Chemical Hygiene

Chemical Hygiene Course Content

Introduction

The purpose of this model Chemical Hygiene Plan (CHP) is to define work practices and procedures to help ensure that laboratory workers at the University of Kentucky are protected from health and safety hazards associated with the hazardous chemicals with which they work.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 entitled "Occupational Exposures to Hazardous Chemicals in Laboratories" is hereafter referred to as the Lab Standard. (See Appendix I of the CHP for a complete copy of the Lab Standard). A summary of the requirements of a Chemical Hygiene Plan is listed below. This course will explain the topics in greater detail and instruct employees of their responsibilities in meeting these requirements.

- Standard operating procedures
- Criteria to determine and implement specific control measures, such as engineering controls and personal protective equipment
- An ongoing program be developed to ensure that fume hoods and other engineering controls are functioning properly
- Information and training requirements
- Circumstances under which a particular laboratory function will require "prior approval"
- Provisions for medical consultation and medical exams
- Designation of the Principal Investigator/Laboratory Supervisor as the Chemical Hygiene Officer
- Additional precautions for work with select carcinogens, reproductive toxins, and extremely toxic substance

This CHP can also be viewed on the Lab Safety page along with other lab safety information. There is a new page with Lab Safety Alerts which has brief descriptions of incidents that have recently occurred in labs.

Determining who is covered by the Lab Standard

OSHA has defined 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." In addition, OHSA defines a laboratory as "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis." Finally, the Laboratory Workers referred to in the Lab Standard are employees. OSHA defines employee as "an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments." An example of a Laboratory Worker would be a University teaching assistant, research assistant or faculty member instructing an academic lab. Students in an academic laboratory would not be considered laboratory workers by OSHA. However, as a matter of university policy, the principles outlined in this Chemical Hygiene Plan will apply to students in our laboratories. Also included, will be visiting professors and volunteers that might be working in the lab. Thus, Laboratory Supervisors must ensure that that these groups that are in their laboratories are adequately instructed in relation to safe laboratory procedures. If there is any question about where the Lab Standard applies and who it covers, the Occupational Health and Safety Department, upon request, will make this determination.

Minors in Lab Policy
For Students working in the lab, prior approval is needed through the Minors in Lab Policy.

Training needs to be done as soon as possible

All Laboratory Workers prior to the commencement of lab duties must read this Chemical Hygiene Plan. In addition to the Plan, the Laboratory Workers must be familiar with and adhere to prudent laboratory safety guideline developed by their laboratory supervisor, UK requirements and other relevant regulatory requirements (e.g. Radiation Safety).

Training records should be kept by the Principal Investigator(PI) or the lab supervisor. One training record will be the certificate that accompanies this training course. Also, a written record stating that each Laboratory Worker has reviewed the Chemical Hygiene Plan and specific health and safety policies and guidelines for the individual lab must be kept by the person in charge of the lab. (See Appendix 3 for an example of a training record form). The University of Kentucky office of Environmental Health and Safety has professionals in several disciplines (e.g. Radiation Safety; Hazardous Materials Management; Fire and Accident Prevention; Occupational Health/Industrial Hygiene) that can be consulted to assist in related laboratory safety issues. See Appendix 2 for and organizational chart.

This model CHP will be reviewed annually by the institutional Chemical Hygiene Officer (CHO) and/or the Chemical Health and Safety Committee. Each laboratory's CHP must be **reviewed annually** by the laboratory's Chemical Hygiene Officer and the "revised date" must be listed on the identification page. [For discussion of Institutional Chemical Hygiene Officer and Chemical Hygiene Officer see Chapter 9.]

Responsibilities

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 its 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 cooperation of all parties involved to ensure that such activities are conducted safely with regard to 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 Department 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

- Remain current on rules and regulations concerning chemicals used on campus.

