAL line of defense from exposure after all other controls have been implemented!

8.1 Engineering Controls

Engineering controls are typically built into the design of a laboratory and are high on the hierarchy of controls because they often do not require active participation on the part of personnel but are able to passively protect personnel from the source of exposure. These types of controls can include ventilation systems and other specialized containment equipment. Research laboratories at the University of Kentucky shall use properly certified exhausted fume hoods, other local exhaust ventilation, glove boxes and other special purpose equipment when there is a likelihood of excessive exposure to air contaminants generated by laboratory activity.

> »A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment
>
> 29 CFR 1910,1450 (e)(3)(iii)

Personnel conducting procedures requiring the use of certain engineering controls shall be trained on the proper use of equipment, and how to recognize if the equipment is properly functioning. PIs/Lab Supervisors are required to implement procedures to ensure required equipment is maintained and verified as in good working order. Information regarding required engineering controls in the laboratory and documentation of personnel training are to be maintained in the laboratory's specific Chemical Hygiene Plan (CHP). Guidance documents regarding two pieces of equipment used in chemical research labs at UK can be found in **Appendix K** (Chemical Fume Hood Operations) and **Appendix L** (Glovebox Operations).

8.2 Administrative Controls

Administrative controls are specified work procedures, policies, processes, or rules implemented to reduce duration, frequency or severity of potential exposure to hazardous chemicals. Administrative controls are generally less effective than elimination/substitution and engineering controls because the hazard itself is not actually being removed or reduced. Administrative controls are only effective when adhered to by properly trained personnel. Examples of administrative controls include enacting a buddy system for work performed on weekends or after business hours, implementing and documenting routine checks and maintaining of critical equipment, exposure monitoring, and requirements for approvals for different types of work. Administrative controls for the research laboratory are documented in the laboratory's specific Chemical Hygiene Plan (CHP). A template Lab Specific CHP can be found in **Appendix I**. A fillable pdf CHP template can also be accessed online at researchsafety.uky.edu.

8.3 Personal Protective Equipment (PPE)

Personal Protective Equipment (PPE) is the last line of protection from exposure to hazardous chemicals and includes items such as eye and face protection, certain types of protective clothing, and/or respiratory protection. PPE shall be selected based on the properties of the chemicals being utilized, the procedures to be performed with them, and the engineering controls available. At the University of Kentucky, all lab personnel are required to wear clothing which covers the legs and closed-toe shoes which also cover the heel. The minimum PPE required for procedures in research wet labs is:

1) Laboratory coat appropriate for materials in use (e.g., A fire resistant lab coat when working with flammable chemicals). Coats are never to be taken home to launder and instead are cleaned according to departmental procedure.
2) ANSI Z87.1 certified eye protection appropriate for the procedures performed (e.g., safety glasses, splash goggles, UV protection)
3) Gloves appropriate for the procedures performed (e.g., nitrile disposable gloves for procedures with nitrile compatible chemicals, thermal protective gloves for procedures with extreme temperatures)

Additional PPE may be called for, depending on the chemicals and procedures in use such as front-covering disposable gowns, shoe covers, steel toed shoes, rubber aprons, and face shields. Determination of PPE shall be based on a risk assessment of materials and procedures is completed by each laboratory and documented in the Lab Specific Chemical Hygiene Plan. A document for this use can be found in the Laboratory Specific CHP Template (**Appendix I**). A separate but differently formatted form that may be used is also available in **Appendix M**. More information regarding selection and types of PPE can be found on the UK Department of Research Safety and the UK Department of Occupational Health and Safety. For assistance with determination and selection of laboratory PPE, please contact labsafety@uky.edu . It is the responsibility of laboratory supervisors/PIs and teaching lab coordinators to ensure employees and students wear appropriate PPE when necessary.

For procedures requiring respiratory or hearing protection, an assessment and enrollment in an Occupational Health program is required. For more information, please contact the UK Department of Occupational Health and Safety.

All PPE shall be removed before personnel leave the laboratory. PPE, including lab coats, is not to be worn in public corridors or spaces.

8.4 Safety Equipment (Emergency showers, Eyewashes, Fire Extinguishers)

Engineering controls, administrative controls, and PPE required for procedures shall be documented on the lab's Standard Operating Procedures (SOP) maintained in the Lab Specific Chemical Hygiene Plan.

Research laboratories with utilization of hazardous chemicals are required to also have a properly functioning eye wash, safety shower and fire extinguisher (rated for the materials in use). All laboratory safety equipment must be inspected and tested on a regular basis to ensure their proper function. While annual testing and verification of this equipment is performed by

UK Physical Plant and Environmental Health and Safety personnel, laboratory personnel have the responsibility to keep aware of the equipment's operational status and follow up with the building or facility manager if correction is needed.

All UK laboratory staff shall be trained as to the location and proper use of this equipment. This is documented on the Laboratory Specific Training Documentation form in **Appendix C.**

Laboratories with an eyewash drench hose installed on the lab sink are required to flush these units on a weekly basis to prevent the buildup of hard water deposits, rust, and other residues from the line. This maintains the hoses' ability to deliver a clean stream of water in the event of emergency. A log to document weekly flushes of the eyewash hose is available for labs in **Appendix H.** Labs shall keep the area around plumbed showers/eyewash installations free from obstruction.

If the fume hood, fume hood alarm, emergency eyewash, safety shower, and fire extinguisher in the laboratory are not functioning properly, please notify the facility manager for the lab and/or contact labsafety@uky.edu.

Using an Eyewash

- Always wash with tepid water or eye solution from the inside edges of the eyes to the outside; this will help to avoid washing the chemicals back into the eyes or into an unaffected eye.
- Water or eye solution should NOT be directly aimed onto the eyeball but aimed at the base of the nose.
- Flush eyes and eyelids with water or eye solution for at least 15 minutes. "Roll" eyes around to ensure full rinsing.
- Immediately seek medical attention, using UK Injury Reporting Procedures.

Using a Safety Shower

- Stand directly under the shower head.
- Pull handle to activate shower.
- Wash with tepid water for a minimum of 15 minutes.
- To turn off the shower push the handle up.
- If needed, immediately seek medical attention, using UK Injury Reporting Procedures.

Fire Extinguisher Visual Inspection

The University of Kentucky's Division of Environmental Health and Safety requires research laboratories to visually inspect their installed fire extinguishers monthly to ensure their extinguishers remain in good working order.

Visual inspection should include the following:

- Pressure gauge needle is inside the green zone
- The handle, gauge, and cylinder are free of damage
- The tamper seal is present and intact
- The pull pin is present and not bent
- The annual inspection tag has been dated within the year

- The three-foot area surrounding the extinguisher is free from obstruction. Extinguishers shall not be hidden behind equipment or furniture or covered.
- Extinguishers shall be in plain sight in a location known to all lab personnel. Never conceal the fire extinguisher behind equipment nor furniture or hang items such as a lab coat on the extinguisher.

If the fire extinguisher has a deficiency, please notify the University of Kentucky Fire Marshal at (859)257-8590.

8.5 General Safety for Research Laboratories

8.5.1 No food or drinks in the labs

Consumption of food and drink within research or teaching wet labs at the University of Kentucky is not permitted. This policy applies to all “wet lab” research and teaching spaces which store, handle or otherwise utilize biological, chemical*, and radiological hazards. This includes but is not limited to the following: laboratory support rooms, makerspaces, or shops where work with any of the aforementioned materials has the potential to contaminate work surfaces, release airborne particles, mists or vapors, or otherwise spread materials with or without knowledge of personnel or others in the area.

- Eating, drinking, gum chewing, applying cosmetics, and taking medicine in research or teaching labs are strictly prohibited.
- Food, beverages, cups, and other drinking and eating utensils intended for human use shall not be washed or stored in these areas.
- Human food or drink intended for research purposes must be labeled with the words "Not for human consumption".
- Storage of food and drink intended for human consumption shall not, under any circumstances, be stored in refrigerators, freezers, or temperature-controlled rooms where hazardous chemicals*, biohazardous materials or biological specimens, or radioactive materials are stored or used.

This policy was created based on OSHA 29 CFR 1910.141 (g)(2), the American Chemical Society’s Safety Guidelines for Academic Laboratories, the Centers for Disease and Control’s Biosafety in Microbiological and Biomedical Laboratories, the National Research Council of the National Academies’ Prudent Practices in the Laboratory and benchmarking with other national academic and research institutions. Many university facilities were not originally designed to provide areas for personnel to safely eat and drink. Departments are strongly encouraged to provide research personnel with suitable break areas for eating and drinking outside of laboratories. This furthers the interest of health and safety and reduces the potential liability for accidental exposure to these materials.

Researchers who feel they have no option but to use an area of a wet lab space for the consumption or storage of food and drink intended for human use, may request a formal documented exemption from this policy by contacting labsafety@uky.edu. Only documented exemptions issued by UK Research Safety are valid.

Guidance for wet labs requesting exemption:
Areas that may be used for eating and drinking must be discrete space, separated from the wet laboratory space by walls extending from floor to ceiling and a closeable door. If the designated eating area is accessed within the primary lab, signage shall be posted on the entry door to the space prohibiting laboratory materials and/or PPE (i.e., lab coats, disposable gloves). Designated eating areas shall adhere to sound hygienic principles and protect against contamination. Personnel must remain vigilant to wash hands after work with materials has ended, PPE is removed, and before entering.

*Hazardous chemicals are those with the following characteristics and are identified by both their container and chemical manufacturer's provided SDS as:

- Carcinogenic or otherwise harmful to human health
- Corrosive
- Flammable
- Harmful to the environment
- Liquids and gases under pressure, including liquid nitrogen tanks and compressed air
- cylinders
- Oxidizing
- Reactive or Explosive

8.5.2 Housekeeping
Keeping the laboratory clean, organized, and functioning properly prevents incidents and injuries. Keep the below guidance in mind when setting up the lab and designing experimental procedures.

- Never obstruct access to exits and emergency equipment such as eyewashes, drench hoses, and safety showers.
- Keep the work area clean and uncluttered, with equipment and hazardous materials properly stored.
- Secure or position benchtop equipment so that it will not be knocked over.
- Keep drawers and cabinets closed and cords and cables off the floor to avoid tripping hazards. Use cable management devices to bundle cords and cables together under desks and lab benches.
- Keep items off the floor to allow your housekeeping service to clean effectively, and to reduce the risk of trips and falls.
- Keep aisles clear of stored materials.
- Promptly clean up spills and dropped materials/equipment to avoid slip hazards.
- Keep sharp or pointed tools properly sheathed or otherwise stored safely when not in use.
- Hang clothing in proper locations; it should not be draped over equipment or benches. • Do not store excess cardboard boxes, equipment boxes, Styrofoam, or lab equipment under lab benches or above shelves/cabinets throughout the lab. This can be a safety as well as a fire hazard.
- Wipe down benchtop surfaces regularly to avoid contaminating the work or employees' clothing.
- Replace bench liners/pads when visibly contaminated.

8.5.3 Management of the Laboratory

The following shall be included in routine laboratory management.

- Working alone with hazardous chemicals shall be avoided when possible. If working alone is necessary, the laboratory CHO/PI shall be informed and approve of this activity.
- Promptly notify the laboratory CHO/PI, the departmental safety liaison or administrator and facility or building manager when lighting, vacuum lines, or other laboratory equipment is not functioning properly. Malfunctioning equipment shall be signed as "out of service" until repair to prevent misuse or incident.
- Experiments involving hazardous chemicals should not be left unattended, but if circumstances require that the experiment run when the lab is not occupied, the laboratory CHO/PI shall be informed and approve of this activity. Circumstances requiring experiments to be left unattended require the use of the sign provided in **Appendix D** to sufficiently communicate to others the materials and conditions required to maintain the experiment and/or to shut down the experiment in the event of emergency.
- Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware since this could lead to chemical exposure. Dispose of broken glassware using lined glass disposal boxes. Razor blades and needles must be disposed of in puncture-resistant hard-sided, and closed containers (e.g., empty milk jug). Sharps used in conjunction with biohazardous materials must always be disposed of in a standard red medical sharps container, to be picked up as hazardous waste by housekeeping or the UK Environmental Quality Management Department (EQMD)
- Use equipment only for its designated purpose. Be familiar with the manufacturer's instructions before using. Inspect equipment for damage; do not use damaged equipment.
- Plan work to minimize bodily contact with chemicals. Handle chemicals in closed containers whenever possible, use care when pouring, and use tools that minimize glove contact with the chemical. Where contact with chemicals is unavoidable, select gloves that are impermeable to the chemical used.
- Whenever possible, open flames shall be replaced by electrical heating units (e.g., replacement of an open flame bunsen burner with a Flameboy or electric sterilizer).

Hand Hygiene

- Wash hands before donning and after removing gloves, and any time that hands may be contaminated. To avoid contamination, remove gloves before handling objects such as doorknobs, keyboards, telephones, and other objects that will be handled by coworkers and or the public not wearing gloves.
- Remove any PPE before leaving the laboratory and entering public areas, including lab coats. Disposable gloves should not be observed on personnel outside of the lab space.

8.5.4 Laboratory and Experimental Design

Consider the safety of laboratory personnel in regard to:

- **Presence of engineered safeguards** – When possible, select equipment that isolates users from heat, sharp edges, pinch points, hazardous energy (such as ultraviolet light, microwaves, or other energy sources), and hazardous materials. If laboratory personnel will maintain equipment, consider their safety during maintenance activities as well as normal operations.
- **Noise** – When possible, select equipment that generates less noise when possible. If equipment produces noise levels over 85 dBA, contact the UK Department of Occupational Health and Safety for evaluation for enrollment in a Hearing Protection Program.
- **Ergonomics** – Labs may contact the UK Department of Occupational Health and Safety for an ergonomic consultation. When possible, choose equipment that:
    - Allows users to maintain neutral postures
    - Adjusts for multiple users
    - Minimizes repetitive activities
    - Runs automatically instead of requiring manual operation
- University of Kentucky Lab Design Standards detailing building, facility, room and equipment requirements for labs can be found in **Appendix J**

8.5.5 Minimizing Exposures for Maintenance or Repair Personnel

Maintenance and repair personnel gain access to laboratory rooms to perform routine tasks (such as changing light bulbs or inspecting eyewashes) and repair chemical fume hoods or other protective equipment, sinks, vacuum lines, and other lab equipment. They are generally unfamiliar with the hazards of the laboratory's materials or the abbreviations that may be used on workplace container labels. A maintenance task could inadvertently cause containers in the work area to tip over, creating a hazard for both maintenance and lab personnel. Therefore, lab personnel shall remove hazardous chemicals and clean the surfaces in areas where maintenance is required by non-laboratory personnel. Maintenance workers may ask the laboratory questions about materials or procedures on site in the laboratory relating to the maintenance task being performed. Lab personnel should be prepared to provide this information or refer the worker to personnel who can provide accurate and timely responses.

9.0 IDENTIFICATION AND EVALUATION OF A HAZARDOUS CHEMICALS

The OSHA Laboratory Standard defines a hazardous chemical 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 exposed employees. The term 'health hazard' includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes". The University of Kentucky also includes flammable, explosive or otherwise self-reactive, pyrophoric and moisture sensitive chemicals in this definition.

Experimental, newly synthesized compounds that have not yet been characterized shall be treated as highly hazardous until characterization and toxicity studies have been completed. Laboratories creating novel compounds are responsible for ensuring these compounds' containers are properly labeled. If a novel chemical is provided to another researcher or transferred outside of the University, the PI/lab is required under the OSHA Laboratory Standard (29 CFR 1910. 1450) and the OSHA Hazard Communication Standard (29 CFR 1910.1200) to create a SDS for the chemical that includes all known chemical and physical properties, hazards, and regulatory information for the chemical. Please contact labsafety@uky.edu for more information.

Before planning experiments and documenting in a laboratory SOP how procedures will be conducted safely, evaluation of the chemical components of the experiment or procedure is required.

Sources of chemical hazard information include:

- The chemical manufacturer's SDS
- The chemical's original container (if manufactured in the USA)
- NIH PubChem website

Safety Data Sheets (SDS)
A Safety Data Sheet (SDS) is a written or printed material concerning a hazardous chemical that is prepared in accordance with the OSHA Hazard Communication Standard. It is intended to provide lab personnel and emergency responders with information that will help them work with that substance in a safe manner. The SDS includes information such as ingredients, physical and health hazards, relevant exposure limits, handling and storage recommendations, physical and chemical properties, reactivity, toxicity, first aid, fire-fighting and accidental release measures.

Labs shall retain copies of all SDS for chemicals stored and used in the lab. These shall be always made accessible to all lab personnel. Electronic availability of these documents is an acceptable alternative to hardcopies only if the Principal Investigator or Laboratory Chemical Hygiene Officer has ensured that all laboratory personnel have demonstrated the ability to locate the necessary information and there is a backup means for obtaining an SDS in the case of failure of the primary electronic system.

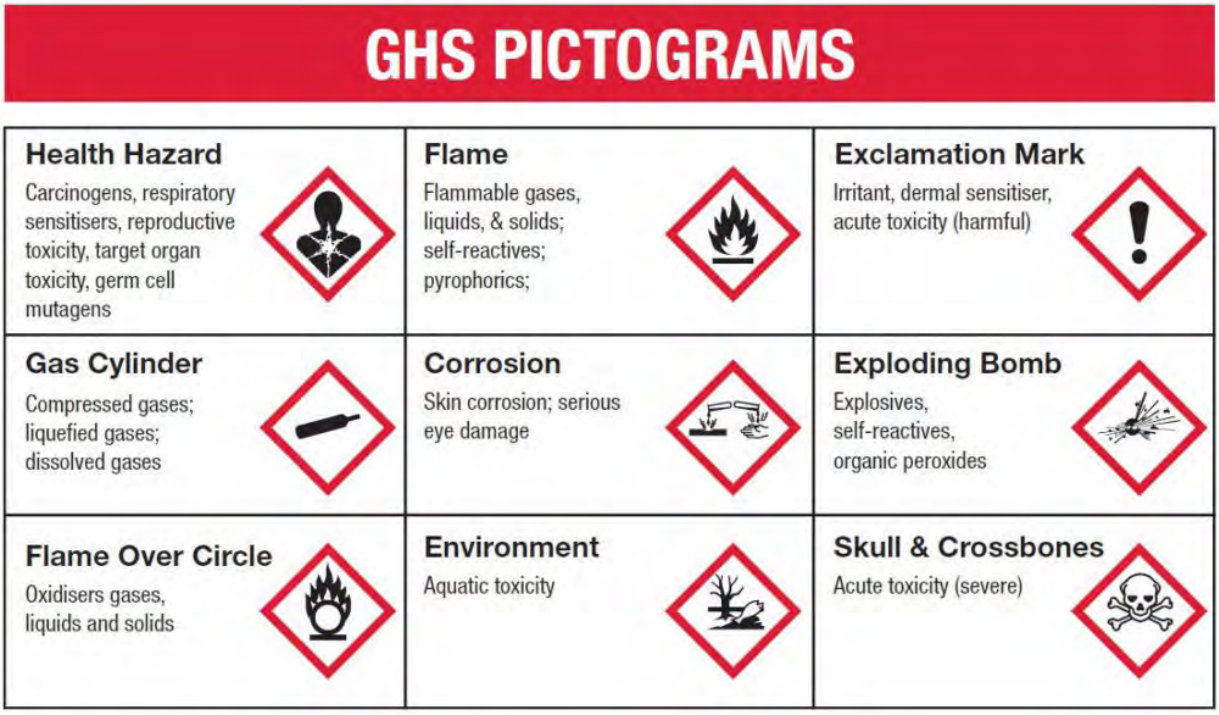
Globally Harmonized System (GHS)

GHS, the Globally Harmonized System of Classification and Labeling of Chemicals, was developed by the United Nations to bring into agreement the chemical regulations and standards of different countries. GHS includes criteria for the classification of health, physical and environmental hazards, as well as specifying what information should be included on labels of hazardous chemicals as well as safety data sheets. For chemical manufacturers in the United States and elsewhere, the elements required for proper communication of chemical hazards under the GHS include:

- Identity of the chemical product
- Use of hazard pictograms (where necessary)
- Use of a signal word – either Danger or Warning – where necessary
- Use of precautionary statements, indicating how the product should be handled to minimize risks to the user (as well as to other people and the general environment)
- Identify of the supplier (who might be a manufacturer or importer)

Information regarding any chemical's characteristics is communicated on the SDS and original container via:

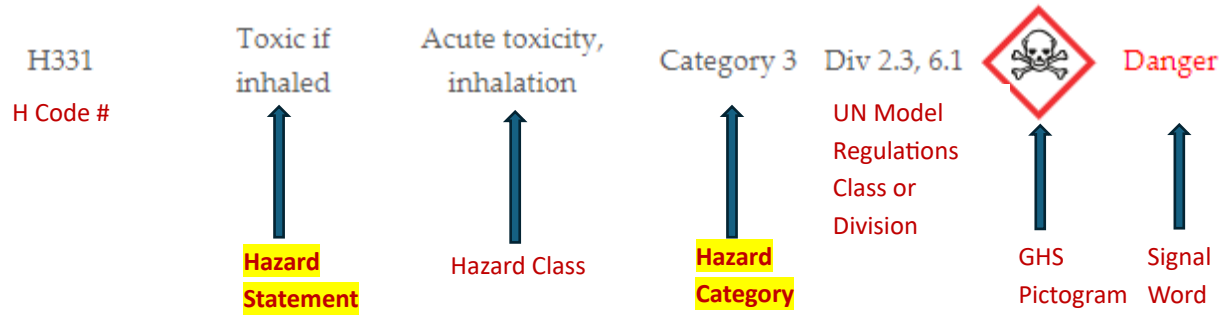
- Hazard Class Pictograms
- GHS Hazard Statements
- Precautionary Statements



GHS Hazard Statements

GHS hazard statements are standardized phrases that describe the nature and degree of hazard associated with chemicals. They're further organized and identified by GHS hazard statement codes, or H codes. These H statements for a chemical describe the applicable hazards to human health or environmental threats.

Example of a GHS Hazard Statement or "H Statement":



GHS **Categories** (#1-5) are used to describe the severity of particular hazard. Under the GHS system, severity of hazard is rated from the highest to the lowest. For example, a Category 1 Acute Toxin is more dangerous than a Category 2, 3, and 4 toxin. The different Hazard Statements in this example are shown below.

Categories 1 & 2 GHS Hazard statement: *"H330: Fatal if inhaled"*
Category 3 GHS Hazard statement: *"H331: Toxic if inhaled"*
Category 4 GHS Hazard statement: *"H332: Harmful if inhaled"*

GHS Precautionary Statements

GHS precautionary statements are standardized phrases that provide guidance on how to properly handle chemical substances and mixtures to prevent or minimize adverse effects. Precautionary statements address the following four concerns:

- Prevention to minimize exposure
- Response in case of spill or exposure
- Storage information
- Disposal information

Examples of a GHS Precautionary Statement or "P Statement"

P261: Avoid breathing dust/fume/gas/mist/vapours/spray.
P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P363: Wash contaminated clothing before reuse.
P403+P233: Store in a well-ventilated place. Keep container tightly closed.
P420: Store separately/away from other materials.
P501: Dispose of contents/container to ...

Laboratory personnel shall be trained and familiar with the GHS for chemical labeling and characterization.

10.0 STANDARD OPERATING PROCEDURES

The OSHA Lab Standard requires documented standard operating procedures for laboratory use of hazardous chemicals.

"Laboratory use of hazardous chemicals", as defined by these regulations [29 CFR 1910.1450 (b)] means handling or use of such chemicals in which all 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.

Individual administrative units, laboratories, or research groups must develop documented, detailed procedures for experimentation and reactions with hazardous chemicals. These procedures must be added to the laboratory's Chemical Hygiene Plan and made available to all laboratory personnel. SOPs may be created for a single chemical, a class of chemicals or for a process involving multiple chemicals.

Q: *My lab already has a written experimental protocol. Can I just take this document and incorporate the safety information?*
A: Yes! This is perfectly acceptable if the required information below is included.

No single format for a lab SOP is required, but to be considered valid, SOP must include:

1) **Lab-specific information**:

- Principal Investigator name
- Laboratory CHO name, if different.
- Building:
- Room(s)
- Designated work area
- Principal Investigator signature and date of finalization or revision.
- Departmental or PI approval date, if approval is required for this process or the use of the chemical.

2) **Hazard identification**:

Describe the circumstances of use for the hazardous chemical, including how any stock solutions and/ or working solutions are prepared. If the SOP is for a process, describe each hazardous chemical that is used in the process.

At minimum, describe the following for each chemical:

- Concentration- Describe the preparatory steps for the needed concentration and/or how the chemical is obtained (e.g. product # 1234, purchased from Sigma-Aldrich) in needed concentration.
- Quantity-Amount needed for individual experiments.
- Frequency-Detail frequency of use for each chemical.
- Location-Indicate use on benchtop, in chemical fume hood, a dedicated location in the lab, etc.

3) Hazard control:
Describe the potential hazards and risks of the hazardous chemicals in use for the procedure(s) and/or the procedures performed with them. What are the inherent hazards and associated risk with using the chemical? Describe the route of a potential exposure (e.g. inhalation, dermal, etc.) and when/how an exposure could occur (e.g. inhalation of gases/vapors, while weighing and mixing, etc.) during the procedure(s) described in the SOP. Consider "worst-case scenarios" when describing the hazards and risk associated with the chemical; how can the risk be minimized? SOPs must also specify:

- **Engineering controls:** Are engineering controls necessary for the chemical(s)? Will the chemical(s) be handled in a chemical fume hood, glove box, biological safety cabinet, or other? Is an eyewash or a safety shower required for the chemical? Please note: In general, chemicals classified as Particularly Hazardous Substances as well as other hazardous chemicals that may be aerosolized, in powder form, concentrated, or are volatile require the use of a chemical fume hood.
- **Administrative Controls: Explain** the work practices used to perform procedures safely. For instance, are there special handling or equipment requirements? Are there any chemical-specific first aid treatments (i.e. calcium gluconate for use of HF)? Describe additional safe work practices, such as keeping containers closed, working away from open flames, etc. Describe how the work surface and other items will be cleaned or decontaminated after use (required for chemicals considered Particularly Hazardous Substances).
- **Personal Protective Equipment:** Describe PPE requirements for each task involving the chemical. How often will PPE be changed? Are there specialized or very-specific PPE requirements (e.g. respirators, flame-resistant lab coats, etc.) for safe use? Please note: Respirator use requires employee participation in the Respiratory Protection Program, which involves medical clearance, annual fit testing, and training. Laboratories with procedures or materials requiring the use of a respirator are asked to fill out the Respiratory Hazard Assessment form accessed **HERE,** or to contact the UK Department of Occupational Health & Safety .
- **Stepwise instruction:** Describe the overall process for safely conducting the procedure.
- **Storage and/or transportation of the chemical(s) used:** Describe how and where the chemical should be stored. Describe how the chemical is transported inside or outside of the laboratory. Include any needed details about chemical incompatibilities, and storage in specific locations such as flammables cabinets, flammables refrigerators, or gloveboxes. If transporting outside of the laboratory, describe the requirement of the use of a rigid-sided, secure-lidded secondary container and use of the freight elevator instead of the public elevator if needed.

4) Instructions for exposure, emergencies, and spill procedures:
Describe how employees should handle a chemical-specific emergency or chemical spill. At the University of Kentucky, "large" spills of volatile or powdered hazardous materials and all mercury spills must be referred to the Environmental Quality Management Department using the following guidance:

Leave the area and notify others not to enter. Report the spill to the UK Environmental Quality Management Department (EQMD)at (859) 323-6280 (M-F 8am-5pm) or after hours by dialing 911 from any on-campus phone or by contacting the UK Police at (859) 257-UKPD (8573).

Researchers may also contact EQMD at (859) 323-6280 for guidance on whether they can safely clean up a spill themselves. Otherwise, consult the manufacturer's SDS of the specific chemical(s) in use for spill instructions and compatibilities for the chemical(s). Be aware of any materials such as paper towels or water that could be incompatible with your spilled chemical!

All waste from cleaning up hazardous chemical spills (including contaminated PPE) must be treated as hazardous waste.

Other considerations for additional information to be added:

- Cessation of work and leaving the immediate area for inhalation hazard concerns.
- Removal of contaminated clothing and/or PPE.
- Flushing with emergency eyewashes and/or drench hoses for eye/skin contact.
- Changing contaminated gloves.
- Contacting Worker's Care in the event of exposure
- For severe emergency or injury, call 911 or proceed to the UK Chandler Hospital Emergency Department

5) Instructions for proper disposal of chemical or experimental waste
Hazardous chemicals are not allowed to be disposed of via the sanitary sewer drain and must be picked up by EQMD by initiating the waste ticketing process (Call 859-323-6280 for more information).

6) Personnel Training
All laboratory personnel performing the operations described in the SOP must be properly trained on its contents. It is the lab-designated Chemical Hygiene Officer's responsibility to document that personnel working in the laboratory have understood the content of the SOP and any other training on laboratory materials and procedures.

Assistance with SOP
To assist in the laboratory's documentation of SOPs, please reference the following page. This chart It provides guidance for when a detailed Lab Specific SOP is required, versus using general guidelines and generic SOPs (available on the Research Safety website or elsewhere) to cover multiple processes and chemicals. Please consult the manufacturers' SDS or NIH PubChem for GHS categorization of the chemicals in use in laboratory procedures. The level of hazard of the chemical and the procedures determine how SOPs are documented. Personnel performing procedures with hazardous chemicals shall be trained on the lab-specific SOPs for operations, with documentation verifying understanding.

In all situations, individual faculty or staff are responsible for monitoring and enforcing adequate safety and hygiene measures in laboratories they supervise. Further guidance and training materials are available at researchsafety.uky.edu.

An SOP template is available in Appendix E. A fillable pdf template is also available at researchsafety.uky.edu or can be accessed by with UK Linkblue credentials **HERE.**

If further assistance is required, please email labsafety@uky.edu.

General Chemical Description:	Particularly Hazardous Substances and High Risk Chemicals	Hazardous Chemicals
SOP Requirement for Lab:	**Lab-Specific SOP** **Required** for the procedures in the lab. Maintain copy in CHP	May use general hazard class guidelines or SOP. Maintain copy in CHP unless procedures call for greater than the minimum PPE for wet labs and/or if engineering controls (e.g., CFH) are not available.
GHS Hazard Class (refer to SDS or PubChem)	**GHS Hazard Category**	
Acutely toxic – *dermal or inhalation*	1 or 2	3 or 4
Acutely toxic – *oral*	1	2
Carcinogen	1, 1A or 1B, 2	
Reproductive Hazard (Fetal or Fertility)	1, 1A or 1B, 2	
Mutagen	1A, 1B, 2	
Specific Target Organ toxicity	Single Exposure: 1 and 2	Repeated Exposure: 1, 2
Sensitizer (skin or respiratory)	Dermal 1A, Respiratory 1, 1B	
Respiratory irritant		3
Skin Corrosion/irritation		1A, 1B, 1C
Eye Damage/Irritation		1
Substances which, in contact with water, emit flammable gases	1, 2	3
Pyrophoric gas, liquid, or solid	1	
Explosives	Unstable or Div 1.1 – 1.3	Div 1.4 – 1.6
Self-reactive or Organic peroxides	Type A and B	Type C, D, E, F, or G
Self-heating	1	2
Flammable		Liquid, Solid, Gas, aerosol: 1,2,3
Oxidizing	Liquid & solid 1	Liquid & solid 2, 3, gas: 1, 2, 3
Gases under pressure	Acutely toxic gases; Pyrophoric gases: Refrigerated liquified gases (cryogens) in large quantities.	Simple Asphyxiants
Corrosive to Metals	1	
OTHER HAZARDS & DESIGNATIONS		
*Non-GHS Carcinogen Designations	NTP Known or reasonably anticipated; IARC Group 1, 2A, or 2B; OSHA listed carcinogens	
Nanoparticles	Synthesis of nanoparticles with chemical components	Use of preformulated nanoparticles for use in vitro or in vivo applications
Investigational Drugs	If properties of the drug are unknown, it is considered a high hazard risk. Consecutive procedures with the drug, after synthesis, require an SOP Investigational Drugs received from or shipped to other investigators must be shipped with an OSHA 29 CFR 1910.1200 compliant SDS. Ref: https://www.osha.gov/laws-regs/standardinterpretations/1991-09-09-0	ONLY investigational drugs synthesized and worked with solely in the PI's lab. SOP for component chemicals maintained in CHP.
EU/Other	Contact with water yields toxic gas; Contact with acids yields (very) toxic gas	Toxic by Eye Contact
EU/Other	Reacts violently with water; Corrosive to Respiratory Tract	May form explosive peroxides
EU/Other	Explosive when dry; Explosive with or without air contact; Strong Hydrogen Fluoride Releaser	Lachrymator

11.0 CHEMICAL HAZARDS

11.1 Anesthetic Gases

Potential workplace exposures to anesthetic gases in research lab settings occur in stand-alone procedure rooms, veterinary and lab animal facilities. Engineering, work practice, and administrative controls that help reduce these exposures in all anesthetizing locations, are identified and discussed below.

