ADVISORY NO. 6.1: OSHA LABORATORY STANDARD: UNIVERSITY OF CINCINNATI CHEMICAL HYGIENE PLAN

CHEMICAL HYGIENE PLAN OUTLINE

1.0 GENERAL PRINCIPLES AND RESPONSIBILITIES

1.1 Policy

It is the policy of the University of Cincinnati to provide a safe working environment where employees have a right to know about chemical health hazards associated with their work. This Chemical Hygiene Plan includes policies, procedures, and responsibilities designed to develop in employees an awareness of potentially hazardous chemicals in the workplace and to train employees in appropriate safe working conditions.

1.2 Purpose

As a user of many chemicals, University employees have the responsibility to maintain proper control of the ordering, storage, use and disposal of these materials, thereby preventing adverse affects from occurring to those employees whom are handling, transporting, storing, or disposing of the chemicals. OSHA requires an effective Chemical Hygiene Plan be developed for each laboratory that monitors and controls the ordering, transport and storage of chemicals and disposal of chemical waste. Establish a contingency plan for chemical spills; provide education and protection for employees; provide protection for employees, students, visitors, and volunteers, as well as for property and the environment. Ensures compliance with all related federal, state, and local regulations; and has the goal to minimize risks associated with the use of hazardous materials throughout the institution. It is intended to be the basis for, and to supplement the safety manuals for site specific laboratory operations.

1.3 Responsible Individuals

Each position within the organization has responsibility for supporting good waste practices within the Institution

President
Senior Vice President and Provost
Sr. Asst. Vice President / Administration and Finance
Director / Environmental Health & Safety
Radiation Safety Officer
Vice President
Dean
Director / Department Head / Chairperson
Faculty / Principal Investigator
Safety Officer / Chemical Hygiene Officer
Laboratory Supervisor
Employee / Student
Contractor

1.4 Chemical Hygiene Responsibilities

Responsibility for chemical hygiene rests at all levels including:

Senior Assistant Vice President has ultimate responsibility for chemical hygiene within the institution and must, with other administrators, provide continuing support for institutional chemical hygiene.

Director of Environmental Health and Safety, the administration of University of Cincinnati has the overall responsibility for safety throughout all areas of the institution. To carry out this responsibility, the University has designated the position of Director of Environmental Health &

Safety, who is responsible for overseeing of environmental health and safety throughout the University.

Deans, Directors, Department Heads and Laboratory Supervisors have overall responsibility for chemical hygiene and safety in the various laboratories. The following items describe the elements of management responsibility:

- Appointing Chemical Hygiene Officers for their respective areas of responsibility;
- Ensure that workers know and follow the chemical hygiene plan, that protective equipment is available and in working order, and that appropriate training has been provided;
- Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment;
- Know the current legal requirements concerning regulated substances and review all activities and procedures involving chemical use to ensure compliance with legal requirements and University of Cincinnati policies and procedures. Provide approval before implementation of new procedures;
- Determine the required levels of protective apparel and equipment; and
- Ensure that facilities and training for use of any material being ordered are adequate.

Chemical Hygiene Officers must:

- Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices;
- Monitor procurement, use, and disposal of acutely hazardous chemicals used at the institution;
- See that appropriate audits are maintained;
- Help project directors develop precautions and adequate facilities;
- Know the current legal requirements concerning regulated substances;
- Seek ways to improve the chemical hygiene program; and
- Review effectiveness of Chemical Hygiene Plan annually.

Employees (Laboratory Workers), who are responsible for:

- Planning and conducting each operation in accordance with applicable chemical hygiene procedures; and
- Developing good personal chemical hygiene habits.
- Knowing and following the Chemical Hygiene Plan.

2.0 EMPLOYEE EDUCATION AND TRAINING

Training is a necessary and important part of the Chemical Hygiene Plan. Safety education is provided for University employees upon employment with refresher training at least annually thereafter, or if a new hazardous chemical is added to the work area. All newly hired University of Cincinnati employees are required to attend orientation training which will include: (1) an overview of environmental legislation, (2) risks associated with occupational workplace exposures to chemicals, and (3) the elements and purpose of the Chemical Hygiene Plan. Detailed, site-specific training is conducted by the employee's immediate supervisor who was trained for the task in train-the-trainer sessions by the Chemical Hygiene Officers. This program serves as the basis for employees being educated in chemical safety, in conjunction with pertinent audio-visual resources

and additional written reference materials. All training is documented in writing by attendance records, with copies to be kept as shown in section 12.

Program Institutional Objectives:
Upon completion of the Chemical Hygiene Training Program, the employee will be able to:

- Recognize the chemical labeling and its meaning;
- Locate the SDS notebook in the workplace;
- Locate the health hazard, physical hazard, environmental protection, and special protection sections in the SDS and explain their use;
- Identify the Institutional Chemical Hygiene Officer by name and title;

Additional Departmental Objectives (which may vary by Department):

- Locate potentially hazardous chemicals in the work area;
- Discuss the major parts of the university protocols for the ordering, handling, labeling, storing, and distribution of chemicals;
- Identify the appropriate personal protective clothing in the area and demonstrate its use;
- Demonstrate emergency procedures in the event of a hazardous chemical spill, think **C.L.E.A.N.**; Think **C.L.E.A.N.** Protocol: **C**ontain the spill, if possible. **L**eave the area, if necessary, after isolating the area (i.e. close doors, run exhaust hoods). **E**mergency procedures: eye wash, shower, and medical treatment. **A**ccess the SDS, for information. **N**otify a supervisor, as well as **911** and the Department of Environmental Safety & Health if necessary.
- Describe any appropriate environmental monitoring protocols;
- Be familiar with proper chemical storage requirements;
- Be familiar with proper chemical waste disposal procedures.

