

Chapter VI: General Laboratory Hygiene

Housekeeping

Often laboratories will have numerous researchers and will require the sharing of common chemicals and equipment. As such it is good to establish, communicate, and document laboratory-specific rules that extend beyond those highlighted in this Chemical Hygiene Plan. The rules and suggestions discussed here are for safety and compliance.

- Keep all aisles, doorways, and areas around emergency equipment (safety eyewash, safety shower, fire extinguishers) clear. In case of an emergency, personnel will need to safely evacuate or have access to emergency equipment.
- Flush your safety eyewash for 3 minutes every week and document on a log sheet. Flushing the eyewash removes any sediment or microbial growth in the line and ensures that it is functioning properly. Some common problems include low pressure, discolored water, too cold, too hot, the area not being accessible, storage of hazardous chemicals, and electrical equipment too close. It is better to discover these problems before an emergency than during one!
- Chemicals should be stored in appropriate cabinets and designated storage rooms. This will allow laboratory workers to easily find chemicals, prevent incompatible storage, and maintain compliant volumes of chemicals. Storage of corrosive chemicals on upper shelves is restricted to prevent accidental exposure to the eyes. All chemical storage above eye level should be discouraged.
- Secondary containers made out of a chemically compatible material (i.e. plastic tubs) are to be used to store corrosives, particularly hazardous substances, and liquid hazardous wastes. Secondary containers are also suitable to segregate incompatible chemicals. These containers should be able to hold at least 110% of the volume of the largest container in case of spill or bottle breakage.
- Refrigerators or freezers storing flammable chemicals must be UL Listed as being acceptable for the storage of flammables. Any refrigerators or freezers in the laboratory not UL Listed as acceptable for the storage of flammables should have a sign indicating "No Flammable Storage." Also no food or drink is permitted inside the laboratory refrigerators or freezers unless it is clearly labeled "Not for Human Consumption." Laboratory-use ice machines should also clearly be labeled "Not for Human Consumption."
- Laboratory workers should keep their benches and work spaces (including fume hoods) clean and clear of excessive clutter. There should be no sign of spill or contamination present. Clean benches and workspaces minimize the possibility of contamination of personnel and experiments. Excessive clutter can also be a research quality and safety issue. In particular, excessive storage in fume hoods can impede the air flow and should be avoided.
- Remove gloves before leaving the lab or when working on computers where glove usage is not universally followed. Cross-contamination from gloves touching commonly used items such as door handles and elevator buttons is unacceptable. An appropriate method when going between labs is to take one glove off and using the ungloved hand for items such as door handles and elevator buttons.
- Keep an accurate inventory and review it at least annually. Annual review can discover chemicals that can become unstable over time before they become extremely hazardous (and expensive) to handle. Annual inventory can also promote the disposal of chemicals no longer needed. Inventories are important for the lab and can prevent costly purchases of chemical

already in their possession. Storage of extra chemicals becomes difficult as laboratory space is limited.

- When possible purchase in small quantities. Ordering larger quantities of a chemical than needed causes difficulty finding an acceptable storage location and might lead to the expiration or deterioration of a chemical.

Personal Hygiene

When working in a laboratory personal hygiene is very important. Lab personnel should always wash their hands after handling chemicals, before leaving for lunch, and at the end of the workday. Long hair and loose clothing should be confined to prevent accidental contamination or entanglement. Labs should not have any food or drink stored and absolutely no consumption of food or drink is allowed. Even the appearance of eating or drinking in the lab is prohibited (e.g., throwing an empty coffee cup in the lab trash can). Finally, cosmetics including lotion and lip balm should not be used in the laboratory.

Hazard and Risk Assessment

Laboratory personnel should be able to assess the hazards and risks associated with their work. For chemicals, hazards are the inherent danger of the chemical or process. Risk is the likelihood of a hazard causing harm. Chemical experiments should have hazard and risk assessments completed and documented appropriately such as in a laboratory notebook. A common mistake made by both inexperienced and experienced researchers is to underestimate the risk. Please be mindful of this tendency.

