

VERSION 2.0

JANUARY 2, 2018



UNC CHARLOTTE

*Environmental Health and Safety*

## CHEMICAL HYGIENE PLAN

UNC CHARLOTTE  
9201 UNIVERSITY CITY BLVD., CHARLOTTE, NC  
28223

## **Hazardous Material Emergency – Contact Phone Numbers**

Emergency – Contact Campus Police 911 from campus phone or 704-687-2200

Campus Police will make contact with Charlotte Fire Department and Environmental Health and Safety (EHS) Office. Hazardous Materials Response team will respond if conditions warrant.

Non-emergency - Contact department laboratory manager or EHS Office / Chemical Hygiene Officer at 704-687-1111.

## TABLE OF CONTENTS

1.0	<a href="#">Introduction</a>	1
2.0	<a href="#">Chemical Safety and Hygiene Responsibilities</a>	1
3.0	<a href="#">Laboratory Safety Plans</a>	3
4.0	<a href="#">The Laboratory Facility</a>	3
4.1	Housekeeping	3
4.2	Maintenance	4
4.3	Signage	4
4.4	Safety Equipment	4
4.5	General Ventilation	4
4.6	Local Exhaust Ventilation (Fume Hoods)	4
5.0	<a href="#">Chemical Receiving, Distribution and Storage</a>	5
5.1	Receiving	5
5.2	Chemical Distribution	6
5.3	Chemical Storage	6
5.4	Chemical Labeling	8
6.0	<a href="#">Principles and Procedures for Working with Laboratory Chemicals</a>	8
6.1	General	8
6.2	Avoidance of "routine" exposure	9
6.3	Equipment and glassware	9
6.4	Personal habits	9
6.5	Personal and protective apparel	9
6.6	Personal protective equipment	9
6.7	Planning	10
6.8	Unattended operations	10
6.9	Use of fume hood/s	10
6.10	Working alone	11
6.11	Working with Allergens and Embryotoxins	11
6.12	Working with Particularly Hazardous Substances (including "Select Carcinogens")	11
6.13	Hydrofluoric Acid Safety	12
6.14	Animal Work with Chemicals of High Chronic Toxicity	13
7.0	<a href="#">Spills and Accidents</a>	13
7.1	Minor spills with human contamination	13
7.2	Minor spills with no human contamination	14
7.3	Major spills	14
8.0	<a href="#">Personal and Environmental Monitoring</a>	14
9.0	<a href="#">Medical Program</a>	14
10.0	<a href="#">Training Program</a>	15
11.0	<a href="#">Inspections</a>	16
12.0	<a href="#">Waste Disposal Program</a>	16
13.0	<a href="#">Records</a>	17

## List of Appendices

<a href="#">Appendix A</a>	Common Flammables, Combustibles, and Peroxide Formers
<a href="#">Appendix B</a>	Common Volatile Toxics
<a href="#">Appendix C</a>	Common Inorganic Acids (Oxidizing and Non-oxidizing)
<a href="#">Appendix D</a>	Common Organic Acids
<a href="#">Appendix E</a>	Common Liquid Bases / Alkaline Chemicals
<a href="#">Appendix F</a>	Common Oxidizers (excluding acids) and Reactives
<a href="#">Appendix G</a>	Common Non-Volatile Toxics
<a href="#">Appendix H</a>	Common Pyrophorics and Water Reactives
<a href="#">Appendix I</a>	Common Dry Solids
<a href="#">Appendix J</a>	Particularly Hazardous Substances
<a href="#">Appendix K</a>	Incompatible Chemicals

## 1.0 Introduction

The University Chemical Hygiene Plan sets forth procedures, work practices and equipment intended to protect laboratory workers from safety and health hazards presented by the laboratory use of hazardous chemicals. The basis for the Chemical Hygiene Plan is the Occupational Safety and Health Administration (OSHA) standard [1910.1450 - Occupational exposure to hazardous chemicals in laboratories](#), hereafter referred to as the "Lab Standard"). Definitions of key terms used in the Chemical Hygiene Plan can be found in the definitions section of the OSHA Lab Standard - 1910.1450 (b). A review of the definitions for "hazardous chemical," "laboratory," "laboratory scale," and "laboratory use of hazardous chemicals" confirms that the Lab Standard applies to most University laboratories.

All University laboratory workers must be made aware of the Chemical Hygiene Plan and should review its contents. The University Chemical Hygiene Plan includes:

1. The assignment of responsibilities under the plan, in addition to those set forth in the University Environmental Health and Safety (EHS) Policy (Policy Statement 703);
2. General principles for working with laboratory chemicals;
3. Guidelines for the development of laboratory facilities;
4. Standard Operating Procedures (SOPs) for the use of University laboratory facilities;
5. Basic rules and procedures for working with chemicals; and
6. Appendices that provide information useful in compliance with the Lab Standard and this document.

The University Chemical Hygiene Plan shall be reviewed at least annually by the EHS Chemical Hygiene Officer (CHO) and revised as needed.

## 2.0 Chemical Safety and Hygiene Responsibilities

In addition to those defined by the University Policy Statement 703, the following individuals assume responsibility for the implementation of this plan as described below.

1. The EHS Director is responsible for:
  - a. Planning and recommending EHS programs which comply with all federal, state and local laws and regulations;
  - b. Overseeing the activities of the CHO;
  - c. Ensuring implementation of the University Hazardous Waste Management Program.
2. The CHO, under the direction of the EHS Director, has responsibility to:
  - a. Develop the Chemical Hygiene Plan and program;
  - b. Work with administrators, principal investigators and laboratory workers to implement appropriate chemical hygiene policies and practices, including assistance with laboratory specific safety plans;
  - c. Monitor procurement, use, and disposal of chemicals used in the lab;
  - d. Conduct or oversee appropriate laboratory inspections to assure compliance with the Chemical Hygiene Plan;
  - e. Help project managers plan adequate laboratory facilities as needed;