The NIOSH REL for nitrous oxide, when nitrous oxide is used as the sole inhaled anesthetic agent, is 25 parts per million (ppm) measured as a time-weighted average (TWA) during the period of anesthetic administration (NIOSH 1977). NIOSH also recommends that no worker should be exposed at ceiling concentrations greater than 2 ppm of any halogenated anesthetic agent over a sampling period not to exceed one hour. In 1989, the American Conference of Governmental Industrial Hygienists (ACGIH) assigned a threshold limit value-time-weighted average (TLV-TWA) for nitrous oxide of 50 ppm for a normal 8-hour workday. ACGIH TLV-TWAs also exist for halothane and enflurane, and are 50 ppm and 75 ppm, respectively.

No anesthesia machine system is totally leak-free (Emergency Care Research Institute 1991). Leakage may originate from both the high-pressure and low-pressure systems of the anesthesia or analgesia machine. The use of induction chambers and bell jars also can expose the researcher to unscavenged waste anesthetic gas (WAG).

Possible health effects of overexposure to anesthetic gas may include, but are not limited to:

- Acute effects: Drowsiness, irritability, depression, headaches, dizziness, and nausea, as well as problems with coordination, audiovisual ability, and judgment.
- Chronic effects: Liver and kidney disease, and adverse reproductive effects.

Engineering Controls

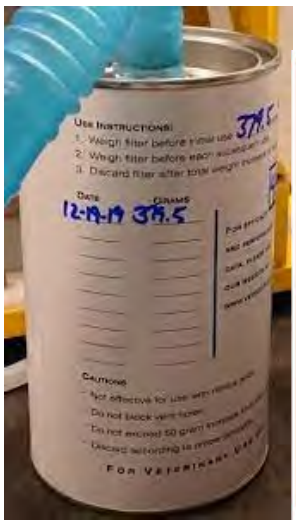
1. Always work in a well-ventilated area with at least 6 room air changes per hour regardless of gas capture/scavenging methods in use. Labs on campus are designed to have air change rates of 6 or greater. If anesthetic gases are to be used outside of a lab setting, contact labsafety@uky.edu for consultation.
2. Prior to anesthesia induction, the anesthesia machine (if used) and its components/accessories should be made ready for use. All parts of the machine should be in good working order with all accessory equipment and necessary supplies on hand. The waste gas disposal system should be connected, hoses visually inspected for obstructions or kinks, and proper operation determined. Machine fittings, inlets, connections, gaskets shall also be inspected for wear and tear. Ensure the vaporizer is properly connected and not misaligned.
3. An appropriate anesthetic gas scavenging system is the first line of defense and the preferred method of control to protect employees from exposure to anesthetic gases. An effective anesthetic gas scavenging system traps waste gases at the site of overflow from the breathing circuit and disposes of these gases to the outside atmosphere. Removal of excess anesthetic gases from the anesthesia circuit can be accomplished by either **active** or **passive** scavenging. When a vacuum or source of negative pressure is connected to the scavenging interface, the system is described as an active system. When a vacuum or negative pressure is not used, the system is described as a passive

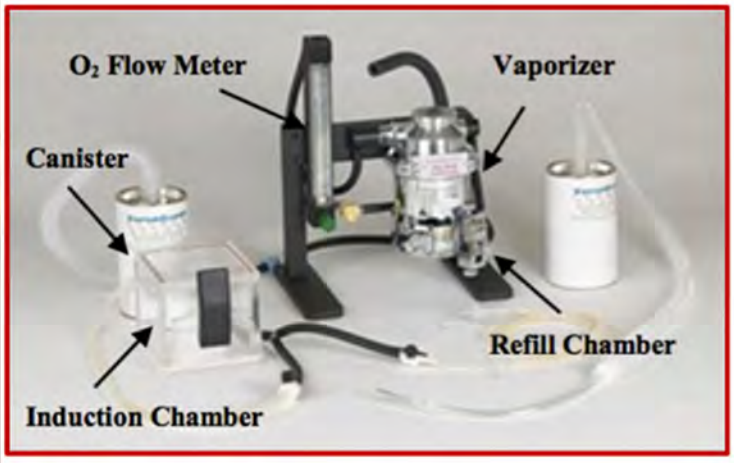
system. The following controls are listed in order of most effective waste gas control to less effective.

a. Active capture/scavenging:
    i. Chemical Fume Hood (CFH): Work in a CFH for best WAG capture performance.
    ii. Active scavenging devices (ducted): WAG collection devices (e.g., snorkel trunk, EVAC-4) are recommended to be ducted to the building exhaust system. Do NOT use the house vacuum as a means of active scavenging.
    iii. Active scavenging devices (ductless): Where WAG collection devices cannot be ducted to the building exhaust system, use a manufacturer recommended air cleaning extraction system with **an activated charcoal adsorption unit** to actively scavenge WAG. NOTE: Charcoal adsorption units CANNOT be used with nitrous oxide.

b. Passive scavenging:
    i. **Do NOT use passive scavenging with nitrous oxide.** Charcoal canisters: This method relies on positive pressure from the anesthesia machine and the anesthetized animal's exhalation to push WAGs into gas adsorption units (i.e., canisters). Any leaks in passive scavenging systems, such as an inadequate seal on the induction chamber cover, tubing, or nose cones, can cause WAG to leak into the work area. Passive scavenging is not recommended for small animal surgery of greater than 3 hours or for stereotaxic surgery of any duration. If using passive scavenging systems, connect one charcoal canister to the animal nosecone and another to the induction chamber.

If options for scavenging are limited, personal respiratory protection may be necessary for researcher health protection. Contact the UK Department of Occupational Health and Safety for consultation.





Charcoal Cannisters shall be dated and weighed prior to each use, with the information captured on the can and/or in a user log. Cannisters shall be replaced when indicated by the product's manufacturer's information (designated weight differential).

Work Practices

1. **Prepare for anesthetic gas use:**
    - Inspect anesthesia equipment and scavenging system.
    - Verify equipment (e.g., fume hood and vaporizer) is currently certified and in proper working condition.
    - Ensure vaporizer is filled with the specific anesthetic agent for which it is designed and certified. Fill vaporizer using an anti-spill bottle adaptor OR conduct filling in fume hood. When filling, wear chemical-resistant gloves, a lab coat, and eye protection.
    - Check for leaks, defects, and damage in anesthesia equipment (including hoses and valves) and scavenging system by pressure testing or by running oxygen through machine and then spraying suspected leaks with soapy water or Snoop. b.

2. **Prepare charcoal canisters for use:**

    Charcoal canisters must be weighed before and after each use to ensure they are within manufacturer's specified limits (e.g., <50 grams above the initial weight); record the date and weight on the canister and/or user log.

    Confirm that the canister is correctly plugged into the breathing system. Use charcoal canisters according to manufacturer's recommendations.

    Ensure the canister holes are not obstructed. Canisters should be used upright, regardless of where gas exit holes are. For example, F/Air canister has exhaust ports at the bottom and requires a canister holder to elevate the canister above the surface of the counter, allowing gas to pass through unobstructed.

3. **Specific safe work practice for anesthetic inductions:**
    - Open-drop anesthetic procedures are not recommended but, if necessary, shall be conducted within a chemical fume hood.
    - Do not turn on the vaporizer until the animal is in the induction chamber.
    - Purge the induction chamber with oxygen for 5 to 15 seconds prior to opening the chamber and retrieving the anesthetized animal.
    - Keep the vaporizer turned off or the nosecone plugged until the animal is properly positioned in the nose cone.
    - Turn off the vaporizer or plug the nosecone before taking the animal out of the nose cone.
    - Co-administration of anesthetic and/or analgesic agents will allow lower isoflurane usage.
    - Minimize WAG leakage from the nose cone by selecting the best-fitting nose cone. Nose cone diaphragms are available from vendors in various sizes to optimize fit. A modified diaphragm may be made from the finger of a powder-free nitrile surgical glove to increase the nose cone fitting. Modified nosecone with a diaphragm is recommended for the passive scavenging system only.
    - Oxygen flow rate and anesthetic concentration should be as low as possible to minimize anesthetic gas usage. This is highly variable and dependent on strain, age, sex, analgesics used, and individual animal.
    - Keep WAG capture/collection devices positioned as close as possible to potential points of release (e.g., at animal nosecone).

- Keep the researcher's breathing zone at maximal distance away from the animal nosecone, as gas concentrations decrease rapidly with distance.

4. **Personal protective equipment**
   Standard PPE for isoflurane use consists of chemical-resistant gloves, lab coats, and safety glasses. Additional PPE may be needed depending on other chemical/physical/biological agents used in the research protocol

5. **Waste Management:**
   - Manage unused/expired anesthetic gases and liquids as hazardous waste: Create hazardous waste pickup tags for disposal by EQMD (Call 859-323-6280 for information).
   - Manage spent charcoal canisters as non-hazardous waste: Seal, bag, and label canisters as "non-hazardous waste" (include disposal date, contact name, and phone number). Request pickup of used canisters through EQMD(Call 859-323-6280 for information).

6. **Equipment Maintenance**
   Anesthesia machines and vaporizers are to be calibrated and certified as recommended by manufacturer (typically biannually). Contact DLAR for additional guidance.

11.2 Compressed Gas Cylinders (CGC)

The outward appearance of a compressed gas cylinder is deceptive. The average standard size cylinder is pressurized at 2,200 pounds per square inch. These cylinders are safe under normal use; however, serious accidents have resulted from the misuse, abuse, or improper handling of compressed gases.

The following principles must be adhered to for safe storage, use, and transportation of compressed gas cylinders.

Cylinder Use, Storage, and Transport

1. Use cylinders in an upright position unless equipment manufacturer provides specific instructions otherwise.
2. Turn all valves off when not in use.
3. Do not modify relief valves.
4. Know the contents, properties, and health hazards associated with the contents. Contents must be clearly labeled.
5. Notify distributor immediately of any problems in the operation or condition of the cylinder (e.g. dents).
6. Ensure all hardware connecting the cylinder to receiver is compatible with the pressure and contents to which it is exposed always use the correct gauge for the pressure and chemical to which it is exposed.
7. Select the smallest reuseable cylinder compatible with the need.
8. Always release pressure from regulator before disconnecting.
9. Emergencies: in the event of a cylinder emergency such as a significant leak, evacuate the area, shut the door, and call 911.
10. Always return compressed gas cylinders when finished. Vendors charge "demurrage fees" (rental) on compressed gas cylinders. These fees can often add up to exceed the purchase price of the gas if the cylinders sit for extended periods in storage. If cylinders cannot be returned to supplier, contact Environmental Management (859) 323-6280 for instructions.
11. The valve protection cap should be left in place until the cylinder is secured and ready for use. Never struggle with a cylinder cap or use a screwdriver to remove a cylinder cap. Do not drop cylinders or allow them to be struck with violent force.
12. Compressed gas cylinders shall be secured with a single approved chain, strap, or stand to prevent them from falling. The chain or strap shall be noncombustible and attached to a stationary building support, such as a wall, floor, or cylinder cart, when in transportation. Restraint chains or straps shall be positioned about 2/3 of the way up the cylinder, above its center of gravity, between the shoulder and midpoint of the cylinder. Chains/Straps shall be tightly fitted to hold the cylinder in place. No more than 2 cylinders shall be restrained with a single chain or strap to a stationary building support, **excluding** vice clamp attachments to tables or benches. No more than one cylinder may be restrained per vice clamp restraint.
13. Never store cylinders of flammable gases (empty or full) near cylinders of oxygen or other oxidizers. A minimum separation of 20 feet or specially designed separation wall must be maintained. When practical, store cylinders a minimum of 20 feet from flammable liquids and away from sources of heat. If this is not practical, consult University Fire Marshal 257-6326 for additional options.

14. Never store cylinders in a means of egress.
15. Clearly mark "empty" cylinders with tag or sign. Writing "MT" in chalk or on label is not acceptable. Separate "empty" and "full" cylinders to avoid confusion and do not store empty cylinders in your laboratory.
16. Cylinders should not be placed, stored, or used on sides unless recommended by manufacturer.
17. Cylinders must be hydrostatically tested every 10 years. Note the last test date on top of the cylinder. Notify the supplier immediately if outdated cylinders are identified.
18. Keep the number of flammable gases to a minimum. The number of flammable gas cylinders (10"x50") must not exceed 3 cylinders per 500 square feet in a non- sprinkled building or 6 cylinders per 500 square feet in a sprinkled building.
19. Never rely on color-coding to identify the compressed gas cylinder. Color codes are for the owner's convenience.
20. Transport cylinders in an upright position.
21. Never roll or drag full or empty cylinders. Preferred transport method is to secure cylinders (with valve covers in place) to a hand truck or similar mode of transport.
22. Do not move a cylinder that has a regulator on it even if main tank valve is off.
23. Treat "empty" cylinders with same respect as "full" cylinders.
24. Transport of cylinders via stairs is discouraged unless other means of upper floor access is not available. When transporting cylinders via stairs, the cylinders must be capped and secured in an upright position to a hand truck suitable for use on stairs.

Extremely Toxic and Pyrophoric Gases

1. Extremely toxic and/or pyrophoric gases require special care for use, storage, and transport. This may include special gas-monitoring systems, alarms, storage cabinets (or other ventilation devices), and/or special transport procedures.
2. Notify Research Safety before purchasing or using extremely toxic and/or pyrophoric gases. Research Safety will assist in the evaluation of special facility needs and training requirements for using these materials.

The following gases or any other gas that has a threshold limit valve (TLV) less than 1 part per million (PPM), a flash point less than 0 F, or is pyrophoric should be registered with OH&S before purchase or use:

- Arsine - extremely toxic (TLV 0.05 PPM) and extremely flammable
- Chlorine - extremely toxic (TLV 0.5 PPM)
- Diborane - extremely toxic (TLV 0.1 PPM) and extremely flammable
- Germane - extremely toxic (TLV 0.2 PPM)
- Hydrogen Selenide - extremely toxic (TLV 0.05 PPM) and highly flammable
- Hydrogen Sulfide - extremely toxic (TLV 10 PPM) and very offensive odor
- Mercaptans (thiols) - extremely toxic (TLV's vary 0.5 PPM) flammable, offensive odor
- Phosgene (carbonyl chloride)- extremely toxic (TLV 0.1 PPM)
- Phosphine - extremely toxic (TLV 0.3 PPM)
- Silane - pyrophoric
- Stibine - extremely toxic (TLV 0.1 PPM)
- Any chemical that does not have a TLV.

11.3 Controlled Substances

The DEA defines controlled substances as drugs or chemicals that have the potential to be addictive or habit-forming. These substances are divided into 5 schedules (I-V) based on their potential to be habit forming and medicinal usefulness. Researchers engaged in activities utilizing U.S. Drug Enforcement Administration (DEA) Controlled Substances are required to register directly with the DEA. More information can be reviewed at https://www.deadiversion.usdoj.gov/schedules/schedules.html.

Basic Requirements for PI Ordering Controlled Substances Inventory (29 CFR 1304.11)

• A complete and accurate recorded inventory of all stocks of controlled substances must be established on the date you first engage in the manufacture, distribution, or dispensing of controlled substances.
• A new recorded inventory must be initiated at least every two years. Security (29 CFR 1301.71 thru 74)
• Schedule I and II controlled substances must be stored in a "double lock" drug safe or a lockbox that is securely fastened with a security cord within a locked, substantially constructed cabinet.
• Schedules III, IV, and V are stored in a securely locked, substantially constructed drawer or cabinet.
• If there is a theft or loss of controlled substances, notify the DEA Field Division Office in your area, by submitting Form 106 within one business day of discovery of such loss or theft.
• Controlled Substances should never be given to non-registrants without proper designation from the DEA.
• Areas where controlled substances are stored shall be accessible only to an absolute minimum number of specifically authorized personnel. Furthermore, when it is necessary for employee maintenance personnel, nonemployee maintenance personnel, business guests, or visitors to be present in or pass through controlled substances storage areas, the registrant shall provide for adequate observation of the area by an employee specifically authorized in writing.
• For disposal coordination, contact Environmental Management at 859323-6280.

Breakage or Spillage of controlled substances: Breakage of controlled substances does not constitute a "loss" of controlled substances. When there is breakage, damage, spillage or some other form of destruction, any recoverable controlled substances must be disposed of according to DEA requirements. Damaged goods may be disposed of through a "reverse distributor" or by a DEA approved process. The DEA recommends that any registrant seeking to dispose of controlled substances first contact the nearest DEA Diversion Field Office for disposal instructions. In no case should drugs be forwarded to the DEA unless the registrant has received prior approval from the DEA. If the breakage or spillage is not recoverable, the registrant must document the circumstances of the breakage in their inventory records. Two individuals who witnessed the breakage must sign the inventory records indicating what they witnessed. The submission of a DEA Form 41, Registrants Inventory of Drugs Surrendered is not required for non-recoverable controlled substances.

Orphaned Controlled Substances: When a controlled substance is found but the "owner" is not known (e.g. a PI who has retired or left the university, or a substance(s)

purchased prior to being classified as a controlled agent) then it is classified as "orphaned". In these circumstances an official from the responsible department must take temporary possession of the "orphaned" controlled substance(s) and then notify the DEA to determine an appropriate disposition/disposal plan. For any such orphaned substances the following information should first be ascertained prior to contacting the DEA: (a) DEA Registration number (if available); (b) the location where the drugs were found (lab number, building); (c) name of the controlled substance(s); (d) content of each individual container; (e) number of containers; and (f) size of each container. An approved disposal plan can then be determined by the DEA.

11.4 Corrosives

Corrosives irritate or burn the eyes and skin by direct contact, the respiratory tract by inhalation, and/or the gastrointestinal system by ingestion. Corrosive liquids present a significant hazard by accidental contact via spills and splashes. Corrosive gases cause severe nose, eye and throat irritation or penetrate the lungs. Corrosive solids can cause burns to the skin and eyes. Dust from corrosive solids can be inhaled and cause irritation or burns to the respiratory tract

When storing and using corrosives in the laboratory, be aware of the following to ensure proper safety practices:

1) Eye and, when using large amounts with a potential for spill/splash, face protection shall be worn when corrosive liquid chemicals are handled.
2) Chemically compatible gloves and chemically resistant protective clothing (i.e. lab coat, apron) shall be worn to protect against skin contact.
3) Always add acids or bases to water and not the reverse.
4) **Acids and bases must be segregated for storage.**
5) Mineral (inorganic) acids must be segregated from organic acids for storage.
6) Liquid corrosives shall be stored below eye level and be contained in spill trays/bins.
7) Adequate quantities of spill control materials should be readily available. Specialized spill kits for acids and bases are available through most chemical and laboratory safety supply catalogs.
8) Manipulations of materials that pose an inhalation hazard from fumes or dust shall be performed in a chemical fume hood to control exposure. If this is not possible for procedures to be performed, personnel must be evaluated for whether a respiratory protection program is needed for the lab.
9) Regulators and valves should be closed when a corrosive gas cylinder is not in use and flushed with dry air or nitrogen after use. When corrosive gases are to be discharged into a liquid, a trap, check valve, or vacuum break device should be employed to prevent dangerous reverse flow.

Acid Storage

Mineral acids, including phosphoric, hydrochloric, nitric, sulfuric, and perchloric acid can be stored in a cabinet designed for corrosive acids. These are non-metallic cabinets without internal metallic parts, have acid resistant coating and a cabinet floor constructed to be able to contain spillage. Volatile acids, such as oleum or concentrated nitric acid, should be stored either in an acid cabinet or in a vented cabinet, such as the fume hood base, particularly after they have been opened. Concentrated mineral acids can be very reactive, even with each other.

Organic acids such as acetic acid should be stored separately from mineral acids. While it is always best to segregate, acetic acid should be stored other flammable liquids due to its flammability.

PERCHLORIC ACID The handling of concentrated perchloric acid is particularly dangerous and should not be performed in any fume hood except those specially designed for perchloric acid use. Any heating of perchloric acid or 73% or greater concentrations require a special dedicated laboratory fume hood equipped with a wash down system. Contact the UK Department of

Occupational Health and Safety for more information. Labs shall contact OHS prior to the purchase of anyhydrous or concentrated perchloric acid for consultation on suitable engineering controls. All lab areas with this chemical in use shall be equipped with a safety shower.

Procedures with low temperature and low concentration perchloric acid protocols shall be performed in a chemical fume hood void of clutter and chemicals unrelated to the procedures

Perchloric acid is a highly reactive material when in contact with incompatible materials. It can explode on contact with many organics and can form potentially explosive perchlorates through contact with metals. Perchloric acid must be stored and used in glass or other inert, and preferably unbreakable, containers. Containers of perchloric acid shall be labeled with the dates of receipt, opening, and expiration.

Perchloric acid stored within the lab should be kept to a minimum. The maximum limit within the lab should be kept below 450 grams (1 pound). It should be inspected monthly and if discolored should be disposed of immediately. The storage of anhydrous perchloric acid is discouraged. Storage for a short time, even less than 10 days poses a severe risk.

PICRIC ACID can form explosive salts with many metals, or by itself when dry. It is incompatible with other storage groups and should be stored separately. Containers shall be checked periodically for signs of crystallization or buildup around container openings. Containers of picric acid shall be labeled with the dates of receipt, opening, and expiration.

11.5 Cryogenic Materials

Because of the inherent danger, only knowledgeable personnel should handle cryogenic materials, fluid piping systems, and related equipment. A variety of physical hazards are associated with this class of material:

- Serious burns to the skin can result from direct contact with a cryogen or related equipment.
- Permanent damage to the eyes can result from contact with liquid cryogen.
- Liquid cryogens warmed above their critical temperature will generate high pressures that can cause a confining vessel to rupture or even explode. Fully containing a cryogenic fluid as a liquid at room temperature is usually not feasible. For example, the pressure required to maintain liquid nitrogen at room temperature is 43,000 psi.
- Cryogens have significant potential for creating oxygen deficiency because they have large liquid-to-gas expansion ratios, generally greater than 700 to 1. A small spill produces a large volume of gas that can displace air in a confined space, creating a serious oxygen deficiency.
- In addition to being a physical hazard and an asphyxiant, cryogenic material may also be corrosive, flammable, or reactive. Storage dewars and process vessels must be labeled with the common name of the contents written in English. Safety Data Sheets (or comparable safety information) and emergency leak or spill procedures for each cryogen must be available in the immediate area where these materials are stored or used.

Safe handling practices must be observed whenever working with or around cryogens. Do not use cryogens in unventilated spaces such as closets or transport in vehicles without adequate ventilation. When transferring cryogen from pressurized dewars with hoses or tubing, be sure to verify that there are pressure relief devices between all valves. Cryogens can be trapped in the transfer hose or in the tube between two valves, which may cause the hose to rupture and whip around out of control.

Cryogenic liquids present special fire and explosion hazards. A flammable mixture cooled in the presence of air with liquid nitrogen or liquid oxygen can cause oxygen to condense and thereby create an explosive mixture. Keep these mixtures away from ignition sources. Transport fragile cryogenic containers with caution-use a hand truck. Cushion glassware in a protective covering to prevent injury caused by flying glass in the event of implosion/explosion.

Personal Protective Equipment for Working with Cryogenic Material

Eye, hand, and body protection must be worn to prevent contact of liquid cryogens with the eyes or exposed skin. A hazard evaluation performed on each cryogenic operation will determine the specific personal protective equipment (PPE) required. The following are the minimum PPE requirements for cryogenic operations:

- When pouring liquid nitrogen from a dewar, use non-vented chemical goggles or safety glasses with side shields. When working with liquid nitrogen in an open container or when transferring liquid nitrogen from a pressurized device, use safety glasses and a full-face shield.

- When working on materials at cryogenic temperatures, wear loose-fitting gloves made for cryogenic work (or leather welding type without gauntlets) to assure that skin will not freeze to cold pipes or metal parts. Loose-fitting gloves can be thrown off readily if cryogen is spilled into them. Small spills of liquid nitrogen, if not trapped against the skin, will usually evaporate without causing damage.

- Wear closed-toe shoes that cover the top of the foot or boots with trouser legs extended over the top of the boot.

- Wear long-sleeved clothing made of non-absorbent material, cuff-less long trousers worn outside boots or over shoes, and an apron made of leather (or other appropriate material) when handling large quantities of cryogens.

- Ear plugs or earmuffs may be required where excessive noise levels occur near filling and venting operations.

Emergency Procedures for Frostbite Injuries

The most likely cause of frostbite to the hands and body is contact with cold metal surfaces. Frostbite can be instantaneous if the skin is moist. Immediate treatment is vital. Report promptly to a medical care facility or call 911 and follow these suggestions:

- Warm the affected area rapidly by immersion in water (not to exceed 105° F), body heat, or exposure to warm air.
- Calm the victim and avoid aggravating the injury. People with frostbitten feet should not walk on them. Do not rub or massage the affected parts of the body.
- If the eyes are affected, flush them with water for least 15 minutes.
- Always seek medical attention for frostbite injuries.

11.6 Explosives and Reactive Chemicals

The OSHA Laboratory Standard defines an explosive as a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature. There are many laboratory chemicals that can become unstable or potentially explosive over time when the chemical becomes desiccated or contaminated with other materials, air, or water. Explosives can result in damage to surrounding materials, generation of toxic gases, fire, and injury to personnel. Before undertaking any procedures with a potential for explosion, researchers should determine whether a safer chemical can be substituted in the experiment. Lab personnel must gain prior approval from the PI/Laboratory CHO for use of these materials, have documented training on safe use, and a written SOP maintained in the lab specific Chemical Hygiene Plan. For assistance with lab-specific SOP development for the use of the materials in this section of the UK institutional Chemical Hygiene Plan, please contact labsafety@uky.edu .

Examples of explosive and potentially explosive chemicals include:

- Compounds containing the functional groups azide, acetylide, diazo, nitroso, haloamine, peroxide, and ozonide
- Nitrocellulose
- Di- and Tri-nitro compounds
- Peroxide forming compounds
- Picric acid (dry)
- 2,4-Dinitrophenylhydrazine (dry)
- Benzoyl peroxide (dry)

Containers of these types of chemicals shall be marked with the receive date, opened date, and expiration, if applicable. Containers shall be routinely checked for signs of deterioration or degradation, crystalline growth, and discoloration of the chemical. Containers exhibiting these signs shall be immediately reported to the UK Environmental Quality Management Department at (859) 323-6280. **Lab personal shall not attempt to move the container.**

Lab personnel using these materials are never to work in the lab alone. Use of these materials must be indicated on door signage and signs in the work area. A safety shower and suitable extinguisher is absolutely required for any area working with these materials. Please consult the UK Fire Marshal to ensure an appropriate extinguisher is available for use in the laboratory.

Additional work practices for utilization of potentially explosive or reactive chemicals:

- Provide a mechanism for adequate temperature control and dissipation of excess heat and pressure.
- Use shielding as appropriate to minimize personnel exposure and injury, and facility damage.
- Minimize the quantity of reactive chemicals used or synthesized to the smallest amount needed.
- Utilize shields and barricades, and personal protective equipment (such as face shields with throat protectors and heavy gloves)

- Review any proposed changes to laboratory procedures, especially any plans for **scaling up** the reaction with the PI or other designated knowledgeable person before performing them.
- Consider performing a "dry run" of new procedures involving pyrophoric chemicals to help identify overlooked handling issues or hazards, and to increase users' proficiency.
- Remove any and all unnecessary chemicals from the CFH, glovebox, or working area before commencing procedures with these types of chemicals.

11.6.1 Pyrophoric Chemicals

OSHA defines a chemical as pyrophoric if a small quantity of the chemical will ignite within 5 minutes after coming into contact with air. Liquid or gaseous pyrophorics are of enhanced concern. Water vapor can also cause some pyrophorics to ignite. The ability of pyrophoric chemicals to spontaneously ignite on contact with air and/or water usually requires that they be handled under an inert atmosphere through use of a glove box and/or special handling techniques.

Examples of some phyrophorics include:

- Grignard Reagents: RMgX (R=alkyl, X=halogen)
- Metal alkyls and aryls: Alkyl lithium compounds; tert-butyl lithium
- Metal carbonyls: Lithium carbonyl, nickel tetracarbonyl
- Metal powders (finely divided): Cobalt, iron, zinc, zirconium
- Metal hydrides: Sodium hydride
- Nonmetal hydrides: Diethylarsine, diethylphosphine
- Non-metal alkyls: R3B, R3P, R3As; tetramethyl silane, tributyl phosphine
- Phosphorus
- Potassium
- Sodium
- Gases: Silane, dichlorosilane, diborane, phosphine, arsine

A commonly discussed pyrophoric lab chemical in terms of lab safety practices and potential injury is tert-butyllithium under hexanes. In 2008, a UCLA lab technician lost her life in a highly publicized lab accident. This incident led to the first instance in the USA of an academic institution and the principal investigator being prosecuted as liable in a court of law. Use of pyrophoric chemicals call for specialized engineering controls and procedures to prevent incident. Use of these chemicals requires prior approval from the PI/Laboratory CHO, documented training on safe their safe use, and a written SOP maintained in the lab specific Chemical Hygiene Plan. Contact labsafety@uky.edu for more information.

When using pyrophoric chemicals:

- Store in the original manufacturer container (e. g., Sure Seal bottles) unless experimental work requires transfer to other containers.
- Septum tops may leak after perforation. These shall be inspected on a regular basis.
- Pyrophoric chemicals that require refrigeration must be **only** stored in a refrigerator that is designed and constructed for storing flammable liquids, no

exceptions. Pyrophorics should be stored in a dedicated refrigerator, not in a refrigerator that also contains flammable liquids.

- Routinely check pyrophorics stored in a protective solvent to ensure that there is sufficient liquid.
- Do not return pyrophoric chemicals to their original storage container as small quantities of impurities can cause fire or explosion.

11.6.2 Moisture-sensitive Chemicals

Some laboratory chemical compounds react violently with water to form toxic vapors and/or flammable gases that can ignite and cause a fire. If the lab is using or storing moisture sensitive compounds and the lab does not have a Class D fire extinguisher present, then please contact the UK Fire Marshall at (859) 257-6326

11.6.3 Piranha Solution

A review of various piranha solutions with methods and protocols can be found at DOI: 10.1021/acs.chas.1c00094 .

Piranha solution is typically a 3: 1 mixture (v/v) of concentrated sulfuric acid and 30% aqueous hydrogen peroxide. There is also a “Base Piranha” typically composed of ammonium hydroxide and hydrogen peroxide. Piranha reacts violently with organic substances and therefore is both dangerous, and highly effective for cleaning surfaces, in addition to functionalizing some surfaces with hydroxyl groups. The acid piranha’s reaction is self-starting, and the base piranha requires heating before the reaction is initiated. Piranha is used to clean residue off substrates. It is extremely deleterious to skin or eyes, resulting in severe burns. Vapors are corrosive to mucous membranes and the upper respiratory tract. While this solution is highly corrosive, its reactivity increases its risk for inadvertent harm.

Reactivity

Mixing sulfuric acid and peroxide is extremely exothermic. Risk of uncontrolled exotherm can be somewhat decreased by slowly adding, with thorough continuous stirring to minimize “hot spots”, 30% H2O2 (aq) to sulfuric acid (never add in opposite order) and ensuring that all wetted surfaces are free of organic contaminants. Some metal contaminants can also initiate violent exotherm. Latent off-gassing from piranha mixtures is known and therefore containers should be vented to lessen chances of over pressurization.

Piranha Solution is a very strong oxidizer. Explosions can and do occur when piranha comes into contact with organic materials.