The chemical safety material covered includes the following audiovisual materials published by Savant, which are approximately an hour in length and are supplemented by other materials:

> “Hazard Communication: The Chemical Worker's Right to Know”
> “Chemical Safety Measures, Spills and Disposal”
> “Handling Hazardous Chemicals”

Attendance records and short quizzes will document proficiency and be kept in individual employee departmental files, as well as in the Department of Environmental Health & Safety. Other topics covered in the training sessions are:

- The content and location of the University of Cincinnati Chemical Hygiene Plan (CHP)
- OSHA Hazard Communication
- Identification of hazardous chemicals:
  - Location of the master chemical inventory (Department of Environmental Health & Safety) and departmental (or sectional) listings (in work area).
  - Location of Departmental (or sectional) SDS file.
  - Safety Data Sheets (SDS) description & use.
  - Chemical labeling and location information (hazard, carcinogen and other warnings)

- General procedures for handling hazardous chemicals. (Many of these procedures are specific in departmental sessions.)
  - Work practices (including: ordering, labeling)
  - Proper moving, storage, use, and storage
  - Selection and proper use of personal protective equipment and clothing (where appropriate)
  - Permissible Exposure Level (PEL) definitions and references
  - Required environmental monitoring
  - Signs and symptoms of exposure
  - Conditions to avoid
- Environmental protection
  - Emergency procedures
- Documentation of initial and annual training
- Program Evaluation and Improvement

In addition, all laboratory personnel receive a copy of the "Right-to-Know Training Program Guide for Laboratory Employees" as a personal reference source for working with chemicals. The descriptions, definitions, practices and standards contained in the manual are aimed at increasing employee understanding and awareness and at reducing employee exposure to all hazardous substances in the work place.

The Laboratory Division (or section) of the Department of_____may have more detailed or specific CHP's, including lists and amounts of chemicals on hand, and/or specific handling instructions.

Area	Contact Person	Telephone

2.1 Safety Data Sheets (SDS) and Reference Materials

The primary source of reference in determining whether a chemical is hazardous or not is the SDS provided by the chemical supplier. These sheets are physically available in the immediate work area of the laboratory. Copies will be made available to employees for chemicals they work with (at no charge) upon requested.

SDS are maintained by an assigned individual, generally the supervisor, in each laboratory or area where hazardous chemicals are used. The sheets are kept in a bright yellow notebook organized alphabetically by compound, along with an inventory of the chemicals used by the laboratory. Each person in the laboratory is instructed as to where this information is kept. A master file of all MSD sheets for the University is kept by the Department of Environmental Health & Safety, as well as by the Department of Emergency Medicine, and the Cincinnati Fire Department.

A brief description of the sheets and their contents is given for informational purposes. SDS are obtained on each hazardous chemical that is used in this facility. The SDS is obtained from the supplier and/or manufacturer of the product. The SDS is to list all components ofthe product

which comprise 1% or greater of the total mixture. If a component has been identified as a carcinogen, then it should also be listed if it comprises 0.1% or greater of the total product.

A SDS should also contain information relative to the physical and chemical characteristics andthe health hazards of the hazardous chemical. This should also include primary routes of entry (i.e., inhalation, or ingestion). OSHA Permissible Exposure Limit (PEL) or American Conference of Governmental Industrial Hygienists (ACGIH) recommended Threshold Limit Value (TLV) should also be provided.

Other sections of the SDS include safe handling procedures (i.e., hygienic practices, necessary protective measures during repair and maintenance on contaminated equipment, and spill cleanup procedures), control measures (i.e., appropriate engineering controls, work practices, or personal protective equipment), emergency and first aid procedures, as well as name, address and telephone number of the chemical manufacturer, importer, or other responsible party preparing or distributing the SDS who can provide additional information if necessary during an emergency. Finally, thedate of preparation of the SDS or the last change to it must be included. SDS's are to be checked for the required information given in Appendix B and if not complete, a request must bemade of the supplier to provide a corrected SDS.

Reference Materials
Another reference material specifically provided to all laboratory employees is a copy of the "Right-to-Know Training Guide for Laboratory Employees" as a personal reference source for working with chemicals.

Copies of the references listed in section 13, page 21 of this document are available in_____. In addition, many other chemistry reference texts are available to the employees.

2.2 External Resources

Select external organizations may provide additional information or assistance related to Chemical Hygiene issues. **All contact with these agencies and groups should be coordinated through the Chemical Hygiene Officer or the Department of Environmental Health & Safety.**

3.0 ORDERING CONSIDERATIONS

The University of Cincinnati adheres to the small quantity approach for purchasing hazardous substances to ensure both laboratory economy and safety. Chemicals are to be purchased only in the quantities needed on a short-term basis. Exceptions to this rule must have the approval of the Laboratory Director and the Departmental Chemical Hygiene or Safety Officer.