Deans, Directors and Heads of Academic and Administrative Units have the primary responsibility for the health and safety of their staff and students. Specific responsibilities regarding the implementation of the Chemical Hygiene Plan include:

- Collaborate with faculty and staff to adapt the Model Chemical Hygiene Plan to include lab-specific guidelines and to develop strategies to implement the Plan
- Consider the idea of developing departmental-wide laboratory safety training programs and/or committees
- Make budget arrangements for health and safety improvements. It is the responsibility of these respective individuals to request the necessary monies in the budget process

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

- Inform and train employees concerning chemical safety as required by this Plan. Retain training records and all documentation
- Implement and enforce rules and standards of this plan concerning health and safety for laboratories under the supervisor's jurisdiction and restrict access to the laboratory (see Authorized Access in Chapter 3 "Standard Operating Procedures")
- Serve as the Chemical Hygiene Officer for his/her laboratories
- Ensure compliance of laboratory workers with this Plan
- Ensure the availability and enforce the proper use of appropriate personal protective equipment and relevant health and safety reference materials
- Remain cognizant of chemicals stored and used in labs and their associated hazards
- Develop an annual inventory of chemicals present in the laboratory (see Appendix IV for sample inventory form)

A Lab Supervisor discusses information on a MSDS with a Lab Worker.

- Conduct internal inspections of labs for health and safety concerns and maintain an inspection log of inspection findings (see Appendix V for a sample self inspection form)
- Request assistance from Environmental Health and Safety, as needed
- Request allocation of funds from superiors for health and safety improvements as needed, or budget into research grant proposals

Laboratory Worker responsibilities regarding implementation of the Chemical Hygiene Plan:

- Follow all health and safety standards and rules
- Report all hazardous conditions to the laboratory supervisor
- Wear or use prescribed protective equipment
- Report any suspected job-related injuries or illnesses to the laboratory supervisor 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
- Request information and training when unsure how to handle a hazardous chemical or procedure

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Standard Operating Procedures

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

This Plan represents a minimum set of guidelines for the handling of hazardous chemicals in laboratories at the University of Kentucky. Individual administrative units, laboratories or research groups are required to develop more detailed procedures as their situations warrant. These procedures must be written, added to the laboratory's Chemical Hygiene Plan, and made available to Laboratory Workers. Acceptable lab safety references such as those listed in the Appendix I may be adopted in whole or may be useful in developing additional procedures. In all situations, individual faculty or staff will be responsible for enforcing adequate safety and hygiene measures in laboratories they supervise. If necessary, additional assistance from Environmental Health and Safety is available. A table of violations can be used as a guide for enforcing the adequate safety and hygiene measures. The following standard operating procedures apply to all labs at UK:

#1 - GENERAL

Respect and understand the safety and health hazards associated with the chemicals and

equipment in your laboratory, and practice the following general safety guidelines at ALL times:

Authorized Access. The Laboratory Supervisor must restrict access to laboratories. Children (under age 17) are not allowed in laboratories except as authorized by the Laboratory Supervisor for an officially sanctioned activity (e.g. class or open house). Pets are also prohibited from laboratories.

Containers. Check the integrity of containers and if damaged or leaking, transfer to an acceptable container or call Hazardous Materials Management for assistance (323-6280). For disposal, fill out a "hazardous waste ticket" and mail to Hazardous Materials Management. Observe compatibility; for example, hydrofluoric acid must not be stored in glass and some oxidizers should not be stored in plastic containers.

Compressed Gas Cylinder Handling. Use appropriate handcarts to move cylinders. Cylinders must be secured at all times. Extremely toxic gases (e.g. hydrogen sulfide, chlorine, arsine) should not be moved through regular exit corridors, particularly during business hours. Always consider cylinders as full and handle them with corresponding care.
NOTE: For additional information on cylinder handling, go to the Compressed Gas Cylinders Guide.


Proper movement of a compressed gas cylinder.

Glass Tubing. When inserting tubing into stoppers, lubricating tubing as well as wearing gloves or wrapping in a thick cloth will help protect hands from being cut in the event of the tubing slipping and breaking.

Housekeeping. Exits, aisles and safety equipment must NOT be obstructed in any way with equipment, furniture, etc. No items must be stored in the corridors. For questions related to the use of corridors or any exiting or Fire Marshal issue, contact the Fire Marshal office (257-6326).

Food, Drink, Cosmetics. Eating, drinking and the application of cosmetics (including lip balm) is forbidden in areas where hazardous chemicals are used and must be done only in well-defined designated non-chemical areas. Do not store food in the same refrigerator with chemicals, biohazards or radioactive materials. Refrigerators, microwaves and ice machines must have labels that denote their use, i.e. "Not for food or drink."


Never drink where hazardous chemicals are being used.

Horseplay. Horseplay, practical jokes or other inappropriate and unprofessional behavior in the laboratory setting is forbidden. Avoid distracting or startling any other workers.