- f. Maintain the central Safety Data Sheet (SDS) file, which is mandated by the OSHA Lab Standard;
  - g. Know the current legal requirements concerning regulated substances; and
  - h. Annually review the chemical hygiene program and seek ways to improve it.
3. The Department Chair or Manager has overall responsibility for chemical hygiene within their respective department.
4. The Principal investigator (PI) / Lab Manager has overall responsibility for chemical hygiene in the laboratory including responsibility to:
  - a. Be familiar with the regulations and University policies and programs, which pertain to his or her laboratory;
  - b. Ensure that a laboratory safety plan (see section 3.0) is developed for the laboratory, reviewed by all personnel and is up to date with current laboratory practices;
  - c. Ensure that workers know and follow the chemical hygiene rules that protective equipment is available and in working order, and that appropriate training has been provided;
  - d. Provide regular, informal chemical hygiene and housekeeping inspections, including routine inspections of emergency equipment (in addition to, or in conjunction with, Laboratory reviews performed by EHS);
  - e. Produce an annual chemical inventory list utilizing the [UNCC Chemical Inventory Form](#), which includes all chemicals present in their laboratory spaces;
  - f. Know the current legal requirements concerning regulated substances used in their laboratories;
  - g. Determine (with the assistance of EHS) the required levels of protective apparel and equipment that ensure its availability to laboratory personnel and enforce its use;
  - h. Request assistance from EHS as needed;
  - i. Allocate or secure funds for health and safety improvements as required for the conduct of new operations;
  - j. Ensure that facilities and training for use of any material being ordered are adequate;
  - k. Ensure that the laboratory is properly decommissioned, in conjunction with the EHS Office, after the completion of research activities and prior to departure from the University.
5. Laboratory workers are responsible for:
  - a. Understanding and complying with University policies and programs, which pertain to his or her laboratory, work, including the planning and conducting of each operation in accordance with the University Chemical Hygiene Plan;
  - b. Using appropriate personal protective equipment as required by the operation being conducted;
  - c. Refraining from the operation of any equipment without authorization and proper instruction;
  - d. Following both oral and written instructions from his or her PI or supervisor;
  - e. Requesting information and training when unsure how to handle a hazardous chemical or procedure;
  - f. Reporting to his or her PI or supervisor any unsafe conditions, accidents or chemical exposures; and

- g. Developing and using good personal chemical hygiene habits.

### 3.0 Laboratory Safety Plans

The PI or lab manager shall ensure that their laboratory has a laboratory specific safety plan. EHS has developed safety tools that can be used to develop a laboratory specific safety plan.

A **Laboratory Safety Plan** including [Chemical Guidance Documents](#) provided by EHS that is pertinent to the individual laboratory. Some examples of these guidance documents include

- Completed Lab Safety Plan template specific to the lab (in development)
- [Chemical Standard Operating Procedures](#), including but not limited to:
  - Diethyl Ether
  - Ethidium Bromide
  - Hydrogen Peroxide (>30%)
  - Nitric Acid
  - Chloroform
  - Formalin and Paraformaldehyde
  - Sulfuric Acid
  - Acrylamide
- Experiment Standard Operating Procedures not provided on EHS website.

### 4.0 The Laboratory Facility

The laboratory facility should have adequate, well-ventilated stockrooms/storerooms, laboratory hoods, sinks and other safety equipment, including eyewash fountains and drench showers. There should be an alarm system to alert occupants to fires and other incidents in all parts of the facility, including isolation areas such as cold rooms. Chemical hygiene related equipment (hoods, etc.) should be periodically inspected and repaired where applicable. The work conducted and its scale must be appropriate to the facilities.

#### 4.1 Housekeeping

Floors should be cleaned regularly. Stairways and hallways should not be used as storage areas. Access to exits, emergency equipment, and utility controls should never be blocked. The work area should be kept clean, and chemicals and equipment should be properly stored. Lab workers should always keep their immediate work area uncluttered, and clean it up upon completion of an operation and at the end of each day.

#### 4.2 Maintenance

Equipment should be maintained in serviceable condition. Preventive maintenance schedules should be established for equipment as required. Machine guards and shielding should remain in place, and be replaced if removed for maintenance or repairs.

### 4.3 Signage

The following signs should be posted conspicuously:

- Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers should be posted on entrance door
- Warnings at areas or equipment where special or unusual hazards exist (such as designated areas for the storage of Hazardous waste).

### 4.4 Safety Equipment

Safety and emergency equipment should be available. This includes (where applicable):

- Drench-type safety shower;
- Eyewash fountain;
- Fire extinguisher;
- Fire alarm and telephone for emergency use must be easily accessible to each lab;
- Chemical Spill Kits pertinent to the chemicals used in each area;
- First Aid Kits.

### 4.5 General Ventilation

The general ventilation system should have air intakes and exhausts located to avoid the intake of contaminated air. This system must provide a source of fresh air for occupants and for replacement of air exhausted by local ventilation devices (hoods), but it should not be relied on for protection from toxic substances released into the laboratory.

It must ensure that laboratory air is continuously replaced (4-12 room air changes/hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control), preventing the increase of air concentrations of toxic substances. General airflow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas. Air diffusers and grilles should be designed and located such that air is directed over laboratory personnel and towards the lab exhaust, moving contaminated air away from workers' breathing zones. The static air pressure within the lab must be less than that of adjacent spaces, such that airflow is into the laboratory from non-laboratory areas. Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate. Quality and quantity of ventilation should be evaluated on installation, regularly monitored and reevaluated whenever a change in local ventilation devices is made. Problems with the general ventilation of the laboratory should be reported to Facilities Management.

### 4.6 Local Exhaust Ventilation (Fume Hoods)

The chemical fume hood is an important engineering control in the reduction and prevention of exposure of laboratory workers to hazardous materials found in the laboratory. It is an effective means of capturing toxic, carcinogenic, offensive or flammable mists, vapors, fumes or dusts that would otherwise be released into the laboratory environment. Hoods can also provide a physical containment for laboratory operations.



Laboratory hoods should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use. Airflow into and within the hood should not be excessively turbulent; hood face velocity should be adequate (typically 80-100 linear feet per minute). Laboratory fume hoods will be inspected and certified by EHS. Fume hoods not meeting the required face velocity will be removed from service, as required by the Lab Standard.

Laboratory hoods should not be used for chemical storage. Excessive loading of the bench significantly detracts from hood performance. Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed. Allowing volatile chemicals to evaporate within the hood is an unacceptable means of disposal.

When necessary, equipment in hoods should be fitted with traps, condensers or filters to remove hazardous gases, vapors or dusts and prevent their release to the environment. Operations should be performed at least six inches from the face of the hood to prevent interference from cross drafts (a stripe on the bench surface is a good reminder). Place large objects in the hood up on blocks to allow airflow under them. When the hood is in use, the sash should be lowered as far as practical. The sash should not be raised above the 100 feet per minute (fpm) mark when hazardous substances are being used in the hood. The sash can protect workers from chemical splashes and sprays, as well as fires and minor explosions.