There are many reasons for concluding that "less is better":

- Unused chemicals can constitute as much as 40% of the hazardous waste generated from laboratories.
- Smaller packages are emptied faster, reducing the chance for decomposition of reactive compounds.
- Breakage is substantially less in small package sizes.
- Risk of accident and exposure to the hazardous material is less when handling smaller containers.
- Storeroom space is reduced.

3.1 Chemical Ordering and SDS Requests

- Persons ordering a solid, liquid or gaseous chemical or mixture of chemicals (but not a commercially prepared kit) must check the item against the specific laboratory's SDS index.

If an SDS sheet is not available in the lab, i.e., the chemical has not been used before, the purchase requisition must state "SDS needed" for each chemical that requires one.

Note: Each lab must have a SDS sheet from every supplier from whom any chemical is ordered. If sodium chloride is ordered from both JT Baker and Fisher Chemical the laboratory must have SDS from both suppliers.

- Orders requiring a SDS sheet from the supplier (whether manufacturer or distributor) will be coordinated by the laboratory supervisor and the Department of Environmental Health & Safety.
- SDS will be requested from the supplier when an order is placed by Purchasing. The SDS should arrive with the chemical or be faxed according to our specifications. A copy of **new** SDS's are sent by the Department of Environmental Health & Safety to the ordering department, where it will be filed alphabetically in the SDS binder of the ordering laboratory.
- The Department of Environmental Health & Safety will record the receipt of new SDS's.
- Each laboratory will annually conduct a physical chemical inventory to compare SDS forms and chemicals on hand, and forward it to the Departmental Safety Committee and to the Department of Environmental Health & Safety.

3.2 Labeling System

Most bulk chemical materials (of 1 lb. or >) received from chemical manufacturers are prelabeled with hazard warnings from the National Fire Prevention Association document 704M published code showing hazardous materials (the NFPA diamond) including: blue - health ratings, red - flammability ratings, yellow - reactivity ratings and white - special information. In addition, a similarly colored vertical label described as Hazardous Materials Identification System (HMIS) can be used. Some suppliers provide storage ratings by color of the label. All red labeled materials are stored together, all yellow-labeled materials are stored together and so on. All materials not labeled with NFPA ratings are to be labeled with a consistent system by the assigned individual in the laboratory.

Labeling requirements include the following:

- Do not remove or deface manufacturer's labels.
- Labels must contain the identity of the chemical and appropriate hazard warnings, which usually include health, flammability and reactivity information. The NFPA or HMIS system is to be used as the standard labeling system. This is a simple system of ratings between 0 and 4 in several categories. It is designed so a rating of 0 is of no hazard and a rating of 4 is extremely hazardous. CAS and graphic hazard warning information are usually supplied on the labels of chemicals purchased through commercial sources.

Hazard Ranking Description (NFPA/HMIS)

Health (BLUE)

0	Minimal Hazard	no significant risk to health.
1	Slight Hazard	irritation or minor reversible injury possible.
2	Moderate Hazard	temporary or minor injury may occur.
3	Serious Hazard	major injury likely unless prompt action is taken and medical treatment is given.
4	Severe Hazard	life threatening major or permanent damage may result from single or repeated exposures.

Flammability (RED)

0	Minimal Hazard	materials, which are normally, stable and will not burn unless heated.
1	Slight Hazard	materials that must be preheated before ignition will occur.

	Flammable liquids in this category will have flash points (the lowest temperature at which ignition will occur) at or above 200 F (NFPA Class 111B).
2 Moderate Hazard	material, which must be moderately heated before ignition, will occur, including flammable liquids with flash points at or above 100 F and below 200 F (NFPA Class 11 & Class 111A).
3 Serious Hazard	materials capable of ignition under almost all normal temperature conditions, including flammable liquids with flash points below 73 F and boiling points above 100 F as well as liquids with flash points between 73 F and 100 F (NFPA Classes IB and IC).
4 Severe Hazard	very flammable gases or very volatile flammable liquids with flash points below 73 F and boiling points below 100 F (NFPA Class IA).

Reactivity (YELLOW)

0 Minimal Hazard	materials, which are normally stable, even under fire conditions, and which will not react with water.
1 Slight Hazard	materials, which are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy violently.
2 Moderate Hazard	materials which in themselves are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water.
3 Serious Hazard	materials, which are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation, or materials which react explosively with water.
4 Severe Hazard	these materials are readily capable of detonation or explosive decomposition at normal temperatures and pressures.

4.0 GENERAL PRINCIPLES TO REDUCE EXPOSURE TO CHEMICALS

(Ref 2, 4 & 7) – page 21

- It is prudent to minimize all chemical exposures. Because few laboratory chemicals can be used without any hazard, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals. Skin contact with chemicals should be avoided as a primary rule.
- Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized. For work with substances which present special hazards, special precautions should be taken. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
- Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of fume hoods and other ventilation devices.
- Institute a Chemical Hygiene Program. The chemical hygiene program designed to minimize exposures is mandatory; it is a regular, continuing effort, not merely a standby or short-term activity.

- Observe the PELs, TLVs. The Permissible Exposure Limits of OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded.