Equipment. Use proper equipment that is in good condition. For example, never use chipped or cracked glassware. Shield pressurized or vacuum apparatus and safeguard against bumping or overheating.

No Smoking. This policy exists throughout the University and applies in all laboratories.

Never smoke around flammable liquids.

Unattended Experiments. Frequently, laboratory operations are carried out continuously or overnight. For experiments involving hazardous operations, it is essential to plan for interruptions in utility services such as electricity, water and inert gas. Operations are to be safe and plans made to avoid hazards in case of failure. If necessary, arrangements for routine inspection of the operation are to be made and, in all cases, the laboratory lights should be left on and an appropriate sign posted on the door.

Door View Panel. Lab view panel should not be covered.

Disposal of Waste. It is important to segregate wastes. To request pick-up of hazardous waste, biohazardous waste or chemicals, call Hazardous Materials Management at 323-6280. Disposal of all laboratory waste must follow the procedures specified by Hazardous Materials Management. To request pick-up of radioactive wastes, contact Radiation Safety at 323-6780.

Hazardous Materials. Hazardous materials should not be used on open laboratory benches.

Mouth Pipetting. Mouth pipetting is forbidden.

Mercaptans. To avoid false reporting of natural gas leaks, the Physical Plant department should be contacted when mercaptans are used in a laboratory in such a manner that persons outside of the laboratory could smell the mercaptan and suspect a natural gas leak in the building. For more information about mercaptans please see the fact sheet ( ).

Natural Gas. The Natural Gas Emergency Response Procedures are designed to provide a structured means for safe evacuation and notification of affected personnel when a potential Natural Gas Emergency exists. For more information please see the natural gas fact sheet.

Perchloric Acid. If perchloric acid is heated above ambient temperature it will give off vapors that can condense and form explosive perchlorate salts. Hence, when heating perchloric acid above ambient temperature, a specifically designed and dedicated perchloric acid fume hood with a wash down system or a local scrubbing or trapping system must be used.

Always use a special perchloric acid hood when heating perchloric acid.

Working Alone. When working with acutely hazardous materials, it is advisable to have a second person present, or at a minimum, maintain surveillance via telephone contact.

#2 - PERSONAL

Personal protection and personal hygiene are two very basic aspects of laboratory safety. Wearing appropriate personal protective equipment and practicing good personal hygiene as described below will minimize exposures to hazardous chemicals during routine use and in the event of an accident.

Personal Protective Equipment. OSHA has amended standards for personal protective equipment (PPE) to require employers to assess the workplace to determine if there are hazards requiring the use of PPE and certify that this assessment was performed. The following generic PPE requirement for labs can be used and supplemented as appropriate. For additional hazards, contact Occupational Health and Safety Department, 7-3827.

HAZARD ASSESSMENT AND PERSONAL PROTECTIVE EQUIPMENT REQUIREMENTS FOR GENERAL LABORATORY OPERATIONS			
Hazard	**Personal Protective Equipment Required**		
	Eye	**Face**	**Hand/Skin/Body**
Any lab use of chemicals	Safety glasses at all times		Lab coat
Use of corrosive chemicals, strong oxidizing agents,	Chemical splash goggles	Full face shield and goggles (for work with	--Resistant gloves (See Appendix 6 for chemical resistance of common glove

carcinogens, mutagens, etc.		over 4 liters of corrosive liquids)	materials) --Impervious lab coat, coveralls, apron, protective suit (for work with over 5 gallons corrosive liquids)
Temperature extremes			Insulated gloves for handling ovens, furnaces, cryogenic bath and other devices over 100 degrees Centigrade or below -1 degrees Centigrade
Sharp objects (broken glass, insertion of tubes or rods into stoppers)			Heavy cloth barrier or leather gloves

Attire. Wear a lab coat or apron, cover legs and feet (no sandals or open-toed shoes), and confine loose clothing and long hair. For additional information see the PPE & Apparel in Chemical Labs Fact Sheet.

Damaged shorts a researcher was wearing when mixing some incompatible chemicals.

Gloves. Gloves are essential when working with hazardous substances. The proper gloves will prevent skin absorption, infection or burns. All glove materials are not equally effective in protection from chemical hazards. Consult a chemical resistance chart such as the one found in Appendix VI, consult a glove manufacturer or contact Hazardous Materials Management (323-6280) or Occupational Health and Safety (257-3827) for assistance in appropriate selection.