Incident at UK

UK Environmental Quality Management Department (EQMD) picked up a Piranha waste container from a research facility which then exploded in their facility a er housing it for three days. The cause could not be determined but it was suspected the container was either contaminated or had not been mixed well. In either case, transport added enough energy to create off gassing and over pressurization of the container.

Work practices for the use of Piranha solution:

- Always use glass (Pyrex® is preferred) containers. Piranha solution can degrade plastic containers.
- Ensure all containers are properly labeled to identify those containing piranha acid solutions.
- Always mix the solution in a chemical fume hood
- Always add hydrogen peroxide to sulfuric acid while gently stirring. DO NOT add sulfuric acid to hydrogen peroxide.
- Piranha solution preparation is highly exothermic, readily generating temperatures exceeding 100°C. Handle with care to avoid thermal burns.
- Do not mix piranha solution with incompatible materials such as organic acids, organic solvents, or other organic materials. Do not mix with bases. Mixing piranha with incompatible materials can lead to an explosion.
- When submerging items in piranha baths, place items in the piranha solution slowly and carefully. The solution needs me to stabilize after each item is added. Apply piranha solution to substrates carefully as well.
- NEVER TIGHTLY CAP piranha solutions. To prevent pressure buildup, a vented cap should be used.

A lab coat, safety goggles and chemically compatible gloves (e.g., latex, butyl) gloves should be used when working with Piranha. If procedures involve anticipated splash or use large quantities, a rubber apron and safety goggles shall be used. ALL work with Piranha solution will be conducted within a certified chemical fume hood. All research labs utilizing Piranha shall maintain laboratory specific Standard Operating Procedures (SOP) for its safe use in the lab's specific Chemical Hygiene Plan (CHP). All personnel using Piranha shall be properly trained in its use, with its documentation maintained in the lab's specific CHP.

11.7 Flammables and Combustible Liquids

Flammables and combustible chemicals are easily ignited and may present a serious fire or explosion hazard. The lower the flash point of flammable liquids, the more dangerous it is.

- Flammable liquids have a flash point below 100°F.
- Combustible liquids have higher flash points of 100°F to 200°F.
- Flammable solids include finely divided solid materials which, when dispersed in air, could ignite. Flammable solids have an ignition temperature below 212°F

Other classes of chemicals with a high fire hazard include oxidizers, pyrophoric chemicals, and water-reactive chemicals.

Storage Guidance for Flammables and Combustibles

- Keep flammables away from all ignition sources: open flames, hot surfaces, direct sunlight, spark sources.
- Store flammables separate from other hazard classes, especially oxidizers and toxics.
- Separate flammable gases from oxidizing gases with an approved noncombustible partition or by a distance of 20 feet.
- Store flammable liquids in approved safety containers or cabinets.
- In instances where static electricity may accumulate and ignite flammable vapors, ground and bond flammable liquid containers.
- Know where the lab fire extinguishers are located and ensure all lab staff are trained in their use.
- Keep flammable liquids that require cold storage in flammables-safe or explosion-proof refrigerators or freezers. Retrofitting household-type refrigerators for use with flammables is prohibited!

11.7.1 Policy for Storing Flammable Liquids in a Household-Type Refrigerator or Freezer

Approved by the UK Fire Marshal 2/23/24.

Flammable liquids must be stored in a refrigerator/freezer that is specifically designed to house these liquids. Flammable and explosion-proof refrigerators/freezers that comply with NFPA 45 and OSHA 29 CFR 1910.307 standards are approved for flammable liquid storage. However, flammable materials may be stored in a nonflammable-approved (e.g., household-style) refrigerator or freezer ONLY under Exception A or Exception B, below:

Exception A

This exception is applicable to reagent kits of small volume such as are commonly found in biological and biomedical-type labs. Often, one or more of the reagents in these kits contains an organic solvent such as ethanol or acetonitrile in a concentration which is often a trade secret. Many of these kits need to be stored cold. This exception also applies to small Sepharose columns wetted with a mixture containing ethanol or other flammable solvent.

1. To comply with this exception, conditions **2 through 4, <u>shall ALL be met</u>**.

2. Flammable solvent(s) present in the reagent shall have a boiling point equal to or higher than methanol (boiling point 64.7 °C, 148.5 °F).

- Methanol, ethanol, acetonitrile, 1-propanol, and isopropanol are examples of acceptable solvents.
- In the case of a solvent containing a mixture of chemical species and, therefore, boiling over a range of temperatures, the initial boiling point shall be taken.

3. Individual bottles shall NOT contain more than 15 mL of flammable reagent.

4. Reagent kits shall be stored in secondary containment with air-tight lids.

- Lids shall be secured by clasps, threaded, or a tight press fit.
- Secondary containment shall be of adequate quality and construction to give a reasonable assurance of an air-tight seal.

5. Decent quality food storage containers designed to be air-tight should be generally suitable. Other possibilities include polyethylene screw-top containers with good seal (e.g. Nalgene™ brand).

6. Secondary containment with warped lids, cracking, damaged sealing surfaces, or where rubber gaskets or other seals are missing shall NOT be used.

Exception B

This exception applies to cases <u>which do not fall under exception A.</u>

1. To comply with this exception, conditions 2 through 4 shall ALL be met.

2. The flash point shall be:

- At least 120 °F (48.9 °C); OR
- At least 100°F (38 °C) AND the flammable material is an aqueous solution containing more water than solute.

3. The total quantity of flammable material in the fridge or freezer shall not exceed 1 L (liquid) or 1 kg (solid).

- If flammable solids and liquids are both present, then the sum of the mass of solid in kilograms and the volume of liquid in liters shall not exceed 1 (one).

4. All vessels containing >1 mL of flammable material shall be stored in an appropriate plastic or metal secondary container with a sealable lid. The secondary container shall be:

- Durable (not readily breakable); AND
- Fitted with a secure air-tight lid; AND
- Not be susceptible to degradation by materials stored in the refrigerator/ freezer.

NOTE: The definitions of flammables and combustible liquids used here were set using the Global Harmonization System. However, Fire Codes may use the definitions and classifications addressed in Subsections 3.3.33 and Chapter 4 of NFPA 30.

Chemical	Flashpoint	Boiling Point
Acetone 133 °F (56°C)	0°F (-18°C)	133 °F (56°C)
Ethanol	55°F (13°C)	173.3 °F (78°C)
20% Ethanol	97°F (36°C)	212°F (100°C)
Isopropanol	53°F (12°C)	181°F (82°C)
Methanol	54°F (12°C)	147 °F (65°C)
Ethyl Ether	-49°F (-45°C)	94 °F (35°C)
Isopentane	-49°F (-45°C)	82°F (28°C)

11.7.2 Limits for Flammable Solvent Storage in Laboratories (Excluding Laboratories in Health Care Occupancies)

This standard is based on the 2000 Kentucky Fire Prevention Code that references NFPA 30 and NFPA 45. University laboratories are classified as a Class B (Moderate Fire Hazard) and the following listed quantities comply with this classification.

1. The total amount of flammable solvents within the laboratory shall not exceed ten (10) gallons per 100 sq.ft.
2. The total amount of unprotected solvents within the laboratory shall not exceed five (5) gallons per 100 sq.ft.
3. Solvents in excess of the amounts listed in item #1 shall be in an inside (bulk) storage rooms meeting NFPA 30.
4. Flammable solvents with a flash point < 100° F) must not be stored in an ordinary refrigerator and instead use an explosion proof refrigerator or flammables-safe refrigerator.

Lab Size Area (# sq ft)	Total Volume of Flammable Solvent Allowable (gal)	Total Volume of Unprotected Flammable Solvent Allowable (outside of a flammables cabinet or flammables-safe refrigerator)
100	10	5
400	40	20
500	50	25

Definitions:

Solvent: any flammable or combustible liquid with a flash point below 200°F, including hazardous waste.

Unprotected Solvent: any solvent not in a flammable liquid storage cabinet or safety can.

Flammable Liquid Storage Cabinet: a metal cabinet meeting the design and construction requirements of NFPA 30 and having been tested and listed by Underwriters Laboratories (UL) or Factor Mutual (FM) Laboratories.

Safety Can: a metal can meeting the design and construction requirements of NFPA 30 and having been tested and listed by Underwriters Laboratories (UL) or Factor Mutual (FM) Laboratories. The safety can shall be a maximum 2-gallon capacity.
Inside (Bulk) Storage Room: a room constructed to meet the requirements of NFPA 30.
Laboratory: Room/space within four defining walls or an open-area concept defined with positioning of lab work benches/shelving.
Ordinary Container: A glass container no larger than one gallon or a metal can no larger than five gallons.

Recommended Practices

- Glass containers should be limited to 1 pint in size whenever practical.
- Transferring of solvents should always be done in a laboratory hood or an approved bulk storage room.
- Rubber carboys shall be used when carrying 1-gallon glass containers of liquid.
- All 5-gallon metal cans shall be stored in an approved flammable liquid storage cabinet or in an approved bulk storage room.
- Glass containers not in use shall be stored in flammable liquid storage cabinets.

11.8 Mercaptans

Mercaptans, also known as *thiols*, contain a functional group of sulfur and hydrogen (-SH). Low molecular weight mercaptans are of particular concern for public safety because many mercaptans can be mistaken as a natural gas leak. It is these low molecular weight mercaptans, because of their volatility, that are of greatest concern. Mercaptans have odor thresholds reported as low as 0.2 ppb. This means that even used in the hood, operations that volatilize small amounts can create odors across campus. Mercaptans are typically heavier than air and under certain weather conditions will not dissipate easily.

There are several prudent practices to follow to reduce complaints and unnecessary evacuations. They are:

- Open, dispense, purge and/or use only in a properly functioning chemical hood
- When storing, ensure the container is clean and lid sealed properly
- Only purchase and use amounts that are necessary for planned procedures
- Use closed containers and septums whenever possible
- Never leave containers open and unattended even in the hood
- Report spills immediately*

Reporting

PPD should be notified prior to use of mercaptans if the operation is suspected to cause complaints or has caused campus reports of a natural gas leak. The physical plant's Delta room is staffed 24 hours a day and can be contacted at (859)-257-2830.
Spills inside the hood contact PPD Delta room (859)-257-2830 immediately. Then contact Environmental Quality Management for assistance in cleanup at (859)-323-6280.

Please be aware that any reports of a suspected gas leak will be handled according to UK's Incident Action Plan. Fire, police, physical plant and safety representatives have an obligation to ensure public safety. This can mean evacuations and down time for many people. Please follow these guidelines and establish communication with PPD and Occupational Health and Safety (859)-257-3827 prior to emergencies. This can prevent or shorten emergency responses.

11.9 Nanomaterials

Nanoparticles are those at dimensions between approximately 1 and 100 nanometers (nm). A nanometer is one billionth of a meter, which is near-atomic scale. Lab personnel working with unbound nanoparticles may be exposed to hazardous materials via inhalation, skin contact, or ingestion.

Given the various methods for nanoparticle synthesis and differing experimental goals at the University of Kentucky, a risk assessment shall be completed for the work, lab ventilation and containment equipment verified, and other controls designed for the processes specific to the research lab.

If laboratory procedures involve the synthesis of nanomaterials, please contact labsafety@uky.edu so that facility ventilation and engineering controls may be evaluated. In workplaces where workers will be exposed to nanomaterials, the employer shall provide information and training to their workers. This information and training should include at least the following:

- Identification of nanomaterials the employer uses and the processes in which they are used.
- Results from any exposure assessments conducted.
- Identification of engineering and administrative controls and personal protective equipment (PPE) to reduce exposure to nanomaterials.
- The use and limitations of PPE; and
- Emergency measures in the event of a nanomaterial spill or release

Control of Potential Exposures:

- Consider the hazards of precursor materials in evaluating process hazards such as acidity, basicity, oxidizing or reducing strength, and flammability. Consideration should also be given to the high reactivity of some ultrafine powdery materials, which poses potential fire and explosion hazards.
- Evaluate nanomaterial transfer methods, temperature controls and other process controls.
- Laboratory equipment and exhaust systems should also be evaluated for any nanomaterial contamination before removal, remodeling, or repair. Equipment that was previously used to manufacture or handle nanoparticles should also be evaluated for any nanomaterial contamination before disposal or reuse.
- Administrative controls, such as appropriate signs and labels, access control, and a chemical hygiene plan including standard operating procedures (SOPs) and hazard assessment shall be documented.
- The work area and equipment should be cleaned regularly to avoid any exposure. Immediately clean spills involving nanomaterials according to **written protocols or SOPs** and using proper personal protective equipment. Typical methods for cleaning spills can be used for cleaning surfaces contaminated with dry powder nanomaterials. Never use flammable solvents for cleaning nanomaterials with flammable or pyrophoric properties. Clean dry nanomaterials with damp cloths, or by wetting the powder before wiping. Avoid using compressed air or other high-energy techniques, such as brushing or shaking, to remove nanomaterials from clothing. **Dry sweeping or use of compressed**

air for cleanup in areas with procedures of unbound nanoparticles shall be prohibited.

- Handling, weighing, mixing, or sonication of engineered nanomaterials shall be performed in a ventilated enclosure (e.g., glove box, laboratory hood, process chamber) equipped with high-efficiency particulate air (HEPA) filters. Where operations cannot be enclosed, local exhaust ventilation equipped with HEPA filters and designed to capture the contaminant at the point of generation or release shall be provided.

Exposure Control Plan

UK has developed guidelines for research involving nanomaterials. These guidelines closely follow NIOSH's suggested exposure control procedures. Controlling exposures for nanomaterials is much the same as for any particulate. Since the toxicological data are somewhat limited, controls may be more stringent than they would be for a similar material in the non-nano size range. The following is a general description of what considerations will be made for processes and laboratory specific SOP.

A. **Engineering Controls** - the first line of defense in protection from exposures.
   1. Closed systems – A closed system is one in which pipes, glassware, and chambers seal the material from the user.
   2. Fume Hoods -The most common type of engineering control to be utilized at UK will be fume hoods. In general, UK labs performing research utilizing engineered nanomaterials in solid/powder form will be performed in designated fume hoods. Fume hoods will also be used for processes that have the potential to aerosolize engineered nanomaterials that are in solution.
   3. Clean Benches or Laminar Flow Hoods - Some processes and labs will utilize clean bench systems that are equipped with HEPA (high efficiency particulate air) filtered air to provide both product and worker protection. Hoods that do not provide worker protections will not be used when manipulating dry/powder engineered nanomaterials.
   4. Each process will be evaluated, and employee exposure monitoring performed to ensure the utilized engineering controls are effectively capturing the materials. Contact the UK Department of Occupational Health and Safety at (859) 257-7600.

B. **Work Practices -** SOPs for work involving nanomaterials are required.
   1. Wet methods for the manufacture or fabrication of nanomaterials are preferred. This will decrease the probability of inhalation exposures by reducing airborne particles. Processes that utilize other techniques will be evaluated on an individual basis and work practices developed.
   2. All operations will take place in a designated area. Labs approved for this work have at least a fume hood, hand washing facilities, and emergency shower and eyewash stations. All labs and lab workers are required to follow the UK Chemical Hygiene Plan. In this document, all lab workers are required to dress appropriately, not store consumables in the lab, not eat, drink, smoke, apply makeup or lip balm in the lab, and to wash hands before leaving the lab.
   3. Additional templates for Material and Operations Specific SOPs can be found at the following website: GoodNanoGuide

C. **Personal Protective Clothing**- Standard laboratory protective equipment will be worn which includes lab coat with cuffed sleeve, safety glasses and closed toed shoes.
   1. Gloves shall be worn when handling engineered nanomaterials. Selection shall be based on available data of how various nano materials affect different kinds of gloves. Current testing of glove materials can include particles in the nano size range, i.e. viruses. Ensure

gloves have been tested by the manufacture for protection against nanomaterials. When nanomaterials are in suspension, the solvent will dictate the glove material. General compatible glove material information can be found in the UK Chemical Hygiene Plan (CHP) or for assistance on glove material compatibility contact the specific glove manufacturer or contact UK Occupational Health and Safety (OHS) at 257-3827.

2. Respirators - In general, respiratory protection should not be required for work with engineered nanomaterials. OHS will evaluate operations to determine if available engineering controls are not adequate and will assign appropriate respirators. Affected individuals will be enrolled in lab specific respiratory protection programs that will require fit testing and training.

D. **Clean-up and disposal** - Standard techniques will be used to clean up spills and disposal of nanomaterials. Refer to UK Hazardous Waste Manual for specific information of call 323-6280.

1. Dry material spills outside of the fume hood or clean bench will be considered a hazardous materials spill. If lab personnel are not part of a respiratory protection program, then the SOP will indicate that the lab will be cleared and secured. Environmental Quality Management (EQM) will be contacted to clean. EQM employees have the PPE and training required for cleaning spills in the lab.

2. Liquid spills will be evaluated based on the solvent the materials are suspended in. Due to typical research quantities needed in a lab, it is not anticipated that these spills will be large. Small spills will be handled by lab personnel following lab specific SOPs that have been developed. Particularly hazardous solvent spills will be identified in the lab SOP and the appropriate course of action will be described.

3. Disposal- Nanomaterials in themselves do not constitute a hazardous waste. All local, state, and federal regulation must be followed for wastes that meet certain criteria. Prior to working with engineered nanomaterials, the appropriate waste stream will be determined and written in the specific SOP. Contact EQMD at (859) 3232-6280 for assistance with waste management of nanomaterials.

DI. Medical Surveillance - Engineered nanomaterials that contain materials regulated by current OSHA standards will be subject to the requirements of those standards. NIOSH is currently working on recommendations as to when medical surveillance should be implemented for workers potentially exposed to nanomaterials, regulated, and not otherwise regulated.

1. The need for medical surveillance for nanomaterials that are not otherwise regulated will be assessed on an individual project/operation basis. A risk- based approach will be taken using such factors as route of entry, available toxicological data, engineering and work practice controls, duration of activity, and results of exposure monitoring. The medical surveillance will be a cooperation between the laboratory worker, the Principal Investigator of the laboratory, Occupational Health and Safety, as well as a medical provider if needed.

2. OSHA regulated material - Medical surveillance may be required for research involving these hazardous materials. A review of the requirement will be done for each nanomaterial utilized and a determination made.

Nanomaterials Safety Resources for Research Labs:

- CDC General Safe Practices for Working with Engineered Nanomaterials in Research Laboratories
- NIOSH Workplace Design Solutions: Protecting Workers during Nanomaterial Reactor Operations
- NIOSH Approaches to Safe Nanotechnology: Managing the Health and Safety Concerns Associated with Engineered Nanomaterials
- NNI Resources for Nanotechnology Laboratory Safety
- ACS Nanotechnology Safety Resources
- AIHA PPE for for Engineered Nanoparticles

11.10 Oxidizers

Oxidizing chemicals are materials that spontaneously evolve oxygen at room temperature or with slight heating, or those that promote combustion. Strong oxidizers are capable of forming explosive mixtures when mixed with combustible, organic or easily oxidized materials.
This class of chemicals includes:

- Peroxides
- Chlorates
- Perchlorates
- Nitrates
- Permanganates

Work Practices:

- Handling of oxidizers should be performed in a chemical fume hood.
- Keep work area clear of heat, unnecessary organic chemicals, reducing agents, and flammable or combustible material.
- When dispensing oxidizers, DO NOT return excess chemicals to the original container. Impurities may be introduced into the container which may cause a fire, explosion or other unwanted event or contamination.
- The need for safety shielding should be reviewed and utilized any time there is a risk of explosion, splash hazard or a highly exothermic reaction. All manipulations of oxidizing chemicals, which pose this risk, should occur in a fume hood with the sash in the lowest feasible position (18 inches or less).
- All materials contaminated with oxidizing chemicals pose a fire hazard and should be disposed of as hazardous waste.

NOTE: **The use of certain concentrations of perchloric acid must be performed in a fume hood equipped with washdown facilities**

Storage:

- Store oxidizers away from sources of heat, in a cool dry location.
- Segregate oxidizers from all other chemicals in the laboratory. Oxidizers shall be separated completely from flammable materials. Oxidizing gases must be separated by flammable gases by a minimum of 20 feet or by a rated firewall.
- Minimize the quantities of strong oxidizers stored in the laboratory.
- Containers of liquid oxidizers should be stored in unbreakable secondary containment tubs or trays separate from materials with other hazard classifications.

11.11 Particularly Hazardous Substances (PHS)

OSHA's Lab Standard (29 CFR 1910.1450) defines particularly hazardous substances as including select carcinogens, reproductive toxins, and chemicals with high acute toxicity. The OSHA Lab Standard also requires provisions for additional employee protection be included in the laboratory's specific Chemical Hygiene Plan for all work involving PHS. This means 1) maintaining written SOPs, 2) maintain an accurate inventory of all PHS in the lab. Best practices for storage of PHS includes storage under lock and key with access to documented authorized personnel only, 3) Establishment of a designated area and use of containment devices such as fume hoods or glove boxes, 4) Establishment of procedures for safe removal of contaminated waste. Signage for use of laboratories with procedures with these chemicals can be found in **Appendix N** and at researchsafety.uky.edu.

The University of Kentucky has identified additional laboratory chemicals with reactive, explosive or other high-risk physical characteristics that are considered as having the same requirements as OSHA defined PHS for the purposes of UK's chemical safety programming. These chemicals are addressed specifically in the UK institutional Chemical Hygiene Plan in Section 11. 4 Corrosives and 11.6 Explosive and Reactive Chemicals, and 11.9 Nanomaterials.

All use of "PHS" at the University of Kentucky requires approval from the PI/Laboratory CHO, have documented training on safe use and a written SOP maintained in the lab specific Chemical Hygiene Plan. For assistance with lab-specific SOP development for the use of the materials in this section of the UK institutional Chemical Hygiene Plan, please contact labsafety@uky.edu .

Determination of whether a chemical in use is considered a PHS by UK Research Safety can be made by consulting the manufacturer's SDS for the chemical in question, or by searching for the chemical's CAS number at NIH PubChem website. If a chemical possesses any of the following GHS or other listed categorizations or lists any of the Hazard Statements, or other statements shown below, it is considered a Particularly Hazardous Substance.

Carcinogens:

- GHS Carcinogenicity Category 1A, 1B, or IARC Group 1, or NTP "Known to be Human Carcinogens" or OSHA-listed carcinogens.
- GHS Category 2 AND IARC Group 2 (A or B), AND NTP "Reasonably Anticipated to be Human Carcinogens"
- H350 May cause cancer.
- H351 Suspected of causing cancer, Carcinogenicity.

Reproductive Toxins and Mutagens

- GHS Reproductive Toxicity Category 1A or 1B
- GHS Germ Cell Mutagenicity Category 1, 1A, B
- H340 May cause genetic defects.
- H360 May damage fertility or the unborn child
- H362 May cause harm to breast-fed children.

Acute Toxins

- GHS Acute Toxicity, Inhalation or Dermal exposure Category 1 or 2

- H310, Fatal in contact with skin
- H330, Fatal if inhaled.
- GHS Specific Target Organ Toxicity, Single Exposure Category 1
- H370, Causes damage to organs.

Other High-Risk Health Hazards

- GHS Skin or Respiratory Sensitizer Category 1, 1A, or 1B
- H317 May cause an allergic skin reaction.
- H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
- “Corrosive to the respiratory tract”

High-Risk Physical Hazards

- Pyrophoric Liquids and Solids Category 1 or 2
- H250 Catches fire spontaneously if exposed to air.
- Self-heating substances and mixtures Category 1
- H251 Self-heating; may catch fire.
- Substances and mixtures which in contact with water, emit flammable gases Category 1 or 2
- H260 In contact with water releases flammable gases which may ignite spontaneously.
- H261 In contact with water releases flammable gas
- Explosives—Unstable or Divisions 1.1-1.3
- Explosive when dry, or Explosive with or without air contact
- EUH029 “Contact with water liberates toxic gas”
- EUH032 “Contact with acids liberates very toxic gas”
- GHS Oxidizing Gas, Liquid, or Solid Category 1
- Self-reactive or Organic peroxides—Type A or B
- “Reacts violently with water”
- “Strong Hydrogen Fluoride releaser”
- Corrosive to Metals, Category 1

11.12 Peroxide Forming Chemicals (PFC)

Chemicals in this group can form peroxides over time and can become sensitive to heat, shock, and/or friction. Accumulation of peroxide formers in the laboratory has resulted many documented lab accidents. Peroxide formation is an autoxidation reaction that can be initiated by light, heat, concentration, contamination, and/or loss of an inhibitor. Peroxide-forming chemicals are divided into three categories (Class A, B, and C) outlined in the tables below.

The chemicals listed below should be tested for the formation of peroxides on a periodic basis and documented in a testing log. Information documented shall include the name, manufacturer, lot number, and chemical inventory # of the tested chemical, the method of testing, and results. Lab Safety inspectors may request to see documentation of testing when observing any PFC container that is improperly dated and/or expired.

Class 1 PFC (Storage): This group forms explosive levels of peroxides without concentration; these are the most hazardous and can form explosive peroxide levels even if not opened. Several methods are available to check for peroxides; the two most common are the use of peroxide test strips or the potassium iodide test. These chemicals shall be tested for peroxide formation or discarded after **3 months** of receiving the chemicals.

CLASS 1 PFC	
Butadiene	Potassium metal
Chloroprene	Sodium amide
Divinyl acetylene	Tetrafluoroethylene
Isopropyl ether	Vinyldiene chloride
Potassium amide	

Class 2 PFC (Concentrated): This group of chemicals will readily form peroxides when they become concentrated (e.g., via evaporation or distillation). The concentration process defeats the action of most auto-oxidation inhibitors. As a result, these chemicals shall be tested for peroxide formation or disposed of within **12 months** of receiving.

CLASS 2 PFC	
Acetal	Ethylene glycol dimethyl ether
Cumene	Furan
Cyclohexene	Methylacetylene
Cyclopentene	Methylcyclopentane
Diacetylene	Methyl isobutyl ketone
Dicyclopentadiene	Tetrahydrofuran
Diethylether	Tetrahydronaphthalene
Dioxane	Vinyl ethers

Class 3 PFC (Polymerization): This group of chemicals forms peroxides due to initiation of polymerization. When stored in a liquid state, the peroxide forming potential dramatically increases. Liquids shall be tested for peroxide formation or **discarded after 6 months, gases after 1 year.**

CLASS 3 PFC	
Acrylic acid	Methyl methacrylate
Acrylonitrile	Styrene
Butadiene	Tetrafluoroethylene
Chlorobutadiene	Vinyl acetate
Chlorotrifluoroethylene	Vinyl acetylene Vinyl chloride
Vinylidene chloride	Vinyl pyridine

Work Practices:

- Never work alone with peroxide forming chemicals.
- Due to the strict limitations on prolonged storage of peroxide formers, do not order large containers, only order the amount of peroxide formers you need for planned or foreseeable experiments.
- Always keep a testing record for peroxide forming chemicals including the date received, date opened, and date last tested. Each bottle should be labeled with this information.
- Review the Safety Data Sheets (SDSs) for all chemicals used in the experiment.
- All manipulations of peroxide formers should be conducted in containment devices (e.g. fume hoods, gloveboxes, or similar devices). When working in a fume hood keep the sash as low as possible.
- If there is a high probability of fire or explosion a portable blast shield inside the fume hood is recommended.
- Test for peroxides before any distillation or purification of peroxide forming chemicals. Use extreme caution when concentrating or purifying peroxide forming chemicals as explosions can occur (https://ehs.uci.edu/safety/pdfs/lesson-learned_peroxide.pdf).
- Never allow peroxide formers to evaporate to dryness, such as during distillation, always leave a minimum of 20% liquid.
- Peroxide crystals formed in a chemical container are particularly likely to accumulate within the threads of the screw cap and may explode when subject to heat, light, friction, or mechanical shock (e.g. unscrewing the cap). Never open, move, or disturb a bottle that is suspected to have peroxides.
- For liquids evidence of possible peroxide formation includes formation of solids or crystals, visible discoloration, and liquid stratification.
- For solids evidence of possible peroxide formation includes formation of a surface crust, and discoloration of the solid.
- Alkali metals and amides should be evaluated based on visual criteria only. There are no peroxide tests that can be used on these materials.
- Never open, disturb, or move a container suspected of having peroxides, immediately notify UK EQMD (859) 323- for evaluation or disposal.

NOTE: The use of certain concentrations of perchloric acid must be performed in a fume hood equipped with washdown facilities

Storage Guidance for PFC:

- Label every container of peroxide forming chemicals with the date received, date opened, and date last tested.

- Segregate peroxide forming chemicals from incompatible materials.
- Store away from ignition and initiation sources such as flames, static electricity, heat, and light.
- Peroxide forming chemicals should be stored in their original manufacturer's container.
- Minimize the quantity of peroxide forming chemicals stored in the lab.
- If possible, keep the material under an inert atmosphere (e.g. nitrogen, argon) when not in use, except for chemicals that contain an inhibitor that requires oxygen to function.

11.13 Sensitizers

A sensitizer is a substance that can cause exposed people to develop an allergic reaction in normal tissue after repeated exposure to the substance. Examples of compounds that may cause sensitization in some individuals are diazomethane, various isocyanates, formaldehyde, and benzylic and allylic halides.

Use a properly functioning chemical fume hood (CFH) when handling sensitizers that can be inhaled (via mist/fume/gas/vapor). If the process does not permit the handing of such materials in a fume hood, contact the UK Department of Occupational Health and Safety (859) 257-2924 for review of laboratory ventilation.

Handling processes should be designed to minimize the potential for splash, splatter, or other likely scenarios for accidental contact.

12.0 CHEMICAL WASTE MANAGEMENT

UK requires that all individuals that have any role in the management of hazardous waste be knowledgeable of its safe and compliant handling and be able to provide proof of that knowledge. To generate and manage hazardous waste at UK requires completion of the online UK EHS Hazardous Waste training to perform the associated duties in a way that ensures safe and compliant operations.

The Hazardous Waste Contingency Plan is a valuable reference guide regarding Hazardous Waste Contingency Plan areas that accumulate hazardous waste [Satellite Accumulation Areas (SAA)].

This plan also outlines Emergency Action Plans (BEAP) involving hazardous waste:
https://ehs.uky.edu/env/media/contingency-plan-quick-reference-guide.pdf.
View BEAPs - Building Emergency Action Plan Manager (uky.edu)

Disposal of all laboratory waste must follow the procedures specified by Environmental Management: Waste Management | Environmental Quality Management (uky.edu).

To request pickup of **hazardous, biohazardous, or chemical** waste, call UK Environmental Quality Management at (859) 323-6280 or complete an waste pickup request.

To request pickup of **radioactive wastes**, contact Radiation Safety at (859) 323-6780.

General Rules for Chemical Waste:

(a) Chemical waste should be accumulated at or near the point of generation, under the control of laboratory workers.

(b) Each waste type should be stored in a compatible container pending transfer or disposal. Waste containers should be clearly labeled and kept sealed when not in use.

(c) Incompatible waste types should be kept separate to ensure that heat generation, gas evolution, or another reaction does not occur.

(d) Waste containers should be segregated by how they will be managed. Waste containers should be stored in a designated location that does not interfere with normal laboratory operations. Ventilated storage and secondary containment may be appropriate for certain waste types.

(e) Waste containers should be clearly labeled and kept sealed when not in use. Labels must include hazard warnings as appropriate.

(f) Non-explosive electrical systems, grounding and bonding between floors and containers, and non-sparking conductive floors and containers should be used in the central waste accumulation area to minimize fire and explosion hazards. Fire suppression systems, specialized ventilation systems, and dikes should be installed in the central waste accumulation area.

(g) Waste management workers should be trained in proper waste handling procedures as well as contingency planning and emergency response. Trained laboratory workers most familiar with the waste should be actively involved in waste management decisions to ensure

that the waste is managed safely and efficiently.

(h)Engineering controls should be implemented as necessary, and personal protective equipment should be worn by workers involved in waste management.

It is essential to segregate waste for its proper storage, handling, and ultimate disposal in a suitable waste stream. Guidance to assist laboratories with proper waste segregation can be found in **Appendix F.**

13.0 SHIPPING AND TRANSPORT

To protect the public at large, the US Department of Transportation (DOT) regulates the shipping and transportation of hazardous materials in commerce on roadways and airways. A hazardous material is defined as any substance or material that could adversely affect the safety of the public, handlers or carriers during transportation. All DOT hazardous materials are listed in the DOT's Hazardous Materials Table.

The regulations for shipping hazardous materials apply to all individuals involved in the shipping process, including individuals who:

- Arrange for transport.
- Package materials.
- Mark and label packages.
- Prepare shipping papers.
- Handle, load, secure and segregate packages within a transport vehicle.

Non-compliance with these standards is subject to civil penalties up to $50,000 per violation and up to $100,000 if death, serious illness, severe injury to any person or substantial destruction of property. Criminal penalties may result in penalties up to 10 years imprisonment. The requirements can be found in 49 CFR Parts 171-178 and cover the documentation, packing, marking, and labeling of hazardous materials as well as the training of shippers, carriers, and handlers. International Air Transport Association (IATA) regulations also apply when shipping hazardous chemicals by common air carriers such as FedEx since these carriers require that IATA rules are met.

In addition to proper packaging and labeling, the regulations require that the individual receive training that must be refreshed at minimum of every three years or when there is a significant change in the regulations. The UK Environmental Quality Management Department offers shipping training to individuals on campus, with separate courses geared toward chemical, biological, and radiological materials.

PLEASE NOTE: With very few exceptions no hazards materials can be carried on or transported in checked luggage on any commercial airline flight. It is the responsibility of the PI to know which substances are hazardous, which are not, and to communicate this information to laboratory members.

Moving Hazardous Materials Between Locations on Campus

The employees involved in moving the hazardous materials (i.e., hazardous chemicals, biohazardous agents, or radiological materials) must be familiar with present hazards and trained in basic handling techniques. Before commencement of moving activities, a plan for emergencies must be established and a spill kit must be on hand in case of an accident or environmental discharge. Secondary containment consisting of a shatterproof, securely sealed container marked with the hazards contained must be used for all materials in transport between locations.

Items of a dangerous nature are not allowed on any public bus, or personal vehicles. These could include but are not limited to flammable liquids; dangerous, toxic or poisonous substances; storage batteries; and caustic chemicals.

General Transportation Requirements Indoors/Outdoors:

1. Transport hazardous materials only during normal work hours (Mon-Fri 8:00AM-5:00PM) and plan route with Lab CHO.
    a. Avoid transporting hazardous materials during class changes and in high traffic areas.
    b. A freight elevator should be used if available for moving hazardous materials within buildings/floors.
2. Check for leaks or physical damage to primary and secondary containers prior to transport.
3. Transportation of larger bottles/packages between and within buildings:
    a. Use indoor corridor connections whenever possible to avoid leaving the building.
    b. Use a cart or bottle tote safety carrier.
    c. Have suitable personal protective equipment (safety glasses & clean gloves).
    d. Move cautiously especially around corners and when on uneven terrain.
4. Transporting small sample containers/vials between labs within the same building and floor or between buildings:
    a. Containers should be in secondary containment lined with absorbent material in case of a leak.
    b. Know location of spill supplies in case of an accidental release or spill in a hallway. Contact UK EQMD at (895) 323-6280 for spill assistance within a building or outdoors.
    c. Proper PPE (lab coat and eye protection) should be worn when transporting materials from one lab directly to another lab within the same building (no stops).
    d. One hand should be left ungloved to touch communal surfaces (e.g., door handles, elevator buttons).

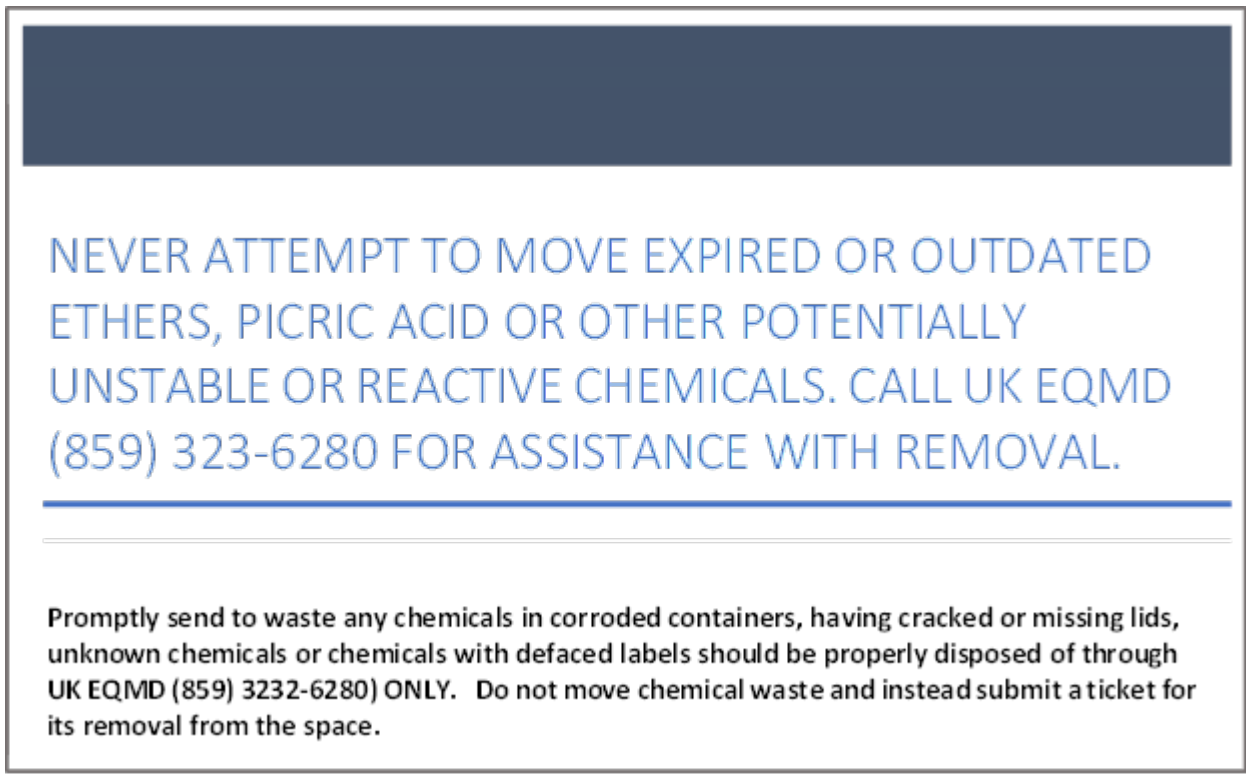
For Hazardous Chemicals:

1) Review SDS prior to transport. Be knowledgeable of the hazards and precautions of the material being transported. Familiarize yourself with product regulations and supplier instructions.
2) Small quantities (≤4L) of individual containers may be carried within a shatterproof, leaf proof, lidded secondary container or bucket.
3) Large quantities (≤ 20L) of individual containers/packages must be transported in a within a shatterproof, leaf proof, lidded secondary container on a cart.
4) Transport incompatible materials (e.g., acids /bases; flammables/oxidizers) within separate secondary containers.
5) Primary containers must be labeled with full chemical name in English with primary hazards communicated by verbiage or GHS pictograms.

Requirements for Compressed Gases and Cryogens:

1. Inspect dewars, cylinders, and hand trucks for damage prior to transport. Do not attempt to transport damaged dewars or cylinders.
2. Ensure cylinders are secured with a chain, protective caps, and valve outlet caps in place.
3. Transport cylinders and dewars using suitable material handling equipment (e.g. cart, hand truck).
4. Dewars equipped with integrated castors may be transported outdoors using two people to stabilize and control the dewar during transport.
5. Transport via elevator presents potential entrapment hazards. Transport via passenger elevator is prohibited when a freight elevator is present in the building. Freight elevators should be used when transporting compressed gas cylinders and dewars.
    i. Warn potential riders to use the stairs or wait for an unoccupied car.

ii. Arrange to have a colleague meet the cylinder on the destination floor.
iii. Load the cylinder/dewar into the empty elevator.
iv. Place a sign across the entrance of the elevator or in a clearly visible location on the hand truck.
v. Press the number for the destination floor and exit the elevator; do not ride in an elevator with a compressed gas cylinder or dewar.
vi. Remove the cylinder/dewar and signage from the elevator at the destination floor.



14.0 LABORATORY INSPECTIONS

Labs are provided advanced notification (no less than 2 weeks) prior to the annual Lab Safety Inspections, along with a list of the potential findings and corrective actions for them. Notices are sent via the SciShield system and will provide the scheduled inspection dates with college or departmental administrative personnel assigned to facilitate inspections.

Passing Annual Lab Safety Inspection Quickly and Successfully

1. Review the lab's profile information in the SciShield system, including the space listing, personnel and hazards. If any changes are needed, email them to scishield@uky.edu .
2. Ensure all lab personnel (including minors, volunteers, etc.) are reflected on the lab's Chemical Hygiene Plan (CHP) personnel page, as well as their documented Lab Specific Trainings are maintained in the blue "Lab Safety Manual" binder/CHP.
3. Update all required online training refresher modules.
4. Review and update door signage.
5. Prepare the lab for annual inspection by using Lab Safety Inspection-Potential Findings and Corrective Actions in **Appendix G** or access HERE using Linkblue credentials.

Lab Safety Inspection Reporting

During the performance of the Lab Safety inspection, or shortly after the inspection has concluded, available laboratory personnel on site are counseled on the violations and actions needed to correct them. Violations that are easily corrected are encouraged to be resolved at this time. If so done, a finding will not be assigned, though a note of the situation may still be included on the report. Any additional concerns or questions are also discussed at the time of inspection. The inspection report consisting of the findings and required corrective actions is then emailed to the Principal Investigator/Lab CHO and the listed Group Compliance Liaison via the SciShield system within two to three working days of the inspection date.

Automatic, system-generated Inspection Report notifications are sent to the listed PI and Group Liaison:

- Once, when the inspection report is submitted to the system by the inspector.
- Each time a comment or response is entered by the inspector or lab representative.
- Weekly, when an inspection report's status is "Pending Resolution" or "Needs Assistance" until the status is changed. Inspection reports indicate when any finding is a repeat violation from a previous inspection.

Communication between the lab and the inspector regarding the report is conducted within the SciShield system. The lab and inspector can document any concerns and ultimately resolve any findings. The inspector will continue to work with the lab on the correction of findings until there are no pending issues and at that time, finalize the report. Inspection reports with no response from the lab within 30 days of the date of the report will be finalized with pending findings unresolved.

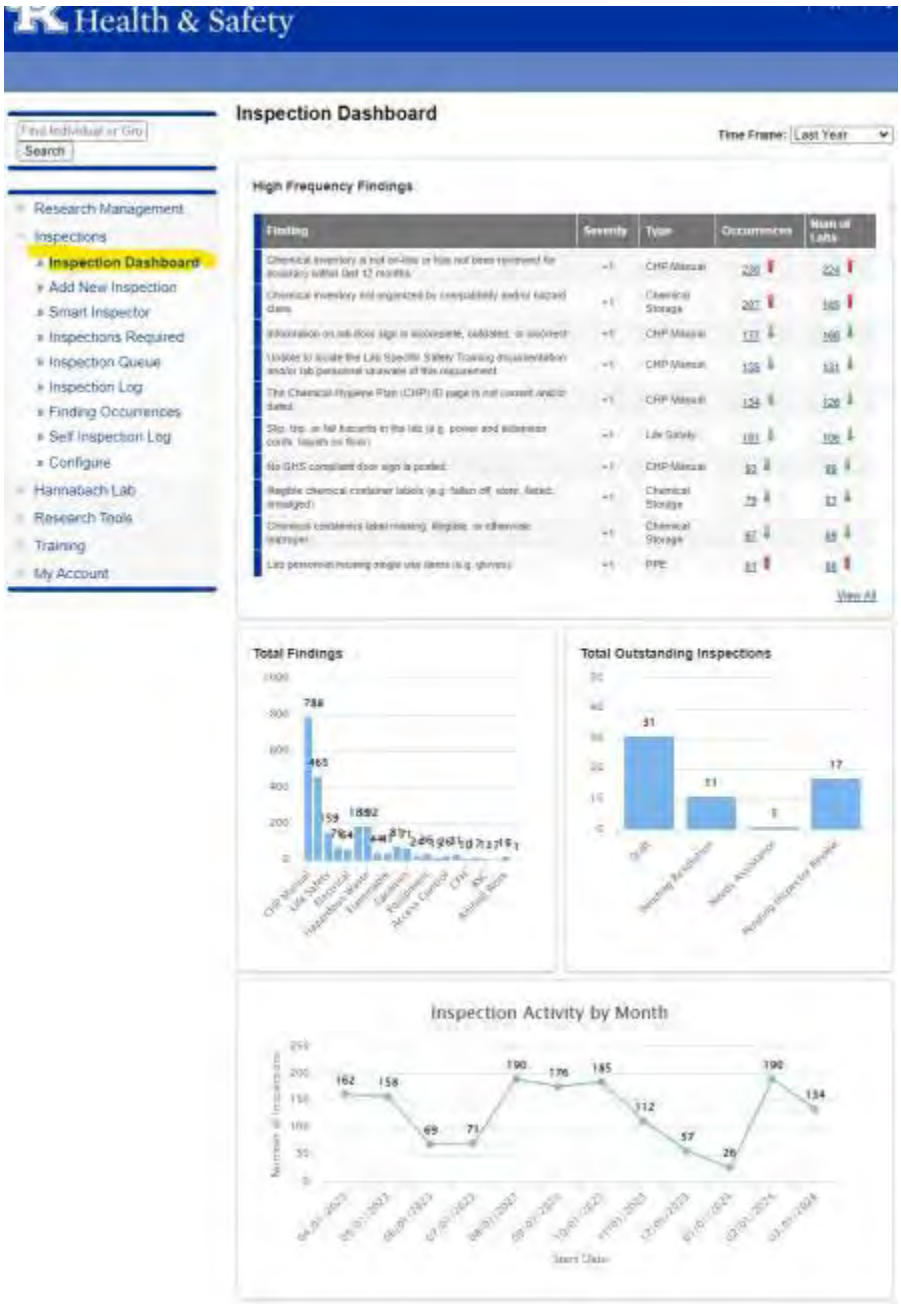
Issues requiring intervention from EHS departments (e.g. discharged fire extinguishers, broken safety showers, faulty chemical fume hoods) will be forwarded to the relevant department by the Lab Safety inspector.

Department/College Representatives & Group Liaisons:

Results from laboratory inspections are available to departmental and/or College representatives to assist with timely corrections or needed repairs via SciShield's Inspection Dashboard, under the "Inspections" menu heading. Departmental representatives are encouraged to verify their lab listings (PI

and spaces) under their departments' inspection dashboard in the SciShield system. Send an email to scishield@uky.edu if corrections are needed.

It is the individual departments' responsibility to determine how best to follow up with the individual labs to ensure these violations are corrected in a timely manner. Notification to department/College officials by Research Safety will be made for unresponsive or problem laboratories that present a continued risk to UK personnel and facilities as evidenced by repeated or numerous findings on Lab Safety Inspections.



15.0 UNIVERSITY PROCEDURES

15.1 New Lab Onboarding

Whether a research lab is brand new to UK's campus research community, or at a UK-owned site not on the main campus in , please send the following information to scishield@uky.edu so that we may document the information for the lab in our online laboratory inspection & training system:

Name of Principal Investigator. If this lab will be separate from or in addition to the PI's primary research lab, please also designate a name for the lab
Building and room locations for all spaces the laboratory occupies. This includes special-purpose rooms, storage rooms, bench space, and shared spaces. Please indicate which spaces are shared with other researchers.
Laboratory Manager/CHO name, if applicable, and any other lab personnel.
Please also indicate if hazardous chemicals will be used or stored in the lab. It will be arranged for a copy of the UK Chemical Hygiene Plan and other useful Research Safety guidance materials to be delivered to the lab.
All laboratory personnel, including students, interns and visiting scholars, working in wet labs are currently required to complete the following online Research Safety training modules (located within the SciShield system):

Chemical Hygiene Plan/Laboratory Safety
Hazardous Waste
Fire Extinguisher*

Please be aware that for access to be granted to the waste ticketing system, personnel must already have Hazardous Waste training completed.

*Individuals under the age of 18, not enrolled as a student at the university are exempt from this training.

15.2 Moving Locations on Campus or Cessation of Lab Operations/Exit from the University of Kentucky

This information provides guidance on procedures for moving or exiting laboratory space(s) where procedures have been performed with or storage of potentially hazardous materials. Potentially Hazardous Materials may include but are not limited to:

- Infectious agents (viral, bacterial, fungal)
- Recombinant or synthetic nucleic acid materials (ex: plasmids with inserts, viral vectors)
- Human or infected animal blood, fluids, cells, and tissues.
- Human blood, blood products, fluids, tissues, cell lines
- Toxins of biological origin (ex: cholera toxin, tetrodotoxin, botulinum neurotoxin)
- Corrosive, acutely toxic, sensitizing, oxidizing, flammable, or reactive experimental chemicals
- Radionuclides, Radiation producing equipment.
- Laboratory equipment that has been used in conjunction with the above listed materials.

Procedures

IN ORDER TO RECEIVE CLEARANCE FROM THE DEPARTMENT OF RESEARCH SAFETY, THE FOLLOWING PROCEDURES MUST BE COMPLETED:

I. **Determine what hazardous materials** are currently housed in your laboratory, and of these, determine which of these materials will be moved to your new location, transferred to another investigator, or disposed.

A. If any biohazardous, chemical or radioactive materials will be shipped off campus, all appropriate DOT/IATA regulations must be followed. Please contact Environmental Management (859) 323-6280 for information on shipping requirements.

B. Some materials may be moved between UK laboratories using appropriate primary and secondary containers.

1. Primary containers.

a. Seal the agent in a leak-proof primary container. Typically, this is the vial or container in which the agent is stored.

b. Small or delicate items should also be placed in a sealed, plastic zip-top style bag.

2. Secondary containers.

a. Place primary container in the secondary container.

b. Secondary container should be of a leak-proof and shatter-proof design capable of containing contents if dropped in transit.

c. Thin or non-reinforced Styrofoam containers are NOT appropriate for use as secondary containers. These types of containers are not shatter-proof.

d. Ensure the outside of secondary container is devoid of contamination of hazardous materials before removing from the lab space. If the originating lab possesses biohazardous materials, disinfect the outside of the secondary container with a 10% bleach solution followed by water or 70% ethanol to remove bleach residue.

e. Label secondary container with a universal biohazard sticker or radiation symbol/sticker, if transporting these materials. See the end of this document for examples of these symbols.

3. Transport secondary container to new location.

a. Do not wear gloves while transporting the secondary container. Disinfection of the outer surface of the container removes the need for gloves.

b. Choose appropriate transport path.

i. Avoid high traffic areas and areas where patients are present.

ii. Use freight elevators.

iii. Minimize transport outside of buildings.

4. Remove the primary container and place in new storage location.

5. Disinfect inside and outside of secondary container if needed, based on transported contents.

II. **No hazardous materials, waste, or contaminated equipment may be left in the laboratory**.

Please ensure that all hazardous materials and waste remaining in the laboratory are Properly decontaminated and disposed of via ticketing/pickup, autoclaving or chemical disinfectant approved for the agent(s) in use.

A. Check in cold rooms, freezers, and refrigerators for materials that could easily be forgotten. Old samples, chemicals, materials from past staff and students or inherited samples must be either disposed or moved. These pieces of equipment, if remaining behind in the lab space, must be emptied, and will be checked before clearance is issued by Research Safety.

B. Disposal of preserved specimens may require special handling since the preservative is usually a hazardous chemical. If the tissues/organs are small (mouse size organs) and not easily recognizable, the entire vial may be treated as chemical waste. However, larger human organs must be separated from the liquid preservative and disposed into red bag waste and the liquid collected as chemical waste. Please contact the office of Environmental Management (859) 323-6280 for disposal of either red bag or chemical waste.

C. Disposal of radioactive materials requires notification to and pickup by the Radiation Safety Team. Please contact the Radiation Safety team at (859) 323-6276.

D. All Sharps materials should be collected into an approved secure lidded sharps container and disposed through waste ticketing.

III. **Clean and decontaminate all work surfaces including bench tops, doors, and cabinet handles**.

If the laboratory had biohazardous materials in use, decontamination shall be performed with freshly prepared 10% bleach solution followed by water or 70% ethanol to remove bleach residue.

IV. **Decontaminate all equipment that has been used in conjunction or contaminated with hazardous materials**. Any equipment that has been labeled with the universal biohazard or radiation symbol must be inspected by and cleared by Research Safety representatives.

A. Clean inside and outside of equipment with soap and water.

B. Wipe down inside and outside of equipment. Biohazardous materials requires wipe down with a suitable disinfectant appropriate for the agent(s) in use and which is specified on the laboratory's Institutional Biosafety Committee (IBC) registration. For radioactive materials, consult the Radiation Safety Team at (859) 323-6276.

C. Below you will find specific decontamination information for common laboratory equipment.

1. Refrigerators/Freezers
    a. Clean out refrigerator and defrost freezer if present.
    b. Triage contents to reduce what is to be moved or disposed.
    c. Refrigerators and freezers must be emptied of all contents.
2. Incubators and water baths
    a. These must be drained of all standing water including water in water-jacketed incubators.
3. Liquid nitrogen dewars
    a. Remove contents of dewar.

b. Allow any remaining liquid nitrogen to evaporate from dewar in a well-ventilated area.

4. Biological Safety Cabinets (BSC)

a. Remove all contents from the BSC.

b. Wipe down inside and outside exposed surfaces with a disinfectant solution such as 10% bleach solution followed by water or 70% ethanol to remove bleach residue. At no time should the user attempt to access the inner mechanical system of the BSC.

c. In certain cases, BSCs may need to be decontaminated by a certified contractor prior relocation or use by the next laboratory occupant. If you are exiting a laboratory that contains a BSC, please contact the Biosafety team at (859) 257-1073 one month prior to your exit date to allow for sufficient time to schedule any additional required decontamination.

5. Chemical Fume Hoods (CFH) a. Remove all contents from the CFH and ensure surface is cleared of any debris. b. If the inside of the CFH is free from spills, clean the inside working surface and sash with soap and water. Dry with paper towels.

V. When you have completed the procedures described above, please email labsafety@uky.edu to schedule required the Lab Clearance audit and any remaining equipment clearance.

This audit documents the space as cleared of all hazards and is required of all research science laboratories before relinquishing occupation of a lab space. An example of the Research Safety lab clearance form can be found at the end of this document. PLEASE NOTE: PPD HOUSECLEANING STAFF SHALL NOT BE PERMITTED TO DEEP CLEAN THE SPACE PRIOR TO DOCUMENTATION OF THE CLEARANCE OF HAZARDOUS MATERIALS.

PLEASE NOTE: Lab Clearances/exits may involve other departments within UK EHS, depending on the scope of work and materials in use.

A. Disposal of radioactive waste or equipment that contains a radioactive source (for example, liquid scintillation counters, gas chromatographs) should be coordinated through Radiation Safety (859) 323-6276.
B. Oils must be removed from pumps, capacitors, power supplies, or other oil-filled equipment. For assistance with analysis of the oil and assistance with oil disposal contact Environmental Management (859) 257-3285.

Additional Notes

A 10% bleach solution followed by water or 70% ethanol to remove bleach residue is the most commonly recommended disinfectant at UK. Appropriate contact time for 10% bleach is 15-20 minutes. However, laboratory personnel should choose a disinfectant that is approved for the agent(s) of use in their laboratory. Information on the approved method of disinfection for your agent(s) can be found in the Primary Investigator's approved UK Institutional Biosafety Committee Registration Form.

15.3 Safety of Minors in Research Program

The Department of Research Safety is committed to supporting the education and training of fledgling scientists by stewardship of the Safety of Minors in Research Laboratories Program. The University of Kentucky (UK) hosts a robust and ever-expanding scientific research program with hundreds of laboratories that store and/or utilize an array of hazardous materials as part of their work. The Safety of Minors in Research Laboratories Program and its policy allow for the performance of hazard identification and risk assessment by Research Safety staff for a wide variety of projects minor students actively conduct or observe with mentorship and guidance of university researchers. Completion of this program's requirements is crucial in ensuring that standard operating procedures, appropriate safety practices, and online training are documented and in place before minor students can begin work in these spaces.

Timely approval for submitted applications for this program requires the cooperation of the minor student (and student's guardian), the administrative official(s) of the sponsored program (i.e., school internship coordinator), the Principal Investigator or Laboratory CHO of the project's laboratory or location, and the Department of Research Safety.

Safety of Minors in Research Policy

Scope: This policy applies to persons under the age of 18, whether a visiting high school student, employee, or volunteer, conducting research or taking part in activities as part of a sponsored project, in all University of Kentucky research or clinical laboratories, greenhouses, farm properties, animal facility, procedure or housing spaces, and field lab/work locations.

Minors under the age of 14 are not permitted inside of any of these University of Kentucky locations unless as part of an official UK sponsored program, tour, or event (i.e., science fair) designed for youth under the age of 14 for which documented safety policies have been established. For information about university-sponsored programs, please visit: https://administrativeservices.uky.edu/risk-management/minors-on-campus

Enrolled UK students under 18 working in a university laboratory are not required to complete this process. Safety training and hazard assessments for these individuals shall be completed as part of UK Research Safety's routine teaching and research laboratory oversight processes.

All persons under 18 are prohibited from specific listed activities, under federal and state child labor laws. Principal Investigators, students, and their guardians shall inform themselves as to what is allowable within the scope of activities and materials used in the proposed project and hosting laboratory. All minor students and their guardians should understand the risks involved in all proposed work and how those risks are minimized. Read the list of prohibited activities by minors here.

Responsibilities of the host Principal Investigator/Lab Designated CHO:

1. Read and understand the UK Safety of Minors in Research Policy and prohibited activities for minors.
2. Ensure the Safety of Minors in Research submission form has been filled out completely and accurately before submission, including the student guardian's signature page, confirming awareness of planned procedures and materials. Incomplete forms will not be reviewed.
3. Ensure the project description is adequate for proper risk assessment by

Research Safety. This information should not be a copied project overview Statement from a grant or institutional oversight committee, but instead detail the specific procedures and materials the student will be directly using or shadowing as someone else performs.

4. If the student is to work with or be supervised by assigned laboratory personnel other than the listed PI/Lab CHO, this individual shall be named in the project description and have completed the necessary online trainings for lab personnel in addition to documented Lab-Specific training.
5. Ensure the hazard assessment is filled out appropriately. For any box checked on the hazard assessment table, a description of the specific material and procedures involved is required in the project description.
6. Ensure the Safety of Minors in Research form has been submitted to the Department of Research Safety and has gained approval before the student begins work in the laboratory. Ensure notification has also been provided to any institutional oversight committees (i.e., IACUC, IBC, IRB).
7. Ensure the minor student has completed the required training before beginning work in the laboratory. Completion of these trainings is required before EHS approval will be issued for work on site in the lab.
8. Once the minor student is on site, ensure to provide and document Laboratory Specific Training, including Fire and Emergency policies and evacuation procedures. Minors shall not be responsible for extinguishing a fire. Information shall focus on personal safety and notification via 911 including how/when to activate fire alarms, evacuation routes, detection of natural gas or relevant hazardous chemical odors.
9. Ensure the minor student is provided proper personal protective equipment (PPE), and is trained in its donning/doffing, utilization, and disposal. Always ensure the minor student wears proper PPE during procedures with hazardous materials including when the minor will be shadowing lab personnel performing work with hazardous materials.
10. Ensure the minor student is always supervised when in the laboratory.
11. Ensure the hours worked comply with UK Human Resources Policy #16 Employment of Minors.
12. Ensure the laboratory is in full compliance with all applicable UK Research Safety Programs and regulations.

Responsibilities of the minor student (and guardian):

1. Read and understand the UK Safety of Minors in Research Policy and prohibited activities for minors.
2. Ensure the Safety of Minors in Research submission form has been filled out completely and accurately before submission, including the student guardian's signature page, confirming awareness of planned procedures and materials. Incomplete forms will not be reviewed.
3. Ensure the project description is adequate for proper risk assessment by Research Safety. This information should not be a cut and pasted project overview statement, but instead detail what procedures and materials the student will be directly using/ performing or shadowing as someone else performs. If the student is to work with or be supervised by assigned laboratory personnel other than the PI/Lab CHO for the project's duration, this person shall be named in the project

description.

4. Ensure the hazard assessment is filled out appropriately. For any box checked on the hazard assessment table, a description of the specific material and procedures involved is required in the project description.
5. Complete all required online training before beginning work in the laboratory.
6. Once on site, complete Laboratory Specific Training, including Fire and Emergency policies and evacuation procedures. Minors shall not be responsible for extinguishing a fire. Information shall primarily focus on personal safety and notification via 911. This information shall include how/when to activate fire alarms, evacuation routes, and detection of natural gas or relevant hazardous chemical odors.
7. Always wear all provided personal protective equipment (PPE) when working or observing work with hazardous materials. Adhere to all instructions given regarding its donning, doffing, utilization, and disposal.
8. Do not work alone or without supervision when in the laboratory.
9. Ensure the hours worked comply with UK Human Resources Policy #16 Employment of Minors.
10. Comply with all applicable UK Research Safety Programs and regulations.

The complete Safety of Minors in Research Form follows. For a fillable pdf template of this form, visit: researchsafety.uky.edu .

Safety of Minors in Research

Research Safety

Principal Investigator Name:	
Lab CHO Name (if different):	
Minor Student's Name:	
Personnel assigned to mentor or supervise minor student (if different):	

Project Description:

Please summarize the research project(s) that the minor will be working on in the research laboratory or facility.

1) *Briefly, in 2-3 sentences, describe the scope of the project for a lay audience,*
2) *Include a description of all planned procedures, manipulations or assays the student will be directly performing and/or shadowing as lab personnel performs. Specify which activities will be hands-on vs. observed,*
3) *Identify any hazardous materials or equipment to be used during the aforementioned activities (i.e., specific biohazardous materials or laboratory chemicals, lasers).*
4) *Describe the personal protective equipment (ppe), engineering controls and hazard mitigation procedures involved in the described procedures,*
5) *Please feel free to include or attach any supplementary materials that will assist in the description of the project. The submission site for the Safety of Minors in Research form allows the for attachment of files.*

PI Name:

Minor Name:

Research Safety

Safety of Minors in Research

Principal Investigator: Comple. on of this form will serve to inform the Department of Research Safety as they conduct their risk assessment for the project, and includes general recommendations for PPE for the activities described. You may also use this form as a guide to what training is required for the activities the student will perform or observe.

Parent/Legal Guardian: Scientific research involves the potential for exposure to various hazards. When deciding to allow your child to participate in research projects conducted at the University of Kentucky, it is important to be aware

PROJECT HAZARD ASSESSMENT

Please check the box for each activity in which the student will participate directly or observe in close proximity.

Check if YES	Activity (Animal Hazards)	Potential Hazard(s)
☐	Working with live animals	Animal bites, allergies.
☐	Working with live animals in conjunction with other hazards (i.e., chemicals, infectious agents)	Animal bites, allergies. Exposure to hazardous materials used in conjunction with animals
Check if YES	**Activity (Biological Hazards)** 	**Potential Hazard(s)**
☐	Working with unpreserved human blood, bodily fluid, or other potentially infected materials	Exposure to infectious material
☐	Working with preserved animal and/or human specimens or samples	Exposure to infectious material or preservative chemicals
☐	Working with Risk Group 1 (RG1)infectious agents or recombinant/ synthetic nucleic acid materials handled at Biosafety Level 1 (BSL-1)	Eye or skin irritation, potential for infection in immunocompromised individuals
☐	Manipulation of Risk Group 2 (RG2)cell lines, viruses, bacteria, or other organisms handled at Biosafety Level 2 (BSL-2)	Exposure to infectious material, particularly via broken skin, mucous membranes or ingestion

Minors are prohibited from working in areas designated as or performing procedures with biological materials requiring Biological Safety Level 3 (BSL3) or higher containment.

Check if YES	Activity (Chemical Hazards)	Potential Hazard(s)
☐	Working with corrosives 	Eye or skin damage
☐	Working with acute toxins 	Poisoning, increased potential for eye or skin damage, potential injury via inhalation or ingestion
☐	Working with organic solvents or flammable liquids/solids 	Eye or skin damage, potential harm via skin or eye contact

Safety of Minors in Research

PROJECT HAZARD ASSESSMENT (continued)

Please check the box for each activity in which the student will participate directly or observe in close proximity.

Check if YES	Activity (Chemical Hazards)	Potential Hazard(s)
☐	Working chemicals with known detrimental effects on human health or for which there are sensitivity or allergy concerns 	Eye or skin damage, potential injury via skin or eye contact, inhalation or ingestion
☐	Minor chemical spill cleanup	Eye skin, or respiratory damage, potential injury via skin or eye contact

Minors are prohibited from performing procedures with, or working in an area with active use reactive chemicals, explosives, or large volumes (>4L) of flammable liquids.

Check if YES	Activity (Laser Hazards)	Potential Hazard(s)
☐	Performing alignment, trouble-shooting or maintenance that requires working with an open beam and/or defeating the interlock on any Class 3 or 4 laser system	Eye damage
☐	Viewing a Class 3R laser beam with magnifying optics (including eye glasses)	Eye damage
☐	Working with a Class 3B or 4 laser open beam system with the potential for producing direct or specular reflections	Eye and skin damage

Check if YES	Activity (Nanomaterials)	Potential Hazard(s)
☐	Working with engineered nanomaterials	Inhalation and dermal exposure. Level of hazard is determined by the nature of the nanomaterial

Check if YES	Activity (Physical Hazards)	Potential Hazard(s)
☐	Working high temperatures, including working with hot liquids or equipment, or with open flames.	Burns, splashes, or fire
☐	Working with an apparatus or equipment with contents under vacuum or pressure, including compressed gas cylinders	Increased potential for injury or bodily harm, especially the eyes
☐	Working with cryogenic liquids (i.e., working with adding or removing freezer vials from a liquid nitrogen dewar). Working with very cold to freezing equipment or dry ice	Frostbite or skin burn. Skin, eye and tissue damage. Lacerations for other injury from exploding vials from rapid warming or inappropriate storage of dry ice in closed containers

PI Name:

Minor Name:

Research Safety

Safety of Minors in Research

PROJECT HAZARD ASSESSMENT (continued)

Please check the box for each activity in which the student will participate directly or observe in close proximity.

Check if YES	Activity (Physical Hazards)	Potential Hazard(s)
☐	Washing glassware	Lacerations
☐	Working with loud equipment, noises, sounds, or alarms	Potential damage to or loss of hearing
☐	Working with a centrifuge	Exposure to hazardous materials, lacerations from unbalanced rotors
☐	Working with sharps (i.e., needles, scalpels, glass slides and pipettes).	Laceration, exposure to hazardous materials via skin puncture
Minors are prohibited from areas or activities requiring the use of a respirator.		

Activity (Radiological Hazards) 	Potential Hazard(s)
Minors are prohibited from performing any activities involving sealed or unsealed radioactive materials, or radiation producing equipment. Minors can observe procedures with these materials from a distance.	

PI Name:

Minor Name:

Research Safety

Safety of Minors in Research

Principal Investigator/Sponsor

I, _____ , agree to sponsor the minor,

_____ , and by my signature below agree to the following:

- I have read, understand, and will adhere to the University of Kentucky Safety of Minors in Research Policy and understand that approval from the University of Kentucky Department of Research Safety must be granted before the minor may participate in any research activities.
- I will provide the minor with Laboratory Specific Training, specific to the laboratory hazards associated with the Minor's research project.
- I will provide personal protective equipment (PPE) appropriate and specific to the laboratory hazards present.
- This Minor will be always supervised while in the laboratory. The Minor will never be left unsupervised.
- This Minor's hours of work will comply with Federal Regulation 29 CFR 570.35.
- My laboratory is in full compliance with all applicable Research Safety programs and regulations and any UK institutional regulatory oversight committees (i.e., IBC, RSC, IRB, IACUC).

PI Signature: _____

Date of Signature _____

Minor Student

I, _____ , by my signature below, agree to the following:

- I have read, understand, and will adhere to the University of Kentucky Safety of Minors in Research Policy to best protect myself and those around me from accidental exposures and/or incidents.
- I have read and understand the hazard assessment for this project and will follow all instructions provided to me in the laboratory regarding safe practices and procedures, including the wearing of all assigned prescribed personal protective equipment (PPE) for all activities involving hazardous materials.

Minor Student Signature: _____

Date of Signature _____

Parent/Guardian of Minor Student

I, _____ , by my signature below, agree to the following:

- I have read and understand the Safety of Minors in Research Policy, including the hazard assessment for this project. I understand the hazards associated with my child's research project.
- I understand and agree that my child's research project may be suspended at any time, at the discretion of the University of Kentucky and its officers, agents, and employees, if the safety of my child, University of Kentucky employees and/or other volunteers becomes a concern.

Guardian Signature: _____

Date of Signature: _____

APPENDIX A: OSHA LABORATORY STANDARD

U.S. DEPARTMENT OF LABOR

Occupational Safety and Health Administration

- **Part Number:** 1910
- **Part Number**
- **Title:** Occupational Safety and Health Standards
- **Subpart:** 1910 Subpart Z
- **Subpart Title:** Toxic and Hazardous Substances
- **Standard**
- **Number:** 1910.1450
- **Title:** Occupational exposure to hazardous chemicals in laboratories.
- **Appendix:** A, B
- **GPO Source:** e-CFR

1910.1450(a)

Scope and application.

1910.1450(a)(1)

This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

1910.1450(a)(2)

Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

1910.1450(a)(2)(i)

For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

1910.1450(a)(2)(ii)

Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

1910.1450(a)(2)(iii)

Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.

1910.1450(a)(3)

This section shall not apply to:

1910.1450(a)(3)(i)

Uses of hazardous chemicals which do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart Z, even if such use occurs in a laboratory.

1910.1450(a)(3)(ii)

Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions might include:

1910.1450(a)(3)(ii)(A)

Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

1910.1450(a)(3)(ii)(B)

Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

1910.1450(b)

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.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

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 and

(ii) meets the requirements of paragraph (e) of this section.

Designated area means an area which may be used for work with "select carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

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; carcinogenity; 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.

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 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;

(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.

1910.1450(c)

Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the

permissible exposure limits specified in 29 CFR part 1910, subpart Z.

1910.1450(d)

Employee exposure determination -

1910.1450(d)(1)

Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring 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 PEL).

1910.1450(d)(2)

Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

1910.1450(d)(3)

Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

1910.1450(d)(4)

Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

1910.1450(e)

Chemical hygiene plan - General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

1910.1450(e)(1)

Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

1910.1450(e)(1)(i)

Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

1910.1450(e)(1)(ii)

Capable of keeping exposures below the limits specified in paragraph (c) of this section.

1910.1450(e)(2)

The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

1910.1450(e)(3)

The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

1910.1450(e)(3)(i)

Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

1910.1450(e)(3)(ii)

Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

1910.1450(e)(3)(iii)

A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

1910.1450(e)(3)(iv)

Provisions for employee information and training as prescribed in paragraph (f) of this section;

1910.1450(e)(3)(v)

The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

1910.1450(e)(3)(vi)

Provisions for medical consultation and medical examinations in accordance with paragraph (g)

of this section;

1910.1450(e)(3)(vii)

Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

1910.1450(e)(3)(viii)

Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

1910.1450(e)(3)(viii)(A)

Establishment of a designated area;

1910.1450(e)(3)(viii)(B)

Use of containment devices such as fume hoods or glove boxes;

1910.1450(e)(3)(viii)(C)

Procedures for safe removal of contaminated waste; and

1910.1450(e)(3)(viii)(D)

Decontamination procedures.

1910.1450(e)(4)

The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

1910.1450(f)

Employee information and training.

1910.1450(f)(1)

The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.

1910.1450(f)(2)

Such information 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. The frequency of refresher information and training shall be determined by the employer.

1910.1450(f)(3)

Information. Employees shall be informed of:

1910.1450(f)(3)(i)

The contents of this standard and its appendices which shall be made available to employees;

1910.1450(f)(3)(ii)

The location and availability of the employer's Chemical Hygiene Plan;

1910.1450(f)(3)(iii)

The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

1910.1450(f)(3)(iv)

Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

1910.1450(f)(3)(v)

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 received from the chemical supplier.

1910.1450(f)(4)

Training.

1910.1450(f)(4)(i)

Employee training shall include:

1910.1450(f)(4)(i)(A)

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.);

1910.1450(f)(4)(i)(B)

The physical and health hazards of chemicals in the work area; and

1910.1450(f)(4)(i)(C)

The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

1910.1450(f)(4)(ii)

The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

1910.1450(g)

Medical consultation and medical examinations.

1910.1450(g)(1)

The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

1910.1450(g)(1)(i)

Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

1910.1450(g)(1)(ii)

Where 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, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

1910.1450(g)(1)(iii)

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, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

1910.1450(g)(2)

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

1910.1450(g)(3)

Information provided to the physician. The employer shall provide the following information to the physician:

1910.1450(g)(3)(i)

The identity of the hazardous chemical(s) to which the employee may have been exposed;

1910.1450(g)(3)(ii)

A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

1910.1450(g)(3)(iii)

A description of the signs and symptoms of exposure that the employee is experiencing, if any.

1910.1450(g)(4)

Physician's written opinion.

1910.1450(g)(4)(i)

For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

1910.1450(g)(4)(i)(A)

Any recommendation for further medical follow-up;

1910.1450(g)(4)(i)(B)

The results of the medical examination and any associated tests;

1910.1450(g)(4)(i)(C)

Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and

1910.1450(g)(4)(i)(D)

A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

1910.1450(g)(4)(ii)

The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

1910.1450(h)

Hazard identification.

1910.1450(h)(1)

With respect to labels and safety data sheets:

1910.1450(h)(1)(i)

Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

1910.1450(h)(1)(ii)

Employers shall maintain any safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

1910.1450(h)(2)

The following provisions shall apply to chemical substances developed in the laboratory:

1910.1450(h)(2)(i)

If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

1910.1450(h)(2)(ii)

If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

1910.1450(h)(2)(iii)

If the chemical substance is produced for another user outside of the laboratory, the employer

shall comply with the Hazard Communication Standard (29 CFR 1910.1200) including the requirements for preparation of safety data sheets and labeling.

1910.1450(i)

Use of respirators. Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

1910.1450(j)

Recordkeeping.

1910.1450(j)(1)

The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

1910.1450(j)(2)

The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.20.

1910.1450(k)

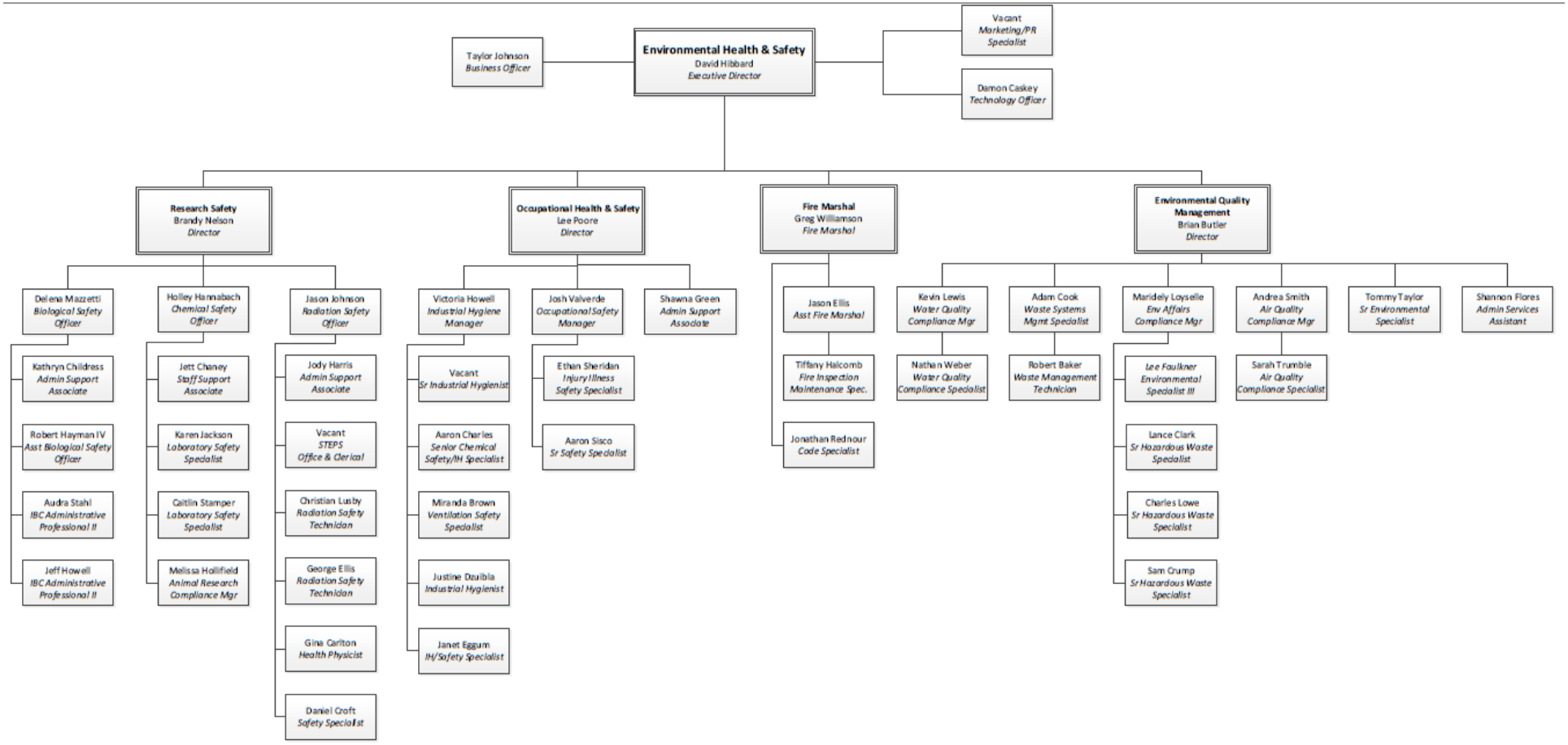
Reserved

1910.1450(l)

Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[55 FR 3327, Jan. 31, 1990; 55 FR 7967, March, 6, 1990; 55 FR 12777, March 30, 1990; 61 FR 5507, Feb. 13, 1996; 71 FR 16674, April 3, 2006; 77 FR 17887, March 26, 2012]

APPENDIX B: UK EHS ORGANIZATIONAL CHART



APPENDIX C: LAB SPECIFIC TRAINING DOCUMENTATION

Research Safety

Laboratory-Specific General Safety Training Record

Name of individual:	**Linkblue ID#:**
Principal Investigator:	**Designated CHO**
Building(s)/Room(s) of active work:	**Supervisor:**

This checklist may be used by University of Kentucky research laboratories to document laboratory-specific safety training for personnel. Other training on materials and procedures specific to the lab shall be added and documented as needed. Training documentation for laboratory personnel shall be stored in the laboratory's Chemical Hygiene Plan or Laboratory Safety Manual.

Please place a check mark to show that training on the topic has been completed by the above-named individual.

Emergencies	
	Location of emergency contact information for UK Police and response to medical, fire, or other emergencies.
	Worker response to building, facility, and safety equipment alarms (i.e., chemical fume hood, glove box, biological safety cabinet) including the review of established building emergency evacuation routes.
	Location and proper use of emergency equipment such as eyewash stations, fire extinguishers, fire pull stations, safety showers, first aid, and spill kits for the materials in use.
	Procedures for seeking medical attention. Reporting requirements for laboratory incidents, accidents, and near misses, particularly those relating to personal injury.
General Lab Safety	
	Contact information for lab operations (i.e., Principal Investigator, the designated Laboratory Chemical Hygiene Officer, departmental safety liaison, facility manager, custodial services).
	Food and beverages are prohibited in the laboratory. Designated food storage and eating areas are defined for the individual.
	The physical, chemical, biological and radiological hazards of the materials present in the lab and the signs and symptoms of exposure.
	Laboratory and facilities requirements including but not limited to: • Doors to laboratory remained closed to the common corridors • Appropriate lab attire (closed toe shoes, no shorts, long hair restrained) • No gloved hands, lab coats or other PPE in hallways, restrooms, elevators and other public areas • Use of rigid-sided, lidded, and leak-proof secondary transport containers for hazardous materials • Required approvals and training for procedures and/or materials • Room or Equipment User Logs
	Types of personal protective equipment (PPE) to be used for procedures and where they are stored. The minimum PPE required of all University of Kentucky wet labs are disposable gloves, lab coat, and eye protection.
	Proper use of and any hazards presented by laboratory equipment. (i.e., thermal, electrical, mechanical). Examples of hazardous equipment are vacuum pumps, sonicators, Bunsen burners, UV lamps, microtomes, anesthesia equipment, hot plates, etc.
	Daily work practices including but not limited to: • Donning and safe doffing of PPE, particularly disposable gloves • Proper and frequent handwashing • Proper storage and disposal of materials in use
	Proper disposal of distinct types of waste in the laboratory (i.e., chemicals, biohazards, radiological, sharps)
Chemical Safety (for laboratories using hazardous chemicals)	
	Familiarity with the content and location of: • Occupational Safety and Health Administration (OSHA)Laboratory Standard [29 CFR 1910.1450] • UK General Chemical Hygiene Plan • Laboratory-specific Chemical Hygiene Plan, including Standard Operating Procedures (SOP) • Safety Data Sheets (SDS) for laboratory chemicals
	Detection methods, signs or symptoms of exposure or release of hazardous chemicals in the lab (i.e., odors, monitoring equipment, visual appearance) and the proper course of action if detected.
	Location of all PPE needed for procedures

Chemical Safety (cont.)	
	Proper use of the chemical fume hood, glovebox, blast shielding, or other exposure protection equipment and their monitoring devices/methods.
	Proper chemical segregation and storage based on hazard and compatibility, including chemical labeling requirements
	Chemical spill procedures and required reporting
Biological Safety (for laboratories using biological hazards)	
	Location and proper use of laboratory disinfectants
	Signs and symptoms associated with exposure to the hazards specific to the laboratory, including infectious agents to humans, plants, or animals, recombinant or synthetic nucleic acid materials and routes of potential exposure (needle stick, skin contact, eye splash, etc.)
	Reporting requirements for laboratory incidents and accidents, especially resulting in personal injury and/or exposure to **infectious agents and/or recombinant or synthetic nucleic acid materials**
	Biohazardous waste triage procedures (ex: autoclave vs use of effective disinfectants)
	Autoclave procedures, particularly pertaining to decontamination of biohazard waste
	Standard microbiological procedures and guidance in HHS/CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL)
	Familiarity with the NIH Guidelines for Research Involving Recombinant DNA Molecules and the lab's Institutional Biosafety Committee protocol
	Proper use of Biological Safety Cabinets (BSCs), if applicable
	Biological spill procedures and required reporting
Radiation Safety (for laboratories using radiological materials or equipment with radioactive sources)	
	Location of Radiation Safety Officer name and number
	Onsite, Initial, Basic and Advanced Training, completed in order, for authorization to use radioactive materials
Hazardous Waste (for laboratories generating hazardous waste)	
	Location and types of hazardous waste containers
	Appropriate labeling of hazardous waste
	Proper hazardous waste storage and waste ticketing procedures

I have trained the above-named individual on the topics noted above as they pertain to the scope of work, materials and procedures used in my laboratory.

Principal Investigator/Designated CHO signature:

Principal Investigator/Designated CHO name (printed):

I have been instructed about, have read, and understand the contents and concepts presented to me, as described above, and agree to abide by the principles and instructions that have been provided to me in this training. I understand that if I have any questions about the training, materials, the information presented, or if I experience any problems in performing my tasks with potential hazards, it is my responsibility to seek clarification from the Principal Investigator or designated Laboratory Chemical Hygiene Officer.

Laboratory Personnel signature:

Laboratory Personnel name (printed):

APPENDIX D: UNATTENDED EXPERIMENT SIGN

Research Safety
Chemical & Lab Safety Team
labsafety@uky.edu

A completed sign shall be placed on the CFH when experiments are left unattended

IN CASE OF EMERGENCY

Contact: **Phone & Email**	

If an emergency situation is present, please contact user and if safe to do so, enact the following:

Description of Emergency Shut-down Procedures:

Circle if any apply to emergency shut-down procedures.

Turn on/off water	Turn on/off _____	Evacuate Lab
Turn on/off gas	Unplug _____	Call 911
Turn on/off vacuum	Open/Close_____ valve	
Turn on/off Heat	Close Sash	
Turn on/off Nitrogen	Walk Away	

AVOID THE FOLLOWING MATERIALS WHILE EXPERIMENTS ARE UNDERWAY

Circle if any are incompatible with the experiment

Acids	Air	Alcohols	Bases	Cold	Flammables
Heat	Halogens	Mercury or Heavy Metals	Oxidizers	Pressure	Shock
Water					

INTENDED CONDITIONS

Complete if any apply to ideal experimental conditions

Temperature_____	Pressure_____	Stirring_____	Vacuum_____
Nitrogen _____	Oxygen_____	Air _____	Keep dark or Covered
Keep Open / Closed	Color _____	pH _____	Translucent / Opaque
Viscosity _____	Other _____		

UNATTENDED HAZARDS

Experiment Will Be Left Unattended **Y / N**

Unattended Hazards

(Circle if any apply)

Acid	Base	Oxidizer	Flammable
Reactive to Air	Inhalation Hazard	Toxic	Mercury or Heavy Metal
Reactive to Water	Reactive to Shock	Biohazard 	Radiactivity 
LOW HAZARD			

Standard Operating Procedure:

Laboratory Information

Department:	
Principal Investigator(s):	
Designated laboratory-specific chemical hygiene officer):	
Laboratory **emergency contact** (name and phone):	
Laboratory phone:	
Designated area (s) of these procedures with chemicals(s): (building and room):	
Agent storage location (building and room) and specifics regarding location/container/cabinets:	

Chemical Information

Chemical Name(s), including CAS No:	
GHS Classification and Hazard Statements (see SDS sheet provided by the chemical's manufacturer): **Example:** *Ethanol: H225: Highly Flammable liquid and vapor [Danger Flammable liquids]; H319: Causes serious eye irritation [Warning Serious eye damage/eye irritation]*	

Signs and symptoms of exposure or release	
Routes of exposure	
Required engineering controls: (i.e., chemical fume hood, biological safety cabinet, glove box, temperature control, humidity control, shielding, luer-lock syringe, in-line HEPA filter,etc.)	
Personal Protective Equipment (PPE) required for procedures:	
Known incompatibilities with chemical(s):	
Special storage and handling considerations:	
Please list the approximate amount(s) of chemical(s) utilized in all procedures	

Please describe, in a stepwise fashion, the work practices and procedures involved in the handling and utilization of this agent. **Please be clear and complete in the description of procedures (i.e., measuring, weighing, pouring, mixing, injection, mixing, transporting, administration to animals, heating, etc.).** **Be sure to include any precautionary safety steps undertaken during these procedures.** **Please submit additional pages, if necessary.**	

Waste collection and disposal procedures:	Waste chemicals shall be collected in a secured area. The area shall be free from evidence of spills. A Hazardous Waste label shall be affixed to the collection container and components shall be listed on the label as they are introduced into the container. **Do not date containers until the day of scheduled pickup**. Additionally, the container shall be marked with the hazard class of the chemical waste (i.e., Ignitable, Toxic, Reactive, Corrosive). When the container is no more than 2/3 full, date the container and submit a pick-up request in the UK waste ticketing system:
Spill procedure: Lab Specific Notes on Spill Response:	**Major spills of stock solution**: Leave the area and notify others not to enter. Report the spill to the UK Environmental Quality Management Department (EQMD)at (859) 323-6280 (M-F 8am-5pm) or after hours by dialing 911 from any on-campus phone or by contacting the UK Police at (859) 257-UKPD (8573). **Minor spills of manageable amount:** If necessary, contact EQMD for guidance. Consult manufacturer's SDS for instructions and compatibilities for your chemical (Be aware of any materials such as paper towels or water that could be incompatible with your spilled chemical!
Response procedures in the case of an incident or injury:	UK Employees: • After receiving first aid (refer to the chemical's SDS), report the occupational exposure to a hazardous chemical to UK Worker's Care at 1-800-440-6285. • If needed, an appointment will be made for the employee at UK UHS. • For severe emergency or injury, call 911 or proceed to the UK Chandler Hospital Emergency Department UK Students: • Call UHS at (859) 323-APPT to report an occupational exposure to a chemical hazard. • If needed, an appointment will be made for the employee at UK UHS. **For severe emergency or injury, call 911 or proceed to the UK Chandler Hospital Emergency Department** Additional Lab-Specific Emergency Procedures:

A copy of the manufacturer's SDS for this agent and the PI approved SOP shall be kept in the lab's Chemical Hygiene Plan (CHP). The CHP shall be stored in a location known to all laboratory personnel and is accessible during work hours.

Personnel Training

- Prior to conducting any work with (name of the chemical), designated personnel must be provided training specific to the hazard involved in working with the substance.
- The PI must provide his/her lab personnel with a copy of the SOP and a copy of the SDS provided by the manufacturer. Any further training materials must be documented and stored in the lab's Laboratory Safety Manual and available to internal UK or external oversight agency inspectors.
- The PI must ensure that his/her lab personnel have completed the initial and the consecutive annually required Chemical Hygiene trainings and Hazardous Waste training.

The undersigned have read and understood the content of this SOP and the SDS for:

Lab personnel performing procedures with this agent (typed name)	Date of hands-on training for this agent	Name of person who provided the agent specific training (typed name):	Signature of Lab Personnel

SOP Reviewed and Approved by:

PI: (typed name)	
PI: (signature and date)	
Lab CHO(typed name)	
Lab CHO (signature and date)	

APPENDIX F: LAB WASTE GUIDANCE

Laboratory Waste Guidelines

*Med Center consists of all biomedical buildings on the hospital side of Rose street that are connected by under-ground passages. This includes Medical Sciences, HSRB, Roach, Combs, Whitney -Hendrickson, and Gill Heart buildings.

Research Safety

Questions or concerns may be addressed to:

labsafety@uky.edu

Biohazardous

Description
Infectious microorganisms, recombinant or synthetic nucleic acid materials, parasites, prions, live vaccines, other potentially infectious or human-sourced material

All biohazardous waste shall be placed inside an **orange or clear** autoclavable bag with the **universal biohazard symbol.**

Bagged waste shall then be autoclaved and subsequently placed within an opaque, regular trash bag for pick up by housekeeping staff.

Unautoclaved biohazardous waste shall not be left unsecured and unattended. Waste shall be transported to the autoclave room using a hard-sided tray, bin, or other container.

Hazardous Chemical

Description
Expired chemicals or chemical waste from experiments

Environmental Quality Management (EQM) collects this waste from all areas.

Chemical waste collection containers, appropriate for the collected material must be labeled with a **Hazardous Waste Label, Hazard Warning Information, and contents** when the material is introduced into the container. Chemical waste containers shall be placed in a designated area within the laboratory and until closed and ready for pickup.

EQM will not collect items that are not tagged with a completed E-trax waste card. **Do not date containers.**

Submit a collection ticket via E-trax or Contact EQM for guidance.

EQM/E-trax (859) 323-6280

Glass

Description
Broken glassware

Broken glassware that has not been used in conjunction with biohazards should be disposed of in a plastic-lined, sturdy cardboard box. Once full, the box shall be taped securely shut, labeled with the word "TRASH", and placed with the regular trash for removal by housekeeping staff.

Please note: Housekeeping will not remove boxes that are leaking, insufficiently taped/sealed shut, or over 50 pounds.

If broken glass is contaminated with **biohazardous material**, it must be disposed of as biohazardous sharps waste. Alternatively, this material may be disposed of in the same manner as biohazard contaminated pipettes.

Pathological (Medical)

Description
Recognizable human organs, large amounts of unfixed human tissues, and large volumes (>500 ml) of human blood or blood soaked materials.

At the University of Kentucky, this type of waste is collected by licensed vendor. Therefore laboratory disposal of this waste requires special designation by the use of a **red bag and specific containers**.

Red bags are **never** to be used for regular or autoclaved waste. **Contact EQM** for the collection procedure specific to your location.

EQM/E-trax (859) 323-6280

Pharmaceutical

Description
Hazardous drug waste and equivalent chemical compounds

Pharmaceutical waste meets hazardous waste criteria or is identified as having equivalent characteristics, such as cytotoxic compounds. These shall be discarded in **designated black containers.**

Contact EQM for the collection procedure specific to your location.

EQM/E-trax (859) 323-6280

Serological Pipettes and Pipette Tips

Description
Used serological pipettes and pipette tips

Pipettes and pipette tips which have **not** been used in conjunction with biohazardous materials **or** which have been chemically decontaminated (ex: 10% household bleach) shall be disposed of in a **plastic-lined** box. Once full, the box shall be taped securely shut, labeled with the word "TRASH", and placed with the regular trash for removal by housekeeping staff. **Please note:** Housekeeping will not remove boxes that are leaking, insufficiently taped/sealed shut, or over 50 pounds.

Alternatively, pipettes and pipette tips **contaminated** with biohazardous materials may be collected in a **plastic-lined box, sealed shut,** and **enclosed in an autoclave bag for autoclave processing as biohazardous waste.**

Loose pipets or tips in bagged trash are prohibited.

Radiological

Description
Materials containing or contaminated by radionuclides

All radioactive materials are marked with the **universal radiation symbol:**

Contact Radiation Safety for collection of this waste.

Radiation Safety 859) 323-6777

Sharps

Description
Needles, scalpel blades, biohazard contaminated pipettes, pipette tips, and broken glass

Used needles, syringes, lancets, razor blades, and other sharp objects which have **not** been used in conjunction with biohazards or hazardous chemicals shall be placed in a hard plastic or metal container with a screw-on lid. When full, reinforce lid with heavy-duty tape, label the container with the words "Not recyclable trash" and place with regular trash for collection by housekeeping.

Sharps contaminated with human blood or other potentially infectious material must be placed in a sealed, hard plastic **medical sharps container** that is marked with the **universal biohazard symbol or is the color red.** Medical sharps containers should be no more than 2/3 full and closed shut for pickup by housekeeping (for Med Ctr area*) or EQM.

APPENDIX G: Lab Safety Inspection Potential Finding

Lab Safety Inspection Potential Findings (rev. 2025-0901)

Use this list to prepare before the annual Lab Safety Inspection!
Questions or concerns? Please contact labsafety@uky.edu

Access Control

Area doors open to non-research space. Corrective Actions: Area doors must remain closed to non-research space or shared hallways.

Area doors unlocked when space is unoccupied. Corrective Action: Area doors shall be locked when space is unoccupied.

Biohazardous Waste

Bagged biohazardous waste containers greater than 2/3 full. Corrective Actions: Close and process biohazardous waste containers when no greater than 2/3 full to allow for adequate space for steam penetration and proper fit inside the autoclave chamber.

Bagged biohazardous waste directly on floor, not in leak proof container. Corrective Actions: Biohazardous waste, if not to be immediately autoclaved, should set within a leak proof container to prevent puncture and/or leakage.

CFH

Actively used chemical fume hood not being utilized according to UK safety guidelines. Corrective Actions: Research activities requiring a chemical fume hood (CFH) shall always be performed within a CFH that is functioning according to UK guidelines and which has been UK OHS-certified within the year. Place a "Do Not Use" sign on the malfunctioning CFH or exposure control device. Please notify UK Occupational Health and Safety at 859-257-3827 for correction.

Alarm has been rendered inoperable by tampering. Corrective Actions: Lab shall not tamper with fume hood alarm. Please notify UK Occupational Health and Safety at 859-257-3827 for correction.

CFH baffles are obstructed or there is an excessive amount of materials inside chemical fume hood while in use. Corrective Actions: Keep the area around baffles clear from obstructions. CFH being used for chemical operations shall be free clutter. Only chemicals and equipment used for active experimentation may be temporarily stored in the CFH while procedures are underway.

Chemical fume hood is not appropriate for lab operations, e.g. heating perchloric acid. Corrective Actions:Chemical fume hoods must be appropriate for lab operations.

Chemical fume hood sash is above working height while in use. Corrective Actions: Keep sash at working height during active use and closed at all other times.

CGC

Compressed gas cylinder is not marked with its contents and/or primary hazard(s). Corrective Actions: Compressed gas cylinders must be marked as to their contents with additional communication of primary hazards, using verbiage or GHS pictograms.

Compressed gas cylinder regulator is being used as gas shut off while cylinder valve open. Corrective Action: Turn off cylinder at valve stem when gas is not in use.