4.1 Rules for Safe handling and Use of Chemicals (Ref 2, 4, 7)

- Do not smell or taste chemicals. Apparatus that can discharge toxic chemicals (vacuum pumps, distillation columns, etc.) should be vented into local exhaust devices.
- Inspect gloves and test glove boxes before use.
- Do not allow release of toxic substances in cold rooms or warm rooms, since these have contained recirculated atmospheres.
- Use only those chemicals for which the quality of the available ventilation system is appropriate.
- Do not eat, drink, smoke, chew gum, or apply cosmetics or lip balm in areas where laboratory chemicals are present. Wash hands before conducting these activities.
- Do not store, handle, or consume food or beverages in laboratory areas, storage areas, refrigerators, or use glassware, or utensils that are also used for laboratory operations.
- Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware. Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose.
- Wash areas of exposed skin thoroughly before leaving the laboratory.
- Avoid practical jokes or other behavior that might confuse, startle, or distract another worker.
- Do not use mouth suction for pipetting or starting a siphon.
- Confine long hair and loose clothing.
- Wear shoes at all times in the laboratory. Do not wear sandals, perforated shoes, sneakers, or any shoes made of canvas, or other fabrics.
- Keep the work area clean and uncluttered, with chemicals and equipment properly labeled and stored; clean up the work area on completion of an operation or at the end of each day.
- Ensure that appropriate eye protection, i.e., laboratory goggles, eyeglasses, where necessary, are worn by all persons, in areas where chemicals are handled. Note that contact lenses are not deemed eye protective devices, and their use should be avoided, when possible, in areas where there is a heavy use of chemicals.
- Wear appropriate gloves, i.e., made of material which is selectively protective against the specific chemicals being handled, when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically.
- Development of a respirator program is necessary when air contaminant concentrations are not sufficiently restricted by engineering controls. Elements of the program include (1) occupational medical surveillance (exam), (2) selecting the degree of protection required and the choice of respirator type, (3) fit test and (4) proper maintenance and hygiene of the respirator.
- Use any other protective and emergency apparel and equipment as appropriate (i.e. boots, aprons).
- Disposable lab coats are recommended to prevent chemical contaminants from affecting those who launder cloth lab coats.

- Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation.
- Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) in an unattended operation.
- Use a fume hood selected for operations that might result in release of toxic chemical vapors or dust.

  As a rule of thumb, use a fume hood or other local ventilation device when working with any appreciably volatile substance with a TLV of less than 50 ppm.

  Confirm adequate fume hood performance before use (80-120 fpm face velocity); keep hood closed at all times except when adjustments within the hood are being made. Keep materials stored in fume hoods to a minimum, and do not allow materials to block vents or airflow.

  Leave the fume hood "on" when it is not in active use if toxic substances are stored in it, or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off."
- Be aware of unsafe conditions and see that they are corrected when detected.

4.2 Special Handling Procedures for Highly Toxic or Carcinogenic Materials, Allergens, and Reproductive Hazards

- Allergens (examples: diazomethane, isocyanates, and bichromates): wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.
- Reproductive Hazards (examples: organomercurials, lead compounds, formamide): all employees should handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.
- Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made.
- Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.
- Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

Moderate Chronic or High Acute Toxicity Hazards
(examples: diisopropylfluorophosphate, hydrofluoric acid, and hydrogen cyanide)

- Minimize exposure to these toxic substances by any route using all reasonable precautions.
- Use these precautions for substances with moderate chronic or high acute toxicity used in significant quantities. (Hazard level 2 or greater).
- Use and store these substances only in areas of restricted access with special warning signs.

  Always use a fume hood (previously evaluated to confirm adequate performance with a face velocity of 80-120 linear feet per minute) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance. Trap released vapors to prevent their discharge with the hood exhaust.
- Use personal protection: Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate). Always wash hands and arms immediately after working with these materials.

4.3 Personal Protective Equipment (PPE) and Clothing Selection, Proper Use and

Limitations

(Note: Assistance with matters pertaining to proper selection of protective equipment may be obtained through the Department of Environmental Health & Safety, 556-4968)

- **Equipment:**

  All **biohazard hoods** (biological safety cabinets or biosafety cabinets) are to be inspected annually by a qualified outside vendor, with chemical fume hoods being inspected annually by Facilities Management. Any hood not passing inspection is taken out of service immediately and not used until the hood has passed inspection. It is the responsibility of the employer to purchase the parts and to repair the unit in a timely fashion so as not to endanger the health and well-being of an employee or place the facility at risk. In addition, it is the responsibility of the laboratory department to initiate routine maintenance, such as evaluating and replacing filters.

  Emergency eyewash fountains shall be activated monthly by the individual laboratory to flush the line and verify proper operation. Records (tags, etc.) are maintained in each laboratory.

  Safety showers shall be activated monthly by Facilities Management to flush the line and verify proper operation. Records (tag, etc.) must be maintained in each laboratory.

  Fire extinguishers are inspected monthly by Facilities Management.

- **Clothing:**

  Employees are required to wear gloves when the employee has the potential for direct skin contact with blood, hazardous chemicals, and infectious materials. Masks, eye protection, gloves or chin-length face shields are worn to prevent splashes or sprays of blood, infectious materials, or hazardous chemicals if there is a potential for hand, eye, nose, or mouth contamination. This equipment is located in each respective laboratory.

  Lab coats are to be worn only in the laboratory area and are to be closed to protect the employee's clothing.

  In areas where chemical splashes are potentially great, an impervious apron (generally rubber) appropriate for the task is worn.