When a hood is found to be out of order, all hazardous chemicals should be capped or removed. Laboratory personnel should contact Facilities Management as soon as possible for repair. The hood should be clearly labeled as "Out of Order" until repaired.

Do not use perchloric acid in an ordinary laboratory fume hood. When perchloric acid is heated above ambient temperature, vapors may condense within the exhaust system and form explosive perchlorates. To use perchloric acid, a special perchloric acid hood with a dedicated exhaust and wash down system is required. Identify perchloric hoods with appropriate signage, and do not use them as general-purpose fume hoods. Contact EHS for additional considerations, procedures and precautions for the selection and use of perchloric acid fume hoods.

## 5.0 Chemical Receiving, Distribution and Storage

### 5.1 Receiving

Before a substance is received, the individual who requisitioned the material must obtain information on proper handling, storage, and disposal. They must be aware of all hazardous properties of the material and determine if the facilities where it will be used and the training of the personnel involved are adequate. Often the Safety Data Sheet (SDS) will provide the required information. An accessible copy of the SDS must be kept in the Laboratory/Department and one copy forwarded to EHS. Receiving personnel should be advised that the material has been ordered and should be familiar with the appropriate DOT shipping labels. No container will be accepted without an appropriate identifying label.

The label should contain the following information (as a minimum):

1. Name, address and telephone Number of the chemical manufacturer, importer or other responsible party;
2. Product Identifier;
3. Signal Word;
4. Hazard Statement(s);
5. Precautionary Statement(s);
6. Pictogram(s).

## 5.2 Chemical Distribution

The method of transport of chemicals should reflect both the potential danger and the potential for facility disruption posed by a specific substance. For example, for highly toxic or caustic materials, particular attention must be paid to the personal protection of the transporter.

When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used when possible. Carts should be sturdy and have adequately sized wheels. Flammable liquids should only be transported in proper containers.

Compressed gas cylinders must be handled carefully. The valve cover must always be in place for transport. Cylinders should never be rolled or dragged. A handcart should be utilized with the cylinder strapped in place, even for short distances.

## 5.3 Chemical Storage

Due to the huge array of chemicals that are found in the academic laboratory, chemical storage at a university is a complex subject. Below are some general guidelines. Information on the storage of a specific chemical can be obtained from the Laboratory [Chemical Storage Scheme Table](#), the container label, the SDS, or by contacting EHS.

Chemicals that are highly toxic should be stored in unbreakable secondary containers. Stored chemicals should be examined periodically (at least annually) for deterioration and container integrity. It is recommended that chemicals that are more hazardous be stored below eye level. Chemicals should not be stored on the floor. Chemicals should be stored on shelves containing a lip to avoid accidental spillage.

Pyrophoric materials must be stored in tightly closed containers under an inert atmosphere or liquid. Pyrophoric materials are those that are capable of spontaneous combustion in the presence of air (see Appendix H). All transfers and manipulations of pyrophoric materials must also be carried out under an inert atmosphere or liquid.

Compressed gas cylinders must be stored in an upright position and securely restrained. Full cylinders not in use should have the valve cover in place. Full cylinders must be kept separate from empty cylinders. Cylinders with flammable contents should be separated from oxygen containing cylinders by at least 20 feet.

Amounts of chemicals stored within the laboratory itself should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided. Periodic inventories should be conducted, with unneeded items being discarded or returned to the storeroom/stockroom.

Stockroom personnel should be trained in the handling and spill remediation of the hazardous substances under their control.

Chemicals should be grouped according to the following (many have special storage requirements):

1. Flammable liquids (see [Appendix A](#)) should be stored in flammable-liquid cabinets or specially designed "explosion-proof" refrigerators. If the laboratory contains ten or more gallons of flammable liquids, the use of a flammable-liquid cabinet is mandatory. Generally includes peroxide forming chemicals (also see [Appendix A](#)), which have the potential for explosion, and shall be stored in a cool, dark, dry location, with appropriate labels which include the date opened. These chemicals should be disposed of as hazardous waste upon the date of manufacturer's expiration. As an alternative to disposal, the laboratory may conduct documented monthly tests for the presence of peroxides.
2. Volatile toxics and poisons (see [Appendix B](#)) – Can be stored with flammables in a flammable storage cabinet if there are no other incompatible considerations. Alternative is any enclosed cabinet or shelf to protect from breakage below bench level. These are not to be stored with bases.
3. Oxidizing and non-oxidizing inorganic acids (see [Appendix C](#)) - should be stored in corrosives cabinets, separate from non-oxidizing inorganic acids, flammables, and each other by containment trays.
4. Organic Acids (See [Appendix D](#)) – should be stored in a vented cabinet under a fume hood. Do not store with with bases. Hydrofluoric Acid should be kept in separate storage. Acetic Acid should be stored in a flammable cabinet with other flammables.
5. Concentrated inorganic bases ([Appendix E](#)) should be stored separately from inorganic acids and halogenated organics (volatile toxics).
6. Oxidizing Liquids and Reactives, excluding oxidizing acids – ([Appendix F](#)) should be stored separately from all other chemicals as they are highly reactive. Never store these with flammables.
7. Non-volatile Toxics – ([Appendix G](#)) - may be stored in any storage area, according to its chemical properties. However, they should bear the appropriate warning label (when required).
8. Pyrophorics and Water Reactives – ([Appendix H](#)) – these products should always be isolated from other liquid chemicals and in double containment. They can be stored with dry chemicals if necessary.

9. Dry Solids ([Appendix I](#)) – This general grouping of chemicals should always be kept dry. Cabinets are the suggested means of storage. Always store above liquid chemicals, and keep the more toxic dry solids separate from non-toxics.

See also [Appendix K](#) for a list of general incompatibilities

## 5.4 Chemical Labeling

Chemical containers stored in the laboratory must meet minimum labeling requirements.

Manufacturer original chemical container labels must contain:

- Name, address and telephone number of manufacturer;
- Product Identifier;
- Signal Word;
- Hazard Statement(s);
- Precautionary Statement(s);
- Pictogram(s).

Secondary chemical container labels must contain:

- Product Identifier(s)

Note: Pictogram(s) or other symbol system can be used as best practice for labeling.

## 6.0 Principles and Procedures for Working with Laboratory Chemicals

### 6.1 General

It is prudent to minimize all chemical exposures. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, in addition to specific guidelines for particular types of chemicals. All potential skin contact with chemicals should be avoided.

Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized; for work with substances that present special hazards, special precautions should be taken. One should assume that any mixture would be more toxic than its most toxic components and that all substances of unknown toxicity are toxic. Care must be taken to avoid chemical incompatibilities (see [Appendix K](#)) when planning experiments and operations.

Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere, by use of hoods and other ventilation devices.

Laboratory personnel chemical exposures shall be identified and managed to below established exposure guidelines. Two recognized exposure guidelines include OSHA Permissible Exposure Limits (PELs) and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs). Contact EHS for assistance in identifying and measuring chemical exposure.

The Chemical Hygiene Plan requires that laboratory workers know and follow Plan rules and procedures. In addition to the general principles mentioned above, the following procedures and rules should be used for essentially all laboratory work with chemicals:

## **6.2 Avoidance of "routine" exposure**

1. Develop and encourage safe habits.
2. Avoid unnecessary exposure to chemicals by any route.
3. Do not smell or taste chemicals.
4. Vent apparatus, which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into, fume hoods.
5. Inspect gloves and test glove boxes before use.
6. Do not allow release of toxic substances in cold rooms and warm rooms, since these often have contained, recirculated atmospheres.
7. Use only those chemicals for which the available ventilation system is appropriate.

## **6.3 Equipment and glassware**

1. Handle and store laboratory glassware with care to avoid damage; do not use glassware that is cracked, scratched, or showing other signs of wear or damage.
2. Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur.
3. Use equipment only for its designed purpose.
4. In the event of breakage, clean broken glassware with a brush and dustpan. Always wear hand protection if it is necessary to handle broken glassware.
5. Never dispose of broken glass in the laboratory's general trash container. Place all broken glassware in separate, dedicated puncture-proof box with a clear plastic liner.

## **6.4 Personal habits**

1. Wash areas of exposed skin well before leaving the laboratory.
2. Avoid practical jokes or other behavior that might confuse, startle or distract another worker.
3. Do not use mouth suction for pipetting or starting a siphon.
4. Be alert to unsafe conditions and see that they are corrected when detected.
5. Do not eat, drink, smoke, chew gum, or apply cosmetics in laboratories or areas where laboratory chemicals are present.
6. Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware or utensils, which are also used for laboratory operations.

## **6.5 Personal and protective apparel**

1. Long hair should be confined.
2. Lab workers should not wear loose fitting or dangling clothing.
3. Clothing should cover as much of the worker's skin as possible.
4. Lab workers must wear close-toed shoes at all times in the laboratory - not sandals, perforated shoes, or canvas sneakers.
5. Protective apparel (lab coats, safety eyewear, aprons, shoe covers etc.) with the required degree of protection for substances being handled should be available for each lab worker and visitor as appropriate.

## 6.6 Personal protective equipment

1. Assure that all persons, including visitors, where chemicals are stored or handled, wear appropriate eye protection. Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically.
2. Contact EHS for selection and use of respiratory protection. Refer to the [UNC-Charlotte Respiratory Protection Program](#).
3. Use any other protective and emergency apparel and equipment as appropriate.
4. If contact lenses are worn in the laboratory, inform supervisor so special precautions can be taken.
5. Remove laboratory coats immediately when they become significantly contaminated.

## 6.7 Planning

1. Seek information and advice about hazards.
2. Plan appropriate protective procedures.
3. Plan the positioning of equipment before beginning any new operation.
4. Identify locations of safety equipment such as eyewash/shower stations, spill control equipment, and first-aid supplies.

## 6.8 Unattended operations

1. Leave the lights in the laboratory on.
2. Place an appropriate sign on the door.
3. Provide for containment of toxic substances in the event of failure of a utility service (such as cooling water).

## 6.9 Use of fume hood(s)

1. Use the hood for operations that might result in release of toxic chemical vapors or dust.
2. As a rule of thumb, use a hood or other local ventilation device when working with any appreciably volatile substance with a Permissible Exposure Limit (PEL) of less than 50 ppm.
3. Confirm hood is performing adequately before using it by checking the EHS inspection sticker date, alarms (if applicable), and running the fume hood for a few minutes
4. Do not use Perchloric Acid, Hydrofluoric Acid, or Radiation in a hood. Please contact EHS for approval.
5. Keep hood sash closed at all times, except when adjustments within the hood are being made.
6. Work at least 6 inches inside fume hood sash while wearing appropriate PPE. The general PPE requirement is lab coat, protective chemical resistant gloves, safety glasses and closed toed shoes.
7. Avoid creating air currents across the face of fume hood (e.g. pedestrian traffic, fans, keeping entrance door closed).
8. Keep materials stored in hoods to a minimum and do not allow them to block vents or airflow. Keep the work area and bottom baffles clear from clutter.
9. Remove any electrical units or spark sources from hood when using flammable liquids and/or gases.
10. Do not raise the hood above the 100 fpm mark when working with hazardous chemicals inside the hood.

11. Leave the 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."
12. Do not modify the hood by adding unauthorized manufacture shelving, removing side panels, blocking air foil or any other manufacture unapproved modification.
13. Only use the fume hood for it is intended purpose. Do not use the fume hood for virology or bacteriology work. This work should be completed in a biosafety cabinet.

#### **6.10 Working alone**

1. Avoid working alone in a building.
2. Do not work alone in a laboratory if the procedures being conducted are hazardous.

#### **6.11 Working with Allergens and Embryotoxins**

1. Wear suitable gloves to prevent hand contact with allergens (examples: diazomethane, isocyanates, bichromates or substances of unknown allergenic activity).
2. If you are a woman of childbearing age, handle embryotoxic substances (examples: organomercurials, lead compounds, formamide) only in a hood in which satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.
3. Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made.
4. Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.
5. Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

#### **6.12 Working with Particularly Hazardous Substances (including "Select Carcinogens")**

One goal of the Chemical Hygiene Plan and program is to minimize exposure to highly hazardous chemicals, toxics and reactives (see [Appendix J](#)) using all reasonable precautions. Conduct all transfers and work with these substances in a designated area (e.g., a restricted access hood, glove box, or portion of a lab designated for their use; for which all people with access are aware of the substances being used and necessary precautions). Assure that the designated area is conspicuously marked and that all containers of these substances are appropriately labeled with identity and warning labels.