Fume Hoods and Other Engineering

Safety Shower/Eyewashes. Safety showers and/or eyewashes are required in labs where corrosive chemicals are used. Eyewashes must be tested monthly by laboratory personnel. Safety showers must be tested monthly by building maintenance staff.

Face Shields. Full face shields must be worn when conducting a procedure where splashing is a potential. Full face shields with bottom caps to protect under the chin are preferred due to the tendency to raise the chin when a splash occurs.

Personal Hygiene. Hands should be washed frequently throughout the day,

Controls. See Chapter 5

Personal Use of Chemicals. Lab workers are not allowed to remove chemicals from the lab for personal use.

Eye Protection. It is University of Kentucky policy that personnel including students, staff and visitors in laboratories wear appropriate safety glasses, goggles, or face shields at all times where chemicals are stored or handled. Goggles are required when chemical splashes are possible.

The wearing of contact lenses in labs is a controversial issue. If contact lenses must be worn consult your optometrist or ophthalmologist. When wearing contact lenses in the laboratory it is necessary to wear chemical splash goggles at all times.

before leaving the lab, after contact with any hazardous material, and before eating.

Respiratory Protection. The use of some substances may require the use of respiratory protection (respirators). See Chapter 4 for a discussion of "Controlling Chemical Exposures".

#3 - HAZARDOUS MATERIAL HANDLING AND STORAGE

Hazards associated with various chemicals and gases vary widely. Understanding the hazards associated with a compound and minimizing the quantity used and stored in the lab will decrease chance of injury.

Chemical Spills and Accident Response. As a matter of policy, University personnel should handle their own small spills and releases. For emergency situations i.e., large spills and leaks, evacuate and call 911 (Campus Police) from a safe location. See Chapter 11, Planning for Emergencies for more information.

Chemical Storage. Chemicals ideally should be stored by compatibility, not simply by alphabetical arrangement. Oxidizers should be separated from organics, air/water reactives must be kept dry and cyanides should be stored away from acids. (See Appendix VII for examples of incompatible chemicals).

Volatile toxic substances must be stored in volatile storage cabinets adequate to the purpose. When volatiles must be stored in a cooled atmosphere, explosion-proof refrigerators or similar specially designed equipment must be used.

Examples of Incompatible Chemicals Stored Together

Bleach & Hydrochloric acid.


Potassium dichromate, acetone & perchloric acid.


Sodium borohydride & tetrodotoxin.

Flammables in Refrigerators

Do not store flammable liquids in a refrigerator unless it is approved for such storage. Such Refrigerators are designed not to spark inside the refrigerator. If refrigerated storage is needed, it is advisable to choose an explosion-proof refrigerator or flammable safe refrigerator. The differences in refrigerators are explained here.

Chemical Handling. Encourage the use of poly coated bottles or use bottle carriers for transporting chemicals which are in regular glass containers. Close caps securely and avoid storing chemical containers in hard to reach areas. Pour chemicals carefully, and never add water to concentrated acid. Metal containers and non-conductive containers (e.g., glass or plastic) holding more than five gallons must be grounded when transferring flammable liquids.


Secondary container used for transport of chemicals.

Cylinder Storage. Cylinders must be stored in well ventilated areas with their protective caps screwed on and the cylinder secured (e.g., strapped or chained in an upright position) to reduce the chance of the cylinder being knocked over. Do not store cylinders near heat or high traffic areas. Whenever possible do not store flammables and oxidizers together. Do not store empty and full cylinders together. Clearly mark empty cylinders. Storage of large quantities of cylinders must be done in an approved gas cylinder storage area. For storage and use of flammable gas cylinders, consult Office of Fire Marshal 257-6326.

#4 - LABELS

All chemical containers must be labeled. All labels must be legible, in English and include chemical/product name (chemical formulas alone are not acceptable) and include information related to relevant hazards. (See Appendix XI for Hazard Ratings) Labels on incoming containers must not be removed or defaced. Date all peroxidizable and other chemicals, which may become unstable over time (e.g. picric acid, ethers); test and/or dispose of them when appropriate. Waste chemical containers must be clearly marked "Hazardous Waste" indicating specific name of waste chemical and date when full.

Ethyl ether container that had passed it's expiration date by three years and is obviously deteriorating.