  All personal protective equipment is removed immediately upon leaving the work area (or as soon as possible) and placed in an appropriate "clean storage area" or laundry hamper if soiled. Lab coats may be laundered on site.

  Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer provides, at no cost to the employee, the proper respiratory equipment. The respirators are selected and used in accordance with the requirement of 29 CFR 1910.134 (see Advisory 11.1 or www.osha.gov/comp-links.html).

5.0 HOOD SAFETY

Instructions for Proper Use (Ref 2, 4 & 7)

- Prior to fume hood usage, become familiar with the locations of the nearest exit, emergency shower, eye-wash station and fire extinguisher, and be sure that the pathways to these locations are unobstructed.
- Wear personal protective equipment, e.g., goggles, gloves and lab coats. No hood can prevent all skin absorption. Fume hoods are by no means a replacement for protective wear and good laboratory practices.
- Keep experimental apparatus, and sources of contaminants within the hood, at a distance of at least six inches behind the sash opening to avoid disruption of airflow.

- Avoid cross drafts at the face of the hood, as these will disturb the direction of airflow. Even someone moving quickly across in front of the hood will create sufficient current to cause turbulent activity, which might bring the airborne contaminants into your breathing zone.
- Keep the hood uncluttered; the more cluttered a hood, the more airflow is disturbed. Try not to store chemicals in the hood, aside from small working quantities. Storage of materials/equipment in the hood should be kept to a minimum. Elevate equipment a few inches if possible to allow airflow across the work surface. No peroxide-forming compounds, i.e., ether, may be stored in a hood unless the hood is explosion-proof.
- Where open flame is used, storage of flammable liquids in the hood should be avoided. Flammable liquids should be stored in a safety cabinet or safety room when not in immediate use.
- The vertical sliding sash is used to serve as a physical barrier in the event of chemical splashes or explosions within the hood. For this reason, the sash should be kept below eye level where a minimum face velocity (80-fpm) is achieved. A range of 80-120 fpm face velocity is desired with the higher velocity used with noxious materials or where the possibility of traffic past the hood would disturb the airflow.
- Keep your head outside the face of the hood; keep sash closed when the hood is not attended.
- The work surface of the hood should be thoroughly cleaned after completion of all experiments and immediately following any chemical spills.
- Remain alert to changes in airflow and report hood failure to Work Control (558-2500 or 556-6404).
- Report all emergencies to the Department of Environmental Health & Safety (556-4968).

6.0 STORAGE, GENERAL CONSIDERATIONS

- Every chemical in the lab should have a definite storage place and should be returned to that location after use.
  - Only store small, sealed amounts of chemicals on bench tops.
  - Do not store chemicals in hoods unless they give off toxic or noxious vapors. Storage may interfere with the airflow in the hood.
  - Attention must be given to shelf lives of chemicals to prevent degradation to unstable or explosive states.
- Do not store food in the refrigerators in which chemicals are stored.
- The chemicals stored in the labs shall be inventoried annually. All unnecessary items, designated as waste, shall be listed with name, manufacturer, and amount remaining (see Appendix A: Waste Label). The Department of Environmental Health & Safety (556-4968) should be contacted for disposal procedures.
- Quantities of flammable liquids greater than one liter should be stored in metal or other break resistant containers. Larger quantities should be stored in flammable storage cabinets with self-closing doors or flammable storage rooms.
- When refrigerated storage of volatile chemicals that may produce flammable or explosive vapors is necessary, an approved "explosion proof" refrigerator must be utilized.
- Cylinders of compressed gases should be strapped or chained to a bench or wall and capped

when not in use. Routinely check valves and casings for corrosion and possible malfunctions. Leaking cylinders should be immediately brought to the attention of the area supervisor, and if the leak is serious in nature, Work Control should be contacted (558-2500 or 556-6404) as well as 911.

6.1 Specific Storage Guidelines for Hazardous Materials

Refer to select incompatible chemical lists before storing different chemicals. Many chemicals can be safely stored together, but others generally should not. The general groupings **NOT TO BE MIXED** are as follows:

Acids	Flammables
Bases	Oxidizers
Cyanides	Organic Acids
Heavy Metals	Organic Bases

Many chemicals if mixed will potentially create heat or other dangerous reactions. Examples of chemical classes include:

- Carcinogens or suspect carcinogens must be stored in a secure area and clearly marked **"CARCINOGEN"** or **"SUSPECT CARCINOGEN".**
- Highly toxic chemicals must be stored in sealed jars clearly marked as **"HIGHLY TOXIC-POISON"** and stored in a clearly marked and separate area from other reagents in laboratory or cold room.
- Acids:
  Store large bottles on low shelves or in acid cabinets. Segregate acids from active metals such a sodium, potassium, or magnesium.

  Segregate oxidizing acids from organic acids, flammable and combustible materials.

  Segregate acids from chemicals that could generate toxic or flammable gases upon contact, such as sodium cyanide, iron sulfide, and calcium carbide.
- Bases:
  Segregate bases from acids and other reactive compounds.
- Flammables:
  Store in approved safety cans or cabinets. Segregate from oxidizing acids and oxidizers. Keep away from any source of ignition: heat, sparks, or open flames.
- Oxidizers:
  Store in a cool, dry place. Keep away from combustible and flammable materials. Keep away from reducing agents such as zinc, alkaline metals, and formic acid.
- Water Reactive Chemicals:
  These are generally reactive metals, not often used by general laboratories. Store in a cool, dry place away from any water source. Have a Class D fire extinguisher available in case of fire.
- Pyrophoric Substances:
  Materials that will react with air to ignite when exposed, e.g., white phosphorus. Store in a cool, dry place-making provisions for an airtight seal.
- Peroxidizable Chemicals:
  (e.g., ethyl ether, tetrahydrofuran)
  Store in airtight containers with receiving, opening, and disposal dates. Some materials come with metal mesh braid in the chemical to reduce this peroxide formation hazard. If kept for more than three months after opening, the chemical should be tested for peroxide formation.

7.0 SPILLS AND ACCIDENTS

Note: For spills of serious acute nature contact the Department of Environmental Health & Safety (556-4968) and Emergency Dispatch (911).

Liquid spills should be GENERALLY handled as follows using the **C.L.E.A.N.** plan:

Contain the spill, if possible.
Leave the area, if necessary.
Emergency procedures: utilize available eye wash stations and/or safety shower, and seek medical care.
Access SDS, for information.
Notify a supervisor.

More specific recommendations:

- Look up Safety Data Sheet (SDS) located in the laboratory or in the Department of Environmental Health & Safety and follow instructions accordingly. SDS are also located in the Cincinnati Fire Department. SDS are also available at:

  http://www.enviro-net.com/technical/msds/ or www.ilpi.com/msds/index.chmtl

- Confine or contain the spill to a small area. Do not let it spread.
- For small quantities of inorganic acids or bases, use a neutralizing agent, e.g., sodium carbonate and sodium bisulfide or an absorbent mixture, e.g., soda ash or diatomaceous earth. For small quantities of other materials, absorb the spill with non-reactive material, e.g., vermiculite, dry sand, or absorbent "pillows".
- For larger amounts of inorganic acids and bases, neutralize the spill, then flush with large amounts of water.
- Mop up spill, wringing out the mop in a sink or a pail equipped with rollers.
- Carefully pick up and clean any cartons or bottles that have been splashed or immersed.
- Vacuum the area with a vacuum cleaner approved for the material involved.
- Dispose of all residues according to safe disposal procedures with the help of the Department of Environmental Health & Safety.

8.0 DISPOSAL OF HAZARDOUS AND NON-HAZARDOUS CHEMICALS

(Note: Refer to Environmental Health & Safety Manual Advisories 7.0 - 7.5 Series)

- Drain Disposal (Guidelines - NFPA #2 or less)
  Note that chemicals classified as RCRA wastes, as defined in 40CFR261, should not be drain-disposed, but instead collected for proper disposal.

  Only water-soluble substances should be disposed of in a lab sink.

  - A compound is considered water-soluble if it dissolves to the extent of at least 3%, judged by whether 0.2 ml or 0.1 g dissolves in 3 ml of water in a test tube.
  - The quantities disposed of to the drain must be limited generally to not more than a few hundred grams or milliliters at one time and should be flushed with at least 100 volumes of excess water.

    Strong acids and bases should be neutralized to between pH 6-8 and diluted prior to sink

disposal. If dilution after neutralization is not possible then the concentrated neutralized mixture may be flushed with excess water at rates not exceeding 50 ml/minute.

- Non-Drain Disposal (Guidelines - NFPA #3 & #4)
  The following are NOT drain disposable (refer to Contractor Disposal Procedures described in section C.)
  - Substances with boiling points less than 50°C generally should not be poured down the drain, regardless of solubility, because excess vapor concentrations may result in fire or explosion in the sewer system.
  - Mixtures and non-soluble compounds should not be put down the drain because they may cause blockage or excess vapor concentrations that may result in fire or explosion in the sewer system.
  - Acutely toxic or malodorous substances should not be put down the drain.
  - Hydrocarbons, halogenated hydrocarbons, and nitro compounds containing more than five carbon atoms.
  - Explosive organic chemicals such as azides and peroxides.
  - Water soluble polymers that could form intractable gels in the sewer system.
  - Organic chemicals that are highly toxic in concentrations greater than unavoidable traces.
- Contractor Disposal Procedures
  Hazardous chemical waste, which cannot be disposed by any of the above options, will be disposed of by a commercial contractor as coordinated by Environmental Health & Safety. These materials will be collected and disposed on a periodic basis providing the following guidelines are met:
  - Segregate waste. Do not create mixtures with following exceptions:

    Organic Solvents not containing halogens may be combined with each other. It is often possible to dispose of these materials by incineration. Organic solvents containing halogens may be combined with each other.
  - All individual containers of hazardous waste must be clearly identified and labeled using the on-line label found at: (http://ehs2.uc.edu/chemical/). List only generic chemical names (product names are useless for disposal purposes).
  - Ensure that proper containers are used for the hazards inherent to each chemical waste. Repackage all materials which, are cracked, leaking, corroded, or poorly sealed in a secure secondary container.
- Disposal of Non-hazardous Waste Chemicals
  - If a solid chemical waste is not considered hazardous by the above definition, it may be disposed in the regular trash in SECURE containers. If unsure, call Environmental Health & Safety (556-4968).