Before starting:

1. Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory PI.
2. Be prepared for accidents and spills. Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accidents are available.
3. Assure that at least two people are present at all times if a compound in use is highly toxic or of unknown toxicity.
4. Always, use a fume hood or other containment device for procedures that may result in the generation of aerosols or vapors containing the substance. For a negative pressure glove box, ventilation rate must be at least 2-volume changes/hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly

check for leaks before each use. When using any glove box, trap the exit gases or filter them through a HEPA filter or chemical scrubber before releasing them into the hood.

5. Cover work and storage surfaces with removable, absorbent, plastic backed paper.
6. Always, avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate).
7. Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood.
8. If use of toxicologically significant quantities of such a substance on a regular basis is anticipated, consult a qualified physician concerning desirability of regular medical surveillance.

While working:

1. Work and mount apparatus above chemically resistant trays.
2. If a major spill occurs outside the hood, evacuate the area and assure that cleanup personnel wear suitable protective apparel and equipment. Decontaminate the controlled area before normal work is resumed there. Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance is a dry powder.

When the operation is complete:

Always wash hands and arms immediately after working with these materials.

1. Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.
2. Thoroughly decontaminate contaminated clothing or shoes. Use chemical decontamination whenever possible; ensure that containers of contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel.
3. Store contaminated waste in closed, suitably labeled, impervious containers.
4. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area.

### 6.13 Hydrofluoric Acid Safety

Special precautions must be taken when working with hydrofluoric acid. Use the appropriate personal protective equipment as defined by the SDS. Make sure the integrity of your PPE is intact as a pinhole in a glove can have disastrous consequences. Although HF exposures can result in injury, quick response will minimize the damage. All exposures should be treated immediately even though burns may not be felt for hours. Affected personnel must receive immediate medical attention for all eye and inhalation exposures, and all but the most minor skin burns. A summary of first aid procedures is listed below:

**Skin Contact** – Immediately wash all affected areas with water. Be sure to remove any clothing or jewelry that could trap HF (remove goggles last). Flush skin for fifteen minutes or until medical attention is available. Flushing can be reduced to five minutes if calcium gluconate gel (2.5%) is immediately available. Apply calcium gluconate gel to the affected area (use rubber gloves) every fifteen minutes and massage continuously. Get medical attention. Calcium gluconate gel can be obtained from various vendors.

**Eye Contact** – Immediately flush eyes for at least fifteen minutes with water while holding eyelids open. Get medical attention. Flushing can be limited to five minutes if medical



personnel are immediately available to administer sterile calcium gluconate (1%) solution (via continuous drip).

**Inhalation** – Move to fresh air as soon as possible. Get medical attention. Medical personnel can administer pure oxygen and calcium gluconate (via nebulizer) to patient.

Laboratory personnel should only attempt to clean up small HF spills that do not involve personnel contamination and that are contained and under control. Be sure that good ventilation is available and that personal protective equipment is worn before attempting to clean up a HF spill.

Although accidents involving HF may not be eliminated, pre-planning will minimize the effects of such incidents. All laboratories that store or use HF should develop standard operating procedures that outline how to safely use HF, as well as how to respond to personnel contamination and HF spills. Please contact EHS for more information on HF, or for assistance in developing safe handling procedures.

#### **6.14 Animal Work with Chemicals of High Chronic Toxicity**

1. For large-scale studies, special facilities with restricted access are preferable.
2. When possible, administer the substance by injection or gavage, instead of in the diet.
3. If administering chemicals of high chronic toxicity in the diet, use a caging system under negative pressure or under laminar airflow directed toward HEPA filters.
4. Operations must utilize procedures that minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood).
5. When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or coveralls and, if needed, additional apparel and equipment such as shoe and head coverings, and respirators.
7. Dispose of contaminated animal tissues and excreta by incineration (as biohazard/medical waste).

### **7.0 Spills and Accidents**

A written emergency plan should be established. It should include procedures for ventilation failure, evacuation, medical care, reporting, and drills. A spill control policy should be developed and should include consideration of prevention, containment, cleanup, and reporting. All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit.

#### **7.1 Minor spills with human contamination**

1. Be prepared, know where the nearest eyewash and safety shower are located.
2. Eye Contact: Promptly flush eyes with water for a prolonged period (15 minutes) while holding the eyes open (manually if necessary) and rotating the eyeballs; then seek medical attention.
3. Ingestion: Encourage the victim to drink large amounts of water. Do not induce vomiting, unless instructed to do so by the SDS or other credible source.
4. Skin Contact: Promptly flush the affected area with water (15 minutes) and remove any contaminated clothing or jewelry. When removing pullover shirts and sweaters, take care

not to contaminate the eyes. Wash affected areas with mild soap. If symptoms persist after washing, seek medical attention.

5. Consult the SDS for first-aid recommendations. Keep the SDS with the victim.
6. Promptly clean up spills, using appropriate protective apparel, equipment, and dispose of all contaminated materials in accordance with the University [Hazardous Waste Management Program](#).

## 7.2 Minor spills with no human contamination

1. Warn all nearby people of the spill and potential danger.
2. If the material is flammable (see [Appendix A](#)), turn off all possible sources of ignition such as Bunsen burners (DO NOT TURN OFF or ON electrical switches).
3. Evaluate the hazardous properties and size of the spill to determine if evacuation of the building or additional assistance are needed.
4. Wear appropriate personal protective equipment.
5. Absorb liquid spills using paper towels or commercially available spill absorption materials.
6. Dispose of all contaminated materials in accordance with the University Hazardous Waste Management program.

## 7.3 Major spills

On the UNC Charlotte campus, "large" spills of volatile hazardous materials must be referred to the Campus Police by calling 911 from a campus phone or 704-687-2200 from any phone.

## 8.0 Personal and Environmental Monitoring

Regular measurement of airborne concentrations of hazardous chemicals is not usually justified or practical in laboratories, but may be appropriate when testing or redesigning fume hoods or other ventilation devices, or when a highly toxic substance is stored or used regularly. It is sometimes necessary to perform personal air sampling on an individual lab worker. EHS must be contacted if a lab worker believes they have received a significant chemical exposure or exhibits signs or symptoms of an overexposure to a chemical used in the lab. In addition, if there is any reason to believe that an employee's exposure approaches the OSHA action level or OSHA permissible exposure level EHS must be contacted.

EHS will evaluate exposure potential, perform personal or environmental sampling as appropriate or required, and make recommendations for reducing exposure. Lab workers will be notified in writing within one week of receipt of the results of air monitoring.