Chemical hazards are discussed in Chapter III: Health and Physical Hazards of Chemicals and safe handling practices are covered in Chapter VIII: General Classes of Hazardous Chemicals Standard Operating Procedures. Since the hazard is inherent to the chemical and the process used the only way to minimize the hazard is to eliminate or substitute it for a less hazardous one as described in Chapter IV: Hierarchy of Controls. Risk however is a probability; therefore it can be minimized to acceptable levels. Also described in that chapter are ways to mitigate the hazard to reduce the risk. With chemicals a very easy, effective, and practical way to reduce risk is to use smaller scale.

Transporting Chemicals

Chemicals may have to be transported from one laboratory to another or picked up from a stockroom. Always transport chemical containers in an appropriate secondary container to prevent the spread of a leak or spill. Do not transport incompatibles inside the same secondary container. Labs should use a non-metal cart that has lips on all four sides for spill prevention when transporting larger quantities of chemicals. Proper PPE including eye protection, lab coat, and gloves should be in possession when transporting chemicals.

Chemical Storage

Chemicals must be stored safely and properly to prevent accidental mixing, adverse reactions, and the spread of fire in an emergency. Proper chemical storage first involves the segregation of incompatible materials. Common incompatibles include flammables with oxidizers, acids with bases, inorganic acids with organic acids, and water reactive chemicals with aqueous solutions and alcohols. Please review the chemical Safety Data Sheet for specific incompatibilities. Incompatibles can be segregated by use of a secondary container (i.e. plastic tub). The secondary container should be chemically compatible and be

able to hold 110% of the largest container. Chemicals should not be stored on the ground without secondary containment and away from where they can become a trip hazard.

For storage requirements of specific chemical classes please refer to Chapter VIII: General Hazard Class Standard Operating Procedures. Chemical-specific storage requirements can be found by referencing the chemical's Safety Data Sheet. Additional information can be found on the Chemical Storage and Segregation Guidance Document (https://researchsafety.uchicago.edu/sites/researchsafety.uchicago.edu/files/uploads/Chemical_Storage_0.pdf). Please contact Office of Chemical Safety (chemsafety@uchicago.edu) with questions or concerns.

Handling Chemicals

Before chemicals are handled laboratory personnel should have completed all required training, read this Chemical Hygiene Plan, and conducted a risk assessment for the use of the chemical. The risk assessment should evaluate the need and proper usage of engineering controls, administrative controls, and PPE. It is encouraged that this risk assessment is documented in a laboratory notebook or other written procedure. For handling requirements of specific chemical classes please refer to Chapter VIII: General Hazard Class Standard Operating Procedures. Chemical-specific handling requirements can be found by referencing the chemical's Safety Data Sheet. Please contact Office of Chemical Safety (chemsafety@uchicago.edu) with questions or concerns.

Laboratory Safety Equipment

Due to the hazards and risk associated with research, emergency safety equipment is found in the laboratory. Lab personnel are responsible for knowing the location and safe operation of the laboratory's safety equipment. Below are some common safety equipment. For additional information please refer to the Emergency Safety Equipment Guidance Document (<https://researchsafety.uchicago.edu/sites/researchsafety.uchicago.edu/files/uploads/EmergencySafetyEquipment.pdf>) or contact the Office of Research Safety (researchsafety@uchicago.edu).

- Emergency showers are for the immediate rinsing and flushing of hazardous chemicals or can extinguish fire on a person. At minimum an annual inspection of safety showers is required. Please contact your Building Manager if this has not been completed or if you have concerns.
- Emergency eyewashes are for the immediate rinsing and flushing of hazardous chemicals from one's eyes. Laboratories are required to flush weekly and maintain documentation regarding this weekly test.
- First aid kits should be accessible and their location known to laboratory personnel. The contents of the kit should be consistent with the hazards in your laboratory. Items should be in good condition and unexpired. Common supplies should include bandages, burn cream, antiseptic ointment, exam gloves, absorbent compress, and tape. Special hazards such as hydrofluoric acid will require calcium gluconate gel and biohazards require disinfectant rinse agent (i.e. 3% hydrogen peroxide or a providone-iodine solution).
- Chemical spill kits can be for an individual lab or shared amongst labs, however each laboratory is responsible for making sure its contents are appropriate for the chemicals in their inventory. Typical chemical spill kits will include absorbents, acid neutralizers, caustic neutralizers, pH paper, safety glasses/ goggles, chemical resistant gloves, disinfectant, plastic bags, broom, and dust pan. Certain chemicals such as hydrofluoric acid, formaldehyde, and mercury will have additional supplies needed for a spill response.

- Fire extinguishers are required to be present in all laboratories and the type of extinguisher should be appropriate for the fire hazard present. They should only be used for small fires where the user is trained on the PASS method and comfortable using it.

Use of Hazardous Chemicals in Animal Research

At the University of Chicago a number of studies are conducted using hazardous chemicals with animal models. This may be the use of novel or experimental compounds to discover treatments to disease or can be standard chemicals typically used in veterinary care. Protocols involving the use of animals in research require an Animal Care and Use Protocol be submitted to the Institution Animal Care and Use Committee (IACUC). The use of hazardous chemicals has to be included in this protocol. Animal Resource Center (ARC) and IACUC may have additional requirements for the type, usage, training, and designated areas for hazardous chemical usage in animals.

There are several considerations that must be analyzed when using hazardous chemicals in animals that are unique to animal research. First, many drugs or chemicals must be prepared prior to delivery into the animal. Common preparations include dissolving, dilution, milling and mixing. The preparation of hazardous chemicals for administration into animals should be conducted in the laboratory and never in the Animal Resource Center (ARC, 773-702-6756, <https://animalresources.uchicago.edu/>). It should follow the requirements and recommendations in this Chemical Hygiene Plan regard the use of engineering controls, administrative controls, and personal protective equipment. Please contact Office of Chemical Safety (chemsafety@uchicago.edu) with questions or concerns.

Next, laboratory personnel have to consider how the compound is being delivered to the animal. Different delivery methods can expose the personnel performing the administration to a higher risk. The risk of injection is of major concern, and should be addressed by anesthetizing or properly restraining the animal. ARC veterinarian staff will be able to assist with any questions. In addition to injection the use of anesthetic gases present a possibility for inhalation exposure. Proper scavenging systems should be used to minimize this risk. Please contact Office of Chemical Safety or ARC with questions on scavenging equipment and training.

Another safety consideration is what happens to the chemical once it is in the animal, how is it metabolized, what is its metabolic product, and eventually how is it excreted or shed. Some chemicals are metabolized into nonhazardous or lower hazardous byproducts. Occasionally chemicals are metabolized into more hazardous chemicals. If the compound or metabolites are unknown then they should be assumed to be hazardous and fully excreted.

Once these hazardous agents are excreted they can contaminate the bedding and cages. While researchers typically are not responsible for the cage changes, workers who do perform these tasks rely on you for accurate information so the hazards and risk can be communicated and controlled. It is the researcher's responsibility to fully describe the research in their protocol particularly the use of hazardous chemical. Researchers must follow ARC rules regarding the administration of chemicals, labeling cages with the appropriate hazard, housing the animals in approved locations, and caging of the animals.

Working Alone in the Lab

Working alone implies that another person cannot respond with immediate assistance in the event of an incident, accident, or emergency. Laboratories are potentially hazardous places to work. As such working alone in a laboratory with hazardous chemicals or equipment is strongly discouraged by the

University and can be prohibited by the Department, Laboratory Director, or Principal Investigator. It is the right of the researcher to refuse to carry out experimental procedures while working alone.

If work is to be conducted alone, it is the responsibility of the researcher to:

- inform the supervisor that they will be working alone;
- describe the scope of this work;
- assess the risks associated with the experimental work;
- take the precautions to mitigate the risk;
- review the emergency response.