9.0 MEDICAL PROGRAM

9.1 First Aid

- First Aid kits are to be available in each laboratory.
- Accidents

- **Eye contact**: promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention immediately. (Emergency Dept - 558-4571)
- **Ingestion**: encourage the victim to drink large amounts of water. Seek medical attention immediately as noted above.
- **Skin contact**: promptly flush the affected area with water and remove any contaminated clothing; use a safety shower when contact is extensive.

  Concentrated Acids or Bases: Remove clothing immediately and get into safety shower/sink with excess flowing water. Seek medical attention immediately.
- Identify the chemical.
- Refer to the SDS sheet and follow any additional instructions.
- Call Poison Information, if necessary. 558-5111
- Escort the exposed person to the University Hospital Emergency Room.
- If a spill or incident represents a hazard to other building occupants, notify Environmental Health & Safety (556-4968) and 911.
- All incidents or near misses are to be reported to the area supervisor immediately, and Environmental Health & Safety. Accident reporting form is available at:_____

9.2 Medical Consultation

All employees needing non-emergency medical attention should use UC Health: 3200 Burnet Avenue, South Entrance, 513-585-6600 7:30 a.m.-4:00 p.m., Monday through Friday. After 4:00 p.m., weekends, and holidays, report to the Emergency Department (558-5700).

The Director of UC Health will provide overall medical direction for the occupational health care of exposed employees covered under this chemical hygiene plan.

All medical examinations and consultations are performed by or under the direct supervision of a licensed physician without cost to the employee, without loss of pay, and at a reasonable time and place. A physician experienced in occupational medicine is used whenever possible.

- The employee is sent for medical evaluation:
  - Whenever signs and symptoms associated with a hazardous chemical develop.
  - When environmental monitoring reveals an exposure level routinely above the action level.
  - Whenever an event takes place in the work area such as a spill, leak, or explosion resulting in hazardous chemical exposure.
- The University workplace or laboratory supervisor provides the following information to the physician:
  - Identity of the hazardous chemical(s) to which the employee may have been exposed.
  - A description of the conditions under which the exposure occurred, including quantitative exposure data (if available).
  - A description of the signs and symptoms of exposure.
  - A copy of the SDS for the chemical(s) involved.
- The physician provides a written opinion that will not reveal a specific finding of diagnosis

unrelated to the exposure but will include:

- Any recommendations for further medical follow-up.
- Results of the medical examination and any associated tests.
- Any medical conditions that may be revealed in the course of the examination that may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace.
- A statement by the physician that the employee has been informed of the consultation/examination results and any medical condition that may require further examination or treatment.

Employee medical records will be maintained at UC Health. Copies of the physician's written opinion will be provided for the employee's personnel file.

10.0 EXPOSURE EVALUATIONS AND MONITORING

- Exposure Evaluations:
  An exposure evaluation will be conducted for employees who, as a consequence of a laboratory operation, procedure or activity, reasonably suspect or believe they have sustained an overexposure to a toxic substance. The exposure evaluation shall be conducted by Environmental Health & Safety. It is the employee's responsibility to report the exposure incident immediately to their immediate supervisor for evaluation.

  The employer shall also consider whether it is appropriate to provide an exposure evaluation in the case of a possible exposure in excess of an ACGIH TLV for a substance which has no associated OSHA PEL.
- Environmental Monitoring:
  Air monitoring for select chemicals will be provided as needed by the Department of Environmental Health & Safety (556-4968). Requests for routine scheduled monitoring of select chemicals (i.e. formaldehyde), as required by OSHA, should be initiated by the departmental laboratories.

11.0 DEFINITIONS

Acute
An adverse effect with symptoms of high severity coming quickly to a crises.

C
Ceiling value for exposure limits.

Carcinogen
A substance capable of causing cancer and is regulated by OSHA or is identified by IARC or NTP as a carcinogen or potential carcinogen.

Chemical Agents
A wide variety of materials (fluids) that have a high potential for body entry by various means. Some are more toxic than others and require special measures of control for safety and environmental reasons.

Chronic
An adverse effect with symptoms that develop slowly over a long period of time or that frequently recur.

Combustible
Able to catch on fire and burn.

DOT
Department of Transportation

EPA
Environmental Protection Agency

Exposure Limits
The concentration in workplace air of a chemical thought to be acceptable. Most workers can be exposed at these levels or lower without harmful effects. The exposure limit terms in common use are TLV, STEL or C.

Flammable
Capable of being easily ignited and of burning with extreme rapidity.

Infectious Agents
Sources that cause infections either by inhalation, ingestion, or direct contact with the host material.

Laboratory Scale
Work with chemicals that can easily and safely be manipulated by one person excluding the commercial production of chemicals for sale.

Laboratory Use
A workplace where relatively small quantities of hazardous chemicals are used on anon-production basis.

LC 50
The concentration of a substance in air that causes death in 50% of the animals exposed by inhalation. A measure of acute toxicity.

LD 50
The dose that causes death in 50% of the animals exposed by swallowing a substance. A measure of acute toxicity.

Mutagen
Capable of changing cells in such a way that future cell generations are affected. Mutagenic substances are usually considered suspect carcinogens.

OSHA
Occupational Safety and Health Administration, the regulatory branch of the Department of Labor concerned with employee safety and health.

Overexposure
An employee exposure in excess of the permissible exposure limits (PELs) for anOSHA-regulated substance.

PEL
Permissible Exposure Limit. This is the legally allowed concentration in the workplace that is considered a safe level of exposure for an 8-hour shift, 40 hours per week.

pH
A measure of how acidic or basic (caustic) a substance is on a scale pH 1 to 14. A pH of less than 7 (1-6) indicates that a substance is acidic; and a pH of greater than 7 (8-14) indicates that substance is basic.

Physical Agents

Workplace sources recognized for their potential effects on the body. Heat exposure or excessive noise levels are examples of this risk group.

Regulated Area
A laboratory, an area of a laboratory or device such as a laboratory hood for which access is limited to persons who are aware of the hazards of the substances in use and the precautions that are necessary.

Sensitizers
Agents whose repeated exposure over time creates an allergic reaction at some point in time.

SDS
Safety Data Sheet (www.ilpi.com/msds/index.chmtl)

STEL
Short-term exposure limit. (STEV – short-term exposure value sometimes used).

Sterility
Changes made in male or female reproductive systems resulting in inability to reproduce.

Teratogens
A substance that causes a deformity in newborns if a significant exposure exists during pregnancy.

Toxic Substance
Any substance which is: 1) Regulated by OSHA in 29 CFR Part 1910, Subpart Z (www.osha.gov/comp-links.html) or (2) is found to be a carcinogen or potential carcinogen as defined in this paragraph.

TLV
Threshold Limit Value. The amount of exposure allowable for an employee in an 8-hour day. Sometimes expressed as TLV-TWA or threshold limit value - time weighted average.

12.0 RECORD KEEPING

The laboratory has established and maintained an accurate record for each employee of environmental monitoring, medical consultations, and examinations, including test or written opinion required. **All records are kept, transferred, and made available in accordance with 29CFR1910.20, which is length of employment plus thirty years.**

- The following records are maintained by the Department of Environmental Health & Safety.
  - Inventory and amount records for acutely hazardous substances. (Individual laboratories keep these lists as well.)
  - Environmental monitoring.
  - Laboratory safety audits.
  - Training documentation and attendance.
- UC Health maintains employee medical records.
- Accident records are retained by:
  - Environmental Health & Safety
  - Employee Labor Relations (Workers Compensation)
- Departmental records are kept of:
  - Inventory and amount records for acutely hazardous substances.
  - Environmental monitoring.
  - Laboratory safety audits.

- Training documentation and attendance requests for SDS.

13.0 REFERENCES

The CHP was written in accordance with National Research Council recommendations, as well as federal and state standards.

U.S. Department of Labor, final rule part II. Federal Register, 29 CFR Part 1910.1450 Occupational Exposure to Hazardous Chemicals in Laboratories, Wednesday, January 31, 1990 (www.osha.gov/comp-links.html).

National Research Council. Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, 1981.

National Research Council. Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, 1983.

CRC Handbook of Laboratory Safety, 3rd Ed., CRC Press, 1990.

Threshold Limit Values and Biological Exposure Indices for 1990-1991, American Conference of Governmental Industrial Hygienists, Cincinnati, OH, 1990.

Terry Jo Gile, A Model Chemical Hygiene Plan for Laboratories, Clinical Laboratory Management Association, Inc., 1990.

Stricoff, R. S. and Walters D. B., Laboratory Health and Safety Handbook, John Wiley & Sons, Inc., 1990.

Laboratory Safety and Right to Know Compliance Source book, Pathfinder Associates, Inc., 1990.

OSHA Instruction CPL 2-2.38C, U.S. Department of Labor, Office of Health Compliance Assistance, Oct. 22, 1990.

14.0 APPENDIX A

Laboratories must not only have MSD sheets on all chemicals and from all suppliers, but they must verify that MSD sheets contain the information cited below.

Safety Data Sheet Checklist

You must ensure that each SDS contains the following information:

- √ Product or chemical identity used on the label.
- √ Manufacturer's name and address.
- √ Chemical and common names of each hazardous ingredient.
- √ Name, address, and phone number of hazard and emergency information.
- √ Preparation or revision date.
- √ The hazardous chemical's physical and chemical characteristics, such as vapor pressure and flashpoint.
- √ Physical hazards, including the potential for fire, explosion, and reactivity.
- √ Known health hazards.
- √ OSHA permissible exposure limit (PEL), ACGIH threshold limit value (TLV) or other exposure limits.
- √ Emergency and first aid procedures.
- √ Whether OSHA, NTP or IARC lists the compound as a carcinogen.
- √ Precautions for safe handling and use.
- √ Control measures such as engineering controls, work practices, hygienic practices or personal protective equipment required.
- √ Primary routes of entry.
- √ Procedures for spills, leaks, and clean up.

14.0 APPENDIX B

Sample letter requesting additional SDS information:

Date

ANY Chemical Co.
123 First Street
City, ST 12345

We are seeking additional information, in order to comply with the OSHA Hazard Communication Standard (29 CFR 1910.1200). Our SDS on your product _____ stock number_____, dated / / appears to be missing the following:

Please send an updated SDS sheet to:

Dr. William Johnson
University of Cincinnati
P.O. Box 670900
Cincinnati, OH 45267-0900

Thank you for your cooperation. If you have any questions concerning this request, please contact, Dr. Johnson at
(513) 558-0000.

Yours truly,

William Johnson, Ph.D.
Director of Chemistry