## 9.0 Medical Program

If a laboratory worker develops signs or symptoms associated with a hazardous chemical to which the lab worker may have been exposed, they shall be provided the opportunity to receive an appropriate medical examination. If exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are medical surveillance requirements, medical surveillance shall be established for the lab worker as prescribed by the particular standard. If an event takes place in the lab such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected lab workers shall be provided with the opportunity for a medical examination.

Anyone who believes they are exposed to, or whose work involves regular and frequent handling of, toxicologically significant quantities of a chemical should contact EHS for referral to a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable.

## 10.0 Training Program

The goal of information dissemination and training is to assure that all individuals at risk are adequately informed about the nature of work in the laboratory, its risks, and what to do if an accident occurs. All personnel of the laboratory shall be trained in the proper use of protective/emergency equipment and procedures. Literature and consulting advice concerning chemical hygiene is readily available to laboratory personnel through EHS.

The PI, instructor or lab manager shall ensure that lab workers receive the required training. EHS has developed [Research Laboratory Environment Training Courses](#) and [Safety Training Fact Sheets](#) that will assist PI's with meeting basic safety training requirements. Training shall be at the time of initial assignment to the laboratory and periodically thereafter as needed. Training must be documented ([EHS Training Recordkeeping Workbook](#), [EHS Attendance Form](#)) and at a minimum cover the following requirements:

1. The contents of the OSHA Lab Standard and its appendices
2. The location, availability and applicable contents of the University Chemical Hygiene Plan
3. The permissible exposure limits for OSHA regulated substances used in the lab; or, if the OSHA does not regulate substance; the NIOSH recommended exposure limit or ACGIH threshold limit value
4. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory
5. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to SDSs received from the chemical supplier
6. Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by EHS, continuous monitoring devices, visual appearance or odor of hazardous chemicals being released, etc.)
7. The physical and health hazards of chemicals in the laboratory and the measures lab workers can take to protect themselves from these hazards, **including specific procedures the University has implemented to protect lab workers from exposure to hazardous chemicals**, such as appropriate work practices, emergency procedures, and personal protective equipment to be used
8. EHS offers online general laboratory safety training tools (<http://safety.uncc.edu/training>)

## 11.0 Inspections

As described in Section 2.0 of the Chemical Hygiene Plan, it is the responsibility of the PI or Lab Manager to conduct regular, informal Chemical Hygiene and Housekeeping inspections of their laboratory. EHS has developed an easy to use Laboratory Safety Checklist that can be utilized by the PI / Lab Manager for this important responsibility.

Additionally, the EHS office is charged with conducting or overseeing formal Chemical Hygiene Plan inspections for laboratories. These may come in the form of announced or unannounced

visits, with the scope of these inspections falling within the realm of the Chemical Hygiene Plan and/or General safety measures.

## 12.0 Waste Disposal Program

The goal of proper waste disposal is to assure that minimal harm to people, other organisms, and the environment will result from the disposal of laboratory chemicals. Hazardous waste disposal shall be in accordance with the [University Hazardous Waste Management Program](#). The Hazardous Waste Management Program specifies how waste is to be segregated, stored, and transported. Transport from the institution must be in accordance with DOT regulations. Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened except by highly trained personnel using appropriate personal protective equipment.

Before a worker's employment in the laboratory ends, chemicals for which that person was responsible should be discarded or returned to storage. Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable. Hoods should not be used as a means of disposal for volatile chemicals. Disposal by recycling or chemical decontamination should be used when possible.

## 13.0 Records

This section reviews the requirements for documenting the University's compliance with the Chemical Hygiene Laboratory Standard. The Laboratory Standard requires the following records be maintained for at least 30 years and that they be accessible to the laboratory workers or their representative.

- Air concentration monitoring results
- Exposure assessments
- Medical evaluations
- Medical examination

In addition to the above, training, complaint, equipment repair, inspection and incident records should be retained.

## Appendix A Flammables/Combustibles and

### Peroxide Formers

#### FLAMMABLES AND COMBUSTIBLES

2-MERCAPTOETHANOL	METHACRYLIC ACID
2-NITROPROPANE	METHYL ALCOHOL
ACETIC ACID, GLACIAL	METHYL ETHYL KETONE
ACETONE	MORPHOLINE
BENZALDEHYDE	N-HEXANE
BENZENE BENZYL	NITROBENZENE
ALCOHOLS BROMOB	N-BUTANOL
ENZENE CARBON	PENTANE
DISULFIDE	PHENYL ETHER
CAPROIC ACID	PROPANE
CHLOROBENZENE	PYRIDINE
COLLODION	STEARIC ACID
CYCLOHEXANOL	STODDARD SOLVENT
DIMETHYL SULFIDE	TEMED
EPICHLOROHYDRIN	TERT BUTYL
ETHYL ACETATE	ISOCYANATE TOLUENE
ETHYL ALCOHOL	TRIETHYLAMINE
ETHYLENE GLYCOL	TURPENTINE
ETHYLENE OXIDE	TERT BUTYL ISOCYANATE
FORMIC ACID	XYLENE
GASOLINE	

Reference:

Safety data sheets (SDS)

National Fire Protection Agency document NFPA 321: *Classification of Flammable and Combustible Liquids*, 1991 Edition.

## PEROXIDE FORMERS

1-PENTENE	DIVINYL ACETATE
1,3,5,7-CYCLOOCTATETRAENE	DIVINYL ETHER
2-BUTANOL	ETHER
2-PENTANOL	ETHOXY
2-PROPANOL	ACETATE ETHYL
4-METHYL-2-PENTANONE	ETHER
ACETAL ACETALDEHYDE	ETHYLENE GLYCOL MONO ETHER
BENZYL ALCOHOL	ETHYLENE GLYCOL DIMETHYL
BUTADIENE	ETHER FURAN
BUTYL ETHER	HEXONE
CROTONALDEHYD	ISOPROPYL ETHER
E CUMENE	METHYL ISOBUTYL
CYCLOHEXANE	KETONE PERFLUOR
CYCLOPENTENE	ETHENE POTASSIUM
DECALIN (DECAHYDRONAPHTHALEN)	AMIDE
DIBUTYL ETHER DIETHYLENEGLYCOL	SODIUM AMIDE STYRENE
DIMETHYL ETHER DIETHYL ETHER	TETRAFLUROETHYLENE
DIETHYLENE OXIDE	TETRAHYDROFURAN
DIISOPROPYL	TETRAHYDRO
ETHER DIMETHYL	NAPHTHALINE VINYL
ETHER DIOXANE	ACETATE
	VINYL
	ACETYLENE
	VINYL CHLORIDE
	VINYL ETHERS
	VINYLIDENE CHLORIDE