In agreement with the *Minors In Educational Assignment (MEA)* policy (Policy U610), people under the age of 18 years-old must be directly supervised at all times while in a research laboratory, either by the PI/supervisor or a designee.

Exposure Monitoring

Exposure monitoring is supported by Environmental Health and Safety office. The use of certain chemicals may require periodic exposure monitoring. Also some medical conditions will warrant exposure monitoring. Employees are given the right to observe the testing, sampling, monitoring, or measure of employee exposure as well as given the opportunity to review the results and discuss them with a medical professional.

All laboratory personnel who have been or believe they may have been exposed to a hazardous chemical have the right to receive an employer-provided medical examination. This examination is at no cost to the employee or student. Employees should either go to University of Chicago Occupational Medicine (UCOM, D-136) or the Adult Emergency Room for emergency or after hours care. Students can go to the Student Health Services (R-100) or Adult Emergency Room for emergency or after hours care. Please see Chapter VII: Emergency procedures for more information or contact the Office of Research Safety.

Hazardous Waste

Environmental Health and Safety has released the Hazardous Waste and Disposal Procedures Policy (http://safety.uchicago.edu/pp/environmental/haz_waste_mgt.shtml). Below is a summary and useful instructions to assist with the laboratory's hazardous waste disposal. Questions regarding the disposal of hazardous waste should be directed to Environmental Health and Safety (773.702.9999, safety@uchicago.edu).

Hazardous chemical waste must be collected in containers appropriate for the waste, properly labeled, and picked up by the University's hazardous waste disposal contractor. Due to strict waste regulations, only the vendor currently under contract with the University is legally allowed to remove waste from this campus. Pouring hazardous waste down the drain is prohibited.

Waste collections occur each week on Thursday for labs that submit a request by Wednesday before 3:00pm.

Campus buildings: Submit an on-line request through the EH&S Assistant Program (<http://safety.uchicago.edu/tools/ehs.shtml>) In an effort to efficiently collect waste the use of the EH&S Assistant program is strongly encouraged. However, if necessary, labs can submit a waste pick-up by contacting Environmental Health and Safety, 773.702.9999 (safety@uchicago.edu).

Hospital buildings: Safety and Environmental Compliance, 773.702.1733 (safety@uchospitals.edu).

In an effort to comply with the Environmental Protection Agency's (EPA's) waste minimization policy the University must document efforts to reduce hazardous wastes in the laboratory. It is the responsibility of each PI who generates waste to incorporate the principles of waste minimization into their research activities.

- Limit the amount of chemicals purchased. Purchasing the bulk quantity may be cheaper on the front end, but the disposal costs and environmental impact need to be considered;
- If feasible, substitute less hazardous chemicals;
- Avoid generating "unknown" substances. Properly label the waste container to clearly convey the contents in the bottle to assist the waste disposal vendor in their waste profile and testing;
- If you order excess chemicals or your inventory exceeds your needs, attempt to share inventory items with your fellow PI's.

Empty chemical containers can be disposed after they have been triple rinsed with water, the container label defaced, and there is no sign of chemical residue. If the previous contents were highly toxic or the chemical is on the EPA Acutely Hazardous Waste "P" List collect the rinse water and dispose the wash as hazardous waste. A link to the EPA's "P" List is available on Environmental Health and Safety's Hazardous Waste and Disposal Procedures Policy

(http://safety.uchicago.edu/pp/environmental/haz_waste_mgt.shtml#heading11). Empty bottles can also be used to collect hazardous waste if it is compatible with the waste. The University's hazardous waste disposal vendor can provide additional containers to collect waste. Contact Environmental Health and Safety (773.702.9999, safety@uchicago.edu) for information.

Broken glassware that is not contaminated with hazardous chemicals, biohazards, or radioactive sources can be disposed by packing in a lined cardboard or other rigid container and taped. Disposal of broken glass containers and empty (triple rinsed) chemical containers are removed from the lab differently depending on the building. Please contact your Building Manager for details.