APPENDIX G: Lab Safety Inspection Potential Finding

Compressed gas cylinder restraint too high or too low. Corrective Action: Compressed gas cylinder restraints must be placed between the midpoint and shoulder of the cylinder.

Compressed gas cylinder storage area is not dry, cool and well ventilated. Corrective Action: Make improvements to the existing compressed gas storage area so that it is dry, cool and well-ventilated, or move cylinders to areas that meet these requirements.

Compressed gas cylinder storage area is not permanently posted with class of gases stored in area. Corrective Action: Permanently post names of gases stored in the compressed gas cylinder storage area. Contact labsafety@uky.edu for guidance.

Compressed gas cylinders are being stored or transported without cylinder caps. Corrective Action: Place cylinder cap on compressed gas cylinder when being transported or stored.

Compressed gas cylinders are not properly restrained. Corrective Action: Restraint chains or straps shall be positioned about 2/3 of the way up the cylinder, above its center of gravity, between the shoulder and midpoint of the cylinder. Chains/Straps shall be tightly fitted to hold the cylinder in place. No more than 2 cylinders shall be restrained with a single chain or strap to a stationary building support, excluding vice clamp attachments to tables or benches. No more than one cylinder may be restrained per vice clamp restraint.

Compressed gases stored such that egress is obstructed. Corrective Action: Store compressed gas cylinders such that they do not obstruct egress.

Empty CGC are not segregated from CGC in use. Corrective Actions: Separate "empty" and "full" cylinders to avoid confustion. Do not store empty cylinders in the laboratory.

Incompatible gases are stored together. Corrective Actions: Separate compressed gas cylinders and store them according to compatibility. Flammable gases (e.g., hydrogen, methane, propane, acetylene, carbon monoxide) must be separated from oxygen or other oxidizing gas cylinders by a distance of at least 20 feet or by a barrier at least 5 feet high having a fire-resistance rating of at least one-half hour. Laboratories should use flashback arrestor devices on flammable compressed gas cylinders.

The number of flammable compressed gas cylinders in area exceeds UK storage policy. Corrective Action: Keep amount of flammable gases to a minimum. The number of flammable gas cylinders (10"x50") must not exceed 3 cylinders per 500 square feet in a non- sprinkled building or 6 cylinders per 500 square feet in a sprinkled building.

Toxic gas not properly managed. Corrective Action: Place toxic compressed gas cylinder in a continuously vented cabinet or fume hood.

Chemical Storage

Active use of a high hazard chemical without chemical-specific first aid available. Corrective Actions: When active use of a high-hazard chemical is ongoing, and there is a known immediate first aid treatment possible, keep chemical-specific first aid supplies on hand in the laboratory (e.g., Hydrofluoric acid in the lab without unexpired calcium gluconate, Phenol, or cresols without 50% polyethylene glycol (PEG) 400 solution). Lab personnel shall also be provided with documented training (maintained in the Lab Specific (CHP) for use in the event of emergency exposure.

Chemical container not sealed properly. Corrective Actions: Tightly seal all chemical containers in long-term storage appropriately with a screw cap, seal septum, or keck clip. A closed container is defined as a

container that is sealed employing a lid or other device so that neither liquid nor vapor will escape from it at ordinary temperatures.

Chemical containers in multi-user chemical storage room not labeled as to contents and/or owner. Corrective Action: Chemical containers in multi-user chemical storage must be clearly labeled as to contents and owner.

Chemical containers label missing, illegible, or otherwise improper. Corrective Actions: All labels on laboratory research chemicals shall be undefaced and legible, with the full chemical name written in English or a posted abbreviation, and include GHS pictograms and/or primary hazards (H Statements) of the chemical. Please see researchsafety.uky.edu for more information and guidance on proper chemical labeling.

Chemical containers not dated. Corrective Action: Please label stock chemical containers with the date received and the date opened. if not provided by the manufacturer on the container, time-sensitive chemicals such as peroxides, peroxide formers, unstabilized and amylene-stabilized chloroform, and picric acid also require an expiration date noted on the container.

Chemical inventory not organized by compatibility and/or hazard class. Corrective Actions: Organize chemical inventory by compatibility and hazard groups. Examples of incompatibilities: acids and bases, oxidizers and flammables, inorganic acids and organic acids. Nitric acid and >65% perchloric acid must kept separate in secondary containers from all other flammables, organics, oxidizers and bases. For chemical segregation guidance please see researchsafety.uky.edu.

Chemicals not necessary for research program stored in lab. Corrective Actions: The lab shall only store chemicals necessary for the research involved. Process unnecessary chemicals for disposal via the university's waste ticketing system. Examples of unnecessary chemicals include those abandoned by other researchers, those that have expired, oxidized, which have signs of compromised integrity, or are otherwise unusable for planned procedures.

Expired chemical has not been sent to waste or documented as tested for safety (if applicable). Corrective Actions: Promptly dispose of expired chemicals by submitting a waste ticket. Chemicals that have surpassed the container's listed expiration date,if not promptly disposed, shall be documented as regularly tested (e.g., ethanol-stabilized chloroform over 5 years old). Testing logs must include the date of testing, the manufacturer and lot of the chemical, the chemical inventory ID number or barcode, the method of testing, and the outcome. Contact labsafety@uky.edu for more information.

Inappropriate or no secondary containers used for mercury containing devices. Corrective Action: Use appropriate secondary containers for mercury containing devices.

Integrity of chemical containers is compromised (e.g. cracked, corroded, and/or leaking). Corrective Action: If chemical is still in good condition, move chemical to new container. If chemical not useable, place in appropriate secondary container and process for disposal.

Liquid chemicals are stored improperly (i.e., no spill tray, not upright, on window ledges). Corrective Actions: Storage of hazardous experimental chemicals on the floor should be avoided. If placed on the floor, or near drains, chemicals must be stored within a non-porous, chemically compatible spill tray or protective secondary bin and placed out of the way of foot traffic and electric utility panels. Liquid chemicals must be stored upright and if on shelving, should be below eye level. Chemicals may not be stored on window ledges.

APPENDIX G: Lab Safety Inspection Potential Finding

Oxidizers are stored on incompatible shelf material. Corrective Action: Store chemicals on compatible shelf materials.

CHP Manual

Chemical inventory is not on-line or has not been reviewed for accuracy within last 12 months.
Corrective Actions: University of Kentucky Department of Research Safety policy and best practices stipulate that an accurate chemical inventory, to be reviewed and updated no less than annually, is required for each location that stores chemicals with the following characteristics:
*Carcinogenic or otherwise harmful to human health
*Corrosive
*Flammable
*Oxidizing
*Reactive
*Toxic
*Harmful to the environment
*Liquids and gases under pressure, including liquid nitrogen tanks and compressed air cylinders.
Research laboratories on campus are required to update their documented inventory on no less than an annual basis, utilizing the university's online chemical inventory system.
If you believe this finding is an error, please submit a screenshot/picture of your digital inventory, displaying the date of last reconciliation or entry to labsafety@uky.edu

Information on lab door sign is incomplete, outdated, or incorrect. Corrective Actions: Door signs must be placed on ALL entry doors to spaces that contain hazardous materials and/or equipment.
A compliant door sign shall accurately display:
• PI/responsible individual and emergency contact information
• Symbols for materials stored or used within the space: universal biological or radiological hazard symbols, GHS pictograms for chemicals and compressed gas cylinders
• Text or symbols indicating any other present hazards such as electrical, strong magnetic, noise, etc.
• Required PPE and precautions required for or upon entry
Instructions for generating a new door sign are in the SciShield System, under the Research Tools menu, in the Document Library.

No GHS compliant door sign is posted.
Corrective Actions: Door signs must be placed on ALL entry doors to spaces that contain hazardous materials and/or equipment. A compliant door sign shall accurately display:
• PI/responsible individual and emergency contact information
• Symbols for materials stored or used within the space: universal biological or radiological hazard symbols, GHS pictograms for chemicals and compressed gas cylinders
• Text or symbols indicating any other present hazards such as electrical, strong magnetic, noise, etc.
• Required PPE and precautions required for or upon entry
Instructions for generating a door sign are in the SciShield System, under the Research Tools menu, in the Document Library. For more information, please visit researchsafety.uky.edu or contact labsafety@uky.edu

The Chemical Hygiene Plan (CHP) ID page is not current and/or dated. Corrective Actions: Update and sign the ID page. A Lab Specific CHP template is available in SciShield System, under the Research Tools menu, in the Document Library.

The lab does not have a Chemical Hygiene Plan. Corrective Actions: Research with laboratory use of

hazardous chemicals requires a documented Lab-Specific Chemical Hygiene Plan (29 CFR 1910.1450). A Lab Specific CHP template is available in SciShield System, under the Research Tools menu, in the Document Library. Please complete and store in your blue Lab Safety Manual Binder. For further information see: https://researchsafety.uky.edu/chemical-safety/chemical-hygiene-plan

There are no SOPs available in the lab for procedures involving research chemicals that adversely affect human health. Corrective Actions: Develop and maintain Standard Operating Procedures for work with hazardous chemicals in the Lab-Specific Chemical Hygiene Plan, including documentation that personnel are knowledgeable and trained on the SOP. A blank, fillable SOP template is available in the SciShield System, under the Research Tools menu, in the Document Library.

Unable to locate the Lab Specific Safety Training documentation and/or lab personnel unaware of this requirement. Corrective Actions: Investigator must complete Lab Specific Safety Training documentation for all lab personnel. The Lab Specific Safety Training documentation form is available in SciShield System, under the Research Tools menu, in the Document Library. Please complete and store in your blue Lab Safety Manual Binder.

Electrical

Damaged or frayed power cords are used in the lab. Corrective Action: Repair damaged and frayed power cords.

Energized cords are used without strain relief. Corrective Action: Energized cords must be used with strain relief.

Extension cords being used for permanent wiring. Corrective Action: Do not use as permanent wiring. Unplug when not in use.

Multiple power strips are being used inline. Corrective Action: Disconnect power strips and plug into a wall outlet.

Three foot area around electrical panels obstructed. Corrective Action: Keep 3 foot area around electrical panels free from obstruction.

Emergency Procedures

Emergency numbers are not posted in lab. Corrective Actions: Post emergency numbers in lab for ready access by laboratory personnel in the event of an emergency.

Lab Personnel are not aware of emergency procedures. Corrective Actions: Train all lab personnel regarding their responsibilities in an emergency. These responsibilities may range from notify and evacuate to cleaning up a small spill as long as the personnel are properly trained and comfortable in completing these tasks.

Occupational Injury and Exposure Protocol for Laboratories is not posted or made available to personnel. Corrective Actions: Make Occupational Injury and Exposure Protocol for Laboratories available to personnel.https://ehs.uky.edu/docs/pdf/ohs_lab_exposure_protocol_0001.pdf

Equipment

Access to eyewash is obstructed. Corrective Action: Keep area around eyewash clear.

APPENDIX G: Lab Safety Inspection Potential Finding

Access to fire extinguisher is obstructed. Corrective Action: Keep area around fire extinguisher free from obstructions.

Access to the safety shower is obstructed. Corrective Action: The area around safety shower must remain clear of obstructions.

Fire extinguisher was discharged and not reported. Corrective Actions: The Fire Marshal's office will be contacted to place an extinguisher in lab.

Portable eyewash not maintained. Corrective Actions: Maintain eyewash following manufacturer's specifications. Eye wash solution shall not be expired.

The safety shower activation handle has been rendered inoperable. Corrective Actions: The safety shower activation handle must remain operational at all times.

Facilities

Chemical fume hood alarm is not functional. Corrective Actions: UK OHS will be contacted to initiate correction.

Chemical fume hood is in alarm mode. Corrective Actions: UK OHS will be contacted to initiate correction.

Chemical fume hood is missing an audiovisual alarm. Corrective Actions: Install audiovisual alarm when funds are available. Contact UK OHS for guidance.

Chemical fume hood missing a flow indicator. Corrective Actions: Install flow indicator when funds are available. Contact UK OHS for guidance.

Fire extinguisher has not been inspected annually. Corrective Actions: The UK Fire Marshal's Office will be contacted to inspect the extinguisher.

Fire extinguisher not charged – "not in the green". Corrective Actions: The UK Fire Marshal's Office will be contacted to mount extinguisher on wall.

Fire extinguisher not mounted properly. Corrective Actions: The UK Fire Marshal's Office will be contacted to mount extinguisher on wall.

GFCI outlets not present in required areas. Corrective Action: GFCI shall be installed in areas within 6' of water use.

Mold is growing in cold room. Corrective Actions: Mold was found growing in the cold room. Moldy items must be removed and wipe all surfaces with a cleaning/disinfecting solution. Cardboard and other cellulose-based items must not be stored long term in cold rooms.

No eyewash in lab. Corrective Actions: Install compliant eyewash when funds are available. Contact UK OHS for guidance.

No fire extinguisher in lab. Corrective Actions: The UK Fire Marshal's office will be contacted to place extinguisher in lab.

APPENDIX G: Lab Safety Inspection Potential Finding

No safety shower available in lab. Corrective Actions: Install ANSI Z358.1 compliant safety shower when funds available. Contact UK OHS for guidance.

Positive or static airflow relative to uncontaminated areas. Corrective Actions: Lab airflow must be negative relative to uncontaminated areas. UK OHS will be notified of ventilation issue.

Flammable

Flammable materials are stored in refrigerator/freezer that is not rated for flammables. Corrective Action: Store flammable materials in a flammables-rated refrigeration unit. Please see the Policy on Storage of Small Quantities of Flammables in Household-Type Fridges, with allowable exemptions here: https://researchsafety.uky.edu/chemical-hazards-information/flammables

Flammable storage cabinets left open. Corrective Actions: Flammable storage cabinet doors shall remain closed at all times.

Potentially explosive compounds not dated when opened/tested/refilled in accordance with guide sheet. Corrective Action: Potentially explosive compounds must be dated when opened, tested or refilled. Peroxide forming compounds must be used, tested or disposed no later than 1 year after opening. Consult the manufacturer's SDS and/or other authoritative sources for guidelines for your specific chemical.

Potentially explosive compounds not disposed of by manufacturer's expiration date. Corrective Action: Potentially explosive compounds must be used or disposed by manufacturer's expiration date.

The amount of unprotected flammable solvents in area exceeds amount set by UK Solvent Storage Policy. Corrective Actions: Reduce the amount of flammable solvents in the area in accordance with UK Flammable Solvents Storage Policy:
1. The total amount of solvents within the laboratory shall not exceed ten (10) gallons per 100 sq.ft. when protected within a flammables cabinet.
2. The total amount of unprotected solvents within the laboratory shall not exceed five (5) gallons per 100 sq.ft.when unprotected. Solvents in excess of the amounts listed in item #1 shall be inside (bulk) storage rooms meeting NFPA 30.

Unapproved flammable storage cabinet in use. Corrective Action: Use rated flammable storage cabinet per NFPA 30.

Vent plugs of flammable cabinets have been removed. Corrective Action: Replace vent plugs for flammable storage unit.

General

Applying cosmetics (include lip balm) or handling contact lenses in the lab. Corrective Actions: Applying cosmetics (include lip balm) or handling contact lenses is prohibited in the lab.

Chipped or broken glassware in use in the lab. Corrective Action: Chipped or broken glassware must be repaired or discarded.

Defective, damaged, or unrated tubing used for Bunsen burner. Corrective Actions: Use rated tubing/hose that fits the gas valve outlet and burner inlet. Rated tubing includes fabric-reinforced PVC, fabric-reinforced neoprene (polychloroprene), fabric-reinforced nitrile rubber (NBR), thick-wall non-reinforced neoprene, or tubing specifically designed for Bunsen use provided it is not natural rubber.

APPENDIX G: Lab Safety Inspection Potential Finding

Evidence of eating and/or drinking in the lab. Corrective Actions: Food and drink are prohibited in all research wet labs. Please view policy and instructions for obtaining exemption at:https://researchsafety.uky.edu/cs-policies-and-procedures/food-and-drink-laboratories

Foodstuffs utilized for research not labeled for intended use (e.g., "Food not to be used for human consumption'). Corrective Action: Label all foodstuffs as "Not for Human Consumption" or similar.

Glassware disposed of improperly. Corrective Action: Glassware must be disposed of in rigid cardboard box with plastic liner.

Handwashing sink lacking liquid hand soap and/or paper towels. Corrective Actions: Liquid hand soap and/or paper towels must be made available to allow for handwashing after removal of gloves, when visibly contaminated, and before leaving the lab.

Hazardous equipment, machinery or other devices without safeguarding. Corrective Action: Any machine part, function, or process that could cause injury must be safeguarded (i.e., moving parts, belts, etc.)

Improper pipette disposal in unlined box. Corrective Actions: Line pipette disposal boxes to prevent leakage.

Lab personnel wearing improper attire in the lab (e.g. shorts or open toed footwear). Corrective Actions: Lab personnel must wear proper attire in the lab (e.g. shorts or open toed footwear prohibited).

Poor housekeeping of lab space. Corrective Actions: Appropriate housekeeping of lab surfaces (e.g., floors, walls, and other "housekeeping surfaces") to facilitate cleaning and minimize the accumulation of debris and/or fomites is required.

Sharps containers more than 2/3 full. Corrective Actions: Dispose of sharps containers when 2/3 full.

UV sources not labeled. Corrective Action: UV sources must be labeled.

UV sources utilized without proper shielding and/or PPE. Corrective Action: UV sources must be shielded or utilized with appropriate PPE.

Vacuum sources without vacuum traps. Corrective Actions: Vacuum sources shall have vacuum traps.

Hazardous Waste

Containers accumulating used oil not labeled with the words 'USED OIL.' Corrective Action: Affix a label as 'USED OIL' to any container accumulating oil such as vacuum pump oil and ensure no other waste labels are on the container.

Ethidium bromide or Formalin containers not labeled with NON-RCRA REGULATED Waste labels. Corrective Action: Label any container of used Ethidium Bromide or used Formalin waste as 'NON-RCRA REGULATED WASTE.' These labels may be obtained from EQMD (859) 323-6280.

Evidence of improper disposal (e.g. drain disposal, trash) of hazardous materials that have not been reviewed or approved by EQM. Corrective Actions: Hazardous waste must be ticketed for disposal and pick up by Environmental Quality Management. Any hazardous material to be drain disposed or placed in regular trash must be reviewed and approved by Environmental Quality Management.

APPENDIX G: Lab Safety Inspection Potential Finding

Full hazardous waste containers not ticketed for disposal. Corrective Action: Hazardous waste containers, when filled must be dated with the date on which the container is filled. This may be done by completing a waste ticket for pickup.

Hazardous waste container is not labeled properly. Corrective Action: Hazardous waste containers shall be properly marked with a Hazardous Waste label and complete information regarding the contents of the container, their approximate percentages/volumes, and the hazard characterization and warning for the waste being collected.

Hazardous waste containers pre-dated or pre-ticketed before scheduling pickup. Corrective Action: Dated or ticketed chemical waste containers require immediate submission to EQMD for timely pick-up. Hazardous waste containers must not have a date placed on them until they are filled, and when done, promptly pickup for disposal by EQMD.

Sign identifying the location of the Satellite Accumulation Area not posted. Corrective Actions: The location(s) where hazardous waste is being accumulated must be identified by a red sign indicating the Satellite Accumulation Area (SAA). Contact Environmental Management to obtain the signs.

Unsuitable or incompatible chemical waste container. Corrective Actions: All chemical waste containers must be sealed with a secure lid, unless using an approved funnel for pressure-forming wastes. Containers used for chemical waste must be compatible with the waste collected. Please contact EQMD (859) 323-6280 for consultation or provision of waste collection containers.

Waste containers are not in a secure area or under the control of the generator. Corrective Action: All Hazardous Waste containers must be under the control of the generator. This may be accomplished by having the containers in direct line of sight or having the containers behind a locked door, such as the lab door being locked when personnel are not present in the lab.

Waste containers are uncapped or with unapproved funnels. Corrective Action: All waste containers must be closed with a tight-fitting lid unless contents are in active use and contents are being added. Place a compatible lid on the container or, if the container is used for an equipment effluent reservoir, install a cap with holes fitted for the tubing used. Containers used for pressure-forming waste (e.g., Piranha solution) must be sealed with a cap manufactured to release pressure while preventing spills. These caps may be acquired from UK Environmental Quality Management.

Waste containers without necessary spill trays. Corrective Action: Spill trays for waste chemical containers are required near drains and sinks, as well as for separate storage of incompatible chemical wastes. Spill trays may be obtained from the Environmental Management Department (869) 323-6280.

Life Safety

Aisles or doorways blocked. Corrective Action: Keep aisles, doorways, free from obstruction. If the UK Fire Marshal's Office has previously issued approval for this obstructed doorway, please forward documentation of this approval to labsafety@uky.edu so this finding may be removed from the inspection.

Items stored within 18" of sprinklered ceiling. Corrective Actions: In a sprinklered space, keep a clearance of 18 in. from the ceiling on non-wall adjacent shelving.

Overabundance of combustibles, e.g. cardboard boxes in the lab. Corrective Action: Reduce the amount of combustibles in the lab to what is necessary.

APPENDIX G: Lab Safety Inspection Potential Finding

Slip, trip, or fall hazards in the lab (e.g. power and extension cords, liquids on floor). Corrective Action: Keep area free from slip, trip, and fall hazards.

PPE

Appropriate PPE not available. Corrective Actions: PPE for the work conducted shall be made available to personnel at all times.

Lab coats laundered at home. Corrective Actions: Lab coats must be laundered on premises or through an approved vendor.

Lab coats not laundered when visibly soiled. Corrective Actions: Lab coats must be laundered when visibly soiled.

Lab personnel not wearing PPE in accordance with PPE Hazard Assessment. Corrective Action: Lab personnel must wear appropriate PPE in the lab, in accordance with CHP Hazard Assessment.

Lab personnel reusing single use items (e.g. gloves). Corrective Actions: Disposable PPE must be decontaminated and placed in lab waste after use.

PPE is improperly utilized by personnel. Corrective Actions: Personnel shall be trained in the proper utilization of PPE, including requirements for use and its donning/doffing.

PPE stored improperly resulting in the contamination or degradation of PPE. Corrective Action: PPE should be stored according to manufacturer's recommendation.

PPE worn outside of lab area. Corrective Actions: All PPE, including lab coats and disposable gloves, shall be removed before exiting the lab and entering public corridors and non-laboratory spaces.

Training

All lab personnel have not completed Hazardous Waste training within last year. Corrective Action: All persons generating or managing Hazardous Waste must be trained on an annual basis. Access the on line Hazardous Waste Generator Training on the EMD website and insure that all lab personnel complete the training.

Not all lab personnel have taken Chemical Hygiene Plan/lab Safety Training. Corrective Actions: All lab personnel must take the online Initial Chemical Hygiene Plan/Lab Safety training, and thereafter annually complete the CHP Refresher training. Visit researchsafety.uky.edu or email labsafety@uky.edu for instructions on completing this required training.

Research Safety

Weekly Eyewash Inspection Log

Instructions:

Activate emergency eyewash to ensure proper operation. Water should flow within 1 second of valve release and remain flowing.

Ensure there is sufficient water flow. The stream from both eye pieces should be approximately 6 inches in length and meet in the center of the eyewash nozzle.

Ensure the water is clear. If there are any issues, tag the unit as out of service and notify your safety liaison. A work order to UK PPD shall be submitted for correction as a health and safety issue.

When your annual log sheet is complete, file in your blue Laboratory Safety Manual. Records shall be kept for 3 years.

Date	Initials	Date	Initials	Date	Initials

Dept of Research Safety
Lab & Chemical Safety Team
labsafety@uky.edu

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Laboratory Specific Chemical Hygiene Plan for Research Laboratories

This template is designed to provide an organizational framework for ensuring compliance of the individual laboratory with the OSHA Laboratory Standard [29 CFR 1910.1450]. This completed template should be used in conjunction on with the institutional UK Chemical Hygiene Plan. Other formats for the information contained in this document are acceptable if the content possesses all OSHA Laboratory Standard-required elements. Refer to the institutional UK Chemical Hygiene Plan for a list of these requirements. It is the responsibility of the laboratory's Principal Investigator/Laboratory-designated Chemical Hygiene Officer to compile, review and update this Laboratory Specific Chemical Hygiene Plan no less than annually.

The Department of Research Safety reserves the right to request a copy of the laboratory's Lab Specific Chemical Hygiene Plan for the purposes of review and to ensure its completion and compliance with the OSHA Laboratory Standard. Upon annual Laboratory Safety inspection, the laboratory's specific CHP will be checked to ensure its annual review has been completed and that all lab staff have documented lab specific training.

Sections of the UK Laboratory-Specific CHP:

1) Principal Investigator/Chemical Hygiene Officer ID and review signature page
2) Laboratory Personnel page, with documentation of understanding of the CHP
3) Laboratory Personnel Training Documentation
4) Laboratory Specific Emergency Contacts
5) Laboratory Locations and Activities
6) Materials and Procedures requiring PI/Laboratory Chemical Hygiene Officer and/ or departmental approval
7) Laboratory Specific Policies
8) a. Controlling Hazards - Lab Activities and PPE Hazard Assessment
   b. Controlling Hazards - Chemical Hazards in the Laboratory
   c. Controlling Hazards - High Risk Procedures in the Laboratory
9) Safe Operation of Engineering Controls
10) Standard Operating Procedures (SOP)
11) Laboratory Specific Exposure Monitoring and Medical Surveillance
12) Laboratory Specific Chemical Inventory and Safety Data Sheets
13) Supplementary records, documentation, resources or references.

Directions: Please complete all sections of this template. Questions or requests for assistance with or completion of a Laboratory-Specific Chemical Hygiene Plan may be emailed to labsafety@uky.edu .

Section 1: ID and Review

Lab-Specific Chemical Hygiene Plan

Principal Investigator (PI):

Department:

Designated Chemical Hygiene Officer (CHO):
(if none, this designation defaults to the listed Principal Investigator)

Emergency Contact for the Laboratory and phone:

This Chemical Hygiene Plan (CHP) is specific to the following building(s) & room number(s):

Laboratories engaged in the laboratory use of hazardous chemicals must maintain a lab-specific Chemical Hygiene Plan (CHP) which conforms to the requirements of 29 CFR 1910.1450, the Occupational Safety and Health Administration (OSHA) Occupational Exposure to Hazardous Chemicals in Laboratories Standard (Lab Standard). University of Kentucky laboratories may use this document to develop their lab-specific CHP. This cover page must specify the Principal Investigator and specific laboratory spaces where this CHP is used. In addition, all lab employees shall document required trainings such as Lab-Specific Training and any trainings specific to particularly hazardous chemicals or procedures, by placing signed training forms in the CHP.

The contents of the Lab Specific Chemical Hygiene Plan, Laboratory Safety Manual, and any lab-specific information herein have been reviewed and revised as necessary. Personnel under my supervision have been informed of all hazards in the above listed spaces, any required controls for the safe handling of hazardous chemicals, have been trained in the procedures for safe work with hazardous chemicals and are knowledgeable in emergency response procedures for the laboratory.

PI Signature and Date: _____

Designated CHO Signature and Date: _____

Date of Annual Review	PI Signature	Designated CHO Signature

Research Safety

Important Telephone Numbers:
UK Workers Care: 1-800-440-6285
University Health Services: 859-323-APPT
UHS After Business Hours: 859-323-5321
FOR ALL EMERGENCIES CALL 911 and/or PROCEED TO UK CHANDLER HOSPITAL EMERGENCY DEPARTMENT

Lab Specific CHP Section 2: **Labo**ratory Personnel

Principal Investigator:

Department:

Designated Chemical Hygiene Officer:
(if none, this designation defaults to the listed Principal Investigator)

I have read and understand the contents of the Lab-Specific Chemical Hygiene Plan, including any SOPs for safe conduct of procedures utilizing chemicals which present a hazard to human health. I have been made aware of the hazards present in our laboratory, the controls that need to be implemented, and the response procedures should an emergency occur in the laboratory. I hereby acknowledge that I will comply with requirements, policies and work practices described in this plan, including completion of required training(s).

Date	Personnel Name (printed)	Personnel Signature

Research Safety

Important Telephone Numbers:
UK Worker's Care at 1-800-440-6285
University Health Services (UHS): (859) 323-APPT
UHS after hours: (859) 323-5321
For emergencies call 911 and/or proceed to UK Chandler Hospital Emergency Department

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 3: **Personnel Training Documentation**

The OSHA Laboratory Standard requires the following for training laboratory personnel, to be provided by the PI/Laboratory-designated Chemical Hygiene Officer):

- 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 of chemicals in the work area.
- The measures workers can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect workers from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
- The applicable details of the employer's written CHP.

The first trainings listed below are required of all personnel working in wet labs at the University of Kentucky. Add any others required for or by the lab that are provided by internal (i.e. Biosafety Training, Radia. on Safety Training, or hands-on training of specific procedures in the lab) or external (i.e. CITI) sources.

- **Chemical Hygiene/Laboratory Safety Initial and Annual Refresher Training** (online modules hosted by UK Research Safety)
- **Hazardous Waste** (online module hosted by UK EHS)
- **Fire Extinguisher** (online module hosted by UK EHS) **students under the age of 18 not enrolled at the university are exempted from the requirement for completion of this training*
- **Lab Specific Training** (general checklist provided by UK Research Safety, see next page)

Name of Training	Notes (how to access training, specific individuals only, etc.)

Please attach copies of lab-provided training materials and signed statements by employees attesting to completion and understanding of the training.

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Laboratory Specific General Safety Training Record

Name of individual:	**Linkblue ID#:**
Principal Investigator:	**Designated CHO**
Building(s)/Room(s) of active work:	

This checklist may be used by University of Kentucky research laboratories to document laboratory-specific safety training for personnel. Other training on materials and procedures specific to the lab shall be added and documented as needed. Training documentation for laboratory personnel shall be stored in the laboratory's Chemical Hygiene Plan or Laboratory Safety Manual.

Please place a check mark to show that training on the topic has been completed by the above-named individual.

Emergencies	
	Location of emergency contact information for UK Police and response to medical, fire, or other emergencies.
	Worker response to building, facility, and safety equipment alarms (i.e., chemical fume hood, glove box, biological safety cabinet) including the review of established building emergency evacuation routes.
	Location and proper use of emergency equipment such as eyewash stations, fire extinguishers, fire pull stations, safety showers, first aid, and spill kits for the materials in use.
	Procedures for seeking medical attention. Reporting requirements for laboratory incidents, accidents, and near misses, particularly those relating to personal injury.
General Lab Safety	
	Contact information for lab operations (i.e., Principal Investigator, the designated Laboratory Chemical Hygiene Officer, departmental safety liaison, facility manager, custodial services).
	Food and beverages are prohibited in the laboratory. Designated food storage and eating areas are defined for the individual.
	The physical, chemical, biological and radiological hazards of the materials present in the lab and the signs and symptoms of exposure.
	Laboratory and facilities requirements including but not limited to: • Doors to laboratory remained closed to the common corridors • Appropriate lab attire (closed toe shoes, no shorts, long hair restrained) • No gloved hands, lab coats or other PPE in hallways, restrooms, elevators and other public areas • Use of rigid-sided, lidded, and leak-proof secondary transport containers for hazardous materials • Required approvals and training for procedures and/or materials • Room or Equipment User Logs
	Types of personal protective equipment (PPE) to be used for procedures and where they are stored. The minimum PPE required of all University of Kentucky wet labs are disposable gloves, lab coat, and eye protection.
	Proper use of and any hazards presented by laboratory equipment. (i.e., thermal, electrical, mechanical). Examples of hazardous equipment are vacuum pumps, sonicators, Bunsen burners, UV lamps, microtomes, anesthesia equipment, hot plates, etc.
	Daily work practices including but not limited to: • Donning and safe doffing of PPE, particularly disposable gloves • Proper and frequent handwashing • Proper storage and disposal of materials in use
	Proper disposal of distinct types of waste in the laboratory (i.e., chemicals, biohazards, radiological, sharps)
Chemical Safety (for laboratories using hazardous chemicals)	
	Familiarity with the content and location of: • Occupational Safety and Health Administration (OSHA)Laboratory Standard [29 CFR 1910.1450] • UK General Chemical Hygiene Plan • Laboratory Specific Chemical Hygiene Plan, including Standard Operating Procedures (SOP) • Safety Data Sheets (SDS) for laboratory chemicals

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Chemical Safety (cont.)	
	Detection methods, signs or symptoms of exposure or release of hazardous chemicals in the lab (i.e., odors, monitoring equipment, visual appearance) and the proper course of action if detected.
	Location of all PPE needed for procedures
	Proper use of the chemical fume hood, glovebox, blast shielding, or other exposure protection equipment and their monitoring devices/methods.
	Proper chemical segregation and storage based on hazard and compatibility, including chemical labeling requirements
	Chemical spill procedures and required reporting
Biological Safety (for laboratories using biological hazards)	
	Location and proper use of laboratory disinfectants
	Signs and symptoms associated with exposure to the hazards specific to the laboratory, including infectious agents to humans, plants, or animals, recombinant or synthetic nucleic acid materials and routes of potential exposure (needle stick, skin contact, eye splash, etc.)
	Reporting requirements for laboratory incidents and accidents, especially resulting in personal injury and/or exposure to **infectious agents and/or recombinant or synthetic nucleic acid materials**
	Biohazardous waste triage procedures (ex: autoclave vs use of effective disinfectants)
	Autoclave procedures, particularly pertaining to decontamination of biohazard waste
	Standard microbiological procedures and guidance in HHS/CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL)
	Familiarity with the NIH Guidelines for Research Involving Recombinant DNA Molecules and the lab's Institutional Biosafety Committee protocol
	Proper use of Biological Safety Cabinets (BSCs), if applicable
	Biological spill procedures and required reporting
Radiation Safety (for laboratories using radiological materials or equipment with radioactive sources)	
	Location of Radiation Safety Officer name and number
	Onsite, Initial, Basic and Advanced Training, completed in order, for authorization to use radioactive materials
Hazardous Waste (for laboratories generating hazardous waste)	
	Location and types of hazardous waste containers
	Appropriate labeling of hazardous waste
	Proper hazardous waste storage and waste ticketing procedures

I have trained the above-named individual on the topics noted above as they pertain to the scope of work, materials and procedures used in my laboratory.

Principal Investigator or Designated CHO signature:

Principal Investigator/Designated CHO name (printed):

I have been instructed about, have read, and understand the contents and concepts presented to me, as described above, and agree to abide by the principles and instructions that have been provided to me in this training. I understand that if I have any questions about the training, materials, the information presented, or if I experience any problems in performing my tasks with potential hazards, it is my responsibility to seek clarification from the Principal Investigator or designated Laboratory Chemical Hygiene Officer.

Laboratory Personnel signature:

Laboratory Personnel name (printed):

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 4: **Emergency Contacts and Procedures**

Principal Investigator (PI) Name	
PI Office Location	
PI Office Phone	
PI Emergency Phone	
Designated Chemical Hygiene Officer (CHO) Name	
CHO Office Location	
CHO Office Phone	
CHO Emergency Phone	
Building or Facility Manager Name	
Building or Facility Manager Phone	
Departmental Safety Liaison Name (if applicable)	
Departmental Safety Liaison Phone	

The laboratory's emergency evacuation route and meeting point, according to the Building Emergency Action Plan (BEAP):

Chemical Spill Kit location and contents:

EMERGENCIES: 911 For all emergencies call 911 and/or proceed to the UK Chandler Emergency Department

UK Police: (859) 257-8573
PPD Emergencies: (859) 257-2830
UK Worker's Care: (800) 440-6285
University Health Services: (859) 323-2778

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 5: Laboratory Locations and Activities Covered by the CHP

Building	Rooms	Room Assigned to the PI (Y/N)	Shared Facility (Y/N)	Primary Activities of this location *(i.e., microscopy, tissue culture, reagent preparation, chemical glovebox use, experimental procedures/reactions, animal work)*

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 6: Materials or Procedures requiring Prior Approval

Are there specific tasks, procedures or materials that require advance approval of the PI, Lab Chemical Hygiene Officer, or Department before work commences? Please list any required approvals here.

PI/Laboratory-designated CHO: Please check if not applicable to the laboratory.

☐ This laboratory has no requirements for obtaining prior approval for specific materials or procedures.

PLEASE PRINT

Task/Material Requiring Approval	Individual/Role Requesting Approval	Name of official issuing approval and date of approval, if received

Please attach any supplementary instructions or information to this section of the Lab Specific CHP

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 7: **Laboratory Specific Policies**

Lab Specific Policies not covered elsewhere in the CHP
(e.g., No personnel shall work unaccompanied after 6 pm and on weekends, Lab coats must be worn in the lab regardless of work performed, etc.).

☐ **PI/Laboratory-designated CHO: Please check and sign if there are no applicable additional policies for the laboratory.**

☐ Lab coats must be worn at all times regardless of whether work is performed.

☐ To limit the spread of chemical contamination, use of personal electronic devices (e.g., laptops, ipads, cell phones, earbuds) is ☐ prohibited ☐discouraged in the following situations:

☐ To promote awareness of surroundings, including building and lab alarm sounds, use of earbuds or headphones is restricted as follows:

☐ The following areas are designated as "PPE free" areas: (Enter Description of Areas that apply). Prior to working in these areas, remove all PPE and wash hands.:

☐ Working alone requires prior approval from Principal Investigator/Laboratory Director in the following situations:

☐ Unattended experiments must be approved by Principal Investigator/Laboratory Director if they involve:

☐ Heat ☐ Circulating tap water ☐ Possible runaway reaction ☐ Other:

☐ ☐Other (Please describe):

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 8 (a): Laboratory Activities and PPE Hazard Assessment

Personal protective equipment (PPE) is usually required to perform procedures safely. The minimum PPE for procedures in wet labs at the University of Kentucky includes a lab coat, and eye protection suitable for the procedures performed. Various types of PPE in laboratory research might include:

- Protective clothing (e.g., lab coats, smocks, aprons)
- Eye and face protection (e.g., safety glasses, chemical goggles, UV or laser resistant eyewear, face shields,
- Hand protection – gloves (e.g., insulated, cut resistant, disposable or reusable)
- Respiratory protection – respirators (e.g., N95, PAPR, half/full/filtering facepiece)
- Head protection (e.g., bonnets, hard hats)
- Hearing protection (e.g., reusable muffs, reusable or disposable ear plugs)
- Protective footwear (e.g., steel-toed boots, shoe covers)

PPE should not be used as a substitute for engineering controls such as chemical fume hoods, gloveboxes, biosafety cabinets, process enclosures, *etc*., or as a substitute for good work practices and attention to washing hands after PPE is removed. The use of engineering controls such as chemical fume hoods reduces the potential for exposure yet does not eliminate the need for wearing the proper PPE.

When PPE is needed, regulations require that a hazard assessment be performed to identify the specific hazards of concern and the PPE required for protection from those hazards. This hazard assessment may be done for a work area, or for a specific experiment, job, or task. PPE is selected based on this hazard assessment. The Laboratory Standard requires the hazard assessment be documented in writing.

This form can be used to satisfy the hazard assessment and documentation requirements. Once completed, the form must be maintained in the Chemical Hygiene Plan. It also can be to train employees regarding the hazards associated with their work and the PPE required for their tasks. Employees must also receive training on the correct use, maintenance, and limitations of engineering controls and PPE. The PI/Lab CHO is responsible for providing or arranging for this training.

Respiratory protection may be needed for chemical handling when there are not sufficient engineering controls in place. If you believe respiratory protection is warranted, you must also contact UK Occupational Health and Safety or complete the form at: https://ohs.uky.edu/form/respiratory-hazard-assessment-fo?check_logged_in=1

The PPE listed as required in this document is based on the UK institutional Chemical Hygiene Plan and represents the minimum PPE that must be worn in each circumstance. Contact the UK Research Safety at labsafety@uky.edu if there are cases in the laboratory when less PPE may be appropriate based the presence of additional controls or other extenuating circumstances.

For more information on PPE, visit: researchsafety.uky.edu/chemical-safety

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

PPE Requirements per Location

Determine the minimum PPE requirements for entry into or working in labs or other spaces with hazards based on the hazard level of the chemicals within and the procedures performed. PPE for entry requirements and hazard communication in the form of the GHS pictographs shall be indicated on door signage.

A combination of clothing and shoes that fully cover the legs and feet is required when working in spaces that have hazardous chemicals, which includes almost all lab spaces. Similarly, there are requirements to have the legs covered in spaces with other hazards that could pose a risk to individuals, such as physical hazards or biological and radioactive materials that pose an exposure risk.

UK's minimum PPE requirements in wet labs are lab coat, eye protection and gloves for the procedures performed. Please outline any **minimum** lab PPE requirements for each space of the lab, if additional PPE to the UK miminum for wet labs is required for sufficient personnel protection. Include the shoe and clothing requirements, if applicable.

Location	Minimum PPE

Task and Materials Based Hazard Assessment and PPE Requirements

Mark all hazards and operations performed in the Lab. Review the applicable PPE for all checked items.
Be sure to indicate when stricter PPE usage is to be implemented in the space. This chart is not a substitute for lab specific SOPs.

Activity performed in lab?	Materials Involved	Applicable PPE	Engineering Controls and Potential Hazards
☐	Liquid chemicals	***Lab Coat*****:** required ***Eyewear*****:** Safety glasses or goggles required; face shield required if high splash risk ***Gloves*****:** Compatible gloves required ***Other:*** In case of anticipated possible splashes on whole body, chemical resistant coverall or apron	Other controls: Engineering controls based on properties of chemicals and procedures. Potential Hazards: • Skin burn • Eye damage • Skin irritation • Eye irritation • Skin sensitization (systemic reaction) • Spill on floor

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Activity performed in lab?	Materials Involved	Applicable PPE	Engineering Controls and Potential Hazards
☐	Dry chemicals	***Lab Coat*:** Required *Eyewear*: Safety glasses required; dust proof safety goggles for higher hazard chemicals ***Gloves*:** Compatible gloves required; protective sleeves recommended ***Respiratory Protection*:** Respirator required if engineering controls are insufficient.	Other controls: Engineering controls based on properties of chemicals and procedures. Potential Hazards: • Inhalation of airborne particles • Contact with Eyes • Dermatitis • Skin burning • Contaminated floor and surfaces
☐	Highly exothermic reactions	***Lab Coat*:** Flame-resistant lab coat ***Eyewear*:** Goggles and face shield required ***Gloves*:** Compatible gloves required; additional fire resistant gloves may be necessary depending on the task ***Other*:** Non-synthetic street clothing required	Other controls: Engineering controls based on procedures. Potential Hazards: • Fire • Explosion • Skin/eye contact with chemicals • Skin/Eye contact with hot liquids • Inhalation of vapors/gases • Spill on floor and surfaces
☐	Corrosive liquids	***Lab Coat*:** Lab coat required; chemical-resistant (FR/CP) lab coat recommended ***Eyewear*:** Safety glasses or goggles required ***Gloves*:** Compatible gloves required ***Other*:** In case of anticipated possible splashes on whole body, chemical resistant coverall or apron	Other controls: Engineering controls based on properties of chemicals and procedures. Potential Hazards: • Eye/Skin/Respiratory burn • Eye damage • Inhalation of corrosive vapors/gases • Spill on floor
☐	Flammable liquids	***Lab Coat*:** Lab coat required; flame resistant (FR) lab coat recommended based on fire hazard ***Eyewear*:** Safety glasses or goggles required *Gloves*: Compatible gloves required ***Other*:** In case of anticipated possible splashes on whole body, chemical resistant coverall or apron	Other controls: Engineering controls based on properties of chemicals and procedures. Potential Hazards: • Fire • Explosion • Skin/Eye absorption • Inhalation of vapors/gases • Spill and evaporation in lab

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Activity performed in lab?	Materials Involved	Applicable PPE	Engineering Controls and Potential Hazards
☐	Pyrophoric or water reactive compounds outside of glove box	***Lab Coat*:** Flame-resistant lab coat required ***Eyewear*:** Goggles required; face shield recommended ***Gloves*:** Compatible gloves required; Flame-resistant gloves recommended ***Other*:** Non-synthetic street clothing required	Other controls: Engineering controls based on properties of chemicals and procedures. Potential Hazards: • Fire • Explosion • Skin/Eye burn/damage • Inhalation of vapors/gases
☐	Explosive Compounds	***Lab Coat*:** Flame resistant lab coat ***Eyewear*:** Goggles + face shield required ***Gloves*:** Heavyweight gloves, such as anti-static PVC gauntlets, required	Engineering Controls • Use blast shield Other Controls: Based on procedures Potential Hazards: • Fire • Explosion • Skin/Eye burn/damage • Inhalation of vapors/gases
☐	Particularly hazardous substances (PHSs) - select carcinogens, reproductive toxins, and substances with a high degree of acute toxicity	***Lab Coat*:** Lab coat required ***Eyewear*:** Safety glasses or goggles required ***Gloves*:** Compatible gloves required ***Other*:** Disposable sleeve guards may be recommended	Other controls: Engineering controls based on procedures. Potential Hazards: • Inhalation of gases and vapors • Eye/Skin absorption • Eye/Skin irritation • Skin/respiratory sensitization
☐	Toxic chemicals	***Lab Coat*:** Lab coat required ***Eyewear*:** Safety glasses or goggles required ***Gloves*:** Compatible Gloves required	Other controls: Engineering controls based on procedures. Potential Hazards: • Inhalation of gases and vapors • Eye/Skin absorption • Eye/Skin irritation • Skin/respiratory sensitization

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Activity performed in lab?	Materials Involved	Applicable PPE	Engineering Controls and Potential Hazards
☐	Engineered nanomaterials in solution	***Lab Coat*:** Disposable Tyvek-type coveralls or Lab coat based on materials ***Eyewear*:** Safety glasses or goggles required ***Gloves*:** Compatible gloves required; double gloves recommended; Choose the proper gloves based on the solvent used	Other controls: Engineering controls based on procedures. Potential Hazards: • Eye/Skin absorption • Eye/Skin irritation • Skin/respiratory sensitization • Eating/drinking of contaminated food/drinks • Spill and surface contamination
☐	Engineered nanomaterials as dust/particles	***Lab Coat*:** Disposable Tyvek-type coveralls or Lab coat, dependent on materials ***Eyewear*:** Safety glasses or goggles required ***Gloves*:** Compatible gloves required; double gloves recommended ***Respiratory Protection:*** Required if engineering controls are insufficient	Other controls: Engineering controls based on procedures. Potential Hazards: • Inhalation of airborne particles • Eye/Skin absorption • Eye/Skin irritation • Skin/respiratory sensitization • Eating/drinking of contaminated food/drinks • Spill and surface contamination
☐	Chemically preserved animal and/or human specimens	***Lab Coat*:** Gown or lab coat required ***Eyewear*:** Safety glasses or goggles required ***Gloves*:** Compatible gloves required	Other controls: • Chemical fume hood • Necropsy downdraft table • Perfusion station • Local Exhaust Potential Hazards: • Inhalation of gases and vapors • Eye/Skin absorption • Eye/Skin irritation • Eating/drinking of contaminated food/drinks • Exposure to formaldehyde
☐	Cryogenic liquids or dry ice (including working with cryogenic dewars)	***Lab Coat*:** Lab coat required ***Eyewear*:** Safety glasses or goggles required; face shield required when handling cryogenic liquids or cryogenically frozen tubes ***Gloves*:** Insulated cryogenic gloves required	Potential Hazards: • Skin burn • Eye burn • Asphyxiation • Frostbite of limbs

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Activity performed in lab?	Materials Involved	Applicable PPE	Engineering Controls and Potential Hazards
☐	Compressed gases	***Lab Coat*:** Lab coat required ***Eyewear*:** Safety glasses or goggles required ***Gloves*:** Gloves required dependent on task (e.g., work gloves when handling cylinders, chemical-resistant gloves when making/breaking connections with non-inert gases) ***Respiratory Protection*:** May be needed when handling toxic gases	Other Controls: • Gas cabinets and/or monitors may be required depending on type of gas. Potential Hazards: • Inhalation of gases and vapors • Eye/Skin absorption • Asphyxiation • Explosion
☐	Hydrofluoric acid	***Lab Coat*:** Lab coat required; chemical-resistant (FR/CP) lab coat recommended (refer to lab SOP) ***Eyewear*:** Safety goggles and face shield required (refer to lab SOP) ***Gloves*:** Neoprene gloves or double-nitrile gloves required (refer to lab SOP) ***Other*:** Acid resistant apron required (refer to lab SOP)	Other Controls • Engineering controls based on procedures • Calcium Gluconate gel Potential Hazards: • Inhalation of HF vapors • Eye/Skin absorption • Systemic poisoning • Eating/drinking of contaminated food/drinks • Eye/Skin burn
☐	Aqua regia	***Lab Coat*:** Lab coat required; chemical-resistant (FR/CP) lab coat recommended (refer to lab SOP) ***Eyewear*:** Safety goggles required; Face shield recommended (refer to lab SOP) ***Gloves*:** Neoprene gloves required (refer to lab SOP) ***Other*:** Neoprene gauntlets and apron may be required (refer to lab SOP)	Other Controls • Engineering controls based on procedures Potential Hazards: • Inhalation of acid vapors and toxic gases • Eye/Skin absorption • Eating/drinking of contaminated food/drinks • Eye/Skin/Respiratory burn • Explosion
☐	Piranha solution	***Lab Coat*:** Lab coat required; chemical-resistant (FR/CP) lab coat recommended (refer to lab SOP) ***Eyewear*:** Safety goggles required; Face shield recommended (refer to lab SOP) ***Gloves*:** Neoprene gloves required (refer to lab SOP) ***Other*:** Neoprene gauntlets and apron may be required (refer to lab SOP)	Other Controls • Engineering controls based on procedures Potential Hazards: • Inhalation of acid vapors and toxic gases • Eye/Skin absorption • Eating/drinking of contaminated food/drinks • Eye/Skin/Respiratory burn • Explosion

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Activity performed in lab?	Materials Involved	Applicable PPE	Engineering Controls and Potential Hazards
☐	Bromine	***Lab Coat***: Lab coat required; chemical-resistant (FR/CP) lab coat recommended (refer to lab SOP) ***Eyewear***: Safety goggles required; Face shield recommended ***Gloves***: Fluorinated rubber gloves required for liquid bromine; nitrile or neoprene gloves required for aqueous solutions of bromine	Other Controls • Engineering controls based on procedures Potential Hazards: • Inhalation of gas and vapor • Eye/Skin absorption • Skin/ Eye burn and damage • Respiratory irritation
☐	Phenol	***Lab Coat***: Lab coat required; chemical-resistant (FR/CP) lab coat recommended ***Eyewear***: Safety glasses or goggles required ***Gloves***: Double Nitrile gloves, Neoprene ***Other***: Neoprene gauntlets and apron may be required	Other Controls • Engineering controls based on procedures Potential Hazards: • Eye/Skin absorption • Respiratory irritation • Eating/drinking of contaminated food/drinks • Respiratory and skin sensitizer • Skin/ Eye burn • Germ cell mutagen
☐	Animal Surgery	***Lab Coat***: Lab coat required ***Eyewear***: Safety glasses or goggles recommended; ***Gloves***: Nitrile or latex gloves required; puncture-resistant gloves may be recommended Additional, depending on materials administered.	Other controls: • Local Exhaust • Use of tightly sealed and uncracked induction chambers • Use of dated and weighed scavenger cannisters • Use of somniflow • Use of certified anesthesia vaporizer Potential Hazard: • Exposure to anesthetics
☐	Perfusion using paraformaldehyde	***Lab Coat***: Lab coat required ***Eyewear***: Safety glasses or goggles required ***Gloves***: Nitrile gloves required ***Respiratory Protection***: Dependent on location of work, if engineering controls are unavailable.	Other controls: • Chemical fume hood • Necropsy downdraft table • Perfusion station • Local Exhaust Potential Hazard: • Skin sensitizer, skin burns • Irritation to the eyes, nose, throat, and respiratory system; • Lacrimation • Cough; wheezing

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Additional Activities

Please any additional activities not previously listed and describe the hazards and PPE. The purpose of this chart is to describe discrete tasks with limited chemical use. Lengthy chemical procedures and processes are to be documented in the CHP as lab SOP an example has been provided. Attach additional pages as needed.

Task or Activity	Applicable PPE	Engineering Controls and Potential Hazards
Handling hot items (e.g., autoclaved materials, furnaces, heated glassware, water or oil bath)	***Lab Coat*:** Lab coat required *Eyewear*: Safety glasses or goggles required ***Gloves*:** Thermally insulated gloves required; wear chemical-resistant gloves underneath, as needed	Mild to severe skin burns
Removing freezer vials from liquid nitrogen	***Lab Coat*:** Lab coat required *Eyewear*: Safety glasses and face shield required ***Gloves*:** Insulated cryogenic gloves required; wear nitrile or latex gloves underneath if handling biological vials ***Other***: Closed-toed, impermeable shoes required	Skin burn, frostbite
Centrifuge	***Eyewear*:** Safety glasses or goggles required ***Other*:** If centrifuging hazardous materials, wear additional PPE to match the hazard	Explosion, burst tubes, contaminated centrifuge. Exposure to materials through splash, abrasions.

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Lab Specific CHP Section 8 (b): **Chemical Hazards Present in the Lab**

Please check all that apply. Enter requested information where indicated.

CHEMICAL HAZARDS	If checked, enter requested information where indicated.
☐ Acrylamide (unpolymerized)	☐ Used to make gels ☐ For use in other chemical reactions
☐ Aqua Regia	
☐ Biologically-derived toxins (e.g., diptheria toxin, cholera toxin)	List:
☐ β-Mercaptoethanol	
☐ Chloroform	☐ Not stabilized ☐ Stabilized with:
☐ Compressed Gas Cylinders	List:
☐ Corrosives	List:
☐ Cryogens (e.g., liquid nitrogen and dry ice)	List:
☐ Cyanide Salts (e.g., potassium cyanide and sodium cyanide)	List:
☐ Dichloromethane/ Methylene Chloride	
☐ Diethyl ether	
☐ Ethidium Bromide	
☐ Explosives (including Picric Acid)*	List:
☐ Flammable Liquids	List:
☐ Formalin, formaldehyde solutions, and paraformaldehyde	
☐ Hydrofluoric Acid	
☐ HF Releasers (e.g., sodium fluoride, PMSF, potassium fluoride)	List:
☐ Nanomaterials (e.g., carbon nanotubes, dendrimers, lipid-based)	List:
☐ My lab synthesizes nanomaterials	

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

☐ Nitric Acid

☐ Oxidizers List:

☐ Osmium Tetroxide

☐ Perchloric Acid

☐ High Hazard Use (procedures include concentrations greater than 70% or heating)

☐ Phenol

☐ Phosgene

☐ Piranha solution

☐ Pressure and Vacuum* List equipment/materials:

☐ Reactive Chemicals: pyrophoric, water sensitive, water reactive, and other highly reactive materials (e.g., trichlorosilane, nickel carbonyl, aluminum hydride, potassium metal) List:

☐ Sodium Azide*

- No SOP needed for sodium azide present at <1% in a pre-made kit
- Generic SOP when used as preservative
- Lab-specific SOP required when used in chemical reactions

☐ Sulfuric Acid

☐ Tetrahydrofuran

☐ **PHS**: Acutely toxic, toxic to reproduction, or carcinogenic **liquids** (e.g. dimethylformamide, toluene) List:

☐ PHS List is available as a separate document elsewhere.

☐ **PHS**: Acutely toxic, toxic to reproduction, or carcinogenic **solids/powders, suspensions or solutions** (e.g. imidazole, trypan blue, tamoxifen, doxorubicin) List:

☐ PHS List is available as a separate document elsewhere.

☐ **PHS**: Acutely toxic, toxic to reproduction, or carcinogenic **gases** (e.g. chlorine, carbon monoxide) List:

☐ PHS List is available as a separate document elsewhere.

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Lab Specific CHP Section 8 (c): High Risk Procedures in the Lab

High-risk chemical procedures are lab procedures that pose significant risk of serious injury or major property damage if a malfunction were to occur (such as a utility outage, runaway reaction, container failure, or chemical spill/release) and/or which require any of the following:

- Engineering controls **more specialized** than good room ventilation, chemical fume hoods, biological safety cabinets and/or local exhaust such as snorkel or canopy hoods.*
- Personal protective equipment **in addition to** gloves, lab coats, eye/face protection and/or chemical or thermal protective aprons or sleeves.
- **Chemical-specific first aid** treatments or antidotes.

*More specialized engineering controls include (but are not limited to): inert-atmosphere glove boxes used for employee safety, ventilated gas cabinets, oxygen monitors, and/or toxic gas monitors.

A lab-specific SOP, approved by the PI and kept with this plan, is required for all high-risk procedures!

Please check all that apply:

☐ Use of liquid nitrogen or other cryogens in large quantities or in a manner that could displace oxygen. Specify cryogen(s), amount(s), task (if applicable), location {Building and Room number) and approximate room dimensions:

- "Large quantities" include any cryogen piped in from a tank located outside the building.
- For Liquid Nitrogen, "large quantities" would be more than one freezer and one attached liquid cylinder per room. Filling a cryocart or cooler is a task that could displace oxygen.
- Re-evaluation is required if the above-mentioned quantities or tasks move to a different room, or if there is a significant change in procedures or ventilation.

☐ Heating of concentrated perchloric acid (70% or higher). Indicate location, concentration, amount, and frequency of use:

☐ Use of chemicals that are GHS Acutely Toxic Category 1 by inhalation or skin contact in the concentration purchased. List acutely toxic chemicals in the lab:

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☐ Creation or synthesis of nanomaterials where the nano-sized compound is particularly hazardous or high risk. List materials created, including size of particles, and indicate if materials are created as a powder or in suspension:

☐ Use of chemicals for which an antidote or specific first-aid treatment is required (e.g., HF, phenol). List chemical, quantities and concentration in use.

☐ Use of reactive, pyrophoric & explosive chemicals. List chemicals and quantities use.

☐ Chemical procedures involving pressure, vacuum, or heat when failure of the container could result in significant physical hazards, exposure to toxic materials, or fire. List procedures:

☐ Other chemical high risk procedures meeting the definition at the top of this section. List specific procedures/equipment and hazards:

☐ **Our lab does not perform any chemical high-risk procedures based on the definition and examples listed above.**

Signature of PI/Lab Chemical Hygiene Officer_____

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Lab Specific CHP Section 9: Safe Operations of Engineering Controls

Please check all that apply.

☐ **Chemical fume hood (CFH)**

1. **Ensure the CFH has been certified within the last year.** The last certification date is found on a brightly colored sticker on the side of the CFH and is placed by UK OHS at the time of certification. If a CFH has not been certified within the year or has any other signage indicating it is out of order, it shall not be used.
2. **Verify that hood is under negative pressure** by doing the following:
   - ☐ Check digital monitor for flow rate between 80 and 120 fpm. When sash is at maximum safe height indicated on hood (indicated on the certification sticker), flow rate should be close to that shown on most recent certification sticker.
   - ☐ Check magnehelic gauge to verify that pressure needle lines up closely with set point.
   - ☐ Other:

a. **Position sash correctly for work:**

☐ **CFH Vertical Sash:** Hood sash moves vertically – keep sash in lowest practical position while working (no higher than 18" opening). Sash must come down to shoulder height or lower.

☐ **CFH Combination Sash**

- For maximum flexibility, route tubes and cords under airfoil or through access at side of hood. If this is not possible, route these connections under the sash. Avoid running tubes or cords between horizontal sash panels.
- Keep horizontal panels closed and move sash vertically during work. Keep sash in lowest practical position while working. Sash must come down to shoulder height or lower. Alternatively, close sash vertically. Place one sash panel between body and the work in the hood. Work with arms reaching around this sash panel.

☐ **Biological safety cabinet (BSC):** The lab uses a biological safety cabinet for handling of powdered chemicals or water-based solutions/suspensions.

1. Look for certification date within the last year on sticker on or around the sash. If the BSC has not been certified within the last year, it shall not be used for work. Contact the UK contracted vendor listed on the certification sticker to arrange its certification. NOTE: BSCs shall not be used for volatile chemicals.
2. With BSC turned on, verify flow rate by referencing the set point listed on the certification sticker or marked on the magnahelic guage.
3. Work with slow, gentle motions to prevent disruption of laminar flow.
4. Decontaminate BSC after use with suitable disinfectants (refer to approved IBC protocol)

☐ **Local snorkel exhaust:** The lab has "snorkel" exhaust to remove hazardous vapors from the benchtop. The snorkel must be placed as close as possible to the point of contaminant generation (typically within 4 – 6 inches). Contact UK OHS if you exhibit signs of exposure to hazardous or volatile chemicals or otherwise believe the lab snorkel is not capturing contaminants or odors sufficiently.

☐ **Other:**

For "Other" (e.g., inert gas environment glovebox) Please attach instructions to ensure safe operations by lab personnel.

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Lab Specific CHP Section 10: **Standard Operating Procedures**

The OSHA Lab Standard requires documented standard operating procedures for laboratory work involving hazardous chemicals. Please review the UK institutional CHP for more detailed information on SOP requirements.

No single format for a lab SOP is required, but to be considered valid, **SOP must include:**

1) Lab-specific information
2) Hazard identification
3) Hazard controls (administrative, engineering and PPE)
4) Stepwise description of how the procedure is performed safely
5) Instructions for exposure, emergencies, and spill procedures
6) Instructions for proper disposal of chemical or experimental waste
7) Documented personnel training on and understanding of the SOP

A SOP fillable template for use by research labs is available on the Research Safety website and also attached to this section of the Lab Specific CHP Template.

To assist in the laboratory's documentation of SOPs, please reference the following page. This chart provides guidance for when a Lab Specific SOP is absolutely required, versus using more general guidelines and generic SOPs (available on the Research Safety website or elsewhere) to cover multiple processes and chemicals.

Please consult the manufacturers' SDS or NIH PubChem for GHS categorization of the chemicals in use in laboratory procedures. The level of hazard of both the chemical as well as the procedures determine how SOPs are documented.

If further assistance is required, please email labsafety@uky.edu

Please attach all general SOPs or guidelines AND Laboratory-Specific SOPs to this section of the Lab- Specific CHP

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General Chemical Description:	Particularly Hazardous Substances and High Risk Chemicals	Hazardous Chemicals
SOP Requirement for Lab:	**Lab-Specific SOP** **Required** for the procedures in the lab. Maintain copy in CHP	May use general hazard class guidelines or SOP. Maintain copy in CHP unless procedures call for greater than the minimum PPE for wet labs and/or if engineering controls (e.g., CFH) are not available.
GHS Hazard Class (refer to SDS or PubChem)	**GHS Hazard Category**	
Acutely toxic – *dermal or inhalation*	1 or 2	3 or 4
Acutely toxic – *oral*	1 or 2	3 or 4
Carcinogen	1, 1A or 1B, 2	
Reproductive Hazard (Fetal or Fertility)	1, 1A or 1B, 2	
Mutagen	1A, 1B, 2	
Specific Target Organ toxicity	Single Exposure: 1 and 2	Repeated Exposure: 1, 2
Sensitizer (skin or respiratory)	Dermal 1A, Respiratory 1, 1B	
Respiratory irritant		3
Skin Corrosion/irritation		1A, 1B, 1C
Eye Damage/Irritation		1
Substances which, in contact with water, emit flammable gases	1, 2	3
Pyrophoric gas, liquid, or solid	1	
Explosives	Unstable or Div 1.1 – 1.3	Div 1.4 – 1.6
Self-reactive or Organic peroxides	Type A and B	Type C, D, E, F, or G
Self-heating	1	2
Flammable		Liquid, Solid, Gas, aerosol: 1,2,3
Oxidizing	Liquid & solid 1	Liquid & solid 2, 3, gas: 1, 2, 3
Gases under pressure	Acutely toxic gases; Pyrophoric gases: Refrigerated liquified gases (cryogens) in large quantities.	Simple Asphyxiants
Corrosive to Metals	1	
OTHER HAZARDS & DESIGNATIONS		
*Non-GHS Carcinogen Designations	NTP Known or reasonably anticipated; IARC Group 1, 2A, or 2B; OSHA listed carcinogens	
Nanoparticles	Synthesis of nanoparticles with chemical components	Use of preformulated nanoparticles for use in vitro or in vivo applications
Investigational Drugs	If properties of the drug are unknown, it is considered a high hazard risk. Consecutive procedures with the drug, after synthesis, require an SOP Investigational Drugs received from or shipped to other investigators must be shipped with an OSHA 29 CFR 1910.1200 compliant SDS. Ref: https://www.osha.gov/laws-regs/standardinterpretations/1991-09-09-0	ONLY investigational drugs synthesized and worked with solely in the PI's lab. SOP for component chemicals maintained in CHP.
EU/Other	Contact with water yields toxic gas; Contact with acids yields (very) toxic gas	Toxic by Eye Contact
EU/Other	Reacts violently with water; Corrosive to Respiratory Tract	May form explosive peroxides
EU/Other	Explosive when dry; Explosive with or without air contact; Strong Hydrogen Fluoride Releaser	Lachrymator

Standard Operating Procedure:

Laboratory Information

Department:	
Principal Investigator(s):	
Laboratory-designated Chemical Hygiene Officer):	
Laboratory **emergency contact** (name and phone):	
Laboratory phone:	
Designated area (s) of these procedures with chemicals(s): (building and room):	
Agent storage location (building and room) and specifics regarding location/container/cabinets:	

Chemical Information

Chemical Name(s), including CAS No:	
GHS Classification and Hazard Statements (see SDS sheet provided by the chemical's manufacturer): **Example:** *Ethanol: H225: Highly Flammable liquid and vapor [Danger Flammable liquids]; H319: Causes serious eye irritation [Warning Serious eye damage/eye irritation]*	

Signs and symptoms of exposure or release	
Routes of exposure	
Required engineering controls: (i.e., chemical fume hood, biological safety cabinet, glove box, temperature control, humidity control, shielding, luer-lock syringe, in-line HEPA filter,etc.)	
Personal Protective Equipment (PPE) required for procedures:	
Known incompatibilities with chemical(s):	
Special storage and handling considerations:	
Please list the approximate amount(s) of chemical(s) utilized in all procedures	

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Please describe, in a stepwise fashion, the work practices and procedures involved in the handling and utilization of this agent. **Please be clear and complete in the description of procedures (i.e., measuring, weighing, pouring, mixing, injection, mixing, transporting, administration to animals, heating, etc.).** **Be sure to include any precautionary safety steps undertaken during these procedures.** **Please submit additional pages, if necessary.**	

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Waste collection and disposal procedures:	Waste chemicals shall be collected in a secured area. The area shall be free from evidence of spills. A Hazardous Waste label shall be affixed to the collection container and components shall be listed on the label as they are introduced into the container. **Do not date containers until the day of scheduled pickup**. Additionally, the container shall be marked with the hazard class of the chemical waste (i.e., Ignitable, Toxic, Reactive, Corrosive). When the container is no more than 2/3 full, date the container and submit a pick-up request in the waste ticketing system.
Spill procedure: Lab Specific Notes on Spill Response:	**Major spills of stock solution**: Leave the area and notify others not to enter. Report the spill to the UK Environmental Quality Management Department (EQMD)at (859) 323-6280 (M-F 8am-5pm) or after hours by dialing 911 from any on-campus phone or by contacting the UK Police at (859) 257-UKPD (8573). **Minor spills of manageable amount:** If necessary, contact EQMD for guidance. Consult manufacturer's SDS for instructions and compatibilities for your chemical (Be aware of any materials such as paper towels or water that could be incompatible with your spilled chemical!
Response procedures in the case of an incident or injury:	UK Employees: • After receiving first aid (refer to the chemical's SDS), report the occupational exposure to a hazardous chemical to UK Worker's Care at 1-800-440-6285. • If needed, an appointment will be made for the employee at UK UHS. • For severe emergency or injury, call 911 or proceed to the UK Chandler Hospital Emergency Department UK Students: • Call UHS at (859) 323-APPT to report an occupational exposure to a chemical hazard. • If needed, an appointment will be made for the employee at UK UHS. **For severe emergency or injury, call 911 or proceed to the UK Chandler Hospital Emergency Department** Additional Lab-Specific Emergency Procedures:

A copy of the manufacturer's SDS for this agent and the PI approved SOP shall be kept in the lab's Chemical Hygiene Plan (CHP). The CHP shall be stored in a location known to all laboratory personnel and is accessible during work hours.

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Personnel Training

- Prior to conducting any work with (name of the chemical), designated personnel must be provided training specific to the hazard involved in working with the substance.
- The PI must provide lab personnel with a copy of the SOP and a copy of the SDS provided by the manufacturer. Any further training materials must be documented and stored in the lab's Laboratory Safety Manual and available to internal UK or external oversight agency inspectors.
- The PI must ensure that his/her lab personnel have completed the initial and the consecutive annually required Chemical Hygiene trainings and Hazardous Waste training.

The undersigned have read and understood the content of this SOP and the SDS for:

Lab personnel performing procedures with this agent (typed name)	Date of hands-on training for this agent	Name of person who provided the agent specific training (typed name):	Signature of Lab Personnel

SOP Reviewed and Approved by:

PI: (typed name)	
PI: (signature and date)	
Lab Designated CHO (typed name)	
Lab Designated CHO (signature and date)	

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 11: Exposure Monitoring and Medical Surveillance

Where 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, medical surveillance must be established for the affected worker(s) as prescribed by the particular standard.

In some instances, may be necessary to perform personnel exposure monitoring when administrative controls, engineering controls, and PPE may not be sufficient for full protection from exposure to a hazardous chemical. This can occur when chemical exposure levels approach or exceed OSHA's Permissible Exposure Limit (PEL) and/or ACGIH's Threshold Limit Value (TLV). This is usually indicated when engineering controls, such as a chemical fume hood, cannot be used for procedures.

Please describe any specific procedures, tasks, or materials that have the potential for exposure of lab personnel to hazardous chemicals in amounts exceeding the established PEL/TLV.

PI/Laboratory-designated CHO: Please check if not applicable to the laboratory.

☐ Permissible exposure limits for hazardous chemicals in use are not exceeded in this lab.

☐ This laboratory has no requirements for exposure monitoring or medical surveillance.

Please attach any supplementary documentation, instructions, or information relevant to the specific lab's exposure monitoring or medical surveillance to this section of the Lab Specific CHP

APPENDIX I: Lab Specific Chemical Hygiene Plan Template

Lab Specific CHP Section 12: Chemical Inventory and Safety Data Sheets

Federal regulations require that Safety Data Sheets (SDS) be maintained and readily accessible for all hazardous chemicals. University of Kentucky Research Safety, the UK CHP, the UK Chemical Safety Committee, and best practices stipulate that laboratory inventories of hazardous chemicals be updated on no less than an annual basis.

Hazardous chemicals are those with the following GHS characterizations:

- Carcinogenic or otherwise harmful to human health
- Irritant, dermal sensitization
- Corrosive
- Flammable
- Oxidizing
- Reactive/Explosive
- Toxic
- Harmful to the environment
- Liquids and gases under pressure, including liquid nitrogen tanks and compressed air cylinders

Regardless of the method the laboratory uses to inventory their hazardous chemicals, all research labs at the university are asked to update their chemical inventories in the online chemical inventory system every year in conjunction with the Lab Safety Inspection. This furthers compliance by keeping accurate totals of hazardous material storage within acceptable regulatory limits, informs our first responders in the event of an emergency, and facilitates prompt chemical waste pickup.

Please provide a description of where the SDSs are stored and how inventory records are maintained.

Format of the SDS: ☐ Electronic ☐ Hard Copy ☐ Other (explain below)

Location of the SDS:

Method of Maintaining Inventory: ☐ SciShield ☐ Lab Archives ☐ Quartzy ☐ Other (explain below)

Location of Inventory Records:

014219S01 Reference Standards: Laboratory Design Guidelines

Overview: Remodeling and new construction projects offer an outstanding opportunity to improve facilities for current-day research and teaching. One aspect of these improvements is related to safety and health features of the laboratories. This Guideline is provided to help architects/engineers, departmental users and others understand the requirements for new and remodeled University laboratories.

Fire Safety & Building Codes

1. All remodeling and new construction must be reviewed and approved by the University Fire Marshal. Laboratories must be designed for the "moderate hazard" classification according to the Kentucky Building Code and applicable referenced NFPA fire codes (NFPA 45 for campus chemical laboratories and NFPA 99 for hospital chemical laboratories). For laboratories in excess of "moderate
2. Doors
   - Doors opening onto exit corridors must swing with exit egress and must be
   - self-closing and self-latching;
   - Doors within interior partitions shall be self-latching.
3. All door hardware shall meet the requirements for the physically impaired.
4. View panel
   - All doors opening onto the exit corridor and within interior partitions must be provided with view panels;
   - All view panels shall be 3"x33" and shall be 1/4' wire glass in steel frames.
   - All view panels shall be placed directly above the self-latching hardware.
5. Interior partitions more than 6' in height shall be extended to the underside of the structure above.
6. As a minimum, a 5# ABC (all-purpose) fire extinguisher shall be provided adjacent to each door giving access to an exit corridor. Additional units may be required for a particular/specialized hazard(s).
7. Interior and/or windowless laboratories shall be provided with emergency lighting.
8. Aisles/passageways within labs shall be a minimum of 36" of clear and unobstructed width.

Engineering Controls

9. **Fume hoods must comply with UK Design Guidelines for Fume Hoods.**
10. A master gas shut off valve must be provided for each laboratory or group of labs. The valve should be located outside the laboratory adjacent to the means of egress door of the laboratory and clearly labeled as to its purpose.
11. Safety showers and eyewashes must comply with UK Design Guidelines, and must be installed in every laboratory that has a fume hood.
12. Incorporation of proper ergonomic principles must be provided.
13. Shelves and cabinets must be built of non-porous material; secured to the wall; and shelves must have a front lip.
14. Placement of "supply air" and "exhaust air" vents must be located to avoid short-circuited air movement patterns. Further, in laboratories requiring tremendous volumes of supply air such as laboratories with multiple fume hoods, low velocity air diffusers will be required to avoid turbulence and noise.
15. Canopy hoods are generally not acceptable for contaminant exhaust.
16. Laboratories must be designed to pull air into laboratory from the corridor (negative pressure in relation to rest of the building).
17. Electrical outlets located within six feet of sinks, safety showers, or other sources of water shall be Ground Fault Circuit Interrupter (GFCI) outlets/circuits.

General Considerations

18. Laboratories must include the following signage features:
    - Room Number
    - Sign plate should be large enough to include department name, user name(s), emergency contacts etc.
    - Appropriate precautionary signs (e.g. radiation and biohazard)

19. Acid corrosive storage should not be located under fume hoods because acids cause significant corrosion to the fume hoods over time. Separate storage must be provided for acids and solvents.
20. Underwriter's laboratory or Factory Mutual approved solvent storage cabinets are required under fume hoods. These cabinets shall be vented.
21. Carpet is not acceptable for chemical, radioactive, biohazard, or animal use laboratories or laboratory support spaces.
22. Designated break areas outside the chemical use laboratory area are required. At a minimum, a work desk/ break area should be separated from the laboratory work area by a non-combustible transparent barrier to isolate the workers from exposure to hazards.
23. High use radioactive materials labs may require special engineering and facility features (e.g. HEPA filters, seamless flooring, stainless steel bench tops). Such laboratories must be approved by the UK Radiation Safety Officer.

Special Use Laboratories

24. Biological Level 3 laboratories require extensive engineering and architectural features and will be reviewed and approved by the UK Biological Safety Officer and the Institutional Biosafety Committee.

Approved by UK Design Guidelines & Technical Standards Committee June 18, 1998.

Conversion of non-lab spaces to chemical labs represents a "change in occupancy" under Kentucky Building Code. Such conversions require review and approval by the University Fire Marshal **prior** to renovating or occupying the space. The purpose of this standard is to establish minimum criteria, **consistent with the intended use**, to be applied when converting non-lab spaces into rooms for the use of chemicals.

After the effective date of this standard, all chemical lab conversions must be reviewed and approved by the University Fire Marshal. Failure to obtain this approval may result in a "Stop Construction" order or posting of the space as "Illegally Occupied."

The standards for chemical laboratories, classified according to chemical use, are listed in the following table.

Chemical Lab (CL) Classification:	**CL-4**	**CL-3**	**CL-2**	**CL-1**
	Broad use of hazardous chemicals	**Restricted use of hazardous chemicals***	**Hazardous chemical storage only**	**No hazardous chemical storage or use**
Safety Equipment/Systems	**Broad use of non-hazardous chemicals**	**Broad use of non-hazardous chemicals**	**Broad use of non-hazardous chemicals**	**Broad use of non-hazardous chemicals**
Sprinkler	✓			
Supply and exhaust air systems	✓	✓	✓	
Labs on 100% exhaust	✓	✓	✓	
Fume hood	✓			
Sink	✓	✓	✓	✓
Eyewash	✓	✓		
Safety shower	✓	✓		
Portable fire extinguisher	✓	✓	✓	✓
Controlled access (lockable door)	✓	✓	✓	✓
Approved floor surface (no carpet)	✓	✓	✓	✓

* **Restricted use**: In a CL-3 lab, the following hazardous chemicals (see Definitions) are restricted to closed systems (e .g., HPLC, scintillation counter, etc.): gases; volatile liquids or malodorous compounds; solids that may become aerosolized in a process; liquids or solids that may become volatile at elevated temperatures; or reactions that may generate any of the preceding.

Note: CL-4, CL-3 and CL-2 labs must have sufficient HVAC controls to allow them to be maintained negatively pressurized relative to the corridor.

Definitions

For the purpose of this standard, **hazardous chemical** is defined as a substance or mixture that meets one of the following criteria: (a) National Fire Protection Association (NFPA) hazard rating of 3 or 4 for health, flammability or reactivity, or rated as water reactive or oxidizing agent; (b) listed carcinogen; (c) aqueous solution with pH less than 2 or greater than 12.5; (d) strongly malodorous compounds, or (e) hazardous waste.

A **non-hazardous chemical** is defined as a substance or mixture with NFPA hazard ratings of 0, 1 or 2.

A **chemical laboratory** is an area where chemicals are used on a small scale for research, teaching or clinical functions. A laboratory may consist of one or more interconnected rooms.

Miscellaneous

Separate standards may apply for chemical use in cold rooms, animal rooms, greenhouses, and certain other specialized rooms.

These standards by no means constitute an exhaustive list of all the safety requirements for chemical laboratories. Additional requirements may apply to chemical labs using radioactive materials, biohazards and/or animals.

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HOUSING, BUILDING AND CONSTRUCTION
DIVISION OF BUILDING CODE ENFORCEMENT
101 SEA HERO ROAD, STE. 100
FRANKFORT, KENTUCKY 40601-5405
TEL. (502) 573-0373
FAX (502) 573-1059

PAUL E. PATTON
GOVERNOR

DENNIS J. LANGFORD
COMMISSIONER

TERRY M. SLADE
ACTING DIRECTOR

June 30, 2003

Garry Beach/
Harry Enoch
University of Kentucky
Environmental Health & Safety
252 East Maxwell Street
Lexington, Kentucky 40506-0314

Re: Chemical Laboratories & Application of NFPA 45 Chemical Storage Limits

Dear Sirs:

This is in response to your memorandum dated June 13th regarding your proposal for this office to accept using NFPA 45 chemical storage limits in lieu of the current Kentucky Building Code (KBC). We had previously granted this request for the Plant Science Building and your latest memo has added nine- (9) other campus buildings to the list in which you want to use the NFPA 45 storage limits. I concur with your request and rather than list specific buildings I would prefer to use NFPA 45 for all campus buildings that have chemical storage. I plan on working with the Board of Housing to add such a change to the KBC.

If you should have any questions, please feel free to contact me at the noted addresses.

Sincerely,

Terry M. Slade,
Acting Director

TMS/tms
E-mail: Terry.Slade@mail.state.ky.us

Copy: Carvon Hudson, Assistant State Fire Marshall
BCE Technical Advisors

UNIVERSITY OF KENTUCKY

Environmental Health and Safety

Office of the Director
252 East Maxwell St.
Lexington, KY 40506-0314
(606) 257-3241, FAX: (606) 257-8787

MEMORANDUM

TO: Terry Slade

FROM: Garry Beach GB
Harry Enoch HE

DATE: June 13, 2003

RE: Variance Request for Recently Constructed or Renovated Laboratories

The University of Kentucky recently requested and received approval from your office to apply NFPA 45 chemical storage limits in the new Plant Science Building. We have a number of other buildings recently completed or under construction, where, for consistency, we would like to apply the same standard.

Therefore, the University of Kentucky requests a variance from the Kentucky Building Code to allow application of NFPA 45 (*Fire Protection for Laboratories Using Chemicals, 2000 Edition*) in lieu of KBC for establishing storage limits for chemicals in laboratories in the following buildings:

Robotics Building #0108
Wethington Allied Health Building #0200
Bosomworth Health Science Research Building #0305
ASTeCC Building #0286
Ralph G. Anderson Mechanical Engineering Building #0503
Gluck Equine Research Center #0099
Sanders-Brown Gerontology Center #0230
Oliver H. Raymond Civil Engineering Building #0281
Biomedical and Biological Sciences Research Building #0509

NFPA 45 is a widely accepted, modern fire and life safety code, specifically written to protect chemical laboratories. This consensus standard was prepared by a Technical Committee with a wide range of laboratory expertise, was acted on by the National Fire Protection Association at its World Fire Safety Congress in May 2000, and issued by the Standards Council in July 2000. In addition, NFPA 45 is referenced by the *Kentucky Fire Prevention Code* (by way of NFPA 30), which the Division of Fire Prevention uses for its inspections.

The University is seeking approval from the Division of Building Codes Enforcement to use the NFPA 45 maximum quantity limits on chemicals in *2.2 Laboratory Unit Fire Hazard Classification* (Table 2.2.1(a) and Table 2.2.1(b) for Class B, Moderate Fire Hazard Labs) in place of the KBC limits in *414.5 Inside Storage, Dispensing and Use* (Table 307.7(1) and Table 414.2.2).

As a further condition of this variance, the University agrees to the following additional fire protection measures in the above listed buildings, which are not required under KBC:

1. chemical laboratories shall be sprinklered
2. chemical laboratories shall meet NFPA 45 requirements for chemical fume hoods (6.8, 6.9 and 6.13)
3. UL listed flammable liquid storage cabinets shall be provided beneath each chemical fume hood and shall be vented into the hood
4. chemical laboratories shall meet NFPA 45 requirements for perchloric acid hoods (6.11)
5. required exit doors in chemical laboratories shall be self-closing and self-latching
6. interior connection doors in chemical laboratories shall be self-latching
7. door hardware for chemical laboratories shall meet requirements for the physically impaired
8. chemical laboratories shall be provided with fire extinguishers
9. chemical laboratories requiring two exits and windowless labs shall be provided with emergency lighting
10. chemical laboratories shall meet NFPA 45 requirements for chemical storage, handling and waste disposal (Chapter 7)

We have evaluated this request very carefully and believe that this variance offers greater fire protection for these laboratories than KBC. One additional advantage will be to resolve the difficulty raised by the different storage limits in KBC (used by the Division of Building Codes Enforcement) and NFPA 45 (used by the Division of Fire Prevention).

In conclusion, the University argues that fire protection in chemical laboratories will be enhanced by using the chemical storage limits in NFPA 45, as well as the other conditions set out in this memo, in lieu of the limits in KBC and requests approval of this variance for the above listed buildings.

cc: Carvon Hudson

To be used in conjunction with the "Standard for Solvents in Laboratories"
E.H.&S Standard for Solvents (http://ehs.uky.edu/fire/flstpol1.html)

The "Standard for Solvents in Laboratories" is based on the current edition of the Kentucky Fire Prevention Code that references NFPA 30 and NFPA 45. University laboratories are classified as a Class B (Moderate Fire Hazard).

Note that UK requirements are even more restrictive than NFPA 45.

A. **All flammable and combustible liquids are grouped together as solvents.** There is no class differentiation made between these liquids,
B. Ten (10) gallons of solvents are permitted per each 100 gross sq. ft increments per laboratory. Five (5) gallons of this amount must be in safety cans or UL listed safety cabinets,
C. A UL listed safety cabinet is required beneath each chemical fume hood,
D. A laboratory is considered to be the area within the defining four walls,
E. A laboratory unit is the space separated from other areas with fire rated walls ,
F. Write up desk areas, means of egress passageways exterior to the lab, or similar type areas that are not within the defining 4 walls are not to be considered as part of a laboratory,
G. Solvent in excess of the 10 gallons per 100 gross sq. ft. increments within the "laboratory" is considered storage and is required to be stored in inside storage rooms meeting NFPA 30 requirements for dispensing,
H. In situations where one laboratory contains fewer gallons of solvents than permitted per the gross sq. ft. increments, the 100 gross sq. ft increment(s) not being utilized by this laboratory can not be transferred to another laboratory to increase the total solvents within that laboratory.
I. All five (5) gallon cans of flammable solvents shall be stored in approved safety cabinets or approved storage rooms.

Contact the Division of Environmental Health & Safety (257-3241) for additional information on laboratory safety.

May 4, 2007

(014219S04 - Design Guideline for Fume Hoods EH&S supercede if conflicts occur.)

INFORMATION:
Many labs have fume hoods in their work areas. Ongoing maintenance, to ensure proper airflow, is important for the safety of lab workers and building occupants.

POLICY:
Air velocity of hoods will be checked when any changes are made to the system or conditions of inadequate flow are reported. The following list shall be followed to ensure proper operation.

PROCEDURE:
The systems HVAC person shall:

1. Check the hood face velocity with the sash at full face (full open) with an average of about nine readings. Also take a six readings average with the sash at 12 inches (open).
2. Check the dampers, fans, etc., to confirm proper working order and perform needed repairs. Notify Occupational Health and Safety when repairs are complete so they can recheck hood air flow.
3. The face velocity goal is to achieve 80 to 150 fpm average at full face.
4. The following is the standard established by Occupational Health and Safety:

   80-150 FPM meets UK standard
   60-79 "Marginal Use Hood" does not meet standard
   60-200 "Failed Hood" should not be used

5. Record the final readings of the hood on the work order and into the PM record.

If a minimum of 80 - 150 fpm face velocity cannot be obtained with the sash set at 18 inches, notify the Occupational Safety and Lab user.

APPENDIX K: CHEMICAL FUME HOOD OPERATIONS

CHEMICAL FUME HOOD OPERATIONS

Chemical Fume Hood Face Velocities

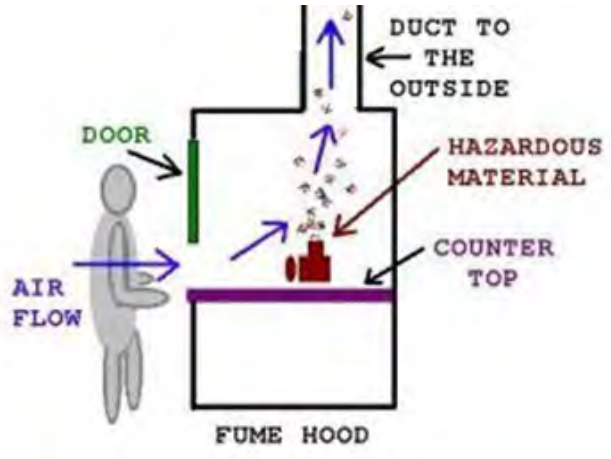
All chemical fume hoods at University of Kentucky facilities shall have face velocities between 80-120 feet per minute (fpm) with the sash at a "working height" (approximately 12 inches). As a rule, chemical fume hoods shall not be operated with the sash fully open to the indicated sash height and shall have the sash closed when not being used. The office of Occupational Health and Safety (OHS) will conduct an annual chemical fume hood inspection and certification program for all chemical fume hoods at the university. Chemical fume hoods with face velocities within the 80-150 fpm range may be used without restriction and will be marked with a chemical fume hood sticker showing face velocity at a height designated with an arrow. The face velocity range from 120 to 150 fpm does not significantly increase the safety of the user but does pose a large energy cost. That is why UK tries to keep face velocities below 120 fpm.

Chemical Fume Needing Repairs

Chemical fume hoods with face velocities below 80 fpm or above 120 linear fpm shall be marked with a sign indicating that the hood may not be used for chemical manipulations. A work order to repair these chemical fume hoods shall be processed as soon as possible. For UKMC this can be done online or by contacting the MCPPD (Medical Center Physical Plant Department) at 323- 6281. For Lexington Campus, contact your building administrator and/or operator. Once the chemical fume hood has been repaired, OHS will need to be contacted to reevaluate the chemical fume hood's performance.

Safe Work Practices for Chemical Fume Hoods

A chemical fume hood cannot provide complete safety against all events that may occur in the chemical fume hood, especially for toxic airborne contaminants with an exposure limit in the low part per billion range. For ordinary exposures, however, a properly designed chemical fume hood in a properly ventilated room can provide adequate protection. Most chemical fume hoods on campus now are equipped with flow monitors. These monitors are designed to give the user a guide for the proper function of the face velocity of the chemical fume hood. Nevertheless, certain work practices are necessary for the chemical fume hood to perform efficiently. The following work practices are required; more stringent practices may be necessary in some circumstances. From the American Conference of Governmental Industrial Hygienists in their text: "Industrial Ventilation: A Manual of Recommended Practices:"



1. All operations that may generate air contaminants at levels above the exposure limit shall be conducted inside a chemical fume hood.

2. Keep all apparatus at least 6 inches back from the face of the chemical fume hood. A stripe on the bench surface is a good reminder.

3. Users shall never put their head in the chemical fume hood when contaminants are being generated.

4. Do not use the chemical fume hood for storage of hazardous chemical waste except for very small quantities of volatile materials.

5. Excessive storage of chemicals or any apparatus in the chemical fume hood will impair the performance of the chemical fume hood. Store flammable chemicals in an approved flammable storage safety cabinet. Store corrosive chemicals in a corrosive storage cabinet.

6. Be sure that the switch is in the on position whenever the hood is in use and test hood periodically for airflow (i.e., using a Kim wipe).

7. Keep the slots and baffles in the chemical fume hood free of obstruction by apparatus or containers. Permanent equipment shall be raised and placed above the surface of the unit to ensure proper airflow.

8. Minimize foot traffic past the face of the chemical fume hood.

9. Keep laboratory doors and windows closed.

10. Do not remove chemical fume hood sash or panels except when necessary for apparatus set-up. Replace sash or panels before operating.

11. Do not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted in the hood.

12. Use an appropriate barricade if there is a chance of explosion or eruption.

13. If a chemical fume hood sash is supposed to be partially closed for operation, the hood shall be so labeled, and the appropriate closure point clearly indicated.

14. Where perchloric acid is heated above ambient temperature, vapors may condense within the exhaust system to form explosive perchlorates. In such instances, specially designed chemical fume hood exhaust systems shall be utilized. These systems will have dedicated exhausts and a water washdown system and may be used for perchloric acid digestions only.

15. All chemical fume hoods shall have spill protection lips (at the front of hood and for cup sinks located in the hood).

Figure 1 An example of a CFH improperly used for storage of containers. Overcrowding prevents proper airflow and containment.

Figure 2 A proper example of a CFH when procedures are not underway.

Training on the function and use of chemical fume hoods is available for researchers at: https://ehs.uky.edu/classes/classes_ohs_0001.php#chemical_fume_hood.

Any questions or requests for assistance in evaluation of chemical fume hoods may be directed to UK OHS at (859) 257-2924.

APPENDIX L: PPE HAZARD ASSESSMENT FORM

PERSONAL PROTECTIVE EQUIPMENT HAZARD ASSESSMENT FORM

The PPE Hazard Assessment form can be used to determine the required PPE by identifying hazards to the employees performing the task and the required PPE. The form is grouped according to the body part requiring PPE.

The form can serve as a written certification of the PPE Hazard Assessment.

Instructions:

1. Conduct a PPE Hazard Assessment initially, when tasks or conditions change, or when PPE is deemed ineffective.
2. Perform a walkthrough of the work area and task or job to be performed. Identify hazards that the employee may be exposed to while performing work activities or while present in the work area.
3. Describe the hazards that are present.
4. If the hazards cannot be eliminated or controlled without the use of PPE then indicate which type of PPE will be required to protect the employee form the hazard
   a. PPE alone should not be relied on to provide protection against hazards but should be used in conjunction with guards, engineering controls and good operating practices.
   b. When selecting PPE select the most protective type available
   c. The lab CHO shall fit the worker with the PPE and give instructions on its use and care.
   d. The lab CHO shall also ensure the employee understands the manufacturer's warning labels and provide training on the limitations of the PPE.
5. Make sure that you complete the following fields on the form (indicated by *)
   a. Name of the worksite or task
   b. Name of person certifying that a workplace PPE hazard assessment was performed
   c. Date the PPE hazard assessment was performed
6. Document and certify the PPE Hazard Assessment and maintain documentation for reference and employee training.

PPE Hazard Assessment Certification Form

Work Location: _____

***Job/Task:** _____

***Assessment conducted by:** _____

***Assessment Date:** _____

***Job Task or Job Performed:** _____

Eye Hazards

Tasks that can cause eye hazards include: working with chemicals and animals; molten metal; chipping; grinding; furnace operations; sanding; welding and woodworking and intense light.

Hazards	Yes	No	Description of Hazard	Required PPE
Chemical	☐	☐		
Dust	☐	☐		
Heat	☐	☐		
Impact	☐	☐		
Light/Radiation	☐	☐		
Electrical (shock and arc)	☐	☐		

Head Hazards

Tasks that can cause head hazards include: working below other workers who are using tools and materials which could fall; working on potentially energized electrical equipment; working with chemicals; and working under machinery or processes which might cause materials or objects to fall.

Hazards	Yes	No	Description of Hazards	Required PPE
Burn	☐	☐		
Chemical Splash	☐	☐		
Impact	☐	☐		
Electrical (shock and arc)	☐	☐		

Hand Hazard

Tasks that can cause hand hazards include: cutting material. working with chemicals, animals and working with hot objects.

Hazards	Yes	No	Description of Hazards	Required PPE
Burns	□	□		
Chemical Exposure	□	□		
Cut/Abrasion	□	□		
Hot/Cold Exposure	□	□		
Puncture	□	□		
Electrical (shock and arc)	□	□		

Foot Hazards

Tasks that can cause foot hazards include: carrying or handling heavy (>15 lbs.) material that could be dropped; performing manual material handling or workingwith chemicals

Hazard	Yes	No	Description of Hazards	Required PPE
Chemical Exposure	□	□		
Compression	□	□		
Impact	□	□		
Puncture	□	□		
Electrical (shock and arc)	□	□		

Noise Hazards

Task associated with equipment that can generate noise greater than 85 dBA. This includes arc flash hazards, rotating equipment grinders etc.

Hazards	Yes	No	Description of Hazards	Required PPE
Moving Machinery	□	□		
Rotating Equipment	□	□		
Electrical (arc and shock)	□	□		

Fall Hazards

Tasks that can cause hazards to the employee as a result of working at elevation or in applications that risk to falling are present

Hazard	Yes	No	Description of Hazards	Required PPE
Heights greater than or equal than 4 feet	□	□		
Working from leading edge	□	□		
Confined Space	□	□		
Operating powered industrial vehicle	□	□		

Body Hazards

Tasks that can cause hazards to the body of the employee in locations where harm to the body could occur**.**

Hazards	Yes	No	Description of Hazards	Required PPE
Wet Environment	□	□		
Dusty Locations	□	□		
Confined Spaces	□	□		
Handling Chemicals	□	□		
Electrical (shock& arc)	□	□		

Respiratory Hazards

Tasks that can cause inhalation hazards in excess of the established exposure limits. Inhalation hazards may consist of exposure to gases, vapors, dust, mist or fumes or fibers. Activities that may be exposed to these types of hazards include abrasive blasting, spray painting, welding, chemical related activities and asbestos maintenance. **All respirator usage must conform to an established Respriatory Use Program in conjunction with assessment and fit-testing by the UK Department of Occupational Health and Safety. Contact (859) 257-2924 for guidance and directions.**

Hazards	Yes	No	Description of Hazards	Required PPE
Chemical Exposure	□	□		
Vapor	□	□		
Dust	□	□		
Respirable Fibers	□	□		
Asbestos	□	□		

Certification

I certify that the above PPE Hazard Assessment was performed on the date indicated. This document is a Certification of the Hazard Assessment per OSHA Standard 29CFR 1910.132.

Printed Name	
Date	
Signature	

DESIGNATED WORK AREA

WARNING

PARTICULARLY HAZARDOUS SUBSTANCES IN USE

AUTHORIZED PERSONNEL ONLY