## Appendix B

### Volatile Toxins (Halogenated Solvents, Carcinogens, Toxins)

ACETONITRILE CARBON  
TETRACHLORIDE  
CHLOROFORM  
DICHLOROMETHANE  
DIMETHYL SULFATE  
DIMETHYL SULFOXIDE  
HALOGENATED ORGANICS

HALOMETHANE  
HALOTHANE  
MERCAPTOETHANOL  
METHYLENE CHLORIDE  
PERFLUOROHEXANE  
PHENOL  
TRITON X100

### KNOWN CARCINOGENS

ACETALDEHYDE  
AMINOBIHENYL  
ARSENIC  
ASBESTOS  
AZATHIOPRINE  
BENZENE  
BENZIDINE  
BERYLLIUM COMPOUNDS  
BIS(CHLOROMETHYL) ETHER

1,4-BUTANEDIOL DIMETHYL-SULFONATE  
1,4-BUTANEDIOL DIMETHYL-SULFONATE  
CHROMIUM / CHROMIUM COMPOUNDS  
CYCLOPHOSPHAMIDE  
ETHYLENE OXIDE  
FORMALDEHYDE  
SILICA DUST (AS QUARTZ/CRISTOBALITE)  
VINYL CHLORIDE

Reference: National Toxicological Report KNOWN CARCINOGENS, 7th ANNUAL REPORT ON  
CARCINOGENS 199

## Appendix C

### Inorganic Acids

#### OXIDIZING

CHLORIC ACID  
CHLOROSULFONIC ACID  
CHROMIC ACID  
FLOUROSULFONIC ACID  
NITRIC ACID

NITROSULFONIC ACID  
PERCHLORIC ACID  
SELENIC ACID  
SULFURIC ACID

#### NON-OXIDIZING

BORIC ACID  
HYDROBROMIC ACID  
HYDRIOTIC ACID  
HYDROCHLORIC ACID

HYDROFLUORIC ACID  
PHOSPHORIC ACID  
SULFURYL ACID



## Appendix D

### Organic Acids

ACETIC ACID  
ACRYLIC ACID  
ACETIC ANHYDRIDE  
BENZOYL BROMIDE  
BENZOYL CHLORIDE  
BENZYL BROMIDE  
BENZYL CHLORIDE  
BUTYRIC ACID  
CHLOROACETIC ACID  
DIMETHYL SULFATE  
FORMIC ACID  
GLACIAL ACETIC ACID  
ISOBUTYRIC ACID  
LACTIC ACID METHYL  
CHLOROFORMATE PHENOL  
PICRIC ACID  
PROPIONIC ACID  
PROPIONYL BROMIDE  
PROPIONYL CHLORIDE  
SALICYLIC ACID  
TRICHLOROACETIC ANHYDRIDE  
TRIFLUOROACETIC ACID

## Appendix E Inorganic

### Bases / Alkaline

AMMONIUM HYDROXIDE  
AMMONIUM SULFIDE  
BARIUM HYDROXIDE  
CALCIUM HYDRIDE  
CALCIUM HYDROXIDE  
CALCIUM OXIDE HYDRAZINE  
POTASSIUM HYDROXIDE  
SODIUM CARBONATE  
SODIUM HYDROXIDE  
SODIUM HYDRIDE  
STRONTIUM CARBONATE

## Appendix F

### Common Laboratory Oxidizers (Excluding Acids)

THE FOLLOWING CLASSES OF CHEMICALS ARE USUALLY CLASSIFIED AS OXIDIZERS:

BROMATES	CHLORATES	PERCHLORATES	CHLORITES
CHROMATES	HYPOCHLORITES	DICHROMATES	PEROXIDES
SUPEROXIDES	NITRATES	NITRITES	PERMANGANATES
PERSULFATES			

SOME SPECIFIC EXAMPLES:

AMMONIUM PERCHLORATE	AMMONIUM PERMANGANATE
BARIUM PEROXIDE	BROMINE
CALCIUM CHLORATE	CALCIUM HYPOCHLORITE
CHLORINE TRIFLUORIDE	CHROMIUM ANHYDRIDE
CHROMIC ACID	DIBENZOYL PEROXIDE
FLUORINE	HYDROGEN PEROXIDE (>30%)
LEAD DIOXIDE	MANGANESE DIOXIDE
MAGNESIUM PEROXIDE	NITROGEN TRIOXIDE
PERCHLORIC ACID	POTASSIUM BROMATE
POTASSIUM CHLORATE	POTASSIUM PEROXIDE
PROPYL NITRATE	SODIUM CHLORATE
SODIUM CHLORITE	SODIUM PERCHLORATE

References: CRC Handbook of Laboratory Safety, 3rd edition.

## Appendix G

### Non-Volatile Toxins

ACRYLAMIDE  
BROMOPHENOL BLUE  
ETHIDIUM BROMIDE  
FORMAMIDE  
IGEPAL  
SODIUM DODECYL SULFATE  
TRIETHANOLAMINE TRIZMA  
BASE

## Appendix H

### PYROPHORIC AND WATER REACTIVE CHEMICALS

#### Pyrophoric Materials

Class of Pyrophoric Compounds	Examples
FINELY DIVIDED METALS	CALCIUM, ZIRCONIUM
ALKALI METALS	SODIUM, POTASSIUM
METAL HYDRIDES OR NONMETAL HYDRIDES	GERMANE, DIBORANE, SODIUM HYDRIDE, LITHIUM ALUMINUM HYDRIDE
PARTIALLY OR FULLY ALKYLATED DERIVATIVES OF METAL AND NONMETAL HYDRIDES	DIETHYLALUMINUM HYDRIDE, TRIMETHYLPHOSPHINE
ALKYLATED METAL ALKOXIDES OR NONMETAL HALIDES	DIETHYLETHOXYALUMINUM, DICHLOROMETHYLSILANE
METAL CARBONYLS	PENTACARBONYLIRON, OCTACARBONYLDICOBALT, NICKEL CARBONYL
USED HYDROGENATION CATALYSTS	ESPECIALLY HAZARDOUS BECAUSE OF THE ADSORBED HYDROGEN
PHOSPHORUS (WHITE)	GRIGNARD REAGENTS