#5 - LABORATORY DOOR SIGNAGE

Each laboratory door must be legibly marked with the following information:

1. Room number
2. Department
3. Laboratory supervisor's name
4. Emergency contacts, including names, office location, and office and emergency telephone numbers
5. Special hazards/instructions (e.g. location of large quantities of flammables or the presence of a "local alarm" system).

Appendix VIII of the CHP has standard laboratory signage. A word version can be downloaded off the web site and filled out electronically.

#6 Example violations

Controlling Chemical Exposures

The Lab Standard requires the employer to determine and implement control measures to reduce employee exposure to hazardous chemicals; and particular attention must be given to the selection of control measures for chemicals that are known to be extremely hazardous. There are three major routes of entry for a chemical to enter the body: inhalation, absorption, and ingestion. Three types of controls for prevention of these various routes of entry include engineering controls, administrative or work practice controls and personal protective equipment. Each route of entry a chemical can take to enter the body can be controlled in a number of ways, as explained below.

Evaluating the risk is the first step. A good place to start researching health and safety information is from the Material Safety Data Sheets (MSDS) that are shipped with the chemical. To access an MSDS on the web click here.

Inhalation Hazards

Inhalation of chemicals is the most common route of entry a chemical can take to enter the body. One good way to reduce any type of exposure is substitution. Try to find a chemical that works just as well but is less volatile or toxic. It could also be changing to a liquid or a solid chemical from a gas. If substitution is not practical, engineering controls such as ventilation should be used to lessen the chance of exposure. The use of well-functioning local exhaust ventilation such as fume hoods, biological safety cabinets, vented glove boxes and other local exhaust systems is often required to minimize exposure to hazardous chemicals. Dilution ventilation may be used to reduce exposure to non-hazardous nuisance odors. For extremely toxic chemicals such as those classified as poisonous gases by State or Federal agencies (e.g., arsine, phosgene) the use of closed systems, vented gas cabinets, fail-safe scrubbing, detection or other stricter controls may be required.

If both substitution and engineering controls are unavailable, the use of personal protective equipment may be required to reduce inhalation exposures. Respiratory protection from dust masks to self-contained breathing apparatus may be utilized to this end. If laboratory employees wear respirators, requirements of the OSHA Respirator Standard (1910.134) must be met and a written respirator program must be implemented. This Standard requires training on the proper use of respirators, medical surveillance to ensure the user is capable of wearing a respirator, and fit testing to ensure that the respirator fits properly. A lab worker or his/her supervisor should contact the Occupational Health and Safety Department (257-3827) in the event that respiratory protection is to be utilized to control exposures to hazardous chemicals.

In addition the following principles should be utilized to reduce the risk of exposure to hazardous chemicals:

- minimization of exposure time for individual employees;
- restricted access to an area where a hazardous chemical is used; and
- proper signage on lab doors to indicate special hazards within.

Skin/Eye Contact Hazards

To reduce the risk of a chemical entering the body via skin and eye contact, engineering controls include substitution and appropriate ventilation as described above in Inhalation Hazards. Also the fume hood sash provides a good physical barrier. The more obvious means of preventing skin and eye contact is the wearing of personal protective equipment such as eye protection, face shields, gloves, appropriate shoes, lab aprons, lab coats, and other protective equipment as appropriate to the hazard. Chemical resistivity of the different types of protective equipment varies significantly. The lab supervisor should consult Appendix VI of the CHP or other references to ascertain that the protective equipment material is resistant to the chemical being protected against. Safety showers/eye wash equipment is required where corrosive chemicals are used. Such equipment should be prominently labeled and not obstructed.

Ingestion Hazards

Ingestion of chemicals is the least common route of entry into the body. However a Laboratory Worker can easily ingest chemicals into the body via contaminated hands if they are not washed prior to eating, smoking or sticking part of the hand or a writing tool that has been contaminated into the mouth. OSHA is strict on some activity in the lab to prevent this type or exposure. The Lab Standard forbids eating, drinking, applying make-up and lip balm in areas where hazardous chemicals are used. Other examples of administrative controls are forbidding mouth pippeting and encouraging good personal hygiene. An engineering control for this type of hazard would be the use of a glove box. And finally wearing the appropriate glove for personal protective equipment.

Exposure Assessment

At the request of faculty, staff or students, exposure evaluations may be conducted by Occupational Health for any suspected overexposure to substances regulated by OSHA. Records of exposure evaluations will be kept in the Occupational Health and Safety Department and provided to the department and affected employees and any other appropriate authorities at the University.

Chemical Hoods and Other Engineering Controls

Chemical Hood Face Velocities

Chemical hoods are the most common engineering control in laboratories. All chemical

hoods at University of Kentucky facilities should have face velocities between 80-120 feet per minute (fpm)with the sash at a "working height" of approximately 12 inches. As a general rule, chemical hoods should not be operated with the sash fully open and should have the sash closed when not being used. The office of Occupational Health and Safety will conduct a chemical hood inspection for all chemical hoods at the university. Chemical hoods with face velocities within the 80-150 fpm range may be used without restriction and will be marked with a fume hood sticker showing face velocity at a height designated with an arrow.

For additional information on the safe use of chemical hoods, see the University of Kentucky's Chemical Hood Guidelines.

Hoods Needing Repairs

Chemical hoods with face velocities below 80 fpm or above 120 fpm must be marked with a sign indicating that the hood may not be used for chemical manipulations. Occupational Health and Safety will turn in a work order to repair these hoods if noted from a regular inspection. If a chemical hood is suspected of not working a work order can be generated by the lab personnel. For UKMC this can be done online or by contacting the MCPPD at 3-6281. For Lexington Campus contact your building administrator and/or operator. Once the hood has been repaired, contact OH&S to reevaluate the hood's performance.

If a hood is well outside an acceptable range it will be marked as failing. A red sticker will be place on the closed sash so that no one mistakenly uses the hood while in this condition. This sticker can only be removed by Occupational Health and Safety of PPD.

Safe Work Practices for Laboratory Fume Hoods

When using a chemical hood, one must remember that the hood does not provide absolute containment or absolute protection from the materials in the hood. That may be especially true for toxic airborne contaminants with exposure limits in the low part per billion ranges. However, for most exposures, a properly designed hood in a properly designed room can provide adequate protection by following certain work practices. The work practices listed below are recommended by the American Conference of Governmental Industrial Hygienists in their text: "Industrial Ventilation: A Manual of Recommended Practices."

A chemical Laboratory chemical hood cannot provide complete safety against all events that may occur in the hood, especially for toxic airborne contaminants with an exposure limit in the low part per billion range. For ordinary exposures, however, a properly designed hood in a properly ventilated room can provide adequate protection. Nevertheless, certain work practices are necessary in order for the hood to perform efficiently. The following work practices are required; more stringent practices may be necessary in some circumstances.

1. All operations that may generate air contaminants at levels above the exposure limit must be conducted inside a hood.

Proper sash height for working inside a chemical hood.

2. Keep all apparatus at least 6 inches back from the face of the hood. A stripe on the bench surface is a good reminder.
3. Do not put your head in the hood when contaminants are being generated.
4. Do not use the hood as a waste disposal mechanism except for very small quantities of volatile materials.
5. Excessive storage of chemicals or any apparatus in the hood will impair the performance of the chemical 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 often for air flow (for example using a chemwipe).

Be familiar with your chemical hood monitor and/or alarm.

7. Using hazardous solids (powders) in hood may not be appropriate.
8. Keep the slots in the hood baffle free of obstruction by apparatus or containers. No more that 25% of the bottom slot should be blocked.
9. Minimize foot traffic past the face of the hood.

Sash movement also creates some turbulence.

10. Keep laboratory doors and windows closed (exception: some laboratories are designed for the lab doors to be open).
11. Do not remove hood sash or panels except when necessary for apparatus set-up; replace sash or panels before operating.
12. 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.
13. Use an appropriate barricade if there is a chance of explosion or eruption.
14. If hood sash is supposed to be partially closed for operation, the hood should be so labeled and the appropriate closure point clearly indicated.
15. Where perchloric acid is heated above ambient temperature, vapors may condense within the exhaust system to form explosive perchlorate salts. In such instances, specially designed chemical hood exhaust systems must be utilized. These systems will have dedicated exhausts and a water wash down system, and may be used for perchloric acid digestions only.
16. All chemical hoods should have spill protection lips (at the front of hood and for cup sinks located in the hood).

Fume Hood Guide

Any questions or requests for assistance in evaluation of chemical hoods may be directed to Occupational Health and Safety at 257-3827.

Employee Information and Training

All individuals who work in laboratories who may be exposed to hazardous chemicals must be apprised of the hazards of chemicals present in their work area. THIS INFORMATION AND TRAINING AS OUTLINED BELOW MUST BE PROVIDED BEFORE INITIAL ASSIGNMENT AND BEFORE NEW EXPOSURE SITUATIONS. Equipment necessary for the safe handling of hazardous substances must also be provided. IT IS THE RESPONSIBILITY OF THE PRINCIPAL INVESTIGATOR TO ENSURE THAT ALL LABORATORY WORKERS HAVE BEEN PROPERLY TRAINED. Occupational Health and Safety Department personnel will give presentations concerning **general** lab safety practices several times a year. However, training **specific** for the particular lab where an employee is assigned is the responsibility of that employee's supervisor. The supervisor must determine the frequency of refresher information and training. Also, any one handling wastes that are classified as hazardous must complete Hazardous Waste training. There is usually a monthly classroom offering and an online course. Contact Hazardous Materials Management at 323-6280 of go to /classes.

Mandatory Information Requirements

Laboratory Workers must be informed of the location and availability of the following:

- "Occupational Exposures to Hazardous Chemicals in Laboratories" (the OSHA Lab Standard - See Appendix I)
- Chemical Hygiene Plan
- Reference materials on chemical safety (including material safety data sheets)
- Permissible exposure limits for OSHA regulated substances, or if there is no applicable OSHA standard, the recommended exposure limits or threshold limit value (TLV) may be provided. Contact Occupational Health and Safety at 257-3827 for assistance
- Signs and symptoms associated with exposure to the hazardous chemicals found in the lab

Mandatory Training Requirements

Laboratory Worker training must include:

- How a release of a hazardous chemicals is going to be detected. Examples of detection methods include visual appearance, odor, detector papers, and an understanding of chemical monitoring devices
- Physical and health hazards of the chemicals
- Hazardous waste training
- The work practices, personal protective equipment, and emergency procedures to be used to ensure that the employee protects himself/herself from overexposure to hazardous chemicals

- Medical consultations and examinations

The manufacturer's material safety data sheets (MSDSs) will generally contain much of the above information needed to comply with the information and training requirements of the OSHA Lab Standard. Laboratory supervisors and employees should understand the relevant MSDSs and/or other comparable literature on the hazardous chemicals which are used or stored in their laboratory. Additional training for specific lab hazards must be provided by the employee's supervisor.

Copies of MSDSs may be obtained from the chemical supplier, via Internet here or from Occupational Health and Safety. Individual departments or laboratories are strongly encouraged to maintain their own files of reference materials.

When all this information is covered the lab worker should sign the training record in Appendix 3 of the CHP.

Prior Approval

The responsibility for approval of the acquisition and use of toxic chemical agents rests with the laboratory supervisor. Some materials including toxic compressed gases, radioactive materials, and certain recombinant DNA and biohazards require prior internal (University of Kentucky) or external approval at various levels. If there are questions concerning the need for approvals, appropriate Environmental Health and Safety departments (e.g. Radiation Safety) should be consulted.

Medical Consultation

An opportunity for laboratory workers to receive medical consultation must be provided under the following circumstances:

- if an employee develops any symptoms thought to arise from chemical overexposure
- after an event such as a major spill, leak or explosion which may have resulted in an overexposure
- The departmental or Institutional Chemical Hygiene Officer identifies an overexposure as the result of an evaluation.

Employees or student workers receiving pay that require medical evaluation should follow the same procedure as reporting an accident. The supervisor should be informed and then **UK Workers' Care** contacted by calling **1-800-440-6285**. The **Form IA-1**, Workers' Compensation First Report of Injury, may be completed at the time of the call by UK Workers' Care or by the employee's supervisor. The original Form IA-1, if completed by the supervisor, is to be sent to UK Workers' Care. Forms are available from UK Benefits at 115

Scovell Hall.

If an **employee** is injured and **DOES NOT SEEK MEDICAL ATTENTION** at this time, an Accident-Occupational Injury/Illness Report, Form-6 in Appendix X of the CHP, should be completed.

Note: Any medical examination required by this Plan 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.

Chemical Use by Pregnant Laboratory Workers

Individuals of childbearing potential are warned to be especially cautious when working with chemicals known to reproductive toxins. Some examples of these chemicals are arsenic, benzene, Cadmium compounds, mercury compounds, and toluene, and formamide. These individuals must use appropriate protective apparel (especially gloves) to prevent skin contact. For more information and a complete list of reproductive toxins, please see here.

Chemical Hygiene Officer

The laboratory supervisor shall serve as the "Chemical Hygiene Officer" for her/his laboratories. The designated Chemical Hygiene Officer has the primary responsibility for safety and health within her/his laboratories. The Chemical Hygiene Officer is also responsible for conducting an annual review of the Chemical Hygiene Plan(s) that apply to his/her laboratories.

The Laboratory Safety Specialist of the Occupational Health and Safety Department is designated as the "Institutional Chemical Hygiene Officer" for the University of Kentucky. The Institutional Chemical Hygiene Officer is responsible for coordinating an annual review of the Model Chemical Hygiene Plan and serving as a resource to the individual laboratory Chemical Hygiene Officers.

Special Provisions for Select Carcinogens, Reproductive Toxins &Toxic Chemicals

Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," (see Appendix X for a list of select carcinogens) reproductive toxins and substances that have a high degree of acute toxicity. The following provisions must be included:

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

In addition to the general safety guidelines mentioned in the first section and throughout the Plan, special precautions are needed when handling genotoxins, reproductive toxins and chemicals with a high degree of acute toxicity. A minimum set of guidelines that should be followed is listed below. The lab supervisor should ensure that these and other precautions designed to minimize risk of exposure to these substances are taken.

- Quantities of these chemicals used and stored in the laboratory must be minimized, as should their concentrations in solution or mixtures.
- Work with genotoxins, reproductive toxins and acutely toxic chemicals must be performed within a certified functioning fume hood, biological safety cabinet, ventilated glove box, sealed system, or other system designed to minimize exposure to these substances. (The exhaust air from the ventilation systems may require scrubbing, or other treatment, before being released into the atmosphere.) In all cases, work with these types of chemicals must be done in such a manner that the OSHA permissible exposure limits or similar standards are not exceeded.
- Compressed gas cylinders, which contain acutely toxic chemicals such as arsine, chlorine, and nitrogen dioxide, must be kept in well-ventilated areas.
- The ventilation efficiency of the designated fume hood, glove box or gas cabinet, and the operational effectiveness of mechanical and electrical equipment used to contain or manipulate these special substances should be evaluated periodically by the laboratory personnel at intervals determined by the Laboratory Supervisor. The interval of evaluating systems may vary from weekly to annually depending upon the frequency of usage, quantities employed and level of hazard.
- Each laboratory utilizing these substances must designate an area for this purpose and must sign or mark this area with an appropriate hazard warning. The designated area may be an entire laboratory like BSL-3 and 4 labs. The designated area can be an area of the laboratory or a device such as a fume hood or glove box. The designated area should be marked with a **DANGER, specific agent, AUTHORIZED PERSONNEL ONLY** or comparable warning sign.

- All laboratory workers who work in a laboratory, which has an area, designated for use with genotoxins, reproductive toxins and acutely toxic chemicals must be trained about the deleterious effects of these substances as well as signs and symptoms regarding exposure to these substances, whether or not they actually work with the substance themselves. Training to ensure the safe handling and storage of these

substances is required for those who use these materials. This training is the responsibility of the Laboratory supervisor and must be done prior to the use of any of these materials.

- Laboratory workers working with these chemicals must have access to appropriate protective equipment and clothing (available at no expense to the workers) and must be trained on how to properly utilize the safety equipment.
- Detection equipment may be required in laboratories where chemicals, especially poisonous gases, with a high degree of acute toxicity are utilized.
- For special disposal information, call Hazardous Materials Management (323-6280).
- The designated working area must be thoroughly and appropriately decontaminated and cleaned at regular intervals determined by the Laboratory Supervisor. The interval may be as short as one day or as long as six months depending upon the frequency of usage and level of hazard.
- Special precautions to avoid release and exposure to highly toxic chemicals, genotoxins and reproductive toxins must be utilized. For instance, volatile substances should be kept cool and contained; gases should have properly functioning valves, check valves, regulators, containment which can withstand pressure buildup, and appropriate piping; and dispersive solids should be kept in closed containers, used in places with minimum air currents, and appropriate contact materials should be used to avoid static charging.