#### Water Reactive Materials

ALUMINUM ALKYL HALIDES	FERROSILICON
ALUMINUM ALKYL HYDRIDES	LITHIUM
ALUMINUM BOROXYDRIDE	LITHIUM BOROXYDRIDE
ALUMINUM CARBIDE	LITHIUM HYDRIDE
ALUMINUM FERROSILICON	LITHIUM NITRIDE
ALUMINUM HYDRIDE	LITHIUM SILICON
ALUMINUM PHOSPHIDE	MAGNESIUM ALKYL
BARIUM	MAGNESIUM HYDRIDE
CALCIUM	MAGNESIUM PHOSPHIDE
CALCIUM CARBIDE	METHYL MAGNESIUM BROMIDE, IN ETHYL ETHER
CALCIUM HYDRIDE	POTASSIUM ALLOYS
CALCIUM PHOSPHIDE	RUBIDIUM
CALCIUM SILICIDE	SODIUM
CESIUM	SODIUM HYDRIDE
DIETHYL, DEMETHYL ZINC	TRICHLORSILANE
ETHYLDICHLORSILANE	ZINC POWDER

Reference: *Bretherick's Handbook of Reactive Chemical Hazards*.

## Appendix I – Dry Solids

### Common Dry Solids

The following are some common dry solids found at University of North Carolina-Charlotte

AGAROSE	L-ASCORBIC ACID
ALBUMIN, FROM BOVINE SERUM	MAGNESIUM SULFATE
ALUMINA ALUMINUM	METALS, VARIOUS
CHLORIDE ALUMINUM	METHYL CELLULOSE
OXIDE AMMONIUM	OXALIC ACID
ACETATE AMMONIUM	PARAFORMALDEHYDE
CARBONATE	PONCEAU S POTASSIUM
AMMONIUM PERSULFATE	CARBONATE POTASSIUM
AMMONIUM SULFATE	CHLORIDE
BORIC ACID	POTASSIUM HYDROXIDE
BOVINE SERUM ALBUMIN	POTASSIUM PHOSPHATE
BROMOPHENOL BLUE	SALICYLIC ACID
CALCIUM CARBONATE	SODIUM ACETATE
CITRIC ACID	SODIUM AZIDE
CUPRIC SULFATE	SODIUM BICARBONATE
DODECYL SULFATE	SODIUM CHLORIDE
EDTA	SODIUM HYDROXIDE
EGTA ETHYLENE	SODIUM THIOCYANATE
OXIDE GLYCINE	SUCCINIC ACID
HYDRAZINE HYDRATE	SUCROSE
HYDROXYLAMINE HYDROCHLORIDE	SULFANILAMIDE
IMIDAZOLE	TRIS BASE
	UREA

## Appendix J

### Resources for "Particularly Hazardous Substances"

The OSHA Laboratory Standard (1910.1450) defines particularly hazardous substances as:

**Carcinogens** – A carcinogen is a substance capable of causing cancer. Carcinogens are chronically toxic substances; that is, they cause damage after repeated or long-duration exposure, and their effects may become evident only after a long latency period.

A chemical is considered a carcinogen, for the purpose of the Laboratory Safety Manual, if it is included in any of the following carcinogen lists:

- OSHA-regulated carcinogens as listed in Subpart Z of the OSHA standards. The current list of substances that OSHA regulates as carcinogens or potential carcinogens follows:

Asbestos	N-Nitrosodimethylamine
4-Nitrobiphenyl	Vinyl chloride
Alpha-Naphthylamine	Inorganic arsenic
Methyl chloromethyl ether	Cadmium
3,3'-Dichlorobenzidine (and its salts)	Benzene
bis-Chloromethyl ether	Coke oven emissions
beta-Naphthylamine	1,2-dibromo-3-chloropropane
Benzidine	Acrylonitrile
4-Aminodiphenyl	Ethylene oxide
Ethyleneimine	Formaldehyde
Beta-Propiolactone	Methylenedianiline
2-Acetylaminofluorene	1,3-Butadiene
4-Dimethylaminoazobenzene	Methylene Chloride

OSHA CURRENT LIST: <http://www.osha.gov/SLTC/carcinogens/index.html>

- Under the category "known to be carcinogens" in the *Annual Report of Carcinogens* published by the National Toxicology Program (NTP) latest edition

NTP CURRENT LIST: <http://ntp.niehs.nih.gov/?objectid=03C9AF75-E1BF-FF40-DBA9EC0928DF8B15>

- Group 1 ("carcinogenic to humans") of the International Agency for Research on Cancer (IARC), latest edition. Chemicals listed in Group 2A or 2B ("reasonably anticipated to be carcinogens") that cause significant

tumor incidence in experimental animals under specified conditions are also considered carcinogens under the OSHA Laboratory Standard.

IARC CURRENT LIST: <http://monographs.iarc.fr/ENG/Classification/index.php>

**Reproductive Toxins** – Reproductive toxins are substances that have adverse effects on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance. When a pregnant woman is exposed to a chemical, the fetus may be exposed as well because the placenta is an extremely poor barrier to chemicals. Reproductive toxins can affect both men and women. Male reproductive toxins can in some cases lead to sterility.

Resources for information about reproductive toxins (Repro Tox, Repro Text, Teris, etc.) can be found through Micromedex.

**Substances with a High Acute Toxicity** – High acute toxicity includes any chemical that falls within any of the following OSHA-defined categories:

- A chemical with a median lethal dose (LD<sub>50</sub>) of 50 mg or less per kg of body weight when administered orally to certain test populations.
- A chemical with an LD<sub>50</sub> of 200 mg less per kg of body weight when administered by continuous contact for 24 hours to certain test populations.
- A chemical with a median lethal concentration (LC<sub>50</sub>) in air of 200 parts per million (ppm) by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when administered to certain test populations by continuous inhalation for one hour, provided such concentration and/or condition are likely to be encountered by humans when the chemical is used in any reasonably foreseeable manner.

## Appendix K

### Incompatible Chemicals

The following are examples of chemical incompatibilities. This list **should not be considered complete** and persons unsure as to the status of a particular chemical are advised to refer to the manufacturer and SDS.

Chemical	Incompatibilities
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals (such as powdered aluminum or magnesium, calcium, lithium, sodium, potassium)	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury (in manometers, for example), chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrites, sulfur, finely divided organic combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens

Fluorine	All other chemicals
Hydrocarbons (such as butane, propane, benzene)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali

Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals
Nitrites	Acids
Nitroparaffins	inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen: flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, gease, oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalies, reducing agents
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate (see also chlorates)	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartartic acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents